IMPLEMENTATION PLAN

June 2011

UPPER SOUTH EAST DRAINAGE NETWORK MANAGEMENT STRATEGY

Government of South Australia
Department for Water

CONTENTS

DEPARTMENT FOR WATER

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INTRODUCTION

An Implementation Plan has been developed to complement the Upper South East Drainage Network Management Strategy (Strategy) which has been prepared under section 43A of the *Upper South East Dryland Salinity and Flood Management Act 2002*. The Implementation Plan identifies how the strategies and principles of the Strategy will be applied to management priorities of the Upper South East (USE) Network, in a practical sense. The Implementation Plan provides information to:

- Assist the managing authority to manage the system in accordance with the Strategy;
- Provide transparency to stakeholders regarding the management of the USE Network at both whole-of-region and sub-regional scales;
- Identify areas for future investigations and works to improve or extend the capabilities and operations of the USE Network as an integrated system; and
- Provide sufficient information to enable stakeholders to understand potential implications of the management of the USE Network to their general sub-regional area.

Information is presented as a set of '*Management Principles*' statements for major source water catchments and network components across the region. Catchments, drains, floodways, watercourses and wetland systems of the region have been divided into a number of 'management units' including:

- Five source water catchments:
    - Southern Bakers Range Catchment;
    - Mosquito Creek Catchment;
    - Naracoorte Creek Catchment;
    - Morambro Creek Catchment; and
    - Tatiara-Nalang Creek Catchment.
- Sixteen USE Network management units
    - **Drain E Swamps -** *Lake Ormerod to Jaffrays Complex;*
    - **Marcollat Watercourse-** *Muddies Swamp to Jip Jip Swamp;*
    - **Gum Lagoon/ Duck Island-** *Rosemary Downs Drain, Bunbury Drain, Coola Coola;*
    - **South-Central Bakers Range Watercourse -** *Drain M to Angel's Road;*
    - **North-Central Bakers Range Watercourse -** *Angels Road to Petherick Road;*
    - **Northern Bakers Range Watercourse -** *Mandina Marshes to Messent Conservation Park;*
    - **Tresant Drain-** *Bloomfield Swamp to Fairview Conservation Park;*
    - **Fairview Drain -** *Lochaber West Road to the Blackford Drain;*
    - **East Avenue Watercourse -** *Boatman's Swamp to the Fairview Drain, including Phillips Gap regulator;*
    - **West Avenue Watercourse -** *Bakers Range transfer regulator to Litigation Lane;*

- **Wimpinmerit -** *Rowney Road West to Bald Hill Drain;*
- **Taratap Watercourse -** *Rushy Swamp to Henry Creek;*
- **Tilley Swamp Watercourse -** *Henry Creek to the Northern Outlet Drain;*
- **Northern Catchments-** *Mount Charles, Bunbury & Taunta Hut Drains;*
- **Morella Basin; and**
- **Releases into the south lagoon of the Coorong.**

Chapter 1: Outlines the management principles for source water catchments.

Chapter 2: Outlines the management principles for USE Network management units.

Chapter 3: Outlines key endangered species under the EPBC Act that relate to the Upper South East area.

Chapter 4: Identifies legislation that is relevant to the development and operation of the USE Network and the principles of the Strategy.

In operating and managing the system the managing authority will act as follows:

- Ensure that water resource assessments are robust and take into account both the short and long term cycles of climatic variation and the implications of climate change scenarios.
- Consolidate and provide reliable specifications of environmental watering requirements (volumetric, spatial and temporal) to meet the needs of key wetland assets across the region.
- Influence future planning and development decisions regarding land-use change (specifically land-uses with significant cumulative impact potential) to ensure that development does not further erode available water resources - particularly in key source water catchments and with recognition to the dependence of 'distant' environmental assets.
- Closely monitor and proactively influence decisions regarding private engineering works to ensure that such developments do not further erode the availability of water resources.
- Closely monitor and proactively influence decisions regarding proposals for water resource storage and use (including Aquifer Storage and Recovery), particularly in key source water catchments, so as to not undermine water resource availability to 'distant' environmental assets.
- Remain closely involved with water allocation planning processes, to provide advice on environmental watering requirements and USE Network capabilities for managing flows, and to ensure environmental water allocations are established as a priority.

These approaches are consistent with the Strategies and Principles outlined in the Strategy.

The Implementation Plan is a working document that will be reviewed regularly and updated, consistent with the principles and strategies of the Strategy.

CHAPTER 1: MANAGEMENT PRINCIPLES FOR SOURCE WATER CATCHMENTS

Broad *Management Principles for Source Water Catchments* have been identified for five key catchments including:

- Southern Bakers Range Catchment - *South of Drain M to the Callendale regulator;*
- Mosquito Creek Catchment - *To Bool Lagoon (and including outlet via Drain M);*
- Naracoorte Creek Catchment - *To Lake Ormerod;*
- Morambro Creek Catchment - *Including Nyroca Channel; and*
- Tatiara-Nalang Creek Catchment - *To the Riddoch Highway.*

Detailed information for each of the source water catchment areas is provided in the following tables including:

- Brief description of the catchment area;
- Profile of the water resource;
- Use of the water resource;
- Critical control points;
- Future USE Network management; and
- Project works.

A map identifying the location of each of these catchments is provided in **Appendix A**.

Management principles for source water catchments:

SOUTHERN BAKERS RANGE (SBR) CATCHMENT *South of Drain M to the Callendale regulator*
DESCRIPTION OF THE CATCHMENT AREA The SBR catchment area extends to the south of Kalangadoo and features average annual rainfalls of 700-800mm. The catchment area exceeds 90,000ha. Surface water from this catchment is delivered to Drain M (above the Callendale regulator) via the SBR Drain, Drain B, Drain C and the Killanoola Drain.
PROFILE OF THE WATER RESOURCE This catchment generates large volumes of freshwater (20-100 GL at <250EC) under normal or higher rainfall conditions .The +40,000ha Drain C catchment (to the east) also contributes flows to Callendale under normal conditions, but is ungauged. The majority of flow is generated downstream of the Riddoch Highway.
USE OF THE WATER RESOURCE There is no large scale water storage in this catchment. The extensive development of hardwood plantations and irrigation across this catchment has significant implications for groundwater draw-down and surface water runoff. At present there is no surface water allocation plan over this catchment. Groundwater extraction is regulated by the Comaum-Caroline Water Allocation Plan (WAP) and Lacepede Kongorong WAP (to be superseded by the Lower Limestone Coast WAP, once adopted).
CRITICAL CONTROL POINTS The Callendale regulator, at the bottom of this catchment has the capability to allow surface flows to drain to the coast at Rivoli Bay (where they can also be retained in Lake George); or to be diverted northwards along the historical Bakers Range watercourse (via the REFLOWS Western Floodway).
FUTURE NETWORK MANAGEMENT Significant flows from the SBR catchment can be directed via the REFLOWS Western Floodway to reinstate historical environmental flow regimes to key wetlands in the USE. Under high flow events water will be released through the Callendale regulator, to flow via Drain M to Lake George (adding to the yield from the Drain M system below the Callendale regulator) and to Rivoli Bay.
PROJECT WORKS No additional major works are identified for this catchment at this time.

Management principles for source water catchments:

MOSQUITO CREEK CATCHMENT

To Bool Lagoon (and including outlet via Drain M)

DESCRIPTION OF THE CATCHMENT AREA

The Mosquito Creek catchment area extends across the border to Edenhope in western Victoria, and features average annual rainfalls of 550-650mm. The effective, discharging catchment area is currently estimated at approximately 100,000ha. Surface water from this catchment drains via natural watercourses to Bool Lagoon.

The much smaller Seymour-Robertson catchment to the south (40,000ha) also feeds Bool Lagoon, but is ungauged.

The current primary outlet to Bool Lagoon is into Drain M, which conveys water to the Callendale regulator (at the SBR watercourse), and to the coast. A flood relief weir is situated in Hack's Lagoon and discharges water to the Mosquito Creek watercourse in flood events. The Mosquito Creek inlet channel has greater capacity than the Bool Lagoon - Drain M outlet.

PROFILE OF THE WATER RESOURCE

This catchment generates large volumes of freshwater (averaging 20 GL at less than 3,000EC) under normal or higher rainfall conditions.

The Seymour-Robertson catchment can contribute significant flows to Bool Lagoon under wet conditions.

USE OF THE WATER RESOURCE

There is no large scale water storage in this catchment[1]. Permit policies outlined in the SE NRM Board's Regional NRM Plan (2010), prohibit any further dam development in the Mosquito Creek catchment upstream of Bool Lagoon. The extensive development of hardwood plantations across this catchment has significant implications for groundwater draw-down and surface water runoff.

At present there is no surface water allocation plan over this catchment. Groundwater extraction is regulated by the existing 2001 water allocation plans. Depending on the extent of the catchment, this could cover areas of the 2001 Comaum-Caroline, Naracoorte Ranges and Lacepede Kongorong WAPs. Note that Lower Limestone Coast WAP is currently being developed and will supersede these WAPs, once adopted.

At present there are no formal cross-border surface water sharing arrangements in place between the South Australian and Victorian Governments to ensure whole of catchment approach to cross border catchment management. However, a cross-jurisdictional pilot project (using the Mosquito Creek Catchment as a study area) sought to identify and address

[1] Large scale water storage in this catchment includes natural and non-natural ie dams.

issues brought about by fragmented management and develop transferable catchment management protocols for the integrated and sustainable management of shared catchments.

The 2006 Park Management and Ramsar Plan includes high level objectives for the future management of the hydrology of the Bool and Hacks Lagoons wetland complex, which are underpinned by a set of water level and flow management guidelines for storage and release of inflows (predominantly from Mosquito Creek) to balance flood mitigation and environmental watering purposes.

The current operating protocols for Bool Lagoon identify operating water levels which equate to the retention of 20 GL in this Ramsar wetland prior to any release of flows into Drain M.

The operation of the USE Network, in particular planned diversions of water from Drain M northwards via the REFLOWS Western Floodway to provide environmental flows to key wetlands in the USE, will be planned and implemented with full consideration to supporting the environmental water requirements and agreed operating targets for the Bool and Hacks Lagoons Ramsar Site.

Known populations of the Yarra Pygmy Perch are found in Bool Lagoon (when flooded). The Southern Bell Frog is known to exist in the Bool Lagoon complex.

CRITICAL CONTROL POINTS

The current Bool Lagoon (Drain M) regulator releases surplus water from Bool Lagoon into Drain M with the Hacks Lagoon spillway acting as a flood relief control.

The Callendale regulator, at the bottom of this catchment has the capability to divert flows northwards along the historical Bakers Range watercourse (via the REFLOWS Western Floodway); or to allow surface flows to drain to the coast (Lake George).

FUTURE NETWORK MANAGEMENT

Flows from the Mosquito Creek (and Seymour-Robertson) catchment will continue to be applied to meet the hydrological requirements of the Bool Lagoon Ramsar wetland complex.

In significant rainfall/runoff events, surplus water from Bool Lagoon will be released to Drain M for transfer to the Callendale regulator (at the Southern Bakers Range watercourse) which has the capability to divert environmental flows northwards along the historical Bakers Range watercourse (via the REFLOWS Western Floodway); or to allow surface flows to drain to the coast (Lake George).

Outflows from this area in very high rainfall/runoff periods flow into the Bakers Range watercourse upstream of the Kercoonda Interchange regulator.

PROJECT WORKS

Upgrade Bool Lagoon regulator.

Management principles for source water catchments:

NARACOORTE CREEK CATCHMENT *To Lake Ormerod*
DESCRIPTION OF THE CATCHMENT AREA The Naracoorte Creek catchment area extends across the border into western Victoria, and features average annual rainfalls of 550-650mm. The effective, discharging catchment area is currently estimated at approximately 90,000ha. Surface water from this catchment drains via natural watercourses to Lake Ormerod (west of Naracoorte) and then into Drain E.
PROFILE OF THE WATER RESOURCE This catchment generates irregular volumes of freshwater (1-30 GL at <250EC) under normal or higher rainfall conditions.
USE OF THE WATER RESOURCE With the exception of Dyne and Mullinger Swamps there is no large scale water storage in this catchment. Considerable groundwater based irrigation in the upper catchment has some implications for groundwater draw-down. There is at this time no surface water allocation plan over this catchment. Groundwater extraction is regulated by the Comaum-Caroline WAP and Lacepede Kongorong WAP (to be superseded by the Lower Limestone Coast Prescribed Wells Area WAP, once adopted). At present there are no formal surface water arrangements in place between the South Australian and Victorian Governments to ensure whole of catchment approach to cross border catchment management.
CRITICAL CONTROL POINTS Lake Ormerod is a popular local landmark and previous management of flows from Naracoorte Creek (which enters into Lake Ormerod) has seen some 500ML retained in the lake before surplus water has been released into Drain E.
FUTURE NETWORK MANAGEMENT Flows from Naracoorte Creek will continue to be directed into Lake Ormerod and Drain E - from where they will be applied to meet the hydrological requirements of key wetlands along Drain E and the Marcollat watercourse. Outflows from this area in very high rainfall/runoff periods flow via Jip Jip Swamp and the Jip Jip channel into the Bakers Range watercourse upstream of the Kercooda Interchange regulator. Prior to the construction of the McCarthy's Waterhole stop-bank and the Jip Jip diversion bank, outflows from this area used to flow northwards to the Bunbury and Coola Coola/Gum

Lagoon watercourses respectively. Reinstatement of the Coola Coola/Gum Lagoon flow path in particular may be a focus for future negotiation with landowners.
PROJECT WORKS No additional major works are identified for this management unit at this time.

Management principles for source water catchments:

MORAMBRO CREEK CATCHMENT

Including Nyroca Channel

DESCRIPTION OF THE CATCHMENT AREA

The Morambro Creek catchment area extends across the border into western Victoria, and features average annual rainfalls of 500-600mm. The effective, discharging catchment area is currently estimated at up to 100,000ha. Surface water from this catchment drains via natural watercourses to Cockatoo Lake (near Keppoch). Outflows from Cockatoo Lake flow via the Nyroca Channel into the Marcollat watercourse, at the upstream end of the Willalooka Wetlands.

PROFILE OF THE WATER RESOURCE

This catchment generates irregular volumes of freshwater (300-2000ML, but up to 1.4 GL at <250EC) under normal or higher rainfall conditions.

USE OF THE WATER RESOURCE

Other than Lake Cadnite and Cockatoo Lake there are no large scale water storages in this catchment.

There are a number of natural runaway holes and drainage wells in the upper catchment that potentially impact upon the surface water yield from the catchment.

Groundwater based irrigation in the upper catchment also has some implications for groundwater draw-down.

The South Australian portion of this catchment is subject to the WAP for the Morambro Creek Prescribed Surface Water Area. Although there has not been significant historical surface water extraction, the irrigators from the Padthaway district have expressed interest in drawing water from the Morambro Creek during flow events for Aquifer Storage and Recovery (ASR), to address significant groundwater table drawdown and consequent increases in salinity resulting from the high levels of extraction from this groundwater resource. The water allocation plan secures a primary volume of water from Morambro Creek for environmental flows and permits a sliding-scale of extraction for ASR, based upon seasonal flow volumes.

Groundwater extraction is regulated by the Comaum-Caroline WAP and Lacepede Kongorong WAP (to be superseded by the Lower Limestone Coast Prescribed Wells Area WAP, once adopted).

At present there are no formal surface water arrangements in place between the South Australian and Victorian Governments to ensure whole of catchment approach to cross border catchment management.

The Southern Bell Frog is known to exist on the Morambro Creek, in Lake Cadnite (near Frances).

CRITICAL CONTROL POINTS

Cockatoo Lake is a popular local landmark and recreational water body. The Lake must fill before water outflows into the Nyroca Channel and on to the Marcollat watercourse. The outflow is through a fixed sill and there is no regulator at this point.

FUTURE NETWORK MANAGEMENT

Flows from Morambro Creek will continue to be directed into Cockatoo Lake, with outflows to the Marcollat watercourse via Nyroca Channel - from where they will be applied to meet the hydrological requirements of key wetlands along the Marcollat watercourse.

Flows in this catchment are managed in accordance with the Water Allocation Plan for the Morambro Creek and Nyroca Channel Prescribed Watercourses (including Cockatoo Lake and the Prescribed Surface Water Area).

Outflows from this area in very high rainfall/runoff periods flow via Jip Jip Swamp and the Jip Jip channel into the Bakers Range watercourse upstream of the Kercooda Interchange regulator.

Prior to the construction of the McCarthy's Waterhole stop-bank and the Jip Jip diversion bank, outflows from this area used to flow northwards to the Bunbury and Coola Coola/Gum Lagoon watercourses respectively. Reinstatement of the Coola Coola/Gum Lagoon flow path in particular may be a focus for future negotiation with landowners.

PROJECT WORKS

No additional major works are identified for this management unit at this time.

Management principles for source water catchments:

TATIARA-NALANG CREEK CATCHMENT *To the Riddoch Highway*
DESCRIPTION OF THE CATCHMENT AREA The Tatiara-Nalang Creeks catchment area extends across the border into western Victoria, and features average annual rainfalls of 400-500mm. The effective, discharging catchment area is currently estimated at up to 100,000ha. There are a number of natural runaway holes in the catchment that potentially impact upon surface water yield. Extensive development of dryland lucerne and other perennial crops, clay spreading, construction of contour banks and stubble retention in this catchment will also affect runoff volumes. Surface water from this catchment drains via natural watercourses to the low, flat country of the Hundred of Stirling (south of Keith).
PROFILE OF THE WATER RESOURCE This catchment generates irregular volumes of freshwater (50-2000ML, but on rare occasion up to 19 GL at <400EC) under normal or higher rainfall conditions. In infrequent high rainfall/runoff periods large volumes of water discharged from these watercourses have been 'trapped' in the landscape south of Keith by the Black Range (to the west) resulting in extensive, prolonged inundation of the landscape.
USE OF THE WATER RESOURCE Except for Eates Swamp, there is no large scale water storage in this catchment. Groundwater based irrigation in the catchment also has had significant implications for groundwater draw-down (particularly in the Hundred of Stirling in the Tatiara Prescribed Wells Area). The South Australian portion of this catchment is subject to the WAP for the Tatiara Prescribed Wells Area. Groundwater in the Tatiara Prescribed Wells Area is currently managed through the 2010 Tatiara Water Allocation Plan. Irrigators in this area are keen to ensure that available surface water is managed to optimise recharge of depleted aquifers and have proposed the exploration of ASR options for discharges from the Tatiara-Nalang Creeks. At present there are no formal surface water arrangements in place between the South Australian and Victorian Governments to ensure whole of catchment approach to cross border catchment management.
CRITICAL CONTROL POINTS There are no significant surface water critical control points in the Tatiara-Nalang Creeks catchment at this time. However, if there is a two creek event, the slides into Sandy Joes

runaway holes can be operated to delay water flooding the Canawigarra Road.

The Mount Charles Drain (constructed under the USE Program at the bottom of this catchment) provides the capacity to release discharges from the Tatiara-Nalang Creeks catchment (trapped behind the Black Range) under infrequent extreme rainfall/runoff conditions. Flows into this drain are limited by two regulators (one on Range Road and one on Keith-Cantara Road) which remain closed unless a conscious decision is made to drain flood-water from this landscape.

The Range Road regulator also provides for the diversion of a small volume of freshwater into the adjacent Gum Waterhole wetland.

FUTURE NETWORK MANAGEMENT

Surface water from this catchment will continue to drain via natural watercourses to the low, flat country of the Hundred of Stirling (south of Keith) in higher rainfall periods.

The exploration of ASR options for discharges from the Tatiara-Nalang Creeks to optimise recharge of depleted aquifers may be pursued in the context of WAP review processes.

Under relatively infrequent extreme rainfall/runoff conditions, discharges from the Tatiara-Nalang Creeks, which may cause extensive prolonged flooding across the flat country of the Hundred of Stirling and impact upon agricultural production, may be released via the Mount Charles Drain.

Flows into this drain are limited by two regulators (one on Range Road and one on Keith-Cantara Road) which will remain closed unless a conscious decision is made to drain flood-water from this landscape.

The Range Road regulator will also be operated to provide for the diversion of freshwater into the small adjacent Gum Waterhole wetland.

PROJECT WORKS

No additional major works are identified for this management unit at this time.

The exploration of ASR options for discharges from the Tatiara-Nalang Creeks to optimise recharge of depleted aquifers may be pursued in the context of water allocation planning review processes.

Possible areas for investigation in the future include the feasibility of a pulse regulating capability within the Tatiara Creek and self regulating options upstream of Bordertown.

CHAPTER 2: MANAGEMENT PRINCIPLES FOR USE NETWORK MANAGEMENT UNITS

Broad *Management Principles* have been identified for sixteen *Network Management Units including*:

1. **Drain E Swamps -** *Lake Ormerod to Jaffrays Complex;*
2. **Marcollat Watercourse-** *Muddies Swamp to Jip Jip Swamp;*
3. **Gum Lagoon/ Duck Island-** *Rosemary Downs Drain, Bunbury Drain, Coola Coola;*
4. **South-Central Bakers Range Watercourse -** *Drain M to Angel's Road;*
5. **North-Central Bakers Range Watercourse -** *Angels Road to Petherick Road;*
6. **Northern Bakers Range Watercourse -** *Mandina Marshes to Messent Conservation Park;*
7. **Tresant Drain-** *Bloomfield Swamp to Fairview Conservation Park;*
8. **Fairview Drain;**
9. **East Avenue Watercourse -** *Boatman's Swamp to the Fairview Drain, including Phillips Gap regulator;*
10. **West Avenue Watercourse -** *Bakers Range transfer regulator to Litigation Lane;*
11. **Wimpinmerit;**
12. **Taratap Watercourse -** *Rushy Swamp to Henry Creek;*
13. **Tilley Swamp Watercourse -** *Henry Creek to the Northern Outlet Drain;*
14. **Northern Catchments-** *Mount Charles, Bunbury & Taunta Hut Drains;*
15. **Morella Basin; and**
16. **Releases into the south lagoon of the Coorong.**

A brief outline of USE Network management unit priorities is provided in **Table 1**.

Detailed information for each management unit follows including details on:

- Source water;
- Critical control points;
- Key environmental features;
- Significant agricultural issues;
- Future USE Network management;
- Priorities; and
- Priority maintenance works.

A map for each of these Management Units is available in **Appendix A**.

Table 1: USE Network Management Unit Priorities

Priorities	1	2	3	4	5	6	7	8	9	10	11	12	13
Maintain the arterial flood mitigation service.	✓	-	-	✓	✓	✓	✓		-	-		-	✓
Maintain the arterial flood and salinity mitigation service to reduce inundation and risk of salinity on agricultural lands	-	✓	✓	-	-	-	-	✓	-	-		-	-
Maintain local flood mitigation services.	-	-	-	-	-	-	-		✓	-		-	-
Develop and maintain the arterial flood and salinity mitigation service and environmental flow infrastructure	-	-	-	-	-	-	-		-	✓	✓	-	-
Develop and maintain the arterial flood and salinity mitigation services.	-	-	-	-	-	-	-		-	-		✓	-
Provide optimum environmental flows to key wetland assets (and other wetland features) under changing climatic conditions.	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	-
Direct surplus water resources from this area (ie SC Bakers Range) to the central and northern Bakers Range watercourse and for diversion to the West Avenue watercourse, Tilley Swamp and/or the south lagoon of the Coorong.	-	-	-	✓	-	-	-		-	-		-	-
Periodically divert environmental flows from Drain M (at Callendale) via REFLOWS Western Floodway as available	-	-	-	✓	✓	✓	-		-	-		-	-
Divert environmental flows from Drain M (at Callendale) via REFLOWS Western Floodway as available	-	-	-	-	-	-	-		-	-		-	✓
Provide periodic environmental flows to the Tilley Swamp watercourse under changing climatic conditions - by diverting flows from Bakers Range watercourse; and outflows from the West Avenue watercourse, and the Taratap watercourse into Tilley Swamp for environmental watering, when adequate water resources are available.	-	-	-	-	-	-	-		-	-		-	✓
Divert environmental flows from Drain M (at Callendale) via the REFLOWS Western Floodway as available; and divert a proportion of these flows to the West Avenue watercourse via West Avenue transfer regulator (at Schofield Swamp).	-	-	-	-	-	-	-		-	✓		-	-
Maintain fresh (spring) water flows to Litigation Lane ponds to sustain the resident population of Yarra Pygmy Perch.	-	-	-	-	-	-	-		-	✓		-	-
Manage the transfer of a proportion of flows from the SBR catchment (via the REFLOWS Western Floodway) to the West Avenue watercourse, via the Fairview Drain.	-	-	-	-	✓	-	-		-	-		-	-
Work with relevant landholders to improve on-farm water management and to harvest suitable quality surface (flood) water from agricultural landscape and direct into the watercourse.	✓	✓	✓	-	✓	✓	✓		✓	✓		✓	✓
Divert surplus water (specific details of diversion contained under management principles for each unit)	✓	✓	-	-	✓	✓	-		✓	✓		-	-
Seek to secure legal agreements with landholders to continue to provide environmental flows to privately-owned wetlands	-	-	-	-	-	-	✓		-	-		-	-
Re-establish historic flow path from the Jip Jip Swamp regulator to Gum Lagoon wetlands via Coola Coola watercourse	-	-	✓	-	-	-	-		-	-		-	-
Review landholder agreements for the operation of pumps								✓					
Work w relevant landholders to improve on-farm water management & to harvest suitable quality surface water from agricultural landscape and direct into Wimpinmerit Floodway for delivery to downstream wetlands											✓		

Priorities continued	14	15	16
Maintain the arterial flood mitigation service.	✓	-	-
Flows through the Mt Charles Drain are limited by two regulators, which will remain closed unless a conscious decision is made to drain flood-water from this landscape.	✓	-	-
Under the infrequent extreme rainfall/runoff conditions discharges from the Tatiara-Nalang Creeks catchment which cause extensive prolonged flooding that may impact upon agricultural production may be released via the Mount Charles Drain.	✓	-	-
Retain opportunistic environmental flows in key wetland assets along the drains, under changing climatic conditions.	✓	-	-
Explore ASR options for discharges from the Tatiara-Nalang Creeks in the context of the WAP review processes.	✓	-	-
Work with relevant landholders to improve on farm water management and to harvest suitable quality surface (flood) water from agricultural landscape and direct into wetlands.	✓	-	-
Direct surplus water resources from the northern catchments to Morella Basin and the south lagoon of the Coorong, via the Northern Outlet Drain.	✓	-	-
Deliver environmental flows from the USE Network to the south lagoon of the Coorong as available under changing climatic conditions (generally only under very high rainfall/runoff conditions).	-	-	✓
Manage the detention of water in Morella Basin and subsequent releases into the south lagoon of the Coorong to optimise: • water levels (and related habitat values) and water quality in the Basin (as a significant wetland in its own right); and • releases into the south lagoon of the Coorong.	-	✓	-
Maintain the health of the Morella Basin as a key water-bird drought refuge in the region and as a source of propagules for the south lagoon of the Coorong, under improved hydrological conditions.	-	✓	✓
Maintain water quality monitoring programs to identify any exceedance and/or accumulation of threatening contaminants in the Basin; and to confirm the condition of the water body prior to any release into the south lagoon of the Coorong (in particular any contamination risks).	-	✓	✓
Maintain ecological monitoring programs within the Basin site as part of the regional wetland health monitoring and evaluation framework.	-	✓	-
Maintain 'release' water quality monitoring program to identify any implications of discharge from the USE Network on water quality in the receiving environment of the south lagoon of the Coorong.	-	-[2]	✓

[2] **1= DRAIN E SWAMPS** *2=* **MARCOLLAT WATERCOURSE** *3=* **GUM LAGOON/DUCK ISLAND** *4=***SOUTH-CENTRAL BAKERS RANGE (SCBR) WATERCOURSE** *5=* **NORTH-CENTRAL BAKER'S RANGE (NCBR) WATERCOURSE** *6=* **NORTHERN BAKER'S RANGE (NBR) WATERCOURSE**, *7=* **THE TRESANT DRAIN -** *Bloomfield, 8=* ***FAIRVIEW DRAIN***, *9=***EAST AVENUE WATERCOURSE**, **10=WEST AVENUE WATERCOURSE, 11 = WIMPINMERIT,** *12=* **TARATAP WATERCOURSE,** *13=***TILLEY SWAMP WATERCOURSE,** *14=***NORTHERN CATCHMENTS,** *15=***MORELLA BASIN,** *16=* **RELEASES INTO THE SOUTH LAGOON OF THE COORONG**

Management principles for USE Network management units:

DRAIN E SWAMPS

Lake Ormerod to Jaffrays Complex

SOURCE WATER

The Drain E area represents the historical discharge flow path from Bool Lagoon (and the Mosquito Creek catchment) and from Naracoorte Creek.

For many years the principal outflow from Bool Lagoon has been via Drain M to the coast.

Drain E currently receives cross-border flooding flows from Naracoorte Creek, as well as its large local catchment area.

CRITICAL CONTROL POINTS

Hacks Lagoon flood-relief structure; and in association Bool Lagoon (west) regulator – for discharges into Drain M.

Lake Ormerod - discharge of Naracoorte Creek flows into Drain E.

Lochaber Swamp regulator - detention/retention of flows in Drain E in this large swamp.

Jaffrays Swamp regulator - detention/retention of flows in this large wetland complex.

KEY ENVIRONMENTAL FEATURES AND HABITATS OF BIODIVERSITY SIGNIFICANCE

Many wetlands along the watercourse have been heavily degraded by agricultural development and modified to provide better drainage of surface water.

Management agreements have been established with some landholders to protect wetlands along the watercourse, to reinstate sills and build regulators to fill wetlands whilst also providing for flood management.

Key wetland assets include: Lake Ormerod, Garry Swamp, Lochaber Swamp, Fishers Swamp, Black Cocky Lagoon, Seagull Swamp, Fisher Swamp, and Jaffrays Complex.

Southern Bell Frog is known to exist in Lake Ormerod.

SIGNIFICANT AGRICULTURAL ISSUES

Flood Mitigation: This area is very prone to extensive inundation under normal to higher rainfall conditions.

Drain E has been developed to provide a flood mitigation service through this area – discharging these floodwaters northwards into the Marcollat watercourse. Private on-farm drainage has been developed to connect into the arterial system. Drain E however is quite varied in its construction capacity and ability to transmit flows effectively.

Salinity: Salinity is not regarded as a significant issue in this part of the landscape.

FUTURE NETWORK MANAGEMENT

Flows from Naracoorte Creek (discharging from Lake Ormerod) will continue to be directed

through Drain E to the Marcollat watercourse, upstream of the Jaffray's Complex.

Environmental flows will be diverted/ retained variously in targeted wetlands along the Drain E corridor; subject to water resource availability, the regional Adaptive Flows Management Framework and established management plans and other arrangements in place with respective landholders.

Surplus flows through the Marcollat watercourse follows a natural flow path into the Bakers Range watercourse via Jip Jip Swamp, where they can be directed to the significant wetlands of the Northern Bakers Range area, or to the Coorong.

PRIORITIES

Maintain the arterial flood mitigation service.

Provide optimum environmental flows to key wetland assets (and other wetland features) under changing climatic conditions.

Work with relevant landholders to improve on-farm water management and to harvest suitable quality surface (flood) water from agricultural landscape and direct into the watercourse.

Direct surplus water resources from this area to the northern Bakers Range watercourse, Tilley Swamp and/or the south lagoon of the Coorong.

PROJECT WORKS

Establish wetland environmental flow regulators as identified by individual agreements.

PRIORITY MAINTENANCE

Nil

Management principles for USE Network management units:

MARCOLLAT WATERCOURSE *Muddies Swamp to Jip Jip Swamp*
SOURCE WATER The Marcollat area receives cross-border flooding flows from Morambro Creek – via Nyroca Channel which discharges into the upstream end of the Willalooka Wetlands; and from Naracoorte Creek - via Drain E, which discharges above the Jaffrays Complex; as well as its large local catchment area.
CRITICAL CONTROL POINTS Little Bool Lagoon (Round Swamp) regulator; and in association Bool Lagoon (west) regulator – for discharges into Drain M. Jaffrays Swamp regulator – flood mitigation and retention of flows from Drain E. Willalooka Wetlands regulators – flood mitigation and retention of flows. Jip Jip Swamp regulator – flood mitigation and retention of flows.
KEY ENVIRONMENTAL FEATURES AND HABITATS OF BIODIVERSITY SIGNIFICANCE Many wetlands along the watercourse have been heavily degraded by agricultural development and modified to provide better drainage of surface water. Some have been affected by increasing groundwater and soil salinity. Management agreements have been established with some landholders to protect wetlands along the watercourse and to reinstate sills and build regulators to fill wetlands whilst also providing for flood management. Key wetland assets include: the Willalooka Wetlands, Kyeema Swamp and Jip Jip Swamp.
SIGNIFICANT AGRICULTURAL ISSUES Salinity: Very high level salinity impacts are expressed in parts of the area. A groundwater drainage service has been provided to the worst salinity-affected areas by means of the Didicoolum Drain. Flood Mitigation: The Didicoolum Drain has been designed to exclude fresh surface water from the drain and incorporates environmental flow 'overpasses' to enable surface flows from the local rural catchment to be harvested and cross efficiently over the drain into the watercourse. Landholders are supported by regional agronomists to adopt on-farm measures, such as clay spreading and perennial pasture establishment to manage recharge, and can apply gypsum and other measures to address sodicity, where it may occur.

FUTURE NETWORK MANAGEMENT

Saline groundwater base-flows in the Didicoolum Drain will flow via the USE Network to Morella Basin for controlled release into the south lagoon of the Coorong.

Flows from Nyroca Channel (Morambro Creek) and Drain E (Naracoorte Creek) will continue to be directed through the Marcollat watercourse.

Environmental flows will be diverted/retained variously in targeted wetlands along the Marcollat watercourse; subject to water resource availability, the regional Adaptive Flows Management Framework and established management plans and other arrangements in place with respective landholders.

Surplus flows through the Marcollat watercourse follows a natural flow path into the Bakers Range watercourse via Jip Jip Swamp - where they can be directed to the significant wetlands of the Northern Bakers Range area, or to the Coorong.

PRIORITIES

Maintain the arterial flood and salinity mitigation service.

Provide optimum environmental flows to key wetland assets (and other wetland features) under changing climatic conditions.

Work with relevant landholders to improve on-farm water management and to harvest suitable quality surface (flood) water from agricultural landscape and direct into the watercourse.

Direct surplus water resources from this area to the northern Bakers Range watercourse, Tilley Swamp and/or the south lagoon of the Coorong.

PROJECT WORKS

No additional major works are identified for this management unit at this time.

Establish wetland environmental flow regulators as identified by individual agreements.

PRIORITY MAINTENANCE

Removal of vegetation in the downstream sections of the Didicoolum Drain

Machine cleaning of Didicoolum Drain is required to remove silt.

Rock beaching is required to maintain access tracks across freshwater overpasses.

Install a regulator on Little Reedy Swamp outlet to provide low flow management.

Repairs are required to seal leak in South Reedy Regulator and reinstate sill on Big Reedy Outlet bank.

Management principles for USE Network management units:

GUM LAGOON/DUCK ISLAND

Rosemary Downs Drain, Bunbury Drain, Coola Coola

SOURCE WATER

The Gum Lagoon wetlands historically received much of their environmental flows from the Marcollat catchment (and linked catchments) via the Jip Jip Chanel and Coola Coola watercourse. This flow has been almost entirely cut off by private works, the establishment of a 'stop bank' on the Coola Coola watercourse and the construction of the older section of the Didicoolum Drain. Likewise, northward flow to the Bunbury watercourse was cut-off by the construction of the stop-bank at McCarthy's Waterhole.

The Duck Island wetlands receive much of their environmental flows from local catchment, but also from the extended catchment area to the south and east. The development of the upper Bunbury Drain had the potential to reduce the flow of water from the east, but a connecting diversion channel into the Duck Island area enables such flows to be maintained. The development of the Rosemary Downs Drain (to the south) harvests flows from this extended catchment area and directs them northwards into the Duck Island area via natural watercourse country.

CRITICAL CONTROL POINTS

Bunbury Drain diversion regulators – divert water from the upper Bunbury Drain into Duck Island.

Rosemary Downs Drain diversion regulator directs water from this drain preferentially northwards to the Duck Island area or releases excess floodwaters into the Didicoolum Drain.

The Duck Island regulator retains water in the Duck Island lagoon and/or releases water into the Taunta Hut Drain.

Jip Jip Swamp regulator controls releases of water from the Marcollat watercourse into the Bakers Range watercourse.

KEY ENVIRONMENTAL FEATURES & HABITATS OF BIODIVERSITY SIGNIFICANCE

The Gum Lagoon and Duck Island Complex are managed under cooperative arrangements between the Department of Environment and Natural Resources and Duck Island partners. The complex is one of the largest intact remnants of Melaleuca shrub-land, banksia woodland and deep swamps in the region and supports active Malleefowl nesting mounds.

The Management Plan for the complex identifies that the natural regime of infrequent flooding should be restored to the deep Red Gum lagoons in the western section of the park and that the reinstatement of an appropriate hydrological system will be crucial to the sustainability and health of this important and rare watercourse habitat.

Key wetland assets include: Gum Lagoon Conservation Park/ Duck Island Complex.

SIGNIFICANT AGRICULTURAL ISSUES

Salinity: High level salinity impacts are expressed in agricultural lands surrounding the complex. A groundwater drainage service has been provided to the worst salinity-affected areas by means of the Didicoolum Drain to the south of the complex and extensive private on-farm works.

Flood Mitigation: The agricultural lands surrounding the complex are prone to inundation under normal and higher rainfall conditions. Extensive private on-farm works have been developed to the south of the complex in particular, aimed at shedding surface water from the landscape, generally in the direction of the Bakers Range watercourse.

Landholders are supported by regional agronomists to adopt on-farm measures, such as clay spreading and perennial pasture establishment to manage recharge, and can apply gypsum to address sodicity, where it may occur.

FUTURE NETWORK MANAGEMENT

Saline groundwater base-flows in the Didicoolum Drain will flow via the USE Network to Morella Basin for controlled release into the south lagoon of the Coorong.

Flows from Nyroca Channel (Morambro Creek) and Drain E (Naracoorte Creek) will continue to be directed through the Marcollat watercourse.

Surplus flows through the Marcollat watercourse follow a natural flow path into the Jip Jip Swamp (and the Bakers Range watercourse). The historic flow path from the Jip Jip Swamp to the Gum Lagoon wetlands, via the Coola Coola watercourse must be redeveloped.

Suitable quality flows from the upper Bunbury Drain will be directed into the Duck Island complex.

Suitable quality flows from the Rosemary Downs Drain will be directed preferentially northwards to the Duck Island area; under extreme runoff/inundation events, excess floodwaters may be released into the Didicoolum Drain.

Environmental flows will be diverted/retained variously in the Gum Lagoon/Duck Island Complex; subject to water resource availability, the regional Adaptive Flows Management Framework and established management plans and other arrangements in place with respective landholders.

The infrequent releases of water from the Duck Island regulator will be planned so as not to flood downstream agricultural land (now largely protected by the Taunta Hut Drain).

PRIORITIES

Maintain the arterial flood and salinity mitigation service.

Provide optimum environmental flows to key wetland assets (and other wetland features) under changing climatic conditions.

Work with relevant landholders to improve on-farm water management and to harvest

suitable quality surface (flood) water from agricultural landscape and direct into the watercourse.

Re-establish the historic flow path from the Jip Jip Swamp regulator to the Gum Lagoon wetlands via Coola Coola watercourse.

PROJECT WORKS

Negotiate, design, develop and utilise an environmental flow pathway from Jip Jip Swamp regulator to the Gum Lagoon wetlands via Coola Coola watercourse, including:

- A diversion regulator for flow northwards along the Coola Coola watercourse;
- An environmental flow overpass across the Didicoolum Drain;
- The removal of the stop-bank on the Coola Coola watercourse; and
- The installation of flow/retention regulating structures along the Coola Coola watercourse.

PRIORITY MAINTENANCE

Track maintenance is required along the Bunbury Drain to repair sand erosion.

Repairs are required to seal around diversion regulator structure on Rosemary Downs Drain.

Machine cleaning of Didicoolum Drain near Rosemary Downs Drain is required to remove silt. Consideration should be given to preventing stock access to the drain.

Rosemary Downs track on spoil needs to be levelled for access.

Management principles for USE Network management units:

SOUTH-CENTRAL BAKERS RANGE (SCBR) WATERCOURSE *Drain M to Angel's Road*
SOURCE WATER The SCBR watercourse presently derives most of its water resources from its large local catchment area (north of Drain M). Significant historical flows from the SBR catchment (south of Drain M) – which generates very large volumes of freshwater (20-100 GL @ <250EC) under normal or higher rainfall conditions – have been largely cut off by this drain and are drained to the sea. Yields from this catchment have also been significantly affected over recent years by the extensive development of commercial Blue Gum plantation forests.
CRITICAL CONTROL POINTS The Callendale regulator (on Drain M) has the capability to allow surface flows to drain to the coast at Rivoli Bay (where they can also be retained in Lake George); or to be diverted northwards along the historical Bakers Range watercourse (via the REFLOWS Western Floodway).
KEY ENVIRONMENTAL FEATURES AND HABITATS OF BIODIVERSITY SIGNIFICANCE Many wetlands along the watercourse have been heavily degraded by agricultural development and modified to provide better drainage of surface water. Management agreements have been established with some landholders to protect wetlands along the watercourse, to reinstate sills and build regulators to fill wetlands whilst also providing for flood management. **Key wetland assets include**: Broadlands Swamps, DiGiorgio Wetlands, Katani Park (Green) Swamp, and Brooklyn Swamps.
SIGNIFICANT AGRICULTURAL ISSUES **Flood Mitigation:** This area is very prone to extensive inundation under normal to higher rainfall conditions. The SCBR watercourse has been modified, primarily by removing sills between wetlands and using the watercourse to provide a flood mitigation service through this area – discharging these floodwaters northwards along the SCBR watercourse. This watercourse drainage system however is quite varied in its construction capacity and ability to transmit flows effectively. Private on-farm drainage has been developed to connect into the arterial system. On the limited occasions in recent years where water from this southern catchment has been diverted northwards along its historic flow path, there has been considerable resistance from

landholders in this area as a result of inundation of their agricultural land. This relates to the current configuration of the Bakers Range watercourse in this section, and that it is not constructed to contain or manage such large flow events.

Salinity: Salinity is not regarded as a significant issue in this part of the landscape.

FUTURE NETWORK MANAGEMENT

Flows generated by the local catchment will continue to be directed through the SCBR watercourse, which will be significantly upgraded under the REFLOWS project to improve flow capacity and efficiency.

These will be augmented from time to time by significant flows from the SBR catchment which will be directed via the REFLOWS Western Floodway to reinstate historical environmental flow regimes to key wetlands in the USE.

Environmental flows will be diverted/retained variously in targeted wetlands along the SCBR watercourse; subject to water resource availability, the regional Adaptive Flows Management Framework and established management plans and other arrangements in place with respective landholders.

Surplus flows from this area follow a natural flow path northwards along the Bakers Range watercourse, where they can be directed to the significant wetlands of the Northern Bakers Range area, and/or diverted to the West Avenue watercourse, Tilley Swamp and the south lagoon of the Coorong.

PRIORITIES

Maintain and improve the arterial flood mitigation service.

Provide optimum environmental flows to key wetland assets (and other wetland features) under changing climatic conditions.

Periodically divert environmental flows from Drain M (at Callendale) via the REFLOWS Western Floodway as available.

Work with relevant landholders to improve on farm water management and to harvest suitable quality surface (flood) water from agricultural landscape and direct into the watercourse.

Direct surplus water resources from this area to the central and northern Bakers Range watercourse and for diversion to the West Avenue watercourse, Tilley Swamp and/or the south lagoon of the Coorong.

PROJECT WORKS

Establish wetland environmental flow regulators as identified by individual agreements.

PRIORITY MAINTENANCE

No maintenance issues identified within the new construction.

Maintain surveillance of maintenance issues and respond as required.

Management principles for USE Network management units:

NORTH-CENTRAL BAKERS RANGE (NCBR) WATERCOURSE

Angels Road to Petherick Road

SOURCE WATER

The NCBR watercourse presently derives most of its water resources from the very large local catchment area (north of Drain M).

Significant historical flows from the SBR catchment (south of Drain M) – which generates very large volumes of freshwater (20-100 GL at <250EC) under normal or higher rainfall conditions – have been largely cut off by this drain and are drained to the sea.

The development of the Fairview Drain, Tatiara Bypass Drain (both of which carry saline groundwater) also intercept substantial fresh surface water from this local catchment as these drains were not constructed with the newer surface water exclusion/overpass features (as on the Didicoolum Drain); and further reduce available supplies of environmental water, particularly under average or lower rainfall/runoff conditions.

CRITICAL CONTROL POINTS

The Callendale regulator (on Drain M) has the capability to divert significant flows for the Southern Bakers Range catchment (south of Drain M) northwards along the historical Bakers Ranges watercourse (the REFLOWS Western Floodway); to augment local environmental flows.

The Tatiara Swamp diversion regulator enables fresh flows from SBR catchment (via the REFLOWS Western Floodway) to be diverted into the NCBR watercourse and service key wetlands between Tatiara Swamp and Petherick Road.

The combined operation of the James Road regulator (Fairview Drain) and the Nepowie regulator (NCBR catch-drain) enables saline base-flows in the Fairview Drain to be drained to the sea and fresh seasonal flows to be directed northwards along the NCBR watercourse.

The planned new West Avenue transfer regulator will enable freshwater from the REFLOWS Western Floodway to be transferred from the NCBR watercourse (at Schofield Swamp) to the West Avenue Watercourse (via the Fairview Drain).

Under high rainfall/runoff conditions the Fairview Drain, Tatiara Bypass Drain and NCBR catch-drain can be used to carry fresh environmental flows to the NCBR, Northern Bakers Range and West Avenue watercourse.

KEY ENVIRONMENTAL FEATURES AND HABITATS OF BIODIVERSITY SIGNIFICANCE

Many wetlands along the watercourse have been heavily degraded by agricultural development and modified to provide better drainage of surface water; however a number of large wetlands in this region retain significant valuable wetland habitat components that with adequate environmental flows can be sustained as quality wetland assets into the future.

Management agreements have been established with some landholders to protect wetlands along the watercourse and to reinstate sills and build regulators to fill wetlands whilst also providing for flood management.

Key wetland assets include: Tatiara Swamp, Schofield and Cave Swamp Complex, Chimney Pots Swamps, Fishfarm Swamp, Bin Bin Swamp, Del Fabro's Floodplain, Hanson-Tiver Scrub CP, Tiver Scrub Floodplain, Dirty Joes, Pretty Johnnys.

SIGNIFICANT AGRICULTURAL ISSUES

Flood Mitigation: This area is prone to inundation under normal to higher rainfall conditions.

The NCBR watercourse has been modified, primarily by removing sills between wetlands and using the watercourse to provide a flood mitigation service through this area – discharging these floodwaters northwards along the NCBR watercourse. This watercourse drainage system however is quite varied in its construction capacity and ability to transmit flows effectively.

The Tatiara Bypass Drain and the Bakers Range catch-drain have been designed to capture surface water from the agricultural landscape. Some private on-farm drainage has been developed to connect into the arterial system.

On the limited occasions in recent years where water from the SBR catchment (south of Drain M) has been diverted northwards along its historic flow path, there has been considerable resistance from some landholders in this area as a result of inundation of their agricultural land. This relates to the current configuration of the Bakers Range watercourse in this section and that it is not constructed to contain or manage such large flow events.

Salinity: High level salinity impacts are expressed in parts of the area. A groundwater drainage service has been provided to the worst salinity-affected areas by means of the Fairview Drain (in the south) and the Bakers Range Catch Drain (to the north).

Landholders are supported by regional agronomists to adopt on-farm measures, such as clay spreading and perennial pasture establishment to manage recharge, and can apply gypsum and other measures to address sodicity, where it may occur.

FUTURE NETWORK MANAGEMENT

Flows generated by the local catchment will continue to be directed through the NCBR watercourse, which will be upgraded in parts to improve flow capacity and efficiency.

These will be augmented from time to time by significant flows from the SBR catchment which will be directed via the REFLOWS Western Floodway to reinstate historical environmental flow regimes to key wetlands in the USE.

A proportion of flows from the SBR catchment (via the REFLOWS Western Floodway) will be transferred to the West Avenue watercourse, via the Fairview Drain.

Environmental flows will be diverted/retained variously in targeted wetlands along the NCBR watercourse; subject to water resource availability, the regional Adaptive Flows Management Framework and established management plans and other arrangements in place with respective landholders.

Surplus flows from this area follow a natural flow path northwards along the Bakers Range watercourse - where they can be directed to the significant wetlands of the Northern Bakers Range area, Tilley Swamp and the south lagoon of the Coorong.

PRIORITIES

Maintain and improve the arterial flood mitigation service.

Provide optimum environmental flows to key wetland assets (and other wetland features) under changing climatic conditions.

Periodically divert environmental flows from Drain M (at Callendale) via the REFLOWS Western Floodway as available.

Manage the transfer of a proportion of flows from the SBR catchment (via the REFLOWS Western Floodway) to the West Avenue watercourse, via the Fairview Drain.

Work with relevant landholders to improve on farm water management and to harvest suitable quality surface (flood) water from agricultural landscape and direct into the watercourse.

Direct surplus water resources from this area to the central and northern Bakers Range watercourse, Tilley Swamp and/or the south lagoon of the Coorong.

PROJECT WORKS

Complete the development of the REFLOWS Western Floodway including monitoring infrastructure.

Design and develop the West Avenue transfer regulator on the Fairview Drain at Schofield Swamp.

Undertake upgrades to the design/capacity of portions of the NCBR surface water management infrastructure to optimise flow capacity and efficiency as required.

Establish wetland environmental flow regulators as identified by individual agreements.

Subject to future funding – retrofit the Fairview, Tatiara Bypass and Bakers Range groundwater drains to maintain the separation of saline groundwater and fresh surface water and harvest surface water from the agricultural landscape into keys wetlands.

PRIORITY MAINTENANCE

Trim overgrown Tea-Tree bushes on the Bakers Range Catch Drain in Hanson Scrub CP-Tivers Scrub floodplain

Trim overgrown Tea-Tree bushes from within the Bakers Range floodway south of G-Cutting

Track maintenance is required along the Bakers Range Catch Drain in Hanson Scrub CP-Tivers Scrub floodplain, and along the Ballater East Drain to remove rocks and repair sand erosion

Machine cleaning of drains is required to remove silt in the Bakers Range Catch Drain

Remove blockages along the Bakers Range Watercourse between Tivers Scrub and Petherick

Road.

Develop an access track along the Watervalley Drain between Tivers Scrub and Petherick Road.

Machine cleaning of Ballater East and Wongawilli Drains is required to remove silt

Management principles for USE Network management units:

NORTHERN BAKERS RANGE (NBR) WATERCOURSE

Mandina Marshes to Messent Conservation Park

SOURCE WATER

The NBR watercourse presently derives water most regularly from its large local catchment and from the of the Bakers Range and Didicoolum drainage networks (subject to water quality – salinity).

In normal and higher rainfall/runoff periods volumes of water from these sources are adequate to sustain the basic function of many the wetlands in the NBR.

In the lower rainfall periods of the past decade, sub-optimal water (>3000EC) from the Bakers Range and Didicoolum drainage networks has been fed into these wetlands and has impacted upon freshwater ecology.

Significant historical flows from the SBR catchment (south of Drain M) – which generates very large volumes of freshwater (20-100 GL @ <250EC) under normal or higher rainfall conditions – have been largely cut off by this drain and are drained to the sea.

To sustain this watercourse will require the availability of flows (of significant volume; 10-50 GL) from adjacent and more distant catchment areas.

CRITICAL CONTROL POINTS

The Kercoonda Interchange regulators manage the flow and quality of water delivered into the wetlands of the NBR, via the Mandina Marshes and/or the Mandina Bypass Drain; and can divert water particularly saline base-flow (but also surplus freshwater during high flow periods) to Mount Rough, Tilley Swamp and the Coorong (via Morella basin).

The Callendale regulator (on Drain M) has the capability to allow surface flows to drain to the coast at Rivoli Bay (where they can also be retained in Lake George); or to be diverted northwards along the historical Bakers Ranges watercourse (via the REFLOWS Western Floodway).

The Mandina Bypass Drain enables flows to be diverted around the Mandina Marshes and into Cortina Lakes (and points north).

The Mandina Outlet regulator (at Log Crossing) controls retention and release of flows from Mandina/Cortina Complex, northwards to the Pitlochry Lakes.

The Mouse-hole regulator (at the Taunta Hut Road) controls retention and release of flows from the Pitlochry Lakes, northwards to the Bonney's Camp Complex.

The overpass on the Northern Outlet Drain allows flows northwards to Alf's Flat (Messent CP) and incorporates a regulator to divert flows during very infrequent, 'extreme' flow events to be released via the Northern Outlet Drain to Morella and the Coorong.

KEY ENVIRONMENTAL FEATURES AND HABITATS OF BIODIVERSITY SIGNIFICANCE

Most of the wetlands of the NBR watercourse have been somewhat degraded by altered regional and local hydrology (including the input of sub-optimal saline water) and also by agricultural management practices, particularly grazing.

However, the extensive wetland assets of this part of the Bakers Range watercourse still represent the largest and some of the most significant remnant wetlands in the region; and with the delivery of the best possible environmental flows (under the significantly modified hydrology of the region) can be sustained as viable wetland assets into the future.

Much of the wetland area in the NBR watercourse is managed under the Wetlands & Wildlife - Watervalley Wetlands and Heritage Agreement Areas Management Plan.

Key wetland assets include: Mandina Marshes/Lakes Complex, Cortina Lakes, Pitlochry Lakes, Bonneys Camp Complex and Alf's Flat (Messent Conservation Park).

Migratory waders such as Sharp-tailed Sandpiper, Red-necked Stint and Common Greenshank have been observed in Northern Bakers Range. Wood sandpiper has been observed in wetlands of the Northern Bakers Range.

SIGNIFICANT AGRICULTURAL ISSUES

Flood Mitigation: This area is very prone to extensive inundation under normal to higher rainfall conditions.

The NBR watercourse has been modified by landholders, primarily by removing sills between wetlands and the development of banks and drains to provide a flood mitigation service to agricultural production areas and to direct water preferentially to wetland areas of interest within the drainage system. These modifications have however been developed in an ad hoc manner and are quite varied in their construction capacity and ability to transmit flows effectively.

Private on-farm groundwater drainage has been developed to connect into the watercourse.

Salinity: Salinity is an issue in the low lying portions of this part of the landscape; however agricultural development has historically been focussed on more elevated topography, largely due to the historical inundation of the low country.

There is a school of thought that the expression of salinity in areas to the west of the NBR watercourse has been exacerbated during period where large volumes of water (including sub-optimal saline groundwater) have been held in the NBR watercourse; however this relationship has not been comprehensively investigated to date.

FUTURE NETWORK MANAGEMENT

Flows generated by the local catchment will continue to be directed through the NBR watercourse, under agreed flow management guidelines established between the USE Network authority (under the Adaptive Flows Management Framework) and Wetlands and Wildlife.

These will be augmented from time to time by significant flows from the SBR catchment which will be directed via the REFLOWS Western Floodway to reinstate historical

environmental flow regimes to key wetlands in the USE.

Environmental flow retentions for key wetlands in this area will be managed in accordance with the general principles of the Watervalley Wetlands and Heritage Agreement Areas Management Plan and other individual agreements.

The objective of delivering substantial periodic flows to the historical terminal wetland area of Alf's Flat (Messent Conservation Park) remains an aspirational target of the Adaptive Flows Management Framework, albeit a difficult one to achieve under anything less than extreme rainfall/runoff conditions.

Surplus flows from this area can be directed through the wetlands of the NBR to the Northern Outlet Drain (as 'flushing flows'), where they can be diverted into the drain and onwards to Morella Basin and the south lagoon of the Coorong; and/or may be diverted at the Kercoonda Interchange to Henry Creek, Tilley Swamp and the south lagoon of the Coorong.

Likewise sub-optimal (saline) flows and flows for other environmental watering purposes may be diverted at the Kercoonda Interchange - for example to the Mt Rough area, Tilley Swamp and/or the south lagoon of the Coorong.

PRIORITIES

Maintain and improve the arterial flood mitigation service.

Provide optimum environmental flows to key wetland assets (and other wetland features) under changing climatic conditions.

Periodically divert environmental flows from Drain M (at Callendale) via the REFLOWS Western Floodway as available.

Work with relevant landholders to improve on farm water management and to harvest suitable quality surface (flood) water from agricultural landscape and direct into the watercourse.

Direct surplus water resources from this area to the south lagoon of the Coorong, via Morella Basin.

PROJECT WORKS

Complete the development of the REFLOWS Western Floodway including monitoring infrastructure.

Establish wetland environmental flow/retention regulators to optimise the management of water throughout the extensive wetland assets of the NBR.

PRIORITY MAINTENANCE

Develop an access track along the Kercoonda Drain between Petherick Road and Telowie Inlet.

Major track maintenance and required along the Northern Outlet Drain to repair erosion washouts.

Further revegetation of drain cutting required through Stoneleigh Park/Bonneys Camp Heritage Agreement Area. Repairs are required to seal leaks around the Mandina Bypass Regulator.

Management principles for USE Network management units:

THE TRESANT DRAIN

Bloomfield Swamp to Fairview Conservation Park

SOURCE WATER

The wetland lagoons in Fairview Conservation Park (and the nearby Bloomfield Swamp) are relatively small in regional terms. They are serviced from local catchment, to the south east, including the surface water drainage capacity of the small Tresant Drain.

This local surface water drain optimises the delivery of fresh surface water from the available catchment area into these wetlands.

CRITICAL CONTROL POINTS

The Bloomfield Swamp South regulators manage the flow and quality of water delivered into Bloomfield South and Bloomfield Swamp.

The Kangoora Lagoon regulators manage the flow and quality of water delivered into Kangoora Lagoon in Fairview Conservation Park.

The Fairview Swamp regulators manage the flow and quality of water delivered into Fairview Swamp in Fairview Conservation Park.

The terminus of the Tresant Drain is designed for excess water to spill from the drain and flow through floodplains of Fairview Conservation Park into Fairview Swamp.

KEY ENVIRONMENTAL FEATURES AND HABITATS OF BIODIVERSITY SIGNIFICANCE

The 1,400ha Fairview Conservation Park contains two lagoons and extensive areas of seasonally inundated floodplain and is a rare intact remnant of the freshwater wetland habitat that was once typical of the region.

Together with the privately owned Bloomfield Swamp and Bloomfield Swamp South these wetlands represent a series of river red gum fringed freshwater swamps that support considerable wetland values when inundated. Additional wetland areas exist adjacent to Fairview Conservation Park and the Tresant Drain that have the potential for flow restoration.

Key wetland assets include: Bloomfield South Swamps, Bloomfield Swamp and the lagoons of the Fairview Conservation Park (Kangoora Lagoon and Fairview Swamp).

SIGNIFICANT AGRICULTURAL ISSUES

Flood Mitigation: The catchment area of the Tresant Drain is prone to inundation under normal to higher rainfall conditions.

The Tresant Drain has been developed to provide a flood mitigation service through this area – discharging these floodwaters northwards into Fairview Conservation Park.

Some private on-farm drainage has been developed to connect into the arterial system.

Salinity: Salinity is not regarded as a significant issue in this part of the landscape.

FUTURE NETWORK MANAGEMENT

Flows generated by the local catchment will continue to be directed via the Tresant Drain into the wetlands of Fairview Conservation Park and Bloomfield Swamp.

Environmental flows in this system and retention of water flows in key wetlands in this area will be managed under individual agreements.

PRIORITIES

Maintain the arterial flood mitigation service.

Provide optimum environmental flows to key wetland assets under changing climatic conditions.

Work with relevant landholders to improve on-farm water management and to harvest suitable quality surface (flood) water from agricultural landscape and direct into the watercourse.

Seek to secure legal agreements with landholders to continue to provide environmental flows to the privately-owned wetlands.

PROJECT WORKS

No additional major works are identified for this management unit at this time.

PRIORITY MAINTENANCE

No urgent maintenance issues have been identified.

Maintain surveillance of maintenance issues and respond as required.

Management principles for USE Network management units:

FAIRVIEW DRAIN *Lochaber West Road to the Blackford Drain*
SOURCE WATER The Fairview Drain derives its water resources from a substantially reduced local catchment (north of the Lochaber West Road) which generates brackish water flows under normal or higher rainfall conditions, freshening during high rainfall events. The wetland lagoons adjacent the Fairview Drain are relatively small in regional terms and some are serviced by pumping water from the Drain.
CRITICAL CONTROL POINTS The Fairview Drain acts as a conduit for water. Three of the wetland areas are serviced by their own 30cm pumps that have the capacity to deliver approximately 6ML of water per day. Two weirs exist on occupational crossings on the Fairview Drain to hold water in the drain at a depth that allows pumping to occur. The weir on Woolumbool Road diverts water into an adjacent wetland to alleviate downstream inundation. Six additional weirs exist along the drain and are operated for groundwater management.
KEY ENVIRONMENTAL FEATURES The Fairview Drain Swamps generally support open water fringed with River Red Gum woodland. The condition of the basins varies from saline and supporting halophytes (samphire) amongst dead remnant River Red Gums, to regenerating Melaleuca shrublands within fresh/brackish water. Areas of open water and flooded meadows are present within the swamps. Key wetland features include Locks (Cane's) Swamp, Gary Johnsons Swamp, Stephen Johnsons Swamp, unnamed Swamps (River Red Gum Swamp north east of Woolumbool Road), Alaman Swamp East, Alaman Swamp West.
SIGNIFICANT AGRICULTURAL ISSUES Flood Mitigation: The flood risks for this area are considered to be low-moderate following construction of the Fairview Drain and landholder constructed subsidiary drains. Salinity: Salinity impacts are expressed in parts of the area of the Fairview Flats. These areas are now considered to have improved with the construction of the Fairview Drain and associated on-ground works. Groundwater management with weirs will continue to support adjacent farmland.
FUTURE NETWORK MANAGEMENT Surface waters of suitable quality generated by the local catchment will continue to be

directed into the wetlands adjacent the Fairview Drain.

Environmental flows will be delivered to the NCBR Watercourse via the Nepowie Regulator subject to water resource availability, the regional Adaptive Flows Management Framework and established management plans and other arrangements in place with respective landholders.

Saline groundwater levels will be managed to promote leaching of salts from the soils and to support pasture growth in Spring.

Drain water flows (brackish/semi-saline) will be managed to support REFLOWS diversions in the Fairview Drain from the West Avenue transfer regulator on the NCBR Watercourse (freshwater delivery to the West Avenue Watercourse).

PRIORITIES

Maintain the arterial flood and salinity mitigation service to reduce inundation and risk of salinity on agricultural lands.

Landholder agreements for the operation of pumps require regular review.

PROJECT WORKS

Investigate re-hydration of swamps north east of Woolumbool Road/Fairview Drain intersection in consultation with the landholders.

PRIORITY MAINTENANCE

Ongoing maintenance of pumps that supply the Fairview Drain Swamp is required.

Remove/trim overgrown Tea-Tree bushes on the Fairview Drain and undertake track maintenance to repair erosion washouts.

Machine cleaning of drain required to remove silt.

Develop new diversion regulator on the Fairview Drain to support diversions to the Nepowie Regulator.

Repair leakage under Nepowie Regulator boards.

Management principles for USE Network management units:

EAST AVENUE WATERCOURSE

Boatman's Swamp to the Fairview Drain, including Phillips Gap regulator

SOURCE WATER

The northern East Avenue watercourse derives its water resources from its substantially reduced catchment (north of the Lucindale-Kingston Road) which generates intermittent volumes of freshwater (at <250EC) under normal or higher rainfall conditions.

CRITICAL CONTROL POINTS

The Phillips Gap regulator (adjacent to Boatman's Swamp) has the capability to allow surface flows from the southern 40% of the remaining catchment area to drain through the Avenue Range into the Jacky White drainage system and then to the coast at Kingston.

The Hundred Line Drain.

KEY ENVIRONMENTAL FEATURES AND HABITATS OF BIODIVERSITY SIGNIFICANCE

Many wetlands along the watercourse have been heavily degraded by agricultural development and modified to provide better drainage of surface water.

Management agreements have been established with some landholders to protect wetlands along the watercourse and to reinstate sills and build regulators to fill wetlands whilst also providing for flood management.

Key wetland assets include: Boatman's Swamp, and the remnant wetlands that formed part of the Deep Swamp complex.

SIGNIFICANT AGRICULTURAL ISSUES

Flood Mitigation: This catchment is prone to inundation under normal to higher rainfall conditions.

The East Avenue watercourse has been modified, primarily by removing sills between wetlands and using the watercourse to provide a flood mitigation service through this area – discharging these floodwaters to the Jacky White Drain via the Phillips Gap regulator; and northwards along the East Avenue watercourse - ultimately into the Fairview Drain.

Private on-farm drainage has been developed to drain agricultural land into the watercourse. Recent surface drainage works under the USE Program have improved the capacity of this catchment to transmit flows northwards more effectively to the significant remnant wetland assets on the watercourse.

Salinity: Salinity is not regarded as a significant issue in this part of the landscape.

FUTURE NETWORK MANAGEMENT

Flows generated by the local catchment will continue to be directed northwards to the significant remnant wetland assets along the East Avenue watercourse.

Environmental flow retentions for key wetlands in this area will be managed by existing sill levels or under individual management agreements.

Under high rainfall/runoff conditions, water surplus to the requirements of the wetlands along the watercourse will overflow northwards into the Fairview Drain or may be diverted to the Jacky White Drain via the Phillips Gap regulator, to prevent excessive, prolonged inundation of agricultural land.

PRIORITIES

Maintain local flood mitigation service.

Provide optimum environmental flows to key wetland assets (and other wetland features) under changing climatic conditions.

Work with relevant landholders to improve on farm water management and to harvest suitable quality surface (flood) water from agricultural landscape and direct into the watercourse.

Direct surplus water resources from this area to the Jacky White Drain via the Phillips Gap regulator, when required to prevent excessive, prolonged inundation of agricultural land.

PROJECT WORKS

No additional major works are identified for this management unit at this time.

Establish wetland environmental flow/retention regulators as identified by individual agreements.

PRIORITY MAINTENANCE

No urgent maintenance issues have been identified.

Maintain surveillance of maintenance issues and respond as required.

Management principles for USE Network management units:

WEST AVENUE WATERCOURSE

Bakers Range transfer regulator to Litigation Lane

SOURCE WATER

The West Avenue watercourse presently derives water resources from a substantially reduced catchment (north of Rowney Road and the Blackford Drain) which generates intermittent volumes of freshwater (at <5000EC) under normal or higher rainfall conditions.

Significant historical flows from the larger Keilira Flat catchment (south of Rowney Road) have been largely cut off by the development of extensive on-farm drainage to remove surface water and saline groundwater, and by the Blackford Drain.

The quality of surface water from the catchment is progressively declining, with increasing soil salinity across the agricultural landscape and there is insufficient yield from this local catchment to meet the volumetric needs of all wetlands along the watercourse, let alone to provide reliable environmental water to the large remnant floodplain areas in this catchment.

To sustain this watercourse will require the availability of flows (of significant volume; 10-15 GL) from distant catchment areas.

CRITICAL CONTROL POINTS

The West Avenue transfer regulator will enable freshwater from the REFLOWS Western Floodway to be transferred from the NCBR watercourse (at Schofield Swamp) to the West Avenue Watercourse (via the Fairview Drain).

KEY ENVIRONMENTAL FEATURES AND HABITATS OF BIODIVERSITY SIGNIFICANCE

Many wetlands along the watercourse have been degraded by agricultural development and modified to provide better drainage of surface water.

However a number of large wetlands in the central part of the catchment retain significant valuable wetland habitat components (among the most intact in the region) that with adequate environmental flows can be sustained as quality wetland assets into the future.

Management agreements have been established with some landholders to protect wetlands along the watercourse and to reinstate sills and build regulators to fill wetlands whilst also providing for flood management.

Key wetland assets include: Park Hill wetland complex, Smiths Swamp, Parrakie wetland complex, England's wetland complex, Telecom Island and Westslopes, Double Swamp, Telowie Swamps, Henry Creek and Litigation Lane Ponds.

A known population of the Yarra Pygmy Perch is present in Litigation Lane Swamps on Henry Creek.

Southern Bell Frog is known to exist in Rocky Swamps (Parrakie wetlands).

SIGNIFICANT AGRICULTURAL ISSUES

Flood Mitigation: This area is prone to extensive inundation under normal to higher rainfall conditions.

Private on-farm drainage has been developed to drain agricultural lands into the watercourse.

Like the Didicoolum Drain, the Bald Hill Drain is designed to exclude fresh surface water from the drain and incorporates environmental flow 'overpasses' to enable surface flows from the local rural catchment to be harvested and cross efficiently over the drain into the watercourse.

Salinity: Significant salinity impacts are expressed in parts of the area. The Bald Hill Drain will provide a groundwater drainage service to these salinity-affected areas.

Landholders are supported by regional agronomists to adopt on-farm measures, such as clay spreading and perennial pasture establishment to manage recharge, and can apply gypsum and other measures to address sodicity, where it may occur.

FUTURE NETWORK MANAGEMENT

Saline groundwater base-flows in the Bald Hill Drain will flow via the USE Network to Morella Basin for controlled release into the south lagoon of the Coorong.

Fresh surface water flows generated by the local catchment will continue to be directed to the watercourse - the Bald Hill Drain is been designed to exclude fresh surface water from the drain and incorporates environmental flow 'overpasses' to enable surface flows from the local rural catchment to be harvested and cross efficiently over the drain into the watercourse.

These will be augmented from time to time by flows from REFLOWS Western Floodway.

Environmental flows will be diverted/retained variously in targeted wetlands along the watercourse; subject to water resource availability, the regional Adaptive Flows Management Framework and established management plans and other arrangements in place with respective landholders.

Surplus flows through the West Avenue watercourse follows a natural flow path northwards, to Telowie Swamp, then to Henry Creek - where they can be directed to Tilley Swamp, or to the south lagoon of the Coorong.

PRIORITIES

Develop and maintain the arterial flood and salinity mitigation service and environmental flows infrastructure.

Provide optimum environmental flows to key wetland assets (and other wetland features) under changing climatic conditions.

Divert environmental flows from Drain M (at Callendale) via the REFLOWS Western Floodway as available; and divert a proportion of these flows to the West Avenue watercourse via the West Avenue transfer regulator (at Schofield Swamp).

Maintain fresh (spring) water flows to Litigation Lane ponds to sustain the resident population of Yarra Pygmy Perch. Work with relevant landholders to improve on-farm water management and to harvest suitable quality surface (flood) water from agricultural landscape and direct into the watercourse. Direct surplus water resources from this area to Henry Creek, Tilley Swamp and/or the south lagoon of the Coorong.
PROJECT WORKS Nil
PRIORITY MAINTENANCE Minor machine cleaning of the Bald Hill Drain is required to remove silt. Works are required on newly constructed regulators to bring them to design levels and specifications.

WIMPINMERIT DRAIN

Rowney Road West to Bald Hill Drain

SOURCE WATER

The Wimpinmerit Drain presently derives water resources from a substantially reduced catchment (north of Rowney Road) which generates intermittent volumes of freshwater (at <5000EC) under normal or higher rainfall conditions.

Significant historical flows from the larger Bin Bin Flat catchment (south of Rowney Road) have been largely cut off by the development of road infrastructure and the construction of the Fairview Drain.

CRITICAL CONTROL POINTS

The Toops Gap regulators manage the flow and quality of water delivered into Toops Gap wetland from the upstream section of the drain.

Groundwater regulators control groundwater levels adjacent the drain.

The Wimpinmerit Gap regulators manage surface water flows into and out of the Wimpinmerit Drain at a narrow section of the alignment.

The Wimpinmerit Diversion Regulator manages the flow and quality of water delivered from the drain into the wetlands of the West Avenue Watercourse, or to the Bald Hill Drain.

KEY ENVIRONMENTAL FEATURES & HABITATS OF BIODIVERSITY SIGNIFICANCE

Toops Gap is a privately managed conservation area protected by Management agreement in the upstream area of the catchment. The area supports a large area of seasonally inundated floodplain and terrestrial habitats on surrounding hills.

SIGNIFICANT AGRICULTURAL ISSUES

Flood Mitigation: This area is prone to inundation under normal to higher rainfall conditions.

The Wimpinmerit Drain design incorporates a shallow floodway to enable fresh surface water flows from the local rural catchment to be harvested and flow efficiently adjacent the drain for delivery to downstream wetlands in the West Avenue Watercourse.

Salinity: Salinity impacts are expressed in parts of the area. The Wimpinmerit Drain will provide a groundwater drainage service to these salinity affected areas.

FUTURE NETWORK MANAGEMENT

Surface waters generated by the local catchment will continue to be directed into the wetlands of the West Avenue Watercourse.

Environmental flows in this system and retention of water flows in Toops Gap will be managed under individual agreements.

Saline groundwater base flows in the Wimpinmerit Drain will flow via the USE Network to

Morella Basin for controlled release into the south lagoon of the Coorong.

Fresher winter groundwater flow will be diverted to wetlands of the West Avenue Watercourse or via the USE Network to the Tilley Swamp Watercourse.

Winter and spring groundwater levels can be managed with regulators to support pasture growth and prevent loss of surface water.

PRIORITIES

Develop and maintain the arterial flood and salinity mitigation service and environmental flows infrastructure.

Provide optimum environmental flows to key wetland assets (and other wetland features) under changing climatic conditions.

Work with relevant landholders to improve on-farm water management and to harvest suitable quality surface (flood) water from agricultural landscape and direct into the Wimpinmerit floodway for delivery to downstream wetlands.

PROJECT WORKS

No additional major works are identified for this management unit at this time.

PRIORITY MAINTENANCE

Repair of sand erosion along access tracks and in the drain.

Machine cleaning of drain are required to remove silt.

Management principles for USE Network management units:

TARATAP WATERCOURSE

Rushy Swamp to Henry Creek

SOURCE WATER

The Taratap watercourse presently derives water resources from a substantially reduced catchment (north of Rowney Road and the Blackford Drain) which generates intermittent volumes of freshwater (at <5000EC) under normal or higher rainfall conditions.

Significant historical flows from a catchment (south of Rushy Swamp) have been largely cut off by the development of the Blackford Drain and Murrabinna-Blackford Drain system.

The quality of water in surface drains in this catchment has declined over recent years as a consequence of the build up of salt in the soil profile, across the agricultural landscape; although this salt in the shallow soil profile may be effectively flushed by one or two wetter annual rainfall/runoff cycles.

There is sufficient yield from this local catchment to meet the volumetric needs of the key wetlands along this watercourse, under normal or higher rainfall conditions.

CRITICAL CONTROL POINTS

The Taratap surface water drain provides a flood mitigation service to the Taratap Flat and harvests water from the agricultural landscape for diversion into key wetland assets in the middle catchment.

Weir/diversion/overpass structures along the Taratap Drain provide for the diversion of water into the watercourse at Yeulba Swamp, Marwood's lane, England's Lane and Varcoe's Lane.

The bank along the western side of the drain provides a containment structure for water in the wetlands and enables the retention of environmental water at greater depth on the swamps.

KEY ENVIRONMENTAL FEATURES AND HABITATS OF BIODIVERSITY SIGNIFICANCE

Many wetlands along the watercourse have been heavily degraded by agricultural development and modified to provide better drainage of surface water.

Management agreements have been established with some landholders to protect wetlands along the watercourse and to reinstate sills and build regulators to fill wetlands whilst also providing for flood management.

Key wetland assets include: Yeulba Swamp and the extension of (un-named) wetlands northwards through the Marwood, England and Varcoe properties; also Pateanbury Swamp.

Migratory wader - the Latham's Snipe has been observed in the Taratap watercourse.

SIGNIFICANT AGRICULTURAL ISSUES

Flood Mitigation: This area is very prone to extensive inundation under normal to higher rainfall conditions.

The Taratap surface water drain provides a flood mitigation service to the Taratap Flat and harvests water from the agricultural landscape for diversion into key wetland assets in the middle catchment – and discharging excess floodwaters northwards to the Tilley Swamp Drain and/or watercourse. Private on-farm drainage has been developed to connect into drain 'overpasses' at key points to enable surface flows from the local rural catchment to be harvested and conveyed efficiently into the watercourse.

Salinity: Salinity is an issue in this part of the landscape; however landholders in the central catchment opted for a shallow surface drain mitigation solution (which they felt had been largely effective in the past in minimising salinity problems) to ensure the availability of environmental flows to key wetlands along the watercourse.

FUTURE NETWORK MANAGEMENT

Flows generated by the local catchment will continue to be diverted into the watercourse via on-farm, cross-catchment drainage and the Taratap surface drain.

Weir/diversion/overpass structures along the Taratap Drain provide for the diversion of water into the watercourse.

The bank along the western side of the drain provides a containment structure for water in the wetlands and enables the retention of environmental water at greater depth on the swamps.

Environmental flow retentions for key wetlands in this area will be managed under individual agreements.

Under higher rainfall/runoff events the Taratap Drain will be operated to discharge excess floodwaters northwards to the Tilley Swamp Drain; where they can be directed to the substantial wetlands of the Tilley Swamp watercourse and/or the south lagoon of the Coorong.

PRIORITIES

Provide optimum environmental flows to key wetland assets (and other wetland features) under changing climatic conditions.

Develop and maintain an arterial flood mitigation service.

Work with relevant landholders to improve on farm water management and to harvest suitable quality surface (flood) water from agricultural landscape and direct into the watercourse.

Direct surplus water resources from this area northwards, to the substantial wetlands of the Tilley Swamp watercourse and/or the south lagoon of the Coorong.

PROJECT WORKS

No additional major works are identified for this management unit at this time.

Since constructing the Taratap Drain and observing it operate under wet conditions several landholders have requested additional laneway 'overpass' structures to improve flows from agricultural landscape into the watercourse.

Establish wetland environmental flow regulators as identified by individual agreements.

PRIORITY MAINTENANCE

Track maintenance is required along the Taratap Drain to repair muddy sections.

Management principles for USE Network management units:

TILLEY SWAMP WATERCOURSE *Henry Creek to the Northern Outlet Drain*
SOURCE WATER The Tilley Swamp watercourse presently derives most of its water resources from its local catchment area. This watercourse has not received adequate environmental flows for several decades as a consequence of altered hydrology associated with the development of catchment areas as far south as the Lower South East; and the dry climatic phase over the past 15 years. There is insufficient yield from the local catchment to meet the volumetric needs of all the wetland features of this watercourse particularly the large floodplain area that characterises this catchment. To sustain this watercourse will require the availability of flows (of significant volume; 10-20 GL) from adjacent and more distant catchment areas.
CRITICAL CONTROL POINTS Henry Creek diversion regulator – diverts outflows from the West Avenue watercourse into Tilley Swamp. Tilley Swamp Drain (Petherick Road) diversion regulator – diverts outflows from the West Avenue watercourse into Tilley Swamp (at the Tilley Swamp Conservation Park). Tilley Swamp outlet regulator controls the discharge of flows from Tilley Swamp watercourse into the Tilley Swamp Drain (and on to Morella Basin).
KEY ENVIRONMENTAL FEATURES AND HABITATS OF BIODIVERSITY SIGNIFICANCE Many of the wide shallow wetlands along the watercourse have been heavily degraded by agricultural development and by the ingress of native shrub-lands (particularly Salt Paperbark *Melaleuca halmaturorum*) as a consequence of altered hydrology over a prolonged period. Management agreements have been established with some landholders to protect wetlands along the watercourse in the anticipation of improved environmental watering opportunities in the future. Key wetland assets include: The wetland sumps and floodplains (largely unnamed) defined in the Tilley Swamp Risk Assessment identified Stage II and III reports.
SIGNIFICANT AGRICULTURAL ISSUES **Flood Mitigation**: This area is prone to inundation under higher rainfall conditions only. This watercourse has not received significant flows for several decades as a consequence of altered hydrology across the region; and the dry climatic phase over the past 15 years. Tilley Swamp Risk Assessment consultation with landholders did not identify any significant risks associated with infrequent inundation of this watercourse.

Salinity: Salinity is not regarded as a significant issue in this part of the landscape – predominantly due to this area not being subject to recharge-affecting inundation for an extended period.

FUTURE NETWORK MANAGEMENT

The Tilley Swamp Drain is primarily a transfer drain – carrying water from the central USE catchments to Morella Basin (and then to the south lagoon of the Coorong). It also has the effect of capturing surface water (generated under higher rainfall/runoff conditions) from the eastern portions of the catchment.

There are two diversion structures along the Tilley Swamp Drain (allowing suitable quality water in the drain to be diverted into the watercourse) – one at Henry Creek and one at Petherick Road.

Flows generated by the local catchment (essentially the areas west of the Tilley Swamp Drain) will continue to be move into the watercourse.

These will be augmented from time to time by significant flows from the central USE catchments. Outflows from the West Avenue watercourse (including flow diversions from the REFLOWS Western Floodway) can be diverted into Tilley Swamp watercourse at the Henry Creek diversion regulator. Outflows from the Taratap watercourse and cross catchment transfers from the Bakers Range watercourse, via the Kercoonda Interchange and the Kercoonda Drain can be directed into the Tilley Swamp watercourse at Tilley Swamp CP/Petherick Road.

Environmental flow retentions for key wetlands in this area will be managed under individual agreements.

Surplus flows and through flows from Tilley Swamp will be returned to the Tilley Swamp Drain via the outlet regulator to flow into Morella Basin (and ultimately the south lagoon of the Coorong).

PRIORITIES

Maintain the arterial flood mitigation service.

Provide periodic environmental flows to the Tilley Swamp watercourse under changing climatic conditions - by diverting flows from Bakers Range watercourse; and outflows from the West Avenue watercourse, and the Taratap watercourse into Tilley Swamp for environmental watering, when adequate water resources are available.

Divert environmental flows from Drain M (at Callendale) via the REFLOWS Western Floodway as available.

Work with relevant landholders to improve on farm water management and to harvest suitable quality surface (flood) water from agricultural landscape and direct into the watercourse.

PROJECT WORKS

No additional major works are identified for this management unit at this time.

Some landholders believe that engineering of the Tilley Swamp watercourse must be reassessed to ensure that it has the capacity to handle flows to drain water north, even in high rainfall years. Improving capabilities of the system will be considered in liaison with landholder catchment groups.

PRIORITY MAINTENANCE

Trim overgrown Tea-Tree bushes on the Tilley Swamp Drain downstream of Safari Track.

Track maintenance is required along the Tilley Swamp Drain to repair erosion

Machine cleaning of the Tilley Swamp Drain is required to remove silt between the Northern Outlet Drain Junction and Morella Basin.

Management principles for USE Network management units:

NORTHERN CATCHMENTS

Mount Charles, Bunbury & Taunta Hut Drains

DESCRIPTION OF THE CATCHMENT AREA

Unlike the central USE catchments, the northern catchments feature an undulating topography of low dunes and swales; creating smaller, self-contained drainage catchments, which hold water under normal or higher rainfall/runoff conditions, with consequent localised recharge/salinity problems.

The variation to this is the Tatiara-Nalang Creeks catchment area, which extends across the border into western Victoria, and features average annual rainfalls of 400-500mm. This catchment generates irregular volumes of freshwater (50-2000ML, but on rare occasion up to 19 GL at <400EC) under normal or higher rainfall conditions. Surface water from this catchment drains to the low, flat country of the Hundred of Stirling (south of Keith), where in infrequent high rainfall/runoff periods large volumes of water have been 'trapped' in the landscape by the Black Range (to the west) resulting in extensive, prolonged inundation.

The Mt Charles, Bunbury and Taunta Hut Drains, in the northern catchments are surface water drains only. Their purpose is for flood mitigation to prevent extensive, prolonged inundation of otherwise hydrologically 'closed' areas, by providing an outlet for trapped surface water. These very long drains must have a continuous hydraulic gradient to enable water to flow to the point of discharge and they therefore gradually deepen along their length, and offer some groundwater draw-down effect in areas along their lower portions.

CRITICAL CONTROL POINTS

The Mount Charles Drain (commencing at the bottom of the Tatiara-Nalang Creeks catchment) provides the capacity to release discharges from this catchment (trapped behind the Black Range), under infrequent extreme rainfall/runoff conditions. Flows through this drain are limited by two regulators (one on Range Road and one on Keith-Cantara Road) which remain closed unless a conscious decision is made to drain floodwater from this landscape, and a regulator downstream of Cadzows Road that remains open to allow for saline flow.

The Range Road regulator also provides for the diversion of a small volume of freshwater into the adjacent Gum Waterhole wetland, and the Cadzows Road Regulator allows for diversion of suitable flows into an adjacent wetland.

Environmental watering retention weirs are constructed on the Mutton's, Parnell's and Cavanagh's wetlands on the Mount Charles Drain.

The Bunbury Drain incorporates a small flow diversion regulator to direct flows from its upper catchment into the Duck Island wetland complex and two water level control weirs in its upstream alignment.

The Bunbury Drain also incorporates two diversion regulators to divert water into Sanders

Scrub and a groundwater control weir on the Erelma Downs property.

On the Taunta Hut Drain, six environmental watering retention weirs are located to service a number of wetlands including those in Bunbury Conservation Reserve.

KEY ENVIRONMENTAL FEATURES AND HABITATS OF BIODIVERSITY SIGNIFICANCE

Many wetlands along the watercourse have been degraded by agricultural development and severe localised salinity.

Management agreements have been established with some landholders to protect wetlands along the watercourse and to build regulators to fill wetlands whilst also providing for flood management.

Key wetland assets include: Gum Waterhole, Cadzows Road Swamp, Muttons, Parnells and Cavanaghs wetlands, on the Mount Charles Drain; the Duck Island complex, Sanders Scrub and Nappers Scrub on the Bunbury Drain; McQueens Heritage Area, Herriots Heritage Area, Nashs Swamps, Bunbury Conservation Reserve, Holdsworths Swamps and Stopp Swamps on the Taunta Hut Drain; Bunbury Swamp and Kendal Swamp, to the west.

SIGNIFICANT AGRICULTURAL ISSUES

Flood Mitigation: Surface water from the Tatiara-Nalang catchment drains to the low, flat country of the Hundred of Stirling (south of Keith), where in infrequent high rainfall/runoff periods large volumes of water have been 'trapped' in the landscape by the Black Range (to the west) resulting in extensive, prolonged inundation.

The wider area is prone to localised inundation under higher rainfall conditions, which creates water table mounding and exacerbates salinity in low lying parts of the topography.

The Mt Charles, Bunbury and Taunta Hut Drains are surface water drains only - their purpose is to provide an outlet for trapped surface water. Private on-farm drainage has and can be developed to connect into the arterial system.

Salinity: Severe, localised salinity is a significant issue in the low lying parts of the landscape. The mitigation of localised inundation and recharge is the focus of engineering measures in these catchments.

FUTURE NETWORK MANAGEMENT

Surface water from the Tatiara-Nalang catchment will continue to drain via natural watercourses to the low, flat country of the Hundred of Stirling (south of Keith) in higher rainfall periods.

Irrigators in the Tatiara Prescribed Wells area are keen to ensure that available surface water is managed to optimise recharge of depleted aquifers and have proposed the exploration of ASR options for discharges from the Tatiara-Nalang Creeks. The exploration of ASR options for discharges from the Tatiara-Nalang Creeks may be explored in the context of the WAP review processes.

Under the infrequent extreme rainfall/runoff conditions discharges from the Tatiara-Nalang Creeks catchment may be released via the Mount Charles Drain to prevent extensive

prolonged flooding that may impact upon agricultural production.

PRIORITIES

Maintain the arterial flood mitigation service.

Flows through the Mt Charles Drain are limited by two regulators, which will remain closed unless a conscious decision is made to drain flood-water from this landscape.

Under the infrequent extreme rainfall/runoff conditions discharges from the Tatiara-Nalang Creeks catchment which cause extensive prolonged flooding that may impact upon agricultural production may be released via the Mount Charles Drain.

Retain opportunistic environmental flows in key wetland assets along the drains, under changing climatic conditions.

Explore ASR options for discharges from the Tatiara-Nalang Creeks in the context of the WAP review processes.

Work with relevant landholders to improve on farm water management and to harvest suitable quality surface (flood) water from agricultural landscape and direct into wetlands.

Direct surplus water resources from the northern catchments to Morella Basin and the south lagoon of the Coorong, via the Northern Outlet Drain.

PROJECT WORKS

No additional major works are identified for this management unit at this time.

The exploration of ASR options for discharges from the Tatiara-Nalang Creeks to optimise recharge of depleted aquifers, in accordance with the 2010 Tatiara Water Allocation Plan.

PRIORITY MAINTENANCE

Maintenance is required along the Mount Charles Drain to repair erosion of tracks, hill cuttings and sandy areas along the alignment.

Machine cleaning of the Taunta Hut and Mt Charles Drains is required to remove silt.

Management principles for USE Network management units:

MORELLA BASIN
SOURCE WATER The Morella Basin (in Martin Washpool Conservation Park) is the final control point in the USE Network. Morella is managed as a wetland in its own right and can be operated as a balancing storage under higher rainfall-runoff conditions. Both groundwater discharge base-flow and event-based flows captured into the USE Network (which cannot be applied to environmental watering) end up in Morella Basin. The Morella basin has a storage capacity of approximately 20 GL (with a further 20 GL backup storage available in the Tilley Swamp watercourse). Drainage base-flow into the basin varies from 5-10 GL (depending on seasonal rainfall). Water-body salinity under these circumstances is generally in the range of 10,000-20,000EC, but evapo-concentration during prolonged retention can see salinities rise to 35,000EC. Event-based flow can vary from nothing (extremely dry years) to potentially 20+ GL (in extreme rainfall conditions). Water-body salinity under these circumstances is generally in the range of 6,000EC (and downwards), but evapo-concentration during prolonged retention will again see salinities rise.
CRITICAL CONTROL POINTS The Morella Basin discharge regulator controls the retention of water within the Basin; and releases from the basin into the south lagoon of the Coorong.
KEY ENVIRONMENTAL FEATURES AND HABITATS OF BIODIVERSITY SIGNIFICANCE Morella Basin is contained within the 2,258ha Martin Washpool Conservation Park and managed by the Department of Environment and Natural Resources. The hydrology of the wetland has been restored by drainage discharges and regular releases to the south lagoon of the Coorong South. This has promoted the recovery of Morella into a functioning wetland that supports aquatic and riparian vegetation, and a variety of fauna. Morella is an important waterbird refuge in the region and provides habitat for resident waterbirds and migratory waders, including threatened and protected species. The surrounding former pasture land has been successfully revegetated to provide a habitat link between the Coorong National Park and Martin Washpool, and provide a buffer area around the basin and now supports rare bird species. Key wetland assets include: Morella Basin, Martin Washpool Floodplain. Migratory waders such as Sharp-tailed Sandpiper, Red-necked Stint and Common Greenshank have been observed in Morella Basin. Common Sandpiper and Curlew Sandpiper have been observed at Morella Basin.

SIGNIFICANT AGRICULTURAL ISSUES

Flood Mitigation: The operating level of the Morella Basin prevents flooding of adjacent agricultural lands.

Salinity: Salinity levels in the Basin are managed by balancing inflow and release timings and volumes. There is no evidence of problematic salinity accumulation in the basin at over the past 8 years of operation. Evapo-concentration modelling of the Basin as part of the Tilley Swamp Risk Assessment Stage 2 investigation indicates that salinity within the basin can be managed by this method.

FUTURE NETWORK MANAGEMENT

Morella will continue to receive and retain combinations of saline base-flow and event-based flows from the USE Network.

These will be augmented from time to time by significant flows from the Lower South East catchments via the REFLOWS Western Floodway.

Retention of water in Morella Basin and subsequent releases into the south lagoon of the Coorong will be managed to optimise:

- Water levels (and related habitat values) and water quality in the Basin (as a significant wetland in its own right); and releases into the south lagoon of the Coorong.
- The health of the Morella Basin will be maintained - as a key water-bird drought refuge in the region and as a source of propagules for the south lagoon of the Coorong, under improved hydrological conditions.
- Salinity levels in the Basin will be managed by balancing inflow and release timings and volumes with regard to the established evapo-concentration modelling.

PRIORITIES

Manage the detention of water in Morella Basin and subsequent releases into the south lagoon of the Coorong to optimise:

- Water levels (and related habitat values) and water quality in the Basin (as a significant wetland in its own right); and
- Releases into the south lagoon of the Coorong.

Maintain the health of the Morella Basin as a key water-bird drought refuge in the region and as a source of propagules for the south lagoon of the Coorong, under improved hydrological conditions.

Maintain water quality monitoring programs to identify any exceedance and/or accumulation of threatening contaminants in the Basin; and to confirm the condition of the water body prior to any release into the south lagoon of the Coorong (in particular any contamination risks).

Maintain ecological monitoring programs within the Basin site as part of the regional wetland health monitoring and evaluation framework.

PROJECT WORKS No additional major works are identified for this management unit at this time.
PRIORITY MAINTENANCE None identified.

Management principles for USE Network management units:

RELEASES INTO THE SOUTH LAGOON OF THE COORONG

SOURCE WATER

The Coorong is a substantial water body that receives water resource inputs from a number of sources:

- Marine tidal inflow and outflow through the Murray Mouth (and there is a school of thought that there may be significant tidal interchange through the sand dunes of the Young Husband Peninsula;
- Somewhat saline groundwater inputs from large scale unconfined aquifer to the east;
- Freshwater inputs from the Murray River; and
- Historically, significant periodic large-scale inflows of freshwater from the South East.

Although there is varying detail of understanding about these inputs, a comprehensive understanding of the water budget for the entire Coorong and the hydrodynamics within the system has not been established.

In recent decades a number of these key inputs have been severely compromised:

- Inputs from the Murray River have become far more intermittent and smaller over recent decades as a result of water abstractions, the detention of flows to maintain weir pools along the River and the prolonged drought period of the last 15 years;
- The consequential constriction and periodic closing of the Murray Mouth has significantly reduced the capacity for tidal exchange (to most of the Coorong beyond the immediate vicinity of the Mouth); and
- Altered catchments and hydrology in the South East have significantly reduced fresh surface flows northwards (ultimately to the south lagoon of the Coorong).

The development of the USE Network and in particular the REFLOWS Western Floodway aims to re-connect the catchment and provide the capacity to deliver significant volumes of freshwater northwards to key wetlands in the USE; and under high rainfall/runoff conditions, to deliver water to the south lagoon of the Coorong.

Both groundwater discharge base-flow and event-based flows (that can't be applied to environmental watering) from the USE Network end up in Morella Basin. The Morella Basin is the final control point in the USE Network for releases into the Coorong.

CRITICAL CONTROL POINTS

The Morella Basin discharge regulator controls the retention of water within the Basin; and releases from the basin into the south lagoon of the Coorong.

KEY ENVIRONMENTAL FEATURES AND HABITATS OF BIODIVERSITY SIGNIFICANCE

The 50,000 ha Coorong National Park was declared in 1966 to conserve the distinctive

landscape, coastal dune system, lagoons, wetlands and coastal vegetation and the great variety of birds, animals and fish that live in or visit the area.

As a habitat for numerous species of migratory birds and as a refuge for birds in times of drought, the Coorong is important in a national and international sense. The Coorong was included on the list of 'Wetlands of International Importance especially as Waterfowl Habitat', (the Ramsar List) on 21 December 1975 and the 'Agreement between Australia, Japan and China for the Protection of Migratory Birds and Birds in Danger of Extinction and their Environment' on 30 April 1981.

The Coorong is also an archaeological site of national importance with middens and burial sites throughout the park giving evidence of Aboriginal occupation over many thousands of years.

The habitat values of the south lagoon of the Coorong have been substantially compromised as a consequence of progressive salinisation. Salinity levels in the south lagoon of the Coorong have increased dramatically over the last decade, from a 'normal' (and Ramsar target) condition between brackish and marine, to hyper-marine (up to five times salinity of seawater).

Key aquatic plant assemblages in the lagoon (key food resources for waterbirds) have all but disappeared; fish species have likewise essentially disappeared; and the habitat capacity for resident and migratory water birds is significantly compromised at this time.

SALINITY

Water quality in the south lagoon of the Coorong has declined dramatically – particularly with regard to salinity levels, which have increased from a 'normal' condition between brackish and marine to hyper-marine (up to five times salinity of seawater).

This progressive salinisation effect is now being observed in the northern lagoon.

The historic, periodic, large-scale freshwater inflows from the South East into the south lagoon of the Coorong are believed to have been extremely significant in re-freshening both the southern and northern lagoons from time to time and thereby countering the natural evapo-concentration/progressive salinisation process that occurs in this water body.

FUTURE NETWORK MANAGEMENT

The south lagoon of the Coorong will continue to receive combinations of saline base-flow and event-based flows from the USE Network through planned/controlled releases from Morella Basin. These will be augmented from time to time by significant flows from the Lower South East catchments via the REFLOWS Western Floodway.

Detention of water in Morella Basin and subsequent releases into the south lagoon of the Coorong will be managed to optimise:

- Water levels (and related habitat values) and water quality in the Basin (as a significant wetland in its own right); and
- Releases into the south lagoon of the Coorong.

The health of the Morella Basin will be maintained - as a key water-bird drought refuge in the

region and as a source of propagules for the south lagoon of the Coorong, under improved hydrological conditions.

The capacity of freshwater inputs into the Coorong from the South East is extremely limited under current climatic/surface water flow conditions; however the development of the USE Network and in particular the REFLOWS Western Floodway is aimed to re-connect the catchment and optimise the capacity of the highly modified South East landscape to deliver volumes of freshwater northwards to key wetlands in the USE; and under high rainfall-runoff conditions, to deliver water to the south lagoon of the Coorong.

The Coorong South Lagoon Flows Restoration Project (CSLFRP) is an action proposed in the long-term plan for the Coorong, Lower Lakes, Murray Mouth (CLLMM) region. This project is very similar to the existing REFLOWS Project. Government is currently investigating the feasibility of using a combination of natural watercourses, newly constructed floodway and existing drains to divert freshwater from the south east towards the south lagoon of the Coorong. This freshwater currently discharges to the sea, and has been linked to degradation of sea grass beds. Modelling by CSIRO indicates that the CSLFRP, in combination with current existing inflows from the South east to the Coorong, has the potential to maintain the salinity of the south lagoon of the Coorong within the target range for ecosystem health potentially even in the absence of barrage flows.

PRIORITIES

Deliver environmental flows from the USE Network to the south lagoon of the Coorong as available under changing climatic conditions (generally only under very high rainfall/runoff conditions).

Maintain the health of the Morella Basin as a key water-bird drought refuge in the region and as a source of propagules for the south lagoon of the Coorong, under improved hydrological conditions.

Maintain water quality monitoring programs to identify any exceedance and/or accumulation of threatening contaminants in the Morella Basin; and to confirm the condition of the water body prior to any release into the south lagoon of the Coorong (in particular any contamination risks).

Maintain 'release' water quality monitoring program to identify any implications of discharge from the USE Network on water quality in the receiving environment of the south lagoon of the Coorong.

PROJECT WORKS

Complete the feasibility investigation of an additional environmental flows floodway from the South East to deliver into the south lagoon of the Coorong.

PRIORITY MAINTENANCE

None identified.

The related management of environmental flows to key 'protected areas'

Section 38 of the *National Parks and Wildlife Act 1972* requires that a management plan is prepared for each reserve established under the Act. A management plan sets forth proposals in relation to the management and improvement of the reserve and the methods by which it is intended to accomplish the objectives of the Act in relation to that reserve.

Once adopted, the provisions of a plan must be carried out and no activities undertaken unless they are in accordance with the plan.

A number of parks in the USE feature wetland assets that have been affected by modified catchment hydrology over many decades and/or can be serviced by environmental flows manipulated through the USE Network. The plans for these parks vary enormously based upon their size, but more importantly based upon when these plans where developed and as it relates to environmental flows, the level of knowledge regarding hydrology and environmental water requirements at that time.

Bool and Hacks Lagoons Ramsar Site

Bool and Hacks Lagoons are freshwater wetlands that feature a number of semi-permanent lagoons characterised by shallow, circular swamps and creeks. The site has an area of 3,200 ha and is one of five Ramsar Convention Wetlands of International Importance in South Australia. The wetlands provide significant breeding habitat and drought refuge for waterbirds and act as a buffer storage basin in the regional drainage system.

The 2006 Park Management and Ramsar Plan for this site features a detailed discussion of the natural hydrological patterns that affected this wetland complex, the changes to hydrology as a consequence of the progressive development of the region, the nature of current water management arrangements in the context of the wetland's interaction with Drain M and the ecological implication of these changes.

At present, the active management of the water levels in Bool and Hacks Lagoons occurs primarily in response to water levels reaching or exceeding the agreed (flood risk) water levels. The present agreed levels, aim to achieve both conservation and flood mitigation objectives. The primary conservation objective is to retain water in the lagoons for as long as possible into the summer to maintain vegetation communities and provide breeding habitat and refuge for waterbirds, particularly when other parts of south-eastern Australia dry out.

Inflow rates into the lagoon from Mosquito Creek during wet winters can be substantially higher than the capacity of Drain M downstream of the lagoon and when this occurs the overflow rates from the lagoon have to be regulated to safe rates with the excess water temporarily stored in the lagoon. The South Eastern Water Conservation and Drainage Board (SEWCD Board) must ensure that the capacity of Drain M downstream of Callendale is not breached from the sum of inflow of these drainage systems. The agreed operating protocols are considered suitable by the SEWCD Board for flood mitigation purposes.

The 1994 plan for the Fairview Conservation Park (the discharge target for fresh flows from the Tresant Drain) is very brief, and whereas it refers to the wetland lagoons which are a key feature of the park, its only reference to hydrology and environmental flows is: 'to maintain the natural water regime of the lagoons'.

The 1994 plan for the Big Heath Conservation Park is similarly brief, but does include a discussion of altered regional hydrology as it has affected the park (particularly Drain M); and identifies an objective to 'enhance the wetland habitat values of the park' – by consulting with the SEWCD Board regarding the impacts of altered hydrology on the park and investigating the modification of water regimes to approximate pre-drainage conditions.

The 1996 draft plan for the Messent Conservation Park discusses altered regional hydrology as it has affected the park - the result of which has been to virtually halt all flows to Messent and Tilley Swamp; and discusses the then-proposed northern outlet drain alignment through the park and issues regarding managing impacts of construction and subsequent access (including fauna crossings) but does not discuss future hydrology or environmental flows.

The more recent 2005 plan for Gum Lagoon Conservation Park features a good, quite applied discussion of modified hydrology as it affects the park, and includes amongst its strategies, to:

- Promote a surface water regime to re-instate infrequent flooding of the wetland complex with acceptable quality water;
- Support the management of a minimum impact flood-in/flood-out surface water drainage scheme for the Northern Catchment of the Upper South East; and
- Ensure the USE Network managers understand the hydrological principles in place for the park and adjoining Duck Island area.

Likewise the 2006 plan for the Hanson Tiver Scrub Conservation Park on the Bakers Range watercourse (dissected by the Bakers Range catch-drain) features a good discussion of modified hydrology as it affects the park; commits to participate in regional water management initiatives and recognises that the system will be managed into the future under an Adaptive Flows Management Framework.

All plans recognise that modified regional and local hydrology over many decades has and continues to impact upon environmental flows to wetland assets.

The articulation of this problem and response strategies have become more substantial over the past 10 years.

Although most of the existing plans identify the objective of improving environmental flows to wetland assets - none provide detailed descriptions of the functional requirements of these wetland assets or prescriptions for the management of environmental flows.

Over the past six years of the USE Program DFW, DENR and SEWCD Board personnel have collaborated closely to define the functional requirements of these wetland assets and establish targets for the management of environmental flows through the USE Network.

The future provision of environmental flows to key 'protected areas'

Bool and Hacks Lagoons Ramsar Site

The 2006 Park Management and Ramsar Plan includes high–level objectives for the future management of the hydrology of the Bool Lagoon/Hacks Lagoon wetland complex, which are underpinned a set of water level and flow management guidelines for storage and release of inflows (predominantly from Mosquito Creek), balancing flood mitigation and environmental watering purposes.

Objectives

- Ensure regional water management objectives are consistent with the maintenance of the ecological character and habitat diversity.
- Maintain habitat diversity through the management of water and addressing hydrological threats to the ecological character.
- Secure cross-border agreements and protocols to ensure adequate supply of water to maintain ecological character.

Flow Management Guidelines

Manage water in accordance with the target levels of:

- 48.15m AHD (Australian Height Datum) during June;
- 48.24m AHD during July;
- 48.30m AHD at the end of the first week in August;
- 48.40m AHD during the third week of August;
- 48.55m AHD at the end of August; and
- 48.61m AHD for as long as possible from the second week in September,

to maximise ecological value of the peripheral lagoons through the development of a water management strategy.

The operation of the USE Network, in particular planned diversions of water from Drain M northwards via the REFLOWS Western Floodway to provide environmental flows to key wetlands in the USE, will be planned and implemented with full consideration to supporting the environmental water requirements and agreed operating targets for the Bool and Hacks Lagoons Ramsar Site.

Fairview Conservation Park: '…to maintain the natural water regime of the lagoons…'

The wetland lagoons in Fairview Conservation Park (and the nearby Bloomfield Swamp) are relatively small in regional terms. They are serviced from local catchment, to the South East, including the surface water drainage capacity of the small Tresant Drain. This part of the USE Network optimises the delivery of fresh surface water from the available catchment area into these wetlands.

Big Heath Conservation Park: *'…enhance the wetland habitat values of the park by investigating the modification of water regimes to approximate pre-drainage conditions…'*

Big Heath Conservation Park is immediately adjacent to Drain M and its historical catchment is largely cut off by this drain. A small channel exists to divert water from Drain M into the wetlands of Big Heath, but it is regarded as under engineered to manage the scale of flows required to meet the hydrological needs of Big Heath. Also any substantial filling of Big Heath CP would result in flood-out over quite extensive areas of productive farmland adjacent to the parks northern boundary, as the natural topography along this boundary does not contain any inundation.

To improve the delivery of environmental flows to Big Heath Conservation Park will require:

- The development of an agreed environmental watering plan – to be incorporated into the Park Management Plan;
- The development of inundation containment banks along the park's boundary (particularly the northern boundary); and
- The construction of a more substantial diversion regulator from Drain M, to deliver a proportion of outflows from Bool Lagoon along Drain M, into Big Heath.

Gum Lagoon Conservation Park: *'…to re-instate infrequent flooding of the wetland complex of the park and adjoining Duck Island area…'*

The historical flow path to the wetlands of Gum Lagoon, was predominantly that of outflow from the Marcollat watercourse (and associated eastern and southern catchments), via the expansive Coola Coola watercourse/wetland system.

This flow path has been cut off:

- First by the 'private works' development of a stop-bank across the flow path at Petherick Road, preventing movement of water northwards into the once extensive wetlands of the Coola Coola watercourse (of which Gum Lagoon represents the northern remnant); and
- Second, by the retrospectively approved 'private works' development of the old section of the Didicoolum Drain.

To reinstate this flow path would require:

- Negotiation and/or an 'Order' to remove the stop-bank;
- The construction of an environmental flow overpass across the Didicoolum Drain; and
- The development of a regulator at the junction of the Jip Jip (Marcollat system) outflow watercourse and the flow path towards Coola Coola.

Under these conditions, outflows from the Marcollat system in normal or higher rainfall periods could be diverted to the wetlands of Gum Lagoon.

Complimentarily, the Duck Island wetlands receive much of their environmental flows from local catchment, and from the extended catchment area to the south and east. The development of the upper Bunbury Drain had the potential to reduce the flow of water from the east, but a connecting diversion channel into the Duck Island area enables such

flows to be maintained. The development of the Rosemary Downs Drain (to the south) harvests flows from this extended catchment area and directs them northwards into the Duck Island area via natural watercourse country.

Suitable quality flows from the upper Bunbury Drain will be directed into the Duck Island complex and suitable quality flows from the Rosemary Downs Drain will be directed preferentially northwards to the Duck Island area. Under extreme runoff/inundation events, excess floodwaters may be released into the Didicoolum Drain.

Hanson-Tiver Scrub Conservation Park: *'…this park will be managed into the future under an adaptive management framework…'*

The Hanson-Tiver Scrub complex is a large Melaleuca floodplain situated on the Central Bakers Range watercourse.

This floodplain area historically relied upon local cross-catchment flows of surface water in lower rainfall periods and more substantial flows up the Bakers Range watercourse during higher rainfall/runoff events. Yields from its catchment to the south have been reduced by the development of drainage (particularly Drain M and more recently the Fairview Drain). Local cross-catchment flows are now intercepted by the Water Valley Drain.

Currently, environmental flows to this floodplain conservation park are provided by way of the managed diversion of fresh flows along the Bakers Range watercourse. Such a diversion last occurred in 2004.

Hanson-Tiver Scrub Conservation Park will continue to be a target for environmental flow diversions along the Bakers Range watercourse, subject to the availability of suitable water at the Tatiara diversion regulator.

Alf's Flat (Messent Conservation Park)

The wetlands of the Messent Conservation Park represent the northernmost extent of the Bakers Range watercourse. These wetlands would historically have received only infrequent inundation, in very high to extreme rainfall/runoff phases (often over several consecutive years).

These wetlands have not received significant environmental flows since the early 1980s due to large-scale modification of their historic catchment areas and the protracted dry climatic phase of the past ten years.

The vegetation cover of these wetlands has changed markedly during this time with the extensive in growth of the desert banksia (*Banksia ornata*) and related species, following fire events.

Delivering environmental flows to Alf's Flat under current catchment conditions is perhaps the most difficult in the region. At the simplest level, this would require the availability of conservatively 45 GL of water at the Kecoonda Interchange; a third of which will be required to fill the wetland storage volumes between this control point and Messent Conservation Park. The wetlands of the Messent Conservation Park have been estimated to hold between 15 GL (nominal storage volume) and 26 GL (full capacity).

Investigations are underway to define the detailed environmental flow requirements and inundation storages of the wetlands of the Northern Bakers Range watercourse and to

model the evapo-concentration implications of various input water quality/volume scenarios, as a basis for management decision making.

Ongoing work will examine, in detail, the feasibility of delivering environmental water to the wetlands of Messent Conservation Park (the flow path and diversion capability to do so certainly exist).

Tilley Swamp Conservation Park

Environmental flows to Tilley Swamp Conservation Park are provided by way of diversions of suitable quality water from the Tilley Swamp Drain.

These flows are generated under normal and higher rainfall/runoff conditions, as outflows from the West Avenue and/or Taratap watercourses; or in the form of cross-catchment transfers from the Bakers Range watercourse, via the Kercoonda Drain.

Tilley Swamp CP will continue to be a target for environmental flow diversions from the Tilley Swamp Drain, subject to the availability of suitable water in this part of the USE Network.

Martin Washpool Conservation Park (Morella Basin)

The Morella Basin within the Martin Washpool Conservation Park near Salt Creek is the final control point for the balancing and release of flows from the USE Network into the south lagoon of the Coorong. It is also a significant wetland asset in its own right.

Morella Basin was historically a brackish to saline wetland, but with dramatically reduced environmental flows to this part of the landscape, resulting primarily from large-scale catchment modification, the wetland had declined to a poor state of health.

The Basin has a detention capacity of some 20 GL. With the development of the USE Network, discharging into and through the Basin, the wetland has received and retained annual inputs of brackish to saline flows (representing both saline groundwater base-flow and rainfall/runoff event flow) over the past 10 years.

The health of the wetland has recovered significantly during this time and it has served as an important refuge site for water birds during recent years, especially during drought conditions.

Detention and releases of water from Morella Basin are planned to optimise the waterbird habitat values of the wetland, and during the past several years in particular, to provide critical over-summer refuge habitat. The annual watering plan is developed in consultation with DENR and the Coorong Task Force and is reviewed and endorsed by the USE Program's Environmental Management Advisory Group (EMAG) and approved by the USE Program Board.

Morella Basin will continue to receive varying flows (both in terms of volume and quality) from the USE Network and to be managed to optimise the health of the wetland and its waterbird habitat values.

CHAPTER 3: KEY ENDANGERED SPECIES IDENTIFIED UNDER THE ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999 (COMMONWEALTH)

Yarra Pygmy Perch (*Nannoperca obscura*)

The Yarra Pygmy Perch (*Nannoperca obscura*) can be found in deep, fresh, tannin-stained water, with salinities generally less than 5,000 EC. This species will spawn in soft submerged aquatic vegetation such as Chara and Milfoil.

In the USE, known populations are located in deep permanent pools in Mosquito Creek and Bool Lagoon (when flooded); and in the Litigation Lane Swamps on Henry Creek. There are past records from within the wetlands of the Northern Bakers Range, however infrequent and low environmental flows and sub-optimal water quality over the past decade make it unlikely that any currently persist.

Yarra Pygmy Perch are located (outside of the USE area) in Drain M, at Magarey's Lane regulator, and near Lake George. The same genetic stock exists throughout the region suggesting that Mosquito and Bool are the source areas for transmission throughout the drain, watercourse and wetland network when big flows occur.

Yarra Pygmy Perch are threatened by reduced freshwater flow and/or salinisation of habitat, and under some circumstances by competition from the introduced 'Mosquitofish' (Gambusia ssp.).

Maintaining the security and quality of water from the Mosquito Creek catchment into Bool Lagoon and the appropriate management of this wetland complex is the most significant management objective to sustain this species in this key refuge area with the region.

It is regarded as unlikely that this species will expand or persist widely across the USE, even with improved management of environmental flows through the USE Network, as its habitat preference is not consistent with the nature of most wetlands in the region (particularly under current and likely future catchment conditions).

The species may be able to establish/persist in niche habitat areas (such as Henry Creek – the only other known location of this species in the region at this time) under a carefully managed flow regime. Environmental flows to Henry Creek will be managed for these purposes.

Southern Bell Frog (*Litoria raniformis*)

The Southern Bell Frog (*Litoria raniformis*) prefers semi-permanent freshwater with salinity levels less than 5,000 EC and that are heavily vegetated with submerged and emergent aquatic vegetation. The species tends to be associated in the South East region with

wetlands featuring *Triglochin procerum*, but has also been found amongst *Baumea arthrophylla*.

The species is known to exist:

- In Lake Cadnite near Francis;
- On the Morambro Creek;
- In Lake Ormerod;
- In the Bool Lagoon complex;
- In Rockys Swamp (Parrakie wetlands); and
- Magarey's Lane on Drain M (outside of USE).

Their habitat exists elsewhere on the West Avenue watercourse.

There are past records (1980s to early 1990s) of the species in the wetlands of the Northern Bakers Range and unconfirmed reports of Southern Bell Frog tadpoles in the Mandina/Cortina wetland complex as recently as 2009.

The species was once widespread and common in the South East and may exist in other locations, but is less readily detectable than other frogs.

The species is threatened by reduced freshwater flow and/or salinisation of habitat.

It is unlikely that this species will expand or persist widely across the USE, even with improved management of environmental flows through the USE Network, as its habitat preference is not consistent with the nature of many wetlands in the region (under current and likely future catchment conditions).

However the species may be able to establish/persist in a number of appropriate habitat areas under a carefully managed flow regime. For example; the expansion of the current, limited population at Rockys Swamp on the West Avenue watercourse, to other wetlands along this watercourse may be facilitated by the improved frequency and scale of environmental flows resulting from the REFLOWS Western Floodway development. Similarly, the reintroduction of the species to wetlands of the Bakers Range watercourse may be possible if supported by improved management of environmental flows, including flows from the historical catchments of the Lower South East.

Such an effort would require the development of a species recovery plan, incorporating the management of environmental flows through the USE Network.

Migratory waders

Migratory waders, including such species as the Sharp-tailed Sandpiper, Red-necked Stint and Common Greenshank are habitat generalists, and will feed in salt marsh as readily as mudflats on fresh and salt water.

These species generally prefer shallow open water. They have been observed in Morella Basin, wetlands of the Northern Bakers Range, Taratap watercourse, and less frequently in

the West Avenue wetlands or those further inland – such wetlands may be too deep for their feeding purposes.

Freshwater specialists include the **Wood Sandpiper** (observed in the wetlands of the Northern Bakers Range) which likes shallow open water; and **Latham's Snipe** which prefers a grassy/tussock habitat and freshwater flooded meadows (observed in the Taratap watercourse, Schofield's and Tatiara Swamps on the Bakers Range watercourse).

Others include the **Common Sandpiper** observed at Morella Basin and Salt Creek in salty/estuarine water; the **Curlew Sandpiper** (observed in the wetlands of the Northern Bakers Range, the Taratap watercourse and Morella Basin) which has a tendency to fresher water.

The success of these species within the USE landscape will be facilitated by the improved frequency and scale of environmental flows delivered through the USE Network under the Adaptive Flows Management Framework, particularly efforts to maintain refuge habitat during dryer climatic cycles.

Orange-bellied Parrot

There are estimated to be only some 150 Orange-bellied Parrots left in Australia.

They are generally a coastal margin based species. Throughout the year Orange-bellied Parrots are found in salt marshes, coastal dunes, pastures, shrub lands, estuaries, islands, beaches and moorlands within 10 km of the coast. Holes in eucalypts are used for nesting.

They prefer to feed on the edge of wetlands, where they are protected on one side by water, and the other by a wall of vegetation and are quite specific in this preference. They feed on a variety of plants, including samphire.

The species' current non-breeding mainland distribution is from the mouth of the Murray River, along the coast, to South Gippsland. In South Australia, Carpenter Rocks is their principal remnant site, however records indicate that the Orange-bellied Parrot's former distribution extended as far west as York Peninsula.

Recent sightings have occurred around Canunda National Park and in the southern part of the Coorong National Park.

Currently, the main threat to the Orange-bellied Parrot is the loss and fragmentation of its non-breeding marsh habitat.

The species may be able to re-establish or persist in niche habitat areas (such as the Coorong and Morella Basin) under a carefully managed flow regime.

A number of avifauna specialists are interested in Morella Basin as a habitat opportunity for the species in the context of its proximity to the Coorong and its current 'managed' condition.

The success of this species within the USE may be facilitated by the improved frequency and scale of environmental flows delivered through the USE Network under the Adaptive Flows

Management Framework, particularly efforts to maintain the health of saline and brackish wetlands such as Morella Basin and Tilley Swamp.

CHAPTER 4: LEGISLATIVE CONTEXT FOR THE OPERATION OF THE USE NETWORK

This chapter identifies legislation that is relevant to the development and operation of the USE Network, the principles of the Strategy and Implementation Plan. Key legislation and policy includes:

- ***South Eastern Water Conservation and Drainage (SEWCD) Act 1992***
- **State Natural Resources Management Plan**
- **South East Regional Natural Resources Management Plan**
- **Regional water allocation planning under the *National Resources Management Act 2004***
- **Environmental Protection (Water Quality) Policy 2003**
- ***Native Vegetation Act 1991***
- **Statutory plans under the *National Parks and Wildlife Act 1972***
- ***Aboriginal Heritage Act 1999***
- ***Environmental Protection and Biodiversity Conservation (EPBC) Act 1999 (Commonwealth)***

4.1 Relevance of the *South Eastern Water Conservation and Drainage (SEWCD) Act 1992* to the Strategy and Implementation Plan.

Currently, the SEWCD Act 1992 (or its successor) is the primary legislative platform for the ongoing management and development of the USE Network, at the conclusion of the USE Act. In this regard it is an important piece of legislation to the future success of the Strategy.

The SEWCD Act doesn't contain many of the specific features of the USE Act; however, it does have a number of parallel foundation elements. For example, it has the objects of providing for the management of flooding, improving soil quality and production generally, and to enhance and develop natural wetlands and the environment.

Under the SEWCD Act, the SEWCD Board has functions to provide an effective and efficient system for managing the surface water of the region, by conserving, draining, altering the flow and utilising this water in any manner. It may carry out works for the purpose of lowering the level of the water table, and undertake research in water conservation, drainage and management. The Board has, in performing its functions, the power to acquire land, develop and hold assets and enter into contracts and agreements with third parties.

The SEWCD Act is largely silent on the SEWCD Board's functions regarding the manner in which drainage and environmental flow goals should be pursued. Historically, the SEWCD Board has not been directly involved in the provision of environmental flows in any significant way.

The SEWCD Act requires the Board to develop a management plan to direct its activities in the administration of the Act. Historically, this plan has been akin to a business plan - identifying the intended scope of work of the Board; rather than a strategic resource management plan – defining regional drainage and/or environmental flow management goals, principles or guidelines.

Considerable work has been undertaken over the past few years to prepare for the transition of the USE Program to a regional managing authority, at the completion of the current USE Program.

4.2 Relevance the State Natural Resources Management Plan to the Strategy and Implementation Plan

The vision of the State Natural Resources Management (NRM) Plan 2006-11, is:

> ***'South Australia, a capable and prosperous community, managing natural resources for a good quality of life within the capacity of our environment for the long term.'***

This achievement of this vision is framed under four Goals.

Goal 1 'Landscape scale management that maintains healthy natural systems and is adaptive to climate change' - recognises that taking a landscape scale approach to NRM is essential to manage the risks associated with continuing shifts in landscape pattern and function - particularly associated with predicted climate change - at the right spatial scale and over appropriate timeframes. Policies under this goal highlight that landscapes must be managed for multiple objectives, including maintaining ecosystems and ecological processes, regional economic development, and building strong regional and rural communities.

Goal 2 'Prosperous communities and industries using and managing natural resources within ecologically sustainable limits' - recognises that our natural resources are critical to the prosperity of our State - our quality of life, economic development and our health, recreational, cultural and social needs being met. The allocation and use of natural resources within their 'ecologically sustainable limits' is fundamental to achieving the vision of the Plan. Policies under this goal highlight the need for such fundamentals as water allocation planning, water use efficiency and the provision of adequate environmental flows; and for landscape-capacity based development of sustainable industries.

Goal 3 'Communities, governments and industries with the capability, commitment and connections to manage natural resources in an integrated way' - recognises that community engagement and empowerment are vital for sustainable solutions to be owned and delivered by stakeholders; and that a broad range of community skills and resources, as well as ongoing commitment and good connections will need to be engaged, and where necessary developed. It also recognises that fundamental to the success of the Plan will be access to the best and most recent knowledge, generated through responsive and ground breaking research and technological innovation. Policies under this goal highlight that sourcing, commissioning, evaluating and using a wide range of cultural, social, economic,

environmental, scientific and technical skills, knowledge and expertise to foster ongoing learning and innovation will be empowering and motivating. Local people, as well as education and research institutions must all be recognised and engaged.

Goal 4 'Integrated management of biological threats to minimise risks to natural systems, communities and industry' - recognises that pest animals and plants, pathogens and over-abundant native species have had major impacts on biodiversity, agricultural industries and public health and that the risks they pose to our terrestrial and aquatic ecosystems, including productive systems, are likely to increase as a result of climate change, global trade and travel. Policies under this goal identify that an integrated approach based on a risk management framework will be taken to minimise current and future impacts and wherever possible, prevent new pest species from becoming established.

The USE Program has been consistent with (and in many ways an advanced model of) the vision, goals and broad range of policy principles of the State NRM Plan. It is a multi-dimensional initiative, with purposes to: protect agricultural and environmental lands from dryland salinity; mitigate the direct and indirect impacts of widespread and protracted flooding; provide environmental flows to protect and enhance wetland ecological values; and protect and enhance significant ecological assets through covenants and practical management plans with private landholders.

Similarly, the Strategy specifically defines the principles of managing the USE Network:

- Focussed on integrated management under changing environmental and climatic conditions;
- At the landscape scale, and over appropriate timeframes;
- To optimise both ecosystem, rural production and regional economic outcomes;
- Applying local knowledge and the best available science to decision making; and
- Engaging with the community to leverage and build capacity.

4.3 Relevance of the South East Regional Natural Resources Management Plan to the Strategy and Implementation Plan

The South East NRM Plan was adopted by the Minister for Environment and Conservation on the 31 May 2010. The Regional NRM Plan sets the direction for Natural Resources Management in the region. The vision contained within the Plan is healthy landscapes for better living. The Plan provides guidance to assist the region to achieve a balance between environmental, social and economic outcomes.

The South East NRM Plan guides and leads strategic NRM activity in the region, as well as the operation of the NRM Board. The Plan details the investment of funds raised through the NRM levy in the South East, and also funds sourced externally.

This vision will be supported by four draft Strategic Goals:

Goal A: ***Healthy landscapes supporting high value ecological systems***

Goal B: ***Regional communities active in natural resources management***

Goal C: ***Resilient industries taking responsibility for sustainable use and management of natural resources***

Goal D: ***Leadership, adaptability and partnerships for effective natural resources management***

Current Management Action Targets that are supported by or have implications for the management of the USE Network and the USE Drainage Network Management Strategy are:

A.2 Understanding of the hydrogeological processes underpinning the region's water resources, including cross-boundary interactions and the implications of climate change, is improved by 2015.

A.4 The Bool and Hacks Lagoon and Coorong Ramsar Sites are managed to ensure no adverse change in Ecological Character, in accordance with Australian Ramsar Management Principles and EPBC Act (1999), by 2015.

A.6 Risk-based strategies are developed and implemented to maintain (or improve) the quality of groundwater and surface water (e.g. stormwater, drains and effluent) entering wetland, coastal and marine habitats, by 2015.

A.7 By 2015, the opportunities for and quantity of 'fit for purpose' water retained in the landscape are increased in areas identified to be appropriate.

A.12 Environmental refuges in drains are identified, and appropriate management options are developed and implemented to aid biodiversity, by 2015.

C.1 The region's water resources are managed within sustainable limits, by 2017.

C.3 The impacts of significant changes in land use on the region's natural resources are assessed and understood (ongoing).

C.6 Appropriate plant-based systems for drained and undrained salt-affected landscapes are developed, and systems adopted across at least 25% of affected areas in the region, by 2015.

C.12 The area of perennial plant systems that contribute to healthy landscapes is increased by 20%, by 2015.

C.15 The understanding of the impacts of current agricultural practices on soil health is improved, including establishing the relationships between soil organic carbon and sustainable land management, and priority actions are identified, by 2015.

D.2 Adaptive management arrangements for the region's water resources are defined and progressively implemented (e.g. integrated water-monitoring strategy, risk-based strategies to protect water supply and quality, etc.), by 2017.

D.5 The Regional Flow Management Strategy is developed, by 2015.

D.6 The level of support, both human and financial, for biodiversity conservation of the Region's remaining native vegetation on privately-owned land is maintained or improved compared with 2007 level (ongoing).

D.9 Existing (in 2007) cooperative (including legislative) arrangements are managed to improve the condition of habitats on public and private land, and new cooperative

management agreements are agreed to and implemented to include at least three (3) key habitat areas, by 2015.

The development and management of the USE Network has and will continue to contribute to the Goals and relevant Management Action Targets identified within the South East NRM Plan.

4.4 Relevance of regional water allocation planning under the *Natural Resource Management Act 2004* to the Strategy and Implementation Plan

The *Natural Resources Management Act 2004* provides that both the needs of the natural environment and human demands be considered in determining appropriate limits on the amount of water which can be diverted from the watercourse for all uses. This involves careful investigation of the water resource capacity and sustainability.

A Water Allocation Plan (WAP) is a legal document summarising the rules for allocation, use and transfer of water from prescribed water resources. They are prepared under the authority of the *Natural Resources Management Act 2004*. WAPs are prepared by the Natural Resource Management Boards of individual areas and adopted by the Minister.

There are presently four groundwater allocation plans in the South East Region, the:

- Comaum-Caroline WAP and Lacepede Kongorong WAP (to be superseded by the Lower Limestone Coast Water Allocation Plan, once adopted);
- Padthaway WAP;
- Tatiara WAP; and
- Tintinara-Coonalpyn WAP.

These establish a framework for the sustainable management of the groundwater resources in these irrigation areas, by providing for the allocation (and trade) of water, while maintaining the health of natural resources and ecosystems.

The Morambro Creek and Nyroca Channel Prescribed Watercourses (including Cockatoo Lake and the Prescribed Surface Water Area) is the only surface water resource and surface water area currently prescribed in the SE NRM Board region.

The protection and formal management of surface water is a priority for the SE NRM Board. The opportunities and avenues for ensuring the protection of surface waters are presently under discussion. Permit policies in the SE Regional NRM Plan (2010) relating to water affecting activities such as dams, wetland management works, bridge construction and other matters currently apply.

A range of permit policies to guide water affecting activities are outlined in the SE Regional NRM Plan (2010).

Although having progressed significantly over the past five years the development of water resource assessments and water allocation policy has some way to go before water resource management across the region is comprehensively addressed.

In the mean time considerable work is being done to improve surface water and groundwater resource assessments in the region.

In implementing this Strategy USE Network manager will need to be conscious of the present status and directions of these processes and the current limitations of knowledge so as to support the development of robust water policy in the region and compliment to the efforts of agencies involved.

4.5 Relevance of the Environment Protection (Water Quality) Policy 2003 to the Strategy and Implementation Plan

The cornerstone of the *Environment Protection Act 1993* is the definition of the general environmental duty that: A person must not undertake an activity that pollutes, or might pollute, the environment unless the person takes all reasonable and practicable measures to prevent or minimise any resulting environmental harm.

Almost any human activity, by definition, 'pollutes' and is therefore technically in breech the 'general environmental duty of care'. However, the Act also provides that failure to comply with the 'duty' does not of itself constitute an offence; rather that compliance with the 'duty' may be enforced by the issuing of an environment protection order (or similar).

To help define the expected standards of environmental duty of care the Act provides for the establishment of environment protection policies (EPP) - for example to set out requirements, standards, goals and/or guidelines relating to a polluting or potentially polluting activity.

The Environment Protection (Water Quality) Policy 2003 provides for the protection of water quality under the Act. Specifically this EPP provides that; a person, who is undertaking an activity, must take all reasonable and practicable measures to avoid the discharge or deposit of waste from that activity into any waters.

Of note: Section 4(3) of the EPP - Application of Policy – Provides that Except for Part 5 (referring to **Stormwater Pollution Codes of Practice**), this policy does not apply to the ultimate discharge of stormwater from a public stormwater disposal system into any waters by public authority responsible for the system.

The **Stormwater Pollution Code of Practice for Local, State and Federal Agencies** provides information on strategies and techniques to reduce the incidence of stormwater pollution from agency developments and operations. With respect to the operation and management of public stormwater systems (such as the USE Network) the code clearly promotes the design and management of stormwater systems in accordance with an integrated, total catchment management framework, and incorporated best management practices.

The EPP also establishes water quality criteria (Schedule 2) and provides that; a person must not, by discharging a pollutant into any waters, cause any water quality criteria applicable to those waters to be exceeded or, if already exceeded, to be further exceeded.

Since 2003, the USE Program has developed and maintained a comprehensive water quality monitoring program. The raw data from these programs is provided to the EPA for

consideration as it is received and results of these programs are evaluated and published in an annual monitoring program report.

The general view of the EPA with respect to the water quality situation in the USE Network is that: the USE landscape is comprised of generally low-risk catchments; the water quality criteria exceedences observed are trivial and consistent with expected background levels of naturally occurring contaminants and that the water quality monitoring program in place provides a good coverage of the system under normal operating conditions and an effective platform from which to escalate investigations and response in the event of a significant contamination issue being observed.

The raw data from this program has been provided to the EPA for consideration. Results have been evaluated and published in the annual Water Quality Monitoring Report and subsequently referred to relevant government agencies and related bodies (EPA, DENR, DFW, SEWCD Board, SENRM Board, EMAG and ultimately the USE Program Board) for consideration and advice.

The EPA, DENR and EMAG in particular provide perspective with respect to the results and findings of the program, and influence the development of subsequent monitoring work. As a consequence of this baseline Monitoring Program for example, the USE Program has also undertaken nutrient composite-sampling monitoring programs in partnership with the EPA to estimate the net 'load' of nutrients being released into the Coorong from the scheme – which was found to be negligible.

With the occurrence of the next very-high to extreme rainfall/runoff event(s), the 'discharge' monitoring program (south lagoon of the Coorong) will be expanded to parallel the early cycles of this program (additional number of sampling points, increased sampling frequency, prolonged sampling duration) under high flow conditions. This will provide important comparative information with respect to the discharge plume, mixing processes and net effect on the water quality of the receiving environment.

4.6 Relevance of the *Native Vegetation Act 1991* to the Strategy and Implementation Plan

The *Native Vegetation Act 1991* provides for the control of clearance of native vegetation and for incentives and assistance to landowners in relation to the preservation and enhancement of native vegetation.

The provisions of this Act relevant to the USE Program and the Strategy relate primarily to the potential clearance of native vegetation during construction processes.

Section 27 of the Act provides that native vegetation may be cleared in prescribed circumstances. Section 5 of the Native Vegetation Regulations, 2003 establishes a standing arrangement for native vegetation clearance relating to construction under the USE Program.

Native vegetation may be cleared within the USE Project Area, for the purposes of the construction or maintenance of water management works under the SEWCD Act 1992 - by the SEWCD Board; or *Upper South East Dryland Salinity and Flood Management Act 2002* by

the relevant Minister; in accordance with an approved management plan; or where the clearance is incidental to related repair or maintenance work.

The native vegetation management plans relating to drain developments under the USE Program commonly describe the general principles under which environmental flows would be managed in the future as part of the discussion about the benefits of the constructed works by comparison to the related loss of native vegetation.

It is generally regarded that the USE Program makes every effort to minimise vegetation clearance associated with construction – and the process of management plan development and clearance approvals has become very streamlined between the organisations.

The plans developed to date incorporate very general, high-level articulations of environmental flow objectives; consistent with those that underpin the Adaptive Flows Management Framework – bearing in mind that these may vary from time to time, on the basis of evolving knowledge and experience.

The Native Vegetation Council has been briefed by USE Program personnel on the nature of adaptive flows management and has been very accepting of the relevance of this approach to managing environmental flows to and vegetation within key wetland systems linked to the USE Network. Under these circumstances it is not considered likely that there will be any significant conflict with the interests of the Native Vegetation Council in the future.

However, importantly, the definition of "clearance", in relation to native vegetation includes the draining or flooding of land, or any other act or activity, that causes the killing or destruction of native vegetation, or any substantial damage to native vegetation.

It is very likely that from time to time in the future, managed environmental flows will result in the inundation of wetland systems that will in the natural course of events disadvantage (kill) some vegetation associations (particularly invading terrestrial species, i.e. melaleuca) and advantage other associations/habitats (i.e. Gahnia sedge lands, emergent macrophytes, etc – generally the open water habitats) - which may well be part of the deliberate purpose of the inundation.

The resolution of this type of issue in terms of the requirements of the *Native Vegetation Act 1991* will require close consultation with and ultimately the support of the Native Vegetation Council. Subsequently, it may be appropriate to submit a general wetland inundation/vegetation management plan to obtain formal endorsement from the Native Vegetation Council for such courses of action under the umbrella of the Adaptive Flows Management Framework and decision support system.

4.7 Relevance of statutory plans under the *National Parks and Wildlife Act 1972* to the Strategy and Implementation Plan

Section 38 of the *National Parks and Wildlife Act 1972* requires that a management plan is prepared for each reserve established under the Act. A management plan sets forth proposals in relation to the management and improvement of the reserve and the methods by which it is intended to accomplish the objectives of the Act in relation to that reserve.

Once adopted, the provisions of a plan must be carried out and no activities undertaken unless they are in accordance with the plan.

A number of parks in the USE feature wetland assets that have been affected by modified catchment hydrology over many decades and/or can be serviced by environmental flows manipulated through the USE Network. The plans for these parks vary enormously based upon their size, but more importantly based upon when these plans where developed and as it relates to environmental flows, the level of knowledge regarding hydrology and environmental water requirements at that time.

All plans recognise that modified regional and local hydrology over many decades has and continues to impact upon environmental flows to wetland assets. The articulation of this problem and response strategies have become somewhat more specific over the past 10 years.

Although most of the existing plans identify the objective of improving environmental flows to wetland assets - none provide detailed descriptions of the functional requirements of these wetland assets or prescriptions for the management of environmental flows. Generally, all plans identify the need to promote a surface water regime to re-instate periodic inundation of wetland assets complex with acceptable quality water in a manner that (to the extent possible) reflects historical natural flow patterns.

Personnel from the USE Program, DWLBC, DENR and SEWCD Board have collaborated to define the functional requirements of these wetland assets and establish targets for the management of environmental flows through the USE Network. It is now widely recognised that the development and delivery of complex environmental flow prescriptions will come through the Adaptive Flows Management Framework and decision support system developed under the USE Program.

Regional park management plans do not incorporate any specific barriers or prescriptions for the delivery of appropriate environmental flows through the USE Network - based upon the general principle and intent of replicating 'natural' inundation cycles to enhance the environmental values (particularly wetland habitat values) of these parks.

4.8 Relevance of the *Aboriginal Heritage Act 1999* to the Strategy and Implementation Plan

The *Aboriginal Heritage Act 1999* provides the legal framework to protect and manage Aboriginal heritage. Under this legislation, all Aboriginal sites, objects and remains in South Australia that are of significance to Aboriginal tradition, archaeology, anthropology and/or history are protected.

As part of its legislative responsibility, the Aboriginal Heritage Branch maintains the Central Archive, which includes the Register of Aboriginal Sites and Objects. The Central Archive contains some 6600 site recordings, 1200 cultural heritage reports and other published material. The Register is not a comprehensive record of all Aboriginal Sites and Objects in South Australia, and sites or objects will exist that have not been previously recorded in the Archive.

A series of Guidelines have been developed to assist the public to understand the Act and their responsibilities with respect to the protection of Aboriginal heritage. These Guidelines are generally oriented towards the identification and management of Aboriginal heritage 'sites' and 'objects' – particularly in the context of proposed developments or works.

Consistent with this orientation, the most likely and significant implication for the USE Program with respect to this legislation relates to the design and construction of engineering works and similarly ongoing maintenance.

The USE Program has historically enjoyed a very respectful and cooperative relationship with the Aboriginal communities that have an interest in the country on which the USE Network has been developed and this should continue, based upon a process of genuine consultation.

The Ngarrindjeri community in particular have had a close interest in the management of water in the region, particularly with respect to returning fresh flows to the south lagoon of the Coorong, and have been generally supportive of the purpose and efforts of the USE Program in this regard.

There is nothing to suggest at this point in time that either the provisions of the Act or the priorities of interest to the relevant Aboriginal communities will be the basis for any significant conflict relating to the operations of the USE Network; so long as the flow management objectives of the USE Network, particularly that of providing environmental flows to protect and enhance wetland and watercourse ecological values (including the Coorong) are legitimately pursued.

4.9 Relevance of the *Environment Protection and Biodiversity Conservation (EPBC) Act 1999 (Commonwealth)* to the Strategy and Implementation Plan

The EPBC Act provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places — defined in the Act as 'matters of national environmental significance'.

The EPBC Act applies to seven matters of national environmental significance, including: world heritage sites, national heritage places, wetlands of international importance (Ramsar wetlands), nationally threatened species and ecological communities, migratory species, Commonwealth marine areas and nuclear actions.

Generally, the EPBC Act comes into play when a proposed action ('proposal' or 'project') has the potential to have a significant impact on a matter of national environmental significance. Such proposals must be 'referred' for assessment, including a public comment phase. A determination is made as to whether or not the proposal should proceed, and if so, whether any specific conditions need to be attached to that approval.

The Upper South East Dryland Salinity and Flood Management Plan was approved under the *Environment Protection (Impact of Proposals) Act 1974*, preceding the EPBC Act. With the establishment of the USE Program in 2003, it was confirmed that this standing approval would carry forward, and that no additional referral or approval under the EPBC Act was

required. The USE Program (including construction, environmental programs and operational management) is an approved project for the purposes of the EPBC Act.

To date variations of physical scope of the 'approved' USE Program have not required further EPBC Act referral, as they have been regarded as being consistent with the scope of intent, established objectives and broad terms of reference of the 'approved' Program.

The ongoing implementation of the USE Network, under the umbrella of the Adaptive Flows Management Framework, is not likely to trigger the requirement for additional referral under the EPBC Act – so long as such implementation and operation remain consistent with the 'approved' scope of intent, established objectives and broad terms of reference of the USE Program.

Any developments or operations that are clearly not congruent with these terms of reference and which have the potential to have a significant impact on a matter of national environmental significance may require separate referral, assessment and approval.

APPENDIX

Map 1: Regional watercourse and drainage infrastructure

Map 2: Modelled source water catchments

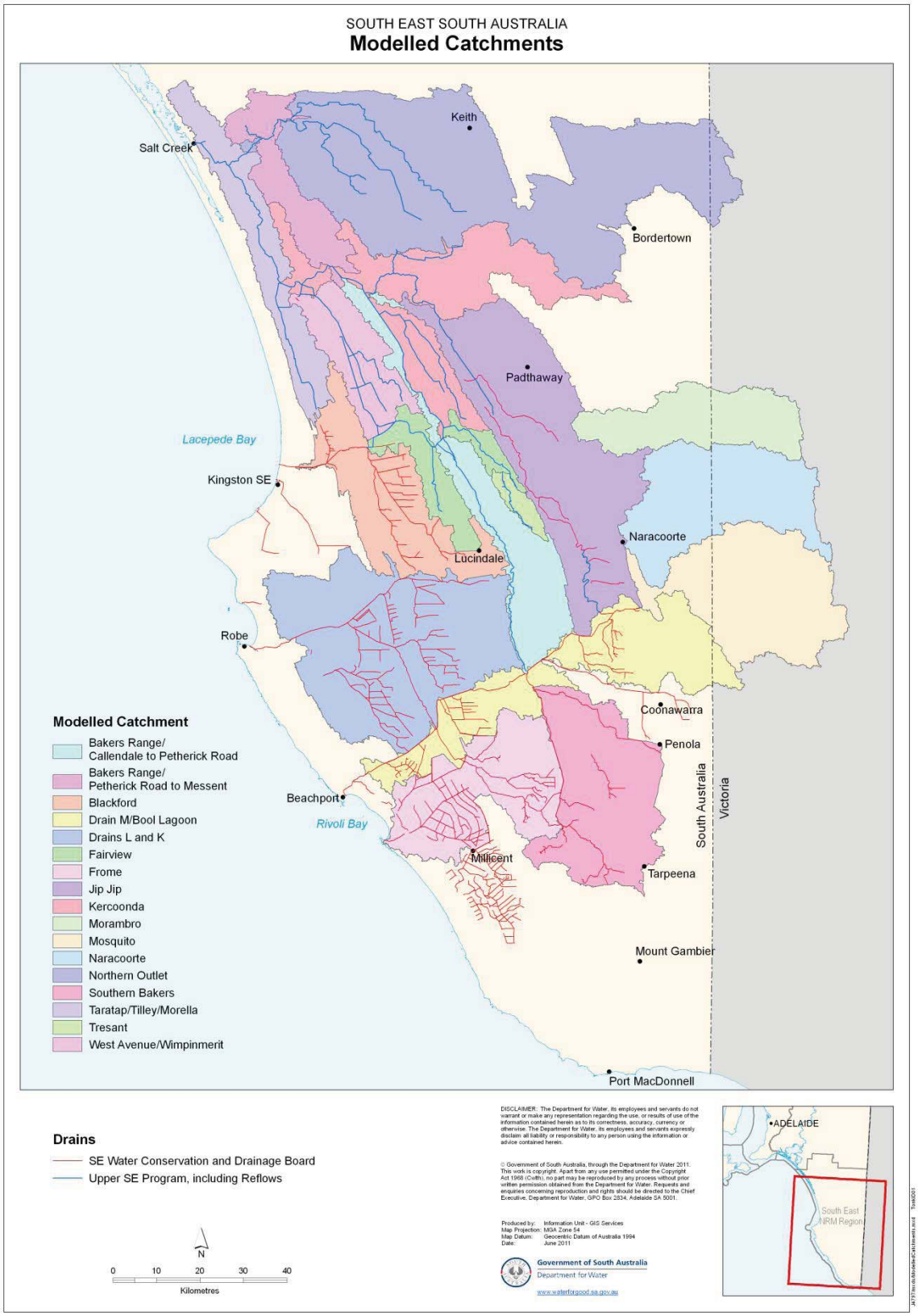
Map 3: Network Management Units of the Upper South East Network

Map 4: Local Government Areas

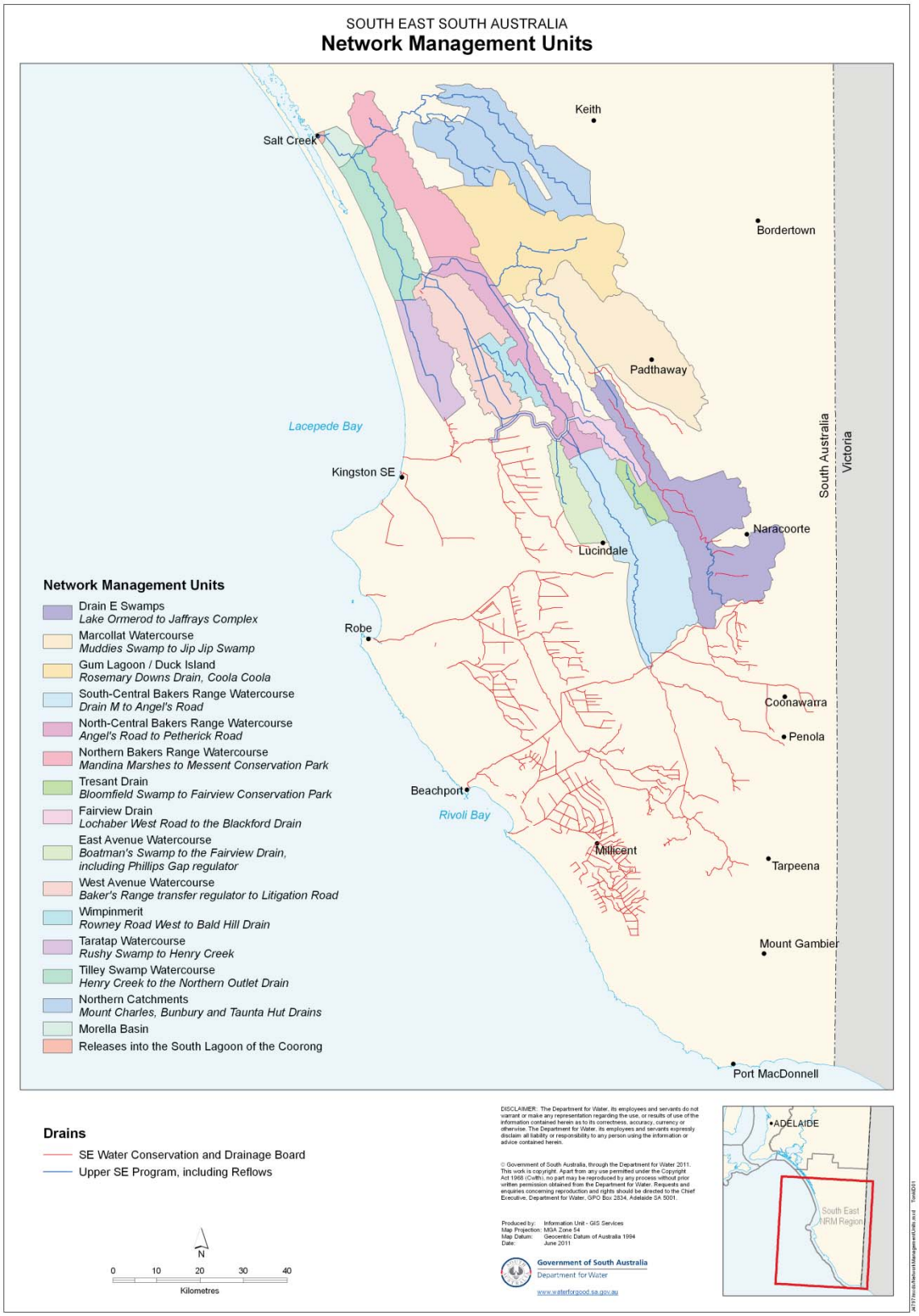
Maps 5 – 21: Schematics of USE Network management units

Map 1: Regional watercourse and drainage infrastructure

Map 2: Modelled source water catchments



Map 3: USE Network Management Units

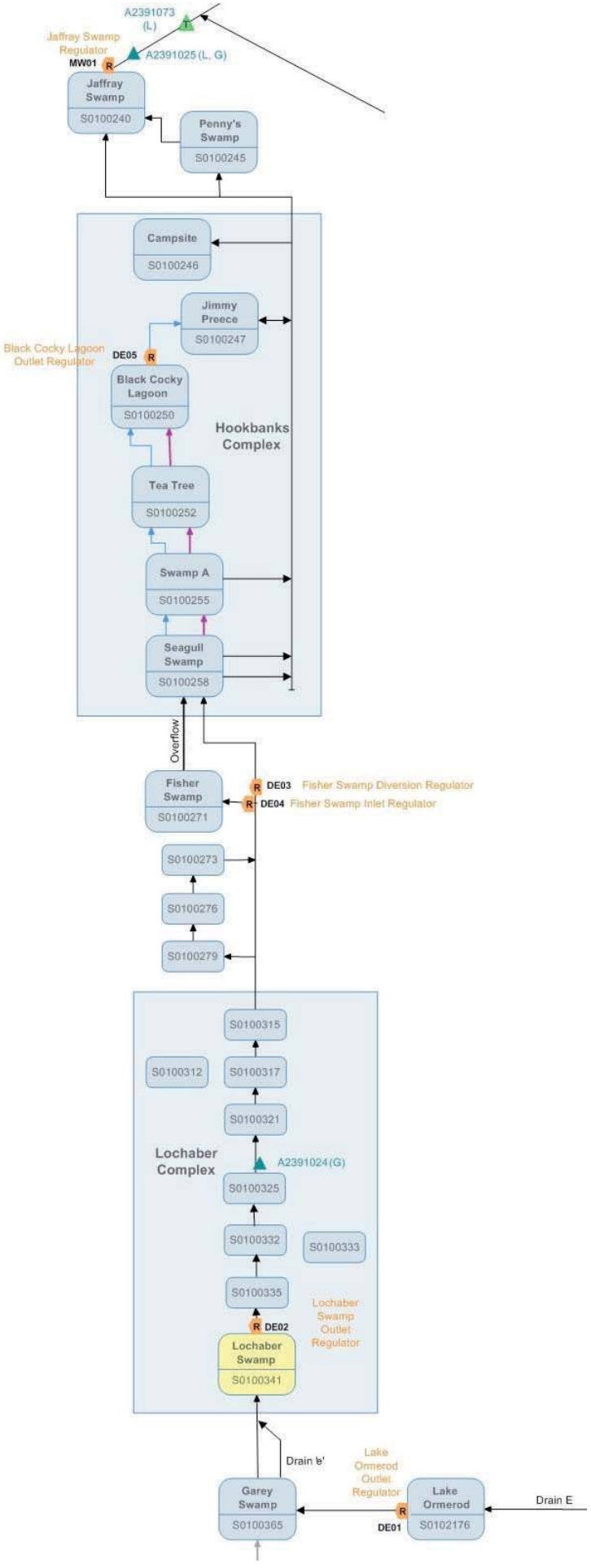


Map 4: Local Government Areas

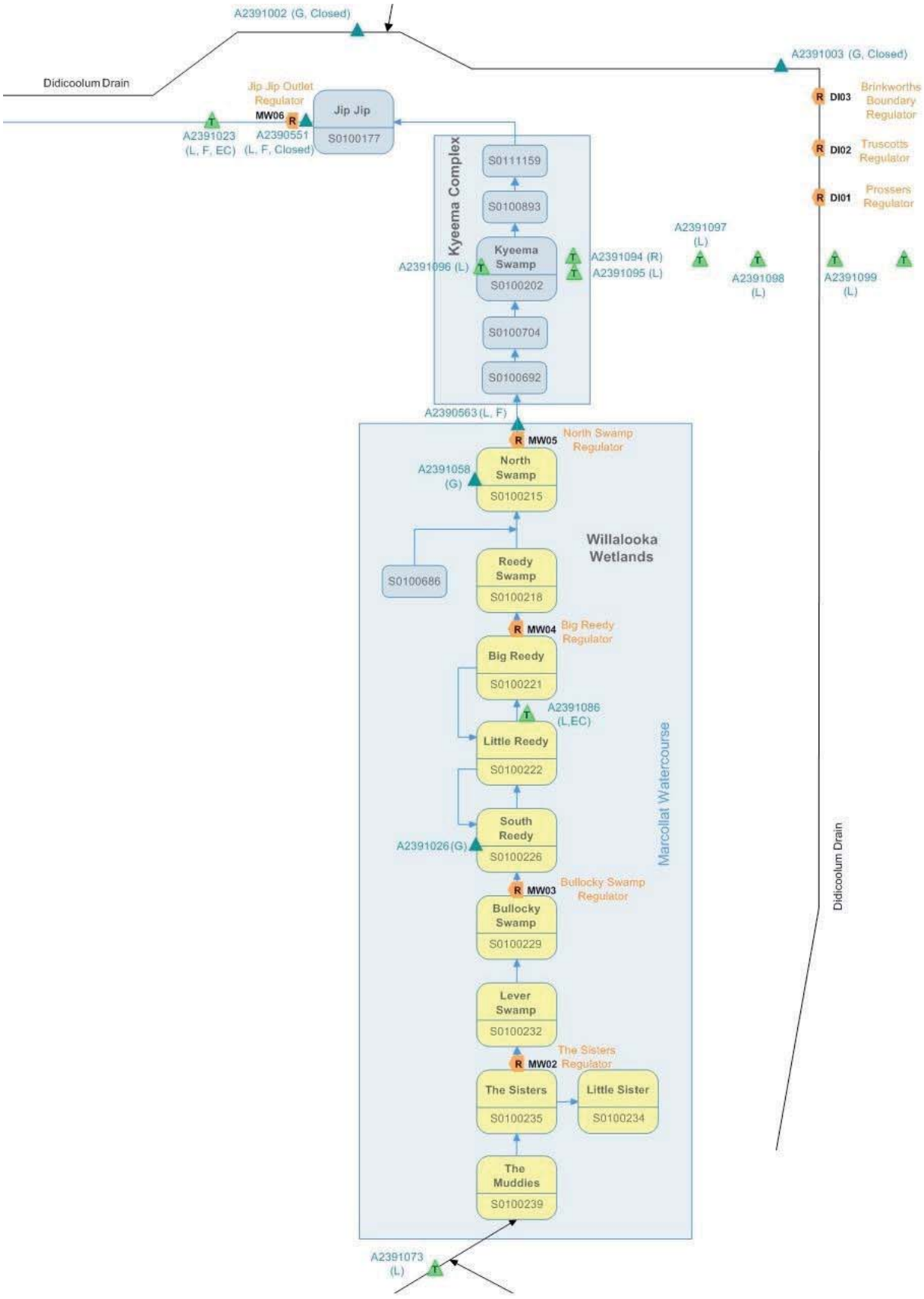
Map 5-18B: Schematics of USE Network Management Units

See following A3 pages

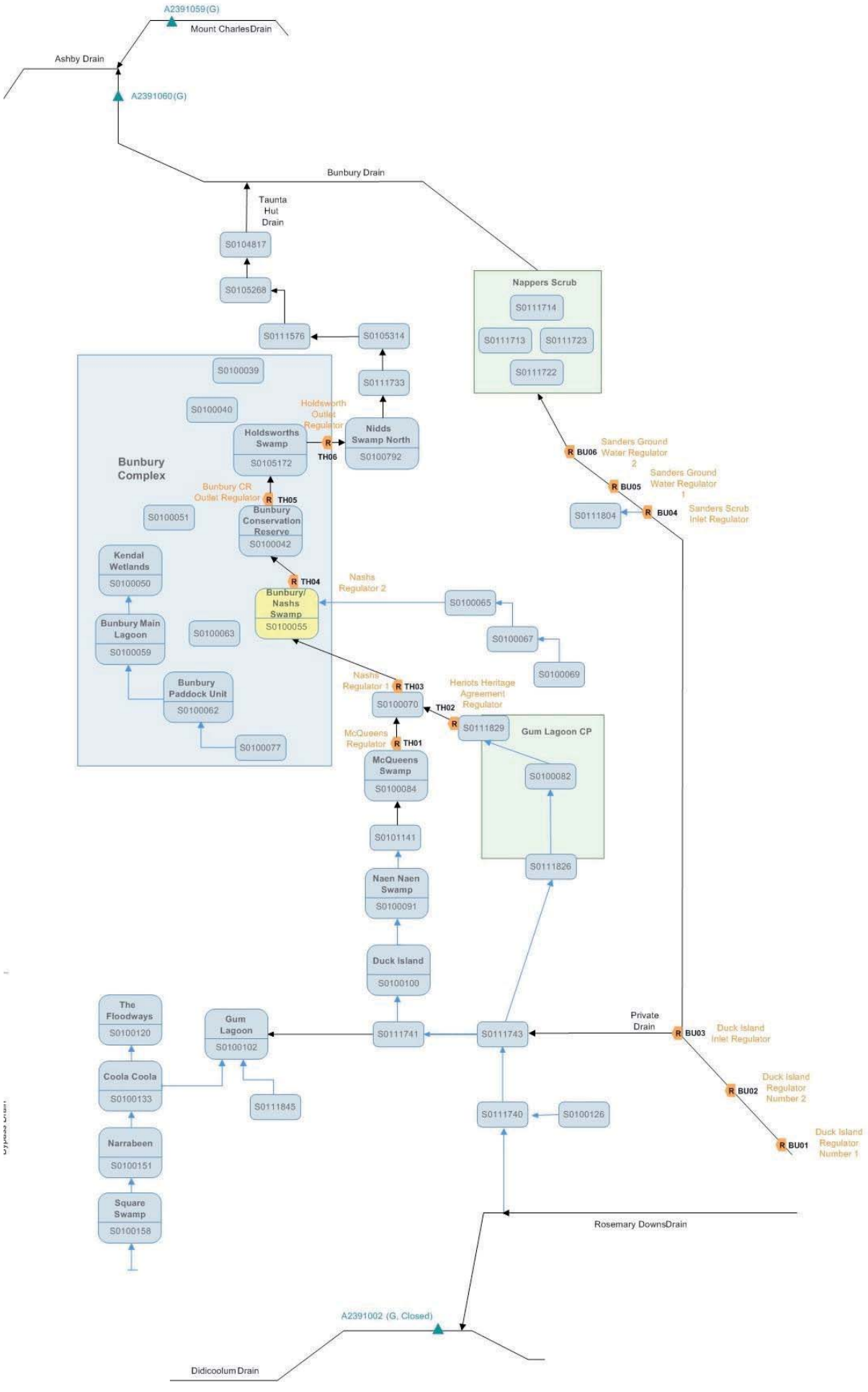
Map 5: Drain E Swamps Schematic (Lake Ormerod to Jaffrays Complex)



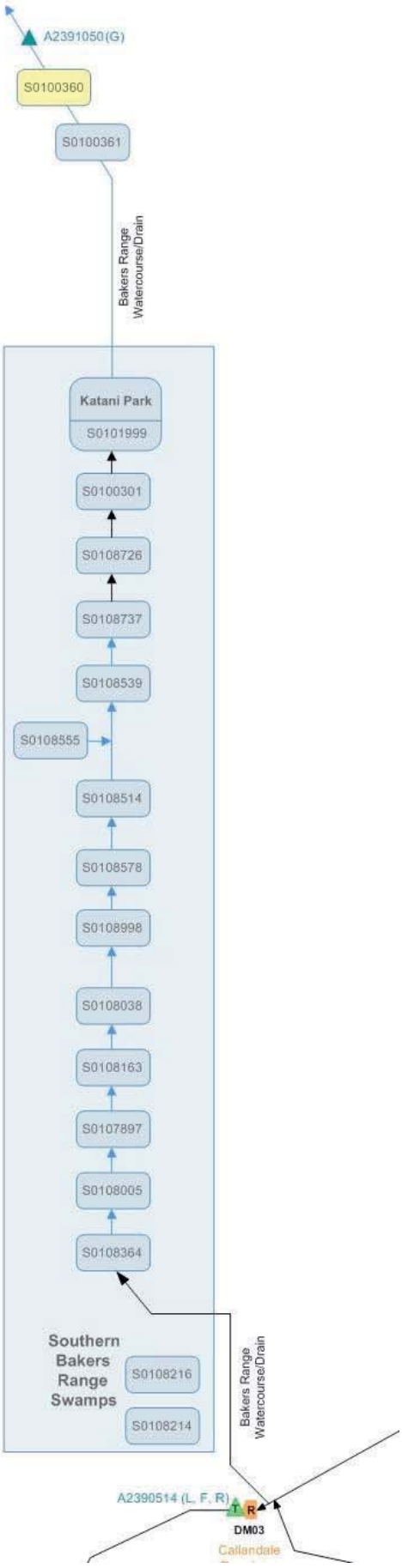
Map 6: Marcollat Watercourse (Muddies Swamp to Jip Jip Swamp)



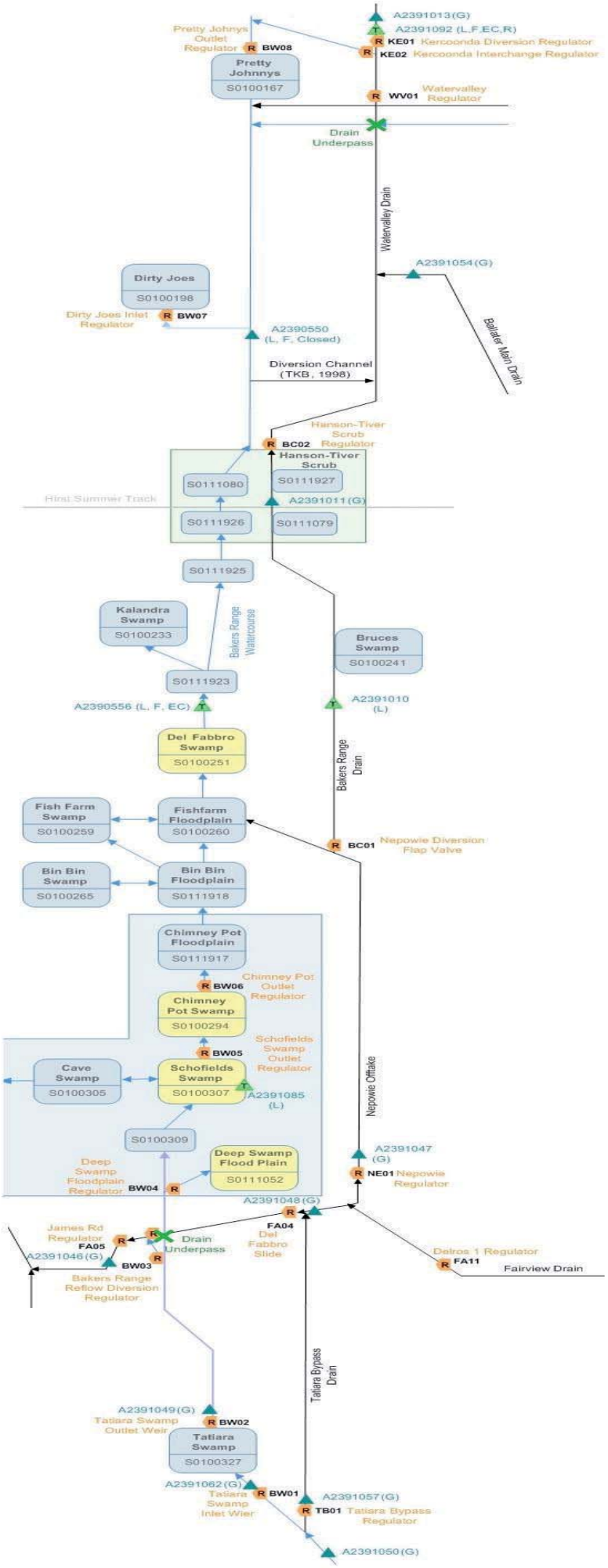
Map 7: Gum Lagoon/ Duck Island Schematic (Rosemary Downs Drain, Bunbury Drain, Coola Coola)



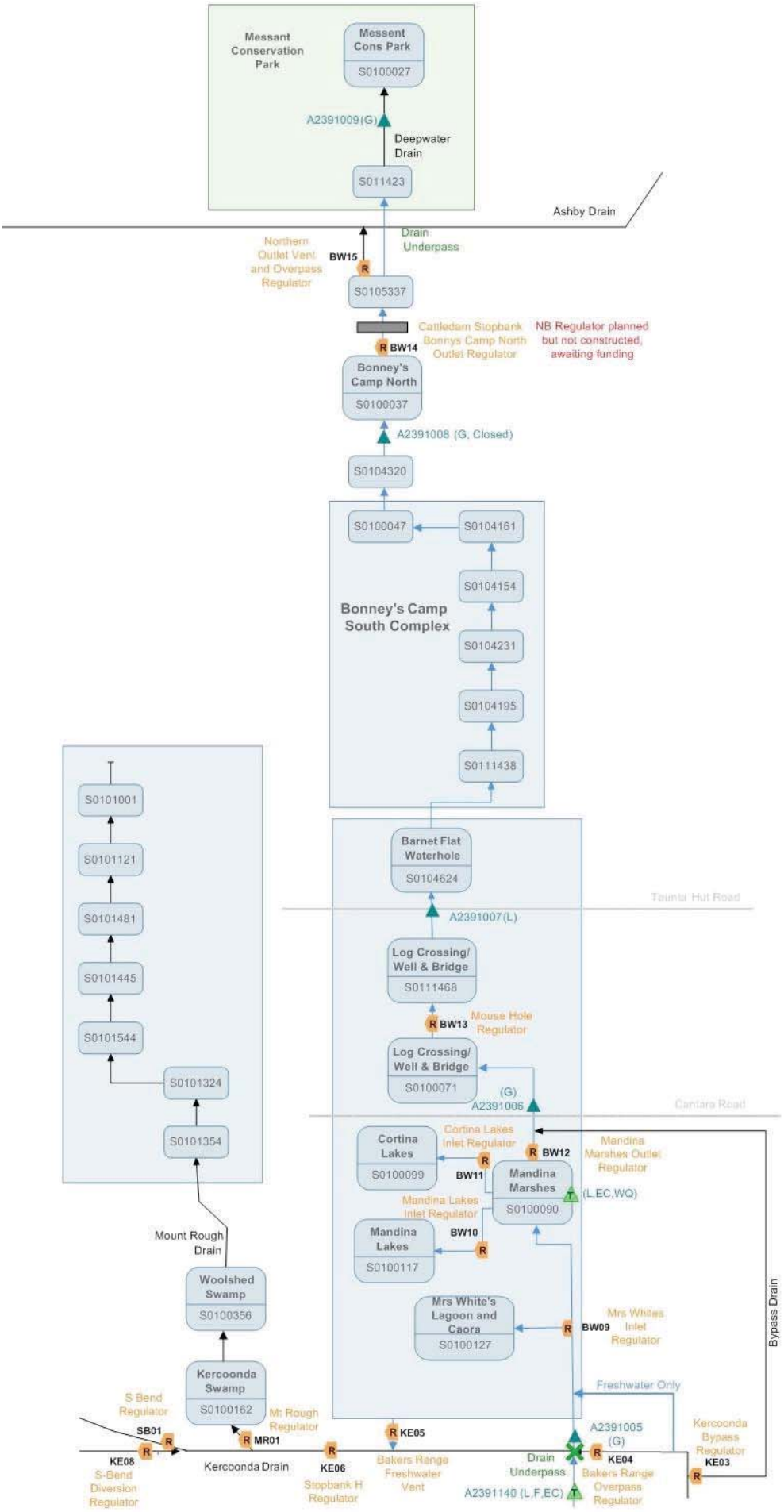
Map 8: South-Central Bakers Range Watercourse (Drain M to Angel's Road)



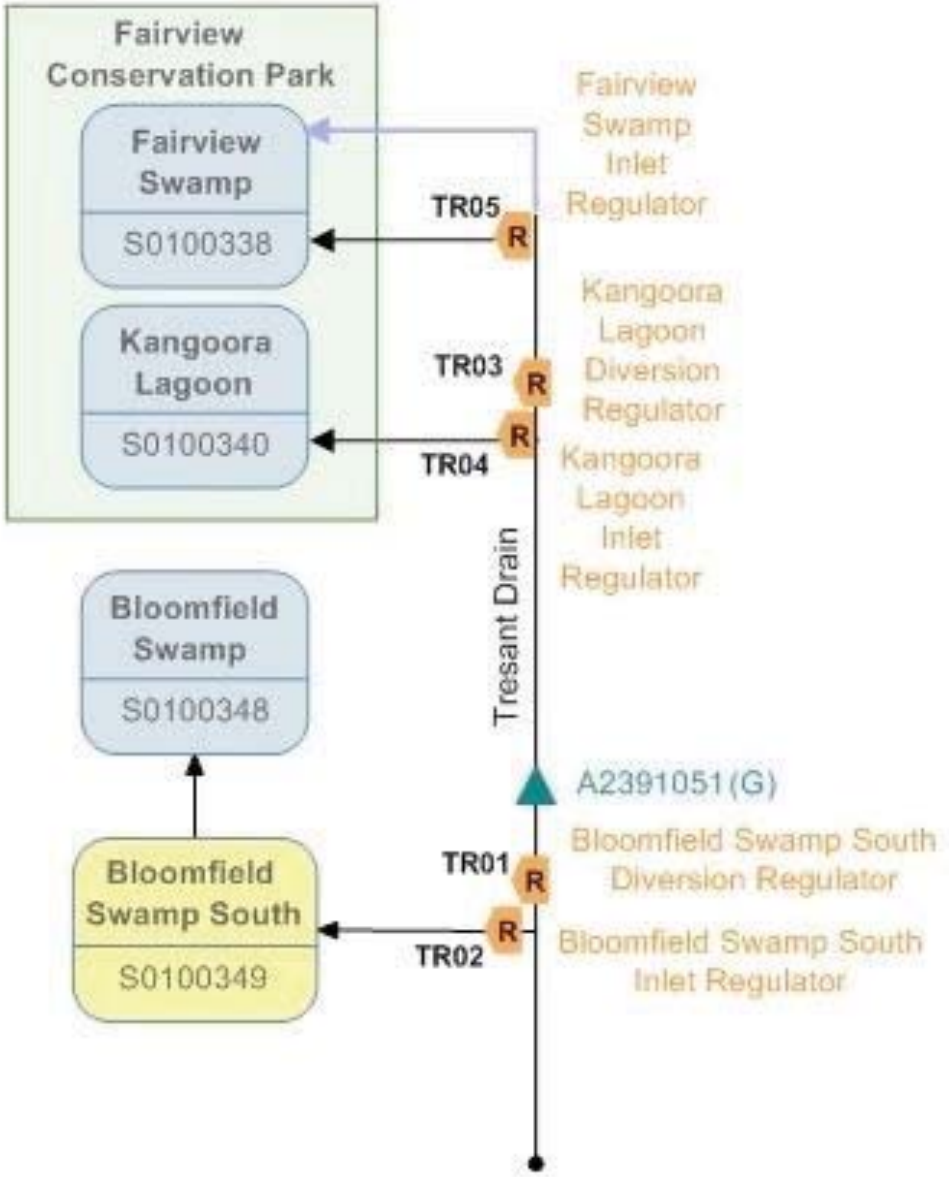
Map 9: North-Central Bakers Range Watercourse (Angels Rd to Petherick Rd)



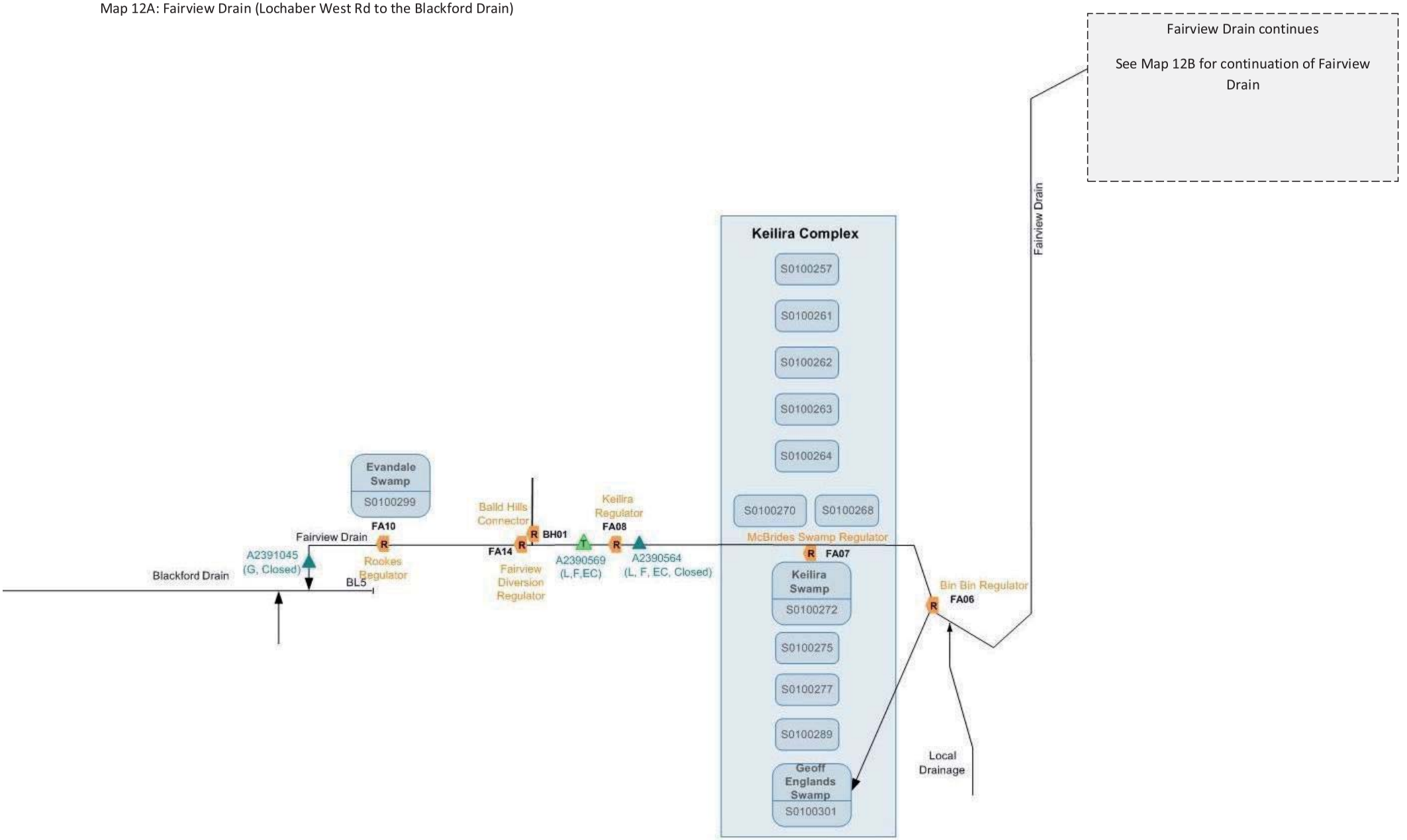
Map 10: Northern Bakers Range Watercourse (Mandina Marshes to Messent Conservation Park)



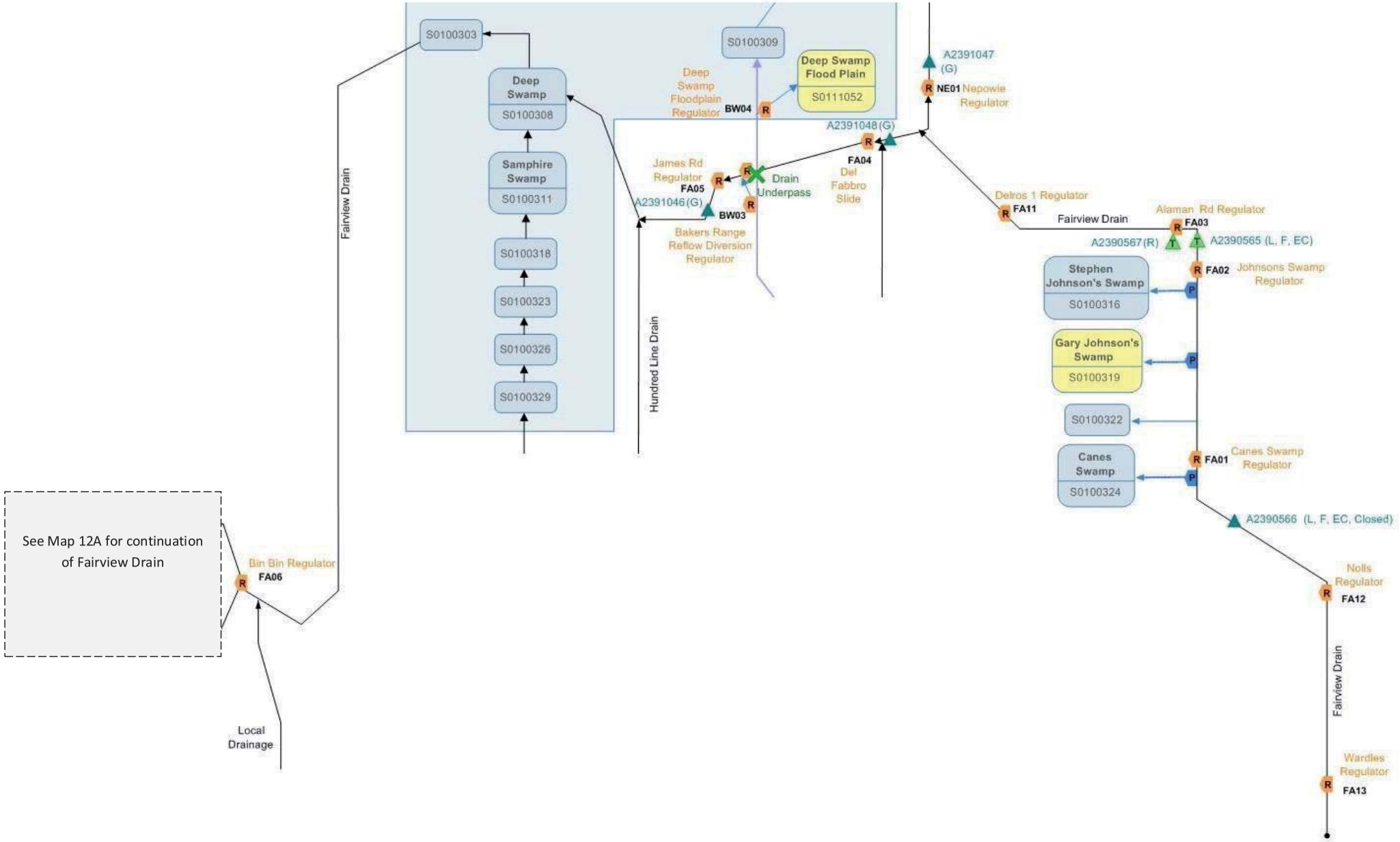
Map 11: Tresant Drain (Bloomfield Swamp to Fairview Conservation Park)



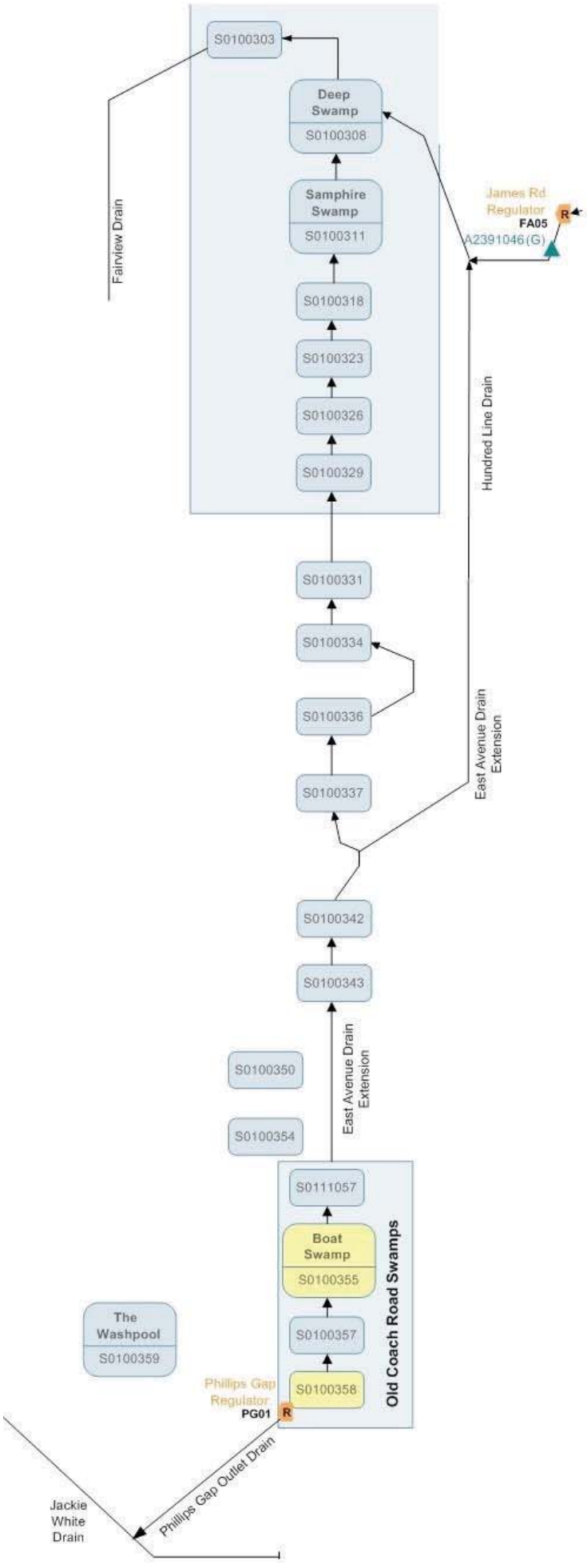
Map 12A: Fairview Drain (Lochaber West Rd to the Blackford Drain)



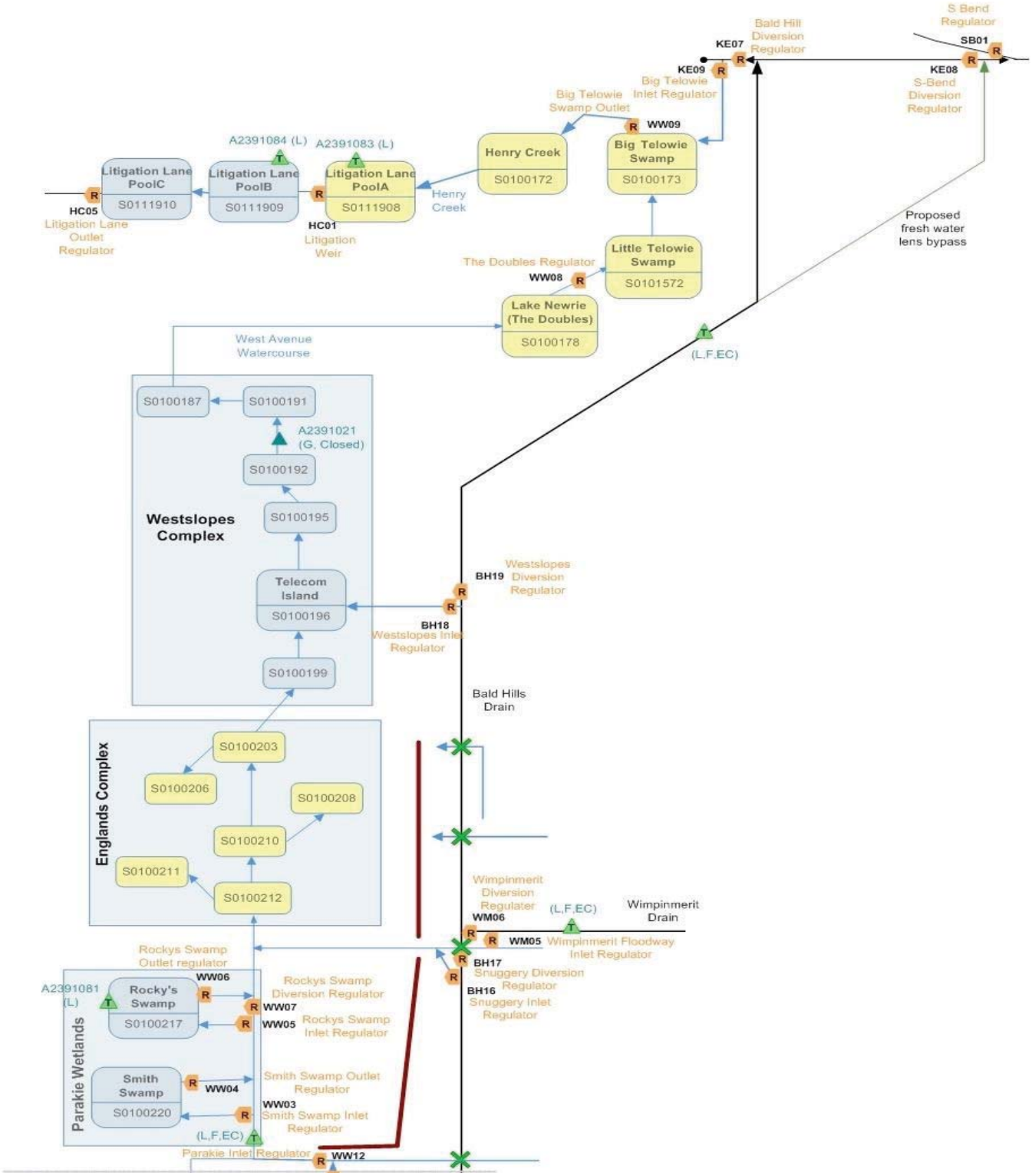
Map 12B: Fairview Drain (Lochaber West Rd to the Blackford Drain) continued



Map 13: East Avenue Watercourse (Boatman's Swamp to the Fairview Drain, including Phillips Gap regulator

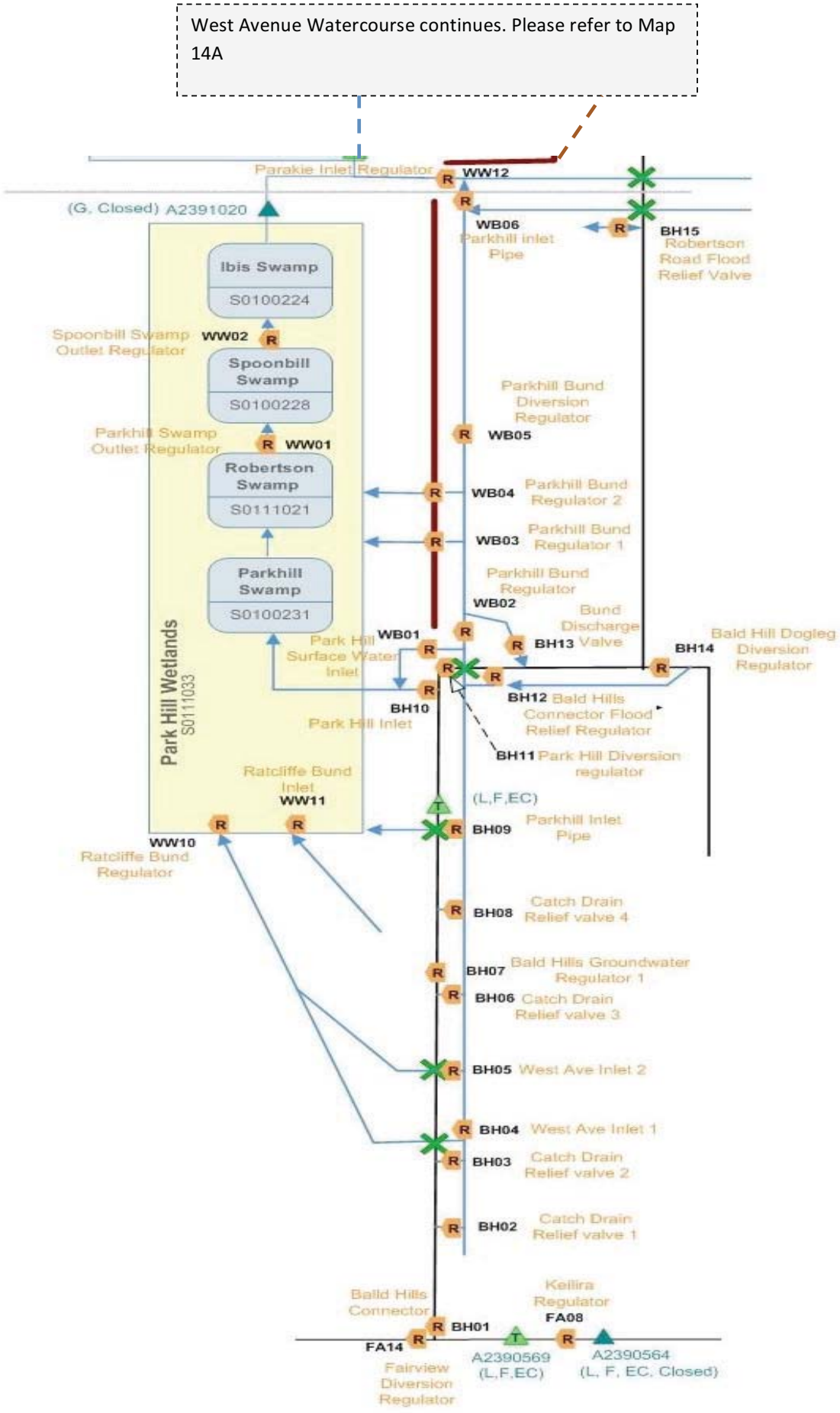


Map 14A: West Ave Watercourse (Bakers Range transfer regulator to Litigation Lane)

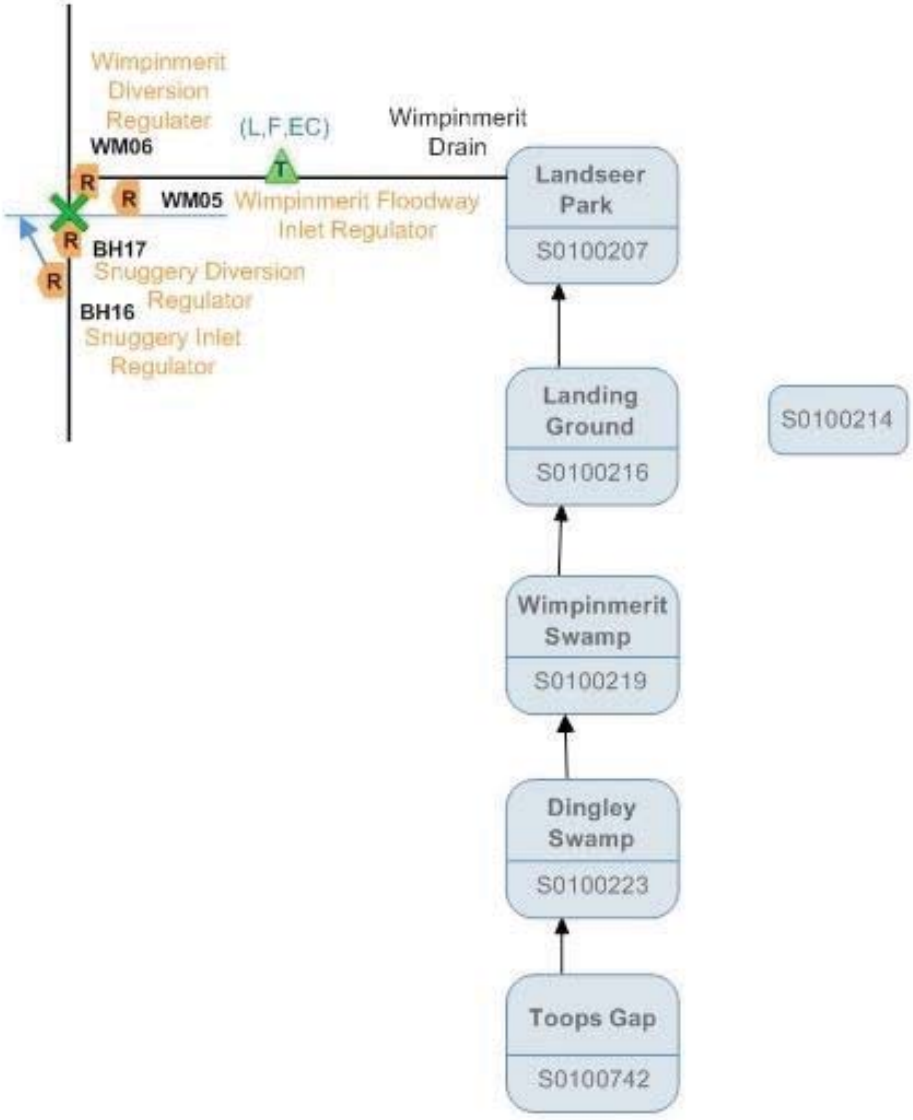


West Ave Watercourse continues. Please refer to Map 14B

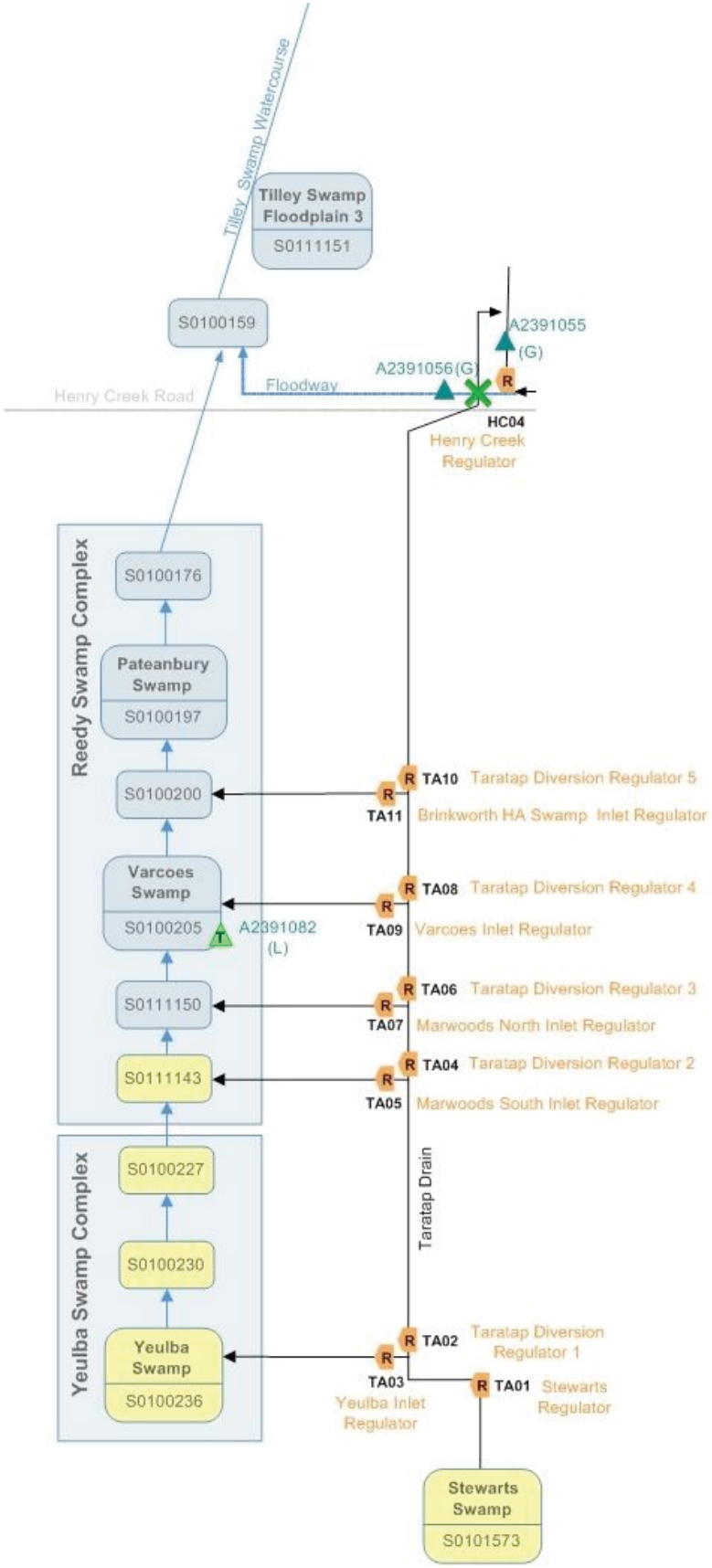
Map 14B: West Ave Watercourse



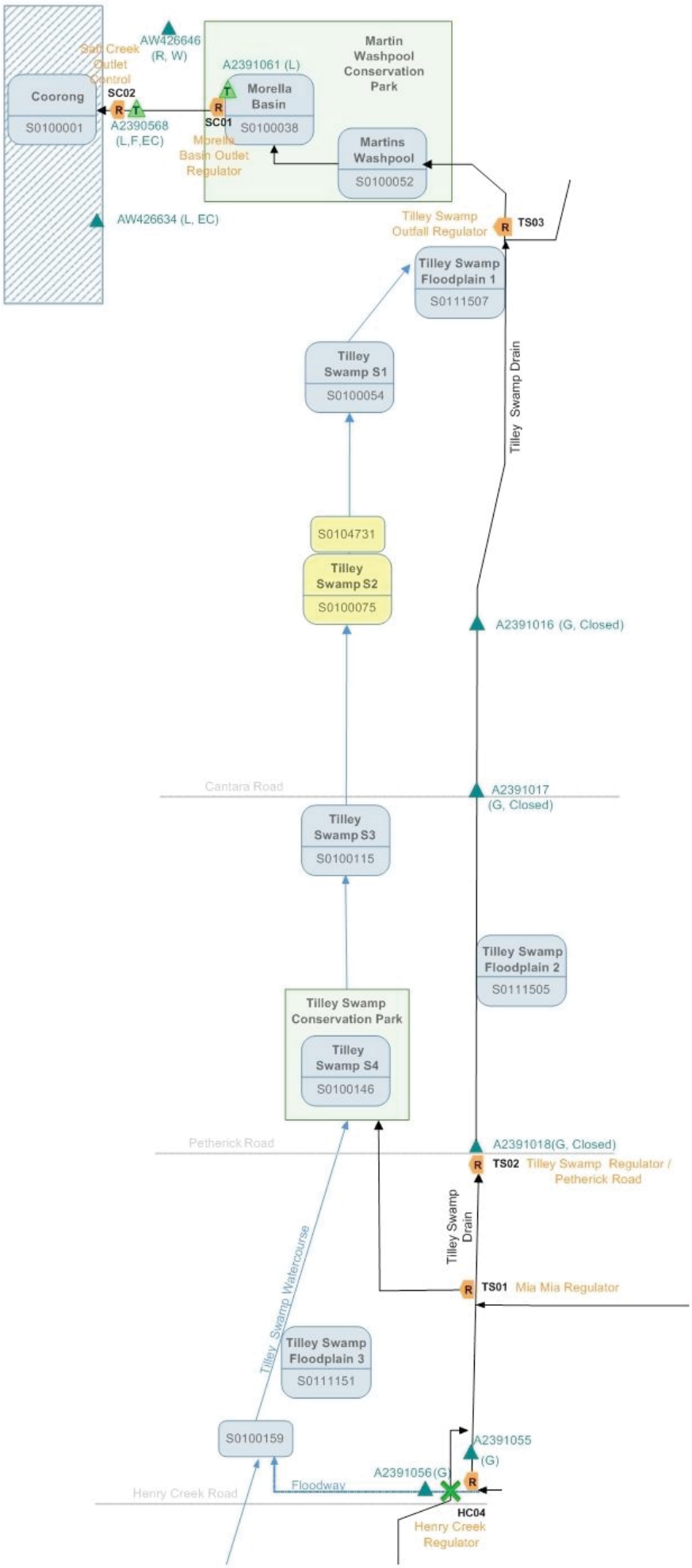
Map 15: Wimpinmerit (Rowney Road West to Bald Hill Drain)



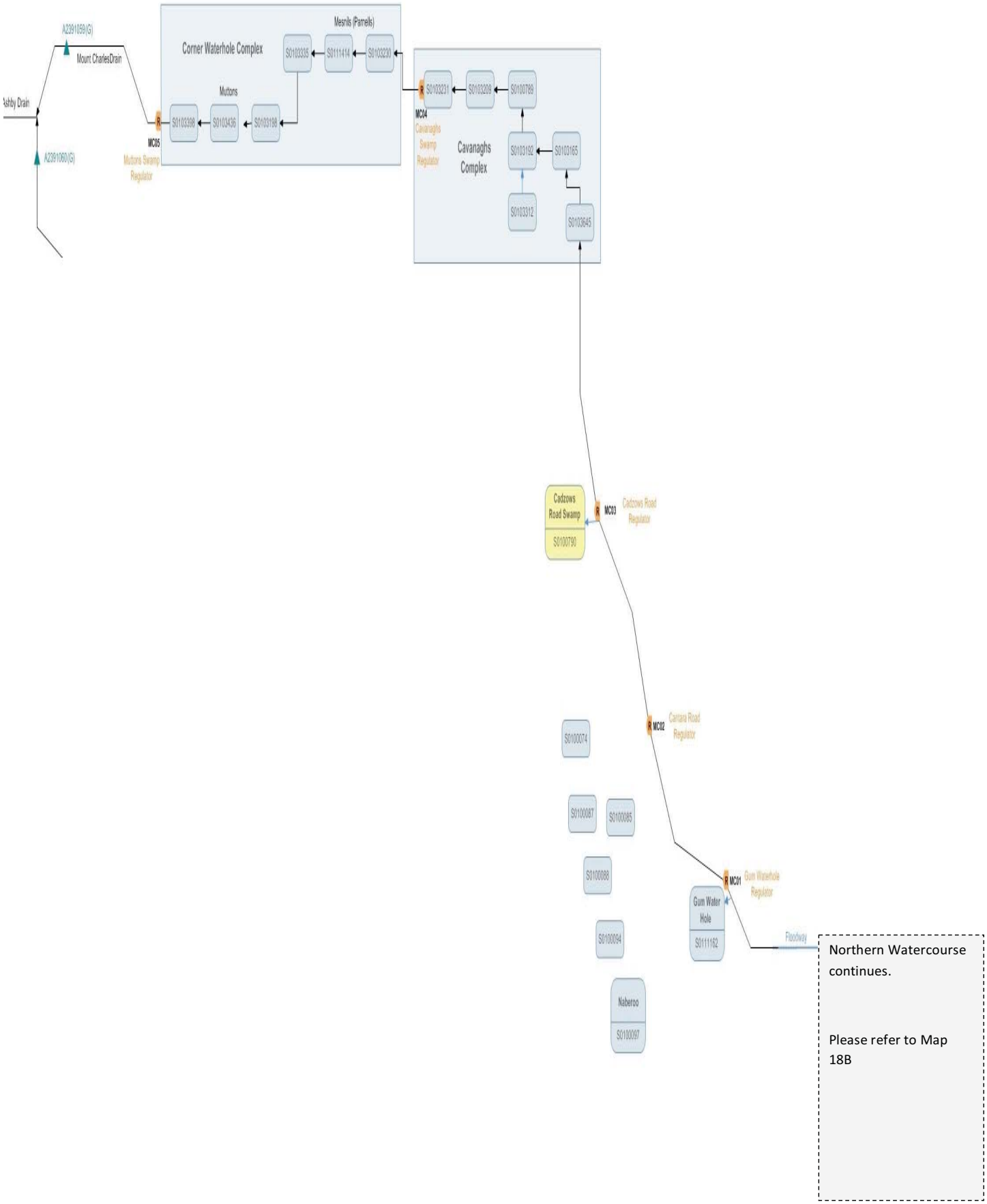
Map 16: Taratap Watercourse (Rushy Swamp to Henry Creek)



Map 17: Tilley Swamp Watercourse (Henry Creek to the Northern Outlet Drain)



Map 18A: Northern Catchments (Mt Charles, Bunbury and Taunta Hut Drains)



Northern Watercourse continues.

Please refer to Map 18B

Map 18B: Northern Catchment continued (Mt Charles, Bunbury, Taunta Hut Drains

Northern Watercourse continues.

Please refer to Map 18A