

FOREWORD

The purpose of this paper *Environmental Assessment Procedure for Primary and Community Integrated Surface Water Management* is twofold:

1. To identify State and Commonwealth responsibilities and requirements in relation to the protection and enhancement of the environment, and
2. To provide a standard framework and procedure for carrying out environmental assessment of the physical and biological environment for Integrated Surface Water Management / Drainage Systems (including Community and G-MW Primary Surface Water Management Systems).

Environmental assessment and evaluation procedures change frequently as our knowledge of the natural environment increases. Accordingly this procedure will be reviewed at regular intervals to ensure that the best methods are always used.

The first four initial versions of these guidelines have been used within the Northern Irrigation Region for the assessment of proposed surface drainage systems over the last 15 years. As proposed Drainage Systems expand into different geographical areas, a range of additional issues are encountered. This version takes into account these additional issues and refines the environmental assessment procedure.

CONTENTS

FOREWORD	I
ACKNOWLEDGMENTS	I
ABBREVIATIONS/GLOSSARY	II
SUMMARY	III
PART 1 ENVIRONMENTAL POLICIES AND GUIDELINES	1
1. INTRODUCTION	1
2. PURPOSE OF SURFACE WATER MANAGEMENT / DRAINAGE SYSTEMS	3
2.1 INTRODUCTION	3
2.2 VICTORIAN SALINITY PROGRAM	3
2.3 THE LAND AND WATER SALINITY MANAGEMENT PLANS	4
2.4 SURFACE DRAINAGE STRATEGY	4
2.5 COMMUNITY SURFACE WATER MANAGEMENT/DRAINAGE SYSTEMS	6
2.6 PRIMARY (ARTERIAL) WATER MANAGEMENT/DRAINAGE SYSTEMS	7
3 ENVIRONMENTAL PROTECTION POLICIES	8
3.1 ENVIRONMENTAL POLICIES AND LEGISLATION	8
3.1.1 <u>Catchment and Land Protection Act 1994</u>	8
3.1.2 <u>Flora and Fauna Guarantee Act 1988</u>	8
3.1.3 <u>Environment Protection and Biodiversity Conservation (EPBC) Act 1999</u>	9
3.1.4 <u>Water Act 1989</u>	10
3.1.5 Goulburn Broken Catchment Native Vegetation Management Strategy 1999	11
3.1.6 National Framework for the Management and Monitoring of Australia's Native Vegetation (ANZECC 1999)	11
3.1.7 National Strategy for Ecologically Sustainable Development (ESD) 1992	12
3.1.8 Ramsar Convention	12
3.1.9 Victoria's Biodiversity Strategy through Victoria's Native Vegetation Management –A Framework for Action.	13
3.1.10 Shepparton Irrigation Region – Surface Water Management Strategy Review – Strategic and Implementation Plan 2002	14
3.1.11 <i>Public Land Classification – Land Conservation Council</i>	14
3.1.12 <i>Summary of Legislation, policy and programs</i>	14
3.2 Victoria's Native Vegetation Management – A Framework for Action.	16
3.2.1 Principles for Native Vegetation Management	16
3.2.2 Understanding the Net Gain Goal	17
3.2.3 Three Step Approach to applying Net Gain	18
3.3 MEASURING NET GAIN OUTCOMES	21
3.3.1 Habitat Hectares	21

PART 2 PROCEDURES FOR ENVIRONMENTAL ASSESSMENT	22
4.0 ROLES AND RESPONSIBILITIES	22
4.1 DPI - ROLES AND RESPONSIBILITIES	22
4.2 ENVIRONMENTAL ASSESSMENT REVIEW / SIGN OFF PROCEDURE	23
5. PROCEDURE FOR ENVIRONMENTAL ASSESSMENT OF INTEGRATED SURFACE WATER MANAGEMENT/DRAINAGE SYSTEMS	24
5.1 OBJECTIVES OF ENVIRONMENTAL ASSESSMENT	24
5.2 INITIAL ENVIRONMENTAL ASSESSMENT PROCEDURE	25
5.3 DETAILED ENVIRONMENTAL ASSESSMENT PROCEDURE	25
5.3.1 Avoid – Minimise – Offset (The three-step approach for vegetation retention and protection)	25
5.3.2 Section 1: Resource Inventory	26
5.3.3 Section 2: Catchment Overview	26
5.3.4 Section 3: Fieldwork and Environmental Evaluation	27
5.3.5 Section 4: Recommendations	35
5.4 CULTURAL HERITAGE ASSESSMENT	35
5.3 SUPPORTING PROCESSES AND/OR DOCUMENTATION	36
5.5.1 Initial Alignment and Design Inspection	36
5.5.2 Design Alignment and Landowner Negotiation	36
5.5.3 Final Design Alignment Inspection and Report	36
5.5.4 Flora and Fauna Database Search	38
5.5.5 Environmental Protection and Biodiversity Conservation Act 1999 Response (Attachment 8)	38
6. ENVIRONMENTAL EVALUATION CRITERIA	39
6.1 NOTABLE SPECIES/ASSOCIABILITY WITH HERITAGE SITES	39
6.2 RARITY AND UNIQUENESS OF ECOSYSTEM TYPE	39
6.3 HABITAT DIVERSITY	40
6.4 NATURALNESS	40
6.5 VALUE FOR NATIVE VEGETATION	41
6.6 VALUE FOR BIRD USE	41
6.7 FISH	41
6.8 MAMMALS, REPTILES AND AMPHIBIANS	41
6.9 SIZE	42
7. DPI ENVIRONMENTAL ASSESSMENT SUMMARY AND CHECKLIST	43
7.1 ENVIRONMENTAL ASSESSMENT - SUMMARY	43
7.2 CHECKLIST OF ISSUES	46
8. REFERENCES & BIBLIOGRAPHY	47

ATTACHMENT 1

Initial Environmental Assessment of Integrated Surface Water Management/Drainage Systems

ATTACHMENT 2

Field Definition of a Wetland

ATTACHMENT 3

Procedure for Filling Out Data Sheets

ATTACHMENT 4

Data - Sheets

ATTACHMENT 5

Atlas of Victorian Wildlife Incidental Sightings –Information & Recording Sheets

ATTACHMENT 6

Suggested Reporting Format

(Summary Sheets)

ATTACHMENT 7

Suggested Format for the Final Alignment Natural Features Booklet

ATTACHMENT 8

Suggested Format for the Letter of notice of Listed Species, Habitats and Communities within a Catchment under the Flora and Fauna Guarantee Act 1988 and the Environment Protection and Biodiversity Conservation Act 1999

to Goulburn Murray Water for consideration in the Planning Process.

ACKNOWLEDGMENTS

Important contributions have been made by others in formulating this environmental assessment procedure for surface water management schemes. Special thanks needs to be given to the following people for their ideas, input and critical comment:

Murray Chapman, Rod McLennan, Caroline Douglas, Brendan Atkins, Elizabeth Beovich, Ian Davidson, Rick Felton, Paul O'Connor, Sue Garner, Peter Johnson, Colin Leitch, Bernard Robb, Alan Robley, Keith Ward and Andrew Warner.

Alan Lugg deserves special recognition for the instigation of environmental assessment procedure for salinity management plans in Victoria and the formulation of the conservation evaluation procedure initially used in the Kerang Lakes Area.

This procedure has since been adapted and extended for use in environmental assessment of drainage schemes and now for integrated surface water management proposals.

Comments from the Community Surface Drainage Co-ordinating Committee (CSDCC) delegates and the other agency and non agency contributors in developing this version is also recognised.

The input of the Environmental Assessment Procedure working group (in 1999), coordinated by Paul O'Connor NRE CSDCC Environmental representative and Merryn Kelly and Greg Turner NRE who have reworked this document and provided critical comment is formally acknowledged.

Ken Sampson
CSDCC Convenor.

This August 2006 Version 5 Update was compiled by Neil McLeod , of the Environmental Management Program, DPI Tatura. Comments and document review from -

Daryl Eaton - Senior Surface Water Management Officer, (GMW Tatura),
Sandy Schroen – Community Surface Water Management Team Leader, (DPI Tatura),
Simone Orscheg – Environmental Assessment Officer, (DPI Kerang),
Georgie Fraser – Environmental Officer, Community Surface Water Management Program (DPI Echuca)
Mani Manivasakan – Senior Engineer, Sinclair Knight Merz), SKM Tatura

Endorsed by the Surface Water Management Working Group on 11.9.2006 and Community Surface Drainage Coordinating Committee on 25.9.2006.

Abbreviations/glossary

AAV	Aboriginal Affairs Victoria
ANZECC	Australia and New Zealand Environment and Conservation Council
ARI	Average Recurrence Interval
BVT	Broad Vegetation Type
CAMBA	China and Australia Migratory Bird Agreement
CMA	Catchment Management Authority
CSD	Community Surface Drain
CSDCC	Community Surface Drainage Coordinating Committee
EA	Environmental Assessment
EAC	Environmental Assessment Coordinator
EAP	Environmental Assessment Procedure
EC	Electrical Conductivity (measured at 25°C)
ECC	Ecological Conservation Council
EPBC	Environment Protection and Biodiversity Conservation
EES	Environmental Effects Statement
EVC	Ecological Vegetation Class
FF	Flora and Fauna (Parks Flora and Fauna - division of NRE)
FFG	Flora and Fauna Guarantee
G-MW	Goulburn-Murray Water
JAMBA	Japan and Australia Migratory Bird Agreement
ISWM	Integrated Surface Water Management
LCC	Land Conservation Council
NRE	Natural Resources and Environment
RWC	Rural Water Corporation (now Goulburn-Murray Water)
SDS	Surface Drainage Scheme
SIR	Shepparton Irrigation Region
SPPAC	Salinity Pilot Program Advisory Council
SWMS	Surface Water Management System
VPP	Victorian Planning Provisions

SUMMARY

The State and Federal Governments require proposed Primary and Community Integrated Surface Water Management Systems (SWMS) to take account of environmental issues during the planning phase. This document provides details on the responsibilities of governments in relation to environmental protection and details the processes to enable the environmental values to be assessed.

The document has been separated into two parts:

- Part One - Environmental Policies and Guidelines
- Part Two - Procedures for Environmental Assessment

Part One recognises that key national and international policies and legislation require that environmental values be protected and where possible enhanced during the development of an Integrated Surface Water Management System.

Key policy documents that ensure that environmental values are protected include the *Environment Protection and Biodiversity Conservation Act 1999*, *Catchment and Land Protection Act 1994*, Ramsar Convention, Victoria's Biodiversity Strategy, the *Flora and Fauna Guarantee Act (1988)*, Goulburn Broken Native Vegetation Management Strategy 2000, JAMBA and CAMBA Treaties, LCC Recommendations and Waterway Protection Policy.

Part Two provides technical details on environmental assessment procedures to the community, engineers who design systems and Government agencies as the stakeholders and ensures that environmental issues are addressed from inception of the system through to the planning phase (includes survey and design, negotiation, final assessment phase and application for planning permit).

An environmental assessment and evaluation should aim to:

- a) Broadly describe the environmental values remaining in natural and semi-natural ecosystems throughout the catchment,
- b) Identify the threats (in relation to integrated surface water management systems) that may be impacting on the environmental values identified during the assessment,
- c) Advise the interested parties on means of protecting and enhancing the environmental values of the catchment, and
- d) Identify areas for protection, enhancement and revegetation and encourage landowners and stakeholders to protect and enhance such areas through regeneration or revegetation opportunities.

The environmental assessment will highlight areas of environmental value and enable recommendations to be made on water regimes or management strategies required to maintain and enhance those environmental values.

It is proposed that the environmental assessment for Primary and Community Integrated Surface Water Management Systems be conducted at two levels;

- (i) initial environmental inspection, and if deemed necessary by initial inspection, then
- (ii) detailed environmental assessment.

The two-stage assessment process is advantageous, as not all Primary and Community Integrated Surface Water Management/Drainage systems require extensive environmental survey due to their small size or lack of natural features. However in some cases, detailed assessment will automatically be required due to the presence of significant environmental features.

Environmental Assessment data sheets are used to provide the essential basic information for an assessment of the surface water management proposal - based on good scientific knowledge and procedures. Each data sheet has a common encoding system as a header to allow different data sheets to be linked. The format and information included on the data sheets has been developed to allow data entry directly into the Regional and State Flora Data Base, the Wildlife Data Base, Victorian Wetland Data Base and entry into the DSE Minimum Data Set for wetlands.

PART 1 ENVIRONMENTAL POLICIES AND GUIDELINES

1. INTRODUCTION

The State and Federal Governments require that Primary and Community Integrated Surface Water Management Systems take account of environmental issues during the planning phase (Surface Water Management Strategy Review- SIR 2002). The process for the Environmental Assessment Procedure has been agreed to by both levels of Government, (*ratified by the Australian Heritage Commission 1997*), based on the **four-tier** approach to considering environmental factors.

The four-tier approach consists of:

One: A Government approved Salinity Management Plan/Catchment Management Plan.

Two: An Integrated Surface Water Management/Drainage Strategy as part of the Plan;

Three: The two stage Environmental Assessment process as outlined in this document, and

Four: DPI's ongoing commitment to servicing Primary and Community Integrated Surface Water Management/Drainage forums. This commitment is to ensure that the identified environmental factors and the requirements of both levels of Government are taken into account during the development of the proposal.

Note: Provided that the proposed Integrated Surface Water Management/Drainage System works are developed in accordance with this four tier approach, the requirement for each individual proposal to go through the Environmental Effects Statement (EES) process may be negated. This does not exempt the Surface Water Management Program from the EES process as particularly large and complex projects having significant environmental impacts that may trigger such a referral may still need to be referred to determine whether an Environment Effects Statement is required.

State, National and International policy documents exist to ensure that during land use planning the environment is protected and where possible enhanced. Key documents that ensure that environmental values are protected include:

- The Ramsar Convention – promotes to ecological conservation and wise use of all wetlands
- Victoria's Biodiversity Strategy – provides principles and objectives for the conservation and management of biodiversity.
- *Environment Protection and Biodiversity Conservation Act 1999*– requires the referral of an 'Action' to the Minister for consideration.
- *The Flora and Fauna Guarantee Act 1988*– provides a legislative framework for the conservation of biodiversity in Victoria
- *Catchment and Land Protection Act 1994* - sets out a framework for integrated management and protection of catchments with community participation.
- JAMBA and CAMBA Treaties – International migratory bird agreements to protect the wetland habitats of listed species,
- Victoria's Native Vegetation Management – A Framework for Action. Provide guidelines for the protection of native vegetation in Victoria.
- Land Conservation Council Recommendations - enables public land areas to be classified and protected by providing recommendations according to their classification with subsequent implementation by Government.
- Local Government Planning provisions - Earthworks, Drainage, Flooding and Native Vegetation planning controls.

These policy documents and treaties ensure that adequate environmental protection is given to the natural environment. Australia and the State of Victoria have a responsibility under these policies to ensure that a 'net gain' conservation outcome is achieved in environmental values.

The intention of the environmental assessment is to broadly describe the environmental values remaining in natural and semi-natural ecosystems throughout the catchment, and to advise the interested parties on means of protecting and enhancing environmentally significant areas.

The purpose of this document, *Environmental Assessment Procedure for Integrated Surface Water Management*, is to identify environmental policies and guidelines for protection of the environment and to provide a standard framework and procedure for carrying out the environmental assessment of integrated surface water management/drainage systems, whilst ensuring that the responsibilities of government are met.

2. PURPOSE OF SURFACE WATER MANAGEMENT / DRAINAGE SYSTEMS

2.1 INTRODUCTION

Surface Water Management is a key component of the Land and Water Salinity Management Plans developed as part of the Victorian Salt Action: Joint Action Salinity Strategy.

In order for the plans in Northern Victoria to be endorsed they have to satisfy the requirements of the Murray Darling Basin Salinity and Drainage Strategy.

2.2 VICTORIAN SALINITY PROGRAM

The acceleration of the salinisation of Victoria's land and water resources in the 1980s was imposing a major economic and environmental cost to the state. It was estimated in the Victorian Decade of Landcare Plan that the production losses in agriculture due to salinity were \$68 million/year in irrigation areas and \$8 million/year in the dryland areas of the state.

During 1997/98 the Victorian Salinity Program spent about \$30 million on planning and implementation of salinity management plans. Victoria's Salinity Program has been a major ongoing initiative of the community and the state government since 1986 and in 1988, Salt Action: Joint Action, the state strategy for managing land and water salinity, in Victoria was released.

The strategy's principal long term goal was "...to manage the salinity of the land and water resources throughout Victoria in order to maintain and, where feasible, improve the social well being of the communities and the environmental quality and productive capacity of the regions".

The strategy's objectives are:

- to provide communities in salt affected areas with the capacity to establish and be responsible for implementation of local salinity mitigation programs
- to help find equitable solutions for individuals and communities suffering from salinity problems
- to minimise social hardship while long-term sustainable solutions to salinity control measures are being established
- to identify and promote sustainable usage of land and water in salt affected areas, and
- to minimise adverse environmental effects of salinity control measures.

The strategy divided the state into nine catchment-based salinity control regions. It also defined a need for 20 sub-regional salinity management plans or regional salinity strategies. These cover those irrigation and dryland regions affected by salinity or are contributing to salinity damage in Victoria, or are downstream within the Murray Darling Basin. Together, the 20 plans and strategies cover approximately 60% of the area of Victoria.

The preparation of salinity management plans was a major emphasis and achievement of the Salinity Program in the first years. All plans are now in the formal implementation phase. Government responses had been provided to all salinity plans as the Program moved into full implementation.

These Land and Water Management Plans have been incorporated into the Regional Catchment Strategies of the Victorian Catchment Management Authorities.

2.3 THE LAND AND WATER SALINITY MANAGEMENT PLANS

The Land and Water Salinity Management Plans were required to take into account economic, social and environmental considerations in their development. These were widely commented on both within the catchment and in the wider community before being endorsed by government.

Implementation of the Land and Water Salinity Management Plans will:

- maintain the productive base of the Region
- protect and enhance the environment from further degradation, and
- prevent the social costs which will occur if high water-tables and salinity are allowed to continue to develop.

The Plans:

- provide the "tools" for salinity control within the region. For example, capital grants to install ground-water pumps, grants for community surface water management/drainage systems and for salt export under the Murray Darling Basin Salinity and Drainage Strategy.
- coordinate activities of government agencies and authorities, and
- coordinate community input to planning and works.

The Plans are all integrated salinity management plans with major Program activities which include Farm works, Sub-Surface Drainage works, Surface Water Management works and Environmental protection and enhancement activities. The integration of the natural resource management focus of the works based Programs is linked through the Environment Program.

All the programs are aimed to prevent accessions to the ground-water or to manage the ground-water such that regional catchment environments have a sustainable future.

The Farm Program reflects this by aiming to reduce ground-water accessions, soil salinisation and waterlogging on farms. The main components of the program include whole farm planning, irrigation redevelopment (grading, channel and drain reconstruction, micro-irrigation, drainage reuse and automation), improved water management, environmental enhancement, tree growing (planting and protection of remnants) and improved productivity.

Farm programs are being facilitated by DPI and DSE officers to ensure that all surface water associated with irrigation stays on the farm. By improving farm management, reducing outfall volumes and by adopting a strategic approach to surface water management, environmental impacts can be reduced.

2.4 SURFACE DRAINAGE STRATEGY

Surface Water Management Strategies were developed as part of the Regional Catchment Strategies and are intimately linked with the farm programs. These, although part of the Regional Catchment Strategies, required separate government endorsement.

The strategies comprise - Community Surface Water Management Systems, Primary Surface Water Management Systems, Drainage Course Declarations, Water Harvesting and Drainage Diversion.

The strategies had to satisfy economic, social and environmental assessment criteria.

The strategies were developed after dividing the Regions into Drainage Areas based on natural drainage catchments. Drainage option packages were then developed for each Drainage Area taking into account the area, length and shape of the catchment, the number of landowners, catchment topography, land use, property size, road and channel infrastructure and environmental issues. The options were generally developed in consultation with community representatives.

The catchment drainage options were then presented to the general community together with indicative costs, benefits and priorities to obtain community endorsement of a preferred strategy. In some cases the process required further refinement of the options and the assessment of their impact on existing works.

An implementation program was developed based on priorities determined using a rating index formula (which includes cost benefit, environment benefit, and community organisation).

Surface Water Management, based on the Strategies, was included in the Salinity Management Plans for the Irrigation Regions to:

- reduce accessions to the watertable
- reduce salinisation
- reduce waterlogging
- reduce road construction and maintenance costs
- redirect counter productive community effort
- provide a catalyst for improvement of farm management practices and other works which improve production and reduce downstream impact
- provide for the restoration of appropriate wetland wetting regimes, and
- preserve the environment for future generations through remnant protection and revegetation.

Surface Water Management Systems are aimed at servicing the irrigation induced component of rainfall run-off. System design is based on a 50mm summer rainfall event (with an ARI of about 1:2 years) falling on the catchment over a 24 hour period being removed in five days.

Surface Water Management Systems are designed to manage water generated during a rain event that falls on ground saturated due to recent irrigation. Even so, some of this water will remain on farms if storages are empty or low. Systems are not designed to offset poor irrigation management or provide outfall for irrigation tail-water.

To ensure the best result in terms of integrated surface water management system design options to reduce farm runoff and to allow for greater than design flow events need to be considered in a strategic context. By including these options in integrated surface water management, the volume of water out-falled will be reduced, which will help minimise environmental impacts and may result in reduction in cost of installing a system. Some options that should be considered in conjunction with other Program activities in a proposed integrated system are:

Natural Drainage Lines and Storage areas – Active flow paths and natural storage basins play an integral role in the dispersal, storage and slow release of higher than design events. It is important that they are recognised and that recommendations for their protection/restoration are considered in the development of an integrated surface water management proposal.

Note: In some Regions, such as the Shepparton Irrigation Region, there are policies which define the “*Control of Works and Activities in Natural Drainage Systems*” – June 1996, which map and identify the extent of activities in these important catchment waterways.

Farm reuse systems - Farm reuse systems can ensure that the amount of water leaving the farm is minimised. This can be achieved by having inlet to the integrated surface water management system at the capacity sill level of the reuse system. This is particularly important in relation to nutrient management and for protecting the environment at outfall.

Off farm strategic reuse and Water harvesting - Off farm strategic reuse and Water harvesting can be used to capture surface water runoff from small catchments to prevent un-seasonal catchment flows. This type of reuse can be strategically placed in a catchment so that it can be used by one or more landholders. This is particularly useful where outfall capacity is limited or during summer rainfall events to reduce the amount of un-seasonal water out-falling to receiving waterways.

Opportunities for improved water management - Opportunities for improved water management methods should be identified and encouraged as part of the assessment. These opportunities should be included in the development of an integrated surface water management system. Depending on catchment morphology and hydrology the following treatment methods should be considered during design:-

The use of vegetated floodways, filter strips, catch dams and reuse systems prior to outfall, drainage diversion from on line sumps/weirs, constructed wetlands for flow retardation and nutrient removal, and vegetated batters - hydromulched or direct seeded.

Remnant Protection - The identification of remnant vegetation within each SWMS catchment is part of the assessment process. This should lend itself to having these remnants identified for protection and/ or enhancement through either landowner negotiations and agreements for protection or the utilisation of Tree Growing Incentives / Landowner Incentives or the Bush Return incentive administered by the Catchment Management Authority. The protection of remnants need not be restricted to sites closely associated with the SWMS rather, such protection should be on a whole catchment basis.

Revegetation Opportunities - (On-line and Off-line Catchment Plantings). The identification of areas suitable for revegetation should also be considered during assessment process. Small and or relatively unmanageable areas created by the SWMS such as cut-off corners and narrow strips should be targeted for revegetation regardless of their proximity to the SWMS. On-line revegetation works generally are delayed until construction works are completed as planting may be damaged during construction. However, 'off-line' plantings elsewhere in the catchment that would/ should not be impacted by SWMS construction should be seriously considered, potentially being several years old on system completion.

Wetland Protection and Enhancement. The Environmental Assessment process should also identify wetlands and wetland complexes within SWMS catchments. Wetlands contribute to the ecological health of the catchment particularly when the respective wetland can be appropriately serviced (watering regime) by the SWMS. Consequently the environmental assessment process and the SWMS design phase should recognise appropriate servicing and subsequent protection of wetlands within the catchment.

2.5 COMMUNITY SURFACE WATER MANAGEMENT/DRAINAGE SYSTEMS

The Community Surface Drainage Incentive Scheme was developed by the Victorian Government in 1987 to encourage the development of regional surface water management/drainage by community groups.

A suitable qualified and/or experienced consultant must carry out survey and design of the systems. The ultimate approval is the responsibility of DPI, DSE, G-MW and Local Government.

The Guidelines for the design of Community Surface Water Management/Drainage systems was developed by the Community Surface Drainage Coordinating Committee (CSDCC) in 1990, to assist consultants in the survey and design of systems. These were updated by the CSDCC in 1997, 1999 and again in 2005. General guidelines on the role of government agencies, municipalities and land-holders have also been produced. These documents are regularly reviewed.

Whilst surface water management/drainage systems reduce accessions to the watertable, the potential impacts to the environment as a result of a SWMS could be high if the 'Environmental Assessment process' were not involved. As a consequence this document was produced to ensure Environmental Assessment procedures are included during the development of each system, to reduce any potential adverse impact of a system on the environment.

2.6 PRIMARY WATER MANAGEMENT/DRAINAGE SYSTEMS

Primary surface water management/drainage systems are designed and constructed by Rural Water Authorities (primarily Goulburn Murray Water) to achieve the same standard as that offered by Community systems. They are designed in accordance with the relevant integrated surface water management/drainage strategy to provide outfall for Community systems at the catchment scale.

Primary systems provide outfall for the wider catchment to/through natural waterways and due to the increased volume of water that they potentially carry and their point of outfall, there is greater potential for primary systems to have an impact on the environment. Because of this potential impact, all proposed primary systems require a detailed Environmental Assessment.

3 ENVIRONMENTAL PROTECTION POLICIES

3.1 ENVIRONMENTAL POLICIES AND LEGISLATION

Key national and international policies and State and Commonwealth legislative documents ensure that the environment is protected and where possible enhanced in the event of altered land management. These policies are particularly relevant in relation to the development of an integrated surface water management/drainage system, and on-ground works cannot occur until agreements within these policies are addressed. Specific policies and legislation extracts and their environmental requirements are listed below.

3.1.1 Catchment and Land Protection Act 1994

The *Catchment and Land Protection Act 1994* – provides an integrated catchment management framework and facilitates the wise management of land and water resources in a whole of catchment framework.

The purpose of the Catchment and Land Protection Act 1994 is –

- to set up a framework for the integrated management and protection of catchments
- to encourage community participation in the management of land and water resources
- to set up a system of controls on noxious weeds and pest animals
- to repeal and amend various Acts concerning catchment and land management.

The objectives of the Catchment and Land Protection Act 1994 is

- to establish a framework for the integrated and coordinated management of catchments which will-
 - a) maintain and enhance long-term land productivity while also conserving the environment; and
 - b) aim to ensure that the quality of the State's land and water resources and their associated plant and animal life are maintained and enhanced.
- to establish processes that can be used to assess the condition of the State's land and water resources and the effectiveness of land protection measures;
- to establish processes to encourage and support participation of land-holders, resource managers and other members of the community in catchment management and land protection;
- to establish and support the operation of the Victorian Catchment Management Council and the Catchment Management Authorities; and
- to provide for the control of noxious weeds and pest animals.

3.1.2 Flora and Fauna Guarantee Act 1988

The *Flora and Fauna Guarantee Act 1988* - sets out guidelines to ensure the continued conservation and protection of Victoria's native flora and fauna through species listings (eg :Victorian Rare or Threatened Species - VROT) and species specific Action Statements.

The purpose of the Act is:

- to establish a legal and administrative structure to enable and promote the conservation of Victoria's native flora and fauna; and
- to provide for a choice of procedures which can be used for conservation, management or control of flora and fauna and the management of potentially threatening processes.

The objectives of the Act are

- to guarantee that all taxa of Victoria's flora and fauna other than the taxa listed in the Excluded List can survive, flourish and retain their potential for evolutionary development in the wild;
- to conserve Victoria's communities of flora and fauna;
- to manage potentially threatening processes;
- to ensure the use of flora and fauna by humans is sustainable;
- to ensure that the genetic diversity of flora and fauna is maintained;
- to provide programs
 - a) of community education in the conservation of flora and fauna;
 - b) to encourage co-operative management of flora and fauna through, amongst other things, the entering into of land management co-operative agreements under *the Conservation Forests and Lands Act 1987*; and
- to encourage the conserving of flora and fauna through co-operative community endeavours.

3.1.3 Environment Protection and Biodiversity Conservation (EPBC) Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* sets out guidelines to allow potential landscape / environmental impacts/ activities to be taken to the Minister (under the Act) as a referral. This is particularly the case when the activity has, will have, or is likely to have significant impact on certain aspects of the environment including rare or threatened species, habitats or communities.

The objective of the *Environment Protection and Biodiversity Conservation Act 1999* is;

- to provide for the protection of the environment, especially those aspects of the environment that are matters of national environmental significance,
- to promote ecologically sustainable development through the conservation and ecologically sustainable use of natural resources;
- to promote the conservation of biodiversity;
- to promote a co-operative approach to the protection and management of the environment involving governments, the community, landowners and indigenous people;
- to assist in the co-operative implementation of Australia's international environmental responsibilities;
- to recognise the role of indigenous people in the conservation and ecologically sustainable use of Australia's biodiversity; and
- to promote the use of indigenous peoples' knowledge of biodiversity with the involvement of, and in co-operation with the owners of the knowledge.

The following sections listed in the Act are of particular note regarding the Environmental Assessment process.

- World Heritage Properties / Areas (Section 12)
- Ramsar Wetlands of International significance (Section 16)
- Listed Threatened species protected under International Agreements (Section 18 – 20)
- Requirements for approval of prescribed actions (Section 25)
- Referral of proposal to take action (Section 67 – 74)
- What are the relevant impacts of an action (Section 82)
- Listed threatened species and ecological communities (Section 178 – 183)
- Protecting Critical Habitat (Section 207A – 207C)
- Listed Migratory Species (Section 209)

The inclusion of the above sections in this document does not necessarily exclude the importance and relevance of other sections within the Act that may relate the Environmental Assessment process.

3.1.4 Water Act 1989

The *Water Act 1989*- among other requirements sets down a legislative framework for the allocation of environmental flows in rivers and wetlands in Victoria. The legislation takes account of environmental requirements or rivers and wetlands through mechanisms such as the granting of bulk entitlements for environmental purposes and ensuring that new developments in water management take account of environmental needs. The purpose of the *Water Act 1989* is

- to re-state, with amendments, the law relating to water in Victoria;
- to provide for the integrated management of all elements of the terrestrial phase of the water cycle;
- to promote the orderly, equitable and efficient use of water resources;
- to make sure that water resources are conserved and properly managed for sustainable use for the benefit of present and future Victorians;
- to maximise community involvement in the making and implementation of arrangements relating to the use, conservation or management of water resources;
- to eliminate inconsistencies in the treatment of surface and ground-water resources and waterways;
- to provide better definition of private water entitlements and the entitlements of Authorities;
- to foster the provision of responsible and efficient water services suited to various needs and various consumers;
- to provide resource for persons affected by administrative decisions;
- to provide formal means for the protection and enhancement of the environmental qualities of waterways and their in-stream uses;

- to provide for the protection of catchment conditions;
- to replace many forms of detailed administrative supervision of Authorities with general supervision by the Minister through approved business plans and express directions; and
- to continue in existence and to protect all public and private rights to water existing before the commencement of the relevant provisions of this Act.

3.1.5 Goulburn Broken Catchment Native Vegetation Management Strategy 1999

On a regional perspective the Goulburn Broken Native Vegetation Management Strategy lists strategies and tasks to establish coordinated efforts by government and the whole community to protect and enhance native vegetation. The Strategy has four primary goals that correlate with the environmental assessment process.

- Maintain the extent of native vegetation types at 1999 levels in keeping with the goal of ‘ net gain’ listed in Victoria’s Biodiversity Strategy 2002.
- Enhance the quality of existing native vegetation by managing 90% of native vegetation cover according to Best Management Practices by 2010.
- Increase the cover of all depleted Broad Vegetation Types (BVT’S) to at least 15% of their pre-European vegetation cover by 2030.
- Increase the viability of threatened species and the extent and quality of threatened ecological communities.

3.1.6 National Framework for the Management and Monitoring of Australia’s Native Vegetation (ANZECC 1999)

This National Framework provides a vehicle for the Implementation of the Natural Heritage Trust Partnership Agreement between Commonwealth, State and Territory Governments. Its primary objective is to reverse the long-term decline in the quality and extent of Australia’s native vegetation by June 2001.

The environmental objectives of the framework are;

- maintaining biodiversity and ecological processes including soil formation, nutrient storages and cycling and providing habitat for fauna;
- protecting water resources, eg vegetation along creeks and streams, trapping nutrients and sediment and reducing bank erosion;
- protecting soil from wind and water erosion ;
- breaking down pollution;
- acting as carbon sinks that absorb greenhouse gases; and
- contributing to a vital part of the hydrological cycle including maintaining regional rainfall patterns

3.1.7 National Strategy for Ecologically Sustainable Development (ESD) 1992

The core objectives of the ESD are

- to enhance individual and community well-being and welfare by following a path of economic development that safeguards the welfare of future generations;
- to provide for equity within and between generations; and
- to protect biological diversity and to maintain essential ecological processes and life support systems.

3.1.8 Ramsar Convention

The Convention on Wetlands of International Importance especially as waterfowl habitat (commonly known as the Ramsar Convention) was held in Iran in 1971. The Ramsar Convention is an international government treaty that provides the framework for international cooperation for the conservation of wetlands. The broad aims of the convention are to halt the worldwide loss of wetlands and to ensure the wise use and conservation of those that remain.

Australia is a contracting party to the Ramsar Convention. Victoria works cooperatively with the Federal government and other States and Territory governments to implement the Ramsar Convention through the ANZECC framework.

Australia's primary obligations under the convention are to:

- Select wetlands of international significance for inclusion on the list;
- Maintain the ecological character of listed sites;
- Promote the wise use of all wetlands;
- Include wetland conservation considerations in land use planning;
- Establish wetlands as nature reserves; and
- Promote training in the field of wetland research and management.

Implementation of the Ramsar Convention is based on the Ramsar Convention Strategic Plan 1997 – 2002 which was adopted at the Ramsar conference in Brisbane in 1996. The priorities of the work program are reflected in the NHT partnership between Victoria and the Commonwealth, as well as in Victoria's Wetland Policy as stated in "Victoria's Biodiversity Strategy – Directions in Management".

Within Victoria, 10 sites are listed under the Ramsar Convention and within northern Victoria, these are Barmah Forest, Gunbower Forest, the Kerang Lakes and Hattah Kulkyne National Park. Any proposed integrated surface water management/drainage program will need to ensure that Australia obligations under the Ramsar Convention are met. This will include ensuring impacts of a system do not impact on downstream Ramsar sites.

3.1.9 Victoria's Biodiversity Strategy through Victoria's Native Vegetation Management – A Framework for Action.

Victoria's Biodiversity Strategy provides guiding principles and overarching objectives for the conservation and management of biodiversity in Victoria. Ultimately Victoria's Native Vegetation Management – A Framework for Action establishes the strategic direction for the protection, enhancement and restoration of native vegetation across the State. It strives to better manage native vegetation and increase the cover of native vegetation in Victoria through;

- active improvement of the quality of existing native vegetation;
- avoidance or minimisation of further permanent losses through clearing;
- strategic increase in the cover of native vegetation biodiverse revegetation; and
- the flexibility that is required to support landowners as they move towards more sustainable land use.

Primary Goal

The Framework's Primary Goal is a reversal, across the entire landscape, of the long term-decline in extent and quality of native vegetation, leading to a "net gain". Additional outcomes achieved by pursuing this primary goal include-

Biodiversity

- The ecological processes and the biodiversity dependant upon terrestrial, freshwater and marine environments are maintained and where necessary, restored;
- The present diversity of species and ecological communities and their viability is maintained or improved across each bio-region;
- There is no further preventable decline in the viability of any rare species or of any rare ecological community;
- There is an increase in the viability of threatened species and in the extent and quality of threatened ecological communities.

Land and Water Quality

- There are improvements in land and water quality due to the restoration and protection of ecological processes within catchments.
- There is a reduction in the impact of secondary salinity on the State's land and water resources by increasing vegetation cover and reducing ground-water recharge.
- To achieve improvements in water quality due to the interception of nutrients in surface run-off.

Climate Change

- Enhanced amelioration of the impact of climate change by significantly increasing Victoria's carbon sinks through revegetation and regeneration.
- Increased carbon sinks and provision of a range of other benefits through the development and expansion of private forestry in a way that complements native vegetation retention.

These goals and objectives must be taken into account during the development of an integrated surface water management/drainage system. The Biodiversity Strategy also provides goals for management specifically for wetlands, and also for communities within the Riverina bioregion (which covers the northern Victorian riverine plains and includes the Shepparton and Torrumbarry Irrigation areas).

3.1.10 Shepparton Irrigation Region – Surface Water Management Strategy Review – Strategic and Implementation Plan 2002

The State and Federal Governments require Integrated Surface Water Management Systems take account of environmental issues during the ‘planning phase’. The federal and state government has a statutory responsibility to ensure that ‘net’ conservation gain to environmental values occur. The process for environmental assessment procedure has been agreed to by both levels of Government and is based on the four-tier approach to considering environmental factors. The four-tier approach is outlined in the introduction of this document.

Provided that the proposed SWMS works are developed in accordance with the four-tiered approach there is no requirement for each individual proposal to undergo a detailed **Environmental Effects Statement EES**. (SIR SWM Strategy Review 2002)

3.1.11 Public Land Classification – Land Conservation Council

Environment Conservation Council Act 1998 (previously the Land Conservation Council) allows for the classification of public land and the implementation of recommendations for management of the resource according to the classification. This Act requires all actions that occur on or may impact on public land are consistent with the Land Conservation Council recommendations as approved by Government.

LCC Classification of the public land within Victoria is based on its uses and values. The LCC classification enables areas of significant environmental value to be recognised and protected by providing recommendations according to use. The LCC made substantial areas available for water supply and drainage purposes and these areas should be used where ever possible in an integrated surface water management/drainage system.

3.1.12 Summary of Legislation, policy and programs

Additional legislation, policies and programs that should be addressed and/or considered during the development of Integrated Surface Water Management /Drainage Systems and contribute to the integrity and validity of the Environmental Assessment process include:

- Directory of Important Wetlands in Australia – identifies significant wetlands in terms of their environmental values within Australia. Includes numerous wetlands within northern Victoria. Any proposed works should identify wetlands listed in this document. Often wetlands listed in this document are also Ramsar listed, or have JAMBA or CAMBA species recorded.
- *Environmental Effects Act 1978* – allows for the development of Environmental Effects Statements (EES) on **high environmental impact proposals**. An EES could be required if works were proposed which were not in accordance with a Government approved Catchment Management Plan and an endorsed integrated surface water management/drainage strategy.
- Heritage River Planning – the *Heritage Rivers Act 1992* provides for the protection and management of nominated rivers in line with approved recommendations of the Victorian Land Conservation Council
- JAMBA and CAMBA – International agreements between Japan and Australia and China and Australia to protect the habitat of birds that migrate between these countries. Australia is required to protect wetland habitat where listed species occur, and numerous JAMBA and CAMBA listed species have been recorded on wetlands in northern Victoria.
- *Planning and Environment Act 1987* – outlines the planning process and requirements for planning systems. Includes development of planning permit applications for which DPI/DSE may be a referral authority.
- Victoria Planning Provisions (VPP) – introduced as part of a planning reform process in 1996 to simplify and standardise the planning process. Shires have developed Planning Schemes with provisions in relation to floodway management and environmental protection including provision for the control of earthworks and drainage activities in some irrigation districts. The VPP’s make reference to the Ramsar Convention.

- Local Government is also responsible for the implementation of the planning provisions as they apply to the Victorian Native Vegetation Retention controls.
- Regional Catchment Strategies – prepared for all ten regional catchments in Victoria in 1997, with the CMAs implementing the proposed programs. Regional Catchment Strategies for the irrigation area recognise the reduction in biodiversity as the key environmental issue within their area. The strategies make recommendations to halt the decline in biodiversity.
- *Regional Vegetation Plans* – Regional Vegetation Plans have been developed for CMA areas. The plans provide details to protect and conserve native vegetation.
- *Salinity Management Plans* - largely implemented under Regional Catchment Management Strategies, have policies and provisions for the protection of the environment at a catchment scale.
- State Environment Protection Policy: Waters of Victoria – provides the basis for protecting water quality in all surface waters in Victoria.

3.2 Victoria's Native Vegetation Management – A Framework for Action.

The following is a summary of the requirements of Victoria's Native Vegetation Framework detailing the principles for Native Vegetation Management, the theory and application of 'Net Gain' and the various levels of 'Conservation Significance'. It is these components of the Framework that help ensure the retention and protection of vegetation and associated habitat and communities within SWMS catchments.

3.2.1 Principles for Native Vegetation Management

Additional to the 'Aim of an Environmental Assessment' and the various policy and legislative requirements as set out in Section 3.1 it is well recognised that the primary objectives of the Environmental Assessment process is to protect and manage native vegetation in Terrestrial and Wetland environments. The following "Principles for Native Vegetation Management" reflects and supports the requirements of Victoria's Native Vegetation Management Framework whilst encompassing the overall objective of Environmental Assessment for SWMS.

1. Retention and management of remnant native vegetation is the primary way to conserve the natural biodiversity across the landscape.
 - All native vegetation has value.
 - Important habitat and populations of endangered species should be protected through voluntary or regulatory means.
 - Biodiversity values are not restricted to threatened and depleted vegetation communities. An adequate proportion of each non-threatened vegetation community must also be managed principally for conservation.
 - Large natural areas of remnant vegetation are of fundamental importance for nature conservation and are irreplaceable. All other things being equal, large remnants are inherently more valuable than small patches that total the same area.
2. The conservation of native vegetation and habitat in a landscape is dependent on the maintenance of catchment processes.
 - Maintaining ecological processes provides productivity, salinity, water quality and other land management benefits.
 - Native vegetation management strategies must be integrated with land protection and resource use, including productive agriculture, for both long term success and for ensuring that land and water protection outcomes are achieved.
3. The cost of vegetation management should be equitably shared according to benefit accrued by the landholder, community and region.
 - Land managers have the responsibility to retain native vegetation.
 - Public resources are to be directed to increasing the extent of native vegetation or to enhancing the quality of native vegetation through appropriate management.
 - Public resources are to be used to facilitate voluntary actions by land-holders and for shared investment in enhancing vegetation of conservation importance.

4. A landscape approach to planning native vegetation management is required. Goals for native vegetation management will be based on bioregions, or sub-units within the Catchment Management Authority region. Priorities for vegetation management should be specific for each bioregion and catchment.
- Multiple patches of the same vegetation community should be retained or enhanced across its geographic range.
 - The position of remnants in the landscape affects their conservation value.

3.2.2 Understanding the Net Gain Goal

Net Gain is

The outcome for native vegetation and habitat where overall gains are greater than overall losses, whilst individual losses are avoided where possible. Losses and gains are determined by a combined quality – quantity measure and over a specified area and period of time. Gains may be either ‘required offsets’ for permitted clearing actions or as a result of land-holder and government assisted efforts that are not associated with clearing. Net gain comprises three essential components to ensure an overall increase in the extent and quality of native vegetation

- A **reduction in losses** in the extent of existing native vegetation,
- A **reduction in losses** in the quality of existing vegetation due to threatening processes, and
- The achievement of **gains in extent and quality** of native vegetation through its rehabilitation and revegetation with indigenous species for bio-diversity conservation and land and water resource outcomes.

The Net Gain Approach

The Net Gain Approach can be expressed in the following manner-

- It has, as a priority to avoid further losses through vegetation clearing;
- It recognises that ‘natural is best’ however partial recovery of quality and extent is possible through active intervention;
- It identifies a quantitative approach to the ‘reverse the decline’ pathway allowing performance measures and target setting;
- That when permitted losses occur that there be adequate effort to balance such losses with commensurate gains in some way;
- That a regional complete picture of native vegetation be established to enable incremental losses and emerging issue evaluation; and
- That the approach plays an important part in assessing ecological sustainable development.

The adoption and subsequent implementation of these factors lead or contribute to a ‘Net Outcome’. Both the method of loss and gains need to be considered when achieving net outcome / net gain.

Contributors to Net Outcome

Losses in **extent** include

- Permanent clearing both permitted and illegal
- Incremental reduction of woodlands through tree decline

Losses in **quality** include

- On going decline from insufficient management of threatening processes.
- Impact from forest harvesting, mining, wildfire and fuel reduction burning.

Gains in **extent** include

- New areas of revegetation for biodiversity conservation, land protection or greenhouse carbon sinks of sufficient indigenous nature.

Gains in **quality** include

- Improved management of threatening processes
- Avoidance of further threatening processes
- Agreeing to forego permitted uses (eg stock grazing)
- Recovery from forest harvesting and mining operations
- Recovery from wildfire
- Supplementary planting into depleted vegetation.

3.2.3 Three Step Approach to applying Net Gain

The three-step approach to native vegetation management fits with the Environmental Assessment process and guides the negotiation process during the SWMS alignment survey and design phases. It is important to remember that the Net Gain approach is to be applied in a way that supports overall conservation of the great majority of existing native vegetation.

These 3 steps are

- 1) To AVOID adverse impacts, particularly through vegetation clearance. This avoid component rests with negotiation with all stake-holders, particularly land-holders to retain and protect all existing natural features and that the construction of the SWMS will contribute to the naturalness, retention and longevity of these natural features.
- 2) If impacts cannot be avoided, to MINIMIZE impacts through appropriate consideration in planning processes and expert input to project design or management. The minimise component also largely rests with the negotiation process however it does in need recognises that some removals etc as a last resort, may be required. This minimise step should be conscious that if removals are required that vegetation of lesser conservation significance should be considered for removal first.
- 3) Identify appropriate OFFSET options. The offset stage is considered as the protection of other like vegetation accompanied by replacement through revegetation or revegetation only using appropriate species specific ratios.

Only after steps 1 and 2 are exhausted should step 3 be implemented or considered. The following points must be considered in order for this 3 step approach to be effective-

General

There must be a clear link between losses and gains to ensure a commensurable outcome. For example the unavoidable clearance of vegetation of significant conservation value must be offset by vegetation of the same conservation significance value. (eg like for like offsets).

Responses to planning applications to clear native vegetation will be graded according to conservation significance and the relative size of the area to be cleared.

Like for like

When 'like for like' is applied, there will be a graded response from a direct link between loss and offset (absolute like for like) down to more flexibility for lower significance.

Landscape Role

When the role of vegetation in the landscape is considered (eg buffering of riparian, protection from salinisation, and erosion, wildlife movement etc) there will be a graded response from close equal consideration for higher significance down to a land protection focus for lower significance vegetation.

Quality objective for offset

To ensure that the use of the 'Habitat Hectare' measure does not allow trade-offs between high and low significance, graded quality thresholds have been set according to conservation significance. This means the loss of higher significance vegetation must be mitigated by the improvement of existing vegetation of comparable quality.

If revegetation is the only means of offset it will generally only be an option for mitigating lower quality or lower significance losses.

Large Old Tree objectives for Offset.

Large old trees are very important habitat providers in the landscape and are in the short term impossible to replace.

Where large old trees (greater than a certain diameter at DBH (refer relevant EVC benchmark) are part of the vegetation remnant to be removed, BOTH protection of other large old trees and recruitment of new trees will be required as part of the offset, with graded responses according to conservation significance. Recruitment may be realised through plantings or regeneration. Any plantings undertaken by the landowner since 1989 and which meet all offset criteria can be used to meet offset requirements.

Stands of scattered old trees.

Both clumps and scattered single old trees occupy the landscape often being the most common way that some vegetation types such as Plains Grassy Woodlands still occur. In this instance the adoption of habitat hectares is 'unnecessarily complex' with simple protection and replacement ratios would be adequate in this case. It is important to note the differences in 'protection' and 'recruitment'.

- a) Areas greater than 4 hectares containing 8 or more large old trees / hectare require PROTECTION as the offset.
- b) Areas greater than 4 hectares containing less than 8 large old trees / hectare require RECRUITMENT as the offset.

The offset ratios will be graded according to conservation significance.

Vicinity

There needs to be an adequate geographic link between losses and associated offsets if mitigation benefits are to generally accrue a catchment benefit. There will be a graded response for 'as close a possible for high significance down to more flexibility for lower significance though still lead to optimal outcome opportunities.

Timing

The delay between clearing and establishment of the offset should not unnecessarily exacerbate environmental values during this transition to recovery and that the timing of offset realisation needs to be appropriate.

There will be a graded response from initiating offsets prior to clearances to initiating offsets as soon as seasonally practicable after clearances.

Formal Agreement to Achieve and Secure Offset.

Management actions required to achieve offsets will be formally established through the routine and streamlined use of management agreements or permit conditions. The planning authority will maintain adequate and readily accessible records of agreed offset arrangements.

Reflecting Conservation Significance in Overall Outcomes for Net Gain.

As a result of applying the above criteria to protection, investment and offset decisions, the following net outcomes can be expected at the regional and statewide levels.

Table 1. Reflecting Conservation Significance in Overall outcomes for Net Gain.

Conservation Significance .	Extent of existing native vegetation	gains in habitat quality - quantity	net outcome
Very High	no losses	substantial gains	substantial net gain
High	losses minimised	moderate gains	net gain
Medium	losses minimised	some gains in medium term	equivalent gain
Low	some losses	some gains in longer term	short term loss longer term equivalent gain
TOTAL			reversal of decline (change from net loss to net gain.

3.3 MEASURING NET GAIN OUTCOMES

To achieve a structured 'Net Gain' outcome the Environmental Assessment process adopts the above Conservation Significance Levels supported by the Habitat Hectare assessment. However, the Habitat Hectare process may not be absolutely applicable depending on the extent of vegetation under assessment. This 'accounting framework' can be used to quantify the net gain outcome for native vegetation associated with SWMS.

3.3.1 Habitat Hectares

It is important to determine not just how much native vegetation is present but also how good it is. In determining what exists, what could be lost and what could be gained there needs to be a measure. The simplest methods would be to adopt an area measure in hectares, however, there needs to be consideration for vegetation quality as it is vegetation quality that determines the effectiveness of biodiversity conservation and catchment protection roles.

There is no absolute measure of general vegetation / habitat quality however there is a range of well accepted indicators.

The Department of Sustainability and Environment (DSE) has developed a state-wide approach for estimating general vegetation / habitat quality using two primary determinants –

- **Inherent site condition** – ie how altered is the site from a notionally optimal state –
 - retention of large old trees (for woodlands and forests)
 - retention of tree canopy (for woodlands and forests)
 - retention of the cover of, and diversity within, understorey life-forms
 - presence of appropriate recruitment
 - absence of weeds
 - presence of litter (leaf / organic)
 - logs (for woodlands and forests)
- **Viability in the landscape context** – ie does the patch of vegetation retain its broader ecological function and linkage in a manner that enables it to respond successfully to natural fluctuations and other disturbance events -
 - Size of remnant vegetation patch
 - Links to and amount of neighbouring patches.

These aspects of general vegetation / habitat quality should be taken into account whilst conducting Environmental Assessments. The combination of these quality measures and landscape context aspects lead to the calculation known as **HABITAT HECTARES** (habitat score X area = habitat hectares) a site based measure of quality and quantity of native vegetation that is assessed in the context of the relevant native vegetation type. A habitat hectare assessment can provide information for three key tasks –

- it provides a snapshot of current site quality
- it can be the basis for estimating what and how much change will occur at a site under different management scenarios
- it provides a means of calculating net outcomes across losses and gains.

PART 2 PROCEDURES FOR ENVIRONMENTAL ASSESSMENT

4.0 ROLES AND RESPONSIBILITIES

4.1 DPI - ROLES AND RESPONSIBILITIES

DPI's responsibility lies in ensuring that Government policies and legislation are followed in the design and construction of an integrated surface water management/drainage system. The reason for this is that Government money can be used to partially fund the systems. If the community group chooses not to follow the requirements set by DSE/DPI, then they are not eligible to receive Government funding and they may be in breach of legislation and the proposal may be subject to the stringent requirements of an Environmental Effects Statement. Private systems would also be subject to the planning provisions of the Planning and Environment Act as administered by Local Government to which DSE and DPI are referral authorities.

A further responsibility of DPI is to assess all reports and options developed by consultants. The process undertaken by DPI for evaluation of the assessment is detailed in section 6 as the final stage of the environmental assessment procedure. The reason for preparation of this paper is to provide a systematic environmental assessment procedure for all integrated surface water management/drainage systems so that DPI's decision making role is consistent across all proposals.

- State Environmental Assessment Representative, on behalf of the State-wide Community Surface Drainage Coordinating Committee (CSDCC), :-
 - Represent the Environmental Assessment officers/Contract Environmental Assessors at the State/ Policy development level.
 - Ensure that the Environmental Assessment Policies/Processes are kept up to date and outlined in the latest version of the Environmental Assessment Procedure (EAP), as per State and Commonwealth responsibilities.
 - To be custodian of the Environmental Assessment Procedure and responsible for the distribution of updates to Environmental Assessors on behalf of the CSDCC.
- DPI Environmental Assessment Coordinator/Project or Program Team Leader :-
 - Ensure that the Environmental Assessment process is carried out according to the latest version of the EAP for all integrated surface water management/drainage works proposed under a Regional Catchment Salinity Management Plan and associated Integrated Surface Water Management/Drainage Strategy.
 - Ensure that all parties, including the relevant business units of DPI/DSE receive copies of the draft Environmental Assessments for review and comment, including copies of the final reports within the required time-lines.
- DPI Biodiversity Assessment Officers/Contract Environmental Assessor :-
 - Ensure that the integrated surface water management/drainage proposal is Environmentally Assessed as per the current EAP including the identification of potential Cultural Heritage sites and the notification of AAV.
 - Ensure that the Environmental Assessments are distributed for draft review and on completion of the final reports.
- DPI Catchment Agricultural Service/Drainage Officer:-
 - Ensure that all integrated surface water management/drainage proposals facilitated by DPI under an approved Salinity Management Plan and endorsed Integrated Surface Water Management/Drainage Strategy are Environmentally and Culturally assessed according to the latest EAP.

4.2 ENVIRONMENTAL ASSESSMENT REVIEW / SIGN OFF PROCEDURE

Completed Environmental Assessments (both initial inspections and detailed assessments) are required to be reviewed and signed off by the relevant parties upon completion. Review and sign off is required regardless of whether the assessment has been conducted by DPI Departmental staff or a Contracted assessor.

Initial Inspection

- Initial assessment report reviewed by DPI Project/Program Team Leader with input from other relevant parties/business units of DPI/DSE, (including Parks Victoria, Forests Management , Flora and Fauna, Land Victoria, Catchment and Agricultural Services and where applicable the Catchment Management Authority/s (CMA) including Floodplain Management; The regional Rural Water Authority ie Goulburn Murray Water (G-MW), Local Government – Planning/Engineering section, Aboriginal Affairs Victoria (AAV) and local Aboriginal groups, the Irrigation Surveyor-Designer/Design and Construction organisation, and the appropriate representative community group eg. Community Surface Water Management (CSWM) group.
- Initial Assessment report to be reviewed within 14 working days, and the
- Final report to be distributed to the relevant parties with 21 working days of the close of return comments.

Detailed Assessment

- Upon completion of an Initial Catchment Inspection and if identified in that assessment, a detailed Environmental Assessment (EA) shall be conducted.
- The draft of the detailed EA report will be reviewed by the DPI Project/Program Team Leader within 21 working days of completion.
- The draft report will be forwarded to all the relevant parties/business units of DPI/DSE for review, comments to be returned within 21 days of distribution.
- The final report will be compiled and distributed to all the relevant parties within 40 working days of the close of return comments.

5. PROCEDURE FOR ENVIRONMENTAL ASSESSMENT OF INTEGRATED SURFACE WATER MANAGEMENT/DRAINAGE SYSTEMS

5.1 OBJECTIVES OF ENVIRONMENTAL ASSESSMENT

The objectives for environmental assessments of integrated surface water management/drainage systems are:

- 1) *to identify and assess all natural environments that may be affected by the proposed integrated surface water management/drainage system.*
- 2) *to identify the current extent and degree of degradation to the natural/semi-natural environment.*
- 3) *to predict impacts to the environment that may occur under the 'no-intervention' scenario.*
- 4) *to identify and assess all environmental impacts of the proposed system options (both direct and indirect impacts). Direct environmental impacts can be defined as those impacts that will directly affect the wetland, for example, tree clearing or infrastructure construction in the body of the wetland. Indirect environmental impacts can be defined as those impacts that will indirectly impact the wetland, for example, an integrated surface water management/ drainage system may alter the natural flows within a catchment which may impact on the hydrological regimes of the wetland.*
- 5) *to identify options and make recommendations for proposed works and management practices that can be implemented to enhance environmental values or minimise environmental impacts.*
- 6) *to identify terrestrial, riparian and wetland areas containing natural features of any conservation significance that have the potential for protection, enhancement, regeneration and revegetation or a combination thereof.*

The environmental assessment should include a detailed resource inventory (Section 6). Key features of the assessment are summarised below:

- 1) *a survey of the flora and fauna and the identification and mapping of significant species, vegetation types, and habitat types (such as hollow bearing trees or significant breeding sites).*
- 2) *an assessment of the health of vegetation and the impact of salinity and current water regime on regeneration, growth, etc.,*
- 3) *an inventory and assessment of the environmental values of all wetlands and other natural/semi-natural ecosystems, which may be affected by the proposed, scheme, both within the catchment as well as downstream areas.*
- 4) *a study of the impacts of salinity and water regime on the ecology of the wetlands and streams in order to understand ecological processes occurring to provide a basis for decision making and recommendation formulation.*
- 5) *an evaluation of the impacts of the proposed system on sites of environmental value and recommendations regarding the mitigation of the impact, including alternative alignment and management options. Impacts should also include downstream impacts.*
- 6) *An assessment of the land status of all public land and identification of significant areas including those of national and international importance.*

As mentioned in Section 4.2 the environmental assessment for Surface Water Management/Drainage Systems are done at two levels;

- (i) initial environmental inspection, and if deemed necessary by initial inspection, then
- (ii) detailed environmental assessment.

5.2 INITIAL ENVIRONMENTAL ASSESSMENT PROCEDURE

Attachment 1 details the procedure for the initial environmental assessment, and provides a general overview of the existing conditions and potential impacts along the proposed system route.

The initial assessment should be applied to all proposed integrated surface water management/drainage systems. A set of guidelines to ascertain if a detailed environmental assessment is required is described below. In some areas, as previously noted, a detailed assessment is automatically required. An initial assessment can still be conducted to locate focus sites for the detailed assessment and to identify preliminary management options. In the vast majority of cases the need for a detailed assessment exceeds these criteria below, however should a catchment be very small containing very little 'environmental assets' the decision as to a further detailed assessment will rest the EMP.

A detailed environmental assessment may be required if;

1. More than 10 landholders are involved; or
2. The proposed Integrated Surface Water Management/Drainage System is greater than 2 kilometres long;
3. If the initial environmental assessment indicates there are sites of environmental significance,
4. Outfall is directly to a waterway other than a Surface Water Management/Drainage System,
5. Areas of national and international significance (such as Ramsar sites) are recorded for the catchment,
6. The proposal is a primary system.

Usually an officer within a DPI region will be responsible for the assessment. This can vary from a Biodiversity Assessment Officer or Native Biodiversity Officer to someone employed solely to investigate surface water management/drainage systems. External consultants can also be used to complete the assessment, they must however work and report to the designated DPI Project Officer.

5.3 DETAILED ENVIRONMENTAL ASSESSMENT PROCEDURE

5.3.1 Avoid – Minimise – Offset (The three-step approach for vegetation retention and protection)

Detailed Environmental Assessments have in the past and are a very comprehensive process maintaining and adopting procedural and legislative changes that benefit the process and the final outcome. Though these changes are reflected in assessment documents and supporting correspondence they are not necessarily highlighted in procedural documents such as this. The requirements of Victoria's Native Vegetation Management: A Framework for Action, has had a considerable contribution to the Environmental Assessment process particularly in the last 5 years. The 'Three Step Approach to Applying Net Gain' is an integral part of current Environmental Assessments, being the foundation for vegetation retention and protection within Surface Water Management System Catchments. This three-step approach is discussed in another section of these procedures however further clarification of its application is required.

At every stage of environmental assessment from the initial contact with designers through the compilation of recommendation in the assessment document, to realignment negotiations and the final alignment check as the "Natural Features on Final Alignment Booklet", the AVOID – MINIMISE – OFFSET approach is implemented. Section 3.2.2 documents this process in detail.

The detailed environmental assessment procedure can be separated into 4 key sections.

5.3.2 Section 1: Resource Inventory

The first part of the assessment involves identifying the resource we wish to protect. This should include assessment of the environmental values in the catchment, as detailed below.

- a) Search libraries and regional resources for reports, papers, and other literature relevant to the site, region or wetland type. Record list, recover literature, read & review, and search references for extra literature.
- b) Search for all maps, aerial photography and other geographic information resources. Produce maps for geomorphic and natural features.
- c) Locate and synthesise other sources of information (e.g. local information from residents, rangers, users, naturalist groups, etc.).
- d) Record information on the natural resources (flora and fauna). Access appropriate DSE/DPI databases (Flora Information System and Victorian Fauna Database). Identify significant flora and fauna populations and map. Include any threatened species listed on the databases, Flora and Fauna Guarantee and the listings under the *Environment Protection and Biodiversity Conservation Act 1999*.
- e) Describe the natural hydrological regime (including groundwater) and the history of regulation or alterations. Detail the salinity level (in terms of depth and EC) of the groundwater and identify any associated problems or issues likely to arise due to the construction of the proposed system.
- f) Describe status of land in area and provide public land status map.
- g) Detail regional, national and international significant areas.
- h) Detail the likely system outfall points and the anticipated impacts of outfalls. For example, if out-falling into a primary system, where does that primary system flow to and what nutrient and salt loads will likely be added to the primary system via the proposed system?

This information is to be collated, as far as practicable, before field assessments are undertaken. It will be used to compare the actual condition of the site with what is to be expected for that ecosystem and assist development of questions about that site, threats and management actions. Record the information on the data sheets as appropriate and extra information should be incorporated into the final report.

5.3.3 Section 2: Catchment Overview

The next step is to develop a catchment overview. This needs to be a map of the catchment at a 1:25,000 scale. Overlays also need to be provided with this map which detail:-

- Proposed system route
- Alternative system options.
- Sub-catchments/blocks for detailed survey
- Soil maps
- Major sites of environmental significance (include significant flora and fauna sites)
- Hydrological regime (include ground-water depths and salinity levels as well as surface hydrological regimes of current water-bodies)
- Public land status
- Proposed outfall site
- Location of wetlands, streams, prior stream depressions, creeks and waterways (including areas of regional, national and international importance).

It is important that all environmental features or significant areas are included in the catchment overview. As part of the process of identifying the resource we wish to protect, fieldwork will be required. Data sheet A (Attachment 4) is used to compile the information at this step.

5.3.4 Section 3: Fieldwork and Environmental Evaluation

Section 3 of the assessment can be separated into two parts:

- Part 1: Collection of field data
- Part 2: Evaluation of the environmental features (Environmental Evaluation Criteria)

Part 1. Collection of field data

Undertake a field assessment of smaller areas of the catchment (sites identified for assessment). The size of these areas is to be decided on in consultation with the DPI representative for the proposed system.

The field assessment should involve:

- a) Mapping and classifying wetlands according to Corrick (Government of Victoria, 1988). Most of the state has already been covered, and maps and digitised wetland data is available from DPI's representative for the system. These will require field verification. A field definition of wetlands that must be included in the assessment is provided in Attachment 2, and is based on the definition described in the "Directory of Important Wetlands in Australia". Part 2 of Attachment 2 lists the respective watering regimes applicable when a wet / dry cycle has to be determined. Mapping of flow-paths and watering regimes should be further detailed in site specific maps within the Assessment document.

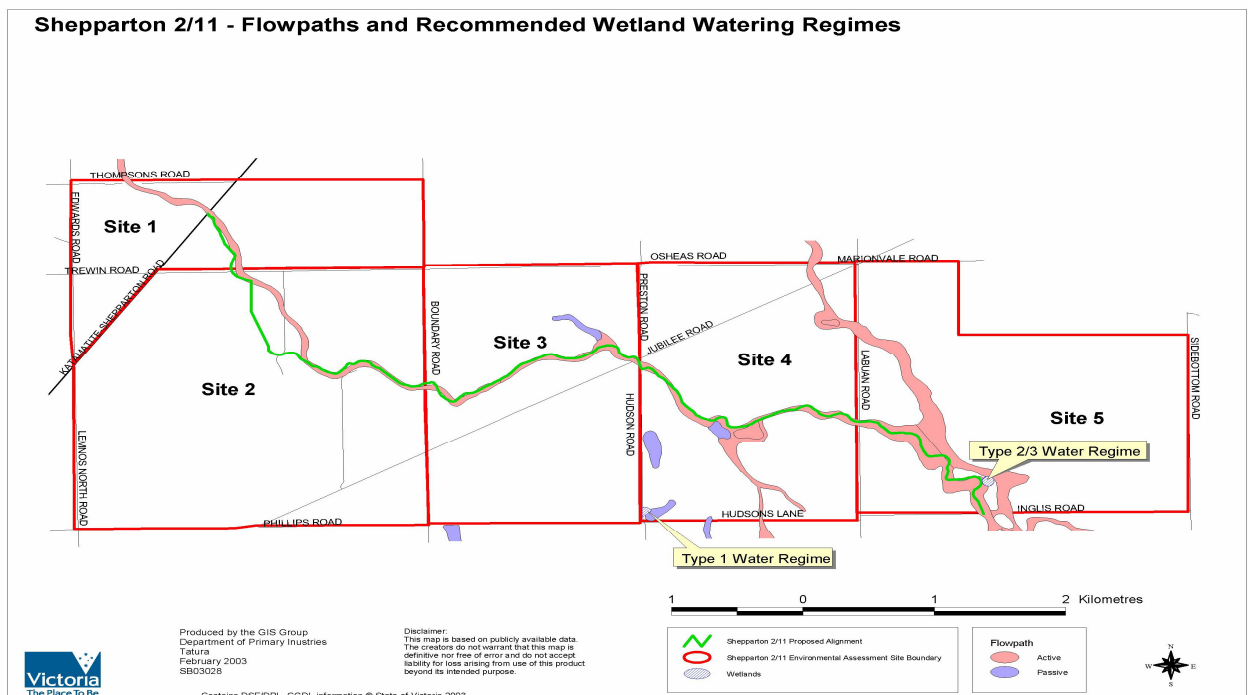


Figure 1 Mapping example of Flow-paths and Recommended Wetland Watering Regimes for the Shepparton 2/11 Primary Surface Water Management System north of Shepparton.

- b) Vegetation survey should include mapping and ground truthing areas of remnant vegetation from aerial photographs, 1:25,000 and 1:100,000 maps. Produce a map of vegetation and habitat types from air photos GIS or LandSat databases or imagery. If possible, maps can be enlarged or photocopied to provide better scale and detail. Significant species and communities according to EVC guidelines should be mapped.

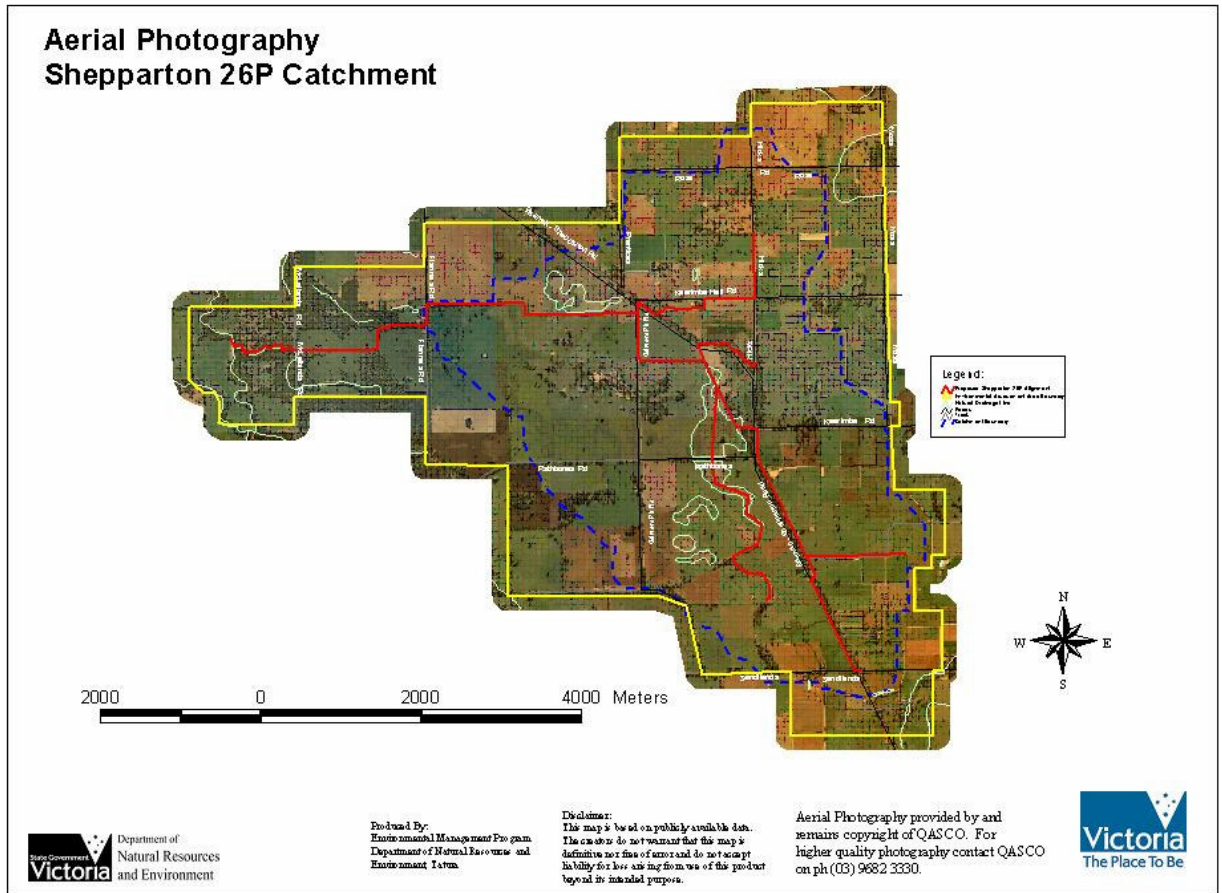


Figure 2 Aerial photo imagery should form the basis of initial desktop studies that then lead to a more informed field study. Detailed field studies in conjunction with GPS “Trimble” capabilities contribute to a feature by feature assessment of the respective catchment.

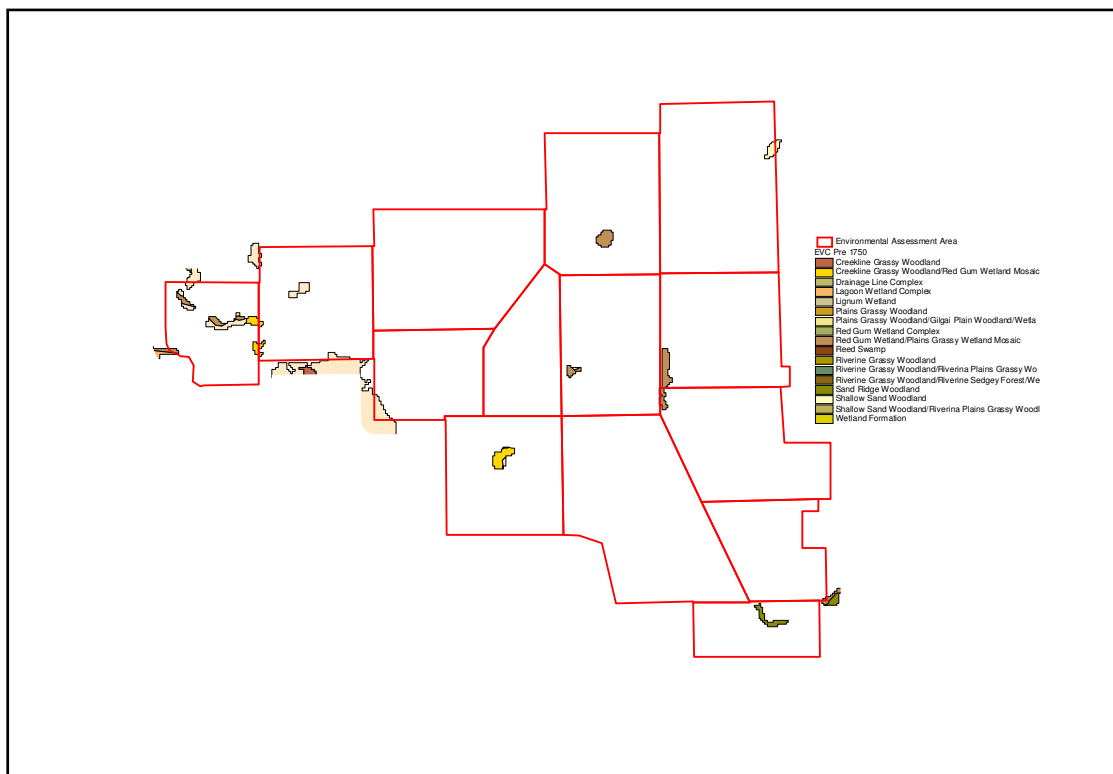
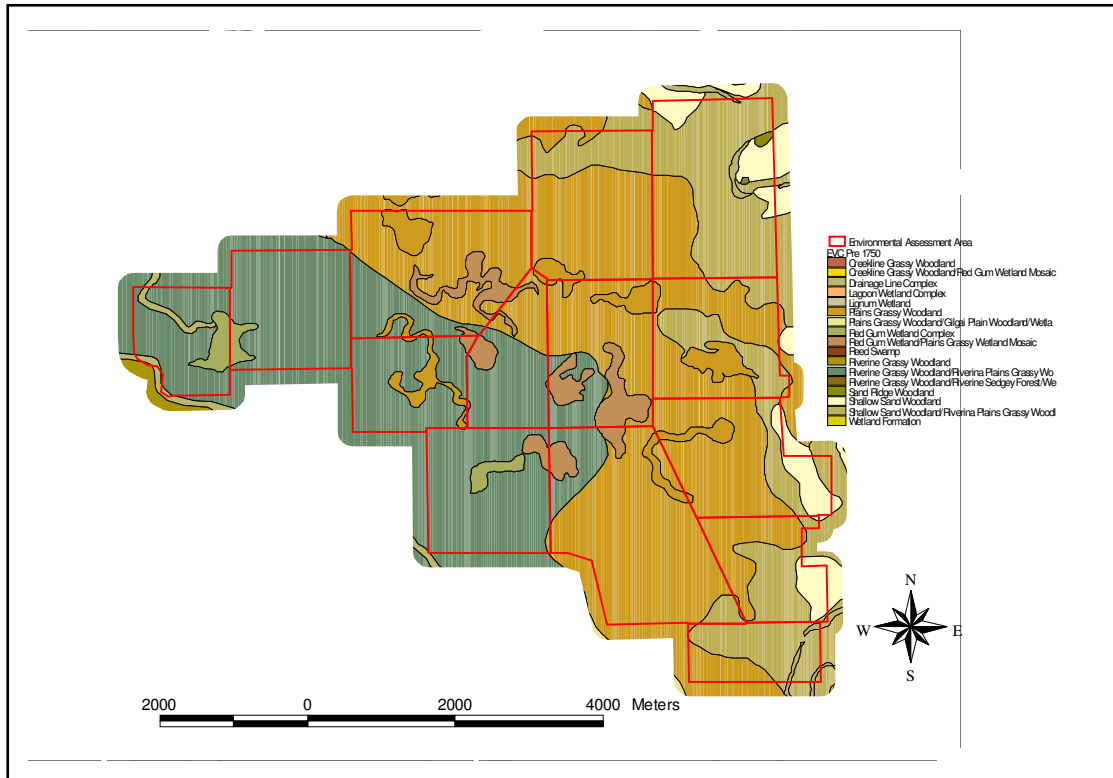


Figure 3 Example of EVC (Ecological Vegetation Class) mapping for the Shepparton 26P catchment showing comparison between 1750 benchmark and remaining 'current' vegetation distribution.

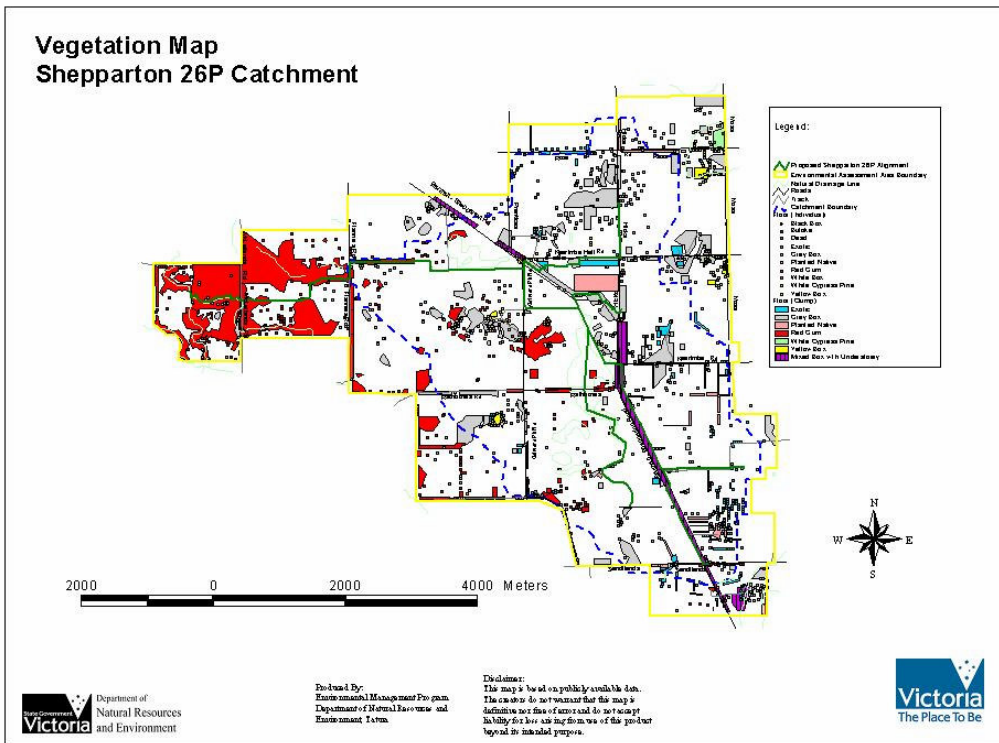


Figure 4 Vegetation distribution within the Shepparton 26P catchment using GPS to map all natural features.

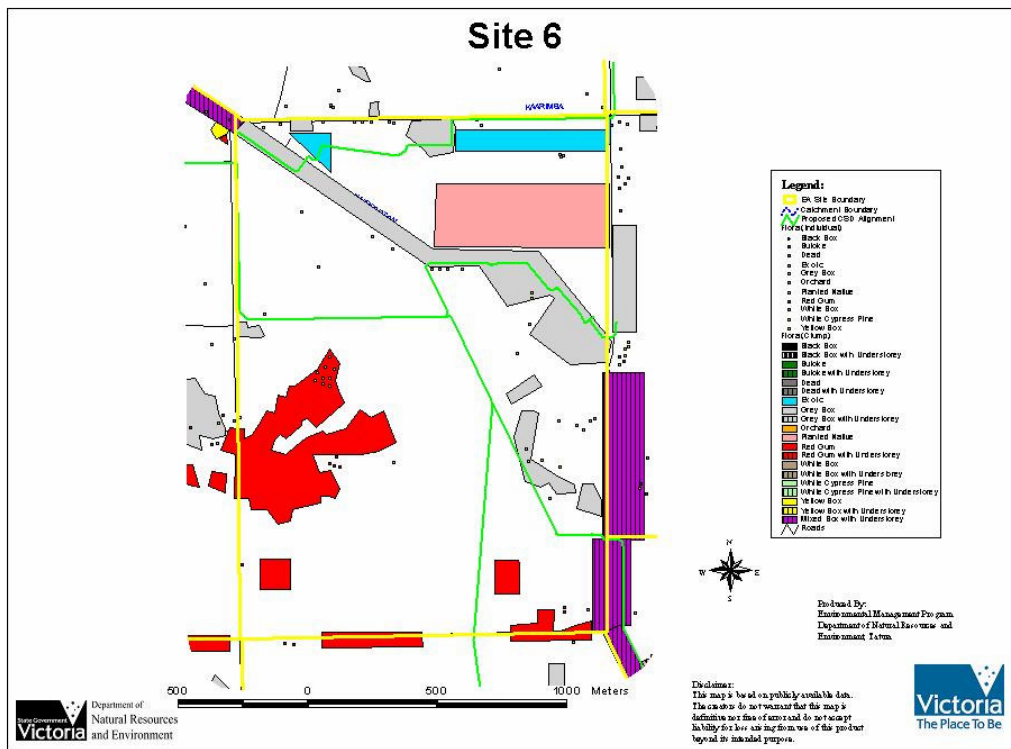


Figure 5 Example of Site 6 within the Shepparton 2/11P catchment detailing the extent of features within the catchment from individual trees to vegetated blocks.

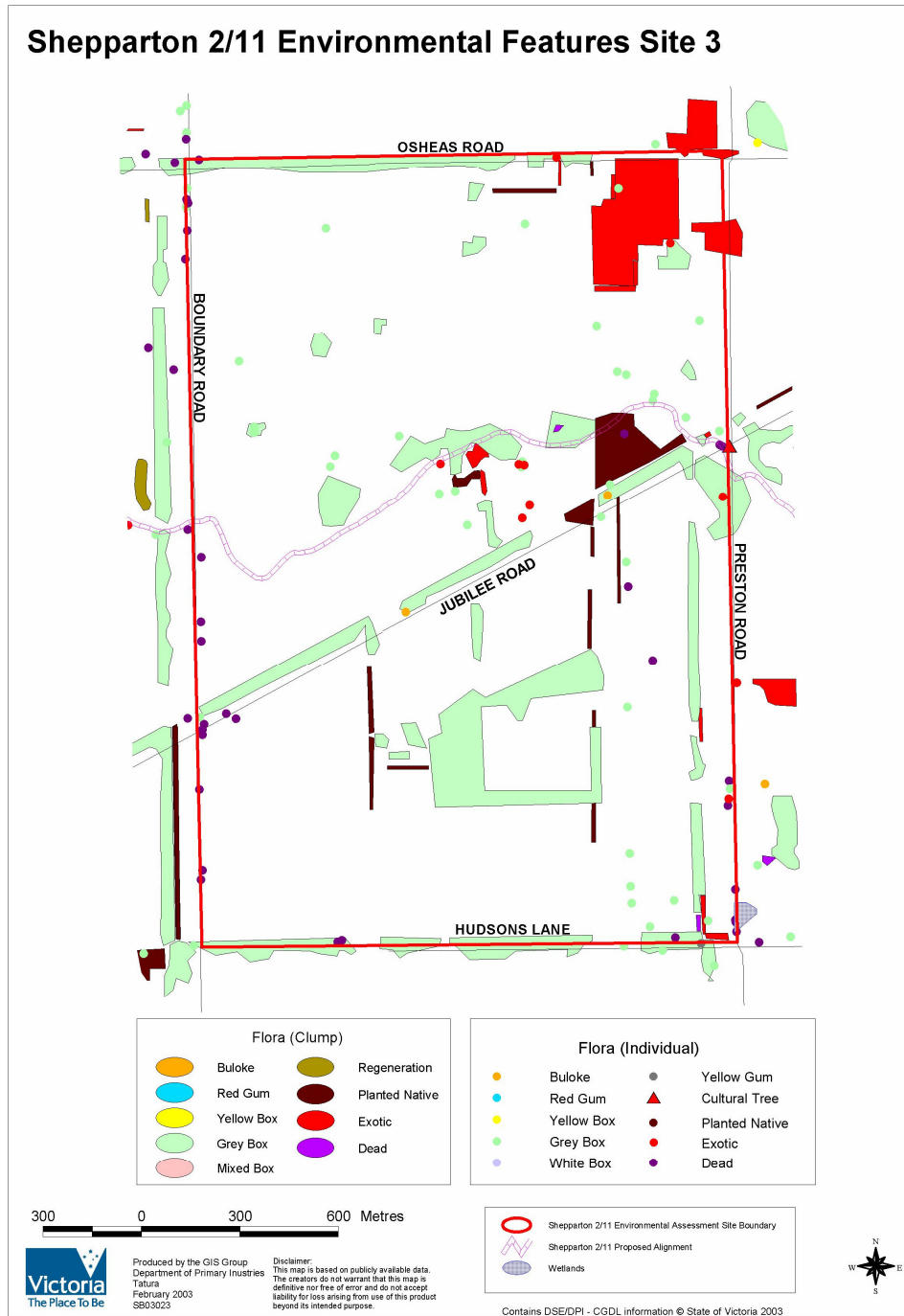


Figure 6 Site 3 vegetation map of the Shepparton 2/11P showing the proposed alignment in relation to natural features and landscape infrastructure.

- c) Fauna survey should include appropriate survey techniques to identify faunal communities. Include locations of significant fauna (Contact DSE for access to the appropriate databases). Faunal survey should include mammals, reptiles, amphibian, fish and invertebrates).
- d) Map incidental sitings of fauna (mammals, reptiles and amphibians including introduced/feral species).
- e) Assessment of water quality parameters. This should include where practicable, EC, nitrates, phosphates, pH, turbidity and dissolved oxygen. This should occur on sites within the catchment that are likely to be impacted on by the scheme, as well as outfall sites.

Table 1 Example of (NTU) readings taken for selected sites within the Shepparton 26P catchment.

Turbidity Readings Recorded During Environmental Assessment				
No.	Date	Site No.	Location	NTU (Nephelometric Turbidity Units)
1	07/02	8	G-MW Channel, Moss Road	150
2	07/02	9	G-MW Channel, Ross Road	80
3	07/02	9	Dam, Hicks Road (CA 10A)	360

Table 2 Example of Phosphorus (P) reading taken at selected sites within the Shepparton 26P catchment.

Phosphorus Readings Recorded During Environmental Assessment				
No.	Date	Site No.	Location	Phosphate Mg/l PO ₄ ³⁻
1	07/02	8	G-MW Channel, Moss Road	0
2	07/02	9	G-MW Channel, Ross Road	0
3	07/02	9	Dam, Hicks Road (CA 10A)	0.75

Table 3 Example of Dissolved Salt (EC –Electrical Conductivity) reading taken at selected sites within the Shepparton 26P catchment.

Dissolved Salt Readings Recorded During Environmental Assessment				
No.	Date	Site No.	Location	EC (µS/cm)
1	07/02	8	G-MW Channel, Moss Road	10
2	07/02	9	G-MW Channel, Ross Road	20
3	07/02	9	Dam, Hicks Road (CA 10A)	160

- f) Identification of areas of public land and their LCC status. These areas should be mapped. Also identify areas that are listed on National or International agreements.
- g) Assessment of hydro-geological parameters. Include depth to ground-water and salinity level of ground-water, as well as identification of ground-water trends and movements within the areas. Clarification as to the likely impact on ground-water movement due to construction of the integrated surface water management/drainage systems should be made.

- h) Identify alignment and management alternatives. This should include options that may reduce or eliminate outfall requirements.

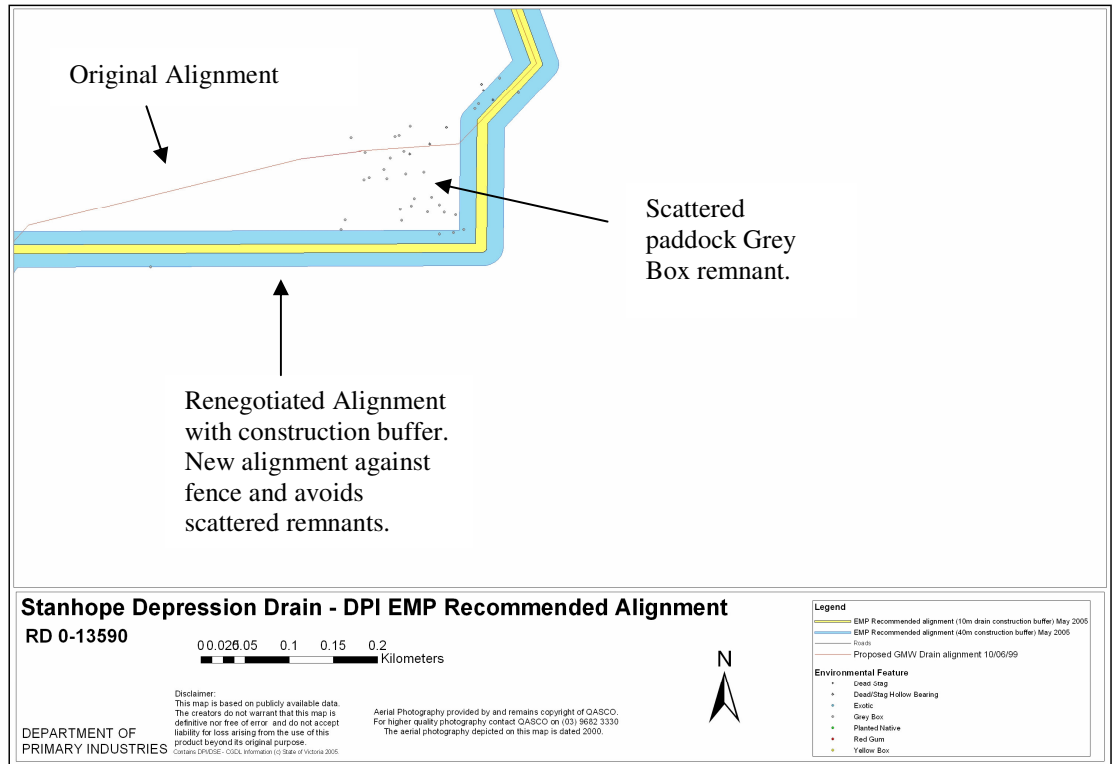


Figure 7 Example of GPS mapping used to produce GIS maps. Realignment of original alignment marginally outside the Drainage Course Declaration will allow the retention of Grey Box remnants.

- i) Identify and assess environmentally threatening processes occurring in the catchment.
- j) Assess environmental features within the catchment and identify areas for environmental enhancement works/management plan development.
- k) Identification of potential areas of Cultural Heritage significance. This is further described in section 5.4
- l) Formulation of management options and recommendations. The above information should be used to develop recommendations for management to ensure that environmental values in the catchment are enhanced and not impacted on due to the construction of the proposed scheme.

The information collected should be recorded on the appropriate data sheets in Attachments 4 and 5. Six data sheets are used to provide the essential basic information for management and conservation decisions. Each data sheet has a common encoding system as a header to allow different data sheets to be linked. The first four numbers (Project No., Date, Site No. and Map name and number and Grid Reference) are used as a trip event (modified from Kaiela FRS Fish Data sheets, Anderson pers. comm.) and the remaining numbers to aid extra identification.

- Site Description sheet A (Attachment 4) is a general site description sheet with basic information for the whole catchment.
- Site Description sheet B (Attachment 4) is to provide a series of maps/environmental appreciation overlays of the catchment, locating environmental features and threats, and the proposed scheme alignment options.
- Quadrat Data sheet (C) (Attachment 4) is for quadrat vegetation community information to be collected for each site or sub-catchment. The size of these assessment areas should be discussed and agreed with the NRE representative.
- Quadrat Description Sheet (D) (Attachment 4) is for a map of each assessment site to allow for an elaboration of the environmental features within the area and to locate photo points/sampling locations.
- Sheet E - Environmental Evaluation (Attachment 4) should be used to record qualitative features which make a site significant or notable.
- The Extra Information sheet (F) (Attachment 4) should be used to record any information which may be of use in the assessment or recommendations that are developed while the fieldwork is in progress.

Any fauna sighted should be recorded on the Atlas of Victorian Wildlife forms for recording in the database.

Flora and fauna sheets have been prepared detailing species that are expected to occur in the area and those that are threatened. These lists can be used as a guide to the species that can be found although they are not exhaustive and should be regularly updated.

The data sheets should be filled out consistently and completely and the procedures for filling out data sheets (described in Attachment 3) will aid in this process. Examples of completed data sheets and reports are available from the DSE/DPI representative.

Part 2. Evaluation of the environmental features (Environmental Evaluation Criteria)

The aim of the evaluation is to highlight environmental features within the catchment and the attributes of that ecosystem that give rise to that value. The principles, method and criteria used are based on the environmental evaluation assessment devised by Lugg *et al* (1989).

A number of different criteria can be used to assess environmental value. The criteria chosen are :

1. Notable Species
2. Rarity of Ecosystem Type
3. Habitat Diversity
4. Naturalness
5. Value for Native Vegetation
6. Value for Waterbirds
7. Value for Fish
8. Value for Mammals/Reptiles/Amphibians
9. Size

NB: No order of importance is implied. These criteria are discussed individually in Part 6 (*Adapted from Lugg et al 1989*);

Other factors that must be taken into account when assessing the environmental value of the area are:

- Listing in “Directory of Important Wetlands in Australia”
- LCC Status and recommendations
- International and national significance (such as Ramsar status, JAMBA and CAMBA and the Register of the National Estate)
- Inclusion in the *Flora and Fauna Guarantee Act 1988*
- Possible referral to the *Environment Protection and Biodiversity Conservation Act 1999*
- Regional significance/linkage to Catchment Management Strategies.

A full description of the environmental Evaluation Criteria is discussed in Section 6 .

5.3.5 Section 4: Recommendations

The recommendations should be developed based on identification of the resources we are aiming to protect and the threats that are affecting the environmental values of the resource. In the report, recommendations should include comments on:-

- Impact of the "no works" scenario as a comparison for assessing the impact of the options
- Impact of proposed system alignment options on site
- Off-site/downstream impacts of proposal
- Alternative options to proposed system
- Changes required to system design to accommodate environmental features
- Recommended actions for protecting and enhancing environmental features

The report should be presented in a format which is suitable to be provided to community members as well as design engineers and technical staff (a suggested structure for the report is located in Attachment 6). Preferably all natural areas will be retained and should be considered for enhancement as part of the works program or at a later date. Guidelines for engineers designing the systems have been developed to aid this process (Goulburn-Murray Water, 2005).

The impact of the principal options must be compared to the "no works" scenario and the impact on the important areas highlighted. Victoria's Biodiversity Strategy as (Victoria's Native Vegetation Management – A Framework for Action) states its primary goal as “ a reversal across the entire landscape, of the long term decline in the extent and quality of native vegetation leading to a NET GAIN’. Consequently any alterations or reduction in the value of the environment as a result of a SWMS will need to display the implementation of the ‘three step approach’ of Avoid – Minimise – Offset leading to a Net Gain.

5.4 CULTURAL HERITAGE ASSESSMENT

A Cultural Heritage Assessment is required for all Integrated Surface Water Management/Drainage Systems. These assessments are undertaken by Aboriginal Affairs Victoria (AAV) and local Aboriginal representatives, with the aim of identifying and protecting Aboriginal heritage sites while, wherever possible, allowing the construction of systems to continue.

It should be noted that under the *State Archaeological and Aboriginal Relics Preservation Act 1972* and the *Commonwealth Aboriginal and Torres Strait Islander Heritage Protection Act 1984*, all archaeological sites and relics are protected. Damage or disturbance, whether deliberate or inadvertent, without a permit is prohibited.

Assessment processes have been developed where it is the responsibility of the proponent to contact the relevant local Aboriginal community organisation/s and the Salinity Archaeologist at AAV prior to the initiation of a system. Also during the development of a Regional Surface Water Management/Drainage Strategy in order to identify the potential location of cultural heritage sites and to advise on impact mitigation strategies.

When projects are further developed it remains the responsibility of the proponent of the system/the administering authority (eg. DPI for Community Surface Water Management System), to contact and supply the project's details to the relevant local Aboriginal community organisation/s and the Salinity Archaeologist at AAV. The Salinity Archaeologist will then arrange a Cultural Heritage Assessment of the area where field assistant/s from the relevant local Aboriginal community organisation/s are employed.

Potential cultural heritage sites identified by DPI Environment Assessment Officers/Contract Environmental Assessors are required to be reported to AAV in the Initial/Detailed Environmental Assessment reports. These potential sites will be verified by AAV during the Cultural Heritage Assessment stage. AAV will also facilitate communications and assist in liaison with local Aboriginal Community organisation/s.

5.5 SUPPORTING PROCESSES AND/OR DOCUMENTATION

5.5.1 Design Alignment and Landowner Negotiation

DPI Environmental Assessment staff should be invited in the negotiation process with Designers and Land-owners from the outset of determination of a system alignment. Early negotiation in this regard contributes to informed design decisions, decision ownership and landowner awareness and promotes efficient cost effective progress through this pre Survey and Design phase. Negotiations should include avoidance of remnant vegetation as a priority, however should an impact be unavoidable every effort should be taken to minimise impacts. The negotiation process should be conscious of both the efficient and effective construction of the SWMS and the protection and enhancement of remnants, promotion of regeneration / revegetation opportunities (catchment wide) and the servicing and protection of wetland complexes.

5.5.2 Initial Alignment and Design Inspection

The assessment of the SWMS during the survey and design period should be initiated as soon as possible after the first 'proposed' alignment is 'determined' and a map is supplied to the EMP. This early involvement further increases the likelihood of remnant protection, appropriate wetland servicing and well placed revegetation opportunities. Furthermore this early involvement contributes to savings opportunities for the SWMP by avoiding un-necessary design changes inherent in previous SWMS design / projects.

5.5.3 Final Design Alignment Inspection and Report

The final design alignment inspection should be conducted using the final design plans provided by the respective design consultants as these plans are usually but not always in electronic format. If available this digitised alignment file is used in a 'Trimble' GPS unit to enable field geo-referenced mapping. A final alignment 'Natural Features on Final Alignment Booklet' is produced outlining the final agreed alignment, a construction buffer zone and all natural features within a 30 metre buffer each side of alignment centre. Each Individual feature is numbered and a detailed inventory of the natural feature is documented in summary tables as an appendix.

This document lists natural features within the 2 x 20 metre buffer of the final alignment centreline and not the entire catchment as **usually** only minor changes to the original alignment occur. Other 'catchment wide' natural features distant to the final alignment would be adequately detailed in the original Environmental Assessment document. However, considerable realignment over new ground is occasionally possible which would be covered by specific section assessments. This document should also provide information satisfying Victoria's Native Vegetation Management- A Framework for Action.

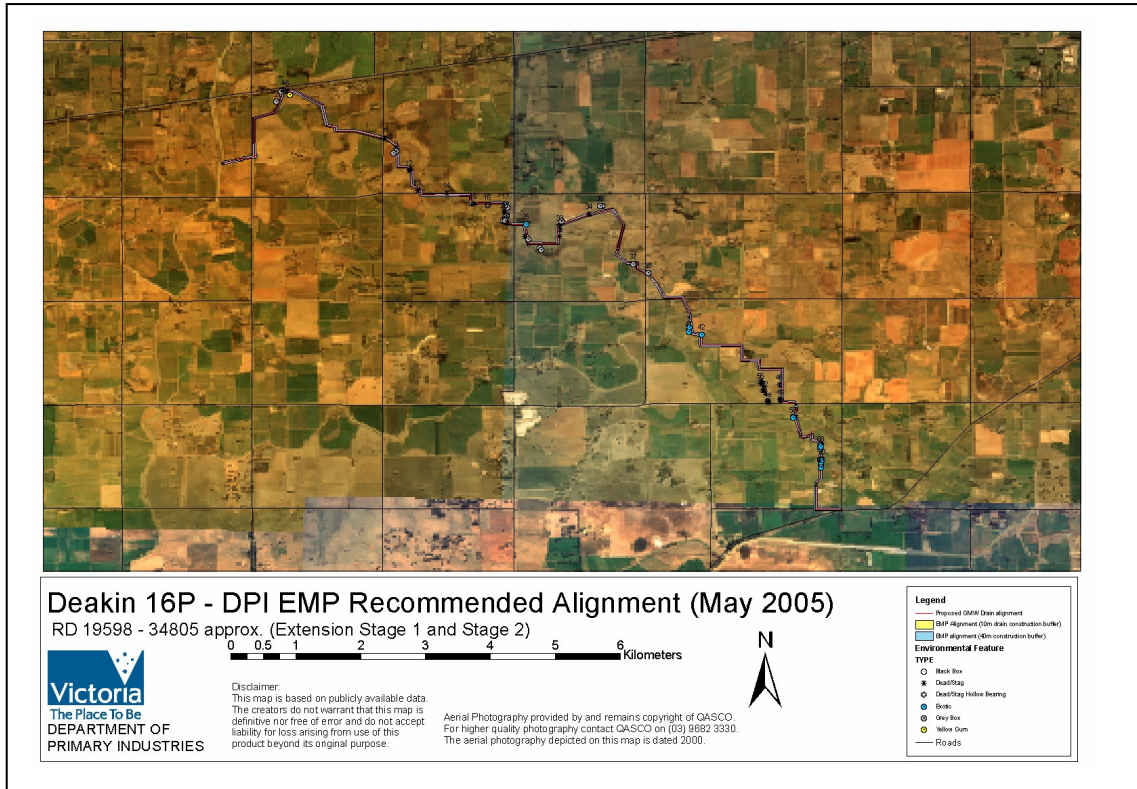


Figure 8 Catchment perspective of Deakin 16P using aerial photography of the entire Deakin 16 Extension alignment. This page forms the front cover of the ‘Natural Features on Final Alignment Booklet’ that accompanies an appropriate letter from the EMP to stakeholders recommending / approving the final alignment as detailed.

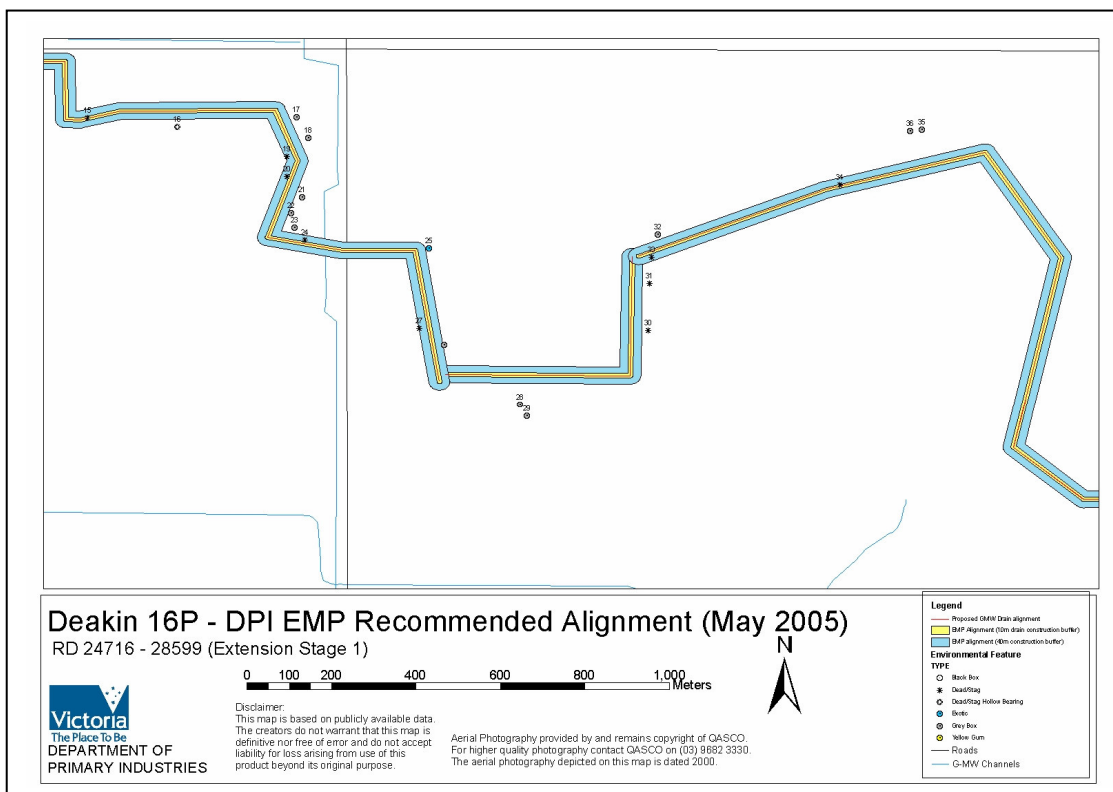


Figure 9 Natural feature mapping associated with the final alignment which has been GPS geo-referenced complemented by individual feature attributes.

5.5.4 Flora and Fauna Database Search

Flora and Fauna Databases such as the DSE Victorian Flora and Fauna Database and Biosites database are examples of databases that should be searched to ascertain anecdotal and historical records of species within the respective catchment. This database search would also support sightings recorded in species lists compiled in the detailed Environmental Assessment. The database search also provides listed species data for the compilation of the EPBC letter forwarded to Goulburn Murray Water prior to Planning Permit Application. This letter assists in the decision that the respective SWMS does or does not cause an Action under *the Environmental Protection and Biodiversity Conservation Act 1999*. (Refer Item 5.5.5).

5.5.5 Environmental Protection and Biodiversity Conservation Act 1999 Response (Attachment 8)

After final design alignment inspection and production of the 'Natural Features on Final Alignment Booklet' the Environmental Assessment program is required to draft a response to Goulburn Murray Water indicating the potential for the existence of species or ecological communities that may have protection under the EPBC Act 1999. This response is required prior to the Application for Planning Permit and / or Application for Amendment.

The response should include :-

- Any flora and / or fauna species, communities or habitats that are listed or known to exist in the SWMS catchment that will trigger, may trigger or likely to trigger the provisions of the EPBC Act 1999.
- Any Wetlands of International Importance, World Heritage Properties, Nuclear Actions or Commonwealth Marine Environments.
- The definition of an 'Action' as defined by the EPBC Act, the 'significant Impact Criteria of an Action as listed in the EPBC Act 1999 and what constitutes an area deemed to be 'important habitat'.

An example copy of this letter is contained as Attachment 8.

6. ENVIRONMENTAL EVALUATION CRITERIA

The criteria for environmental evaluation have been briefly discussed in Chapter 5.3. and are further expanded in this Chapter. The combination of:

- the environmental evaluation,
- fieldwork identifying key species and communities that require protection
- land status recommendations
- state, national and international requirements

will enable recommendations for environmental management to be completed. The evaluation procedure will determine those areas that are high value and should be retained. Based on regional knowledge, DPI will determine other criteria to ensure those areas which are depleted or important in regional strategies will also be retained. The remaining areas, while important, could be used as trade-offs for improved environmental values such as revegetation.

As previously identified, the following criteria have been chosen as environmental evaluation criteria:

1. Notable Species
2. Rarity of Ecosystem Type
3. Habitat Diversity
4. Naturalness
5. Value for Native Vegetation
6. Value for Waterbirds
7. Value for Fish
8. Value for Mammals/Reptiles/Amphibians
9. Size

6.1 NOTABLE SPECIES/ASSOCIABILITY WITH HERITAGE SITES

Areas which support species of presumed extinct, endangered, rare, vulnerable or threatened plants or animals should be given a higher environmental value. From a vegetation perspective, areas containing 'notable species' would be protected by the various levels of 'conservation significance'. The area which supports notable listed species should be managed in order to preserve those species through supporting legislation such as the *Flora and Fauna Guarantee Act 1988* and the *Environment Protection and Biodiversity Conservation Act 1999* in the form of respective listings or an Action / referral.

Notable species are listed in the environmental assessment (Summary Sheets, Attachment 4) so that appropriate management can be implemented. Information relating to notable species can be obtained from databases within DSE /DPI.

Areas associated with sites of identified cultural heritage value (as confirmed by AAV assessment), should be noted and appropriate management recommendations made.

6.2 RARITY AND UNIQUENESS OF ECOSYSTEM TYPE

Rarity of an ecosystem is difficult to define. It can arise through natural processes - a particular type may be naturally rare - or it can arise through the action of man, by modifying all of that type of ecosystem. Nevertheless, in whatever way a certain type has become rare, ecosystems are more valuable simply because they are poorly represented.

Uniqueness is also dependent on the scale used for comparison (local, regional, national, and international). If a range of wetland types or other ecosystems are represented within a local area, it is important to attempt to preserve that range of types within that area.

Uniqueness of wetland type or other ecosystem can be ascertained by examining a summary of wetland type and other natural areas by frequency of occurrence or by total area. Both frequency and total area are used in the environmental assessment.

Within Victoria, ecosystems have been classified into Broad Vegetation Types (BVT's) and Ecological Vegetation Classes (EVC's). These classifications enable vegetation communities to be grouped according to like features. The BVT's have been assigned on the basis of land-systems (including factors such as geology, rainfall elevation and soil type) and the dominant vegetation type. A further, more detailed classification of vegetation has been described and mapped (called EVC's) and will provide detailed information to assist in the protection and management of native vegetation. Protection of native vegetation will in the future focus on ensuring that EVC's are adequately protected within each Bio-region.

6.3 HABITAT DIVERSITY

A wetland or stand of remnant vegetation that contains a range of habitat types (trees, shrubs, reeds, open water, etc.) is of more value than an area that has only one type. An area with a range of habitat types is likely to support a wider variety of both plant and animal species and is more likely to be able to "stand alone", that is provide feeding, roosting and breeding sites for a number of different species.

Connectivity of habitat is also an important part of habitat diversity. If the habitat is continuous such as along rivers or streams, or if it forms a connective link to similar habitat types or provides a stepping stone to other natural ecosystems then its diversity value is increased.

6.4 NATURALNESS

Australian Biological Research Group (undated) states that "nature conservation is ultimately concerned with preserving systems and species that have evolved 'naturally' and are now affected by the 'unnatural' actions of humans. Natural systems cannot, by definition, be recreated by human intervention. Naturalness is an important and useful criteria for conservation value assessment."

There are a number of different indicators of naturalness, each of which is considered.

(i) *Ecosystem Type*

The nature of ecosystems changes as they are subject to man-caused interference. For example, wetlands can change category from a shallow freshwater marsh to a semi-permanent saline wetland through the effects of increasing salinity. These changes are primarily concerned with the water regime of the wetland.

(ii) *Surrounding Use*

This is an indicator of whether or not natural processes are still operating within the ecosystem. For example, if the surrounding vegetation has all been cleared from around a wetland and replaced with urban/agricultural development the ecosystem can no longer be said to be natural, even though the water regime may not have changed.

(iii) *Vegetation*

The vegetation that occurs within and surrounding a natural area, specifically the proportion of introduced plants to native plants, is a good indicator of the amount of change that an ecosystem has been exposed to. A large percentage of introduced plants indicate that there has been considerable interference in the recent past.

It needs to be noted, however, that it is possible for highly modified areas to have a very high conservation value. Their value, in that case, would be for reasons other than naturalness.

6.5 VALUE FOR NATIVE VEGETATION

Natural/Semi-natural areas provide habitats for native plants to live and survive. Often they represent the only areas of native vegetation within a sea of agricultural land. Some areas, by their intrinsic nature and their condition, support larger numbers and a wider range of native species and, occasionally, rare or endangered species. These areas are hence more valuable than areas that have few or widespread native species.

6.6 VALUE FOR BIRD USE

Birds, particularly waterbirds are probably the most visible faunal components of an ecosystem. Birds have the ability to migrate from area to area, but have certain requirements for breeding and feeding habitat. Waterbirds, for example, are entirely dependent on aquatic habitats and, in contrast to other species, cannot make use of other habitats. The ability of an area to support a range of species makes the area more valuable.

(i) *Carrying Capacity*

Carrying capacity is a measure of the total numbers of birds a wetland or area of remnant vegetation supports. Areas that provide ideal feeding and habitat conditions and hence support large numbers of birds are inherently more valuable than areas that support low numbers of birds.

(ii) *Species Diversity*

Species diversity is recognised as one of the important criteria in evaluating areas of environmental value (Rabe & Savage 1979, Margules & Usher 1981, Pressey 1985, Lloyd 1991). When used, in conjunction with other criteria, it provides an indicative measure of the value of any particular site to birds (Lugg, *et al.* 1989, Heron *et al.* 1991 a & b).

(iii) *Breeding*

Birds often have specific requirements for breeding purposes, such as cover, water regimes, vegetation type and isolation. Relatively few areas of remnant vegetation or wetlands are able to supply these requirements. Consequently, areas which provide good breeding opportunities should be considered as valuable.

6.7 FISH

Like waterbirds, fish are dependent on wetland and stream habitats. However, fish present many more problems for adequate surveying (they are far less visible, and they need to actually be caught for positive identification), and less is known of their biological requirements (food, breeding biology and shelter requirements).

Fish, unlike waterbirds, are generally confined to one waterbody (except during floods) and hence if a certain species is present in reasonable numbers in a waterbody it can be assumed that most of its feeding, breeding and shelter requirements are being met within that waterbody.

Consequently, it is possible to make some subjective assumptions about the value of a wetland or waterway for conservation of fish by the variety and abundance of fish species found in that waterway.

The presence of threatened fish species or fish listed on the Flora and Fauna Guarantee Act (1988) will make the wetland or waterway more valuable.

6.8 MAMMALS, REPTILES AND AMPHIBIANS

These groups are considered together because it is difficult and time consuming to gather data. Nevertheless if an area is known to support populations of these animals it should be given a higher conservation value. DPI databases can be used to identify the presence of these fauna types.

6.9 SIZE

All things being equal, a large ecosystem unit area is of more value than a small area. Larger size means reduced disturbance in the interior portions and it provides habitat for species that require large home ranges. However size is also dependent upon shape, especially the ratio of the perimeter to area. Large size also reduces in relevance if the interior of the area is readily accessible to boat traffic or other vehicles. Area is at least easily measured and, in contrast to other criteria, does not change appreciably over time.

7. DPI ENVIRONMENTAL ASSESSMENT SUMMARY AND CHECKLIST

7.1 ENVIRONMENTAL ASSESSMENT - SUMMARY

Environmental Assessment of Proposed Systems

It is the responsibility of the proposer and the designer of the Integrated Surface Water Management/Drainage System to ensure that the final design for each system takes full account of the environmental values likely to be both directly and indirectly affected. This will include ensuring applicable policies and legislation is taken into account.

Proposed Integrated Surface Water Management/Drainage Systems are referred to DPI for comment and the following procedure will be followed:-

Initial Inspection

DPI will arrange a meeting with the proponent or consultant to discuss the existing environmental information available on the area and arrange a site inspection as described in the process detailed in Section 5.5.

DPI will determine on the basis of existing environmental information and the site inspection whether:

- the proposed system is satisfactory.
- the proposed system cannot proceed because of its impact on known high environmental values.
- options are available that would satisfactorily meet environmental concerns.
- there is insufficient information on the environmental values in the area and the environmental impacts of the proposed system. Should there be insufficient environmental information held about the catchment area, site assessments / inspections and supporting desktop studies are required to enable the preparation of an Environmental Assessment Report. During the preparation of the report, the proponent/consultant should follow guidelines prepared by DPI.

The report should be completed by a DPI Environmental / Biodiversity Assessment Officer or by an approved independent consultant.

Existing Conditions Plan

In the preparation of the Environmental Assessment the first step is identification of the resource we wish to protect. This involves the preparation of an existing conditions plan showing

- the native plant and animal communities and including terrestrial vegetation (includes woodland, shrub-land, grassland, riparian vegetation), wetlands (including seasonal, permanent and man made wetlands), rivers and streams. The plan must identify the individual native plant and animal species in the community.
- special interest sites (e.g. conservation, cultural, scientific and archaeological)
- areas of public land (including land status) within the catchment.
- significant species (listed on the FFG Act 1988 and the EPBC Act 1999) locations (both flora and fauna) within the catchment.

- watering requirements for wetlands and rivers within the catchment that may be impacted on by the proposed system.
- all outfall points and estimated quality of outfall water, and the associated downstream impacts.

Analysis

The proposed system is drawn as an overlay on the existing conditions plan in **ArcMap** to identify the potential for on-site and downstream environmental impact and identify any offsets on and off-line.

The analysis must identify whether the system involves any proposed clearance or degradation of native vegetation, loss or degradation of habitat for native fauna and the identification of critical habitat for a species or community of flora and fauna. It must also include any impacts on wetland environments or streams in relation to changes to the natural hydrological patterns and water quality. The 'net gain' conservation policy will need to be applied if any loss to native vegetation are identified. Where impacts are identified, the analysis should then start the process of exploring changes to the design and the consideration of options to minimise the impact on environmental values.

In addition, the potential off-site effects of the proposed system on receiving waterway biota and water quality (from salt, siltation and nutrients) will need to be qualified and quantified, and a net gain conservation provision established.

Options

Options for plan design to address the environmental issues identified above then need to be developed with costings and the preferred option. Early negotiation with designers and landowners are paramount contributing to an efficient timely design phase whilst ensuring protection and enhancement of the catchments natural features. This negotiation component should only cease once a final alignment is agreed and the EMP conducts a Final Alignment Natural Features Booklet".

These options and associated negotiation should be from inception of the concept stage.

Submission by DPI

DPI will advise the proponent and responsible planning authority whether:

- the preferred option for the proposed system is environmentally satisfactory.
- the preferred option for the proposed system would be environmentally satisfactory subject to the adoption of conditions /recommendation specified by DPI.
- one or other of the options are environmentally satisfactory, or would be subject to the adoption of conditions specified by DPI.
- further information is required.
- the proposed system impacts on an area now identified as having environmental values and therefore cannot proceed.

The proposal, with DPI's comments will need to go to the Local Planning Authority.

Post Report Assessment Responsibilities

The Environmental Assessment process does not cease on the completion of the Environmental Assessment Report. Numerous other assessment and advisory duties continue through to final alignment declaration, completion of the planning process and subsequent construction of the system. Ongoing duties additional to those in Section 5.5 include

Reporting to and attending various forums including

D800	(Primary Surface Water Management Working Group with GMW)
SWMWG	Surface Water Management Working Group
CSDCC	Community Surface Drainage Coordinating Committee
COGS	CSWMP Operations Group
System TLG	Specific Alignment Technical Liasion Group
AGM / GM	Specific Alignment General and Annual General Meetings

7.2 CHECKLIST OF ISSUES

Aside from the most appropriate option, the recommendations from DPI will also incorporate recommendations on the issues in the following checklist when applicable.

Checklist of Issues to Consider when Making Recommendations in relation to environmental features on Integrated Surface Water Management/Drainage Systems.

1. **System alignment**
2. **Relevant Strategies, Policies and Legislation (including Catchment Management Authorities Regional Catchment Strategies, Water Quality Strategies and the Biodiversity Strategy.**
3. **EPA requirement with regard to system water quality.**
4. **Outfall site requirements (include impacts of outfall in terms of salinity, nutrients, altered hydrological regimes and silt loads)**
5. **Groundwater management (include groundwater and salinity levels, depth to Surface and EC).**
6. **Water reuse – on and off farm - what is being used?**
7. **Wetland design and management - including watering regime, vegetation requirements, grazing control, fencing requirements, etc**
8. **Spoil disposal**
9. **Revegetation implementation and management, areas for planting**
10. **Amelioratory measures - to lessen the visual and physical impact of the system.**
11. **Safeguards to be introduced - for the protection of areas of ecological value including recommendations for environmental enhancement works/management plan development.**
12. **Native Vegetation Retention Controls - for all native vegetation**
13. **Legislative Responsibilities**
14. **Presence of any rare or endangered species, special management considerations**
15. **Desirable irrigation practices**
16. **Salt disposal entitlements**
17. **Downstream impacts of system flows (impacts on receiving waters). Disposal into waterways should be assessed, and in the case of any negative impacts, should be discouraged.**
18. **Monitoring, management and enforcement of the above matters**
19. **Appropriate disposal of options water (in some cases the system water may be highly saline.**

8. REFERENCES & BIBLIOGRAPHY

- ANCA (1996) A Directory of Important Wetlands in Australia. Second Edition. ANCA, Canberra.
- Australian Biological Research Group (undated). *Conservation Values of Lakes and Wetlands in the South Western Region, Victoria*. A report to Department of Water Resources, Department of Conservation, Forests and Lands and Ministry for Planning and Environment.
- Berntell, A., L. Henriksson, H. Nyman, H. Oskarsson & A. Wenblad. (1988). Criteria for the biological evaluation of lakes from a nature conservation viewpoint. *Verh. Internat. Verein. Limnol.* 23: 1500-1504.
- Blyth, J.D. (1983). Rapid stream survey to assess conservation value and habitats available for invertebrates. In: Myers, K., Margules, C.R. & Musto, I. (Eds) *Survey Methods for Nature Conservation*, Vol. 1. CSIRO, Div. of Water and Land Resources, Canberra.
- Boort West of Loddon Salinity Management Plan (1993) Environmental Values and the Effects of Salinity on the Flora and Fauna of the Boort West of Loddon Catchment. CNR, Bendigo.
- Boulton, A.J. & L.N. Lloyd. (1991). Aquatic macroinvertebrate assemblages in floodplain habitats of the lower Murray River. *Regulated Rivers*, 6: 183-201.
- CFL (1988) The Environmental Condition of the Campaspe West Irrigation District. CFL, Bendigo
- CFL (1988) The Environmental Condition of the Tragowel Plains. CFL, Bendigo.
- DCE (1991) Environmental Assessment for the Avon-Richardson Land and Water Management Plan. DCE, Bendigo.
- Department of Natural Resources and Environment. (1992). *An Assessment of Victoria's Wetlands*. Office of the Environment.
- DNRE (1998) 27 600 Environmental Water Allocation Review of 1997/98 Usage. Unpub. DNRE North West Area.
- Floodplain Ecology Group (1993) Final Report Integrated Watering Strategy for mid-Murray Wetlands (IWS). CNR.
- Floodplain Ecology Group (1993) Water Management options for Mid Murray Wetlands, Victoria. CNR.
- Floodplain Ecology Group (1994) An Environmental Bulk Water Entitlement for the River Murray, Victoria. CNR.
- Floodplain Ecology Group (1993) An Interim Water Management Strategy for Gunbower Forest. CNR.
- Gilligan, B. (1984). A wetland habitat assessment scheme. *Wetlands (Aust)*, 4: 49-55. Goodrick, G. (1983). A description of wetlands in N.S.W. In: Haigh, C. (Ed.) *Wetlands in New South Wales*. N.P.W.S., Sydney.
- Government of Victoria (undated). *Salt Action: Joint Action*. Victoria's Strategy for managing land and water salinity.
- Heron, S., Robley, A. and Robb, B. (1991). *Environmental Assessment of the Proposed Tandarra - Dingee Community Surface Drainage Scheme*. Report to the Tandarra - Dingee Community Surface Drainage Group. Department of Conservation and Environment.
- Heron, S., Robley, A., Robb, B. and Johnson, P. (1991). *Environmental Assessment for the Avon - Richardson Land and Water Management Plan*. Report to the Avon - Richardson Land and Water Management Group. Department of Conservation and Environment, Bendigo.
- Hydrotechnology (1995) An Environmental Water Management Strategy for the Kerang Lakes area.

- International Waterfowl Research Bureau. (1980). *Conference on the Conservation of Wetlands of International Importance Especially as Waterfowl Habitat*. Stimbridge, England.
- Kelly, M, J. (1997) Kerang Lakes Wetland Flooding Planner. DNRE, Bendigo.
- Kelly, M.J. (1997) Environmental Water Allocation (27 600 ML) Proposed Works Program 1997/98. DNRE, Bendigo.
- Kerang Lakes Assessment Group (1989) Conservation Value of Wetlands in the Kerang Lakes Area. DCFL, Bendigo.
- KLAWG (1992) Kerang Lakes Area Draft Salinity Management Plan. Kerang.
- LCC (1983) Murray Valley Area Review. LCC Melbourne.
- Lloyd, L.N. (1991). The conservation significance of the wetlands in the Murray-Darling system: The assignment of conservation values. In: Dendy, T. & M. Coombe (Eds). *Conservation in Management of the River Murray System*. SA Dept of Env't & Planning, Adelaide, S.A.
- Lloyd, L.N. & S.A. Balla. (1986). *Wetlands and Water Resources of South Australia*. Dept of Environment & Planning, Adelaide, SA.
- Lugg, A., Heron, S., O'Donnell, T. and Fleming, G. (1989). *Conservation Values of Wetlands in the Kerang Lakes Area*. Report Number 1 to the Kerang Lakes Area Working Group. Department of Conservation and Environment, Bendigo.
- Lugg, A., Heron, S., O'Donnell, T. and Fleming, G. (1989). *Environmental Values and Effects of Salinity on the Flora and Fauna of the Boort - West of Loddon Salinity Management Planning Area - Draft*. Department of Conservation and Environment, Bendigo.
- Macmillan, L.A. (1993). A method for identifying small streams of high conservation status. In: Myers, K., Margules, C.R. & Musto, I. (Eds). *Survey Methods for Nature Conservation*, Vol.1. CSIRO, Div. of Water and Land Resources, Canberra.
- Maitland, P.S. (1985). Criteria for the selection of important sites for freshwater fish in the British Isles. *Biol. Cons.* 31: 335 – 353.
- Margules, C. & Usher, M.B. (1981). Criteria used in assessing wildlife conservation potential: A review. *Biol. Cons.* 21:79 – 109.
- Margules, C., Higgs, A.J. & Rafe, R.W. (1982). Modern biogeographic theory: Are there any lessons for nature reserve design. *Biol. Cons.* 24:115 – 128.
- Morgan, N.C. (1982). An ecological survey of standing waters in Northwest Africa. II. Site description for Tunisia and Algeria. *Biol. Cons.* 24: 83 – 113
- NRE (1997) Victoria's Biodiversity – Our Living Wealth. NRE, Melbourne.
- NRE (1997) Victoria's Biodiversity – Sustaining Our Living Wealth. NRE, Melbourne.
- NRE (1997) Victoria's Biodiversity - Directions in Management. NRE, Melbourne.
- O'Connor, P.G. DCNR (1994). Environmental Assessment of Mosquito Depression Drain extension Merrigum – Ardmona Road to Midland Highway.
- Pressey, R.L. (1984). A method for describing and evaluation of coastal floodplain wetlands. In: Myer, K., D.R. Margules & I. Musto (Eds). *Survey Methods for Nature Conservation*. Volume 1. CSIRO Div. of Water and Land Resources, Canberra.
- Pressey, R.L. (1985). Some problems with wetland evaluation. *Wetlands (Aust.)* 52(1): 42-51.
- Rabe, F.W. & Savage, N.L. (1979). A methodology for the selection of aquatic natural areas. *Biol. Cons.* 15: 291-300.
- Robinson, I. (1989). Salinity Impact on Rivers, Streams and Wetlands - Shepparton Irrigation Region. DCFL, Benalla Region. In: *Shepparton Irrigation Region Land and Water Salinity Management Plan Background Papers, Vol I*.

- Robley, A. (1992) Environmental Assessment of the Campaspe Dryland Salinity Management Planning Area. DCE, Bendigo.
- Robley, A. (1992) Environmental Assessment of the Loddon Dryland Salinity Management Planning Area. DCE, Bendigo.
- Goulburn-Murray Water, Victoria (1997). *Guidelines for Design of Community Surface Drainage Schemes*.
- Savage, N.L. & Rabe, F.W. (1979). Stream types in Idaho: An approach to classification of streams in natural areas. *Biol. Cons.* 15: 301-315.
- Sheldon, F. & L.N. Lloyd. (1990). Physical Limnology and Aquatic Habitats. In: O'Malley & F. Sheldon. *Chowilla Floodplain Biological Study*. Nature Conservation Society of S.A., Adelaide, SA.
- Sinclair Knight Merz, (1996). *Control of Works and Activities in Natural Drainage Systems – Policy Paper and reference maps for the Shepparton Irrigation Region Significant Drainage Lines*.
- SPPAC, (1989). *Draft Shepparton Irrigation Region Land and Water Salinity Management Plan*.
- Stearns, F. (1978). Management Potential: Summary & Recommendations. In: Good, R.E., D.F. Whigham, and R.L. Simpson. (Eds). *Freshwater Wetlands: Ecological processes and management potential*. Academic Press, New York.
- Thomas, L. (1996) Management of Salinity related threats to the Environmental Features of Campaspe West and Rochester Irrigation Areas.
- Williams, G. (1980). An index for the ranking of wildfowl habitats, as applied to eleven sites in West Surrey, England. *Biol. Cons.* 18: 93-99.

ATTACHMENT 1

**INITIAL ENVIRONMENTAL ASSESSMENT OF INTEGRATED SURFACE WATER
MANAGEMENT/DRAINAGE SYSTEMS**

INITIAL ENVIRONMENTAL ASSESSMENT OF INTEGRATED SURFACE WATER MANAGEMENT/DRAINAGE SYSTEMS

INTRODUCTION: The Department of Sustainability and Environment is required to provide advice as a referral authority before final approval is granted by Local Government for the construction of integrated surface water management /drainage systems. It is DSE's role to ensure that the environment is not compromised unduly by the construction of systems.

PURPOSE: To provide **initial** environmental assessment data to ascertain if further environmental assessment is required.

RESPONSIBILITY: **DPI** Environmental Assessment Officer/ Coordinator /Contract Environmental Assessor

FILLING OUT DATA SHEET:

1. Name of the proposed system.

2. Location

The location of the system in terms of major roads or landmarks.

3. System contact.

Officer in charge of system. Will generally be representative from DPI.

4. Assessment Officer and Date of Assessment.

Department of Primary Industries officer carrying out initial inspection of the proposed system and the date it was carried out.

5. Attachments.

Attach map which indicates public land boundaries (if any), landholder boundaries, route of proposed systems. Scale of 1:25 000 WOULD BE MOST APPROPRIATE. Larger systems may require mapping at 1:100 000.

Also mark areas of remnant vegetation, wetlands or any other areas of environmental interest on this map.

Attach a list of landholders and anything else that may be appropriate.

Identify the appropriate air photo runs for the area and existing soil maps, if any.

6. Outfall

Identify the area of the proposed outfall and specify the catchment area, the proposed discharge volume and quality. Specify any problems that may arise because of the condition and/or location of the current outfall. Identify and assess any downstream impacts on environmental features – include nutrient loads, salinity and silt loads. Identify current outfall waterway values including flow and water quality patterns and instream ecological values.

7. Public Land
Identify the areas of public land involved in the system, if any and highlight the special requirements in terms of permits or system design that may be required. Identify land status and key LCC recommendations associated with the public land.
8. Key National and International classifications
List the status of any environmental areas in the catchment – eg Ramsar status or listing on the Register of the National Estate.
9. Remnant Vegetation
Identify areas of remnant native vegetation within the catchment and mark the boundaries on the map. Describe the vegetation in the table on the following side. Identify the vegetation communities in terms of BVT's and EVC's. Identify the presence of rare ecosystem types.
10. Significant species
Identify any significant flora and fauna species occurring within the catchment. Include presence of JAMBA or CAMBA species or FFG listed species or threatening processes.
11. Wetlands
Identify any wetlands within the catchment and describe the watering regime and vegetation in the table on the following page.
12. Fauna
Identify fauna species and populations that may be impacted on by the system.
13. Other Environmental Considerations
Identify any other features of environmental interest within the catchment, mark them on the attached map and describe the impact the scheme may have on the features.
14. Recommendations
Determine whether the proposed system requires further environmental investigation. If yes, then pass the form on to the appropriate DPI Project officer for further assessment. If it does not, then what recommendations need to be made in order for the system to proceed.

Make sure any sketch maps, additional maps and lists are securely attached to data sheet.

After completion of the sheet pass on to relevant DPI Project officer or file.

INITIAL ENVIRONMENTAL ASSESSMENT OF PROPOSED INTEGRATED SURFACE WATER MANAGEMENT/DRAINAGE SYSTEM

NAME OF PROPOSED SYSTEM:

LOCATION:

SYSTEM CONTACT:

ASSESSMENT OFFICER **DATE OF ASSESSMENT:**

ATTACHMENTS

Attach map of proposed scheme Yes No

Attach list of landholders Yes No

Other attachments: Yes No

Please specify: _____

TOPOGRAPHIC MAPPING:

SOIL MAPPING:

AIR PHOTOS

OUTFALL (Mark location on attached map.)

Proposed Outfall

Catchment Area:

Discharge Volume:

Discharge Quality:

Is this system likely to cause problems with outfall? Yes No

If **YES**, what problems?

Identify and assess downstream impacts of the system

PUBLIC LAND

Are there any areas of public land involved? Yes No

If **YES**, identify land status and potential issues?

NATIONAL/INTERNATIONAL STATUS

Are there any significant areas in terms of Ramsar, or the Register of National Estate? Yes No

REMNANT VEGETATION

Are there any areas of remnant native vegetation within the catchment (includes wetlands)? Yes No

If **YES**, mark boundaries on attached map and describe on reverse side.

Identify relevant BVT and EVC's within the area

SIGNIFICANT SPECIES

Are there any significant species (both flora and fauna) within the catchment? Yes No

If **YES**, list and mark on attached map

WETLANDS

Are there any wetlands within the catchment?

Yes	No
-----	----

If **YES**, mark on attached map and describe on reverse side.

FAUNA

Are there any fauna populations within the catchment?

Yes	No
-----	----

If **YES**, list species and mark any significant population on attached map

OTHER ENVIRONMENTAL CONSIDERATIONS

Are there any other features of environmental interest within the catchment?

Yes	No
-----	----

If **YES**, mark on attached map and describe impacts.

RECOMMENDATIONS

Does the proposed scheme require further environmental investigation?

Yes	No
-----	----

If **NO**, what environmental recommendations should be followed if the proposal is to proceed?

If **YES**, pass this form on for further environmental assessment.

REMNANT VEGETATION (includes wetlands)

AMG Co-ordinates of sites:

	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9	Site 10
Red Gum										
Black Box										
Grey Box										
Yellow Box										
Buloke										
Murray Pine										
Other Trees:										
Lignum:										
Wattles:										
Other Shrubs:										
Cumbungi										
Rushes:										
Other Wetland Species:										
Native Grasses:										
Native Herbs:										
Habitat Value:										

General Comments (tree health, understorey condition, weeds, grazing impact, fencing, etc.)

WETLANDS

AMG Co-ordinates of Sites:

	Site	Site	Site
Approximate Area			
Average/Maximum Depth			
ARI Database/Corrick classification			
Flooding Type: (G-MW)			
Intermittent			
Short Seasonal			
Medium Seasonal			
Prolonged Seasonal			
Semi-Permanent			
Permanent Open Water			
Vegetation (list species):			
Waterbird Habitat Value			

General Comments (wetland condition, tree health, understorey condition, weeds, grazing impact, fencing, etc.)

ATTACHMENT 2

FIELD DEFINITION OF A WETLAND

Field Definition of a Wetland

The Directory of Important Wetlands in Australia has adopted the Ramsar Convention definition of a wetland, and it is appropriate that this definition be adopted for this assessment process. The definition is:

Wetlands are areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt and including areas of marine water with depth of which at low tide does not exceed 6 meters.

The Directory of Important Wetlands has further classified wetlands to suit the Australian situation. The classifications are described in Table 1 (only inland wetlands have been listed here).

Table 1 Wetland Types

Inland Wetlands

1. Permanent rivers and streams
2. Seasonal and irregular rivers and streams
3. Inland deltas
4. Riverine floodplains
5. Permanent freshwater lakes
6. Seasonal/intermittent saline lakes
7. Permanent saline lakes
8. Seasonal/intermittent saline lakes
9. Permanent freshwater ponds
10. Seasonal/intermittent freshwater ponds
11. Permanent saline/brackish marshes
12. Seasonal saline marshes
13. Shrub swamps
14. Freshwater swamp forest
15. Peatlands
16. Alpine and tundra wetlands
17. freshwater springs
18. Geothermal wetlands
19. Inland, subterranean karst wetlands

Human made wetlands

1. Water storage areas
2. Ponds, including farm ponds
3. Aquaculture ponds
4. Salt pans
5. Excavations – gravel pits etc
6. Wastewater treatment plants
7. Irrigated land and irrigation channels
8. Seasonally flooded arable land
9. Canals

Field determination of a wetland can be made by application of several criteria. They are all clearly definable in the field and require little specialist knowledge.

If two of any of these criteria are satisfied, then the area being examined is a wetland. Irrigation bays, and irrigated crops however, are excluded from being wetlands.

CRITERIA

1. **Flooding/Hydrology** - Does the area in question receive enough water to saturate the soil profile? Wetlands include sites which are saturated and inundated with water for some of the year.
2. **Soils** - Does the area in question have common wetland soil type underlying it? "Wetland soils in Victoria often have a high clay content which slows seepage from the wetland into the groundwater system and water pools on the surface of the depression" (Dept. of Conservation and Environment, 1992).

3. **Vegetation** - Is part of the site covered with stands of any of the following types of plants:-

River Red Gum	<i>Eucalyptus camaldulensis</i>
Black Box	<i>Eucalyptus largiflorens</i>
Grey Box	<i>Eucalyptus microcarpa</i>
Lignum	<i>Muehlenbeckia cunninghamii</i>
Rushes	<i>Juncus sp.</i>
Sedges	<i>Eleocharis sp.</i>
	<i>Cyperus sp.</i>
	<i>Baumea sp.</i>
	<i>Schoenus sp.</i>
	<i>Carex sp.</i>
Cumbungi	<i>Typha sp.</i>
Grasses	<i>Paspalum distichum</i>
	<i>Echinichloa crusgalli</i>
	<i>Amphibromus neesii</i>
	<i>Amphibromus nervosus</i>
	<i>Eragrostis infecunda</i>
	<i>Eragrostis australasica</i>
	<i>Agrostis avenacea</i>
	<i>Glyceria declinata</i>
	<i>Glyceria australis</i>
	<i>Glyceria maxima</i>
	<i>Panicum obseptium</i>
	<i>Panicum decompositum</i>
	<i>Isachne globosa</i>
Common Reed	<i>Phragmites australis</i>
	<i>Psuedoraphis spinescens</i>
	<i>Polygonum sp.</i>

4. **Topography** - Is the area in question low-lying or does it form part of a depression in the landscape?

ATTACHMENT 2 (Part 2)

Field Definition of a Wetland

Flooding Patterns and Resultant Wetlands, 'Shepparton Irrigation Region'

Introduction

Wetland hydrology may be described as the flow of water resulting from precipitation, groundwater and surface water run-off into, through and out of a wetland as well as the characteristics of this flow and its interaction with the wetland.

In the short term, hydrology determines vegetation, fauna and most wetland functions. In the longer term hydrology determines through erosion and deposition, the shape, size, depth and even the location of a wetland. This in turn has bearing on the type of vegetation, fauna and wetland functions.

Definition of Wetlands

It is difficult to define precisely what is a "wetland". In the Shepparton Irrigation Region (SIR) wetlands can vary from permanently dry with free-draining outfall, to permanently flooded. This makes it very difficult to clearly distinguish between dryland and wetland.

From a practical point of view, a wetland may be defined by a combination of factors such as its topography, hydrology, soils and vegetation. If a section of ground is flooded or saturated at regular intervals and of sufficient duration it will develop characteristic wetland soils and vegetation.

- a Topography: Wetlands occupy closed depressions (basins) or open depressions (drainage lines).
- b Hydrology: Wetlands are areas subject to prolonged saturation or flooding, either regularly or intermittently. Some arbitrary cut-off point of average annual flooding duration (eg 20-30 days) may be chosen.
- c Soils: Wetlands are typically underlain by hydromorphic soils - in the irrigation areas only (eg. heavy clay soils). Some floodplain areas are underlain by sandy or silty soils. Soil maps can provide a highly useful indication of the location and extent of natural wetland areas, including those which may have been drained and effectively are no longer functioning as wetlands.
- d Vegetation: Wetland vegetation types are distinctly different to dryland vegetation; vegetation is a reflection of current hydrological and soil conditions. In the SIR, sedges (*Carex spp.*, *Cyperus spp.*) and hydromorphic grasses (eg *Poa labillardieri*, *Agrostis avenocea*, *Eragrostis infecundis*, *Paspalum distichum*) are indicators of upper wetland limits.

Types of Wetlands

The type of vegetation and the wildlife species that may be supported within a given wetland is a result of the interaction of many complex factors, the most important being the water supply. The primary aspects of wetland water supply are—

- * Flooding frequency
- * Flooding season
- * Flooding duration
- * Flooding depth
- * Drying frequency
- * Water quality (particularly turbidity, salinity, nutrient and pH levels)
- * Groundwater depth and salinity.

Six wetland types based on watering regime have been identified in the Drainage Design Guidelines. The Type 1 wetland watering regime as referred to in this Assessment is described below.

TYPE 1 - INTERMITTENT WETLAND

General Character:

Seasonal saturation, intermittent, short duration and shallow flooding.

Supports Grey Box, Yellow Box and Black Box open forest - woodland with grass/herb understorey.

Overstorey Vegetation:

Grey Box (*E. microcarpa*) on seasonally saturated clay soils.

Yellow Box (*E. melliodora*) on seasonally flooded, free draining silty-sandy soils.

Black Box (*E. longiflorens*) on higher floodplain areas in the north-western section of the Region with clay-loamy soils.

Generally cleared or semi-cleared, often drained, generally declining due to excessive flooding/saturation and high water tables.

Understorey Vegetation:

drier

- ↓ Pasture species or crops (if inundated < 10 days)
- ↓ Native grasses, rushes and forbs:-
- ↓ *Danthonia spp./Stipa spp./Agrostic sp. etc.*
- ↓ *Juncus spp./Marsilea spp. etc.*
- ↓ *Muehlenbeckia cunninghamii* (Lignum)
- ↓ *Eragrostic infecunda* (Cane Grass)

wetter

Wildlife:

Dryland Species:-

Opportunistic water bird species whilst flooded - feeding, shelter.

Natural Occurrence:

Dryland areas.

Shallow overland floodways.

Free draining prior stream depressions.

Shallow pot holes with local catchments.

Approximate water requirements:

Flooding frequency	-	Seasonal saturation, flooding < 1 in 2 years
Flooding period	-	Winter - early spring
Flooding duration	-	< 1 month (30 days)
Flooding depth	-	<0.1 m (deeper if free draining)
Drying frequency	-	Annual
Dry period	-	Late spring-summer-autumn
Other	-	Watertable > 2 m deep

Utilisation:

Moderate grazing value

Low grazing value with rushes, lignum and cane grass.

Timber.

TYPE 2 - SHORT DURATION SEASONAL WETLAND

General Character:

Regular, short to medium duration and shallow flooding.
Free drainage floodplain with little ponding.
Supports River Red Gum.

Overstorey Vegetation:

River Red Gum (*E. camaldulensis*) open to closed forest
Often cleared or semi cleared, often resulting from drainage of ponding wetlands.

Understorey Vegetation:

drier
↓ Native grasses and herbs:-
↓ *Danthonia spp./Stipa spp./Agrostic sp. etc.*
↓ *Poa labillardieri (Tussock Grass)*
wetter *Juncus spp./Carex spp. (Rushes and Sedges).*

Wildlife:

Dryland Species.
Opportunistic water bird species whilst flooded - feeding, shelter.
Occasional breeding by ducks.

Natural Occurrence:

Free draining floodplains of rivers and streams.
Shallow pot holes and prior stream depressions.
Riparian fringes.

Approximate water requirements:

Flooding frequency	-	Annual (most years)
Flooding period	-	Winter - spring
Flooding duration	-	1-4 months (30 - 120 days)
Flooding depth	-	<0.3 m (deeper if free draining)
Drying frequency	-	Annual
Dry period	-	Summer-autumn
Other	-	Watertable > 2 m deep

Utilisation:

Moderate grazing value
Low grazing value with rushes, lignum and cane grass.
Timber.

TYPE 3 - MEDIUM DURATION SEASONAL WETLAND

General Character:

Regular winter-spring flooding.
Shallow ponding.
Supports River Red Gum

Overstorey Vegetation:

River Red Gum open to closed forest.

Understorey Vegetation:

drier *Eleocharis acuta (Spike Rush) / Myriophyllum spp.*
 ↓ *(Milfoil)/Triglochin procera (Water Ribbons).*
 ↓ *Eragrostis infecunda/Amphibromus neesii/Paspalidium jubiflorum/*
 ↓ *Cynodon dactylon/ Paspalum distichum*
 ↓ *Potamogeton tricarinatus (Floating Pondweed)*
 ↓ *Pseudoraphis spinescens (Moirra Grass).*
wetter

Wildlife:

Dryland Species
Opportunistic water bird species whilst flooded - feeding, shelter.
Breeding by ducks, ibis, herons etc.

Natural Occurrence:

Shallow depressions on floodplains.
Pot holes.
Fringes of open wetlands.

Approximate WATER requirements:

Flooding frequency	-	Annual (most years)
Flooding period	-	Winter - spring
Flooding duration	-	4 - 6 months (120-180 days)
Flooding depth	-	0.4 - 1m.
Drying frequency	-	Annual (most years)
Dry period	-	Summer-autumn
Other	-	Watertable > 2 m deep

Utilisation:

Moderate grazing value
Low grazing value with rushes, lignum and cane grass.
Timber.

TYPE 4 - PROLONGED DURATION SEASONAL OPEN WETLAND

General Character:

Regular prolonged flooding.

Deeper ponding, supports herbaceous aquatic vegetation (beyond limits for River Red Gum)

Aquatic Vegetation:

<u>drier</u>	<i>Eragrostis infecunda</i> (Cane Grass) - tolerates prolonged flooding if irregular
↓	<i>Paspalum distichum</i> (Water Couch) - can dominate in disturbed situations.
↓	<i>Eleocharis acuta</i> (Common Spike Rush) / <i>Myriophyllum</i> sp. (Milfoil)/
↓	<i>Triglochin procera</i> (Water Ribbons).
↓	<i>Potamogeton tricarinatus</i> (Floating Pondweed).
↓	<i>Pseudoraphis spinescens</i> (Moirra Grass)
<u>wetter</u>	<i>Juncus ingens</i> (Giant Rush)

Wildlife:

Most waterbird species - feeding, shelter, breeding

Breeding habitat for Brolga, ibis, ducks, swans, etc.

Natural Occurrence:

Moderately deep depressions on floodplains.

Deeper pot holes.

Stream floodouts.

Fringes of semi-permanent open wetlands.

Approximate water requirements:

Flooding frequency	-	Annual (most years).
Flooding period	-	Winter, spring, summer.
Flooding duration	-	6 - 10 months (180-300 days)
Flooding depth	-	0.6 - 1.5 m.
Drying frequency	-	3-5 years in 5
Dry period	-	Summer autumn

Utilisation:

Moderate summer-autumn grazing value

TYPE 5 - SEMI PERMANENT OPEN WETLAND

General Character:

Semi-permanent flooding or saturation with occasional drying.
Supports herbaceous aquatic vegetation (beyond limits for River Red Gum).

Aquatic Vegetation:-

Herbaceous (prolonged saturation/shallow flooding): *Paspalum distichum* (Water Couch) / *Alisma plantago aquatica* (Water Plantain) / *Polygonium* spp. (Knotweeds).

Emergent: *Eleocharis ophacelata* (Tall Spike Rush) / *Juncus ingens* (Giant Rush) / *Phragmites australis* (Common Reed) / *Typha domingensis* / *Typha orientalis* (Cumbungi)

Rooted Floating-leaf Aquatic Species: *Triglochin procera* (Water Ribbons) / *Ludwigia peploides* (Clovestrip) / *Ottelia ovalifolia* (Swamp Lilly) / *Nymphoides crenata* / (Wavy Marshwort).

Submerged Aquatic Species: *Myriophyllum* spp. / *Potamogeton* spp.

Free Floating Aquatic Species: *Azolla* spp. / *Lemna* spp.

Wildlife:

Many waterbird species (ducks, coots, moorhens, swamphens, crakes, rails, bitterns etc.) particularly if associated open water areas present - feeding, shelter, breeding.

Natural Occurrence:

Deeper depressions on riverine floodplains.

Shallow paleosalinas.

Frings of permanent open water.

Most occurrences in the region (other than on the riverine floodplains are artificial due to summer-autumn irrigation runoff.

Approximate WATER requirements:

Flooding frequency	-	Annual
Flooding period	-	Winter-spring-summer
Flooding duration	-	Semi-permanent (>300 days)
Flooding depth	-	< 1.5 m
Drying frequency	-	1-2 years in 5
Dry period	-	Occasional summer-autumn
Other	-	Freshwater (< 1500 EC max. Summer-autumn draw down by evaporation.

Utilisation:

Water Storage

TYPE 6 - PERMANENT OPEN WATER WETLAND

General Character:

Permanent flooding with rare drying.

Supports aquatic vegetation

Aquatic Vegetation:

Rooted Floating-leaf Aquatic Species: *Triglochin procera* (Water Ribbons) / *Ludwigia peploides* (Clovestrip) / *Ottelia ovalifolia* (Swamp Lilly).

Submerged Aquatic Species: *Potamogeton* spp. / *Vallisneria spiralis*.

Free Floating Aquatic Species: *Azolla* spp. / *Lemna* spp. / *Wolffia* spp.

Potential for algal blooms in conditions of high nutrients and high turbidity levels, where other aquatic plant growth is limited.

Wildlife:

Open water zone of low productivity and relatively low habitat value.

Many waterbird species (ducks, grebes, coots, swans, cormorants, pelicans etc.) if seasonally flooded vegetated fringe present.

Natural Occurrence:

Deep riverine floodplain billabongs and backwaters.

River and stream channels.

Deeper palaeosalines.

Approximate WATER requirements:

Flooding frequency	-	Annual
Flooding period	-	Winter-spring-summer-(autumn)
Flooding duration	-	Almost permanent
Flooding depth	-	< 1.5 m
Drying frequency	-	< 1 year in 5
Dry period	-	Rarely summer-autumn
Other	-	Freshwater (< 1500 EC max.) Summer-autumn drawdown by evaporation

Utilisation:

Water Storage.

ATTACHMENT 3

PROCEDURE FOR FILLING OUT DATA SHEETS

PROCEDURE FOR FILLING OUT DATA SHEET A (ENVIRONMENTAL ASSESSMENT SITE DESCRIPTION)

- Project No.** - Each "project" has a particular number or code which it can be identified by.
- Site No.** - Each site is given a number on the sampling day or site numbers can be fixed for sites where repeat visits occur.
- Map Name** - The name of the 1:100,000 or 1:25,000 map sheet used in mapping the catchment.
- Map No.** - Number of 1:100000 or 1:25000 map sheet used to provide grid reference.
- Grid Ref** - Australian Map Grid reference given for centre of wetland or site.
- Location** - The locality of the drain proposed scheme.
- Recorders Name** - Use Environmental assessors full name.
- Time Taken** - Note time of day using 24hr system (e.g. 1630).
- Weather** - Estimate % cloud cover, wind direction & strength, and rain intensity.
- Aerial Photo No.'s** - The year, run no. and number of the applicable aerial photo's.
- No. Of Photo's Taken at Site** - No. of photos taken at sight and no. on film.
- Parish Map** - The name(s) of the applicable parish map(s) and affected Crown Allotment numbers if appropriate.
- Land Use** - Record the current land use of the site.
- Adjacent Land Use** - Record the land use in adjacent areas.
- Land Status** - Is the land private, wildlife reserve, state forest, etc?
- Altitude** - Record the altitude of the site.
- Aspect** - The direction the site is facing, e.g. north

Physical Description

- Geomorphology** - Select from list:-
- Types
- Floodplains
 - Recent Streams
 - Prior Stream Depressions
 - Paleosalinas
 - Potholes
 - Artificial Impoundments

(Robinson, 1989)

- Subtypes
- Open Systems - Main Channel
 - Anabranches
 - Backwaters
 - Closed Systems - Billabongs
 - Swamps

(Sheldon & Lloyd, 1990)

Relationship to other wetlands/rivers - Is it part of a complex ?, Distance to nearest river/ wetland?.

Ponding Size/Floodplain Size - What is the ponding area (i.e. limit of redgum)? If part of a floodplain what is size of floodplain?

Water Regime-Permanent = water present all year in most years, inundated for more than 10 years in a row;

Semi-permanent = water present in most years but periodically dry out say every 5 years;

Prolonged Seasonal = Dries most years, for a few months

Short Seasonal = Dries most years, for over six months

Intermittent = Irregularly flooded for short periods

Temporary = water dries out each regularly each year.

(Rick Felton, NRE Shepparton, pers.comm.)

Stage of Flooding - Estimate stage of flooding - use background information (rainfall, gauged flow records) to verify field assumptions. Nominate one suggestion from list.

Water Depth - Record water depth at time of visit.

Max Water Depth - Record maximum possible water depth at maximum ponding area (Limit of redgums).

Flow Depth - Estimate depth of inflow and outflow.

Impacts - Mark or note impacts affecting the site.

Biological Description

Vegetation Structure/Zonation - Describe the vegetation structure of the site

Wetland Type - Select from Corrick's classification of wetland categories and subcategories given below:-
(In most areas these will already be mapped and classified.)

Category/Subcategory	Depth (m)	Duration of Inundation
1. Flooded river flat	<2	
2. Freshwater meadow	< 0.3	<4 mo/yr
.1 Herb-dominated		
.2 Sedge-dominated		
.3 Red gum-dominated		
.4 Lignum-dominated		
.5 Black box-dominated		
.6 Cane grass-dominated		

3. Shallow freshwater marsh	< 0.5	<6 mo/yr
.1 Herb-dominated		
.2 Sedge-dominated		
.3 Cane grass-dominated		
.4 Lignum-dominated		
.5 Red gum-dominated		
.6 Black box-dominated		
.7 Dead timber		
.8 Rush-dominated		
.9 Reed-dominated		
4. Deep freshwater marsh	< 2	permanent
.1 Shrub-dominated		
.2 Reed-dominated		
.3 Sedge-dominated		
.4 Rush-dominated		
.5 Open water		
.6 Cane grass-dominated		
.7 Lignum-dominated		
.8 Red gum-dominated		
.9 Dead timber		
.10 Black box-dominated		
5. Permanent open freshwater		
.1 Shallow		
.2 Deep		
.3 Impoundment		
.4 Red gum-dominated		
.5 Cane grass-dominated		
.6 Dead timber		
.7 Black box-dominated		
.8 Rush-dominated		
.9 Reed-dominated		
.10 Sedge-dominated		
.11 Shrub-dominated		
.12 Lignum-dominated		
6. Semipermanent saline	< 2	< 4-12 mo/yr
.1 Salt pan		
.2 Salt meadow		
.3 Salt flats		
.4 Sea rush-dominated		
.5 Hypersaline lakes		
.6 Melaleuca-dominated		
.7 Dead timber		
7. Permanent saline		permanent
.1 Shallow	< 5	
.2 Deep	> 5	
.3 Intertidal flats		
20. Sewage oxidation basin		
21. Salt evaporation basin		

Marginal Habitats - These are essentially dryland vegetation communities that fringe wetlands. Their presence enhances the habitat values and provide a buffer zone of that wetland site. Describe the surrounding habitat that may be present (e.g., a dense fringe of *E. microcarpa*; or, scattered, dead and dying dryland eucalypts with an exotic grass understorey).

Microhabitats - Select from list:

Wetland

1. submerged woody debris ("snags")
2. reeds (*Phragmites australis* & *Typha domingensis*)
3. sedges (*Cyperus* spp. and *Eleocharis acuta*)
4. inundated grasses
5. open water
6. submerged aquatic macrophytes (*Myriophyllum* spp.)
7. floating aquatic macrophytes (e.g. *Azolla* spp. and *Potamogeton*)
8. submerged lignum (*Muehlenbeckia cunninghamii*)

(Boulton & Lloyd, 1991)

Non-wetland

1. Bare ground
2. Rocks/Boulders
3. Dead timber on ground
4. Leaf litter
5. Understorey species (shrubs)
6. Understorey species (grasses)
7. Healthy overstorey (trees or shrubs)
8. Hollows in overstorey
9. Native Grassland

Site Condition - *Intact* is a largely pristine site with few disturbances; *Natural* are sites where disturbances occur but the vegetation and wetland functioning is not greatly affected; *Degraded* sites are where much of the original cover has been lost and the wetland type has been altered.

Attachments - Note the flora and fauna species lists that have been attached and any others

PROCEDURE FOR FILLING OUT DATA SHEET B (ENVIRONMENTAL ASSESSMENT SITE APPRECIATION SHEETS.

Repeat Project No., Date, Site No., Map Name and No., Grid Ref and Location as for sheet A.

Produce at catchment/sub-catchment scale a series of highlighted maps/overlays depicting the location of Environmental features/threats. Overlay the proposed alignment and options for the scheme. Identify/specify wetland wetting regimes and other works relevant to the preferred option.

Map as per notes, adding detail that may be required or copy 1:25,000 or 1:100,000 map and provide overlays as specified in methodology.

PROCEDURE FOR FILLING OUT DATA SHEET C (ENVIRONMENTAL ASSESSMENT - VEGETATION COMMUNITY ASSESSMENT DATA)

Repeat Project No., Date, Site No., Map Name and No., Grid Ref and Location as for sheet A.

Recorders Name - Use recorder's full name.

Sectional or Block Site Transect? - Record whether sectional transects or block sites were used to derive data.

Site Size - Give size (generally defined by road boundaries/other catchment feature of blocks used).

Transect Length/No. Blocks - Give length of sectional transect or number of blocks used.

Land Use - Record the current land use of the site.

Land Status - Is the land private, wildlife reserve, state forest, etc?

Impacts/Disturbance - List any impacts/disturbance at the site.

Vegetation Types - What is the major vegetation community (BVT or EVC) for the site? Select one from the list provided.

Veg Type - Record the appropriate number from the table above.

Common Name - Record the common name of the species.

Species Name - Record scientific names of vegetation within the quadrat sites where possible or take specimens for later identification.

Abundance - Estimate Relative Cover Abundance of that species of that species in quadrat

- P - present
- O - occasional
- C - common
- A - rare

Site No. - Record the site number where the species was collected or identified.

Salt Class No. - Record the salt class number of the species from the publication "Spotting Soil Salting", if applicable.

Comments - Make any further comments that may seem applicable. For example, information could be recorded on:-

- Height - What is the maximum height of the vegetation.
- Structure - Is the vegetation clumped, sparsely distributed, etc?
- Zonation - Where is the plant located - at high water mark, etc.?
- Flowering or seeds - What stage of flowering is the plant at?
(Select from this list: buds, flower, fruit, seed, senescent).
- Regeneration - Are there signs of recent regeneration, if so how high?
- Dieback - Is there any dieback, dead-topping or other problems?

Health - What is the health of the species named?

- 1 - Healthy, <25% bare sticks
- 2 - Living, 26-50% bare sticks
- 3 - Unhealthy, 51-75% bare sticks

4 - Dying, >76% bare sticks

Totals - Record the total number of species, exotics and natives. Keep a running total for the page if there is more than one page of records.

PROCEDURE FOR FILLING OUT DATA SHEET D (ENVIRONMENTAL ASSESSMENT SITE DESCRIPTION)

Repeat Project No., Date, Site No., Map Name and No., Grid Ref and Location as for sheet A.

Map each assessment site as per notes, adding detail that may be required or copy 1:25,000 or 1:100,000 map and provide overlays as specified in methodology.

Mark photo points and direction on map.

Locate sampling points.

Estimates of Soil Type - Estimate the % of clay, silt, sand and gravel in the soil in the quadrat or along the transect.

% Cover - Estimate the % cover of the quadrat in terms of vegetation, bare ground, water and rocks. Estimate the % of logs/snags and litter exposed and inundated.

Water Quality Reading - Provide where practicable water quality assessment data including EC readings from a number of locations and depths to allow for comparison and analysis.

PROCEDURE FOR FILLING OUT DATA SHEET E (ENVIRONMENTAL ASSESSMENT ENVIRONMENTAL EVALUATION QUALITATIVE ASSESSMENT SHEET).

Repeat Project No., Date, Site No., Map Name and No., Grid Ref and Location as for sheet A.

Evaluate the environmental significance of the site by recording those features or attributes which add or identify the significance of the site, in the appropriate space and according to the directions given in Chapter 5.

PROCEDURE FOR FILLING OUT DATA SHEET F (ENVIRONMENTAL ASSESSMENT EXTRA INFORMATION INCIDENTAL SIGHTING AND FIELD MANAGEMENT RECOMMENDATIONS SHEET).

Repeat Project No., Date, Site No., Map Name and No., Grid Ref and Location as for sheet A.

Extra Notes - Record any extra notes for the site that may be used or were observed during the field inspection.

Management Recommendations - Use this area to note any management recommendations that come to mind while in the field.

ATTACHMENT 4

DATA - SHEETS

IMPACTS

(X)

- Salinity
-
- Prolonged inundation
- Drainage
- Land forming
-
- Grazing (License/Illegal)
- Weeds
- Fire
- Roads
- Extraction
- Forestry
- Recreation
- Other:-

ATTACHMENTS:

- Comprehensive Flora List
- Comprehensive Fauna List
- Threatened Flora List
- Threatened Fauna List
- Other
-

<i>PROJECT NO.</i>	<i>DATE</i>	<i>SITE NO.</i>	<i>MAP NAME</i>	<i>MAP NO.</i>	<i>GRID REF</i>	<i>LOCATION</i>

MAP ASSESSMENT SITE: Key information is catchment boundaries, site/sectional divisions. Depict/overlay the Environmental Features and Threats, overlay the alignment options for the proposed scheme. Identify/specify wetland wetting regimes and other works for the preferred option.

<i>TOTAL</i>	<i>SPECIES</i>	<i>NATIVE</i>	<i>*EXOTIC</i>	<i>PAGE TOTAL</i>	<i>FULL TOTAL</i>	

PROJECT NO.	DATE	SITE NO.	MAP NAME	MAP NO.	GRID REF	LOCATION

SITE MAP: Key information is zone boundary, marginal habitat boundary, size and shape of site, position of quadrats (if any), vegetation types, habitats, fences, access, inflow/outflow points, regulators or other structures and any other relevant information. *Mark: Photo and Sampling Points*

ESTIMATES OF SOIL TYPE	ESTIMATES OF % COVER OF QUADRAT	WATER QUALITY READINGS
-------------------------------	--	-------------------------------

% Clay	_____	% Vegetation	_____	1.	_____
% Silt	_____	% Bare Ground	_____	2.	_____
% Sand	_____	% Water	_____	3.	_____
% Gravel	_____	% Rocks	_____	4.	_____
			<i>EXP</i> <i>INUN</i>	5.	_____
		% Logs/Snags	_____	6.	_____
		% Litter	_____	7.	_____

<i>PROJECT NO.</i>	<i>DATE</i>	<i>SITE NO</i>	<i>MAP NAME</i>	<i>MAP NO.</i>	<i>GRID REF</i>	<i>LOCATION</i>
1. NOTABLE SPECIES / ASSOCIABILITY WITH HERITAGE SITES						
2. RARITY OF ECOSYSTEM TYPE						
3. HABITAT DIVERSITY						
4. NATURALNESS						
5. VALUE FOR NATIVE VEGETATION						
6. VALUE FOR BIRD USE						
7. VALUE FOR FISH						
8. VALUE FOR MAMMALS / REPTILES / AMPHIBIANS						
9. SIZE						
10. HIGH VALUE WETLAND CRITERIA.						

<i>PROJECT NO.</i>	<i>DATE</i>	<i>SITE NO.</i>	<i>MAP NAME</i>	<i>MAP NO.</i>	<i>GRID REF</i>	<i>LOCATION</i>

EXTRA NOTES

e.g Incidental Observations

MANAGEMENT RECOMMENDATIONS

ATTACHMENT 5

ATLAS OF VICTORIAN WILDLIFE INCIDENTAL SIGHTINGS –INFORMATION & RECORDING SHEETS

ATLAS OF VICTORIAN WILDLIFE

DATA RECORDING INSTRUCTIONS

SEPTEMBER 1997

The Atlas of Victorian Wildlife is a computer data base of locality records of Victorian wildlife, threatened invertebrate and freshwater fish species. It is intended to function as a tool for land managers, wildlife planners and wildlife researchers by speedily providing baseline data about species distributions and status within defined areas of Victoria.

Records have been collated from a wide range of sources including: fauna surveys conducted by the Flora & Fauna Branch since 1972; Museum of Victoria specimen records; fauna surveys conducted by educational institutions and field naturalists clubs; natural history journals; and records submitted by interested people. The bird database comprises all Victorian records collated during the Atlas of Australian Birds project conducted by the Royal Australasian Ornithologists Union, plus records collected by staff of the Flora & Fauna Branch and other interested groups.

The number of records achieved is highest for birds - over 1 385 486 records from throughout the State. For mammals the coverage is good, with over 142 789 records from most parts of Victoria. The tally for reptiles and amphibians stands at over 90 819 including all specimens from the Museum of Victoria. Tallies of threatened invertebrates and freshwater fish stand at 1139 and 4627 respectively.

A major application of the data is to provide a statewide perspective when assessing applications to have a species listed under the Flora and Fauna Guarantee. For this reason statewide coverage with accurate point data is essential. Such data are also required for stochastic modelling, such as the definition of sites of zoological

significance or prediction of species distribution based on climatic, edaphic and vegetation profiles. The Atlas data also form the basis of wildlife information utilised by the Department's Geographic Information System.

Since faunal distributions are in a continual state of flux, and the abundance of all species fluctuates with environmental conditions and land-use changes, there will always be information which warrants inclusion. However, in future we may set priorities for areas or species for which we most urgently require new data.

The value of the Atlas will depend to a considerable extent on the quality of the data included as well as on the uniformity of coverage. For this reason the reliability of each record is assessed by Flora & Fauna Branch staff. Records are assigned to reliability classes based on current knowledge of the distribution and habitat of the species concerned. The three reliability classes are: Confirmed - substantiated by a specimen or identified by an experienced observer; Acceptable - unconfirmed but little or no reason for doubt; Requires Verification - further substantiation necessary. Where possible doubtful records will be verified and upgraded if appropriate.

We encourage all interested people, both from within and outside the Department of Conservation and Natural Resources, to use the data cards and sheets within this folder to submit their observations for inclusion in the databases.

We also welcome requests for data relating to a defined area or group of species. A charge to defray running

ENQUIRIES: ATLAS OF VICTORIAN WILDLIFE, PO BOX 137, HEIDELBERG 3084.

PHONE: 03 9450 8600 FAX: 03 9450 8737 E-MAIL: BJB@NRE.VIC.GOV.AU

costs may apply to requests to be used
for commercial purposes.

DATA RECORDING INSTRUCTIONS

Records are entered on the Field Data Card (up to 10 species entries) or the Field Data sheet (unlimited species entries). Each card sheet refers to a locality and time period. Mammals, birds, reptiles and amphibians can be entered on a single sheet simply by using the appropriate codes. The field sheet can be used to record general observations, i.e. species list OR intensive fauna surveys OR both.

A sample field data sheet is attached. Wildlife Branch will assign the reference number, project and observer codes.

Dates: Record the period of observation covered by the sheet (e.g. 02 06 1978). If recording on a single day use first date only. For trapping sessions use date first set and date removed. Preferably, the period of observation should fall cleanly into calendar months.

Locality: Describe the locality as precisely as possible using place names on NATMAP series. Preferably give a distance and direction from a named point.

Grid references: Specify the 1:100,000 sheet number (e.g. 8124). Under AMG enter the easting and northing of the locality to 100m or 1km accuracy. If accuracy is to the nearest 1 km enter dashes (not zeros) in the appropriate spaces e.g. 60-17- .

AMG Golden Rule: Eastings (numbers at top & bottom of map) then Northings (numbers at sides of map).

If the locality cannot be located to within 1 km then enter the latitude and longitude to preferably 1' or 5' accuracy. For lat/long blocks give the northern and western boundaries then the block size e.g. 1 for 1' or 5 for 5'.

Altitude: in metres above sea level, read from NATMAP.

Your reference: Space (up to 7 characters) is provided for reference numbers specific to a project, e.g. study site numbers.

Coverage: Give an indication of the survey effort for each group of animals. If you searched thoroughly using a variety of techniques, and feel you recorded most of the species in the group which were likely to be present, score an H (high). Less effort scores M (medium) and a quick visit rates L (low). Incidental observations as you pass through an area (or your only record of a snake was the one that crawled into your sleeping bag) are scored as I (incidental). Herps are reptiles and amphibians. If you made no effort to find a group then leave the relevant space blank.

If you conducted censuses, trapping or spotlighting and have entered the relevant survey method codes (T9001 etc), enter a C under the appropriate taxa covered by that method.

Species Entries

For general observations list in any order the mammals, birds, reptiles and amphibians that you observed. For fauna surveys enter the survey method code, and the species recorded by that method directly beneath the code. Multiple surveys can be entered on the same sheet, demarcated by the survey code.

Species and Code: Enter species name and code from the lists supplied. An abbreviated species name is acceptable.

Count: Enter the actual number of individuals counted, e.g. 3. If the count was an estimate follow it with an E, e.g. 8E. For rough counts use these codes: C1= 1 to 10; C2= 11 to 100; C3= 101 to 1000; C4= 1001 to 10,000; C5= > 10,000.

You may also enter a count qualifier immediately following the count. e.g. 10AM for ten adult males. Remember to enter the species separately for each qualified count. Other useful qualifiers are VA- vagrant, PR - pairs, NE - nests.

NB. Only use other count qualifiers for specific studies.

X: Extra coded information

- B Breeding confirmed (birds: nest with eggs or young; or dependent young out of nest)
- F Subfossil record
- W Beachwashed, stranded
- K Road killed, found dead
- R Released or introduced to a local site (doesn't include established feral populations)
- E Escapee, presumed to have escaped from captivity
- C Roost site. eg. bat cave
- X Believed no longer at this site
- Z Sample found in predator scat or pellet
- V Voucher specimen

T: Type of record

- M Specimen in a museum or other institution
- L Literature, specify reference in notes
- O Observation i.e. seen or heard
- S Seen
- H Heard
- X Observation, Seen or Heard with supporting evidence attached e.g. written description
- T Trapped and released (i.e. hand held)
- I Indirect evidence e.g. tracks or traces, including scats, burrows, diggings, give details in notes (NB. use Z under extra for samples from predator scats)
- A Identified from hair.
- P Pers. comm.

Notes: Use this section for comments on breeding, identification of difficult species and noteworthy observations.

Specimens: We encourage persons holding an appropriate wildlife permit (issued under Section 4 of the Wildlife Act 1975) to submit remains of dead animals, or voucher specimens of difficult species, as confirmation of the identification. Specimens should be frozen solid or soaked in 10% formalin, wrapped in several layers of plastic and delivered to the Arthur Rylah Institute. Specimens soaked in formalin may be sent through the post provided strong waterproof packaging is used.

SURVEY METHOD CODES

These codes are not expected to be used for normal distribution recording, only for detailed censuses. The atlas office can provide advice.

Enter the survey method as the first 'species' entry, with the method code against 'code' and the units of method against 'count'. Then enter the species and numbers trapped/counted. Species entries following the survey method are taken as having been gathered by that method until a new survey method is encountered. More than one method can be entered on the one sheet. To record general (incidental) observations at a survey site enter T9000 then the incidental species. Sheets with no survey method code are assumed to be general observations.

If you use any of these codes put a C in coverage for the appropriate taxa, i.e. Birds C, Mammals C or Herps C.

Remember to use the appropriate units, e.g. calculated trap-nights rather than just the number of traps. If traps were checked for a daylight sample period follow the effort with a D. If traps were located in trees enter T under T in the survey method entry.

SURVEY METHOD CODE

Code	Count	Unit	
T9000			General observation
T9001		trap-nights	Elliott trap
T9002		trap-nights	Cage trap
T9014		trap-nights	Cage & Elliott traps
T9003		trap-nights	Large cage trap
T9004		trap-nights	Funnel trap
T9017			Treadle trap
T9005		trap-nights	Bat trap
T9006		net-hours	Mist net
T9007		hours	Bat tripline
T9008		pit-nights	Pitfall + drift fence
T9009		pit-nights	Pitfall
T9013		number	Hair tubes
T9020		number	Large hair tubes
T9021		number	Small hair tubes
T9016			Scat/Pellet analyses
			code
T9019		number of stags	Stagwatching
T9011	##		Bird census
T9015	##		Bird transect
T9022			Spot point count
T9012	##	no. observers in X	Herp census
T9010		spotlight-hours	Spotlighting
T9018		no. lights in X	Spotlighting on foot **
T9023			Owl census
T9024		pieces of tin	Tin census
T9025			Spenceri Census
T9026		trap-nights	Trap
T9027		##	Spotlighting by area
T9028	%%		Scat census
T9029	##		Frog Census
T9030			Bird Count
T9031	**	no. lights in X	Frog Transect
T9040		minutes (decimal)	500m2 passive herp transect
T9041		minutes (decimal)	250m2 active herp search

effort is entered as minutes (3 spaces) & tenths of ha (2 spaces), thus 02015 for 20 minutes, 1.5 ha.

** effort is entered as minutes (3 spaces) & tenths of km walked (2 spaces), thus 06015 for 60 minutes, 1.5 km.

%% Tenths of km walked in count; then predator, number of scats in count (I); then prey species, frequency in count (ZA)

ENVIRONMENTAL CODES

For specific studies these codes may be entered immediately after the survey method code and before the first species:

T9100			Temperature, Celsius or min/max, thus 5/10
T9101			Cloud cover Clear (0) - complete (8)
T9102			Wind velocity
			0 = calm
			1 = light leaves rustle
			2 = moderate moves branches,
			3 = strong impedes progress
T9103			Precipitation
			0 = nil
			1 = drizzle or light rain
			2 = heavy rain
			3 = rain

current/past 24 hours, thus 0/3

T9104			Moon
			0 = no moon
			1 = 1/4 moon
			2 = 1/2 moon
			3 = 3/4 moon
			4 = full moon
			5 = moon present
T9105			Sunlight e.g. T3C3 see below
			T % time sun on the site
			0 = none
			1 = 30%
			2 = 30-70%
			3 = 70-100%
			C % cover value of sunlight
			0 = cloud
			1 = <10
			2 = 10-30
			3 = 30-70
			4 = 70-100
T9106			Night light
			1 = very dark no moon+cloud,
			2 = dark 1/4 moon, or moon + heavy cloud
			3 = detail seen moon+clear sky
			4 = bright 1/2 moon+no cloud
T9107			Wind direction N,S,E,W etc.
T9108			Weather
			1 = Fine
			2 = Cloudy
			3 = Fog/mist
			4 = Rain
			5 = Snow
T9109			Time, use 24 hour clock

COUNT QUALIFIERS

These codes MAY be entered in the count as a qualifier to the actual count, e.g. 10AM means ten adult males. The qualifier must follow the actual count. A species may be entered several times to indicate counts of different age and sex classes.

AGE & SEX

A	Adult
J	Juvenile
M	Male
F	Female
AM	Adult Male etc.
FP	Tapdpole
S	Sub-adult
LV	Larvae

REPRODUCTIVE CONDITION

U	Teats undeveloped, never bred
D	Teats developed
R	Teats regressed
PG	Pregnant
P*	Pregnant with number of embryos
LA	Lactating
L*	Number of lactating teats
N*	Total teat number
QP	Pouch young present
Q*	Number of pouch young
YD	Dependent young
Y*	Number of dependent young
PF	Vagina perforate
IP	Vagina imperforate
TA	Testes abdominal
TD	Testes descended
	(* = a number)

SUNDRY

PR	Pairs
NE	Nests
VA	Vagrant to area

Z recorded off study site but nearby
 X recorded off study site but very distant
 E Estimated number
 EZ number estimated offsite
 # Recapture
 FS Spot point far (30-50)
 NS Spot point near (0-29)

MICROHABITAT

AC Flying (above canopy)
 FL Flying (within canopy)
 UC Upper canopy
 MC Mid canopy
 LC Lower canopy
 TK On trunk
 IT In tree
 DT In dead tree (stag)
 IH In tree hollow
 HS High shrub
 LS Low shrub
 UG Undergrowth
 IG In grass
 IR In reeds
 GR On ground
 OL On log
 UL Under log
 OR On rock
 UR Under rock
 CL Crevice in log
 CR Crevice in rock
 UB Under bark
 UT Under iron
 IS In soil
 IB In burrow
 RD On road
 BR In/on bridge
 UL Under log
 FC In/on fence/post/stump
 IW In water
 EW Edge of water
 OW Over water
 DA Farm/fire dam/waterhole
 WH Waterhole
 IL In litter
 AW Away from water

PRIORITY SPECIES

We are especially interested in receiving *ALL reports of threatened species and ALL records of reptiles, frogs and mammals*. While we have good broad distribution data for birds we are keen to receive *comprehensive censuses and lists of birds specified to 100 m or 1 km* using AMG grid references. We want ALL records of these threatened species:

Cape Gannet, Malleefowl, King Quail, Red-chested Button-quail, Plains-wanderer, Lewin's Rail, Baillon's Crane, Little Tern, Fairy Tern, Hooded Plover, Eastern Curlew, Painted Snipe, Bush Thick-knee, Australian Bustard, Brolga, Black Bittern, Australasian Bittern, Little Bittern, Cape Barren Goose, Magpie Goose, Freckled Duck, Blue-billed Duck, Grey Goshawk, White-bellied Sea-Eagle, Square-tailed Kite, Grey Falcon, Black Falcon, Letter-winged Kite, Barking Owl, Powerful Owl, Masked Owl, Sooty Owl, Red-tailed Black-Cockatoo, Glossy Black-Cockatoo, Pink Cockatoo, Superb Parrot, Regent Parrot, Turquoise Parrot, Scarlet-chested Parrot, Orange-bellied Parrot, Swift Parrot, Ground Parrot, Red-lored Whistler, Western Whipbird, Ground Cuckoo-shrike, Grey-crowned Babbler, Slender-billed Thornbill, Redthroat, Striated Grasswren, Eastern Bristlebird, Rufous Bristlebird, Rufous-crowned Emu-wren, White-browed Treecreeper, Painted Honeyeater, Regent Honeyeater,

Helmeted Honeyeater, Grey-fronted Honeyeater, Apostlebird, Spotted Bowerbird, Black-eared Miner

Eastern Quoll, Spot-tailed Quoll, Brush-tailed Phascogale, Swamp Antechinus, Paucident Planigale, Common Dunnart, Eastern Barred Bandicoot, Squirrel Glider, Leadbeater's Possum, Mountain Pygmy-possum, Long-footed Potoroo, Brush-tailed Rock-wallaby, Eastern Wallaroo, Greater Long-eared Bat, Large-footed Myotis, Yellow-bellied Sheathtail Bat, Eastern Broad-nosed Bat, Broad-toothed Rat, New Holland Mouse, Smoky Mouse, Heath Mouse, Mitchell's Hopping-mouse, Dingo, Southern Right Whale, Blue Whale, Humpback Whale

Broad-shelled Tortoise *Chelodina expansa*, Leathery Turtle *Dermochelys coriacea*

Tessellated Gecko *Diplodactylus tessellatus*, Bynoe's Gecko *Heteronotia binoei*, Beaked Gecko *Rhynchoedura ornata*, Pink-tailed Worm-Lizard *Aprasia parapulchella*, *Aprasia aurita*, Striped Worm-Lizard *Aprasia striolata*, Striped Legless Lizard *Delma impar*, Hooded Scaly-foot *Pygopus nigriceps*, Mountain Dragon *Tympanocryptis diemensis*, Lined Earless Dragon *Tympanocryptis lineata*, Southern Lined Earless Dragon *Tympanocryptis pinguicolla* Tree Goanna *Varanus varius*, Rosenberg's Goanna *Varanus rosenbergi*, Alpine Bog Skink *Pseudemoia cryodroma*, Glossy Grass skink *Pseudemoia rawlinsoni*, Swamp Skink *Egernia coventryi*, Desert Skink *Egernia inornata*, *Egernia multiscutata*, Narrow-banded Sand Swimmer *Eremiascincus fasciolatus*, Millewa Skink *Hemiergis millewae*, Four-toed Skink *Hemiergis peronii*, Mueller's Skink *Lerista muelleri*, Samphire Skink *Morethia adelaidensis*, Eastern Water Skink *Eulamprus quoyii*, Corangamite Water Skink *Eulamprus tympanum* ssp. (Corangamite), Alpine Water Skink *Eulamprus kosciuskoi*, Western Blue-tongued Lizard *Tilgna occipitalis*, Alpine She-oak Skink *Cyclodomorphus praealtus*, Eastern She-oak Skink *Cyclodomorphus michaeli*.

Woodland Blind Snake *Ramphotyphlops proximus*, Common Death Adder *Acanthophis antarcticus*, Yellow-faced Whip Snake *Demansia psammophis*, Bardick *Echiopsis curta*, Red-naped Snake *Furina diadema*, Small-scaled Snake *Oxyuranus microlepidota*, Western Brown Snake *Pseudonaja nuchalis*, Curl Snake *Suta suta*, Port Lincoln Snake *Suta spectabilis*, Bandy Bandy *Vermicella annulata*, Diamond Python *Morelia spilota spilota*, Carpet Python *Morelia spilota variegata*

Giant Burrowing Frog *Heleioporus australiacus*, Giant Bullfrog *Limnodynastes interioris*, Southern Barred Frog *Mixophyes balbus*, Baw Baw Frog *Philoria frosti*, Blue Mountains Tree Frog *Litoria citropa*, Spotted Tree Frog *Litoria spenceri*, Large Brown Tree Frog *Litoria littlejohni*, Barking Marsh Frog *Limnodynastes fletcheri*, Smooth Toadlet *Uperoleia laevigaya*, Martin's Toadlet *Uperoleia martini*, Tyler's Toadlet *Uperoleia tyleri*

We want ALL BREEDING records of these restricted colonial species (and roosting sites for the bats):

White-faced Storm-Petrel, Fairy Prion, Common Diving-Petrel, Black-faced Shag, Pied Cormorant, Darter, Australasian Gannet, Australian Pelican, Whiskered Tern, Gull-billed Tern, Caspian Tern, Crested Tern, Pacific Gull, Kelp Gull, Glossy Ibis, Royal Spoonbill, Little Egret, Intermediate Egret, Great Egret, Rufous Night Heron, Grey-headed Flying-fox, Eastern Horseshoe Bat, Common Bent-wing Bat, Australian Fur-Seal

We also want all records of threatened invertebrates and threatened freshwater fish.

MAMMALS

Monotremes

W1003 Short-beaked Echidna
S1001 Platypus

Dasyurids

Z1027 Yellow-footed Antechinus
M1034 Swamp Antechinus
Q1028 Brown Antechinus
K1033 Dusky Antechinus
T1817 unidentified antechinus
Y1008 Spot-tailed Quoll
K1009 Eastern Quoll
T1824 unidentified quoll
W1055 Mallee Ningai
K1017 Brush-tailed Phascogale
M1050 Paucident Planigale
A1072 Fat-tailed Dunnart
K1069 White-footed Dunnart
S1061 Common Dunnart
T1800 unidentified sminthopsis

Bandicoots

Y1092 Southern Brown Bandicoot
U1098 Eastern Barred Bandicoot
S1097 Long-nosed Bandicoot
T1801 unidentified bandicoot

Brushtail Possums

Z1115 Mountain Brushtail Possum
K1113 Common Brushtail Possum
T1802 unidentified brushtail possum

Pygmy-possums

G1147 Feathertail Glider
Y1156 Mountain Pygmy-possum
W1151 Western Pygmy-possum
A1152 Little Pygmy-possum
U1150 Eastern Pygmy-possum
T1803 unidentified pygmy-possum

Gliders and Ringtails

S1141 Leadbeater's Possum
S1133 Greater Glider
A1136 Yellow-bellied Glider
E1138 Sugar Glider
C1137 Squirrel Glider
T1804 unidentified glider
C1129 Common Ringtail Possum

Rat Kangaroos

W1179 Long-footed Potoroo
Z1175 Long-nosed Potoroo
T1806 unidentified potoroo

Kangaroos and Wallabies

Z1263 Western Grey Kangaroo
S1265 Eastern Grey Kangaroo
U1266 Eastern Wallaroo
K1261 Red-necked Wallaby
W1275 Red Kangaroo
T1805 unidentified kangaroo
W1215 Brush-tailed Rock-wallaby
E1242 Black Wallaby

Koala & Wombats

E1162 Koala
K1165 Common Wombat

Flying-foxes

Q1280 Grey-headed Flying-fox
S1281 Little Red Flying-fox
T1807 unidentified flying-fox

Horseshoe-bats

W1303 Eastern Horseshoe Bat

Sheath-tail-bats

C1321 Yellow-bellied Sheath-tail Bat

Mastiff-bats

T1839 Mormopterus sp. (eastern form)

T1808 Mormopterus sp. (big penis)
T1809 Mormopterus sp. (little penis)
T1815 unidentified freetail bat
Y1324 White-striped Freetail Bat

Vesper Bats

C1349 Gould's Wattled Bat
Z1351 Chocolate Wattled Bat
T1825 unidentified wattled bat
T1819 Inland Forest Bat
M1378 Southern Forest Bat
C1381 Large Forest Bat
Z1379 Little Forest Bat
T1810 unidentified forest bat
K1341 Common Bent-wing Bat
C1357 Large-footed Myotis
Z1335 Lesser Long-eared Bat
M1334 Gould's Long-eared Bat
Y1332 Greater Long-eared Bat
T1816 unidentified long-eared bat
A1372 Eastern False Pipistrelle
A1364 Inland Broad-nosed Bat
T1811 Eastern Broad-nosed Bat
T1812 unidentified broad-nosed bat

Rats and Mice

Z1415 Water Rat
E1438 Broad-toothed Rat
Y1412 House Mouse
Y1480 Mitchell's Hopping-mouse
K1457 Silky Mouse
M1458 Smoky Mouse
G1455 New Holland Mouse
Q1468 Heath Mouse
T1813 unidentified Pseudomys
Z1395 Bush Rat
U1398 Swamp Rat
S1409 Brown Rat
Q1408 Black Rat
T1818 unidentified Rattus
T1820 unidentified small rodent

Introduced Carnivores

T1835 Dingo
T1836 Dog (feral)
W1531 Dingo or Dog (feral)
A1532 Fox
Y1536 Cat (feral)
T1827 Ferret
U1514 Pig (feral)

Introduced Herbivores

Q1512 Horse (feral)
E1518 Cattle (feral)
S1521 Goat (feral)
U1522 Sheep (feral)
W1523 Fallow Deer
E1526 Red Deer
C1525 Hog Deer
G1527 Sambar
T1814 unidentified deer
Z1511 Brown Hare
M1510 Rabbit

Some Marine Mammals

E1542 Australian Fur Seal
S1549 Leopard Seal
M1546 Southern Elephant Seal
K1561 Southern Right Whale
W1567 Blue Whale
E1578 Sperm Whale
Y1616 Common Dolphin
Q1600 Killer Whale
A1612 Bottlenose Dolphin

BIRDS 1

- Albatross**, Black-browed A088
 Shy Z091
 Wandering U086
 Yellow-nosed C089
Apostlebird Z675
Avocet, Red-necked Q148
Babbler, Chestnut-crowned M446
 Grey-crowned G443
 White-browed K445
Bee-eater, Rainbow C329
Bellbird, Crested G419
Bittern, Australasian K197
 Little G195
Black-Cockatoo, Glossy C265
 Red-tailed A264
 Yellow-tailed G267
Blackbird, Common Z991
Blue Bonnet S297
Boobook, Southern M242
Bowerbird, Satin W679
Bristlebird, Eastern Z519
 Rufous C521
Brolga C177
Bronze-Cuckoo, Horsfield's U342
 Shining A344
Bronzewing, Brush W035
 Common U034
Budgerigar E310
Bushlark, Singing Y648
Bustard, Australian A176
Butcherbird, Grey M702
 Pied Y700
Button-quail, Little U018
 Painted M014
 Red-chested W019
Calamanthus see fieldwren
Chat, Crimson S449
 Orange E450
 White-fronted Q448
Chough, White-winged S693
Cicadabird K429
Cisticola, Golden-headed K525
Cockatiel E274
Cockatoo, Gang-gang Y268
 Major Mitchell's U270
 Pink U270
 Sulphur-crested K269
Coot, Eurasian Z059
Corella, Little W271
 Long-billed A272
Cormorant, Black-faced E098
 Great A096
 Little Black C097
 Little Pied Y100
 Pied G099
Crake, Australian K049
 Australian Spotted K049
 Baillon's U050
 Spotless W051
Crow, Little Z691
Cuckoo, Black-eared S341
 Brush G339
 Fan-tailed E338
 Pallid C337
Cuckoo-shrike, Black-faced A424
 Ground W423
 White-bellied C425
Curlew, Eastern S149
Currawong, Grey C697
 Pied U694
Darter K101
Diving-Petrel, Common S085
Dollarbird U318
Dotterel, Black-fronted Y144
 Inland K145
 Red-kneed A132
Dove, Diamond Z031
 Peaceful M030
 Rock K957
Duck, Australian Wood U202
 Blue-billed Y216
 Freckled E214
 Hardhead G215
 Maned U202
 Musk K217
 Pacific Black Y208
 Plumed Whistling C205
 Pink-eared C213
Eagle, Little K225
 Wedge-tailed Y224
Egret, Cattle S977
 Eastern Reef W191
 Great G187
 Intermediate E186
 Little C185
Emu C001
Emu-wren, Mallee Emu-wren Z527
 Southern M526
Fairy-wren, Splendid Y532
 Superb S529
 Variegated Q536
 White-winged Z535
Falcon, Black U238
 Brown W239
 Grey Q236
 Peregrine S237
 Australian Hobby Z235
Fantail, Grey C361
 Rufous E362
Fieldwren Rufous U502
 Striated T8997
Finch, Red-browed E662
 Zebra C653
Firetail, Beautiful U650
 Diamond U652
Flycatcher, Leaden K365
 Restless S369
 Satin M366
Friarbird, Little E646
 Noisy C645
Frogmouth, Tawny K313
Galah C273
Gannet, Australasian Q104
 Cape K825
Gerygone, Brown M454
 Western Z463
 White-throated K453
Giant-Petrel, Northern C937
 Southern C929
Godwit, Bar-tailed K153
 Black-tailed Y152
Goldfinch, European A996
Goose, Cape Barren M198
Goshawk, Brown C221
 Grey (White) A220
Grassbird, Little E522
Grasswren, Striated C513
Grebe, Australasian C061
 Great Crested A060
 Hoary-headed E062
Greenfinch, European C997
Greenshank, Common U158
Gull, Kelp K981
 Pacific E126
 Silver C125
Hardhead G215
Harrier, Spotted M218
 Swamp Z219
Heathwren, Chestnut-rumped M498
 Shy Z499
Heron, Nankeen Night A192
 Pacific K189
 Rufous Night A192
 Striated C193
 White-faced Y188
 White-necked K189
Hobby, Australian Z235
Honeyeater, Black S589
 Black-chinned A580
 Blue-faced S641
 Brown-headed G583
 Crescent M630
 Fuscous K613
 Grey-fronted Z623
 Lewin's K605
 New Holland Z631
 Painted U598
 Pied E602
 Purple-gaped Y620
 Regent G603
 Scarlet M586
 Singing Q608
 Spiny-cheeked Q640
 Striped K585
 Tawny-crowned K593
 White-eared S617
 White-fronted M594
 White-naped M578
 White-plumed S625
 Yellow-faced M614
 Yellow-plumed M622
 Yellow-tufted W619
Hylacola, Chestnut-rumped M498
 Shy Z499
Ibis, Australian White G179
 Glossy E178
 Sacred G179
 Straw-necked Q180
Jaeger, Arctic Y128
 Pomarine C945
Jacky Winter S377
Kestrel, Australian Y240
 Nankeen Y240
King-Parrot, Australian C281
Kingfisher, Azure W319
 Red-backed S325
 Sacred U326
Kite, Black S229
 Black-shouldered Y232
 Square-tailed E230
 Whistling Q228
Knot, Great S165
 Red Q164
Kookaburra, Laughing M322
Lapwing, Banded G135
 Masked C133
Lorikeet, Little Q260
 Musk E258

BIRDS 2

Purple-crowned G259	Mongolian Z139	Yellow-billed U182
Rainbow U254	Oriental E142	Starling , Common G999
Lyrebird , Superb U350	Red-capped G143	Stilt , Banded Z147
Magpie , Australian S705	Pratincole , Australian S173	Black-winged M146
Magpie-lark W415	Prion , Antarctic Q084	Stint , Long-toed K965
Mallard Y948	Fairy Z083	Red-necked M162
Malleefowl Z007	Lesser Broad-billed S941	Stone-curlew , Bush U174
Martin , Fairy A360	Salvin's S941	Storm-Petrel , Grey-backed Y064
Tree Z359	Slender-billed U942	White-faced K065
Miner , Bell S633	Quail , Brown E010	Wilson's G063
Black-eared Z967	King Y012	Swallow , Welcome K357
Noisy U634	Stubble S009	White-backed M358
Yellow-throated W635	Quail-thrush , Chestnut K437	Swamphen , Purple M058
Mistletoebird A564	Spotted Y436	Swan , Black W203
Monarch , Black-faced K373	Rail , Buff-banded E046	Swift , Fork-tailed W335
Moorhen , Dusky Y056	Lewin's C045	Tattler , Grey-tailed Z155
Myna , Common E998	Raven , Australian M930	Teal , Chestnut U210
Native-hen , Black-tailed G055	Forest Y868	Grey W211
Needletail , White-throated U334	Little E954	Tern , Arctic A952
Nightjar , Spotted Z331	Redthroat K497	Caspian Q112
White-throated M330	Ringneck , Australian G291	Common C953
Oriole , Olive-backed G671	Mallee G291	Crested W115
Osprey K241	Robin , Eastern Yellow Q392	Fairy E118
Owl , Barking U246	Flame M382	Gull-billed Z111
Barn C249	Hooded S385	Little C117
Masked M250	Pink Z383	Whiskered M110
Powerful A248	Red-capped K381	White-fronted U114
Sooty S253	Rose Q384	White-winged Black C109
Southern Boobook M242	Scarlet Y380	Thick-knee , Bush U174
Owlet-nightjar , Australian S317	Rosella , Crimson E282	Thornbill , Brown W475
Oystercatcher , Pied U130	Eastern Q288	Buff-rumped A484
Sooty W131	Yellow T284	Chestnut-rumped S481
Pardalote , Spotted C565	Ruff U934	Inland A476
Striated Q976	Sanderling U166	Slender-billed U482
Yellow-rumped E566	Sandpiper , Broad-billed W167	Striated M470
Parrot , Australian King C281	Common S157	Yellow Z471
Blue Bonnet S297	Cox's T822	Yellow-rumped E486
Blue-winged M306	Curlew K161	Thrush , Bassian G779
Elegant Z307	Marsh W159	Song Q992
Ground G311	Pectoral U978	White's = Bassian
Mallee Ringneck M291	Sharp-tailed Z163	Treecreeper , Brown W555
Mulga Q296	Terek Y160	Red-browed Q560
Orange-bellied K305	Wood M154	White-browed S561
Red-rumped Z295	Scrub-robin , Southern C441	White-throated E558
Regent M278	Scrubwren , Large-billed E494	Triller , White-winged U430
Superb K277	White-browed Y488	Turnstone , Ruddy K129
Swift S309	Sea-Eagle , White-bellied M226	Turtle-Dove , Spotted C989
Turquoise E302	Shag , Black-faced E098	Wagtail , Willie Y364
Pelican , Australian U106	Shearwater , Flesh-footed Y072	Warbler , Clamorous Reed Y524
Penguin , Little K005	Fluttering Q068	Speckled A504
Petrel , Blue K081	Hutton's K913	Wattlebird , Little C637
Cape Y080	Short-tailed G071	Red E638
Great-winged Z075	Sooty E070	Weebill S465
White-headed S077	Shelduck , Australian G207	Whimbrel E150
Phalarope , Red-necked Q932	Shoveler , Australasian A212	Whipbird , Eastern S421
Pigeon , Crested W043	Shrike-thrush , Grey A408	Whistler , Gilbert's Z403
Feral K957	Shrike-tit , Crested A416	Golden E398
Wonga A044	Silvereye E574	Olive S405
Pilotbird E506	Sittella , Varied C549	Red-ored M402
Pipit , Richard's G647	Skua , Great Y980	Rufous K401
Plains-wanderer Y020	Skylark , Common S993	Whistling-Duck , Plumed C205
Plover , Black-fronted Y144	Snipe , Latham's A168	Whiteface , Southern U466
Double-banded A140	Painted M170	Willie Wagtail Y364
Grey Y136	Songlark , Brown Y508	Woodswallow , Black-faced U546
Hooded M138	Rufous K509	Dusky W547
Greater Sand C141	Sparrow , Eurasian Tree U994	Masked Q544
Large Sand C141	House W995	White-breasted Z543
Pacific Golden K137	Sparrowhawk , Collared E222	White-browed S545
Lesser Sand Z139	Spinebill , Eastern G591	
	Spoonbill , Royal S181	

AMPHIBIANS AND REPTILES

Tree Frogs

U3166	<i>Litoria aurea</i>
G3207	Green and Golden Grass Frog
W3175	<i>Litoria raniformis</i>
U3182	Growling Grass Frog
W3203	<i>Litoria citropa</i>
G3215	Blue Mountains Tree Frog
T3906	<i>Litoria ewingii</i>
T3907	Southern Brown Tree Frog
A3192	<i>Litoria paraewingii</i>
T3936	Plains Brown Tree Frog
G3195	<i>Litoria verreauxii</i>
A3204	<i>Litoria v. verreauxii</i>
E3206	Verreaux's Tree Frog
	<i>Litoria v. alpina</i>
	Alpine Tree Frog
	<i>Litoria lesueuri</i>
	Lesueur's Frog
	<i>Litoria littlejohni</i>
	Large Brown Tree Frog
	<i>Litoria spenceri</i>
	Spotted Tree Frog
	<i>Litoria peronii</i>
	Peron's Tree Frog
	<i>Litoria phyllochroa</i>
	Leaf Green Tree Frog

Southern Frogs

W3131	<i>Crinia parinsignifera</i>
E3134	Plains Froglet
G3135	<i>Crinia signifera</i>
C3029	Common Froglet
S3033	<i>Crinia sloanei</i>
U3042	Sloane's Froglet
M3058	<i>Geocrinia laevis</i>
Z3059	Southern Smooth Froglet
Fletcheri	<i>Geocrinia victoriana</i>
A3060	Victorian Smooth Froglet
interioris	<i>Heleioporus</i>
C3061	Giant Burrowing Frog
peronii	<i>Limnodynastes</i>
G3063	Southern Bullfrog
tasmaniensis	<i>Limnodynastes</i>
K3073	Barking Marsh Frog
S3085	<i>Limnodynastes</i>
U3086	Giant Bullfrog
T3921	<i>Limnodynastes</i>
Z3103	Striped Marsh Frog
U3106	<i>Limnodynastes</i>
C3117	Spotted Marsh Frog
Q3120	<i>Mixophyes balbus</i>
C3125	Southern Barred Frog
U3158	<i>Neobatrachus pictus</i>
T3930	Mallee Spadefoot Toad
T3931	<i>Neobatrachus sudelli</i>
T3929	Common Spadefoot Toad
	<i>Neobatrachus sp.</i>
	unidentified spadefoot toad
	<i>Paracrinia haswelli</i>
	Haswell's Froglet
	<i>Philoria frosti</i>
	Baw Baw Frog
	<i>Pseudophryne</i>
	Bibron's Toadlet
	<i>Pseudophryne dendyi</i>
	Dendy's Toadlet
	<i>Pseudophryne</i>
	Southern Toadlet
	<i>Uperoleia laevigata</i>
	Smooth Toadlet
	<i>Uperoleia martini</i>
	Martin's Toadlet
	<i>Uperoleia tyleri</i>
	Tyler's Toadlet
	<i>Uperoleia sp.</i>
	unidentified <i>Uperoleia</i>

Freshwater Tortoises

A2016	<i>Chelodina expansa</i>
C2017	Broad-shelled Tortoise
E2034	<i>Chelodina longicollis</i>
	Common Long-necked Tortoise
	<i>Emydura macquarii</i>
	Murray River Tortoise

Geckoes

K2109	<i>Diplodactylus</i>
damaeus	Beaded Gecko
W2059	<i>Diplodactylus</i>
intermedius	Southern Spiny-tailed Gecko

A2076	<i>Diplodactylus</i>
tessellatus	Tessellated Gecko
C2077	<i>Diplodactylus vittatus</i>
	Wood Gecko
A2092	Tree Dtella
C2105	Bynoe's Gecko
U2138	Thick-tailed Gecko
M2126	<i>Phyllodactylus</i>
marmoratus	Marbled Gecko
S2137	<i>Rhynchoedura ornata</i>
	Beaked Gecko

Legless Lizards

K2141	<i>Aprasia aurita</i>
Z2143	Mallee Worm-Lizard
Q2144	<i>Aprasia inaurita</i>
M2150	Pink-nosed Worm-Lizard
U2154	<i>Aprasia parapulchella</i>
G2167	Pink-tailed Worm-Lizard
G2159	<i>Aprasia striolata</i>
Q2160	Striped Worm-Lizard
U2170	<i>Delma australis</i>
E2174	Southern Legless Lizard
G2175	<i>Delma butleri</i>
	Butler's Legless Lizard
	<i>Delma impar</i>
	Striped Legless Lizard
	<i>Delma inornata</i>
	Olive Legless Lizard
	<i>Lialis burtonis</i>
	Burton's Snake-Lizard
	<i>Pygopus lepidopodus</i>
	Common Scaly-foot
	<i>Pygopus nigriceps</i>
	Hooded Scaly-foot

Dragons

M2194	<i>Amphibolurus</i>
T2917	Tree Dragon
coggeri	<i>Amphibolurus nobbi</i>
S2209	Nobbi Dragon
K2185	<i>Amphibolurus norrisi</i>
W2199	Norris's Dragon
T2919	<i>Ctenophorus fordii</i>
lesueurii howittii	Mallee Dragon
Dragon	<i>Ctenophorus pictus</i>
K2177	Painted Dragon
Y2204	<i>Physignathus</i>
T2915	Gippsland Water Dragon
T2921	<i>Pogona barbata</i>
lineata	Eastern Bearded Dragon
T2922	<i>Pogona vitticeps</i>
pinguicollis	Central Bearded Dragon
Earless Dragon	<i>Pogona sp.</i>
T2991	unidentified bearded dragon
lin/ping.	<i>Tympanocryptis</i>
dragon	Lined Earless Dragon
E2182	<i>Tympanocryptis</i>
diemensis	Southern Lined
	<i>Tympanocryptis</i>
	unidentified earless
	<i>Tympanocryptis</i>
	Mouhtain Dragon

Goannas

G2271	<i>Varanus gouldii</i>
W2287	Sand Goanna
Z2283	<i>Varanus rosenbergi</i>
	Rosenberg's Goanna
	<i>Varanus varius</i>
	Tree Goanna

Skinks

U2682	<i>Bassiana duperreyi</i>
A2464	Eastern Three-lined Skink
E2318	<i>Bassiana platynotum</i>
E2326	Red-throated Skink
carnabyi	<i>Carlia tetradactyla</i>
E2342	Southern Rainbow Skink
T2933	<i>Cryptoblepharus</i>
	Carnaby's Wall Skink
	<i>Ctenotus brachyonyx</i>
	Murray Striped Skink
	<i>Ctenotus brooksi</i>

AMPHIBIANS AND REPTILES

U2374	Brooks's Striped Skink	<i>Ctenotus regius</i>	Z2583	Common Blue-tongued Lizard	<i>Tiliqua rugosa</i>
W2375	Regal Striped Skink	<i>Ctenotus robustus</i>		Stumpy-tailed Lizard	
E2386	Large Striped Skink	<i>Ctenotus taeniolatus</i>	Blind Snakes		
T2936	Copper-tailed Skink	<i>Ctenotus uber</i>	U2586		<i>Ramphotyphlops</i>
orientalis	Uber Striped Skink	<i>Cyclodomorphus</i>	australis		West Australian Blind
T2987	Alpine She-oak Skink	<i>Cyclodomorphus</i>	A2588		<i>Ramphotyphlops</i>
praealtus	Eastern She-oak	<i>Cyclodomorphus</i>	bituberculatus		Peters's Blind Snake
T2988			G2599		<i>Ramphotyphlops</i>
michaeli			nigrescens		Gray's Blind Snake
Skink			Z2603		<i>Ramphotyphlops</i>
G2407	Swamp Skink	<i>Egernia coventryi</i>	proximus		Woodland Blind
Y2408	Cunningham's Skink	<i>Egernia cunninghami</i>	Snake		
C2413	Desert Skink	<i>Egernia inornata</i>	T2965		<i>Ramphotyphlops</i>
A2420	Heath Skink	<i>Egernia multiscutata</i>	sp.	unidentified blind snake	
T2938	Tree Skink	<i>Egernia saxatilis</i>	Pythons		
intermedia	White's Skink	<i>Egernia striolata</i>	T2968	Diamond Python	<i>Morelia spilota spilota</i>
S2429	Alpine Water Skink	<i>Egernia whitii</i>	T2969	variegata	<i>Morelia spilota</i>
E2430	Eastern Water Skink	<i>Eulamprus kosciuskoi</i>			Carpet Python
U2550	Alpine Water Skink	<i>Eulamprus quoyii</i>	Front-fanged Snakes		
K2557	Eastern Water Skink	<i>Eulamprus heatwolei</i>	A2640		<i>Acanthophis</i>
T2957	(WTF) Skink	Yellow-bellied Water	antarcticus		Common Death
T2956	(CTF) Skink	<i>Eulamprus tympanum</i>	Adder		
T2958	ssp. Corangamite Water Skink	Southern Water Skink	T2972	Highland Copperhead	<i>Austrelaps ramsayi</i>
T2986	unidentified water skink	<i>Eulamprus tympanum</i>	T2973	Lowland Copperhead	<i>Austrelaps superbus</i>
K2441	<i>decrensis</i>	<i>Eulamprus sp.</i>	T2989	unidentified copperhead	<i>Austrelaps sp.</i>
S2445	Millewa Skink	<i>Hemiergis</i>	Z2655	<i>psammophis</i>	<i>Demansia</i>
U2446	Four-toed Skink	<i>Hemiergis millewae</i>	Snake		Yellow-faced Whip
M2450	Delicate Skink	<i>Hemiergis peronii</i>	S2665	White-lipped Snake	<i>Drysdalia coronoides</i>
Z2451	<i>guichenoti</i>	<i>Lampropholis delicata</i>	U2666	Masters's Snake	<i>Drysdalia mastersii</i>
G2475	Bougainville's Skink	<i>Lampropholis</i>	W2667	Bardick	<i>Echiopsis curta</i>
Y2492	Mueller's Skink	Garden Skink	C2669	Red-naped Snake	<i>Furina diadema</i>
W2499	Spotted Burrowing Skink	<i>Lerista bougainvillii</i>	S2681	Tiger Snake	<i>Notechis scutatus</i>
W2519	Grey's Skink	<i>Lerista muelleri</i>	K2689	<i>microlepidotus</i>	<i>Oxyuranus</i>
S2525	Samphire Skink	<i>Lerista punctatovittata</i>	C2693	<i>porphyriacus</i>	Small-scaled Snake
U2526	Boulenger's Skink	<i>Menetia greyii</i>	Snake		<i>Pseudechis</i>
C2529	Obscure Skink	<i>Morethia adelaidensis</i>	M2698	Western Brown Snake	Red-bellied Black
Q2444	<i>maccoyi</i>	<i>Morethia boulengeri</i>	Z2699	Eastern Brown Snake	<i>Pseudonaja nuchalis</i>
E2458	coventryi	<i>Morethia obscura</i>	E2650	<i>nigrescens</i>	<i>Pseudonaja textilis</i>
U2462	metallicus	<i>Nannoscincus</i>	Snake		<i>Rhinoplocephalus</i>
T2994	entrecasteauxii	McCoy's Skink	W2711	Coral Snake	Eastern Small-eyed
T2992	<i>cryodroma</i>	<i>Niveoscincus</i>	M2726	Snake	<i>Simoselaps australis</i>
T2993	pagenstecheri	Coventry's Skink	Z2727	Little Whip Snake	<i>Suta dwyeri</i> Dwyer's
W2683	rawlinsoni	<i>Niveoscincus</i>	Y2724	Mitchell's Short-tailed Snake	<i>Suta flagellum</i>
T2995	unidentified grass skink	Metallic Skink	K2813	Port Lincoln Snake	<i>Suta nigriceps</i>
S2541	Spencer's Skink	<i>Pseudemoia</i>	E2722	Snake	<i>Suta spectabilis</i>
Q2452	<i>mustelinus</i>	Southern Grass Skink	Snake		<i>Suta suta</i> Curl
U2578	Blotched Blue-tongued Lizard	<i>Pseudemoia</i>	T2979	unidentified <i>Suta</i>	<i>Suta sp.</i>
W2579	Western Blue-tongued Lizard	Alpine Bog Skink	M2734	Bandy Bandy	<i>Vermicella annulata</i>
Y2580		<i>Pseudemoia</i>			
		Lussock Skink			
		<i>Pseudemoia</i>			
		Glossy Grass Skink			
		grass skink sp.			
		<i>Pseudemoia spenceri</i>			
		<i>Saproscincus</i>			
		Weasel Skink			
		<i>Tiliqua nigrolutea</i>			
		<i>Tiliqua occipitalis</i>			
		<i>Tiliqua scincoides</i>			

AMPHIBIANS AND REPTILES

Eared Seals

G1543 *Arctocephalus forsteri* New Zealand Fur Seal
 E1542 *Arctocephalus pusillus* Australian Fur Seal
 Z1539 *Neophoca cinerea* Australian Sea Lion

Earless Seals

S1549 *Hydrurga leptonyx* Leopard Seal
 Z1555 *Lobodon carcinophagus* Crabeater Seal
 M1546 *Mirounga leonina* Southern Elephant Seal

Right Whales

Q1564 *Caperea marginata* Pygmy Right Whale
 K1561 *Eubalaena australis* Southern Right Whale

Rorquals

M1570 *Balaenoptera acutorostrata* Minke Whale
 Q1572 *Balaenoptera edeni* Bryde's Whale
 W1567 *Balaenoptera musculus* Blue Whale
 C1569 *Balaenoptera physalus* Fin Whale
 T1828 *Balaenoptera sp.*
 W1575 *Megaptera novaeangliae* Humpback Whale

Sperm Whales

S1581 *Kogia breviceps* Pygmy Sperm Whale
 E1578 *Physeter macrocephalus* Sperm Whale

Beaked Whales

A1584 *Hyperoodon planifrons* Southern Bottlenose Whale
 E1594 *Mesoplodon bowdoini* Andrew's Beaked Whale
 U1590 *Mesoplodon densirostris* Blainville's Beaked Whale
 U1038 *Mesoplodon ginkgodens* Ginkgo-toothed Whale
 C1593 *Mesoplodon grayi* Gray's Beaked Whale
 W1591 *Mesoplodon layardi* Strap-toothed Beaked Whale
 Y1596 *Mesoplodon mirus* True's Beaked Whale
 T1829 *Mesoplodon sp.*
 G1587 *Ziphius cavirostris* Cuvier's Beaked Whale

Dolphins and Killer Whales

Y1616 *Delphinus delphis* Common Dolphin
 E1606 *Globicephala melas* Long-finned Pilot Whale
 K1609 *Grampus griseus* Risso's Dolphin
 Y1624 *Lagenodelphis hosei* Fraser's Dolphin
 Q1600 *Orcinus orca* Killer Whale
 W1603 *Pseudorca crassidens* False Killer Whale
 A1612 *Tursiops truncatus* Bottlenose Dolphin

Marine Turtles and Sea Snakes

Q2004 *Caretta caretta* Loggerhead Turtle
 U2007 *Chelonia mydas* Green Turtle
 Z2011 *Lepidochelys olivacea* Pacific Ridley
 S2013 *Dermochelys coriacea* Leatherly Turtle
 T2905 marine turtle sp.
 U2770 *Pelamis platurus* Yellow-bellied Sea Snake



Natural Resources and Environment

AGRICULTURE • RESOURCES • CONSERVATION • LAND MANAGEMENT

Atlas of Victorian Wildlife

Name:.....

Phone:.....

Address:.....

Ref* _____	Prj: _____	Obs: _____	Punched: _____
Checked: _____			

First date: _____

Second date: _____

Locality:

Grid ref:	Lat:3 ___ Long:1 ___ Acc:___	OR	<div style="display: flex; justify-content: space-between; font-size: 8px; margin-bottom: 2px;"> Easting Northing </div> Map: ___ AMG: _____
-----------	------------------------------	----	--

Altitude: _____ Your ref: _____ Coverage: Birds _____ Mammals _____ Herps _____

Species	Code	Count	X	T	R	Species	Code	Count	X	T	R
1						26					
2						27					
3						28					
4						29					
5						30					
6						31					
7						32					
8						33					
9						34					
10						35					
11						36					
12						37					
13						38					
14						39					
15						40					
16						41					
17						42					
18						43					
19						44					
20						45					
21						46					
22						47					
23						48					
24						49					
25						50					
	XXXXX	XXXXX	X	X	X		XXXXX	XXXXX	X	X	X

Notes: e.g. extra evidence for identification, breeding, habitat etc.

Please return to: Atlas of Victoria Wildlife, PO Box 137, Heidelberg, Victoria 3084

Species	Code	Count	X	T	R	Species	Code	Count	X	T	R
51						87					
52						88					
53						89					
54						90					
55						91					
56						92					
57						93					
58						94					
59						95					
60						96					
61						97					
62						98					
63						99					
64						100					
65						101					
66						102					
67						103					
68						104					
69						105					
70						106					
71						107					
72						108					
73						109					
74						110					
75						111					
76						112					
77						113					
78						114					
79						115					
80						116					
81						117					
82						118					
83						119					
84						120					
85						121					
86						122					
	xxxxxx	xxxxxx	x	x	x		xxxxxx	xxxxxx	x	x	x

Notes continued

Data is supplied on the understanding it is for the unencumbered use by DSE

Please return to: Atlas of Victoria Wildlife, PO Box 137, Heidelberg, Victoria 3084

ATTACHMENT 6

SUGGESTED REPORTING FORMAT

(SUMMARY SHEETS)

REPORT STRUCTURE FOR DETAILED ENVIRONMENTAL ASSESSMENT

SUMMARY 2 pages, include recommendations and background

1.0 INTRODUCTION Aims and Objectives

1.1 Objectives:

1. *To identify and assess all natural environments that may be affected by the proposed integrated surface water management/drainage systems..*
2. *To identify the current extent and degree of degradation to the natural/semi-natural environment.*
3. *To predict the likely extent and degree of degradation that will occur under the 'no-intervention' scenario.*
4. *To identify and assess the environmental impacts of proposed system options.*
5. *To identify options and make recommendations for proposed works and management practices that can be implemented to enhance environmental values or minimise environmental impacts.*
6. *Identify alternative water management procedures to minimise drainage runoff.*

2.0 METHODOLOGY

- 2.1 In most cases, this will just be referring to the standard document, and adding any variations that may have been made from this.
- 2.2 Describe how data was collected

3.0 EXISTING CONDITIONS Describe the following for each land unit;

- 3.1 Physical characteristics
- soil, landuse, water quality, hydrology, wetland types.
- 3.2 Biological characteristics
- vegetation communities, fauna, habitat types, ecological processes.
- discuss biological characteristics in line with BVT and EVC classification.
- public land location and status (key LCC recommendations)
- wetlands (location and type), rivers, streams, prior stream depressions
- Ramsar status, Register of the National Estate
- Significant flora and fauna species and populations. Include FFG listings and JAMBA and CAMBA listed species.
- 3.3 Identification of areas of environmental value, using evaluation criteria.
- 3.4 Discussion of threatening processes.

4.0 PROPOSAL Discussion/maps of integrated surface water management/drainage proposal, standards of works being proposed.

4.1 **IMPACTS** Identification of impacts.

On site - what effect will the proposal have in the catchment on the existing conditions.

Off site - what effect will the proposal have in areas downstream of the catchment, particularly rivers and wetlands.

4.2

Environmental Protection and Enhancement

In accordance with legislative and Catchment Plan objectives, opportunities for the protection and enhancement of environmental features should be identified.

Terrestrial and Aquatic Ecosystems on both private and public land which would benefit from environmental protection and enhancement works need to be located and the type of works/management options specified.

Environmental works which are required to be carried out in conjunction with the implementation of the Integrated Surface Water Management/Drainage Scheme must be listed.

Recommend areas for "Net Gain" offset works must also be shown.

5.0 RECOMMENDATIONS Recommend environmentally preferred options.

Recommendations should consider those issues listed in Section 5.

Recommendations should be in line with:

- Statutory Planning requirements (Planning and Environment Act 1987)
- Land Managers approval (in line with LCC recommendations)
- Licensing Authorities (in line with government policy)

Appendices

These should contain any maps, listings of flora and fauna species, extraneous information and the summary sheets as attached.

ATTACHMENT 7

SUGGESTED FORMAT FOR THE FINAL ALIGNMENT NATURAL FEATURES BOOKLET

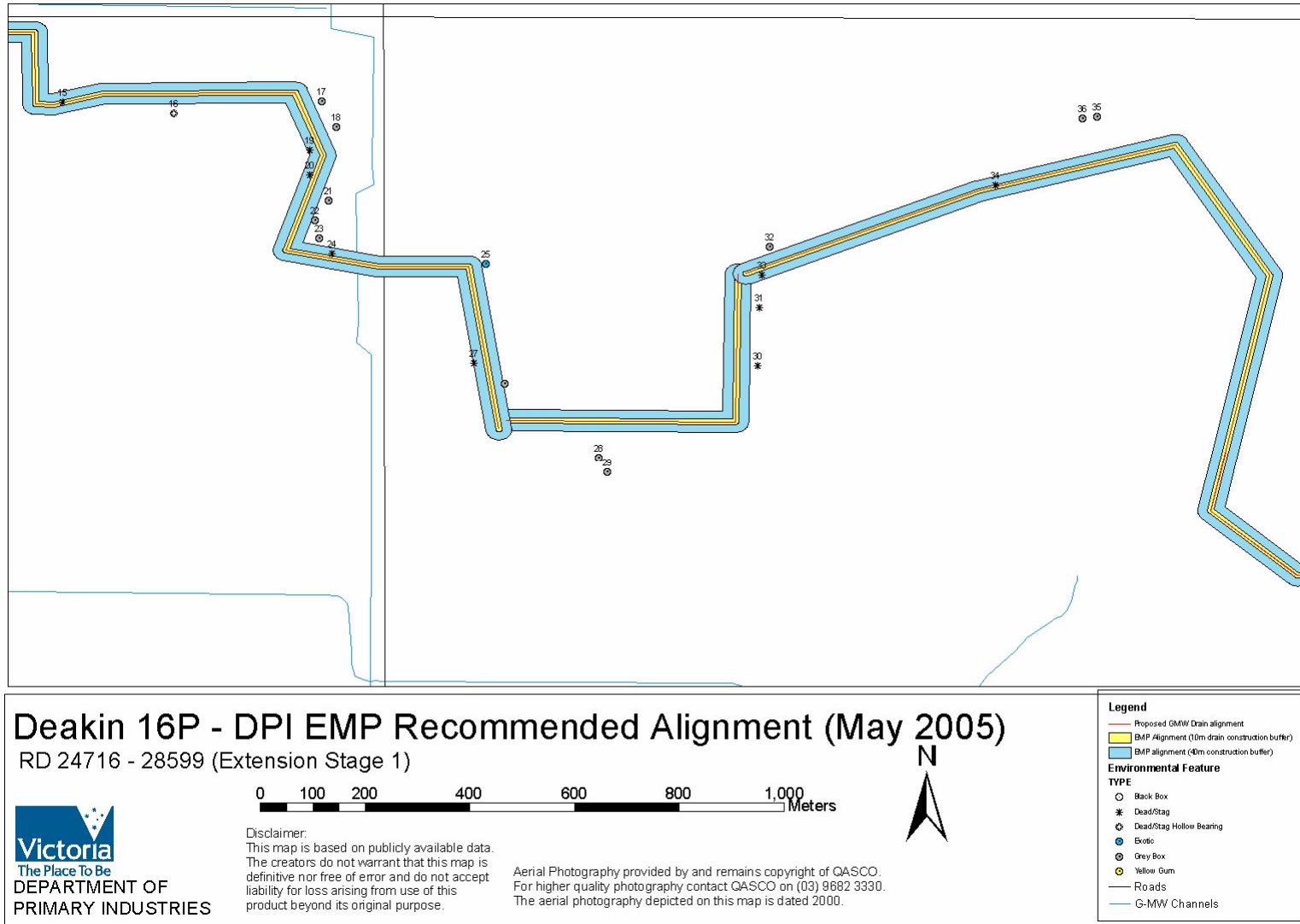


Figure Example of final alignment check by running distance detailing alignment, construction buffer and natural features with 40 metres of the Alignment centre.

ATTACHMENT 8

SUGGESTED FORMAT FOR THE LETTER OF NOTICE OF LISTED SPECIES, HABITATS AND COMMUNITIES WITHIN A CATCHMENT UNDER THE FLORA AND FAUNA GUARANTEE ACT 1988 AND THE ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999 TO GOULBURN MURRAY WATER FOR CONSIDERATION IN THE PLANNING PROCESS.

24 August 2005

Glenn Collins

Surface Water Management Officer

Goulburn Murray Water

P O Box 165

TATURA 3616

Our Ref: NI CS 28 0018 EPBC

Dear Glenn

Re: Deakin 16 Primary Extension SWMS (EPBC Act 1999 / FFG 1988-Species Listing)

Thank you for notifying the Environmental Management Program at the Department of Primary Industries, Tatura (EMP-DPI) of Goulburn Murray Water's (GMW) intent to progress the Deakin 16 Primary Extension Surface Water Management System (SWMS) to construction.

The proposed SWMS had a 'total catchment' Detailed Environmental Assessment completed in December 1995, in accordance with the then DNRE Environmental Assessment Guidelines. Further negotiations with regard to sections of the alignment have been conducted since the original Detailed Assessment was completed. The most recent Environmental Assessment in accordance with current DPI Environmental Assessment Guidelines was conducted in May 2005 listing all trees within a 50 metre (each side of drain centre) buffer of the final SWMS alignment.

Further investigations into the presence of species, communities or habitats which may trigger the provisions of the Commonwealth's Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act 1999) and the Flora and Fauna Guarantee Act 1988 (FFG 1988) have been undertaken.

Under the provisions of the items listed under the EPBC Act 1999, the Deakin 16 Primary Extension SWMS catchment does not contain any *Wetlands of International Importance, World Heritage Properties, Nuclear Actions or Commonwealth Marine Environments*.

Some Listed Migratory Species or Listed FFG Species are known to utilize the wider Deakin Catchment depending on seasonal conditions and the availability of preferred habitats. Of these, one species was identified during the Environmental Assessment process 1995, being Intermediate Egret (*Egretta intermedia*). This species and its status is listed in Table 1 below.

Recent investigations have identified the following rare, threatened, vulnerable or endangered species as being heard, sighted or listed (up to 1999) within the Deakin 16 Primary Extension catchment.

Table 1. Species of Significance (State and / or National Status). (EPBC - FFG)

FAUNA

Common Name	Scientific Name	Listed Status	Conserv Status	EPBC	
Pied Cormorant	<i>Phalacrocorax varius</i>			NT	-
Latham's Snipe	<i>Gallinago hardwickii</i>			NT	-
Bush Stone Curlew	<i>Burhinus grallarius</i>	FFG		EN	-
Brolga	<i>Grus rubicunda</i>	FFG		VU	-
Glossy ibis	<i>Plegadis falcinellus</i>			NT	-
Royal Spoonbill	<i>Platalea regia</i>			VU	-
Intermediate Egret	<i>Ardea intermedia</i>		FFG		CR -
Great Egret	<i>Ardea alba</i>		FFG		VU -
Nankeen Night Heron	<i>Nycticorax caledonicus</i>			NT	-
Australasian Bittern	<i>Botaurus poiciloptilus</i>	FFG		EN	-
Australasian Shoveler	<i>Anas rhynchos</i>			VU	-
Freckled Duck	<i>Stictonetta naevosa</i>	FFG		EN	-
Hardhead	<i>Aythya australis</i>			VU	-
Black Falcon	<i>Falco subniger</i>			VU	-

FLORA

Common Joyweed	<i>Alternanthera nodifolia</i>			k	-
Slender Tick-trefoil	<i>Desmodium varians</i>			k	-
Hydrilla	<i>Hydrilla verticillata</i>			r	-
Waterbush	<i>Myoporum montanum</i>			r	-
Branching Groundsel	<i>Senecio cunninghamii</i>			r	-

NT – Near Threatened. EN – Endangered. VU- Vulnerable. CR- Critically Endangered
k - poorly known in Victoria. r - Rare in Victoria.

FFG - Flora and Fauna Guarantee Act Listed

In accordance with the provisions for *Listed Migratory Species / Listed Species* an *Action* under the (EPBC Act 1999) will require approval from the Commonwealth Environment Minister if the *Action* has, will have, or is likely to have a significant impact on a *Listed Migratory Species* or *Listed Species*.

The Significant Impact Criteria of an *Action* is defined as - An action has, will have, or is likely to have a significant impact on a migratory or listed species if it does, will, or is likely to:

- Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of *important habitat* of the migratory species; or
- Result in invasive species that are harmful to the migratory species becoming established in an area of *important habitat* of the migratory species; or
- Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an *ecologically significant proportion* of the species.

An area of *important habitat* is:

- Habitat utilised by a migratory species occasionally or periodically within a region that supports an *ecologically significant proportion* of the population of the species; or
- Habitat utilised by a migratory species which is at the limit of the species range; or
- Habitat within an area where the species is declining.

The area of habitat suitable for the *Listed Migratory Species / Listed Species* in the Deakin 16 Primary Extension Catchment, could be defined as *non important* in accordance with the criteria identified above. The said catchment does not contain critical habitats and do not hold an ecologically **significant proportion** of known Listed Migratory species or Listed Species (Table 1). Similarly the impact of the proposed works could be defined as Not having a *Significant Impact* because the works are unlikely to have any significant detrimental impact on the area and quality of the known habitats. Conversely environmental works to be carried out as part of the implementation of the proposed Scheme will protect and enhance known habitats as indicated in the 3 Step approach of Avoid, Minimise, Offset incorporated in the Victorian Native Vegetation Management ‘ A Framework for Action’.

The judgement as to whether the works proposed, trigger the requirements of the EPBC Act, is under the provisions of the Act, not decided by DPI as a State authority. The judgement has to be made by the proponent of the works and referred to the Commonwealth Ministers office for a ruling if there is any doubt that the works to be carried out has, will have, or is likely to have a significant impact on such species.

Should you any queries or require further comment please contact Neil McLeod on 03 58 335 250.

Yours sincerely

Neil McLeod
Environmental Assessment Coordinator
Environmental Management Program
Department of Primary Industries
Ferguson Road
TATURA 3616