DWLBC REPORT

Water monitoring review in the Eyre Peninsula Natural Resources Management region

2005/38

Government of South Australia
Department of Water, Land and Biodiversity Conservation

Water Monitoring Review in the Eyre Peninsula Natural Resources Management Region

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Department of Water, Land and Biodiversity Conservation
for
The Eyre Peninsula Natural Resources Management Board

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Report DWLBC 2005/38

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EPCWMB - Jonathan Clark

Bureau of Meteorology (BoM) - Richard Szkup

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FOREWORD

South Australia's unique and precious natural resources are fundamental to the economic and social wellbeing of the State. It is critical that these resources are managed in a sustainable manner to safeguard them both for current users and for future generations.

The Department of Water, Land and Biodiversity Conservation (DWLBC) strives to ensure that our natural resources are managed so that they are available for all users, including the environment.

In order for us to best manage these natural resources it is imperative that we have a sound knowledge of their condition and how they are likely to respond to management changes. DWLBC scientific and technical staff continue to improve this knowledge through undertaking investigations, technical reviews and resource modelling.

Rob Freeman
CHIEF EXECUTIVE
DEPARTMENT OF WATER, LAND AND BIODIVERSITY CONSERVATION

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PREFACE

This report was written during 2005 and provides a useful record of water monitoring activities in the Eyre Peninsula Natural Resources Management (EPNRM) region at the time of writing.

The implementation of the South Australian *Natural Resources Management Act 2004* and the subsequent publication of the South Australian *Natural Resources Management Plan 2006* (NRM Plan) have resulted in fundamental changes in the frameworks for Monitoring and Evaluation in South Australia. This in turn has meant that the roles, responsibilities and constitution of state and regional agencies and organisations may have changed over time and these changes may not be fully reflected within this publication.

The findings of this report do not imply any commitment or obligation on any agency.

EXECUTIVE SUMMARY

Water resources in the Eyre Peninsula Natural Resources Management (EPNRM) region are managed to provide water for domestic, agricultural, horticultural, and industrial use, while providing for the environmental requirements of water dependent ecosystems. This review of water monitoring activities in the EPNRM region is based on a desktop review and seeks to provide the starting point for discussions on the development of an integrated Natural Resources Management (NRM) monitoring framework and strategy.

The review covers information on the six themes of water resources data: surface water quantity, surface water quality, groundwater quantity, groundwater quality, aquatic ecosystems and catchment characteristics. These are convenient thematic divisions of the total resource for monitoring and fit the current division of responsibilities between agencies. However, a more unified approach is a key Goal of the South Australian Government's *Natural Resources Management Plan 2006* (NRM Plan), which is for *"Communities, governments and industries with the capability, commitment and connections to manage natural resources in an integrated way".*

Monitoring, evaluation and reporting of water resources in the EPNRM region is currently fragmented both within and between Government agencies and community based organisations. There is limited communication or exchange of data between the main monitoring networks.

Monitoring of a variety of aspects of water resources, including surface and groundwater quantity and quality, aquatic ecosystems, and marine and estuarine waters, all occur in the EPNRM region, but to varying spatial and temporal scales, and with varying frequencies.

An opportunity exists for State and regional agency agreement to ensure that water monitoring programs:

1. Fulfill the basic requirements of the National Monitoring and Evaluation Framework and National Water Initiative (NWI)
2. Meet the needs of the National Land and Water Resource Audit and for Natural Heritage Trust (NHT) funded programs
3. Comply with the State Monitoring and Evaluation Framework for Natural Resources Management
4. Satisfy the requirements for regional resource condition assessment and management
5. Satisfy the requirements of the State *Environment Protection Act 1993*.

This report is intended to guide the development of future monitoring programs to a greater level of integration and efficiency. However, no onus is allocated for implementation of the proposed actions, as these will be subject to priorities and budgets of individual stakeholder organisations.

Strategic Directions

The following table summarises the strategic issues and current activities of State and regional agencies and organisations at the time of writing.

Some of the issues that are identified are already being addressed and actions are being initiated by relevant agencies.

Issues	Actions	Agency/Organisation [1]
Data and Information management		
Errors, gaps, and breaks in current databases	• Review of standard methods and standard operating procedure	**DWLBC, EPA, BoM, SA Water, DEH, EPNRMB** [2]
Limited or no coordination between monitoring programs	• Develop a water monitoring review process • Create and implement a communication plan • Define the major State level monitoring networks, including creation and management of a logical linkage between monitoring programs • Establish the linkage between State monitoring networks and EPNRMB monitoring and evaluation requirements	**SWMCC** [3] **SWMCC** **SWMCC**, DWLBC, EPA, BoM, SA Water, DEH **EPNRMB,** DWLBC, EPA, SA Water, BoM, DEH, PIRSA
No real effort has been made to organise data collected by various agencies and make it available in an integrated way	• Develop a data and information 'clearing house' • Develop metadata standards • Prepare a geographically based reference compilation	**SWMCC**
Surface Water		
No stream gauging stations outside the Tod catchment	• Re-define objectives of DWLBC's stream gauging • Establish stream gauging station in the Spencer Gulf Basin • Establish water level monitoring in aquatic ecosystems of significant environmental values (e.g. Lake Wangary, Big Swamp, and Little Swamp)	**DWLBC** **DWLBC,** EPNRMB, DEH, EPA **DWLBC**, EPNRMB, DEH
Rainfall monitoring biased at catchments with steep topography	• Establish rain gauges at key locations	**DWLBC**, BoM, EPNRMB, EPA, DEH, PIRSA

Deficiency of long-term ambient water quality data	• Incorporate auto-samplers, dissolved oxygen (DO) and pH probes with current (especially AW512500) and future gauges • Review EPA's Ambient Water Quality Monitoring Program (AWQMP)	**DWLBC**, EPNRMB **EPA**, DWLBC, EPNRMB
Inadequate parameters	• Analyse historical evaporation data from BoM to identify evaporation patterns across the region • Map and register farm dam distribution • Incorporate soil moisture monitor with existing evaporation monitoring site (Tod catchment has highest priority) • Establish urban stormwater and effluent monitoring in major towns, especially in Port Lincoln • Establish link between surface/groundwater	**EPNRMB**, DWLBC, BoM **EPNRMB**, DWLBC, PIRSA **EPNRMB**, DWLBC, BoM, PIRSA **EPNRMB, SA Water,** DWLBC, Local Councils **DWLBC,** EPNRMB, SA Water, PIRSA
No telemetric data (including water quantity and quality measurements)	• Equip base gauging stations with telemetry devices	**DWLBC,** EPNRMB
Groundwater		
Inadequate monitoring of fractured rock aquifers (FRA)	• Establish new observation wells	**DWLBC,** EPNRMB
Incomplete coverage for water quality monitoring	• Increase the number of sampling wells in the Southern Basin Prescribed Well Area (PWA) and Musgrave PWA • Establish new wells at Darke Peak • Combine current salinity and future water quality monitoring	**EPA**, EPNRMB **EPNRMB**, EPA **DWLBC**, EPA
Incomparable sampling technique	• Standardise groundwater sampling methods	**SWMCC**
Pathogenic bacteria not monitored	• Investigate the bacteria risk in major groundwater resources	**EPA, SA Water,** EPNRMB, DWLBC

Aquatic Ecosystem		
Baseline data needs to be updated	• Mapping of all groundwater and surface water dependent ecosystems	**EPNRMB**, DWLBC, DEH, EPA
Monitoring methodology is yet to be developed (especially for saline wetlands)	• Develop a conceptual aquatic ecosystem model • Conduct case research to: o Identify gaps in monitoring information which is required to assess acceptable impacts of ecosystem changes o Study the drivers that cause ecosystem changes, e.g. rainfall, groundwater table declination o Identify key indicators o Understand the responses of the key ecosystem components to ecosystem changes. • Design an integrated aquatic ecosystem monitoring program • Include WDE in the broad State water resource monitoring program	**DWLBC**, EPNRMB, DEH, **DWLBC**, DEH, EPNRMB, EPA **EPNRMB,** DWLBC, EPA, DEH **DWLBC**, EPA, EPNRMB
Catchment Characteristics		
The link between land and water resource conditions is yet to be established	• Conduct catchment-scale study	**DWLBC**, EPNRMB

Notes

1. The lead agency/organisation at the time of writing is highlighted, based on the systemic monitoring model in Section 3.4.
2. Natural Resources Management Board (NRMB) and Catchment Water Management Board (CWMB) are NOT distinguished in this Table or throughout the report.
3. State Water Monitoring Coordination Committee (SWMCC) was superseded by the State Natural Resources Monitoring, Evaluation, and Reporting Policy Group after December 2005.

1 INTRODUCTION

1.1 BACKGROUND

Water monitoring is the process of obtaining information to address specific physical, chemical and biological characteristics of water resources and water dependent ecosystems. Water monitoring is required for many different reasons, including to inform management of human health, ecological condition, and as a measure of management and project effectiveness. These characteristics may include direct measures of water parameters or conditions, as well as summary indicators such as keystone aquatic species.

Water monitoring is often considered to be the process of collecting samples or data. In defining monitoring however, there are other aspects that need to be addressed including: data acquisition (network design, quality assurance and quality control, laboratory analysis, data handling and data analysis); data utilisation; communication; and coordination. Saunders (1985) summarised these aspects of monitoring as follows:

- Data editing – preparation of raw data for entry to databases or for analyses
- Data verification and entry – ensuring that data 'reasonably' represents system parameters
- Data storage, security and accessibility – data are to be stored effectively in a secure, maintained database made available to researchers or the public
- Evaluation – analysis of data to produce information in a usable form
- Regular review – addressing the adequacy of the water information system (including but not limited to the monitoring network), typically addressing the following questions:
    - Is the information being provided sufficient to meet foreseeable needs?
    - Are there any data gaps or redundancies emerging?

The purposes of water monitoring evolve over time. The main reason for the monitoring of water quality for instance, has traditionally been the need to verify whether the observed water quality is suitable for intended uses. The application of monitoring practices and data gathering has evolved to include the determination of trends in the quality of aquatic ecosystems and how they are affected by the release of contaminants, anthropogenic activities, and waste treatment operations. More recently, monitoring has also been undertaken to assess nutrient or pollutant (e.g. salt) fluxes discharged by rivers or groundwaters to lakes and oceans.

As a management tool, water monitoring is identified as a starting point of the management process and as a feedback mechanism to identify how management efforts have affected water conditions. Figure 1 illustrates that monitoring is essential to identifying water resource issues and determining whether actions taken to address the problems have been successful.

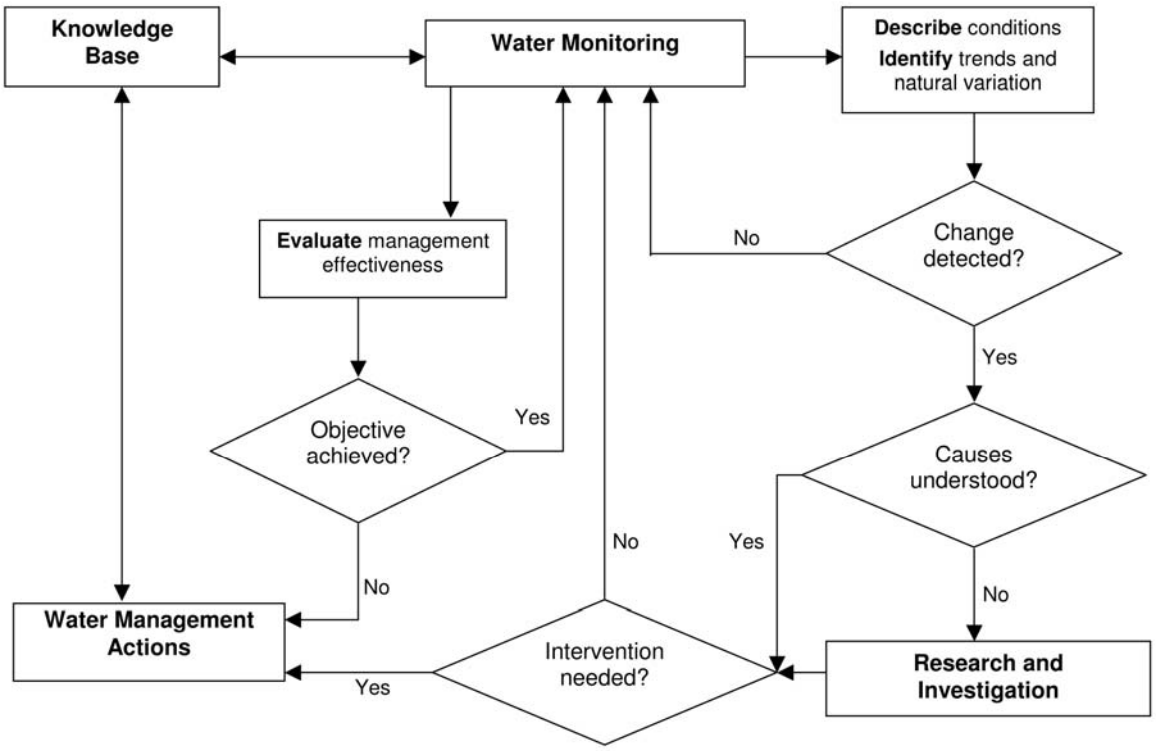


Figure 1. Functions of monitoring in the framework of adaptive water resource management.

Monitoring may at times serve only a single purpose, either in terms of identifying water conditions or as feedback to a management decision. From the management perspective an integrated water monitoring program requires various interconnected elements (Table 5).

Water is a keystone resource for the development and welfare of the Eyre Peninsula. The region relies on reticulated water sourced from an array of discrete resources mainly to the south and west of the Peninsula, and the supply system is currently operating at, or near, its capacity. It is therefore crucial that these resources are protected and used in a sustainable manner.

However, information on the volume and quality of the Eyre Peninsula's water resources and their use is incomplete. In some areas available data is minimal and/or unclear, resulting in planning difficulties. The Interim Eyre Peninsula Natural Resources Management Group and the Eyre Peninsula Catchment Water Management Board (EPCWMB), the predecessors of the Eyre Peninsula Natural Resources Management Board (EPNRMB), both listed monitoring and modelling of water resources as key issues. However, a number of public and private organisations are currently involved in collecting data to monitor the condition of the region's waters. Potential exists for more efficient coordination of the data collection efforts that would result in more timely, reliable, and complete data for better-informed decision making.

Table 1. General classification of water monitoring.
(Adapted from MacDonald, et. al. 1991).

Type	Definition or Purpose
Trend Monitoring	Measurements are made at regular, well-spaced time intervals, in order to determine the long-term trend in a particular parameter
Baseline Monitoring	Used to characterise existing water resource conditions, and to establish a database for planning or future comparisons
Implementation Monitoring	Assesses whether activities were carried out as planned
Effectiveness Monitoring	Used to evaluate whether the specified activities have had the desired effect
Project Monitoring	Assesses the impact of a particular activity or project
Validation Monitoring	Dealing with the quantitative evaluation of a proposed water resource model to predict a particular water resource parameter
Compliance Monitoring	Used to determine whether specified criteria or standards are being met

The State Water Monitoring Review was initiated in 2000 to develop an efficient and integrated water monitoring network in each major region and catchment across South Australia. The State Water Monitoring Review has been overseen by the State Water Monitoring Coordination Committee (SWMCC). This project forms part of the State Water Monitoring Review and is dedicated toward developing an integrated water monitoring strategy for surface water and groundwater resources and water dependent ecosystems (WDE) of the Eyre Peninsula region of South Australia.

1.2 DEFINITIONS AND SCOPE

The State regional water monitoring review has broadly defined monitoring functions to identify improvements needed to support more effective decision making. Table 2 lists the consensus definitions for water resources, monitoring functions, and the purposes of water monitoring adopted by the review.

This report addresses the full range of water resources within the EP region, which include ground and surface waters, fresh and marine environments, and to a limited degree, stormwater and effluents. Six water monitoring themes are covered in this review:

- Surface water quantity
- Surface water quality
- Groundwater quantity
- Groundwater quality
- Water dependent ecosystems
- Catchment characteristics.

Table 2. Key definitions of water monitoring adopted in this review.

Water resources	• Surface and ground waters, estuaries, and near coastal waters • Rain water, storm water and treated effluents, saline/sea water • Associated aquatic communities and physical habitats including wetlands
Water resources data	• Physical including quantity (water level, flow, discharge, etc.), timing, duration and frequency • Chemical/toxicological • Biological/ecological • Associated data including habitat, land use, demographics, contaminant discharges, and other ancillary information such as atmospheric deposition
Monitoring program activities	• Identifying and documenting program goals and purposes • Designing and planning monitoring programs • Coordinating and collaborating with other monitoring agencies • Selecting water resource indicators • Locating appropriate monitoring sites • Selecting data collection methods • Collecting field observations and samples • Analysing samples in laboratories • Developing and operating quality assurance programs • Storing, managing and sharing data • Interpreting and assessing data • Reporting and distributing monitoring results • Evaluating the effectiveness of monitoring programs
Purposes of monitoring	• Assessing status and trends • Characterising and ranking existing and emerging problems • Designing and implementing programs and projects • Evaluating program and project effectiveness • Responding to emergencies

Adapted and extracted from various resources: DWR (2000); DWLBC (2005); NLWRA (2003); UK Environment Agency (2001).

1.3 PROJECT OUTLINE

1.3.1 Objectives

The overall purpose of this project is to provide underpinning knowledge to facilitate possible approaches to coordinate and improve monitoring in the Eyre Peninsula (EP). The project aims to meet the following specific objectives:

- Identifying detailed monitoring requirements for key stakeholders
- Developing an understanding of current water resource data collection and analysis programs and capabilities
- Evaluating the effectiveness of existing water resource data collection and analysis programs and suggesting approaches for standardisation
- Identifying gaps in data and information needed to support critical water management decisions
- Analysing the information gathered to highlight possible commonalities between the requirements of different stakeholders
- Identifying key definitions which may be subject to interpretation and may therefore present possible barriers to harmonisation
- Proposing ways of harmonising monitoring requirements to avoid duplication, and improve cost effectiveness.

For the purpose of this review stakeholders are key bodies or organisations who are involved in water monitoring, and are discussed in further detail in Table 4.

1.3.2 Methodology

The review was divided into three stages (Figure 2):

1. Background research
2. Assessment of existing monitoring networks
3. Future directions.

Each stage involved a series of tasks and is briefly described below.

Stage One: Background Research

1. Each of the key stakeholders identified a series of business needs based on planning requirements, including:
    - Activities of each stakeholder
    - Assessments required to undertake these activities
    - Monitoring and information requirements to undertake these assessments.
2. Roles and responsibilities of water monitoring have previously been determined by the State Water Monitoring Coordination sub-committee (Kneebone, 2000) and agreed by relevant stakeholders, however in South Australia a reform process is currently underway for natural resources management. As a result, the roles and responsibilities of some State and regional organisations and agencies are changing. While some of the detail for the implementation of future natural resources (including water resources) monitoring and evaluation programs will be affected, the fundamental principles which define the roles and responsibilities of various agencies are assumed to remain the same.

3. Key water resource issues specified in the *Eyre Peninsula Catchment Water Management Plan* (EPCWMB, 2005), *Water Supply Master Plan* (PPK, 2002) and the *Natural Resources Management Plan (2004-2007)* (DWLBC, 2005) are considered for monitoring purposes. Special consideration is given to the evaluation, monitoring, and reporting of water resource condition targets (RCT's) stated in the South Australian *Natural Resources Management Plan* (Draft document, DWLBC, 2005).

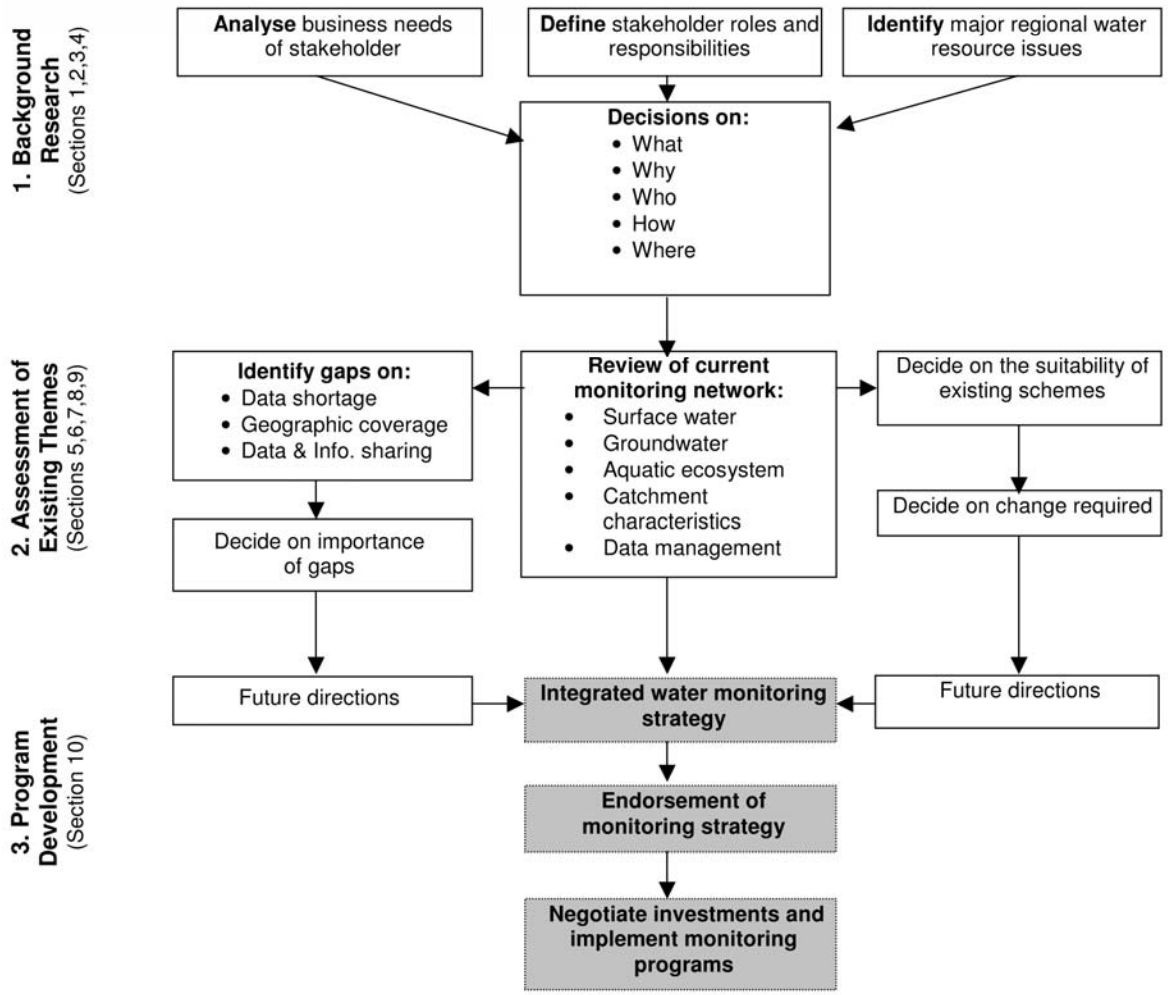


Figure 2. State Water Monitoring Review project plan. The implementation of the last three steps (in shadow) will be dependent on the actions of the SWMCC following this report.

4. An ideal or systemic conceptual monitoring model representing all relevant business needs and the responsibilities of key stakeholders has been designed by the author of this report (Table 5). The following are defined in the model:
    A. Network coverage and density
    B. Parameters
    C. Monitoring frequency
    D. Lead organisations
    E. Data and information sharing mechanisms.

Stage Two: Assessment of Existing Monitoring Networks

5. The current monitoring network includes the existing infrastructure present in the catchment, the databases operated and maintained by key stakeholders, and data and information management arrangements (if any).
6. Performing an inventory of current monitoring networks and mapping them using geographical information system (GIS) technology.
7. By comparing the existing monitoring network with the ideal model, gaps and overlaps are exposed. Gaps to be targeted include:
    A. Data shortage
    B. Adequacy of geographic coverage
    C. Insufficiency of data and information sharing mechanisms.

Stage Three: Suggestions for Future Directions

8. Actions are proposed to address each gap in consideration with regional management priorities.
9. Steps towards an integrated monitoring strategy for EP are proposed.

Depending on feedback received from key stakeholders, the next three steps are projected:

10. Based on the actions proposed in the report an integrated water monitoring strategy for EP will be developed.
11. The State and regional agencies agree to endorse the strategy and individual organisations develop monitoring programs.
12. Communication and negotiation between stakeholders based on the strategy are undertaken to determine investment priorities and cost sharing arrangements.

2 CATCHMENT DESCRIPTION

2.1 GENERAL PHYSICAL FEATURES

Eyre Peninsula (EP) is bordered by Spencer Gulf in the east, the Southern Ocean to the south, the Great Australian Bight to the west and the Gawler Ranges to the north. It stretches nearly 1,000 km from east to west (Figure 3). The total area of the EP Natural Resources Management (NRM) region is over 81,000 km^2, including nearly 30,000 km^2 of coast and marine area, covering roughly 5.6% of South Australia.

Eyre Peninsula is a vast plain with many isolated peaks and low, discontinuous ranges to the north, east and south. The geology is particularly relevant to water resources as it determines where, how and why these resources are located. Aside from the Tod River which discharges to the Spencer Gulf just north of Port Lincoln, there are no significant surface water resources on the Peninsula. There are 17 defined groundwater resources of potable quality located in the three regions of the Southern Basins, the Musgrave Prescribed Wells Area (PWA) and the Robinson Basin.

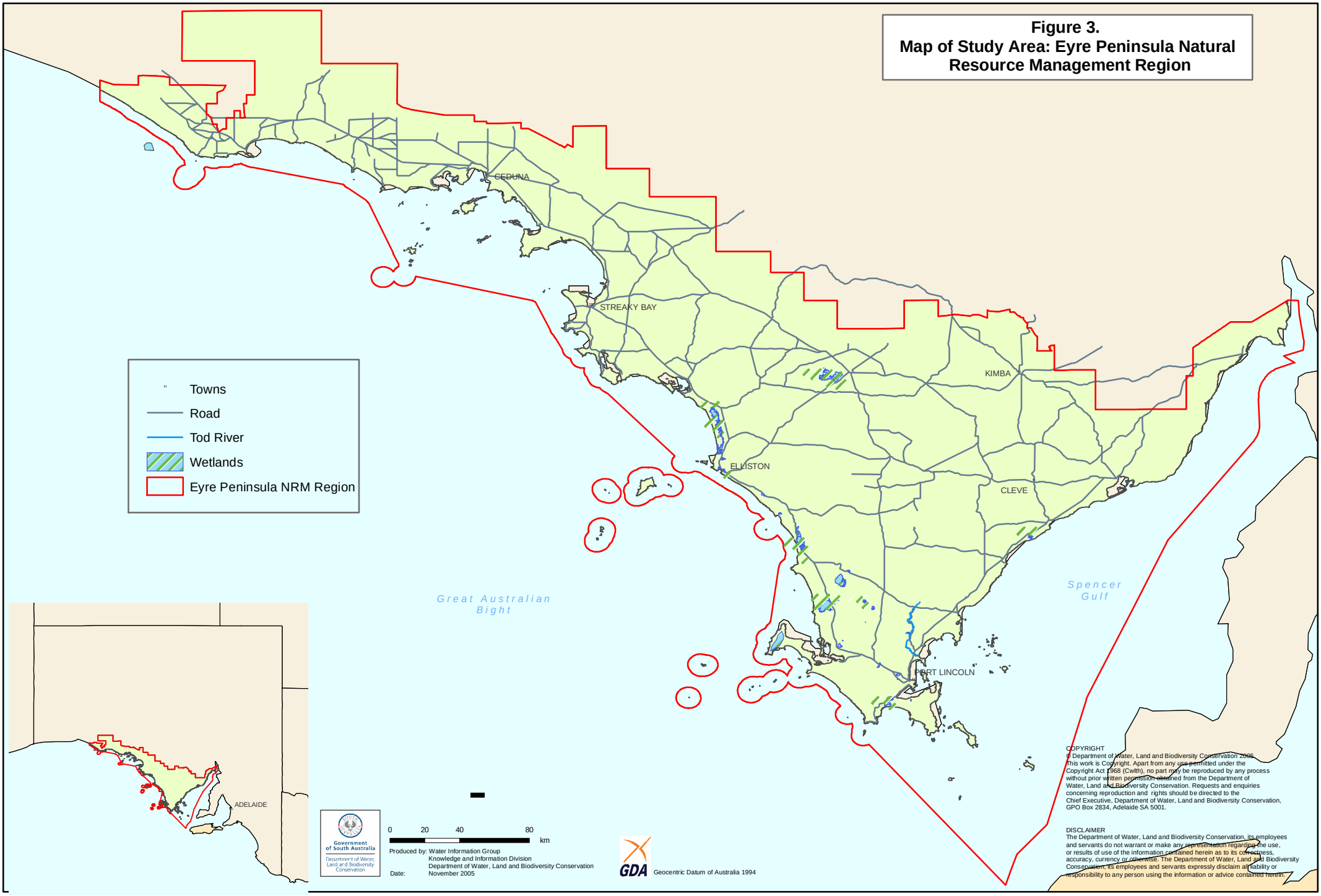
Eyre Peninsula has a characteristic Mediterranean climate, which consists of long, dry and hot summers and cooler, moderately wet winters. Mean annual rainfall ranges from about 250 mm in the Gawler Ranges in the north and northwest to greater than 600 mm south of Port Lincoln. On average, 50% of the rainfall occurs between May and August every year. Annual rainfall variation is very high (the recorded highest value is more than four times higher than the lowest). This inherent variation makes the preparation of water budgets and water resource management difficult. Evaporation is high throughout the region. Mean annual potential evaporation varies between 1,550 mm at the Tod River reservoir and 2,300 mm at Ceduna.

The major soil types are calcareous soils and siliceous sands. Calcareous soils are the most common soils in the region covering nearly 60% of the surface. They have low water holding capacity, are deficient in plant nutrients such as copper, zinc, molybdenum and manganese, and have naturally low levels of phosphates and nitrogen. Siliceous sands cover 20% of the region and are formed from Lowan Sands and Moornaba Sands. They have low inherent fertility, a low water holding capacity, are often highly water repellent, and generate little run-off.

Since European settlement 55% of the original vegetation on EP has been cleared and 43% is still intact. The remaining 2% includes revegetated areas and natural areas such as cliffs, sand dunes and wetlands. Significant areas of remaining native vegetation are in soils less suited to agriculture, such as deep sands or sheet limestone.

The Eyre Peninsula is a significant contributor to the South Australian economy through predominantly primary industries (agriculture and fishing/aquaculture industries with tourism playing an important role over the last three decades). The EP region contains less than 2.5% of the State's population, yet it produces one third of South Australia's grain and two thirds of its seafood harvest. Hence, although the area is relatively sparsely populated, it is highly productive.

Figure 3.
Map of Study Area: Eyre Peninsula Natural Resource Management Region



2.2 SURFACE WATER

2.2.1 Surface Water Resources

EP is one of the driest regions in Australia. Low rainfall, high evaporation and a relatively flat topography result in few surface water resources. Only 0.3 - 0.4% of rainfall on EP runs off to collect in rivers (NLWRA, 2000). The flat topography and gently rolling landscape with dominant winter rainfall limit surface flow to occur mainly during the winter months. The central and western regions of the catchment contribute little or no surface run-off drainage due to the flat landscape. In these regions the rainfall either evaporates or contributes to groundwater recharge of the aquifer.

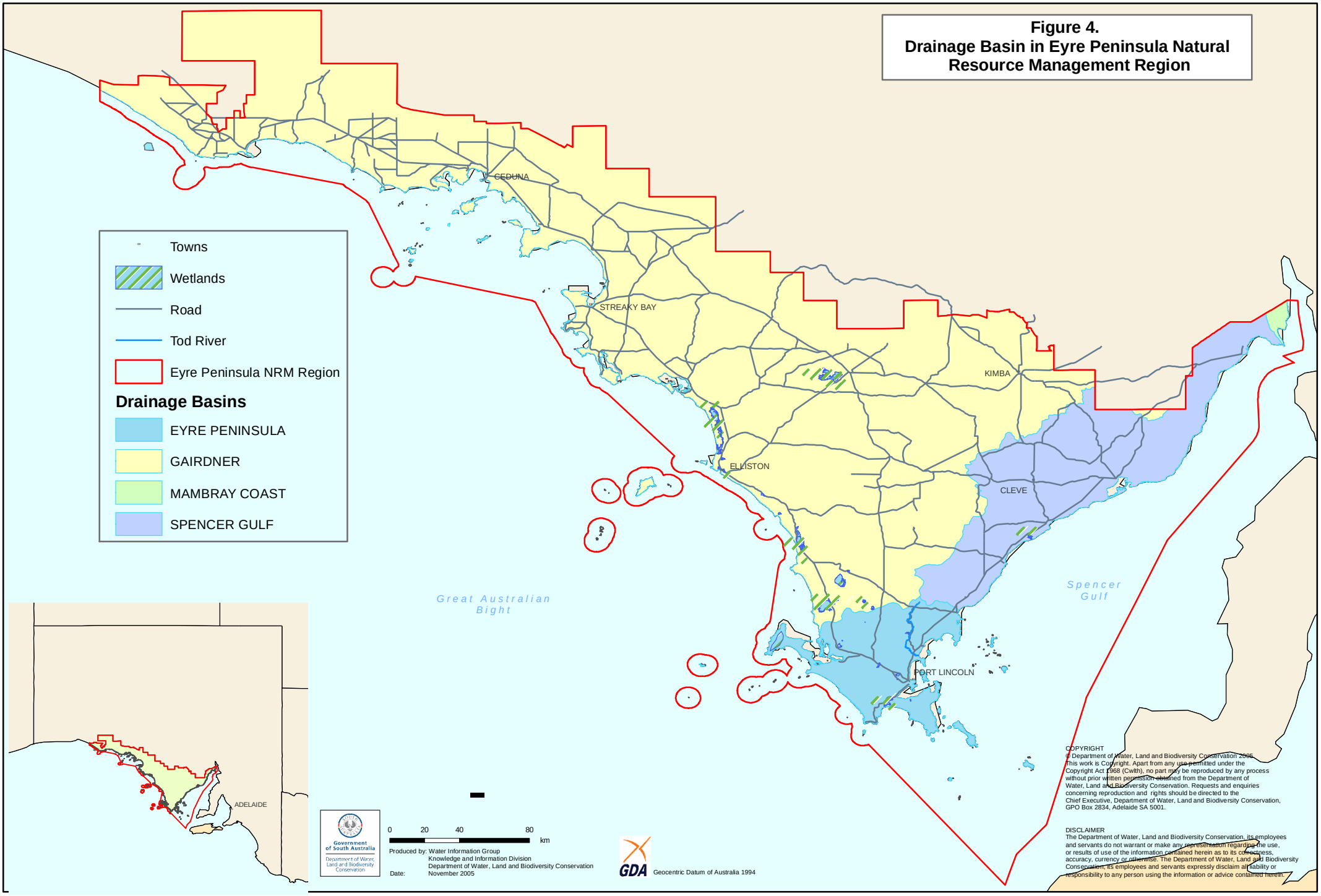
The hydrology of the Peninsula is defined by three river basins: the Eyre Peninsula and Spencer Gulf River Basins of the South Australian Gulf Drainage Division, and the Gairdner Basin of the Western Plateau Drainage Division. The Eyre Peninsula Basin covers the southern end of the catchment from the south of Cummins to the east of Coffin Bay and to the coast. The Spencer Gulf Basin covers the area south of Whyalla to south of Cummins and drains to the eastern coast of Eyre Peninsula. The region also includes a small portion of the Mambray Coast Basin. It includes a number of catchments that discharge to the Spencer Gulf (Figure 4). The vast Gairdner Basin has no major surface water drainage system. The majority of its rainfall contributes to the recharge of the local groundwater system.

Most streams in the region are saline, seasonal and predominantly dry during the summer months. The only significant surface water resource in the region is the Tod River, with a catchment area of about 395 km^2 to the north of Port Lincoln. Land clearances have increased the salinity of surface water in the Tod reservoir (13 mg/L total dissolved solids (TDS) per year) since 1930 (EPCWMB, 2005). For this reason no water is used for reticulated water supply from the Tod Reservoir at present. The Tod Reservoir and the Middle River Reservoir on Kangaroo Island were identified as the two water resources in the State at greatest risk from salinity (Jolly, et al. 2000).

The rainfall patterns and low topography create a range of different stream habitats. Despite the lack of flow and surface water during summer, many systems flow for several months during autumn and spring. These include Pillaworta Creek, parts of the Tod River, Mine Creek and a few sites on Salt Creek near Mangalo. Other creeks have low flows in autumn and are only isolated pools in spring. These include Meadows Creek, Rock Valley Creek, parts of the Tod River, and one site from Salt Creek at Yorkies Crossing. The other major stream type in the region consists of still water pools in autumn and spring. Examples include Coonta, Yeldulknie, Salt, Minniribbie, Waterfall, Pokalalie and Millalee Creeks and the Dutton River.

Eyre Peninsula has a number of identified wetlands covering some 64,000 ha. Eleven of the wetlands are listed as nationally significant. Important inland saline lake systems are also found on EP. These wetland systems are confined mainly to the south and west of the Peninsula. There are also several areas with good quality coastal wetland systems consisting of mangroves and samphire flats. These are located within the numerous bays and tidal inlets around the Peninsula. The eastern portion of Eyre Peninsula contains many degraded saline lake systems and the occasional freshwater wetland. These remaining freshwater wetlands are quickly becoming saline due to the effects of dryland salinity.

Figure 4.
Drainage Basin in Eyre Peninsula Natural Resource Management Region



2.2.2 Surface Water Quality

Salinity is a major issue for rivers and streams on the Eyre Peninsula. The two main mechanisms of salt delivery to streams in the EPNRM region are salt wash-off and groundwater baseflow. Regular monitoring in the Tod River catchment shows that the streams in this region are saline, with concentrations of 700 – 12,800 mg/L TDS between wet and dry seasons (DWR, 2000). In some areas dryland salinity is believed to be a contributing factor.

The only available comprehensive baseline information about water quality in the EPNRM region is provided by the 1994/95 AusRivAS bioassessment which covers most of the streams and creeks located at the eastern part of the Peninsula. The assessment indicates that the Tod River catchment has several sites in the middle reaches that are equivalent to reference site conditions (good quality). Coonta Creek and a small, un-named creek south of the Tod River both have more species present than expected for lowland brackish streams and were given a high rating. Sites from Edillilie and Minniribbie Creeks were generally in good condition in relation to other saline streams in the State. The rivers and streams that rated poorly were generally from the most saline streams such as Dutton River, Driver River, some sites from Salt Creek near Cleve and several smaller salty rivers and streams.

In addition, as part of the national Water Resources Assessment Program, the Engineering and Water Supply (EWS) Department sampled the Tod River catchment to analyse a range of water quality variables (Glatz, 1985). The collected data provides the first comprehensive baseline information for the Tod River catchment.

2.3 AQUATIC ECOSYSTEMS (WETLANDS)

There is no comprehensive, scientifically based information on the condition or extent of wetlands across the EP region. Nevertheless, the Department for Environment and Heritage (DEH) has assessed the environmental status of selected regional wetlands (Seaman, 2002). The assessments covered a range of representative wetlands and are intended to provide a once-off snapshot of wetland condition and conservation value. Of the 27 wetlands assessed and rated in the surveys, three have low environmental value, 16 have moderate environmental value, and 8 have high environmental value. Environmental value in this survey was based on factors such as water quality and the health of surrounding vegetation, in combination with the level of disturbance including vegetation clearance, grazing damage, rubbish dumping and altered water flows. Wetlands with medium and high environmental values were recommended for follow-up work with regard to possible protective measures.

Several wetlands surveyed are considered to be nationally important as they are a good example of a wetland type occurring within a biogeographic region in Australia, according to the criteria set by the Australian and New Zealand Environment Conservation Council (ANZECC). These wetlands include the saline lake systems within Lincoln National Park and Lake Newland Conservation Park. Seven wetlands are recommended by DEH for monitoring and include four wetlands in the District Council of Elliston and three wetlands managed by National Parks and Wildlife, South Australia (Seaman, 2002).

The EPCWMB has recently started a project tilted “A Coordinated Approach to Wetland Management on Eyre Peninsula”. This project seeks to identify the range of wetlands and

water dependent ecosystems across the Peninsula and collate and collect important baseline information on the biological and physical attributes of the region's wetlands.

2.4 GROUNDWATER RESOURCES

Groundwater resources are now the major source of potable (drinkable) water for Eyre Peninsula. About 70% of the water used on EP comes from groundwater, with farm dams and rainwater tanks accounting for the remaining 30%. Surface water flow is limited to the eastern and southern ranges of the region. Currently all of the reticulated water supplies for the Peninsula including domestic and stock uses come from groundwater basins. Groundwater availability and quality is generally better in the south and the west coast. The main groundwater resources on EP are described in Table 3.

2.4.1 Prescribed Groundwater Resources

The National Land and Water Resources Audit (NLWRA) describes the Eyre Peninsula groundwaters as being in the Gawler Groundwater Province and the Eyre Peninsula Groundwater Province (NLWRA, 2000). The Gawler Province contains the Penong, Robinson and Unincorporated Basins. The Eyre Peninsula Province includes the County Musgrave Basin and Southern Basins. The Southern Basins and Musgrave Basin are prescribed pursuant to the *Water Resources Act 1997*.

Southern Basins

The majority of good quality, adequate yielding groundwater reserves occur in the Southern Basins. These basins are in the Bridgewater Formation which was laid down on an ancient landscape in which basement rocks formed a series of north-south ridges and valleys. The aquifers average from around 5 m deep in the Uley South lens to 10 m in the Uley Wanilla (DWR, 2001b) and can be managed as discrete ('independent') lenses (Martin and Clarke, 2000). In much of the region the Tertiary sands are separated from the overlying Quaternary limestones by a confining clay layer. There would be direct recharge to the Tertiary sands where the aquitard is absent – though it would be slower and less pronounced than recharge to the Quaternary limestones (Evans, 2002a). The main lenses in the Southern Basin region are: Coffin Bay, Uley South, Uley Wanilla, Uley East and Lincoln A-D. Water moves freely in the aquifers to provide good yield in wells and salinity levels are often less than 700 mg/L TDS. This feature may enhance the potential impact of any pollution to groundwaters with contaminants being correspondingly more mobile. Historical observation indicates that regional recharge has a direct correlation with annual extraction, piezometric level and groundwater quality of the major lenses.

Table 3. Groundwater hydrogeology of Eyre Peninsula *(Source DWLBC)***.**

Era	Unit, Lithology	Hydrogeology
Recent (Holocene) Cainozoic	*Coastal Dunes:* Fine grained aeolianites, unconsolidated, actively mobile. Grains comprise calcite and shell fragments.	*Unconfined aquifer:* Seasonal, small yielding, thin, low salinity supplies located at the base of the mobile sand dune systems.
Quaternary (Pleistocene) Cainozoic	*Bridgewater Formation:* Aeolianites, fine to medium grained, cross-bedded, weakly to moderately cemented. Grains are calcite and shell fragments, mainly 0.1 – 1.5 mm. Generally calcrete at surface.	*Unconfined aquifer:* Generally low salinity. Permeability ranges from low to very high. Transmissivity ranges from $2.0x10^3$ to $8.0x10^3$ m^3/day/m. The usual target aquifer for large water supplies on Eyre Peninsula.
Tertiary (Eocene) Cainozoic	*Wanilla, Poelpena, and Pidinga Formations:* Clays, sands (quartz) and gravels with thin lignite layers. Sand is generally fine grained, less than 0.5 mm, uncemented or weakly cemented.	*Semi-confined to confined aquifer:* low to moderate permeability but with marked variations vertically and laterally. Salinity variable and generally higher than the overlying unconfined aquifer.
Jurassic Mesozoic	*Polda Formation:* Sands (quartz), silts and clays. Sand grains usually less than 0.5 mm, occasionally up to 3 mm. Sediments generally carbonaceous and contain lignite beds.	*Confined aquifer:* very low permeability, high groundwater salinity generally exceeding 14,000 mg/L TDS.
Neo-Proterozoic Proterozoic	*Pre-Cambrian Basement:* Schists, gneisses and quartzites intruded by granites and basic rocks. Deeply weathered in places.	*Semi-confined to confined aquifers:* Groundwater occurs in the weathered profile or within the fracture spaces of these rocks. Salinity generally exceeds 7,000 mg/L TDS, occasionally lower.

Musgrave Basin

The groundwater resources of the Musgrave area are contained primarily within the Quaternary Bridgewater Formation limestone, and underlying Tertiary sands (DWR 2001a; Evans, 2002b). The Quaternary and Tertiary aquifers are generally separated by a clayey aquitard of Tertiary age. Minor groundwater resources are found within the Jurassic sediments of the Polda Basin and the fractured basement rocks of Precambrian age. Unlike the Southern Basin, it is not as common for the basement rocks to significantly interrupt the overlying aquifers in this area. They are more akin to a large, continuous aquifer with lenses of low salinity water among adjacent more saline water (Martin and Clarke, 2000). The lenses are more likely to interact with each other, with a reduction in pressure or level in one more likely to be transferred to nearby lenses as well. The main lenses in the Musgrave area are: Bramfield, Kappawanta, Polda, Polda North, Polda East, Sheringa A-B, Talia and Tinline.

2.4.2 Groundwater Quality

Groundwater quality across Eyre Peninsula is subject to many influences. These include the depth of systems, potential for contamination, and hydrogeological influences.

The unique shallow groundwater system across the region is highly susceptible to any human induced contamination. For example, the groundwater system is generally less susceptible to bacterial pollution than surface water because of the thin layers of soil and rock that filter out many contaminants infiltrating the aquifers. Bacteria however, occasionally find their way into the groundwater system. Examples of this relate to poorly maintained septic systems in small communities that can contaminate localised groundwater systems and even impact on the marine environment through discharge points.

Groundwater generally contains a range of dissolved mineral substances such as sodium, calcium, magnesium, potassium, chloride, bicarbonate and sulphate. The concentration of dissolved minerals in the groundwater contributes to water salinity in the groundwater system. Fresh groundwater in the Quaternary system of the Southern Basin occurs in the range of 700 mg/L TDS and in the Musgrave region 1,000 mg/L TDS. Underlying Tertiary and basement aquifer systems have a relatively high concentration of dissolved mineral content between 500 to 5,000 mg/L TDS. However, the general trend of water salinity in the production wells in the Southern Basins and Musgrave has shown a steady decline of water quality irrespective of extraction.

There are a variety of small groundwater lenses across the region with dissolved mineral concentrations considered highly saline (>5,000 mg/L TDS). These water resources are used with variable extraction that is dependent on the relevant type of domestic and agricultural use.

The constituents of dissolved minerals (or TDS) can be hazardous to animals or plants depending on water quality. Stock tolerance varies depending on season, feed and pregnancy; and plant tolerance depends on species, soil type, and evaporation rate. For example, dry cattle can tolerate water to around 10,000 mg/L TDS and dry sheep to 13,000 mg/L TDS. Almonds can tolerate up to 500 mg/L TDS, grapevines up to 1,500 mg/L TDS and olives around 3,500 mg/L TDS (ANZECC and ARMCANZ, 2000).

The reticulated water supply in the catchment has a salinity level that generally ranges from 500 to 1,000 mg/L TDS (PPK, 2002). The hydrogeology of groundwater systems providing the majority of the reticulated water supply results in groundwater containing relatively high volumes of calcium and magnesium which impacts on water hardness. Saltwater intrusion into freshwater aquifers is a risk to groundwater quality. Significant monitoring of the saltwater/freshwater interface for the Uley South Basin has been initiated by the Department of Water, Land and Biodiversity Conservation (DWLBC). Sustainable extraction from these aquifer systems is maintained by annual allocation through Water Allocation Plans (WAP's) as required under the *Natural Resources Management Act 2004*.

Management of water resources has resulted in prescription of the Southern Basins and Musgrave area. Local councils whose areas include the Prescribed Wells Area (PWA) incorporate Water Protection Zones in their Development Plan under the *Development Act 1993*. The intention of the Water Protection Zones under the Development Plan is to implement land use controls that prohibit activities that have the potential to contribute chemicals, pesticides and biocides to the subsurface environment. For example, municipal and industrial waste, chemical fertilisers, herbicides and pesticides which are

not properly contained can enter the soil, infiltrate the aquifer, and potentially degrade groundwater quality. Under the Development Plan activities such as intensive animal keeping and waste disposal are indicated as non-compliant. Therefore, development or change in land use in a Water Protection Zone requires advice from the State and regional agencies before the local council makes any decision. In recognition of the potential adverse impact of pollution it is advisable that biological and chemical analysis is routinely carried out for water quality monitoring as it is critical for ensuring sustainable water resource management.

Groundwater information from wells drilled within the catchment is collected by DWLBC and held in the State drillhole database (the Drillhole Enquiry System or DES). The database contains physical and chemical information of the well and available freshwater. In recent years extensive water quantity and quality information has been collected to assist the sustainable management of the prescribed resources (Southern Basin and Musgrave PWA's). The physical and chemical properties of the production aquifers in the PWA's are monitored by the State water supply and delivery authority (SA Water) in cooperation with the Australian Water Quality Centre (AWQC) to ensure appropriate drinking water standards are maintained. Observation wells in the PWA's are monitored by DWLBC and SA Water providing information which ensures the integrity of the groundwater system is maintained.

2.5 COAST AND MARINE RESOURCES

The Eyre Peninsula coastal zone extends for 1,640 km from the Western Australian border, through the Nullarbor cliffs to southern Eyre Peninsula, then northeast to the central Spencer Gulf near Whyalla. The region boasts numerous islands, bays, estuaries, mangroves, rocky reefs, seagrass beds, and both high and low energy shores.

The open coast has several large embayments including Louth, Coffin, Streaky, Smoky and Denial Bays. Five semi-enclosed bays (Franklin Harbour, Port Douglas, Venus Bay, Bairds Bay and Tourville Bay) provide 225 km of bay shoreline. A quarter of the coastline lies in the more protected waters of Spencer Gulf with a predominantly east-southeast orientation. The remainder faces the high energy southern ocean swell and prevailing westerly winds.

The region's coast is dominated by rocky coastline but beaches, estuaries and salt lakes are also represented.

A national audit of Australia's estuaries identified eight estuaries in the region. Of the three estuaries ranked as near pristine in South Australia, two are found on Eyre Peninsula – Smoky Bay and Tourville Bay. The estuaries along the Eyre Peninsula coastline provide important habitat for many different fish and bird species and are popular recreation, tourism and cultural sites.

Eyre Peninsula is host to an abundant and diverse marine life. A large proportion (approximately 70 - 80%) of marine species found in South Australia are endemic to the region. This is further enhanced by the presence of a number of offshore islands.

2.6 KEY REGIONAL ISSUES

The major issues in regard to water resources on EP include both the quantity of available water and the quality of the water. The draft *Eyre Peninsula Catchment Water Management Plan 2005* identified that three key issues must be addressed to ensure a secure and productive future for the region (EPCWMB, 2005). These are:

1. Protection and management of water resources
2. Wise water use
3. Additional supplies.

The main pressures or obstacles to addressing these issues are outlined below.

2.6.1 Development

- Water resource limitations have placed restrictions on the development of the township of Streaky Bay. This has been rectified to some degree by the extension of the water supply network, providing a connection to the Tod Trunk main pipeline.
- Development opportunities in other areas will also be limited if the resources of major local groundwater basins are reserved for reticulated water supply needs.

2.6.2 Salinisation

- Dryland salinisation is estimated to affect 50,000 ha on Eyre Peninsula and is increasing.
- Irrigation over the shallow groundwater resources can cause salinisation of the aquifer through the cyclic salt effect, that is, salt deposited from the atmosphere.

2.6.3 Wetlands and Vegetation

- The protection of freshwater wetlands may conflict with other uses.
- Drawdown of the water table can affect wetland ecology and the viability of surface discharges.

2.6.4 Aquaculture Industry

The aquaculture industry is expanding and gaining significance in EP with increased business activity, household income, and contribution to the region's economic growth and employment levels (EconSearch, 2004). In 2002/2003 the output of aquaculture in EP was $503.4 million representing 94% of the State total.

Inappropriate development of aquaculture in the region however, can produce significant environmental effects. Some of these issues are listed below.

- In poorly planned or over-stocked aquaculture developments high levels of feed and excreta may elevate nutrient levels in the area immediately surrounding the farm, reducing water quality and potentially affecting seagrasses and other naturally occurring marine species.
- The deposition of organic matter on sediments directly beneath farms has the potential to accumulate and negatively impact on native species.
- Activities associated with aquaculture sites can have an adverse impact on the benthic environment. For example, trampling by farm workers can cause damage to benthic communities.
- There is a potential risk of the introduction of exotic species through escape from aquaculture operations.

3 ROLES AND RESPONSIBILITIES OF STAKEHOLDERS

Monitoring and assessment provides an integral function in water resource management by validating the environmental outcomes of management program outputs. It provides the essential feedback about the effectiveness of State and regional efforts to manage water resources and aquatic ecosystem health.

Given the complexity of water resource programs, there are significant data needs among the many agencies and entities involved in the management, protection and restoration of water resources.

The following sections describe the legislative and business needs of key stakeholders. The information provided is not intended to be all-inclusive, but rather an outline of priority needs and uses of water resource data and information in the State and regional programs.

3.1 LEGISLATIVE REQUIREMENTS AND BUSINESS NEEDS

In South Australia the *Natural Resources Management Act 2004* (repealing the *Water Resources Act 1997*) and the *Environment Protection Act 1993* are the two principal Acts which define and shape the State's legislative monitoring, evaluating, and reporting responsibilities associated with water resource management. The roles of major stakeholders in water monitoring as mandated by the legislation are outlined below.

3.1.1 LEGISLATIVE MANDATES

Natural Resources Management Act (SA) 2004

Monitoring of the State's water resources has been conducted by various State agencies for most of the last century. These efforts have largely been directed at characterising aquatic resources and water quality problems of the State, and this basic direction remains valid today.

The South Australian *Natural Resources Management Act 2004* has established a clear mandate for promoting sustainable and integrated management of the State's natural resources. The stated purpose of the Act is:

> "... to assist in the achievement of ecologically sustainable development in the State by establishing an integrated scheme to promote the use and management of natural resources…" (Item seven, *Natural Resources Management Act 2004*, Page 20).

It provides for the protection and management of catchments and the sustainable use of land and water resources, and insofar as is reasonably practicable, seeks to enhance and restore or rehabilitate land and water resources that have been degraded.

Under the Act a structure for the State natural resources management is established, which includes an NRM Council, eight regional NRM Boards and sub-regional NRM groups. Each of these organisations has clearly stated functions regarding water resource monitoring, which are summarised below.

The Minister of the State Government's environment portfolio is required:

10(1)(a) to keep the state and condition of the natural resources of the State under review

10(1)(e) to compile, maintain and update information in relation to the State's natural resources

10(1)(f) to promote public awareness of the importance of the State's natural resources and to encourage the conservation of those resources.

The NRM Council's role is:

17(1)(b) to audit, monitor and evaluate the state and condition of natural resources across the State, and to evaluate and report on -

(i) the performance of the NRM authorities established under this Act

(ii) the integration of natural resources management practices on account of this Act.

The NRM council must prepare and maintain a plan to be called *the State Natural Resources Management Plan* (also referred to as 'the State Plan' or 'State NRM Plan' in this report). The State Plan must:

74(3)(a)

(i) assess the state and condition of the natural resources of the State

(ii) identify existing and future risks of damage to, or degradation of, the natural resources of the State

(iii) provide for monitoring and evaluating the state and condition of the natural resources of the State on an ongoing basis.

74(6) The NRM Council must review the State NRM Plan at least once in every 5 years.

The regional NRM boards have a responsibility:

29(1)(b)

1. to prepare a regional NRM plan in accordance with this Act
2. to implement that plan
3. to keep the plan under review to ensure that the objects of this Act are being achieved.

The regional NRM plan must:

75(3)(e) set out the method or methods that the board will use—

(i) to monitor the state and condition of natural resources for the purposes of this Act, and related trends

(ii) to assess the extent to which it has succeeded in implementing the plan, with particular reference to the monitoring and evaluation of the effectiveness of natural resources management programs and policies implemented at the regional and local level

(iii) to assess the extent to which the board has succeeded in achieving its goals.

The Act also requires each NRM Board to prepare a water allocation plan (WAP) for each prescribed water resource in its region.

76(4) A water allocation plan must –

(a) include-

an assessment of the quantity and quality of water needed by the ecosystems that depend on the water resource and the times at which, or the periods during which, those ecosystems will need that water

an assessment as to whether the taking or the use of water from the resource will have a detrimental effect in the quantity or quality of that is available from any other water resource

(b) provide for the allocation (including the quantity of water that is to be available for allocation) and use of water so that-

an equitable balance is achieved between environmental, social and economic needs for the water

the rate of use of the water is sustainable.

Environment Protection Act 1993

In 1993 the State passed the Environment Protection Act. The Act established the South Australian Environmental Protection Authority (EPA) and authorises it to conduct activities as necessary to carry out purposes of the Act, including monitoring of environmental quality. The followings items delineate the functions of water monitoring requirements of the EPA.

The objectives of the Act are:

10(1)(b)

- to provide for monitoring and reporting on environmental quality on a regular basis to ensure compliance with statutory requirements and the maintenance of a record of trends in environmental quality
- to provide for reporting on the state of the environment on a periodic basis.

The Function of EPA is:

10(1) (g) to institute or supervise environmental monitoring and evaluation programmes.

The State of environment report must:

(a) include an assessment of the condition of the major environmental resources of South Australia

(ab) include a specific assessment of the state of the River Murray, especially taking into account the *Objectives for a Healthy River Murray* under the *River Murray Act 2003*

(b) identify significant trends in environmental quality based on an analysis of indicators of environmental quality

(c) review significant programmes, activities and achievements of public authorities relating to the protection, restoration or enhancement of the environment

(d) review the progress made towards achieving the objects of this Act

(e) identify any significant issues and make any actions that, in the opinion of the Authority, should be drawn to the attention of the Minister.

3.2 OVERVIEW OF AGENCY ROLES

There are numerous agencies and organisations carrying out water monitoring activities in SA's waters at the local, State and National level.

As well as DWLBC, EPA, DEH and regional NRM boards, there are many other organisations or groups that have an interest in collecting water monitoring information, sharing this with State and regional agencies or are interested in obtaining their data. These groups include health, public works and planning departments in local governments, certain private businesses and selected non-governmental environmental organisations (including citizen volunteers), and some university and school programs.

Commonwealth agencies serve as important partners but their focus within the regions is primarily on research and special projects, with the exception of BoM. This section focuses on those programs conducted by DWLBC, EPA, SA Water, and NRM (CWMB) Boards. An outline is provided on the current roles of agencies and organisations involved in water monitoring in Eyre Peninsula, and identifies the key data and information needs of water resource programs. The detailed information of other stakeholders, including mission statement, interests and responsibilities, can be found in *State Water Monitoring Review: Monitoring Partnerships Paper* (Kneebone, 2000).

3.3 MAJOR STAKEHOLDERS

The DWLBC, EPA, DEH, SA Water, BoM, and EPNRMB/CWMB have important roles in water monitoring in the EP region. Their current roles are summarised in Table 3, which also identifies the involvement of other agencies.

3.3.1 Department of Water, Land and Biodiversity Conservation (DWLBC)

As South Australia's principal state natural resources agency, DWLBC's water monitoring interests are focused on providing data and information for:

- Its regulatory and advisory functions
- Scientific investigation
- Policy development
- Its reporting responsibilities.

3.3.2 Environment Protection Authority (EPA)

As the State's principal environmental protection regulatory agency, the EPA's water monitoring interests are related to providing the information necessary to manage the State's pollution control programs, including:

- Discharge permit development
- Assessment of water quality standards
- Verification of permit compliance

- Protection of public health/safety
- Remediation of spills/historical pollution problems
- Determining the status of living aquatic resources
- Community monitoring (transferred or will transfer to DEH).

3.3.3 South Australian Water Corporation (SA Water)

SA Water is responsible for the storage, treatment and distribution of bulk water; the provision of reticulated, potable and public water supplies; and the collection, treatment and disposal of sewage. SA Water's comprehensive water quality monitoring program, from catchment to customer tap, provides key information to assist the management of the water systems and to ensure performance standards are met. It comprises both routine and event-based monitoring programs.

The key objectives of SA Water's monitoring programs are to:

- Determine the quality of water provided to customers
- Determine compliance with guidelines and performance standards
- Identify long-term trends in raw and stored water quality
- Provide key information to facilitate the effective operation of treatment systems
- Provide key information to facilitate the effective drinking water supply operation and distribution
- Identify emerging issues within the total water system.

3.3.4 Department for Environment and Heritage (DEH)

The Department for Environment and Heritage (DEH) is responsible for environment policy, biodiversity conservation, heritage conservation, environmental sustainability and animal welfare, and is a custodian of information and knowledge about the State's environment. The Department also manages the State's public land - land held in the conservation reserve system and as Crown lands. DEH's monitoring activities are predominantly for wetlands and Marine and Coast ecosystems:

1. For wetlands, collate monitoring, survey, and management information for wetlands across the state and link these data to information from associated water resources that wetlands rely upon.
2. For marine and coast systems, DEH is responsible for:
    a. Identification of indicators and assessment methodologies to enable effective monitoring and reporting of the ecological, social and economic changes in the coast and marine environment for SoE Reporting.
    b. Determining risks to South Australia's coastal assets from physical changes through surveys and monitoring.

3.3.5 Bureau of Meteorology (BoM)

The Commonwealth Government Bureau of Meteorology (BoM) is one of the major water resource data collection agencies in South Australia. It is responsible (since 1988) for providing a flood warning service for non-flash flooding (i.e. rivers that take more than six hours to flood) in South Australia. The Bureau also has a significant role in providing rainfall and general climate data for water resource purposes.

BoM has the following basic objectives:

- Climate record — To meet the needs of future generations for reliable and homogeneous climatological data.
- Scientific understanding — To advance the science of meteorology and develop an integrated, comprehensive description and scientific understanding of Australia's weather and climate.
- Community welfare — To contribute effectively to national goals through the development and provision of meteorological and related services.
- International cooperation. — To meet Australia's international obligations and advance Australia's interests in and through international meteorology.

3.3.6 Natural Resources Management Board (NRMB) and Catchment Water Management Board (CWMB)

This report was prepared at a time of transition from the management of water resources under the *Water Resources Act 1997* to *the Natural Resources Management Act 2004,* in which water resources are managed as part of an integrated natural resources system. During this transition, the CWMB and the NRMB co-exist, and the functions and responsibilities of the two Boards are interactive and indistinguishable. In this sense, the Boards are not differentiated throughout this report.

At the regional level the EPCWMB stated its mission as being to:

> "Assist Eyre Peninsula communities understand, manage and be confident about their future access to water (permitting social and economic growth) while protecting the water resources on which they rely."

The EPCWMB aims to meet four main goals. These are:

- Protection and management of water resources
- Efficient use of water resources
- Additional water supplies available for use
- An informed and involved community.

Since its establishment the EPCWMB has made a significant commitment to monitoring, assessing, and tracking the conditions of rivers and coastal waters that are part of the catchment within its service area.

3.4 SYSTEMIC MONITORING MODEL

Based on the model developed for the Adelaide and Barossa Catchment Area by Sinclair Knight Merz (2002), a systemic monitoring model was developed for the EPNRM region. This outlines the current information needs of the various agencies and bodies with an interest in water related monitoring data. The agency classification is modified from the *State Water Monitoring Review: Monitoring Partnership Paper* (Kneebone, 2000) considering the *Natural Resources Management Act 2004* (South Australian Government, 2004). The model is presented in Table 4.

Table 4. Current water monitoring activities in the Eyre Peninsula region.

Category	Parameter	Agency	Geographic scope	Sampling Frequency
Water Availability	Streamflow	DWLBC, SA Water	Catchment	Continuous
	Surface water level	DWLBC, SA Water	Catchment	Continuous
	Surface water storage	SA Water	Catchment	Continuous
	Effluents	SA Water	Project	Continuous
	Aquifer recharge	DWLBC	Regional	Annually
	Groundwater levels	DWLBC, SA Water	Regional	Monthly
	Precipitation	BoM, DWLBC, SA Water	Regional	Continuous Daily
	Evaporation	BoM SA Water	Regional Catchment	Continuous Daily
Water Withdrawal	Farm Dam	DWLBC	Catchment	
	Consumption use	SA Water	Regional	Continuous
	License withdrawal	DWLBC	PWA	6-monthly
Water Quality	**Chemical**			
	Heavy metals	EPA	Regional	Monthly
	Nutrients	EPA	Regional	Monthly
	pH	EPA	Regional	Monthly
	Physical			
	Temperature	EPA, DWLBC	Regional Catchment	Monthly Continuous
	EC	DWLBC, SA Water, EPA	Regional	Continuous
	Turbidity	EPA	Regional	Monthly
	Biological			
	Macro-invertebrates	EPA	Regional	6-monthly
	Indicator bacteria	EPA	Regional	Monthly
Aquatic Ecosystems (Wetlands)	**Physical parameter** • Distribution and size • Land use • Description of site • Size	EPNRMB DEH	Regional Regional	Snap-shot
	Biological Parameter • Vegetation • Biological threats • Flora and fauna	DEH	Regional	Snap-shot
	Chemical parameters • DO • Conductivity • Turbidity • pH • Temperature	DEH	Regional	Snap-shot
Aquatic Ecosystems (Coast and Marine)	Ambient Water Quality	EPA	Regional	Monthly
	Benthic biota*	PIRSA	Site-specified	Annually
	Microbiological*	PIRSA	Site-specified	Various
	Phytoplankton*			
	Water Quality and ecology	DEH	Site-specified	Various
Land use	Land use type	PIRSA, DWLBC	Regional	

1. * Industry sector based environmental monitoring programs.

Table 5. Systemic model of water monitoring developed for the EPNRM region.

Classification	Parameter	Purposes	Lead Agency[1]	Collaborative Agency[2]	Interested Agency[3]
Water Availability	Rainfall	Analyse rainfall patterns Climate change management Forecast flood and drought Calibrate computer models	BoM	DWLBC, NRMB, SA Water	EPA, PIRSA, DEH
	Rainfall intensity	Catchment hydrological model Surface/groundwater relationship Climate change management	DWLBC	BoM, NRMB, SA Water	EPA, PIRSA, DEH
	Catchment streamflow	Water allocation Flood frequency analysis Environment flow Aquatic ecosystem health assessment Water quality assessment	DWLBC	EPA, NRMB, SA Water	BoM, PIRSA, DEH
	Sub-catchment streamflow	Environment flow Aquatic ecosystem health assessment Water quality assessment	NRMB	DWLBC, EPA, SA Water	BoM, PIRSA, DEH
	Reservoir weir in/out flow	Reservoir operation	SA Water	NRMB, DWLBC	EPA, BoM
	Reservoir/ weir capacity	Reservoir operation	SA Water	NRMB, DWLBC	EPA, BoM
	Evapo-transpiration	Catchment hydrological model	BoM	DWLBC, NRMB, SA Water	EPA, DEH
	Storm water	Additional water supplies Aquatic ecosystem health assessment Water quality assessment	NRMB	DWLBC, Local Councils, SA Water, EPA	DEH, BoM

Continued next page.

Classification	Parameter	Purposes	Lead Agency[1]	Collaborative Agency[2]	Interested Agency[3]
Water Availability (continued)	Effluent	Additional water supplies Receiving water body ecosystem health assessment Water quality assessment	SA Water	EPA, NRMB, Local Councils, DWLBC	DEH
	Soil moisture	Catchment hydrological model	PIRSA	DWLBC, NRMB	EPA, DEH
	Groundwater level	Water allocation Environment flow Groundwater dependent ecosystem health assessment Water quality assessment Dryland salinity management Surface/groundwater relationships	DWLBC	EPA, NRMB, PIRSA, SA Water	DEH
	Climate change	All aspects of natural resources management	BoM	PIRSA, DWLBC, DEH, EPA, NRMB, SA Water	
Water Withdrawal	Extraction	Water allocation Environmental flow Catchment water budget	DWLBC	SA Water, NRMB	EPA, DEH
	Water use	Water allocation Environmental flow Efficient use of water resources Catchment water budget	NRMB	DWLBC, SA Water	EPA, DEH
	Farm dam	Catchment hydrological model Environmental flow	DWLBC	NRMB, PIRSA, EPA	SA Water, DEH
Return Flow	Irrigation drainage	Catchment hydrological model Environmental flow Salinity management	PIRSA	DWLBC, NRMB, SA Water, EPA	DEH
	Deep drainage	Dryland salinity management Groundwater quality assessment	PIRSA	DWLBC, NRMB	EPA

Continued next page.

Classification	Parameter	Purposes	Lead Agency[1]	Collaborative Agency[2]	Interested Agency[3]
Water Quality	Pesticides, organics, metals, nutrients, DO, pH, turbidity, temperature, structure of aquatic communities, habitat, macroinvertebrates, Indicator bacteria, others	Classify water quality Trend analysis Pollution incident report Assessment of water quality standards Identify emerging problems	EPA	DWLBC, NRMB, SA Water	DEH, PIRSA
	Salinity (surface and groundwater)	Water quality assessment Evaluation salt interception schemes Dryland salinity management	DWLBC	EPA, NRMB, PIRSA, SA Water	DEH
Aquatic Ecosystems (inland)	Water regime Water quality Biological integrity	Environmental value assessment Ecosystem health assessment Environmental flow Surface/groundwater interaction	DWLBC	EPA, NRMB, DEH	PIRSA
Aquatic Ecosystems (marine)	Water quality Biological integrity	Ecosystem health assessment Environmental value assessment Aquaculture based monitoring	DEH PIRSA	DWLBC, EPA, NRMB	PIRSA DWLBC, EPA

Note

1. Lead agency: under legislative mandate, and is responsible for
   - Developing monitoring strategy, plan, and protocols
   - Data custodian, and supervising data quality assurance
   - Supporting monitoring undertaken by other parties.
2. Collaborative agency: Need information for business operation, contribute to monitoring through joint funding, advise and consultation, etc.
3. Interested agency: it is in the interest of the organisation that monitoring is undertaken.

4 CURRENT MONITORING SYSTEMS

4.1 MONITORING METHODS EMPLOYED

4.1.1 Surface Water Quantity

DWLBC is the State agency primarily responsible for collecting, archiving, analysing, and sharing data on surface water quantity, which includes availability and use. In particular, DWLBC is the main collector of streamflow data, which measures the volume of water flowing through a stream using stream gauges. The stream gauge continuously measures the water level, from which flows of rivers and streams are calculated. The South Australian Government maintains a network of hydrometric stations across the State (as per HYDSTRA, October 2005). These data are made available to the public through the Surface Water Archive accessible from the Internet (http://e-nrims.dwlbc.sa.gov.au/swa/mapindex.htm). Data collected by other agencies such as SA Water and the CWMB (the EPCWMB currently has no gauges) is stored in the HYDSTRA data management and reporting system which is maintained by DWLBC.

The stream gauging stations include a range of in stream structures designed to channel streamflow, or discharge in a manner that produces a relationship between water level and discharge. The stations are equipped with electronic sensors and data loggers (Figure 5). By electronically recording continuous water level at these structures a mathematical relationship of stage or water level versus flow can be used to calculate discharge.

Figure 5. Photos (from left to right) show a stream gauging station on the Tod River (AW512500), an underwater sensor, and data logger.

According to business requirements DWLBC has classified the stream gauging stations into six types (see Appendix A). Each station type has been assigned a priority level, has its unique purposes, and minimum parameter requirements.

4.1.2 Surface Water Quality

The EPA is responsible for assessing the condition of surface waters on a Statewide basis in accordance with the *Environment Protection Act SA 1993*. The EPA conducts an

Ambient Water Quality Monitoring Program (AWQMP) which has four sub-programs: the Rivers and Streams Program, the Marine and Estuarine Program, the Inland Waters (Lakes) Program, and the Groundwater Program. These programs are designed to:

- Provide a qualitative and quantitative assessment of South Australia's surface water quality
- Determine statistically significant changes or trends in the key characteristics of water quality
- Provide data to assess the long-term ecological sustainability of development of surface waters.

The parameters monitored in these programs can be classified as physical, chemical or biological. The choice of water quality parameters is based on those required to support the designated environmental values of the targeted water body. Guidelines for these water quality parameters are provided by the *Australian Guidelines for Fresh and Marine Waters* and the *Australian Guidelines for the Recreational Use of Water* (ANZECC and ARMCANZ, 2000).

Physical parameters measured include turbidity, electrical conductivity (EC, a measure of salinity), and temperature. Chemical parameters can be divided into pH and dissolved oxygen (DO), metals (total Cu, Pb, Ni, Hg, Zn and Cd) and nutrients (NOx, NH_3, TKN, total P,). Biological parameters include an estimate of algal biomass (*Chlorophyll a*), microbiological parameters (faecal coliforms, *Escherichia coli*, faecal streptococci and enterococci, with the EPA currently sampling for *E. coli* in SA), and macroinvertebrates. Some of these parameters (e.g. DO, EC, temperature and pH) are measured in the field when samples are taken, whilst others are analysed at laboratories which are accredited by the National Accreditation and Testing Authority (NATA), such as the AWQC. The macroinvertebrate sampling is consistent with AusRivAS methodology (Section 4.3.4).

Salinity is the current focus of DWLBC surface water quality monitoring. Water salinity is monitored at many hydrometric streamflow gauging stations using EC probes which continuously measure EC and temperature. Moreover, DWLBC can also establish and operate automatic water quality samplers designed to collect data on nutrients, pesticides and pathogens entering SA Water's urban supply reservoirs.

4.1.3 Groundwater

Fluctuations in groundwater levels reflect changes in groundwater storage within aquifers. Two main types of fluctuation can be identified: long-term such as that caused by persistent pumping and/or climatic changes in natural replenishment; and short-term such as that caused by the effects of brief periods of intermittent pumping and/or tidal and barometric changes. Since groundwater levels generally respond relatively slowly to external changes, continuous records from water level recorders are often not necessary. Systematic observations at fixed time intervals are considered adequate for the purposes of most monitoring networks. Where fluctuations are rapid, a continuous record is desirable, at least until the nature of such fluctuations has been identified.

Groundwater monitoring may be divided into the following three main stages:

1. Reconnaissance - with the objective of a preliminary appraisal of the available water resources (e.g. aquifer geometry).

2. General investigations - to obtain information for planning future urban, industrial, and agricultural development (e.g. groundwater flow processes and water budget).
3. Intensive studies of the aquifer(s) (e.g. groundwater recharge rate). This stage of monitoring requires the greatest effort and is necessary for areas of present or potential intensive development.

During each stage of the groundwater investigation information required includes:

- Spatial and temporal variations of the piezometric heads resulting from natural processes and human influence
- Hydraulic constants of the aquifer
- Geometry of the aquifers and aquicludes
- Rates of natural replenishment and outflow
- Rates of abstraction and artificial recharge
- Water quality.

Data on water levels and water quality are obtained from measurements at observation wells and the analysis of groundwater samples. Observation wells are either existing wells carefully selected from those already drilled in the area, or are drilled and specially constructed for the purposes of the particular study. One of the main costs of groundwater studies is the drilling of observation wells, hence it is beneficial to select existing wells wherever possible and incorporate these into the observation network.

In SA monitoring wells have been established to monitor trends in groundwater and/or salinity levels for all areas of the State by a variety of organisations. By law all wells require the issuing of a permit from DWLBC, and details from the drilling operation are submitted as a condition of the permit. This data is then recorded in the SA Geodata database. Observation wells used for monitoring purposes are grouped together into 'networks' that delineate a region in the State, a particular organisation carrying out the monitoring, or a specific aquifer. The Obswell searchable interface is linked to the SA Geodata database and provides access to monitoring well information. Information on the networks and individual wells associated with each of these networks is available on the Obswell website: http://applications01.pirsa.sa.gov.au:102/new/obsWell/MainMenu/menu. Water level and salinity monitoring data is available for users to view and download free of charge. Elevation data, well coordinates, and well construction details are also available.

Wells are read periodically at intervals particular to the well or network. In theory, any organisation that maintains and reads monitoring well data provides the information to DWLBC for entry into the State database. The formality of agreements and timeframes for forwarding information to DWLBC for entry into the State database (SA Geodata) vary. For example, some information is forwarded immediately after wells are actually read, whilst other information is collated and results are forwarded periodically (e.g. on an annual basis).

The major Obswell monitoring networks throughout the region are listed in Section 6.1.1.

4.1.4 Aquatic Ecosystems

AusRivAS

The Australian River Assessment System (AusRivAS) is a rapid prediction system used to assess the biological health of Australian rivers. AusRivAS was developed under the

National River Health Program (NRHP) by the Commonwealth Government in 1994 in response to growing concern for maintaining ecological values in Australia.

AusRivAS has two streams - bioassessment and physical assessment. These correspond with rapid biological assessment protocols and rapid geomorphic, physical and chemical assessment protocols, respectively.

Bioassessment requires data obtained by the sampling of macroinvertebrate communities from the basic habitat types (riffles and edges). Representative samples are identified to species level where possible and physico-chemical characteristics of the site are also measured. The model works by evaluating the measurements of physical and chemical parameters and predicting which species might be present given the conditions identified. A ratio of observed to expected species present gives an indication as to the ecological condition of the site in question.

4.1.5 Community Monitoring

Waterwatch

This program is largely education based monitoring and community capacity building. The Government resourced and community based Waterwatch program incorporates sites throughout the State. School or community groups and individuals are encouraged to adopt sites for regular surveys. Participants are encouraged to sample quarterly, although more or less frequent or irregular sampling may occur depending on interest and availability.

Physical and chemical parameters (including turbidity, phosphorus and nitrogen concentration, pH, temperature and salinity) are measured to produce a pollution index. Macroinvertebrates are sampled to provide an overall species diversity score.

Frog Census

This program is also community based and is currently coordinated by DEH (previously by EPA). The protocol involves the identification of frog species present by identifying their calls. Tape recordings of frog calls are made by volunteers during the second week of September each year and returned for analysis along with site details. Whilst the Census is not quantitative, information on the distribution and abundance of frogs in South Australia can be gleaned.

5 CURRENT SURFACE WATER MONITORING

5.1 WATER QUANTITY

Water quantity data are increasingly important as pressure on existing water supplies continues to grow. Much as debits, credits, and savings in a financial budget need to be quantified to maintain fiscal responsibility, the region's water availability, supply and use need to be comprehensively quantified to ensure sustainable water resource management.

Changes in climate, and to some degree variations in urban growth patterns, agricultural practices, and energy needs, result in fluctuating water demands annually and regionally.

Information on and knowledge of water availability and withdrawal, and the distribution and variability in space and time of these fundamental parameters is an essential prerequisite for a number of activities. These range from the forecasting of floods to the management of water resources and assessment of the potential climate change impacts. The collection and continuous supply of reliable and timely data as well as the establishment and maintenance of historical data sets are basic information requirements for planning and management purposes.

Streamflow gauging stations, rainfall observation stations and evaporation observation stations operated by DWLBC, SA Water and BoM form the water quantity monitoring network in the EP region. Information about these stations including locations, monitoring parameters and data management are described in this Section.

5.1.1 Current Stream Gauging Stations

There is no significant surface water resource in the EP region other than the Tod River catchment. As a result all four current stream gauging stations are located within the Tod River catchment. The locations of individual hydrometric stations are presented in Figure 6. Table 6 shows the details of site operation such as ownership, funding body, and period of record.

The stream gauging network is a vital decision support system in which streamflow related data are collected at the gauges, validated and processed, transferred to a data collection center and placed in a database managed by DWLBC. Information from the database is publicly available via the Internet and also in printed form. The stream gauging network represents an extensive data collection, data storage and management, and information distribution system that supports many information and assessment needs for environmental management purposes, as well as modelling, model calibration, and research.

5.1.2 Water Use Information

A combination of groundwater and surface water provide the source for water use activities on EP. All reticulated water supplies are sourced from these groundwater resources. Total consumption is measured by SA Water's water supply master meters and consumer meters. Apart from SA Water's metered water consumption, information on surface water use is not available.

5.1.3 Rainfall Monitoring

BoM maintains and operates an extensive nation-wide network of rain gauges and pluviometers which are read daily. Figure 7 shows the locations of the BoM network in the EP region. BoM has a total of 98 daily observation sites in the region, of which ten also include pluviometers that can measure rainfall intensity continuously. Furthermore, there are eight Automatic Weather Stations (AWS) in the Peninsula. The AWS's are designed to serve the dual purposes of providing real-time data for the BoM's forecasting, warning and information services, as well as high quality data for the BoM's climate database. In addition, BoM's Hydrological Services Program combines its own data together with the State's stream gauge data to forecast water supplies and floods.

DWLBC and SA Water also carry out meteorological monitoring for their own purposes (refer to Figure 5). DWLBC runs two pluviometers (AW512507 and AW512508) within the Tod River catchment and seven within the Southern Basins (Figure 8). SA Water runs a meteorological station (AW512506) paired with its dam gauge (AW512510) for reservoir operation. The collected rainfall intensity data will be used for groundwater recharge studies.

5.1.4 Evaporation Monitoring

BoM and SA Water are the only two agencies currently collecting evaporation information in the EP (Table 7). BoM has historically operated six daily evaporation monitoring sites (Figure 7), however three have been closed. Two of the current stations (M018012 Ceduna AMO and M018120 Whyalla Aero) are automated weather stations and can measure evaporation rate continuously. SA Water's evaporation pan site at Tod Reservoir has been operating since 1967. At the same site evaporation data was collected from January 1933 to December 1969 using differing types of sunken tanks. The collected data together with the water level data collected by a nearby gauge (AW512510) are used to estimate the water balance of the reservoir.

Figure 6.
The Current and Historic Surface Water Quality and Quantity Monitoring Sites

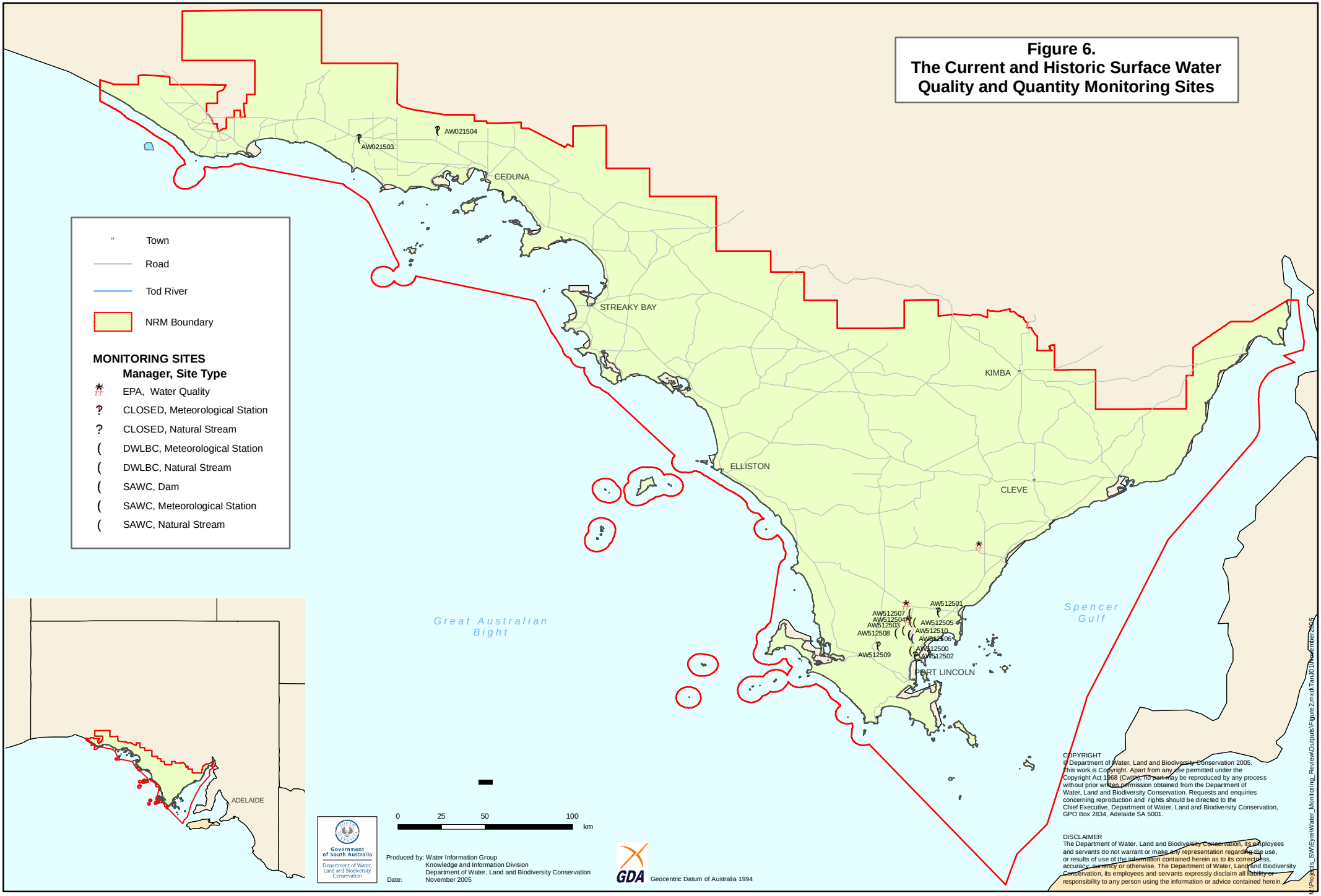


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Table 6. Current and historic stream gauging stations in the EPNRM region.

Site No.	Name	Start	End	Type*	DWLBC category**	Custodian	Funding
AW021503	Penong roaded catchment pluvio at Penong	06/07/1990	07/01/1991	WS/MET	Project	DWLBC	Closed
AW021504	Koonibba catchment pluvio at Koonibba tanks	06/06/1990	07/01/1991	WS/MET	Project	DWLBC	Closed
AW512500	Tod River at 5 km NW of Poonindie	02/18/1972	-	NS	Base	DWLBC	DWLBC
AW512501	Coonta Creek at 9 km west of Tumby Bay	01/01/1936	01/01/1944	NS	Unknown	DWLBC	Closed
AW512502	Fountain springs	01/01/1935	01/01/1955	NS	Unknown	DWLBC	Closed
AW512503	Toolillie Gully at upstream of Tod Reservoir	07/03/1991	-	NS	Project	DWLBC	SA Water
AW512504	Tod River at diversion weir	11/06/1991	-	WS/NS	System	DWLBC	SA Water
AW512505	Pillaworta Creek at diversion weir	08/30/1991	-	WS/NS	System	DWLBC	SA Water
AW512506	Tod Reservoir meteorological station	12/31/1967	-	MET		SA Water	SA Water
AW512507	Tod River catchment pluvio at Kopulta well	07/03/1991	-	MET		DWLBC	DWLBC
AW512508	Toolillie catchment pluvio at Toolillie	07/04/1991	-	MET		DWLBC	DWLBC
AW512509	Popes Creek at Wanilla	12/05/1993	07/28/1999	NS	Project	DWLBC	PIRSA
AW512510	Tod Reservoir	01/01/1922	-	DAM	System	DWLBC	SA Water

* WS: Water Supply; NS: Natural Stream; WS: Water Supply Systems; MET: Meteorological station.

** See Appendix A for further details on DWLBC's category definitions.

Table 7. Evaporation monitoring in the EPNRM region.

Station name	Number	Agency	Open date	Close date
Tod Reservoir meteorological station	AW512506*	SA Water	12/31/1933	-
Ceduna AMO**	18012	BoM	01/02/1968	-
Polda (Gum View)	18139	BoM	01/11/1967	-
Kyancutta	18044	BoM	01/11/1930	01/01/1958
Minnipa Agricultural Centre	18052	BoM	01/01/1965	30/06/2001
Whyalla Aero	18120	BoM	01/12/1993	-

* BoM site (M018181) started evaporation monitoring in January 1968 and closed in December 1996.

** AMO: Airport Meteorological Office.

Figure 7.
BOM's Historic and Current Meteorological Monitoring Network

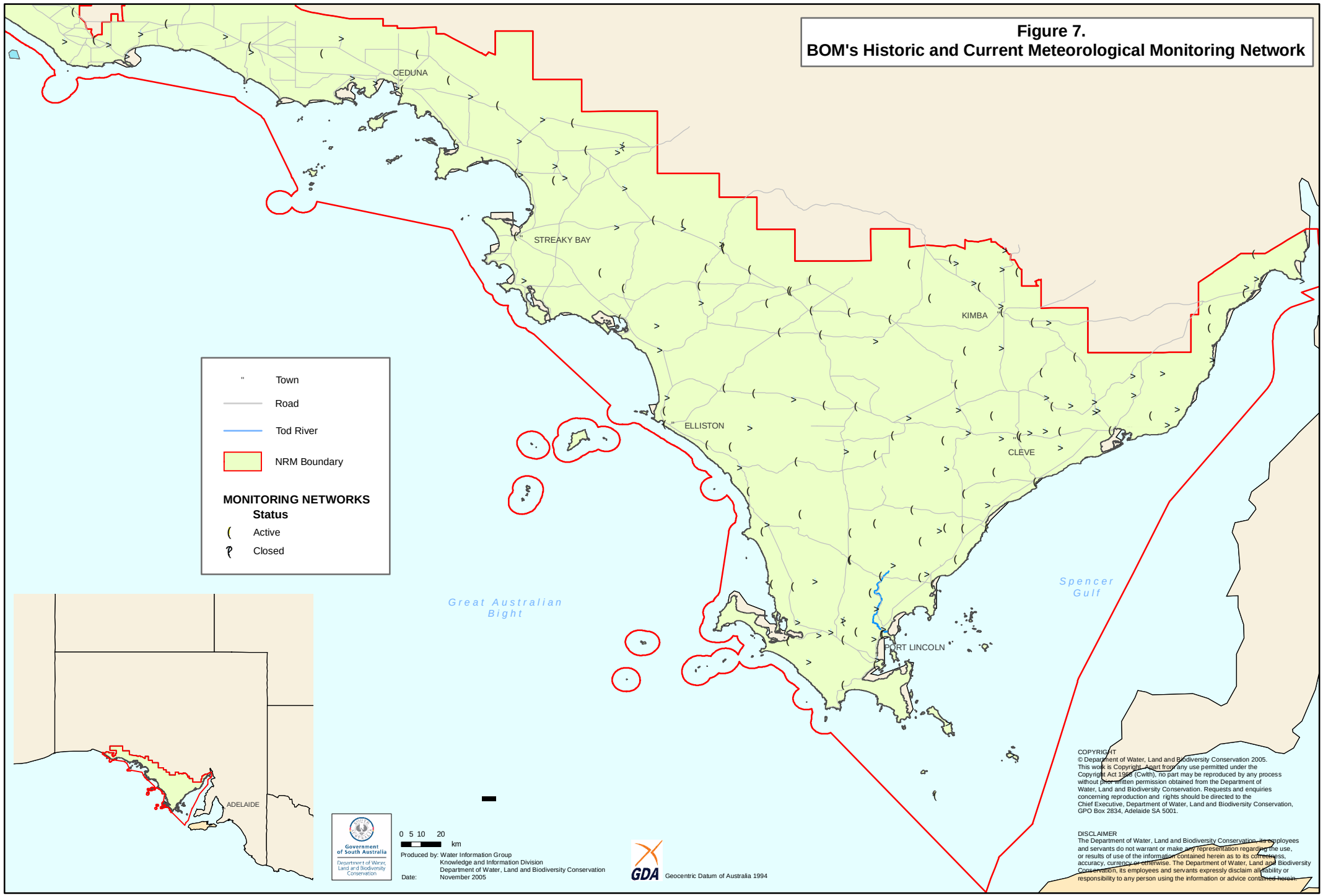
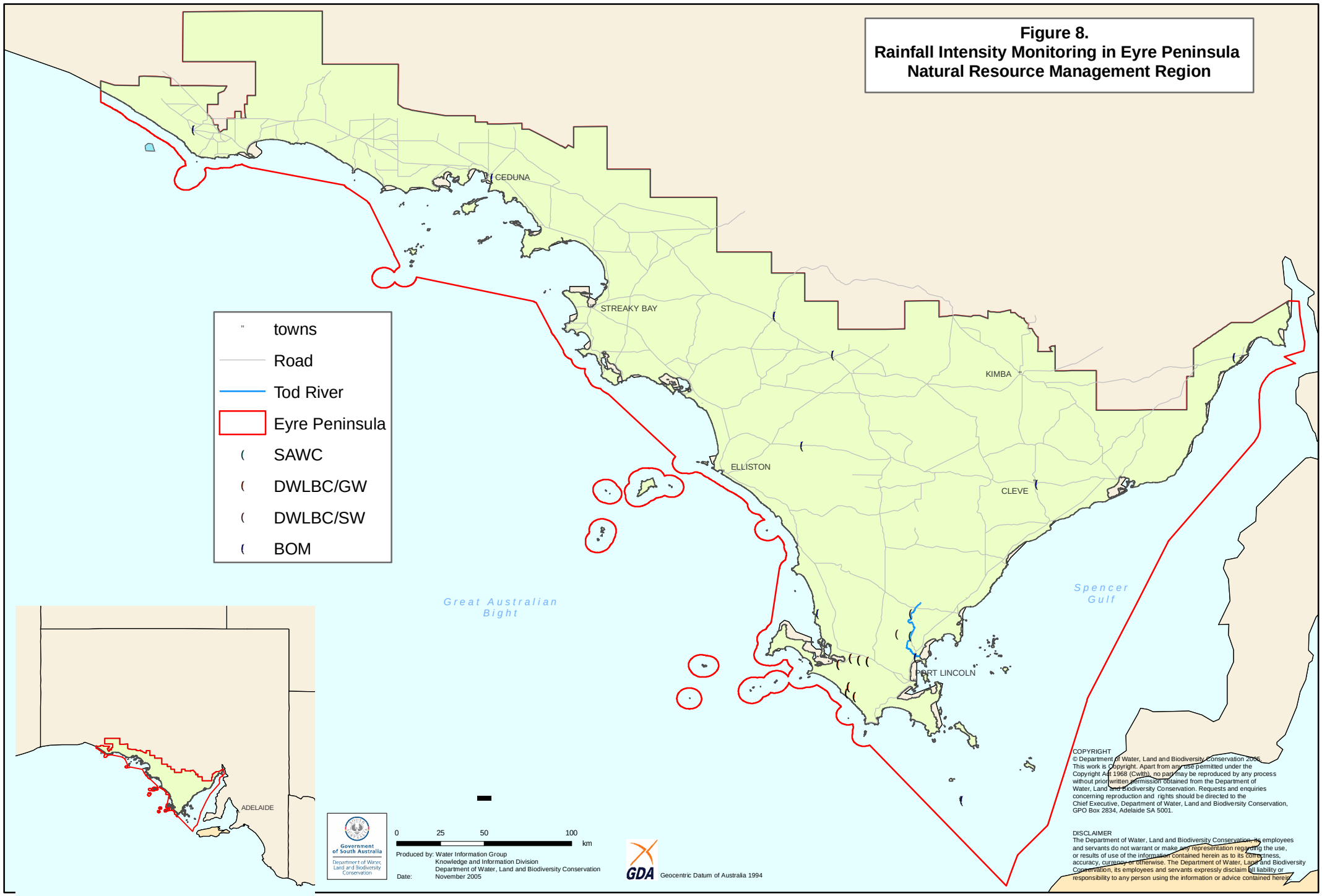


Figure 8.
Rainfall Intensity Monitoring in Eyre Peninsula Natural Resource Management Region



5.2 WATER QUALITY

Data gathered through water quality monitoring is critical to making scientifically based determinations about the status of water resources, the extent of water quality impairments and appropriate solutions. For example, a monitoring program might be able to demonstrate a relationship between changes in land management and the frequency of algal blooms in a catchment.

Basic Statewide water quality monitoring activities in SA are primarily conducted by two agencies. The EPA's water quality monitoring programs principally address ambient water quality and regulatory issues (e.g. permit compliance, modelling and evaluation of water quality standards). Programs run by DWLBC principally concentrate on salinity and aquatic resource issues. Within the EP region both EPA and DWLBC have ongoing water quality monitoring programs, but respective program goals are designed to address specific agency responsibilities.

5.2.1 Ambient Water Quality Monitoring - EPA

In 2003 the EPA expanded the coverage and parameters of its Ambient Water Quality Monitoring Program (AWQMP). It has four sub-programs, namely: Rivers and Streams, Marine and Estuarine, Inland Waters (lakes), and Groundwater. Within the EP region three fixed stream monitoring sites have been established (Table 8, Figure 6). The AusRivAS methodology (described below) was followed for macroinvertebrate sampling and recording. The Marine and Estuarine Monitoring Program includes three sites in Coffin Bay, six sites in Boston Bay, and three sites in Venus Bay (Table 9). Of the three bays Boston Bay has been monitored since 1997 in an effort to examine and establish the cumulative impacts of aquaculture and urban discharges.

Table 8. EPA Ambient Water Quality (Rivers and Streams) Monitoring in the EPNRM region from 2003.

Site Name	Category	Parameters	Frequency
Dutton River	Chemical	NO_x, DO, pH, TKN, soluble P, total P, DOC	Monthly
	Physical	EC, turbidity, temperature	Monthly
	Biological	Macroinvertebrates	Biannually
Tod River: Koppio	Chemical	NO_x, DO, pH, TKN, soluble P, total P, DOC	Monthly
	Physical	EC, turbidity, temperature	Monthly
	Biological	Macroinvertebrates	Biannually
Tod River: White Flat	Chemical	NO_x, DO, pH, TKN, soluble P, total P, DOC	Monthly
	Physical	EC, turbidity, temperature	Monthly
	Biological	Macroinvertebrates	Biannually

1. Macroinvertebrate monitoring sites may slightly differ from chemical monitoring sites.
2. Monitoring methods include laboratory analysis and field data logging of DO, EC, pH and temperature.

Table 9. EPA Marine and Estuarine Monitoring Program in the EPNRM region from 2003.

Location	No. of Sites	Sampling Frequency	Phys-Chem Parameters
Boston Bay	6	Monthly	Chemical, micro
Coffin Bay	3	Monthly	Chemical
Venus Bay	3	Monthly	Chemical, soluble P

1. Chemical parameters refer specifically to:
   - laboratory analysis of NO_x, NH_3, TKN, total P, *Chlorophyll a* and turbidity
   - field measurement of DO, EC and temperature (at locations sampled by AWQC)
2. 'Micro' refers specifically to enterococci and *E. coli.*

5.2.2 Tuna Environmental Monitoring Program (TEMP) – PIRSA

The State's aquaculture industry is concentrated in the EP region. The Eyre Peninsula fishing industry is dominated by tuna farming, with tuna farms being the source of more than 90% of the total output of aquaculture in EP in 2002/03 (EconSearch, 2004).

A large scale tuna fish kill occurred in an aquaculture operation in Boston Bay near Port Lincoln in 1996 resulting in the loss of approximately 1,700 tonnes of tuna valued at $40 million. Although the State Government authority concluded that the cause of the event was asphyxiation caused by sediment stirred up by a storm (Clarke, 1996), there are varying opinions about the actual cause. The event highlighted the need for research and environmental monitoring to understand the impacts of fish farming on marine and coastal waters.

A regional Tuna Environmental Monitoring Program (TEMP) was initiated in 1996. In 2001, TEMP was replaced by a farm site compliance based monitoring program with the same name under the requirements of the *Aquaculture Act SA 2001*. The annual monitoring reports of each tuna farming company can be found through various sources including: the Tuna Boat Owners Association of South Australia (TBOASA); PIRSA Aquaculture; the Office of Coast and Marine (DEH); and the South Australia Research and Development Institute (SARDI) Aquatic Sciences Library. The reports are also accessible through the SARDI website:http://www.sardi.sa.gov.au/pages/sbt/public/environmental_monitoring/temp.htm:sectID=949&tempID=14 (accessed January 2006).

The current TEMP includes:

- A quantitative comparison between video recordings of two on-site transects and one off-site transect. The epibenthic macro-flora and fauna are enumerated and seafloor characteristics such as undulation and sand colour are compared.
- A quantitative comparison of the characteristics of benthic infaunal communities between potentially impacted and control locations. Infaunal abundance and the number of infaunal taxonomic groups found in benthic sediment samples are compared.
- A quantitative comparison of particle size between potentially impacted and control sites.

Quantitative data are used to determine whether there are unacceptable (i.e. non-compliant) differences in the types and abundances of taxonomic groups between control and compliance sites. Non-compliance is defined as a change in the infaunal benthic community, equating to either a four-fold or greater increase in average infaunal group

abundance, or a 50% reduction in the average number of infaunal taxonomic groups, relative to controls.

The TEMP in this form is being undertaken annually by SARDI as a consultancy to the TBOASA on an ongoing basis.

5.2.3 South Australian Shellfish Quality Assurance Program (SASQAP): PIRSA

SASQAP is a joint initiative of the shellfish industries and PIRSA. The program is administered by PIRSA but funded predominantly by the farmed oysters and mussel industries.

SASQAP is a quality assurance program for South Australian farmed shellfish. In achieving this function it also seeks to ensure the sustainable development of a shellfish industry capable of exporting shellfish to any country. All molluscan shellfish farmed in South Australia must meet the strict requirements of SASQAP. Central among these requirements is the classification of the growing area which may take up to two years and involves a detailed shoreline survey of all real or potential pollution sources in the catchment area.

The program has two components for water quality monitoring:

1. Microbiological monitoring: testing for total coliforms, faecal coliforms and *E. Coli*.
2. Biotoxin monitoring: toxic phytoplankton enumeration.

The frequency of monitoring depends upon the purpose of collection (e.g. microbial versus algal monitoring) and the classification status. Usually six microbiology water samples are collected from four to nine sampling sites for each harvesting area per year. Some harvesting areas where adverse conditions pose a risk are sampled 12-15 times per year. Algal water samples are taken every fortnight for the period of October through to May as this coincides with higher water temperatures, and there is therefore a greater probability of detecting a bloom event. Samples are collected monthly outside of this time frame.

SASQAP covers all the shellfish growing areas in the EP: Denial Bay, Smoky Bay, Coffin Bay, Port Lincoln, Louth Bay, Franklin Harbour, and Streaky Bay. The monitoring reports can be accessed though the PIRSA website at: http://www.pir.sa.gov.au/pages/aquaculture/sasqap/sasqap_phyto.htm:sectID=118andtempID=1 (accessed January 2006).

5.2.4 AusRivAS Program

Since 1994 scientists from EPA and AWQC have been assessing the ecological health of rivers and streams throughout South Australia. As part of this work 26 sites on Eyre Peninsula have been assessed (Figure 9). There are no data available for one of these sites (Ponto Creek) probably because there was no surface water present during sampling. Most of the field surveys were completed in 1997 and 1998.

Aside from macroinvertebrate registration, the survey covered a wide range of features of the investigated streams including surrounding land use, sediment, habitat features (e.g. stream depth, width, riparian vegetation and bank stability), macrophytes (floating, submergent and emergent), water column (chemical, physical and biological parameters), and substrate composites. AusRivAS presents the most comprehensive biological dataset

for the EP region considering the geographic coverage, parameter range, and data presentation methodologies. Details of the AusRivAS program including sampling site selection, parameters measured, and field survey techniques and laboratory analysis methods can be found at http://ausrivas.canberra.edu.au/ (accessed January 2006).

5.2.5 Salinity and Water Quality Monitoring - DWLBC

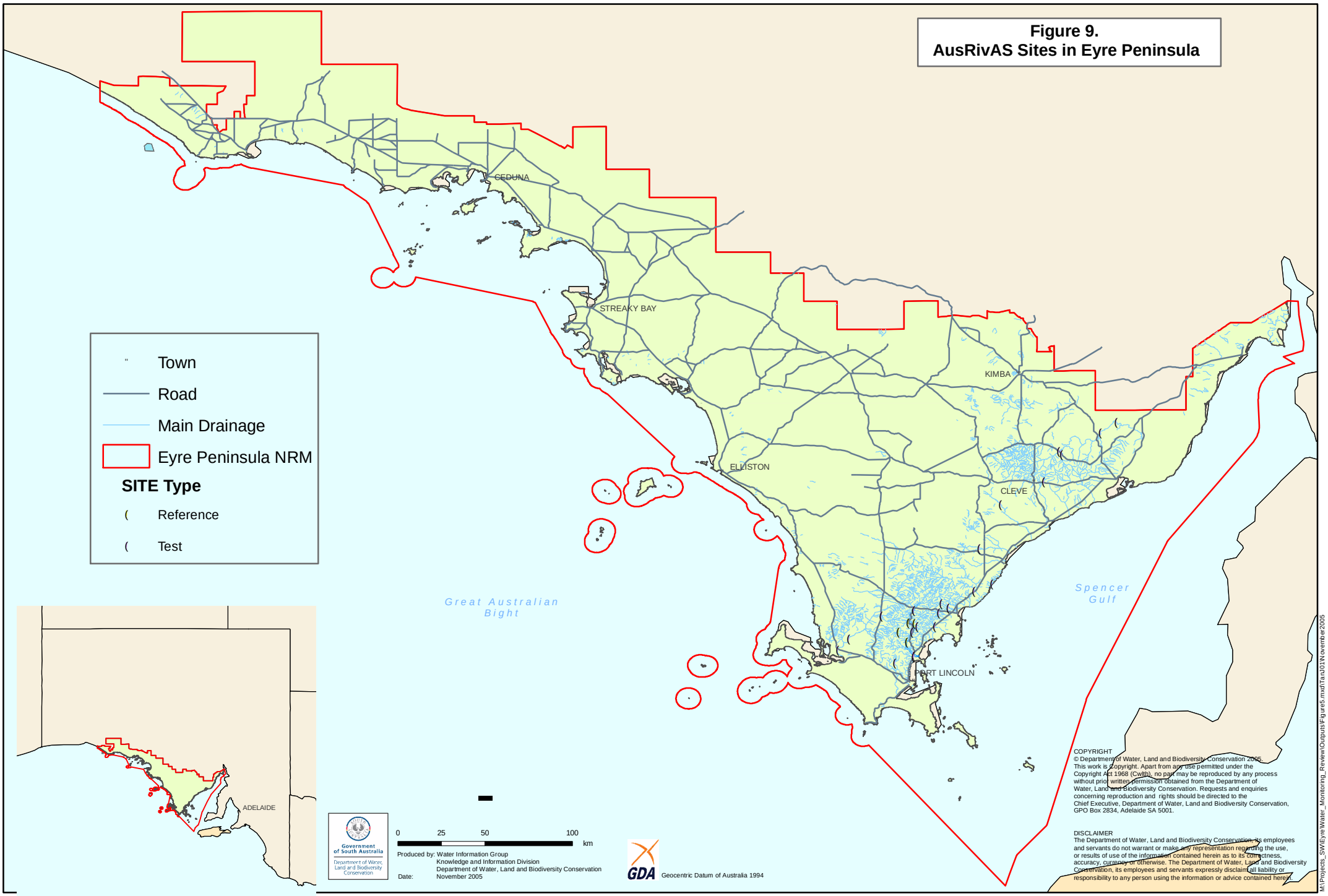
Ongoing and regular salinity monitoring occurs only in the Tod River catchment. Current gauges are all equipped with EC and temperature probes to record EC and temperature. In addition, the gauge station installed at the Tod Reservoir dam (AW512510), run by SA Water since the 1920s, records the daily EC. The EC readings are used for controlling flows into the reservoir.

5.3 GAPS AND OVERLAPS IN MONITORING

5.3.1 Meteorological Monitoring

BoM's precipitation observation network in EP is considered adequate for its designed objectives, such as the monitoring of seasonal climate patterns and the provision of flood warning. However, rainfall data is also frequently used to model both surface water and groundwater responses which require a higher degree of data reliability and accuracy. Mainly for convenience of access, the current BoM network tends to be concentrated in populated regions or communication routes (e.g. road rail) that are in conflict with hydrologically significant regions of high elevation and steep topography (refer to Figures 7 and 8). Consequently, the daily rainfall observation is biased towards the lower, flatter regions and is not well suited to the estimation of total catchment rainfall, particularly in the Tod River catchment. The current rainfall gauges operated by DWLBC (AW512507, AW512508) and SA water (AW512506) in the Tod River catchment are also inadequate for detailed catchment scale studies (Murdoch, written comm., 2005,).

Figure 9.
AusRivAS Sites in Eyre Peninsula



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5.3.2 Stream Gauging Network

To effectively address the multiple water resources management goals in the EP region (e.g. those outlined in the *State Water Plan 2000*, *State Natural Resources Management Plan 2006*, *Eyre Peninsula NRM Plan 2004-2007*, and draft *EPCWMB Plan 2005*) an adequate stream gauging network would need to include:

- Gauges that represent most of the region's major catchments. Issues to be considered include land use type, catchment size, physiography and geology. In particular, the stream gauging network would:
    - Monitor extraction points for regulation.
    - Monitor inflow to receiving water bodies of significant environmental values.
    - Monitor flow in relation to environmental water requirements (EWR's).
    - Monitor flow in relation to water quality issues which may have potentially devastating consequences for commercial industry downstream. For example, nutrients and bacteria levels in Lake Wangary are high due to unrestricted cattle grazing. The lake overflows annually and in its path towards the sea the stream becomes braided and soaks into the soil. However, during flood of significant scale (e.g. once in 100 years) the flow can reach Coffin Bay and have the potential to cause significant economic loss.
    - Monitor flow of stormwater and effluent.
    - Monitor flow in relation to recharge of groundwater and/or surface/groundwater interaction. For example, flows have been reducing in Big and Little Swamps which are an important component of the groundwater basin in this area.
- Gauges that are stable for an extended period of time (ten years or more).
- Gauges that are stable in our time frame intended to measure the effects of climate change.

Despite institutional changes shifts in emphasis of responsibility within Governmental organisations and changes of funding sources, the primary focus of the stream gauging network in SA remains on water supply and to lesser extent water quality (mainly salinity). This is also the case for the gauging network in the EP, the main purpose of which is the operation of the Tod Reservoir.

Aside from the water resource assessment and management purposes of the network however, the data generated is widely needed and used for drought and flood management, investigation of surface water/groundwater interaction, water pollution control, aquatic habitat protection, recreation, and so forth. In this sense, data and information could be misinterpreted when agencies with contemporary environmental roles (e.g. NRMB's) try to extract information from the network for which it is not designed.

These issues are addressed in more detail below.

Operational Data

Although stream gauging data have many applications and many users, the continuous operation of stream gauges has significantly fluctuated from year to year mainly due to shifting financial support. As a result, stream gauges with long-term periods of record are discontinued or have breaks in the systematic record (Figure 10).

Generally, current monitoring of flow cannot meet the acceptable level of accuracy required for surface water resources assessment. This is because the accuracy with which the statistics can be quoted for a given hydrologic parameter decreases with increasing variability of that parameter. The high hydrologic variability, driven by uneven rainfall in the EP region, means that long records are required to meet accuracy standards.

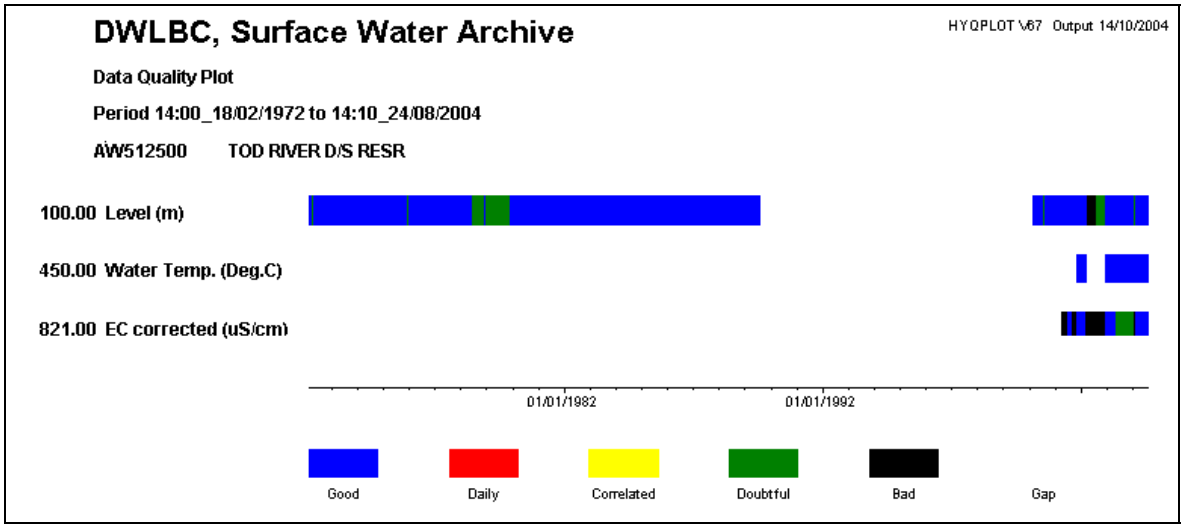


Figure 10. Stream gauging data quality, showing the water level recording break between 1989 and 2000 due to the site being closed, and high percentage of bad data. *(Source: Surface Water Archive).*

The station AW512500 (established in 1972) for example, is serving as DWLBC's base station with the highest priority in the EP region, nevertheless, the record has a large gap between 1989 and 2000 as the site was closed for this period due to lack of financial support. The other three gauges, as system inflow/outflow stations for the Tod Reservoir, also have a high percentage of bad data, as well as shorter recording periods. Consequently, water resource assessment in the Tod River catchment is based on data which were collected before 1989 (e.g. draft *EP Catchment Water Management Plan 2005*, p24). There is another example, when the EPA conducted a project called River Management Plan for the Tod River catchment in 2002, the catchment hydrological assessment was based on model-generated data (Rixon et. al, 2002) because of the shortage of available monitored data.

Spatial Coverage

To effectively address water resources management goals, the stream gauging network must have adequate spatial distribution (physiographic/geologic diversity), represent catchments of various sizes, and include major land use categories.

Stream gauging coverage based on drainage basin is presently satisfactory due to the relatively homogeneous physiography of the EP (the natural variability is insignificant), and the dominance of agricultural production as the main land use (e.g. cropping and livestock grazing) in the area.

However, analysis clearly indicates that there are gaps in spatial coverage from the perspective of gauged and ungauged basins (Table 10). Firstly, there is no gauging station outside the Tod River catchment. No gauge represents the Gairdner and Spencer Gulf Basins. Secondly, although the Tod River is the only significant permanent river, there are thousands of kilometers of seasonal rivers and streams in the region. Generally, there are three types of stream habitat in the region:

1. Seasonal streamflow during autumn and spring (e.g. Pillaworta, Mine Creek, parts of Tod River and Salt Creek)
2. Seasonal flow in autumn and isolated pools in spring (e.g. Meadows Creek and Rock Valley Creek)
3. Still water pools in winter and autumn (e.g. Coonta, Yeldulknie, Minniribbie, Pokalalie and Millalee creeks and the Dutton River).

Resources assessment and estimation of nutrient and salt loadings may be inaccurate due to a lack of available information about these seasonal streams.

Regional coverage can be improved by prioritising and targeting currently ungauged catchments with denser drainage (e.g. catchments within the Spencer Gulf Basin), thereby increasing the percentage of drainage-area covered by stream gauges.

5.3.3 Surface Water Quality

The EP region lacks systematic and/or long-term ambient water quality monitoring, and there are significant gaps in the available data. For example:

- The composite water quality monitoring program carried out by DWLBC or PIRSA has not included the EP.
- Until 2003 the EPA's AWQMP did not include the EP.
- The EPA's River and Stream Survey Program measured a wide range of parameters in Dutton, Salt, and Tod Rivers. To what extent the data were used is unknown.
- There is insufficient information available on the impacts of aquaculture industry on marine and freshwater environments in the EP.

Salinity Monitoring Program - DWLBC

Surface water salinity monitoring is bound up with the stream gauging network. All of the four current ongoing stream gauges are equipped with EC/temperature probes.

As discussed in the previous section, there are large coverage gaps in the current stream gauging network with significant resources not represented. Surface water salinity monitoring is therefore also deficient, as there are no data available outside the Tod River catchment.

Table 10. **Spatial analysis of current stream gauging stations in Eyre Peninsula.** *(Land use data source: PIRSA 2001)*

Drainage Basin	Total Land Area (ha)	Drainage Length (km)	Land Use (%)		Approximate Gauged Land (ha)	% of Total Land Gauged
Eyre Peninsula	320,800	1,396	Crop	39.61	4000	12
			Park/Conservation[1]	23.29		
			Water bodies[2]	1.73		
			Livestock grazing	24.69		
			Modified pasture	7.68		
Gairdner	131,200	453	Crop	71.65	0	0
			Park/Conservation[1]	2.91		
			Water bodies[2]	10.11		
			Livestock grazing	9.82		
			Modified pasture	3.62		
Spencer Gulf	539,300	2,168	Crop	81.55	0	0
			Park/Conservation[1]	6.72		
			Water bodies[2]	8.92		
			Livestock grazing	8.16		
			Modified pasture	0.80		
Gairdner-other[3]	3,678,400	724	Crop	52.81	0	0
			Park/Conservation[1]	19.77		
			Water bodies[2]	0.82		
			Livestock grazing	15.91		
			Modified pasture	8.37		

1. Including National Parks, national feature protection areas, strict native reserves, and other reserve areas.
2. Including lakes, wetlands, streams, and reservoirs.
3. Areas within the EPNRM region but outside the current named catchment.

TEMP and SASQAP - PIRSA

TEMP is a comprehensive compliance monitoring program designed to assess whether the impacts of Tuna farming practices are within the pre-defined ranges by quantitatively comparing the compliance and control sites. These programs are based on the best available marine science, and provide a valuable water quality and biological data source.

The monitoring data to date indicates that the impact of tuna farms on water quality is low. The data also indicates that there is little impact on sediments directly beneath the farms.

The water monitoring part of SASQAP is designed to:

- determine actual microbial and biotoxin levels
- determine an appropriate classification for the growing area

- develop a Management Plan incorporating the adverse conditions that impact on the growing area when real pollution sources are discovered
- complete annual reviews of the growing area classification and management strategy
- respond to environmental events and disease outbreaks should they occur.

Coordination between these programs and EPA's AWQMP (Marine and Estuarine) or any future coastal monitoring program in EP could maximise the use of available data.

AWQMP Network - EPA

In 2003 the EPA expanded the Statewide AWQMP network to around 300 sites (including surface water and groundwater). The expanded network has three fixed sites in the EP (two are located at the Eyre Peninsula drainage basin and the other in Spencer Gulf Basin). Until that time, surface water quality information was chiefly extracted from the AusRivAS program, which surveyed 26 sites in the EP (*SoE 2003*, *Draft EP Water Catchment Plan 2005*).

The recently established ambient (stream) water quality monitoring network is adequate considering the relatively uniform landscape and land use patterns in the region. However, the review pinpointed one main issue associated with the program: monitoring sites are not paired with stream gauging stations, greatly limiting the applicability of collected data.

5.4 FUTURE DIRECTIONS: SURFACE WATER MONITORING

5.4.1 Establish new rain gauges at strategic sites to obtain unbiased rainfall pattern.

New rain gauges located at the lower, flatter regions would greatly improve the ability to estimate catchment rainfall, model catchment water balance, and investigate surface/groundwater relationships.

5.4.2 The objectives and focus of DWLBC's stream gauging network needs review.

As mentioned in section 5.3.2, the main focus of the stream gauging network is to monitor for water supply. Consequently, the stations in the EP are constrained within the Tod Catchment where the Tod Reservoir is located. However, the functions of contemporary natural resources management have advanced far beyond water supply. *The Natural Resources Management Act 2004* delegates the relevant agencies to:

- Assess the state and condition of the natural resources of the State
- Identify existing and future risks of damage to, or degradation of, the natural resources of the State
- Provide for monitoring and evaluating the state and condition of the natural resources of the State on an ongoing basis.

To efficiently carry out these functions, a comprehensive stream gauging network is needed to provide hydrologic information to define, use, and manage the region's water resources. Based on the preliminary analysis of the region's physiography, land use pattern, and drainage distribution, stream gauging coverage based on drainage basin is considered adequate for the region.

The following suggestions are therefore provided.

1. A higher degree of accuracy and reliability in the four existing gauges
2. Additional gauges within the Spencer Gulf Basin covering the seasonal streams and creeks
3. Water levels in important lakes and wetlands such as Lake Wangary, Big and Little Swamps to be recorded at least by simple water level loggers
4. A mechanism be created to ensure the long-term stability of the operation of the network to avoid data gaps
5. Mechanisms to be set up to ensure appropriate backup such that the network has minimal gaps and bad data.

5.4.3 Coordination is needed to enable monitoring programs to make better use of available resources.

Four State agencies (DWLBC, EPA, SA Water, PIRSA) and one Commonwealth agency (BoM) are currently conducting ongoing monitoring programs in the region. These programs vary in their strengths and focuses. For instance, while the BoM's daily rainfall observation network (including pluviometers) has the most comprehensive spatial coverage, the meteorological station (AW512506) operated by SA Water has the longest pan evaporation data.

Although the agencies are largely aware of the ongoing programs maintained and run by other groups, the design of individual agency's monitoring networks does not necessarily take other programs into consideration. The two key barriers to cooperative monitoring identified by this review are outlined below.

Organisations have diverse missions for water monitoring

The drives for organisations to monitor water resources vary widely (refer to Appendices C to G for stated missions). These lead to different data needs and priorities which may effect an organisation's ability and willingness to coordinate monitoring strategies and to share available data.

For example, the EPA's primary interest in water quality data arises from its responsibility to ensure that waters comply with the State's water quality standards. Accordingly, its monitoring approach generally focuses on determining whether certain thresholds are achieved or exceeded. The degree to which measurements are on one side or the other of these thresholds is generally of less consequence. On the other hand, DWLBC's monitoring program is orientated toward obtaining precise measurements of water quality and then tracking changes in these values over time (the status and trends). Accordingly, its monitoring techniques allow for the collection of specific measurements and hence tend to be more expensive. For example, the DWLBC's salinity and water quality monitoring program may use relatively expensive meters to measure water quality parameters such as temperature, DO, pH, and EC. These meters require more calibration and maintenance to ensure accuracy than the test kits used by others seeking to determine compliance with the State water quality standards.

Another example is the rainfall monitoring networks run by BoM and DWLBC. BoM and DWLBC monitor the same parameter for a different purpose. BoM measures rainfall to analyse the seasonal climate patterns and provide flood warning. DWLBC on the other hand, is concerned with evaluating the volume and distribution of rainfall events as they relate to the management and allocation of the consequential surface water resources

and groundwater recharge rates, which requires a higher degree of data reliability and accuracy.

Organisations often use inconsistent monitoring protocols.

When organisations differ in their overall approaches toward monitoring, the varying procedures they use to monitor may result in data that cannot be easily compared. However, as the AWQC is being contracted for laboratory analysis for water samples collected by various organisations, the real barrier originates from sampling protocols.

Within the EP region, the main concern arising during the review process has been the lack of connection between DWLBC's stream gauging network and the EPA's Ambient Surface Water Quality Monitoring Program (AWQMP). The spatial analysis of the two networks revealed that while the EPA's sites are situated in first or second order streams, DWLBC's gauges are located in higher order streams (third or fourth). This makes the inter-reference of the two datasets impossible, and largely limits the potential broader use of the collected information.

Ideally and theoretically, for stream and river monitoring, the water quality information needs to be associated with flow and/or water level data. The combination of quality and quantity data helps to address critical issues for integrated catchment management, including:

- Tracing pollutant movement within the catchment
- Identifying the source of pollutants
- Estimating pollutant loadings from the catchment
- Comprehending the environmental water requirements of aquatic ecosystems.

The following actions are needed to address the above issues:

1. Ensure sufficient resources and authority of the State Strategic Monitoring, Evaluation and Reporting Policy Group to guarantee the multiple use of monitoring data by:
    a. Establishing a 'clearing house' to identify who is collecting what type of data
    b. Developing clearly-defined and generally accepted Governmental metadata standards
    c. Preparing a geographically based reference compilation of monitoring sites to ensure every agency knows where monitoring is taking place.
2. The EPNRMB/CWMB, as the front line manager of the region's water resources and one of the major end users of information, contribute more to water monitoring by:
    a. Identifying data and information needs through the process of establishing regional Resource Condition Targets (RCT's) and Management Action Targets (MAT's)
    b. Recommending sampling sites
    c. Providing on-ground link and coordination of the State monitoring programs where there is no relevant State agencies (i.e. DWLBC, DEH, and EPA) present in the region

d. Funding monitoring programs that are of regional importance but not included in State monitoring frameworks

3. In the Tod River catchment, EPA's Ambient Surface Water Quality Monitoring Network matches with DWLBC's stream gauging network to maximise the use of collected information

4. When planning new stream gauges in the Spencer Gulf Drainage Basin, the EPA's site at the Dutton River and AusRivAS sampling sites are the highest priority.

5.4.4 Data collection, storage, and analysis and delivery needs further improvement.

The current monitoring programs are multi-dimensional and have become increasingly sophisticated over time. For example, the stream gauges deployed within the Tod River catchment are all equipped with EC and temperature probes that capture multiple parameters; and the ambient water quality program includes macroinvertebrate sampling and counting, which provide a comprehensive indication of the stream and river health. Even so, more needs to be done to enhance these programs, build partnerships to advance existing capacity and improve data storage and analysis.

The need for data to be stored so that it can be readily retrieved for analysis, evaluation, and integration with other information cannot be over-emphasised. Three databases are currently used to store water monitoring data: ADAM (BoM), HYSDTRA (DWLBC, SA Water, CWMB and AWQC), and the Environment Data Management System (EDMS) (EPA) database. In addition, some of data is kept as spreadsheets including data kept in electronic files (chiefly Microsoft Excel), floppy disks or CD-ROMs and hardcopy files.

One of the most important aspects of any water monitoring program is how data is analysed and used. An abundance of data can be collected but the information is not useful for reporting or decision making unless it is analysed and evaluated to determine what is occurring in the environment. Once the analysis is complete, the data, analytical reports, and related information need to be properly stored so that they are available to decision makers, stakeholders and public audiences.

Broader data sharing and integration among relevant government agencies is a priority and challenge. The following suggestions are made.

1. None of the stream gauging stations in the EP is telemetered, which means that manual data downloading is practiced at pre-set intervals. The practice unavoidably results in information delay. Upgrading the gauges (at least the current base station, AW512500) with telemetry could greatly improve information flow.

2. The possibility of incorporating auto-samplers, DO and pH probes with the current gauges to take advantage of the existing infrastructure warrants investigation.

3. Making the AWQMP data web-accessible is a high priority (The EPA is planning to make a publicly accessible website for its AWQMP).

4. The EP NRMB/CWMB to be aware of the available data and be able to access the raw data collected.

5. The EP NRMB/CWMB take a leading role in evaluating and reporting the conditions and trends of regional water resources. Currently, the Boards are

heavily reliant on the data and reports produced by State agencies for regional plans due to lack of resources and methodologies. The main shortcomings are:

- lack of a regional focus
- the timeframe of the State report, which may not necessarily concur with regional plans.

6 CURRENT GROUNDWATER MONITORING

Eyre Peninsula relies heavily on groundwater particularly the Southern Basin, therefore the region as a whole needs to be guaranteed the ability to manage these resources sustainably. SA Water and DWLBC have been working cooperatively to ensure that extractions in the Prescribed Wells Area (PWA) are within sustainable limits. An extensive water level and salinity monitoring network exists in the EP region. These networks monitor groundwater levels and salinity in strategic locations and enable these resources to be efficiently managed.

6.1 GROUNDWATER QUANTITY

6.1.1 Groundwater Level

The objectives of the State groundwater level network are to:

- Collect data documenting any change in groundwater storage over time in the principal aquifers
- Provide both long-term and short-term data necessary to assess and predict the response of aquifers to human-induced stresses and natural climatic variations
- Quantify the hydrologic characteristics of aquifers including transmissivity, hydraulic conductivity, and specific capacity
- Define dryland salinity, gauge the effectiveness of investment for on-ground works, assess progress towards RCT's, and determine any change in significance of the salinity threat
- Provide historical baseline data for studies of SA's groundwater resources.

Regular water level monitoring identifies:

1. Pumping the well at a greater rate than the aquifer is capable of producing
2. Changes in groundwater recharge due to land use and surface water development
3. Disturbance of the aquifer during the construction of sewers, drainage ditches, farm dams and roads.

The investigation and monitoring of the region's groundwater resources have been undertaken from as early as the 1930s (Southern Basin). Historically, eleven networks (over 1,200 wells) were established for water level monitoring. These observation networks, made up of a total of 498 wells, are currently used for water level monitoring on Eyre Peninsula (see Figure 11, Table 11). Monitoring frequency varies (monthly, bi-monthly, and six-monthly), and is dependent on the importance of groundwater lenses. Currently, water level monitoring within the PWA is carried out monthly.

6.1.2 Water Use

Planning, allocating and managing water resources for urban, irrigation, commercial and environmental purposes can only be undertaken effectively if water use patterns are understood. While urban water use has been monitored for some time, metering of irrigation/commercial water use has only occurred sporadically.

SA Water, the major groundwater user, monitors its groundwater extractions through its metering system. Water use information for other licenced users is collected by DWLBC through the licence and permit system.

6.1.3 Surface and Groundwater Interaction

Rainfall is the dominant source of recharge to most of the groundwater resources in the EP. Information and discussion about rainfall data can be found in the surface water section (section 5).

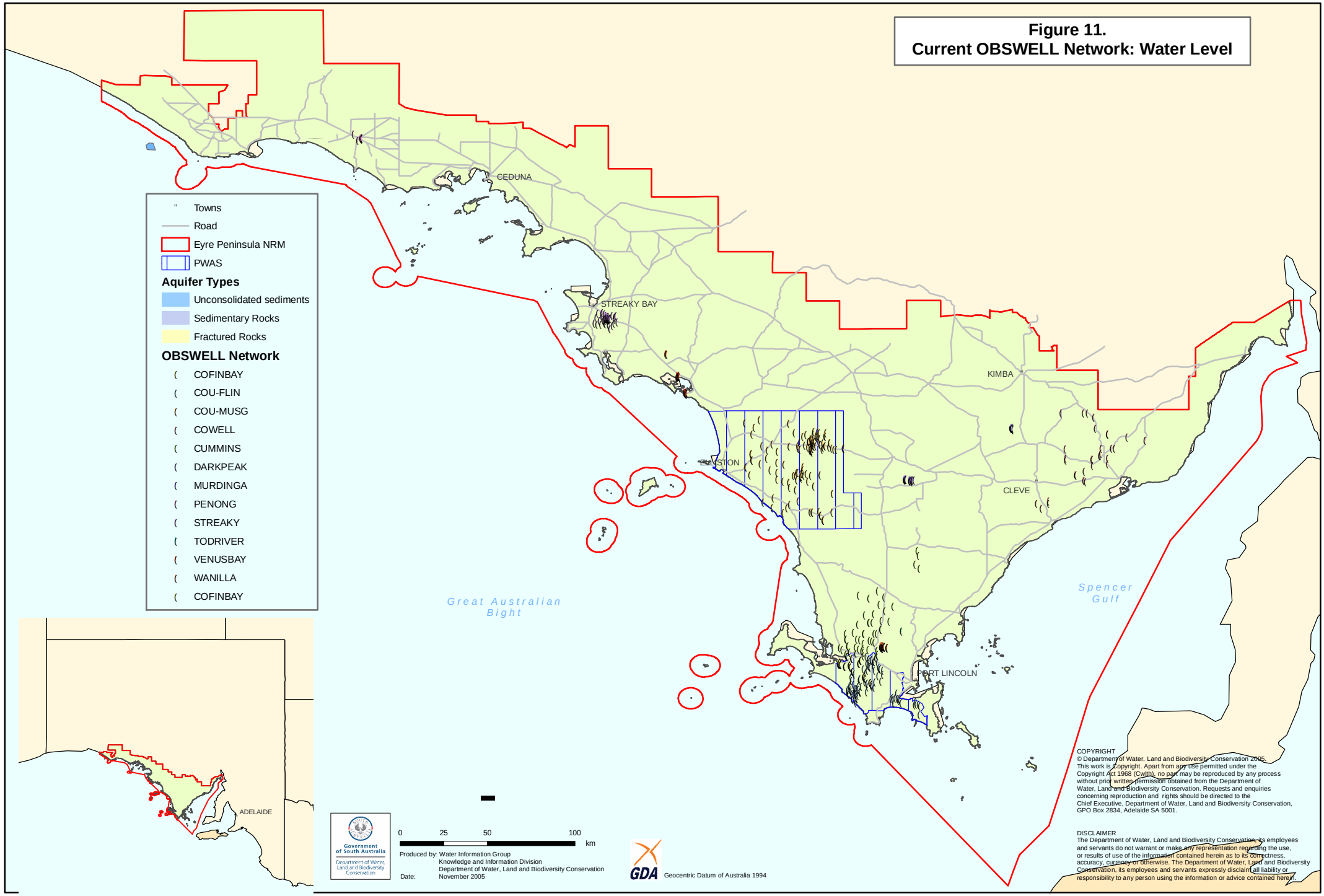
Due to increasing reliance on the Uley South Lens for reticulated water supply, greater understanding about the accurate aquifer storage and recharge rate for these groundwater resources is needed to ensure sustainable groundwater extraction. In 2002, SA Water engaged DWLBC to install seven pluviometers within Uley South (Figure 8). The logged data is currently stored in Microsoft Excel format, and is expected to be transferred into the Surface Water Archive.

Table 11. Current water level observation well networks in Eyre Peninsula.

Network	Number of Wells	Quaternary Limestone	Tertiary Sand	Basement	Other	Unspecified
Cofinbay	18	11	6	1		
Cou-flin	110	82	24	2		2
Cou-musg	132	57	66	2	1[a]	6
Cowell	32					32
Cummins	56					56
Darkpeak	13					13
Murdinga	15					15
Penong	15					15
Streaky	55	6	3		11[b]	35
Todriver	1				1[b]	
Venus bay	20					20
Wanilla	30					30
Total	**498**					

a. Polda formation;
b. Aq (sediment).

Figure 11.
Current OBSWELL Network: Water Level



6.2 GROUNDWATER QUALITY

6.2.1 Salinity Monitoring - DWLBC

Groundwater salinity level is closely monitored in order to:

- Establish baselines of water quality within major aquifers
- Determine areas and extent of seawater intrusion
- Determine groundwater salinity trends
- Evaluate the long-term effectiveness of dryland salinity and water quality programs.

Historical salinity data are available from 11 networks comprised of 473 wells. Currently, 365 wells which are grouped into eight networks, are monitored (Figure 12, Table 12). Recording from Streaky Bay has the longest history: well RIP005 has salinity measurements from 1932.

Salinity monitoring in other networks is irregular and often repeated on a multi-year frequency as changes in groundwater salinity in these areas are shown to be of a slow rate.

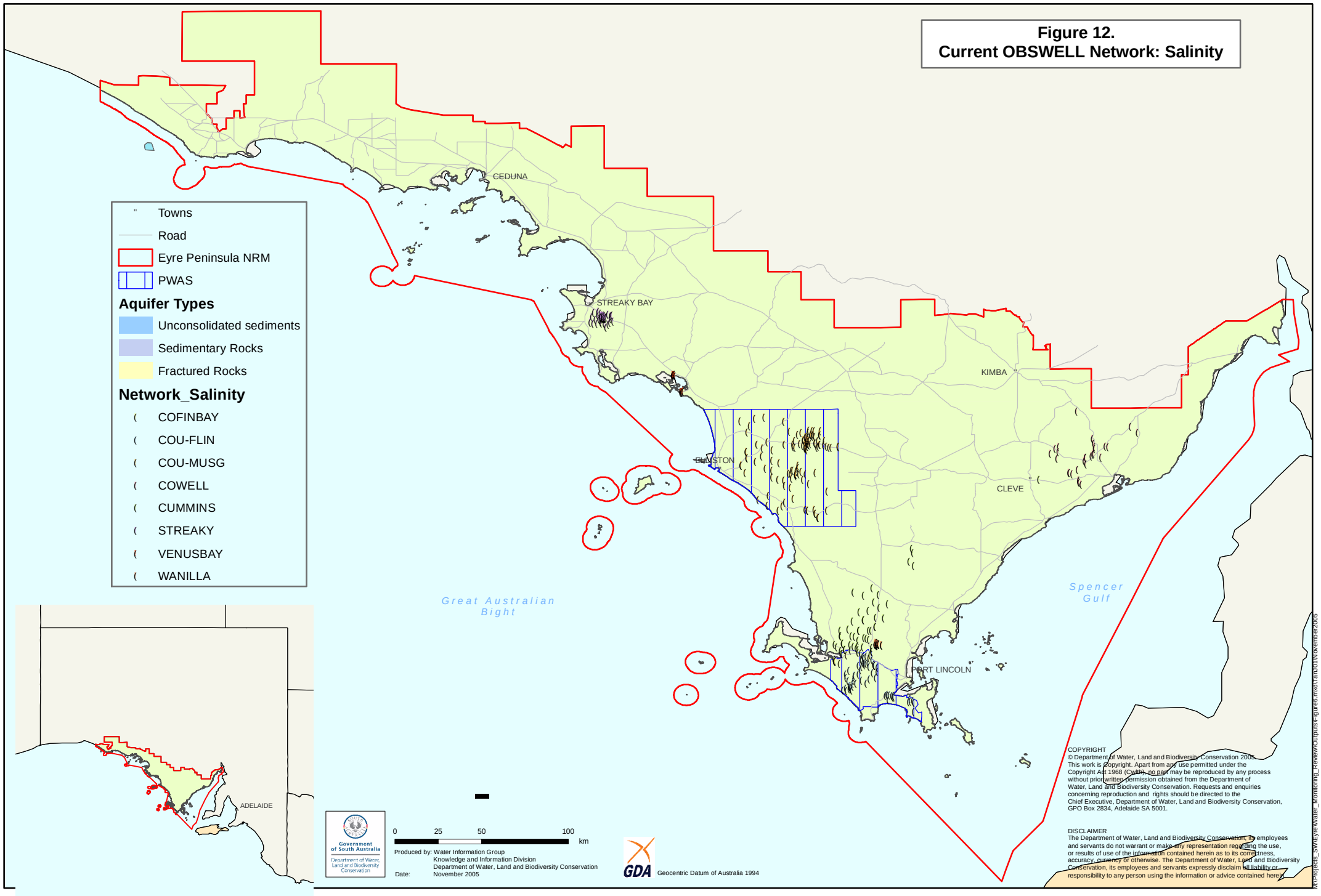
DWLBC oversees the State's salinity and other groundwater quality monitoring through a rotating network approach. A range of water quality parameters including major ion, chloride, bromide, fluoride, nitrate, and pH are measured every seven to eight years.

Table 12. Current Salinity Observation Well Networks in Eyre Peninsula.

Network	Number of wells	Quaternary Limestone	Tertiary Sand	Basement	Other	Unspecified
Cofinbay	8	7	1			
Cou-flin	62	46	13	1		2
Cou-musg	133	53	52	2		6
Cowell	32					32
Cummins	57					57
Streak bay	61		7	3	14 [a]	37
Venus bay	13					13
Wanilla	25					22
Total	**392**					

a. Aq (sediment).

Figure 12.
Current OBSWELL Network: Salinity



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6.2.2 Drinking Water Quality Monitoring – SA Water

As a component of the drinking water quality monitoring program, SA Water samples the major production wells to determine the source water quality (Table 13).

Table 13. SA Water's source water monitoring program.

Site	Parameter
Coffin bay	TDS, Total Hardness, DOC, pH, Nitrate, Total P
Elliston	TDS, Total Hardness, DOC, pH, Nitrate, Total P
Uley south	TDS, Total Hardness, DOC, pH, Nitrate, Total P
Uley wanilla	TDS, Total Hardness, DOC, pH, Nitrate, Total P
Lincoln	TDS, Total Hardness, DOC, pH, Nitrate, Total P
Streak bay	TDS, Total Hardness, DOC, pH, Turbidity, Colour, Nitrate, Total P

6.2.3 Ambient Water Quality Monitoring Program (Groundwater) - EPA

The EPA operates 11 fixed groundwater monitoring sites in the EP region as one component of its AWQMP since 2003 (Table 14). The parameters which include physical, nutrients, heavy metals, major ions, salinity, and pesticides are measured annually. The data collected are incorporated into the EPA's EDMS database.

Table 14. EPA's Ambient Groundwater Quality Monitoring Program

Site	Number	Parameters	Frequency
Streaky Bay	2	Nutrients, heavy metals, major ions, salinity, pesticides, physical	Annual
Musgrave Basin	3	Nutrients, heavy metals, major ions, salinity, pesticides, physical	Annual
Southern Basins	6	Nutrients, heavy metals, major ions, salinity, pesticides, physical	Annual

1. The pesticides being monitored depend on the land uses that influence each aquifer;
2. The whole EPA Ambient Water Quality Program is under review and the content in this table is therefore subject to alteration.

6.3 MUSGRAVE PRESCRIBED WELLS AREA (PWA)

6.3.1 Water Level Monitoring

Groundwater monitoring in the Musgrave PWA began in the 1960s. Historically, more than 600 observation wells were constructed, however only 132 observation wells are currently monitored on a regular monthly basis for water level. Of these wells:

- 56 monitor the shallow Quaternary Bridgewater Formation limestone aquifer
- 67 monitor the Tertiary Poelpena Formation sand aquifer
- 1 monitors the Jurassic Polda Formation sand aquifer
- 2 monitor the Basement aquifer system
- 6 wells have undetermined completions.

6.3.2 Salinity Monitoring

TDS tends to vary at a slow rate, therefore the monitoring of salinity occurs less frequently. Currently 134 observation wells are monitored randomly (approximately six monthly from 1992 to 1997 with the areas were revisited in 2005). Of these wells:

- 57 monitor the shallow Quaternary Bridgewater Formation limestone aquifer
- 67 monitor the Tertiary Poelpena Formation sand aquifer
- 1 monitors the Jurassic Polda Formation sand aquifer
- 2 monitor the Basement Aquifer system
- 7 wells have undetermined completions.

6.4 SOUTHERN BASINS PRESCRIBED WELL AREA (PWA)

6.4.1 Water Level Monitoring

Groundwater monitoring in the Southern Basins PWA began in the late 1930s. Historically 409 observation wells have been constructed. Currently 103 observation wells are monitored on a regular monthly basis for water levels. Of these wells:

- 77 monitor the shallow Quaternary Bridgewater Formation Limestone aquifer
- 4 monitor the Tertiary Uley Formation clay
- 20 monitor the Tertiary Wanilla Formation Sand Aquifer
- 2 monitor the Basement Aquifer system.

6.4.2 Salinity Monitoring

Water quality monitoring occurs less frequently, as TDS tends to vary at a slower rate. Currently 63 observation wells are monitored randomly (six-monthly from 1992 to 1997 with the areas were revisited in 2002-2003) for TDS. Of these wells:

- 48 monitor the shallow Quaternary Bridgewater Formation Limestone Aquifer
- 3 monitor the Tertiary Uley Formation clay
- 11 monitor the Tertiary Wanilla Formation Sand Aquifer
- 1 monitors the Basement Aquifer system.

The monitoring network of the Uley South Lens has recently been upgraded following the review conducted by DWLBC (Clarke *et. al.* 2003). The main changes are:

1. Four historical observation wells (SLE10, ULE133, ULE98 and ULE96) are rehabilitated, and included in the current monitoring network
2. Three new wells (ULE205, ULE206, and ULE208) are drilled at strategic positions in the basin where hydrogeological knowledge gaps have been identified
3. Salinity monitoring was expanded by performing salinity profiling on current observation wells not profiled during the initial review, as well as on new and rehabilitated wells
4. Water-level monitoring records are enhanced by the installation of two additional transducers in the new wells (ULE 205 and ULE 208)
5. Automated monitoring equipment is installed for key wells.

6.5 GAPS AND OVERLAPS IN MONITORING

Despite the monitoring efforts described earlier, a number of pressing technical questions about groundwater resources in the EP region remain. Some of the questions identified during the review include, in no particular order of priority:

- What are groundwater water-level conditions like across the region?
- What are the ambient groundwater quality conditions across the region, particularly for key pollutants like nitrate, pesticides, and pathogens?
- What is the relationship between groundwater level and rainfall for principal groundwater lenses, particularly the most developed, i.e. lenses in PWA?
- What are the dynamics of freshwater/saltwater interfaces and zones of diffusion in areas where groundwater resources are adjacent to the sea?
- Is groundwater quality changing significantly over time, particularly in areas undergoing rapid development?
- What is the quality of groundwater being withdrawn from private wells within shallower aquifers that are not monitored by SA Water's potable water program?
- Where, how and when is groundwater interacting with surface water?
- What are the impacts of groundwater withdrawal on groundwater-dependent ecosystems?
- How much groundwater can be withdrawn without impairing groundwater-dependent ecosystems?

The next two sections address these issues in more detail.

6.5.1 Water Level

Data Availability and Quality

Groundwater levels provide critical and direct information about the hydrologic relationships of recharge to, and discharge from, storage within an aquifer, as well as the direction of groundwater flow. Long-term, systematic measurements of groundwater level data are essential to develop groundwater models and to design, implement, and monitor the effectiveness of groundwater management programs. Fortunately, agencies including DWLBC, SA Water, and PIRSA have been measuring groundwater levels in the EP for many decades.

Groundwater levels of the shallow limestone aquifers in the EP are very dynamic, and can fluctuate dramatically due to short-term changes and stresses such as pumping and long-term trends caused by climatic conditions (Figure 13). Therefore, only long-term and systematic collection of water-level data offers the greatest likelihood that all scales of these trends will be observed. Greater than ten years of continuous data collection is needed to observe a range of water levels and trends.

Water level monitoring in the EP started during the 1930s. Seven decades of efforts have accumulated substantial data and information, which is stored in SA Geodata and can be accessed publicly through the Obswell website. Most of the current observation wells have more than 10 years of historic data. The current monitoring networks can efficiently deliver information about seasonal fluctuations and long-term groundwater level trends in main aquifers, as demonstrated in Figure 13.

Figure 13 shows that the groundwater level has been declining at a rate of about 0.064m per year over a period of 60 years (long-term trend), although there are periods of increasing water level (seasonal changes). The coefficient of determination (R^2) is 0.6439, which means that at 95% confidence level, nearly 65% of the variations could be explained by time (year). The continuous decline since 1985 may be due to the below-average rainfalls and large-scale withdrawals demonstrating the stress this resource is facing.

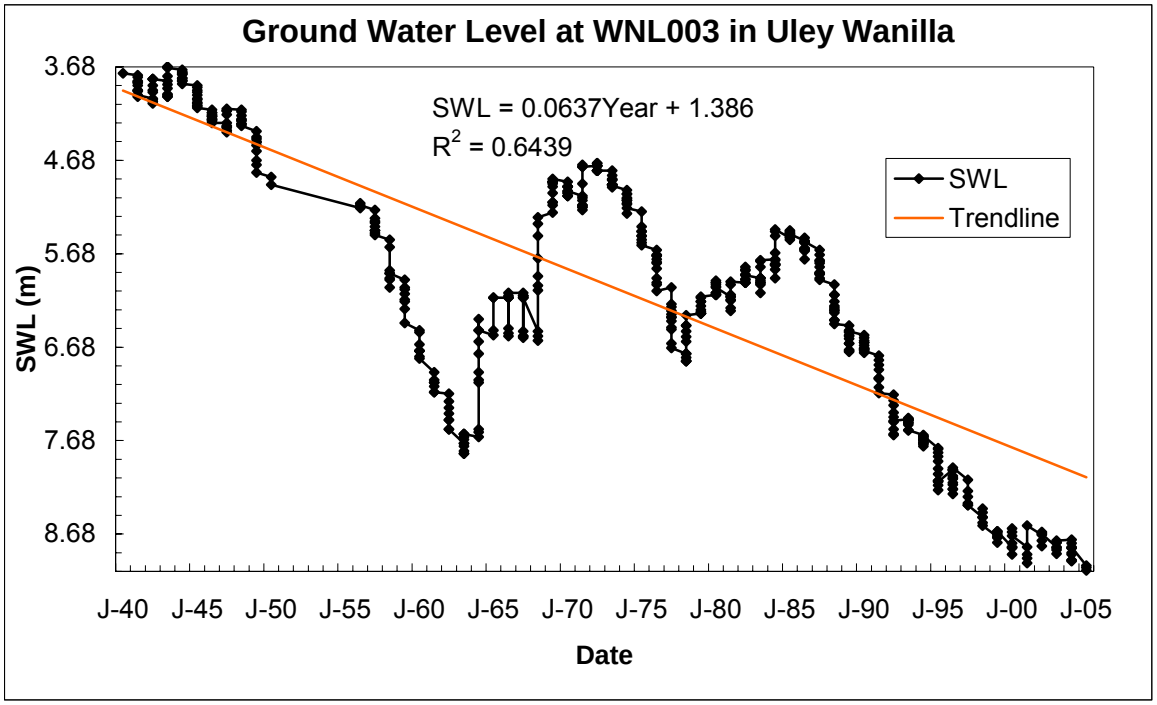


Figure 13. Groundwater levels at Uley Wanilla (well WNL003). Figure shows available data from 1940, and water level decline of approximately 0.064 m per year.
(Data source: Obswell).

Spatial Coverage

The current monitoring networks cover a range of groundwater resources from highly developed (for example, the Uley South aquifer) to undeveloped groundwater lenses (such as Penong). While significant observation wells are for shallow aquifers (the Quaternary limestone and Tertiary sand aquifers), the deeper basement aquifers are also monitored (seven or eight observation wells).

Some information gaps exist. In the EP region, there are more than 7000 water wells, most of which are located along the southwest coast (Figure 14). There are also a significant number of wells located at the fractured rock aquifer area further inland. There is no monitoring of either water level or salinity for these wells.

6.5.2 Water Quality

Data Availability and Quality

A comprehensive groundwater monitoring program must be capable of detecting important changes in water quality ("trend"), as well as the appearance of new pollutants that were not previously detected (the ambient "status").

Due to the relatively short period of operation (from 2003) of the EPA's AWQMP, there is insufficient data for any trend assessment. Salinity levels are the only available long-term groundwater quality monitoring data for the EP region. This review has identified two key data quality issues regarding the salinity database raising the issue of data quality control.

1. Only a few wells have continuous data
2. The percentage of anomalous data is quite high.

The poor data quality makes trend assessment difficult. In the case of well RIP006 in Streaky Bay (Figure 15), although the salinity level is significantly related to the year when samples were taken, the time variable only explains 17.85% of the salinity variation.

Monitoring Constituents

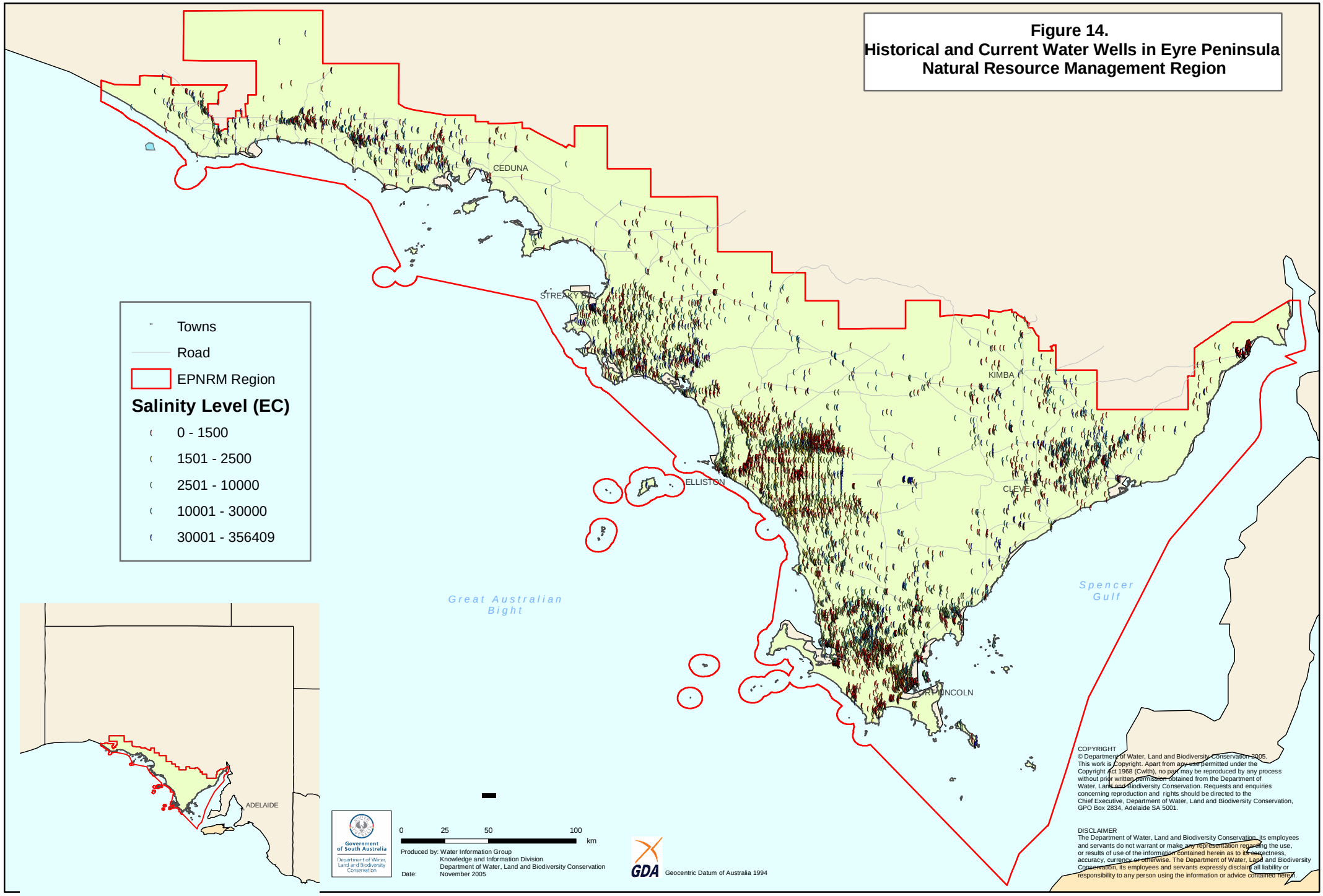
Bacterial analysis is not included in either the SA Water's drinking water monitoring program or EPA's AWQMP. Bacterial analysis determines the total coliform and faecal coliform bacteria in the groundwater. Both are indicator organisms for the potential presence of pathogenic (disease causing) bacteria, and require annual monitoring where groundwater resources have been developed for potable water supply, e.g. the PWA.

Spatial Coverage

The current monitoring programs run by DWLBC, EPA, and SA Water are located along the southwest coastline, where shallow groundwater resources are concentrated and are the most developed areas. Unfortunately, the optimal regional network is not complete. Notable gaps are identified within:

- The vast inland areas where groundwater resources are located within the fractured rock aquifers
- The area further northwest from Streaky Bay, including unconsolidated sediment aquifers and sedimentary rock aquifers
- EPA's AWQMP for groundwater only covers groundwater resources along the south coast.

Figure 14.
Historical and Current Water Wells in Eyre Peninsula Natural Resource Management Region



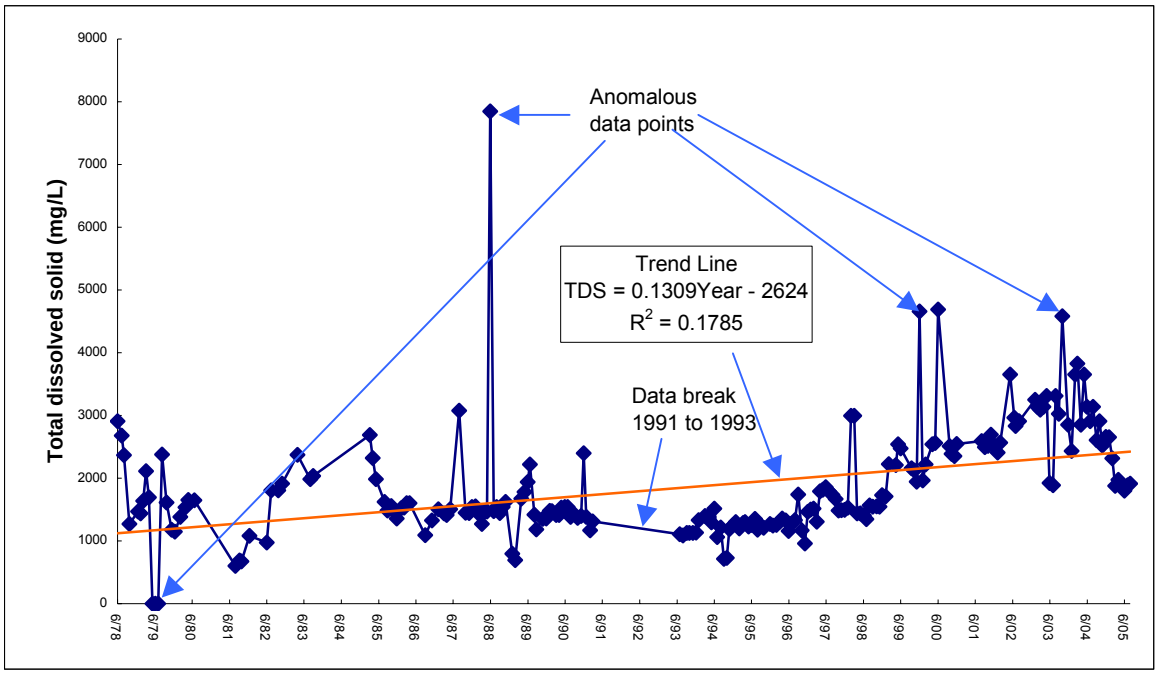


Figure 15. Salinity measured at observation well RIP006 in Streaky Bay, highlighting data breaks and multiple anomalous data points. *(Data source: Obswell).*

6.6 FUTURE DIRECTIONS: GROUNDWATER MONITORING

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6.6.1 Standardised groundwater sampling technique for chemical analysis.

Compared to surface water monitoring, the frequency of groundwater quality monitoring is much lower, for example, the EPA samples wells for AWQMP once per year. Accordingly, it is essential to ensure the samples are representative of the sampled aquifer. Currently, two sampling techniques are practiced: bailing and pumped sampling. While the bailing method gives quick electronic signals to measure parameters as EC, pH, DO, the samples only represent the body of water from where samples are taken. On the other hand, the pumping technique takes a longer time to process (up to 15 minutes to purge), but the samples more correctly represent the targeted aquifer.

It is possible that all agencies use pumped sampling to collect samples for groundwater quality analysis, which is the Australian standard technique for groundwater quality sampling (ANZECC and ARMCANZ, 2000a). A recent review of the Uley South observation well network by Clarke. (2005) highlighted the importance of standardising sampling techniques.

6.6.2 Establishment of additional observation wells to complete the network for water quality monitoring.

There are no guidelines for the number and density of wells to be sampled for groundwater quality assessment in Australia. Internationally however, the US Geological Survey (USGS) suggests the following guidelines.

- In each basin, 20 to 30 wells are to be sampled to provide statistical confidence for broad-scale and detailed (e.g. land use impacts on groundwater quality) groundwater assessment (Gilliom, et.al.,1995).
- No less than one well per 100 km^2 is used for broad-scale assessment (Gilliom, et.al.,1995).
- No greater than one well per 1 km^2 is used for detailed investigations (Squillance, et. al., 1996).

Using these guidelines, the following suggestions are made.

1. The number of sampling wells for salinity monitoring is adequate and satisfactory.
2. To enable detailed groundwater investigation, the number of sampling wells for other water quality parameters (EPA's AWQMP and SA Water source water quality monitoring program) needs to be increased to at least 20 each in the Southern Basin PWA and Musgrave PWA.
3. A broader-scale groundwater monitoring network would allow the comprehensive assessment of the groundwater conditions and states at regional level. This may include establishing new wells in the fractured rock aquifers, possibly using the current water level observation wells at Darke Peak.
4. Bacterial analysis, i.e. total coliform, faecal coliform and *E. coli*. bacteria, be conducted for drinking water supply.
5. Due to the high cost of laboratory analyses, the right balance between spatial coverage and analytical intensity needs careful consideration when designing the monitoring network. The following suggestions are provided for consideration and negotiation by relevant agencies:
    - DWLBC continues its random groundwater quality monitoring to provide the broadest spatial and aquifer coverage across the region and monitor the most comprehensive water quality parameters but at longer intervals
    - The AWQMP carried out by the EPA sample for a larger number of constituents, but at fewer wells
    - The co-incident sampling of the current salinity monitoring network and the EPA Ambient Groundwater Quality Program could save substantial staff time and cost.

7 AQUATIC ECOSYSTEMS

7.1 CURRENT MONITORING

The surface water section (Section 5) covers monitoring for rivers and streams, including the biological component (currently, macroinvertebrates). This section will focus on wetlands and other water dependent ecosystems (WDE) such as springs and water holes.

As introduced in Section 2, Eyre Peninsula has a number of identified wetlands, covering some 60,000 ha. The wetland systems cover a wide range of aquatic ecosystems from freshwater to saline to estuary. The conditions of these aquatic ecosystems vary from fairly pristine mangroves and samphire flats to highly degraded saline lakes and lagoons.

At this time, there is no ongoing monitoring program for these systems in the EP region. The Wetland Inventory (Eyre Peninsula) project conducted by DEH (Seaman, 2002) provides baseline information, and identifies the pressures on, and risks to, the health of these WDE.

To address the threats these systems are facing, the Eyre Peninsula Wetland Committee, which incorporates the EPCWMB, DEH, and EPNRM, is currently taking a coordinated approach to protect and manage the wetlands. The Big and Little Swamps are identified as priorities for the development and implementation of wetland management and recovery plans. However, the lack of ongoing monitoring would greatly constrain the effective management of these important ecosystems.

The EPNRMB currently has a project undertaking a baseline wetland survey focusing on wetland classification within landscape/hydrologic suites, landscape scale impacts, and collection of baseline data about wetland condition. The project was designed to gather information for:

- Guiding future management
- Setting the basis for long-term wetland inventory and monitoring.

7.2 GAPS AND OVERLAPS IN MONITORING

Threats to wetlands and other WDE in the EP region are identified as dryland salinity, vegetation clearance, livestock grazing, introduced plants and animals, and altered water regimes. The review has identified the following fundamental questions remaining unanswered, due to limited information and monitoring data.

1. What is the distribution of each type of wetland?
2. Are the wetlands fragmented?
    - What is the spacial extent of wetlands?
    - What is the ecological connectivity among the habitat patches?
3. How are the wetlands physically linked to the uplands and to the bays (for mangroves and samphire flats)?
    - What are the status and trends in the salinity gradients?
    - How does groundwater extraction impact water regimes of the wetlands (especially in PWA)?
    - How does surface water interception (farm dams, Tod Reservoir) affect wetland water regimes?

- How do ecosystem functions correspond to water regime changes?
- How does land use effect the annual sediment supply for wetlands, especially for mangroves and samphire flats?

4. What are the concentrations of pollutants (nutrients, pathogens, pesticide residues, etc.) in wetlands?
5. What is the distribution, species composition, and abundance of wetland plant communities?
   - What is the species richness for each major wetland type?
   - What is the ratio of native to introduced species?
   - What are the production rates of waterfowl forage plants and other key plant species?
6. What are the distribution and abundance of invertebrates, especially fish and bird prey items?

7.3 FUTURE DIRECTIONS: AQUATIC ECOSYSTEM MONITORING

7.3.1 Map and register of all surface and groundwater dependent ecosystems.

The current wetland baseline survey by EPCWMB can be extended to map the location of all groundwater and surface water dependent ecosystems, especially any with permanent surface expressions such as pools or baseflow reaches within the ephemeral or permanent drainages. This is background information that would provide for informed decisions as to what wetlands need to be monitored, and may also help to identify the best parameter choices and how they function conceptually within the ecosystem, as well as necessary monitoring frequencies, etc.

7.3.2 An integrated wetland monitoring program with three components: early warning indicators, ecosystem or habitat based indicators, and catchment parameters.

The monitoring of water column physical and chemical parameters as a means of tracing early signs of wetland changes in relation to management impacts is widely accepted (Finlayson and Spiers, 1999). Essential parameters to be collected consist of water level, EC, DO, temperature, turbidity, and pH. Other parameters such as nutrients (especially TP and TN), heavy metals, and chlorophyll-*a* may be important for some specified wetlands. Considering the prevailing land uses are cropping and grazing in EP, it would be beneficial to include TP and TN in any future monitoring programs.

Macroinvertebrates are the most extensively used biological indicators for monitoring and assessment of aquatic ecosystem health in Australia, e.g. AusRivAS. However, further scientific research is required to:

- Define the sensitivity of macroinvertebrates to ecosystem changes
- Define the link between macroinvertebrate biodiversity and ecosystem functioning
- Clarify the value of using guilds or functional groups to monitor ecosystem processes
- Identify keystone taxa for saline systems
- Interpret the existence of redundant species

- Relate the invertebrate composition and water quality, especially EC.

There are other biological parameters such as aquatic plants, phytoplankton and periphyton, and vertebrates which are commonly monitored.

Other parameters, which are more related to the impacts of catchment management, are also required to be measured. Land clearance, surface water allocation (including farm dams), groundwater recharge/discharge and extraction, land ownership changes and land use changes all need to be documented and included in the monitoring program.

An example of an integrated wetland monitoring program which includes a list of suggested parameters is presented in Appendix B.

7.3.3 Wetland monitoring included in the broad State water resources monitoring program.

Many of the questions listed in the previous section cannot be answered or explained by the monitoring of wetlands alone. Scientifically, the strong linkage between changes to wetland ecology and the surrounding environment, especially surface water drainage and groundwater recharge and discharge (including extraction), indicates that data and information collected by surface and groundwater monitoring needs to be documented and included in the wetland monitoring program.

Legislatively, the ecosystem is defined as an important component of natural resources in the *Natural Resources Management Act 2004*, and is included in the State monitoring and evaluation framework. Consequently, it is logical and practical that the following measures are undertaken.

1. The EP Wetland Management Committee includes or consults with, experts from DWLBC (surface and groundwater) and the EPA (AWQMP).
2. The future expansion of the surface water and groundwater monitoring network include consideration of the requirements of wetland monitoring, i.e. the inlets of, and discharge areas to, important wetlands be included in the monitoring network.
3. One outcome of the project – 'A Coordinated Approach to Wetland Management' – would be a long-term regional wetland monitoring strategy, which would include:
    a) Strategic monitoring sites
    b) Comparable monitoring protocols and procedures
    c) Comparable quality assurance procedures
    d) Long-term financial commitment
    e) Data and information storing and sharing mechanisms.

8 CATCHMENT CHARACTERISTICS

Catchment characteristics are relevant to all of the six water monitoring themes. A clear example of the effect of land use change on water quantity can be seen in the study by Ruprech and Schofield (1989) of a pair of small catchments in the southwest of Western Australia. By comparing the pair (one cleared, the other untouched), the study demonstrated that clearing native vegetation to establish agricultural crops resulted in an initial increase in streamflow by ~10% of the annual rainfall. This was followed by a slow increase in streamflow of up to ~30% of the annual rainfall. The streamflow from the cleared catchment showed higher and sharper peaks, and an increase in the base flow. The recharge to groundwater also increased in the cleared catchment, resulting in a rise in groundwater level.

Catchment conditions also contribute to water quality. A good example is the study of the nutrients and sediment output by Wasson (1994). According to the author, the basin area has the largest influence on sediment yield, with large basins yielding the most sediment, whereas land use pattern/cover plays a secondary role in Australia.

Although it is generally agreed that catchment characteristics affect water quantity and quality (both surface water and groundwater), there is no universally accepted definition of what the catchment characteristics are. That is because the list of catchment features for water resource management may vary from region to region, and from study to study. This review has identified a number of key catchment features which were broadly used in catchment assessment and hydrological modelling (Table 15). Note that not all the parameters are needed for a specified study.

The majority of the parameters listed in Table 15 are available datasets rather than ongoing monitoring programs. There is an increasing wealth of digital geospatial data available for regional use (at scales of 1:25,000 to 1:250,000). These data are being compiled and managed by State and National natural resources management agencies and land agencies, who recognise the importance of geospatial information for environmental management.

Table 15. Classification of catchment characteristics and data sources.
(Source: National Land And Water Resource Audit)

Characteristics		**Parameters**	**Data Source**
Topography	Relief measures	Catchment relief Catchment relief ratio Longitudinal profile Valley side slope length and angle	Topographic maps, Aeriel images: Geoscience, DEH
	Areal properties	Catchment area Drainage pattern Drainage density Elongation ratio	
	Linear measurements	Stream order Stream length	
Climate		Average annual rainfall Average monthly rainfall	BoM
Geology		Soil type and distribution Vegetation type and distribution	Geoscience, PIRSA DEH, DWLBC
Land management practises		Land use Farm type Fertilization Irrigation Farm dam Stocking density	PIRSA, DWLBC, CWMB, NRMB, NLWRA*, Special studies

9 DATA AND INFORMATION MANAGEMENT

It is essential to effectively manage the large volume of existing information as well as any new information generated. This is a large and complicated task that all involved agencies are facing. Data and information management issues are briefly discussed in this report when reviewing the individual water monitoring themes, i.e. surface water, groundwater, aquatic ecosystems, and catchment characteristics. This section will give an overview of the state-of-affairs in information management across the State agencies, pinpointing the areas that need improvement, and suggesting ways to enhance information delivery. This discussion is Statewide rather than regionally based.

9.1 CURRENT DATA AND INFORMATION MANAGEMENT

Generally, water information now exists in a multitude of formats located in a variety of places (Table 16). This is true both within and among agencies. Over the years, there have been numerous discussions among State agencies and regional organisations about the feasibility of developing a shared water database at the State level. Despite efforts by DWLBC, EPA, and DEH, among others, data today is primarily managed through separate, program–specific databases. Monitoring data is increasingly, but not always, stored in electronic formats. It is used largely within individual programs. Within the State Government, there is no organised system to compile data across programs and archive data over time. The data management practices of programs vary widely. Most programs are focused on current issues and older data in many cases is not available in electronic formats. Mechanisms to integrate and synthesise data across programs are not widely institutionalised.

9.1.1 Surface Water

Water Quantity

Data generated from Hydrometric Surface Water Monitoring across the State is stored in the HYDSTRA database managed by DWLBC. A portion of these data (those collected by DWLBC) is Internet accessible through the Surface Water Archive website. The rain gauge data from the groundwater program is currently not stored in HYDSTRA, but it is intended to incorporate these data in the future.

The Bureau of Meteorology (BoM) has a sophisticated information management system which enables nearly real-time meteorological information to be viewed and downloaded from its website http://www.BoM.gov.au/products/IDS65111.shtml (accessed January 2006). In addition, data collected by pluviometers is transferred into DWLBC's Hydstra database on a regular basis.

SA Water provides downloadable real-time water levels at a number of sites along the River Murray and ten reservoirs at metropolitan Adelaide through its water data update website http://www.sawater.com.au/SAWater/WhatsNew/WaterDataUpdate (accessed January 2006).

Table 16. Summary of major water resource databases of South Australia.
(Source: Phipps, 2003).

Name	Agency	Source	Format	Comments
Australian Data Archive for Meteorology (ADAM)	BoM	BoM	Web-based, Digital Geospatial, CDROM	Historical and real-time
State Surface Water Archive	DWLBC	DWLBC, BoM, SA Water, CWMB,	Web-based, digital, geospatial, Pre-formatted	Moderate data quality Long time delay Limited public access
Obswell	DWLBC	DWLBC, PIRSA, SA Water, CWMB, etc	Web-based, digital, geospatial, Pre-formatted	Data quality Time delay
Drillhole Enquiry System (DES)	DWLBC	PIRSA	Web-based, digital, geospatial	Not specified for water
EDMS	EPA	EPA, SA Water, CWMB, and others	Digital, geospatial, non-digital reports	All environmental quality data Limited public access
National Pollutant Inventory	Australian DEH	EPA		
Digitised Facilities Information System (DFIS)	SA Water	SA Water	Digital, Geospatial	Up-to-date
Water Quality (SA Water)	SA Water	SA Water	Digital Spreadsheet	Limited public access
Waterwatch	EPA or CWMB	Regional Waterwatch Groups	Spreadsheet	Poor data quality

Water Quality

The EPA has developed an Environmental Data Management System (EDMS) to hold data generated by monitoring programs initiated by the organisation, data supplied as a condition of licence requirements on licensees, and data from other sources. The data comprise air, noise, soil, and water quality information, and are being used (chiefly by EPA) to assess trends, provide rapid assessments of environmental quality, provide information needed for *State of the Environment* Reports, determine performance against National Environmental Protection Measures, assess compliance with performance measures, and many other purposes. EDMS is not web-based but is publicly available on request.

Water quality data collected (or funded) by SA Water is stored in a separate database managed by AWQC, and is also not web-based but available on request.

Some of the CWMB, particularly the Torrens and Patawalonga CWMB, operate flow proportional composite water quality sample programs. These data are stored in HYDSTRA. Trend analysis of this data has been done and reports written. Copies of these reports are filed in Libero (http://10.92.15.50/libero/WebOpac.cls), which is a DWLBC intranet site.

9.1.2 Groundwater

Most of the groundwater level and salinity data collected by various parties is stored in SA Geodata, a database maintained by PIRSA. The data is freely accessible via Obswell through the DWLBC website.

Groundwater GIS data, including groundwater provinces, basins, aquifers, and standing water level and concentration of total dissolved salts of the shallowest aquifer, can be downloaded from DWLBC website: http://www.dwlbc.sa.gov.au/subs/gis_data/data.htm (accessed December 2005).

In addition, SA Geodata contains data on all drillholes for the state, not just those related to groundwater. Access to this more extensive data is available through the Drillhole Enquiry System (DES) website: https://info.pir.sa.gov.au/des/desHome.html (accessed December 2005). There is interest from all parties in ensuring that this data is incorporated into SA Geodata.

9.1.3 Aquatic Ecosystem

Data related to aquatic ecosystems is kept by DWLBC, DEH, and the EPA. There is no centralised system of data management, or uniform standards for data collection. Data and information products are available on request to the individual agencies. Currently DWLBC, together with the Flinders University of South Australia and the University of Adelaide, are undertaking a project to develop a best practice framework for monitoring water dependent ecosystems in South Australia, including the development of a database.

9.2 FUTURE DIRECTIONS

There is an increasing demand and need for better access to, and use of, natural resources data and information to support planning and decision-making processes underpinning natural resources management. This is the case across all levels of government, industry and the community.

The need to centralise State water data and information is well documented in *The Review of Water Resource Management Information in South Australia* (Phipps, 2003).

> *Access to water information is required across government and between stakeholders, investors and the general public. Information is currently difficult to access and an overall information management system for South Australia's water information is lacking*.

9.2.1 Data Quality

Quality assurance is an important component of the major monitoring programs. It is important to ensure that the data generated by monitoring, and used to support decision-making in water resource management programs, is valid and appropriate. Although all

State monitoring programs have quality assurance plans that address how the quality of data is assured, data quality issues are identified in major databases (as outlined in the previous sections of this report), raising the need to review the current quality control and assurance programs.

The following key issues about data quality are presented for consideration.

1. The database custodian agencies, namely DWLBC, EPA, DEH, and BoM, complete a review of standard methods and standard operating procedures (SOP) for water resource monitoring; and make actions as appropriate to promote data consistency and comparability.
2. SOP and other quality assurance plans need to be well documented and publicly accessible.
3. Database custodian agencies ensure that they have the expertise and authority to guarantee data suppliers and/or contractors follow SOP.

9.2.2 Real-Time Data

DWLBC and other key agencies (SA Water, BoM) have facilities (telemetry) to provide real-time monitoring data within NRM regions. In the EP, SA Water has telemetric facilities for monitoring its water production wells and delivery system (pipelines and storages), and BoM can provide real-time meteorological data (BoM has six automated weather stations in the EP).

DWLBC however, has no telemetric facility for stream gauges and Obswell networks. The gathering of telemetric data including water quantity and quality measurements is a common practice, and central to contemporary water monitoring. Therefore, the procurement and installation of telemetric devices for the existing and new stream gauges and observation wells in the EP is highly desirable.

The provision of real-time water quality estimates analogous (e.g. salinity, pH, and DO) to those for streamflow is a valuable adjunct to traditional streamflow information. To the extent that resources permit, it would be beneficial if this capability was expanded to the EP as quickly as possible.

9.2.3 Data Management

The integrative nature of water resources demands a centralised data warehouse. A data warehouse is a database designed to support organisational decision-making. It can be updated automatically and structured for rapid online queries. A warehouse stores historical and consolidated data (e.g. flow records, water levels, and water quality parameters, etc.) in a common format. Due to the high capital requirement and maintenance cost, however, the review recognises that it might be more practical to take an evolutionary approach for data management, i.e. a step-by-step capacity-building process.

The following suggestions are proposed for consideration by relevant agencies and authorities.

1. Develop an integrated NRM information management system to facilitate data and information exchange, distribution and access. This will include the development of a State water data and information ‘clearing house’.

A ‘clearing house’ is a decentralised system of servers located on the Internet that contains descriptions of available digital data known as metadata. Metadata are collected in a standard format to facilitate query and consistent presentation across participating sites. A ‘clearing house’ uses readily available web technology for the interested parties or individuals to query, search and present search results. By utilising a standard method for these functions, a ‘clearing house’ allows individual agencies, consortia and geographically defined communities to collectively promote their available digital spatial data.

DWLBC is likely to be the leader in making water information and data easily accessible via the Internet. Moreover, through operating and maintaining the State Surface Water Archive and Obswell, DWLBC has accumulated the necessary skills and expertise. Commitments will be needed from all concerned State and regional agencies to cooperate fully in the development of the webpage.

The DWLBC NRM Program Board is overseeing a project that will develop an NRM Information System as part of the implementation of the *South Australian Natural Resources Management Plan* (SA Government, 2006). The final product of the project would enable information to be publicly accessible to the greatest extent possible.

2. Develop metadata to accompany all geospatial and temporal data collected by various programs.

Metadata is needed to accompany all geospatial and temporal data; and in line with the *South Australian Spatial Information metadata guidelines* (Spatial Information Committee, 2000). This will benefit water resource managers by facilitating information discovery, networked GIS mapping, and assessment and consideration of information uncertainties.

10 PRINCIPAL FINDINGS AND STRATEGIC DIRECTIONS

10.1 PRINCIPAL FINDINGS

A number of agencies (DWLBC, BoM, EPA, SA Water, PIRSA, and EPCWMB/NRMB) currently undertake water resources monitoring for quality and quantity assessments. There is limited or no coordination between monitoring programs run by the different organisations, or even different groups within the same organisation. This review identifies opportunities to strengthen the links among the current monitoring programs listed below to make better use of the available resources.

- Stream gauging network (DWLBC) and AWQMP (EPA)
- Meteorological monitoring/observation stations of BoM, SA Water, DWLBC
- TEMP/SASQAP (PIRSA) and AWQMP-Marine and Estuarine Program
- Obswell – Salinity (DWLBC, SA Water) and AWQMP –Groundwater Program
- AWQMP –Groundwater Program and SA Water Source Water Monitoring
- Stream gauging network and Obswell – water level (DWLBC), AWQMP (EPA), and Integrated Wetland Management (EPCWMB).

The current water monitoring networks in EP have two significant gaps:

1. Spatial coverage is incomplete for both groundwater and surface water
2. Some essential parameters (both water quantity and quality) are not monitored.

Without substantial improvement, the current network cannot properly serve its functions (specified in Section 1). More importantly, it cannot collect appropriate and sufficient data and information to evaluate changes in resource condition in relation to State and regional Resource Condition Targets (RCT's).

The majority of components of the hydrological cycle are inadequately monitored, both spatially and temporally, to allow the development of basin-based hydrological models. These components include water levels/streamflow, evaporation, soil moisture, water use, and surface water/groundwater interactions.

Assessment of the impacts of catchment best management practices on water resources is limited by three factors:

1. Deficiency of water balance data for most of the catchments, primarily due to a lack of stream gauging stations in appropriate locations.
2. Errors, gaps, and breaks in current databases.
3. Deficiency of systemic and/or long-term ambient water quality data.

General information on catchment characteristics is available from various sources. However, it is not clearly understood how the available information can be best used to support water resources management. The link between land and water resource conditions in EP is yet to be established.

Enhanced data delivery is an important and highly valued component of an integrated water monitoring program. Access is needed to a broader range of geospatially-linked data (unit values, channel cross sections, remotely sensed images, velocity fields, stream

network positions, and catchment attributes) to enable richer data interpretation than presently occurs.

10.2 STRATEGIC DIRECTIONS

During this review several common ideas arose within each of the monitoring themes. These have been grouped together into overall strategic actions. Specific actions were also developed for each monitoring theme. The following paragraphs summarise these strategic directions.

10.2.1 Overall Strategic Directions

Action 1: Developing a water monitoring review process for identifying and coordinating monitoring efforts.

If monitoring is to remain viable it must be flexible enough to adapt to changes in regional priorities or other aspects of natural resources management. Most changes to monitoring will need to be made based on information gleaned from previous data collection efforts. Periodic and planned re-evaluation of the monitoring program is therefore suggested at two different time scales:

- Annual reviews would be used to assess and communicate the progress of monitoring, the quality of data collected, and any immediate findings such as violations of water quality standards or the emergence of new issues. A work plan for the following year, with priorities and agency responsibilities for upcoming monitoring actions, would also be determined.
- Every fifth year the reassessment would include a more substantial analysis of data by the participating organisations. In addition to the annually examined aspects of the plan, topics for analysis would include an evaluation of trends in the data, effects of resource management, synthesis of data from multiple monitoring tasks (for example the relation of sediment transport to nutrient loading), and actions for modifications to the monitoring program.

Action 2: Creating and implementing a communication plan for monitoring information.

A communication plan would be developed to coordinate communication efforts, identify needs, provide tools and strategies, and identify resources, partners and opportunities.

Action 3: Establishing common protocols that enable data comparison among agencies, and that are consistent with objectives for data collection.

The use of common, clearly defined protocols for sample collection, processing, and laboratory analysis is important wherever possible to ensure the comparability of data collected by different organisations or over time within an individual organisation.

Action 4: Developing quality assurance plans for each major monitoring element.

Quality assurance plans will be critical to the success of monitoring. Good quality controlled data and assessments of these data, can allow for comparison among agencies and over time, whereas poor quality controlled data can prevent such comparisons.

Although all State monitoring programs have quality assurance plans, data quality issues are identified in major databases. A complete review is needed within database custodian agencies of standard methods and SOP for water resource monitoring resulting in appropriate strategies to promote data consistency and comparability. SOPs and quality

assurance plans need to be documented and publicly accessible. Database custodian agencies require the authority and expertise to ensure data suppliers and/or contractors follow the SOP.

Action 5: Establishing a data management strategy.

In order for monitoring data to be used to assess status and trends of water resources, compliance and management effectiveness, these data will need to be available. An agreed strategy for data management would enhance the ability of different organisations to have access to monitoring data.

Issues requiring discussion will include both programmatic and institutional issues as well as technical issues. Programmatic and institutional issues include funding and staffing as well as agreement on data sharing and data standards. Technical issues include system location, operation and maintenance, system compatibility, database design (for example, centralised or dispersed), and data accessibility.

Action 6: Working to increase the availability of information, reports, and other products to other agencies and the public.

A key criterion in assessing the success of the monitoring program is the degree to which the data collected, and the findings resulting from them, are used. A good monitoring program not only satisfies the data requirements of the data collection agencies themselves, but also services a range of audiences, including scientific researchers, resource managers, policy makers, and the general public, who will often have different needs. For example, water resources managers and policy makers are most likely to use interpretations resulting from the monitoring program such as reports, rather than raw data.

Including these end users as part of the data collection and interpretive process will increase the relevance of the monitoring program and the likelihood of its continued support by the involved organisations and public alike. This action is differentiated from Action 5 by its emphasis on results and analysis in order to provide information to the public. Action 5 is more orientated towards the mechanics of making monitoring data available among agencies or other researchers for the purpose of analysis.

Action 7: Establishing a link between the State water monitoring networks and EPNRMB monitoring and evaluation requirements.

The need for resource condition and trend monitoring is a very strong subject reflected in the theme-specific actions. One specific element discussed is the need to develop a monitoring framework for assessing progress towards those RCT's specified by EPNRMB, as well as the effectiveness of management actions and the possibility of adopting and tailoring the current monitoring network.

10.2.2 Specific Actions — Aquatic Ecosystems

Action 1: Mapping all groundwater and surface water dependent ecosystems to gain a preliminary understanding of the ecology of the systems.

This understanding is vital to the development of an aquatic ecosystem conceptual model, and the identification of risks and threats which could then provide for informed decisions as to which wetlands need to be monitored, and help identify the best parameter choices, frequencies, and so forth.

Action 2: Developing an integrated aquatic ecosystem monitoring program which includes three essential components: early warning indicators, ecosystem or habitat based indicators and catchment parameters.

Action 3: Considering aquatic ecosystem monitoring within the broad State Water Resources Monitoring Framework.

10.2.3 Specific Actions — Groundwater

Action 1: Establishing additional observation wells to complete the network for water quality monitoring.

The number of sampling wells for water quality monitoring need to be increased to at least 20 each in the Southern Basins PWA and Musgrave PWA. New wells are needed in the fractured rock aquifers (FRA's).

Action 2: Establishing new observation wells (water level) in FRA's.

Action 3: Installing continuous water level loggers in selected observation wells.

Action 4: Standardising the groundwater sampling technique for chemical analysis.

Action 5: Including bacterial analysis, i.e. total coliform and faecal coliform bacteria, in water quality monitoring program.

10.2.4 Specific Actions — Surface Water

Action 1: Redefining the objectives and focuses of DWLBC's stream gauging network to mirror its modern NRM goals.

Action 2: Establishing stream gauging stations and/or water level recorders in the Spencer Gulf and the Gairdner Basins.

Action 3: Incorporating auto-samplers, DO and pH probes with the current and future stream gauges.

Action 4: Equipping the base gauging stations with telemetry devices.

Action 5: Considering co-locating EPA's AWQMP and DWLBC's stream gauging network.

Action 6: Analysing evaporation data from BoM to determine evaporation patterns across the region.

Action 7: Mapping and registering farm dam distribution.

Action 8: Incorporating soil moisture monitoring with the evaporation monitoring sites.

Action 9: Establishing the link between surface/groundwater.

Action 10: Establishing water level recorders for regionally important aquatic ecosystems, for example, Lake Wangary, Big and Little Swamps.

Action 11: Establishing new pluviometers in strategic sites to obtain unbiased rainfall estimates in priority catchments.

SI UNITS COMMONLY USED WITHIN TEXT

Name of unit	Symbol	Definition in terms of other metric units	
Millimetre	mm	10^{-3} m	length
Metre	m		length
Kilometre	km	10^{3} m	length
Hectare	ha	10^{4} m^2	area
Microlitre	μL	10^{-9} m^3	volume
Millilitre	mL	10^{-6} m^3	volume
Litre	L	10^{-3} m^3	volume
Kilolitre	kL	1 m^3	volume
Megalitre	ML	10^{3} m^3	volume
Gigalitres	GL	10^{6} m^3	volume
Microgram	μg	10^{-6} g	mass
Milligram	mg	10^{-3} g	mass
Gram	g		mass
Kilogram	kg	10^{3} g	Mass

GLOSSARY OF TERMS AND ACRONYMS

A

ADAM - Australian Data Archive for Meteorology.

Ambient water monitoring - All forms of monitoring conducted beyond the immediate influence of a discharge pipe or injection well; May include sampling of sediments and living resources.

AMO – Airport Meteorological Office.

ANZECC - Australia New Zealand Environmental Consultative Council.

ARMCANZ - Agriculture and Resource Management Council of Australia and New Zealand.

Aquatic community - An association of interacting populations of aquatic organisms in a given water body or habitat.

Aquatic ecosystem - Stream channel, lake or estuary bed, water, and/or biotic communities and the habitat features that occur therein.

Aquatic habitat - Environments characterised by the presence of standing or flowing water.

Aquiclude - In hydrologic terms, a formation which contains water but cannot transmit it rapidly enough to furnish a significant supply to a well or spring.

Aquifer - A body of rock that is sufficiently permeable to conduct groundwater and to yield economically significant quantities of water to wells and springs.

AusRivAS - Australian River Assessment System. A national river and stream health assessment program run by the Australian Government.

AWQC - Australian Water Quality Centre.

AWS – Automatic Weather Station.

AWQMP - Ambient Water Quality Monitoring Program. Run by the South Australian Environment Protection Authority (EPA) since 1996.

B

Benthic zone – The lowest level of a body of water, such as an ocean or a lake. It is inhabited mostly by organisms that tolerate cool temperatures and low oxygen levels, called benthos or benthic organisms.

Bioassessment - An evaluation of the biological condition of a water body by using biological surveys and other direct measurements of a resident biota in surface water.

Biological integrity - Functionally defined as the condition of the aquatic community that inhabits unimpaired water bodies of a specified habitat as measured by community structure and function.

Biomonitoring - The measurement of biological parameters in repetition to assess the current status and changes in time of the parameters measured.

Biota - All organisms including animals, plants, fungi, and microorganisms found in a given area.

BoM - Bureau of Metrology, South Australia.

C

Catchment - The land area that drains into a stream, river, lake, estuary or coastal zone.

Compliance monitoring – Monitoring conducted in order to ensure the meeting of immediate statutory requirements, the control of long-term water quality, the quality of receiving waters as determined by testing effluents, or the maintenance of standards during and after construction of a project.

Contaminant - A material added or introduced by humans or natural activities that may, in sufficient concentrations, render the environment unacceptable for biota. The mere presence of these materials is not necessarily harmful.

CWMB – Catchment Water Management Board.

D

Data comparability - The characteristics that allow information from many sources to be of definable or equivalent quality so that this information can be used to address program objectives not necessarily related to those for which the data were collected. These characteristics need to be defined and would likely include detection limit precision, accuracy, bias, and so forth.

DES - Drillhole Enquiry System. A database of drillholes in South Australia. Maintained by the Department of Water, Land and Biodiversity Conservation (DWLBC).

DEH - Department for Environment and Heritage, Government of South Australian.

DFIS – Digitised Facilities Information System.

DHS - Department of Human Services, Government of South Australia.

Diversity - The distribution and abundance of different kinds of plant and animal species and communities in a specified area.

Dryland salinity - The process whereby salts stored below the surface of the ground are brought close to the surface by the rising water table. The accumulation of salt degrades the upper soil profile, which impacts on agriculture, infrastructure and the environment.

d/s – downstream.

DO - Dissolved Oxygen.

DOC - Dissolved Organic Carbon.

DWLBC - Department of Water, Land and Biodiversity Conservation, Government of South Australia.

DWR - Department of Water Resources, Government of South Australia.

E

EC - Electrical Conductivity.

Ecological indicators - Plant or animal species, communities, or special habitats with a narrow range of ecological tolerance. Such indicators may be selected for emphasis and monitored because the presence and abundance of these indicators serve as a barometer of ecological conditions within a management unit.

Ecosystem - A system that is made up of a community of animals, plants, and bacteria and the interrelated physical and chemical environment.

EDMS - Environmental Database Management System. Administered by the Environment Protection Authority, South Australia.

Effectiveness monitoring - Documents how well management practices meet intended objectives. Monitoring evaluates the cause and effect relationships between management activities and the condition of natural resources.

Emerging environmental problems - Problems that may be new and/or are becoming known because of better monitoring and use of indicators.

Environmental water requirement - The water regimes needed to sustain the ecological values of water dependent ecosystems, including ecosystem processes and biological diversity.

EP - Eyre Peninsula.

EPA - Environment Protection Authority, Government of South Australia.

EPCWMB -Eyre Peninsula Catchment Water Management Board.

EPNRMB - Eyre Peninsula Natural Resources Management Board.

Estuarine habitat - Tidal habitats and adjacent tidal wetlands that are usually semi-enclosed by land but have open, partly obstructed, or sporadic access to the open ocean, and in which ocean water is at least occasionally diluted by freshwater run-off from the land.

EWR – Environmental Water Requirement.

EWS – Engineering and Water Supply Department, Government of South Australia.

F

Fixed-station monitoring - The repeated long-term sampling or measurement of parameters at representative points for the purpose of determining environmental quality characteristics and trends.

G

Geomorphic - Related to the physical properties of rock, soil and water in and around a stream.

GIS - Geographic Information Systems. A computerised system for combining, displaying, and analysing geographic data. GIS produces maps for environmental planning and management by integrating physical and biological information (soils, vegetation, hydrology, living resources, etc,) and cultural information (population, political boundaries, roads, bank and shoreline development, etc.).

Groundwater - Water occurring naturally below ground level or water pumped, diverted and released into a well for storage underground.

GW – Groundwater.

H

Habitat - (1) A place where the physical and biological elements of ecosystems provide a suitable environment, as well as the food, cover, and space resources needed for plant and animal existence. (2) The physical/chemical theatre in which the ecological play takes place; it is a template for the biota, their interactions, and their evolution.

Hydric - Having or characterised by excessive moisture (e.g. hydric soil).

Hydrogeology - The study of groundwater which includes its occurrence, recharge and discharge processes, and the properties of aquifers.

Hydrophytic - Of or related to hydrophyte. A hydrophyte is a plant adapted to growing in water, waterlogged soil or on a substrate that becomes inundated on a regular basis.

HYDSTRA – A time series data management system that stores continuously recorded water related data such as water level, salinity and temperature. It provides a powerful data analysis, modelling and simulation system, and contains details of site locations, setup and other supporting information.

I

Impact - A change in the chemical, physical, or biological quality or condition of a water body caused by external sources.

Implementation monitoring - Documents whether or not management practices have been applied as intended. Project and contract administration is a part of implementation monitoring.

Indigenous species - A species that originally inhabited a particular geographic area.

M

Macroinvertebrate - Aquatic invertebrates including insects (e.g. larval Ephemeroptera and Trichoptera), crustaceans (e.g. amphipods), molluscs (e.g. aquatic snails) and worms (e.g. Platyhelminthes) which inhabit a river channel, pond, lake, wetland or ocean.

MAT - Management Action Targets.

Metadata - Information that describes the content, quality, condition, and other characteristics of data.

Method comparability - The characteristics that allow data produced by multiple methods to meet or exceed the data quality objectives of primary or secondary data users. These characteristics are yet to be defined but are likely to include data quality objectives, bias, precision, information on data comparability, and so forth.

Monitoring - (1) The repeated measurement of parameters to assess the current status and changes over time of the parameters measured. (2) Periodic or continuous surveillance or testing to determine the level of compliance with statutory requirements and/or pollutant levels in various media or in humans, animals, and other living things.

N

NATA - National Association of Testing Authorities (Australia).

Native species - Any animal and plant species originally in Australia. Also as “indigenous species”.

NHT – Natural Heritage Trust.

NLWRA - National Land and Water Resource Audit.

Nonpoint-source pollution - A contributory factor to water pollution that cannot be traced to a specific location. For example, pollution that results from water run-off from urban areas, construction sites, agricultural and silvicultural operations, etc.

NRHP – National River Health Program. Developed by the Commonwealth Government in 1994.

NRM – Natural Resources Management.

NRMB – Natural Resources Management Board.

NWI – National Water Initiative.

O

Obswell - Observation Well Network.

P

P - Phosphorous.

Perennial streams - Permanently inundated surface stream courses. Surface water flows throughout the year except in years of infrequent drought.

PIRSA - Department of Primary Industries and Resources, Government of South Australia.

Pluviometer - An automated rain gauge consisting of an instrument to measure the quantity of precipitation over a set period of time.

Point-source pollution - Pollution discharged through a pipe or some other discrete source from municipal water treatment plants, factories, confined animal feedlots, or combined sewers.

Population - (1) For the purposes of natural resources management and planning, the set of individuals of the same species that occurs within the natural resource of interest. (2) An aggregate of interbreeding individuals of a biological species within a specified location.

Prescribed water resource - A water resource declared by the Governor of South Australia to be prescribed under the *Water Resources Act 1997*. Includes groundwater to which access is obtained by prescribed wells. Prescription of a water resource requires that future management of the resource be regulated by a licensing system.

Prescribed well - A well declared to be a prescribed well under the *Water Resources Act 1997*. See also Prescribed water resource.

PWA - Prescribed Wells Area.

PWRA – Prescribed Water Resources Area.

R

RCT - Resource Condition Target.

Reticulated water - Water supplied through a piped distribution system.

Riparian - Of, pertaining to, or situated or dwelling on the bank of a river or other water body.

Riparian area - Geographically delineable areas with distinctive resource values and characteristics that comprise the aquatic and riparian ecosystem.

Riparian dependent resources - Resources that owe their existence to a riparian area.

Riparian ecosystems - A transition between the aquatic ecosystem and the adjacent terrestrial ecosystem. Identified by soil characteristics or distinctive vegetation communities that require free or unbound water.

Riparian habitat - The transition zone between aquatic and upland habitat. These habitats are related to and influenced by surface or subsurface waters, especially the margins of streams, lakes, ponds, wetlands, seeps, and ditches.

Riverine habitat - All wetlands and deep water habitats within a channel, with two exceptions: wetlands dominated by trees, shrubs, persistent emergent mosses or lichens; and habitats with water that contains ocean-derived salt in excess of 0.5 parts per thousand.

S

SA Geodata - A collection of linked, publicly accessible databases storing geological and hydrogeological data. Custodianship of data related to minerals and petroleum is vested in PIRSA. Custodianship of groundwater related data is vested in DWLBC.

SARDI - South Australian Research and Development Institute.

SASQAP - South Australian Shellfish Quality Assurance Program.

SA Water - South Australian Water Corporation.

SOP - Standard Operating Procedures.

Sub-catchment - The area of land determined by topographical features within which rainfall will contribute to run-off at a particular point.

Surface water - Water flowing over land (except in a watercourse), (1) after having fallen as rain or hail or having precipitated in any other manner; or (2) after rising to the surface naturally from underground; or (3) water of the kind that has been collected in a dam or reservoir.

Surface Water Archive - An Internet based database linked to HYDSTRA operated by DWLBC. It contains rainfall, water level, streamflow, and salinity data collected from a network of surface water monitoring sites located throughout South Australia.

SW – Surface water.

SWMCC - State Water Monitoring Coordinating Committee (1999 –2005).

T

TBOASA - Tuna Boat Owners Association of South Australia.

TDS - Total Dissolved Solids. A measure of water salinity (in mg/L).

TEMP - Tuna Aquaculture Industry Environmental Monitoring Program

Tertiary aquifer - A term used to describe a water-bearing rock formation deposited in the Tertiary Geological period (from 1-70 millions years ago).

Threatened species - Any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

TKN - Total Kjeldahl Nitrogen.

TN - Total Nitrogen.

Toxic - Relating to harmful effects to biota caused by a substance or contaminant.

TP - Total Phosphorus.

Turbidity - The cloudiness or haziness of water (or other fluid) caused by individual particles that are too small to be seen without magnification, thus being much like smoke in air.

U

u/s – upstream.

USGS - United States Geological Survey.

W

WAP – Water Allocation Plan.

Water allocation - In relation to water licensing, is the maximum quantity of water that a licensee is entitled to take and use pursuant to an authorisation under section 11 of the *Water Resources Act 1997*.

Water Allocation Plan - A plan prepared by a CWMB or water resource planning committee and adopted by the Minister in accordance with Division 3, Part 7 of the *Water Resources Act 1997*.

Water column - A section of water extending from the surface of a body of water to its bottom. In sea or ocean, this is referred to as the pelagic zone.

Water dependent ecosystems - Those parts of the environment, species composition and natural ecological processes which are determined by the permanent or temporary presence of flowing or standing water above or below ground. The in-stream area of rivers, riparian vegetation, springs, wetlands, floodplains, estuaries and lakes are all water dependent ecosystems.

Water hardness - A measure of the amount of metallic salts (normally calcium and magnesium) found in water. Hard water can inhibit the action of some surfactants and reduce the effectiveness of the cleaning process.

Water quality criteria - Comprised of both numerical criteria and narrative criteria. Numerical criteria are developed by the Environment Protection Agency (Commonwealth Government of Australia) or the States. These are scientifically derived ambient concentrations for various pollutants of concern for the protection of human health and aquatic life. Narrative criteria are statements that describe the desired water quality goal.

Water quality data - Chemical, biological, and physical measurements or observations of the characteristics of surface and ground waters, atmospheric deposition, potable water, treated effluents, and waste water and of the immediate environment in which that water exists.

Water quality information - Derived through analysis, interpretation, and presentation of water quality and ancillary data.

Water quality monitoring - An integrated activity for evaluating the physical, chemical, and biological character of water in relation to human health, ecological conditions, and designated water uses.

Water quality standard - A law or regulation that consists of the beneficial designated use or uses of a water body, the numerical and narrative water quality criteria that are necessary to protect the use or uses of that particular water body, and an anti-degradation statement.

Water resource monitoring - An integrated activity for evaluating the physical, chemical, and biological character of water resources, including: (1) surface waters, groundwaters, estuaries, and near-coastal waters; and (2) associated aquatic communities and physical habitats, which include wetlands.

Water resource quality - (1) The condition of water or some water-related resource as measured by biological surveys, habitat quality assessments, chemical-specific analyses of pollutants in water bodies, and toxicity tests. (2) The condition of water or some water-related resource as measured by habitat quality, energy dynamics, chemical quality, hydrological regime, and biotic factors.

Wetlands - Habitat that is transitional between terrestrial and aquatic, where the water table is usually at or near the land surface, or land that is covered by shallow water. Wetlands have one or more of the following characteristics: at least periodically, the land supports predominantly hydrophytic plants; the substrate is predominantly undrained hydric soil; the substrate is nonsoil and is saturated with water or covered by shallow water at sometime during the yearly growing season.

WDE - Water Dependent Ecosystem.

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APPENDIX A - MONITORING STATION CATEGORIES

Stream gauging station category (modified from Greenwood, 2001).

Station Category	Purpose	Minimum Parameters	Duration	Frequency	Priority
Base Station	To monitor outflow from the major yielding section/s of the catchment	Rainfall Water Level / Streamflow Stream Salinity (EC and Temp)	Ongoing indefinitely (at least every 25 years)	Download Quarterly	High
Basin Outflow Station	Streamflow leaving the catchment, for example, flows into the ocean, inland lakes or interstate	Water Level / Streamflow Stream Salinity (EC and Temp)	Done as required for auditing and statutory reporting (5-10 years)	Download Quarterly	High
System Inflow / Outflow	Relates to streamflow entering or released from heavily developed or regulated river systems and infrastructure, for example in and out of Prescribed Areas and upstream and downstream of reservoirs	Water Level / Streamflow	Medium Term (10 years)	Download Quarterly	High
Representative Stations	Streamflow from areas representing particular features for example hydrological characteristics, vegetation types or land use practices. Can be independent of catchment	Water Level / Streamflow Stream Salinity (EC and Temp)	Medium Term (10 years)	Download Quarterly	High / Medium
Project Station	Hydrological information not normally obtained from the monitoring network. Virtually any project of interest, for eg. surface / groundwater interactions.	Project Specific	Usually Short-Term (5 years) but variable	Project Specific	Medium / Low
Environmental Station	Sites considered significant for monitoring the water requirements of aquatic ecosystems	Water Level / Streamflow Stream Salinity (EC and Temp) Other parameters as required	Short / Medium Term (5-10 years)	Project Specific	Medium / Low

APPENDIX B - A HYPOTHETICAL WETLAND MONITORING PROGRAM

Spatial Scale Monitoring Element Sample Parameters	Method	Type[1]	Frequency[2]	Lead Agency[3]
Regional Climate				
Rainfall	Pluviometer	ST	Continuous	BoM
Evaporation	Evaporation Pan	ST	Continuous	BoM
Regional Geology				
Topography	Survey	ST	O	PIRSA
Soil Type	Survey	ST	O	PIRSA
Regional Hydrology				
Streamflow	Gauging Station	ST, CO, EV	Continuous	DWLBC
Groundwater depth	Observation well	ST, CO, EV	Monthly	DWLBC
Salinity gradient	Observation well	ST, CO, EV	Annually	DWLBC
Landscape Ecology				
Surrounding Land use	Remote Sensing	ST, EV	E5	DWLBC
Habitats Patch Size and distribution	Remote Sensing	ST, EV	E5	DWLBC
Farm dam size and distribution	Registration	ST, CO	Update Annually	EPNRMB
Wildlife species rich. & abund.	Various	ST, EV	Annually	DEH
Site Hydrology				
Pond Water level	Staff Gauge	ST, EV	Continuous	DWLBC
G/water depth	Piezometer	ST, EV	Continuous	DWLBC
Salinity Gradients	Piezometer	ST, EV	Annually	DWLBC
Water Quality				
Temp., Turbidity, DO, EC, pH	Data Logger	ST, CO, EV	Monthly	EPA
Nutrients, Heavy metals, TOC, Faecal coliform, *Chlorophyll a*	Grab sampling, Lab	ST, CO, EV	Monthly	EPA
Substrate				
Sediment Rate	Sediment trap	ST, EV	E2	PIRSA
Root Zone salinity	Lab	ST, EV	Annually	PIRSA
Root Zone density, pH, Gain Size	Lab	ST	E2	PIRSA

Continued next page.

Habitat				
Size	Remote sensing	ST, CO, EV	E5	DEH
Bank or Channel stability	Field survey	ST, EV	E5	DEH
Buffer size and condition	Field survey	ST, EV	E5	DEH
Riparian & aquatic plant dist.	Remote sensing	ST,CO, EV	E5	DEH
Biological				
Plant species richness	Transect plot	ST, EV	E5	DEH
Macroinvertebrate species richness	AusRivAS	ST, EV	6-monthly	EPA
Vertebrate species richness	Various	ST, EV	Annually	DEH

1. Monitoring Type: ST, Status and Trend; CO, Compliance, EV, Evaluation;
2. Frequency: O, one time effect, E×, Every × years;
3. Lead Agency: under legislative mandate is responsible for: (1) developing monitoring strategy, plan and protocols, (2) data custodianship, (3) supervision of data quality assurance, (4) supporting monitoring undertaken by other parties.

APPENDIX C - WATER MONITORING IN THE EPNRM REGION BY DWLBC

Agency's Mission

- Integrated management of all South Australia's natural resources.
- Improved health and productivity of our biodiversity, water, land and marine resources.
- Community, industry, Governments and other stakeholders working together to achieve high quality natural resources management outcomes.
- There is greater capability and willingness to invest in natural resources management to provide a sustained funding base.
- Wise resource allocation provides for the best environmental, social and economic outcomes.

Table 17. Water quantity parameters, frequency and geographic scope of collection by DWLBC.

	Geographic scope			Frequency of Collection			
Data Type	Regional	Catchment	Project-specific	Continuously	Monthly	Other	Not Collected
Water availability							
Runoff							√
Streamflow	√	√	√	√			
Water level	√	√	√	√			
Water storage			√			√	
Aquifer recharge			√			√	
Groundwater levels	√		√		√		
Precipitation	√		√	√			
Evapo-transpiration							√
Soil Moisture							√
Water Withdrawal							
Withdrawal							√
Consumptive use							√
Return Flow							√

Table 18. Water quality parameters, frequency and geographic scope of collection by DWLBC.

	Geographic scope			Frequency of Collection			
Data Type	Regional	Catchment	Project-specific	Continuously	Monthly	Other	Not Collected
Chemical							
Pesticides							√
Organics							√
Metals							√
Nutrients							√
DO							√
Physical							
pH							√
Temperature	√			√			
Salinity (GW)	√					√	
Salinity (SW)	√			√			
Turbidity							√
Biological							
Structure of aquatic communities							√
Habitat							√
Macro-invertebrates							√
Indictor bacteria							√

Water Quantity Data

DWLBC measures surface water level, flow, rainfall, and rainfall intensity through its Hydrometric Surface Water Monitoring network. A network of observation wells has been constructed to monitor groundwater levels.

Water Quality Data

The current focus of DWLBC surface water quality monitoring is on salinity. However, DWLBC can also establish and operate automatic water quality samplers designed to collect data on nutrients, pesticides and pathogens entering SA Water's urban supply reservoirs. Water salinity is monitored at many hydrometric streamflow gauging stations using an EC probe.

Storage Method and Accessibility

DWLBC's surface water data (quantity and quality) are stored in the HYDSTRA database. The analysed and raw data from HYDSTRA are fed into the State Surface Water Archive which is a freely accessible, interactive, GIS-based website. The groundwater data are stored in the Obswell database. The Obswell facility provides on-line access to the State's observation well monitoring

data. Water level and salinity monitoring data is available for users to view and download free of charge. Elevation data, well coordinates, and well construction details are also available.

Surface Water Monitoring Site

Site	Name	Easting	Northing	Start	End	Type	Custodian
AW021503	PENONG ROADED CMT	312529	6465471	07/06/1990	01/07/1991	MET	DWLBC
AW021504	KOONIBBA TANKS CMT	350629	6470671	06/06/1990	01/07/1991	MET	DWLBC
AW512500	TOD RIVER D/S RESR	578709	6174244	18/02/1972		NS	DWLBC
AW512501	COONTA CK 9KM W T B	592080	6196492	01/01/1936	01/01/1944	NS	DWLBC
AW512502	FOUNTAIN SPRINGS	580912	6171289	01/01/1935	01/01/1955	NS	DWLBC
AW512503	TOD/TOOLILLIE GULLY	575349	6185762	03/07/1991		NS	DWLBC
AW512504	TOD R DIVERSION WEIR	578803	6190793	06/11/1991		NS	DWLBC
AW512505	PILLAWORTA CK/DIV WR	580785	6190614	30/08/1991		NS	DWLBC
AW512506	TOD RESERVOIR MET	578231	6183295	31/12/1967		MET	SA Water
AW512507	KOPULTA WELL PLUVIO	578479	6195892	03/07/1991		MET	DWLBC
AW512508	TOOLILLIE CMT PLUVIO	571774	6184563	04/07/1991		MET	DWLBC
AW512509	POPES CK/WANILLA	563329	6176970	28/07/1999	05/12/1993	NS	DWLBC
AW512510	TOD RESERVOIR	578210	6183540	01/01/1922		DAM	DWLBC

Groundwater Monitoring Wells

NETWORK	OBS_N	EASTING	NORTHING	AQUIFER	START	END
COFINBAY	LKW37	544192	6167594	Qpcb(CB-A	07/11/1986	02/06/2005
COFINBAY	LKW43	543513	6167514	Qpcb(CB-A	07/11/1986	02/06/2005
COFINBAY	ULE72	552977	6167776	Qpcb(CB-C	27/06/1967	02/06/2005
COFINBAY	ULE176	555173	6160039	TpQau	25/02/1981	02/06/2005
COFINBAY	LKW27	546343	6165870	Qpcb(CB-A	27/06/1967	02/06/2005
COFINBAY	LKW8	550027	6163560	Tbw	27/06/1967	02/06/2005
COFINBAY	WNL44	560234	6168886	Qpcb(UW)	03/11/1986	02/06/2005
COFINBAY	ULE172	558667	6156042	Qpcb(UE)	25/02/1981	02/06/2005
COFINBAY	WNL35	553699	6169879	Qpcb(CB-C	27/06/1967	02/06/2005
COFINBAY	LKW15	549746	6170793	Qpcb(CB-B	27/06/1967	02/06/2005
COFINBAY	LKW39	544098	6167422	Qpcb(CB-A	07/11/1986	02/06/2005
COFINBAY	ULE177	555766	6159315	TpQau	25/02/1981	02/06/2005
COFINBAY	LKW6	548957	6165677	Tbw	27/06/1967	02/06/2005
COFINBAY	LKW22	548574	6166746	Tbw	27/06/1967	02/06/2005
COFINBAY	ULE173	558205	6156864	ALs	25/02/1981	02/06/2005
COFINBAY	LKW41	543913	6168652	Qpcb(CB-A	04/02/1987	02/06/2005
COFINBAY	LKW38	544106	6167428	Qpcb(CB-A	07/11/1986	02/06/2005
COFINBAY	LKW40	544296	6167304	Tbw	07/11/1986	02/06/2005
COU-FLIN	WNL46	558830	6169787	Qpcb(UW)	02/05/1991	01/06/2005
COU-FLIN	LNC14	569052	6162619			

NETWORK	OBS_N	EASTING	NORTHING	AQUIFER	START	END
COU-FLIN	LNC9	569004	6147972	aq(SEDIME	31/07/1957	07/11/1996
COU-FLIN	LNC11	569862	6147989	aq(SEDIME	13/07/1957	04/02/1991
COU-FLIN	LNC12	571298	6148107		31/07/1957	26/11/1996
COU-FLIN	LNC5	569434	6149352	aq(SEDIME	31/07/1957	07/11/1996
COU-FLIN	LNC3	569957	6149883	aq(SEDIME	31/07/1957	01/10/1990
COU-FLIN	LNC13	571769	6151127	aq(SEDIME	31/07/1957	06/01/1959
COU-FLIN	SLE63	571512	6147038	aq(SEDIME	06/01/1959	05/04/1986
COU-FLIN	SLE41	572755	6145020	Qpcb(LB-B	04/11/1964	05/10/1993
COU-FLIN	SLE34	572066	6146165	aq(SEDIME	06/01/1959	01/10/1990
COU-FLIN	SLE60	571401	6147323	aq(SEDIME	06/01/1959	18/11/1996
COU-FLIN	SLE59	571506	6147336	aq(SEDIME	06/01/1959	18/11/1996
COU-FLIN	SLE64	570999	6147670	Qpcb(LB-B	31/07/1957	31/05/2005
COU-FLIN	SLE23	570171	6146887	aq(SEDIME	31/07/1957	18/11/1996
COU-FLIN	SLE22	570136	6147043	aq(SEDIME	31/07/1957	01/10/1990
COU-FLIN	SLE52	569008	6147295	Qpcb(LB-A	27/02/1958	31/05/2005
COU-FLIN	SLE53	569352	6147160	aq(SEDIME	31/07/1957	26/11/1996
COU-FLIN	SLE54	569352	6147160	aq(SEDIME	31/07/1957	26/11/1996
COU-FLIN	SLE33	571665	6145938	aq(SEDIME	27/02/1958	01/10/1990
COU-FLIN	SLE32	570749	6145399	aq(SEDIME	27/02/1958	18/11/1996
COU-FLIN	SLE27	570306	6145983	aq(SEDIME	06/01/1959	30/03/1987
COU-FLIN	SLE57	571502	6147140	aq(SEDIME	06/01/1959	26/11/1996
COU-FLIN	SLE55	570557	6146979	aq(SEDIME	06/01/1959	02/10/1987
COU-FLIN	SLE67	570067	6146875		09/02/1966	02/10/1978
COU-FLIN	SLE30	569334	6144842	Qpcb(LB-B	06/01/1959	31/05/2005
COU-FLIN	FLN55	580507	6144394	Qpcb(LB-C		
COU-FLIN	FLN13	578018	6146235	aq(SEDIME	06/01/1959	27/11/1996
COU-FLIN	FLN54	575093	6146816	aq(SEDIME		
COU-FLIN	FLN1	573040	6146784	aq(SEDIME	06/01/1959	01/10/1990
COU-FLIN	FLN2	573435	6146530	aq(SEDIME	06/01/1959	02/10/1989
COU-FLIN	FLN50	577402	6142784	aq(SEDIME	11/02/1960	04/10/1983
COU-FLIN	FLN6	578141	6145166	aq(SEDIME	11/02/1960	27/11/1996
COU-FLIN	FLN5	573761	6144394	aq(SEDIME	06/01/1959	01/10/1990
COU-FLIN	FLN15	578749	6146716	aq(SEDIME	06/01/1959	01/10/1990
COU-FLIN	FLN16	578398	6147141	aq(SEDIME	06/01/1958	27/11/1996
COU-FLIN	FLN17	579448	6147568	aq(SEDIME	06/01/1959	27/11/1996
COU-FLIN	FLN19	579208	6146789	aq(SEDIME	06/01/1959	27/11/1996
COU-FLIN	FLN20	579822	6146593	aq(SEDIME	06/01/1959	01/10/1990
COU-FLIN	FLN42	581209	6138237	Qpcb(LB-C	22/04/1958	31/05/2005
COU-FLIN	FLN44	579990	6136302	aq(SEDIME	22/04/1958	01/10/1986

NETWORK	OBS_N	EASTING	NORTHING	AQUIFER	START	END
COU-FLIN	FLN34	579895	6144443	aq(SEDIME	11/06/1958	27/11/1996
COU-FLIN	FLN25	580908	6144449	Qpcb(LB-C	11/06/1958	31/05/2005
COU-FLIN	FLN24	580633	6145506	aq(SEDIME	06/01/1959	01/10/1990
COU-FLIN	FLN53	574110	6143226	aq(SEDIME	06/01/1959	01/10/1990
COU-FLIN	FLN8	579474	6145563	Qpcb(LB-C	09/04/1959	31/05/2005
COU-FLIN	FLN49	578037	6141764	aq(SEDIME	11/02/1960	01/10/1990
COU-FLIN	FLN29	581386	6143376	Qpcb(LB-C	11/02/1960	31/05/2005
COU-FLIN	FLN27	582085	6142252	aq(SEDIME	03/09/1975	28/11/1996
COU-FLIN	FLN33	580312	6144523	aq(SEDIME	02/06/1975	05/04/1986
COU-FLIN	FLN41	580953	6139916	aq(SEDIME	22/04/1958	25/11/1996
COU-FLIN	FLN35	579799	6144235	Qpcb(LB-C	03/09/1975	31/05/2005
COU-FLIN	LNC7	568613	6147940	aq(SEDIME	31/07/1957	01/10/1990
COU-FLIN	SLE6	554975	6144797	Qpcb(US)	23/05/1962	19/11/1996
COU-FLIN	SLE7	553816	6146045	ALs+Qpcb(	23/05/1962	02/04/1990
COU-FLIN	SLE8	553030	6146132	Qpcb(BRWT	30/10/1962	19/11/1996
COU-FLIN	SLE11	551475	6146127	Qpcb(BRWT	20/03/1963	19/11/1996
COU-FLIN	SLE10	551475	6145291	Qpcb(US)	29/04/1963	05/02/2004
COU-FLIN	SLE14	558837	6146971		18/12/1963	26/06/1969
COU-FLIN	SLE16	556473	6147065	Tbw	26/01/1965	20/11/1996
COU-FLIN	SLE13	555154	6147053	Tbw	27/08/1962	12/10/1982
COU-FLIN	SLE2	560856	6146330	Qpcb(BRWT	23/05/1962	19/11/1996
COU-FLIN	SLE45	568470	6143403	aq(SEDIME	22/04/1958	01/10/1990
COU-FLIN	SLE47	568000	6147410	Qpcb(LB-A	19/09/1957	31/05/2005
COU-FLIN	SLE49	568529	6147409	aq(SEDIME	31/07/1957	26/11/1996
COU-FLIN	ULE96	548677	6153738	Qpcb(BRWT	01/09/1961	30/05/2005
COU-FLIN	ULE125	554870	6154059	Qpcb(BRWT	23/01/1962	11/11/1996
COU-FLIN	ULE87	561664	6153914	TpQau	23/05/1962	11/11/1996
COU-FLIN	ULE88	562807	6154293	Tbw	23/05/1962	11/11/1996
COU-FLIN	ULE81	561431	6152245		23/03/1965	11/11/1996
COU-FLIN	ULE167	560024	6153927	Qpcb(UE)	25/02/1981	06/07/1994
COU-FLIN	ULE118	552535	6152030	Qpcb(BRWT	23/01/1962	09/11/1996
COU-FLIN	ULE124	556021	6154011	Qpcb(BRWT	23/01/1962	11/11/1996
COU-FLIN	ULE121	554627	6153170	Qpcb(BRWT	23/01/1962	11/11/1996
COU-FLIN	ULE120	554984	6152180	Qpcb(BRWT	23/01/1962	01/10/1990
COU-FLIN	ULE141	556430	6151537	Tbw	23/01/1962	30/05/2005
COU-FLIN	ULE143	554370	6149263	Qpcb(BRWT	04/04/1961	20/11/1996
COU-FLIN	ULE151	557036	6147735	Qpcb(BRWT	23/05/1962	20/11/1996
COU-FLIN	ULE191	551985	6152055	Qpcb(US)	03/05/1991	30/05/2005
COU-FLIN	ULE187	551844	6152819	Qpcb(US)	03/05/1991	30/05/2005

NETWORK	OBS_N	EASTING	NORTHING	AQUIFER	START	END
COU-FLIN	ULE186	551763	6153404	Qpcb(US)	03/05/1991	30/05/2005
COU-FLIN	ULE102	549893	6149686	Qpcb(US)	30/05/1961	30/05/2005
COU-FLIN	ULE135	551618	6149131	Tbw	26/04/1961	30/05/2005
COU-FLIN	ULE145	552601	6149494	Qpcb(US)	04/04/1961	30/05/2005
COU-FLIN	ULE137	552306	6150337	Qpcb(BRWT	04/04/1961	20/11/1996
COU-FLIN	ULE116	551908	6151135	Qpcb(BRWT	19/01/1961	09/11/1996
COU-FLIN	ULE104	550886	6150909	Qpcb(BRWT	30/05/1961	09/11/1996
COU-FLIN	ULE98	547745	6151751		30/05/1961	30/05/2005
COU-FLIN	ULE148	554105	6147512		29/04/1963	20/11/1996
COU-FLIN	ULE185	551131	6153174	Tbw	03/05/1991	30/05/2005
COU-FLIN	ULE117	551460	6150279		25/03/1966	09/11/1996
COU-FLIN	ULE113	550795	6152314		25/03/1966	09/11/1996
COU-FLIN	ULE138	552782	6150881		25/03/1966	20/11/1996
COU-FLIN	ULE114	550945	6151573	Qpcb(US)	25/03/1966	30/05/2005
COU-FLIN	ULE136	552056	6149822		25/03/1966	01/10/1990
COU-FLIN	ULE190	551425	6152066	Qpcb(US)	03/05/1991	30/05/2005
COU-FLIN	ULE75	551335	6166379		27/06/1967	16/11/1996
COU-FLIN	ULE43	561675	6164581		11/11/1964	04/10/1990
COU-FLIN	ULE61	562966	6164967		13/10/1965	04/10/1990
COU-FLIN	ULE41	563436	6165350			
COU-FLIN	ULE60	562892	6164295		11/11/1964	12/11/1996
COU-FLIN	ULE45	561530	6163112		13/10/1965	04/10/1990
COU-FLIN	ULE46	561542	6162384		15/04/1969	02/04/1990
COU-FLIN	ULE56	563529	6162530	Qpcb(BRWT	14/02/1966	12/11/1996
COU-FLIN	ULE63	562008	6163941		11/11/1964	04/10/1990
COU-FLIN	ULE62	562432	6163943		11/11/1964	08/01/1973
COU-FLIN	ULE53	561858	6163072		11/11/1964	04/10/1990
COU-FLIN	ULE57	564350	6162379		11/11/1964	12/11/1996
COU-FLIN	ULE47	561565	6162144		11/11/1964	12/11/1996
COU-FLIN	ULE84	561981	6155583		23/05/1962	11/11/1996
COU-FLIN	ULE66	560152	6163430		15/10/1968	05/04/1986
COU-FLIN	ULE44	561447	6164028		11/11/1964	12/11/1996
COU-FLIN	ULE67	559507	6163789		11/11/1964	23/11/1996
COU-FLIN	ULE64	560873	6164269		13/10/1965	08/10/1985
COU-FLIN	ULE69	558347	6163691		15/10/1968	09/05/1979
COU-FLIN	ULE51	561356	6159607		08/01/1973	04/10/1979
COU-FLIN	ULE92	550371	6156026	Qpcb(US)	19/01/1961	30/05/2005
COU-FLIN	ULE128	552999	6156230		30/05/1961	22/05/1964
COU-FLIN	ULE162	554790	6158610		25/02/1981	01/06/2002

NETWORK	OBS_N	EASTING	NORTHING	AQUIFER	START	END
COU-FLIN	ULE164	556751	6156486	Tbw	25/02/1981	30/09/2004
COU-FLIN	ULE174	556752	6156486	ALs+Tbw	25/02/1981	30/05/2005
COU-FLIN	ULE166	558926	6154778	Qpcb(UE)	25/02/1981	30/05/2005
COU-FLIN	ULE77	550671	6161942	Qpcb(US)	27/06/1967	30/05/2005
COU-FLIN	ULE131	554104	6160978		30/05/1961	15/11/1996
COU-FLIN	ULE37	557395	6167052		11/11/1964	15/11/1996
COU-FLIN	ULE3	558270	6165353	Qpcb(BRWT	23/11/1949	18/09/1992
COU-FLIN	ULE36	557506	6166303	Qpcb(UW)	26/07/1950	01/06/2005
COU-FLIN	ULE12	555160	6164858			
COU-FLIN	ULE14	557593	6165264		11/11/1964	04/10/1990
COU-FLIN	ULE28	559971	6164664		11/11/1964	15/09/1984
COU-FLIN	ULE5	557862	6164268		16/09/1968	04/12/1974
COU-FLIN	ULE29	560475	6164492		10/08/1966	04/10/1990
COU-FLIN	ULE33	558907	6165776		11/11/1964	05/05/1980
COU-FLIN	ULE21	559966	6166170		11/11/1964	14/11/1996
COU-FLIN	ULE34	558162	6166226	Qpcb(UW)	11/11/1964	01/06/2005
COU-FLIN	ULE24	561290	6166195			
COU-FLIN	ULE16	556594	6166764		11/11/1964	13/11/1996
COU-FLIN	ULE7	556968	6163983	Qpcb(UW)	09/03/1944	01/06/2005
COU-FLIN	ULE1	559800	6166693	Qpcb(BRWT	13/11/1956	01/04/1988
COU-FLIN	ULE6	557669	6163883		16/09/1968	07/01/1976
COU-FLIN	ULE9	556075	6164044		14/03/1967	03/04/1987
COU-FLIN	ULE10	555670	6164378		14/06/1966	08/10/1987
COU-FLIN	ULE25	561504	6165496		11/11/1964	08/10/1987
COU-FLIN	LKW18	550118	6169467		27/06/1967	16/12/1974
COU-FLIN	LKW19	549838	6168705		27/06/1967	06/11/1996
COU-FLIN	LKW1	550030	6168150		27/06/1967	01/10/1990
COU-FLIN	LKW17	549282	6169167		27/06/1967	02/10/1989
COU-FLIN	LKW16	549879	6169706		27/06/1967	06/11/1996
COU-FLIN	LKW5	549346	6166176		27/06/1967	22/11/1996
COU-FLIN	LKW23	548184	6166771	Qpcb(CB-B	27/06/1967	16/11/1996
COU-FLIN	LKW4	550120	6166416		27/06/1967	22/11/1996
COU-FLIN	LKW3	549781	6167750	Tbw	26/06/1967	16/11/1996
COU-FLIN	LKW7	548332	6164893		27/06/1967	22/11/1996
COU-FLIN	LKW28	549205	6161002		28/02/1973	28/02/1974
COU-FLIN	LKW12	549182	6160076	Tbw	27/06/1967	30/05/2005
COU-FLIN	LKW10	549497	6158656		08/06/1972	08/11/1996
COU-FLIN	LKW34	549381	6158040	Tbw	19/01/1961	30/05/2005
COU-FLIN	LKW11	548906	6159181		08/06/1972	01/10/1990

NETWORK	OBS_N	EASTING	NORTHING	AQUIFER	START	END
COU-FLIN	WNL41	553848	6169256		27/06/1967	29/06/1971
COU-FLIN	WNL10	557152	6170374		11/11/1964	14/11/1996
COU-FLIN	WNL17	557928	6171070			
COU-FLIN	WNL15	557928	6171070		11/11/1964	04/10/1990
COU-FLIN	WNL21	559087	6169956		11/11/1964	04/10/1990
COU-FLIN	WNL24	559374	6168250		11/11/1964	04/10/1990
COU-FLIN	WNL1	557482	6168761		08/01/1973	04/10/1990
COU-FLIN	WNL2	557382	6168719		11/11/1964	04/10/1990
COU-FLIN	WNL5	557627	6169244		11/11/1964	13/11/1996
COU-FLIN	WNL20	558884	6170379		11/11/1964	14/11/1996
COU-FLIN	WNL43	558929	6170053	Qpcb(UW)	03/11/1986	01/06/2005
COU-FLIN	ULE180	564261	6163795	TpQau	03/11/1986	01/06/2005
COU-FLIN	ULE182	563330	6157649	Qpcb(UE)	03/11/1986	01/06/2005
COU-FLIN	LNC15	569928	6147920	Qpcb(LB-A	02/05/1991	31/05/2005
COU-FLIN	FLN56	578928	6143970	Qpcb(LB-C	02/05/1991	31/05/2005
COU-FLIN	ULE196	551618	6149131	Qpcb(US)	03/05/1991	30/05/2005
COU-FLIN	ULE198	562978	6164721	Tbw	03/05/1991	01/06/2005
COU-FLIN	ULE199	562978	6164721	Qpcb(UE)	03/05/1991	01/06/2005
COU-FLIN	WNL47	557484	6170105	Qpcb(UW)	02/05/1991	01/06/2005
COU-FLIN	LNC10	569415	6148105	aq(SEDIME	19/09/1957	07/11/1996
COU-FLIN	LNC4	569703	6149339	aq(SEDIME	31/07/1957	07/11/1996
COU-FLIN	LNC1	570428	6151120	aq(SEDIME	31/07/1957	05/04/1986
COU-FLIN	SLE37	572070	6146760	Tbw	27/02/1958	31/05/2005
COU-FLIN	SLE40	572786	6146874	aq(SEDIME	06/01/1959	01/10/1990
COU-FLIN	SLE36	572011	6146664	aq(SEDIME	11/02/1960	18/11/1996
COU-FLIN	SLE26	570606	6146094	aq(SEDIME	19/09/1957	18/11/1996
COU-FLIN	SLE43	571079	6144778	aq(SEDIME	27/02/1958	05/10/1970
COU-FLIN	FLN52	576326	6143530	aq(SEDIME	11/02/1960	01/10/1990
COU-FLIN	FLN10	578351	6146040	aq(SEDIME	06/01/1959	01/10/1986
COU-FLIN	FLN18	579694	6147053	aq(SEDIME	06/01/1959	02/10/1984
COU-FLIN	FLN21	580156	6146263	aq(SEDIME	01/06/1952	27/11/1996
COU-FLIN	FLN22	580595	6146596	aq(SEDIME	06/01/1959	27/11/1996
COU-FLIN	FLN43	581430	6136691	aq(SEDIME	22/04/1958	01/10/1990
COU-FLIN	FLN46	579363	6138345	aq(SEDIME	30/04/1958	25/11/1996
COU-FLIN	FLN48	578633	6142073	aq(SEDIME	11/02/1960	01/10/1990
COU-FLIN	FLN30	580255	6143679	aq(SEDIME	11/02/1960	28/11/1996
COU-FLIN	FLN28	581672	6142457	aq(SEDIME	11/02/1960	05/01/1976
COU-FLIN	FLN31	580507	6144483	aq(SEDIME	03/09/1975	03/10/1984
COU-FLIN	SLE4	555302	6143893	Qpcb(US)	23/05/1962	19/11/1996

NETWORK	OBS_N	EASTING	NORTHING	AQUIFER	START	END
COU-FLIN	SLE12	553028	6147157	Qpcb(US)	23/05/1962	20/11/1996
COU-FLIN	SLE1	562029	6147293	Qpcb(BRWT	23/05/1962	19/11/1996
COU-FLIN	ULE89	557114	6154243	Tbw	23/05/1962	30/05/2005
COU-FLIN	ULE158	558367	6147803	Qpcb(BRWT	26/06/1969	25/06/1970
COU-FLIN	ULE139	553492	6151286	Qpcb(US)	23/01/1962	30/05/2005
COU-FLIN	ULE97	548796	6152874	Qpcb(US)	30/05/1961	30/05/2005
COU-FLIN	ULE101	549563	6150501	Qpcb(US)	25/03/1966	30/05/2005
COU-FLIN	ULE188	551243	6152585	Qpcb(US)	03/05/1991	30/05/2005
COU-FLIN	ULE48	561809	6161886		11/01/1966	07/04/1989
COU-FLIN	ULE86	560447	6157304	Qpcb(UE)	23/05/1962	01/06/2005
COU-FLIN	ULE129	553254	6157630		30/05/1961	24/06/1964
COU-FLIN	ULE165	557408	6155950		25/02/1981	01/06/2002
COU-FLIN	ULE76	551341	6163376		22/12/1969	16/11/1996
COU-FLIN	ULE8	556457	6164052		14/06/1966	04/10/1990
COU-FLIN	ULE4	558090	6164541		11/11/1964	02/04/1990
COU-FLIN	LKW25	546704	6166467		27/06/1967	05/04/1986
COU-FLIN	LKW13	549826	6160078		01/06/1961	08/11/1996
COU-FLIN	WNL34	553737	6170629		20/12/1967	03/12/1986
COU-FLIN	WNL13	557758	6171077		03/11/1972	14/11/1996
COU-FLIN	WNL4	556840	6169049		15/08/1968	07/04/1989
COU-FLIN	SLE66	570282	6144179	aq(SEDIME	22/04/1958	05/10/1970
COU-FLIN	ULE122	555032	6152616	Qpcb(BRWT	25/06/1966	11/11/1996
COU-FLIN	ULE42	562777	6165304		11/11/1964	04/10/1990
COU-FLIN	LNC8	568800	6148180	Qpcb(LB-A	03/09/1975	31/05/2005
COU-FLIN	SLE50	568426	6147586	aq(SEDIME	03/09/1975	26/11/1996
COU-FLIN	ULE31	559340	6164081		11/11/1964	15/11/1996
COU-FLIN	FLN38	578508	6143678	aq(SEDIME	11/02/1960	05/04/1990
COU-FLIN	ULE100	548437	6150643		30/05/1961	09/11/1996
COU-FLIN	ULE169	553190	6158187	Tbw	25/02/1981	30/05/2005
COU-FLIN	ULE2	558930	6166531	Qpcb(BRWT	21/04/1941	04/10/1990
COU-FLIN	LKW29	549950	6158317		01/03/1961	22/12/1969
COU-FLIN	WNL45	561794	6168057	Qpcb(UW)	03/11/1986	01/06/2005
COU-FLIN	WNL29	557928	6171070			
COU-FLIN	LNC2	570596	6150846	Qpcb(LB-A	31/07/1957	31/05/2005
COU-FLIN	SLE39	572413	6146492	aq(SEDIME	06/01/1959	01/10/1990
COU-FLIN	SLE35	571565	6146549	Qpcb(LB-B	06/01/1959	31/05/2005
COU-FLIN	ULE107	550801	6153911	Qpcb(BRWT	19/01/1961	09/11/1996
COU-FLIN	ULE184	551157	6153167	Qpcb(US)	03/05/1991	30/05/2005
COU-FLIN	ULE192	551672	6151480	Qpcb(US)	03/05/1991	30/05/2005

NETWORK	OBS_N	EASTING	NORTHING	AQUIFER	START	END
COU-FLIN	ULE54	562502	6163103		11/11/1964	12/11/1996
COU-FLIN	ULE58	563303	6163101		11/11/1964	04/10/1990
COU-FLIN	ULE49	562010	6160927		13/01/1969	12/11/1996
COU-FLIN	ULE82	559895	6154977		23/05/1962	11/11/1996
COU-FLIN	ULE175	553391	6159216	Tbw	25/02/1981	30/05/2005
COU-FLIN	ULE39	558105	6167076		11/11/1964	15/11/1996
COU-FLIN	ULE20	559933	6166358	Qpcb(UW)	13/11/1956	01/06/2005
COU-FLIN	ULE18	556824	6167991	Qpcb(UW)	11/11/1964	06/11/2000
COU-FLIN	SLE68	571828	6147370	Qpcb(LB-B	02/05/1991	31/05/2005
COU-FLIN	ULE194	547857	6151029	Qpcb(US)	03/05/1991	30/05/2005
COU-FLIN	ULE197	552506	6152937	Qpcb(US)	01/03/1991	30/05/2005
COU-FLIN	ULE140	555048	6151091	Qpcb(BRWT	23/01/1962	21/11/1996
COU-FLIN	ULE35	557517	6166141		11/11/1964	04/10/1990
COU-FLIN	ULE178	555160	6164858	TpQau	03/11/1986	01/06/2005
COU-FLIN	LKW2	549193	6168170		27/06/1967	16/11/1996
COU-FLIN	SLE21	570416	6147564	aq(SEDIME	31/07/1957	03/03/1975
COU-FLIN	FLN45	579555	6137287	aq(SEDIME	22/04/1958	25/11/1996
COU-FLIN	FLN37	578780	6144364	aq(SEDIME	11/06/1958	28/11/1996
COU-FLIN	FLN39	579802	6142875	aq(SEDIME		
COU-FLIN	FLN36	579113	6144285	aq(SEDIME		
COU-FLIN	ULE142	555285	6149954	Qpcb(BRWT	04/04/1961	20/11/1996
COU-FLIN	ULE134	550991	6148604	Qpcb(US)	26/04/1961	30/05/2005
COU-FLIN	ULE99	549244	6151804	Qpcb(US)	30/05/1961	30/05/2005
COU-FLIN	ULE115	551703	6151900		25/03/1966	09/11/1996
COU-FLIN	ULE55	562357	6162392		11/11/1964	12/11/1996
COU-FLIN	ULE50	561718	6159837		11/11/1964	12/11/1996
COU-FLIN	ULE83	560899	6155227		23/05/1962	11/11/1996
COU-FLIN	ULE78	552015	6161455		27/06/1967	01/10/1990
COU-FLIN	ULE168	552072	6161025		25/02/1981	08/11/1996
COU-FLIN	ULE26	561383	6165024		11/11/1964	04/10/1979
COU-FLIN	ULE32	558912	6164860		11/11/1964	04/10/1990
COU-FLIN	ULE13	557225	6164948		11/11/1964	13/11/1996
COU-FLIN	ULE11	555338	6164692		11/11/1964	04/10/1990
COU-FLIN	LKW24	546754	6167287		27/06/1967	16/11/1996
COU-FLIN	LKW14	549838	6161383		27/06/1967	08/10/1981
COU-FLIN	WNL36	552973	6168823		27/06/1967	16/11/1996
COU-FLIN	WNL18	557928	6171070		15/10/1968	02/04/1990
COU-FLIN	WNL6	557440	6169912		11/11/1964	14/11/1996
COU-FLIN	WNL23	558763	6169738		11/11/1964	04/10/1990

NETWORK	OBS_N	EASTING	NORTHING	AQUIFER	START	END
COU-FLIN	WNL48	557523	6170019	Qpcb(UW)		
COU-FLIN	FLN14	577279	6146815	aq(SEDIME	06/01/1959	01/10/1990
COU-FLIN	LKW9	548646	6162890		27/06/1967	02/04/1990
COU-FLIN	WNL14	557928	6171070		15/10/1968	04/10/1990
COU-FLIN	SLE46	567653	6143204	aq(SEDIME	22/04/1958	05/04/1983
COU-FLIN	ULE149	555960	6148154	we	23/05/1962	20/11/1996
COU-FLIN	ULE79	554613	6160749		28/07/1961	22/11/1996
COU-FLIN	ULE200	558290	6165412	Qpcb(UW)	03/05/1991	01/06/2005
COU-FLIN	WNL8	557523	6170019		11/11/1964	01/04/1988
COU-FLIN	SLE9	553295	6145202	Qpcb(BRWT	29/04/1963	19/11/1996
COU-FLIN	ULE195	562978	6164721	Tbw	03/05/1991	01/06/2005
COU-FLIN	FLN32	580616	6144540	aq(SEDIME	11/06/1958	01/10/1990
COU-FLIN	FLN40	580081	6140854	aq(SEDIME	08/05/1958	01/10/1990
COU-FLIN	FLN47	578897	6139351	aq(SEDIME		
COU-FLIN	LNC6	568310	6147879	aq(SEDIME	31/07/1957	07/11/1996
COU-FLIN	SLE3	559899	6145553	Tbw	23/05/1962	19/11/1996
COU-FLIN	SLE25	570496	6146403	aq(SEDIME	06/01/1959	18/11/1996
COU-FLIN	SLE28	569320	6145759	aq(SEDIME	06/01/1959	18/11/1996
COU-FLIN	SLE29	568957	6145171	aq(SEDIME	06/01/1959	18/11/1996
COU-FLIN	SLE38	572346	6146890	aq(SEDIME	06/01/1959	01/10/1990
COU-FLIN	SLE44	569318	6143719	aq(SEDIME	22/04/1958	01/10/1988
COU-FLIN	SLE56	571012	6147012	aq(SEDIME	06/01/1959	30/03/1987
COU-FLIN	SLE58	571583	6147360	aq(SEDIME	27/02/1958	18/11/1996
COU-FLIN	SLE61	571704	6147210	aq(SEDIME	27/02/1958	18/11/1996
COU-FLIN	SLE65	571637	6144275	aq(SEDIME	27/02/1958	03/08/1971
COU-FLIN	ULE23	560958	6166373		11/11/1964	04/10/1990
COU-FLIN	ULE27	560816	6165365		11/11/1964	15/11/1996
COU-FLIN	ULE30	559806	6164304		11/01/1967	03/04/1987
COU-FLIN	ULE38	557118	6167558		11/11/1964	04/10/1990
COU-FLIN	ULE68	557619	6163245		11/11/1964	04/10/1990
COU-FLIN	ULE70	557849	6164577		16/07/1968	05/11/1975
COU-FLIN	ULE73	552660	6166544		27/06/1967	01/10/1990
COU-FLIN	ULE91	549787	6157033		19/01/1961	08/11/1996
COU-FLIN	ULE94	548812	6155195		01/09/1961	01/03/1991
COU-FLIN	ULE95	548764	6154439	Qpcb(BRWT	01/09/1961	03/05/1991
COU-FLIN	ULE103	550925	6150143	Qpcb(BRWT	30/05/1961	09/11/1996
COU-FLIN	ULE112	551533	6152396		19/01/1961	09/11/1996
COU-FLIN	ULE119	553612	6152654	Qpcb(BRWT	22/02/1962	01/10/1990
COU-FLIN	ULE123	555673	6152585	Qpcb(BRWT	23/01/1962	11/11/1996

NETWORK	OBS_N	EASTING	NORTHING	AQUIFER	START	END
COU-FLIN	ULE130	553336	6159342		30/05/1961	09/11/1996
COU-FLIN	ULE132	561819	6148466	we	23/05/1962	01/10/1990
COU-FLIN	ULE133	550115	6147801		23/05/1962	05/02/2004
COU-FLIN	ULE144	553565	6149318	Qpcb(BRWT	04/04/1961	20/11/1996
COU-FLIN	ULE146	553079	6148580		26/09/1962	20/11/1996
COU-FLIN	ULE147	552034	6147706	Qpcb(US)	23/05/1962	30/05/2005
COU-FLIN	ULE150	557152	6148635	Qpcb(BRWT	23/05/1962	20/11/1996
COU-FLIN	ULE163	555833	6157311	Tbw	25/02/1981	30/05/2005
COU-FLIN	ULE170	552105	6158199		25/02/1981	09/11/1996
COU-FLIN	ULE176	555173	6160039	TpQau	25/02/1981	02/06/2005
COU-FLIN	WNL12	557928	6171070		11/11/1964	02/04/1990
COU-FLIN	WNL16	557928	6171070		13/10/1965	15/09/1984
COU-FLIN	WNL19	558626	6170608		11/11/1964	14/11/1996
COU-FLIN	WNL22	559087	6169295		11/11/1964	07/01/1977
COU-FLIN	WNL30	557928	6171070			
COU-FLIN	WNL32	557928	6171070		11/11/1964	05/08/1976
COU-FLIN	WNL33	553568	6171184		27/06/1967	01/10/1990
COU-FLIN	WNL37	552507	6168172		27/06/1967	16/11/1996
COU-FLIN	ULE202	548850	6154438	Qpcb(US)	03/05/2001	30/05/2005
COU-FLIN	ULE110	552496	6153307			
COU-FLIN	LKW6	548957	6165677	Tbw	27/06/1967	02/06/2005
COU-FLIN	LKW8	550027	6163560	Tbw	27/06/1967	02/06/2005
COU-FLIN	LKW15	549746	6170793	Qpcb(CB-B	27/06/1967	02/06/2005
COU-FLIN	LKW22	548574	6166746	Tbw	27/06/1967	02/06/2005
COU-FLIN	LKW27	546343	6165870	Qpcb(CB-A	27/06/1967	02/06/2005
COU-FLIN	LKW37	544192	6167594	Qpcb(CB-A	07/11/1986	02/06/2005
COU-FLIN	LKW38	544106	6167428	Qpcb(CB-A	07/11/1986	02/06/2005
COU-FLIN	LKW39	544098	6167422	Qpcb(CB-A	07/11/1986	02/06/2005
COU-FLIN	LKW40	544296	6167304	Tbw	07/11/1986	02/06/2005
COU-FLIN	ULE65	560347	6164090	Tbw	16/09/1968	01/06/2005
COU-FLIN	ULE127	552582	6154685	Tbw	30/05/1961	30/05/2005
COU-FLIN	ULE171	556266	6162440	Qpcb(UW)	25/02/1981	01/06/2005
COU-FLIN	ULE181	564263	6161250	Qpcb(UE)	03/11/1986	14/12/2000
COU-FLIN	ULE183	561968	6160579	Qpcb(UE)	03/11/1986	01/06/2005
COU-FLIN	ULE193	551891	6150894	Qpcb(US)	03/05/1991	30/05/2005
COU-FLIN	WNL3	557939	6169101	Qpcb(UW)	18/12/1940	01/06/2005
COU-FLIN	LKW43	543513	6167514	Qpcb(CB-A	07/11/1986	02/06/2005
COU-FLIN	ULE172	558667	6156042	Qpcb(UE)	25/02/1981	02/06/2005
COU-FLIN	ULE173	558205	6156864	ALs	25/02/1981	02/06/2005

NETWORK	OBS_N	EASTING	NORTHING	AQUIFER	START	END
COU-FLIN	ULE177	555766	6159315	TpQau	25/02/1981	02/06/2005
COU-FLIN	WNL35	553699	6169879	Qpcb(CB-C	27/06/1967	02/06/2005
COU-FLIN	WNL11	556145	6170389		11/11/1964	08/10/1987
COU-FLIN	ULE204	551915	6147884	Qpcb(US)	02/01/2003	30/05/2005
COU-FLIN	ULE203	548740	6155231	Qpcb(US)	14/11/2002	30/05/2005
COU-FLIN	LKW41	543913	6168652	Qpcb(CB-A	04/02/1987	02/06/2005
COU-FLIN	SLE42	572364	6145434	aq(SEDIME	27/02/1958	05/04/1986
COU-FLIN	SLE51	569422	6147581	aq(SEDIME		
COU-FLIN	FLN12	578013	6146007	aq(SEDIME	11/02/1960	27/11/1996
COU-FLIN	FLN9	579239	6145879	aq(SEDIME	11/02/1960	01/10/1990
COU-FLIN	ULE111	551174	6153321		01/03/1961	02/04/1990
COU-FLIN	ULE59	563354	6164100	Qpcb(BRWT	11/11/1964	02/10/1989
COU-FLIN	ULE85	561241	6156050		23/05/1962	01/10/1990
COU-FLIN	ULE93	548974	6156103		01/08/1961	08/11/1996
COU-FLIN	ULE40	558564	6166578		11/11/1964	02/10/1989
COU-FLIN	ULE15	556128	6166223		11/11/1964	13/11/1996
COU-FLIN	ULE80	554839	6161336		26/07/1961	22/11/1996
COU-FLIN	LKW21	549270	6166969	Tbw	27/06/1967	01/10/1990
COU-FLIN	WNL9	558023	6170835		11/11/1964	06/02/1991
COU-FLIN	WNL26	558136	6168312		11/11/1964	15/11/1996
COU-FLIN	ULE201	550347	6150178	Qpcb(US)	04/07/2002	30/05/2005
COU-FLIN	WNL44	560234	6168886	Qpcb(UW)	03/11/1986	02/06/2005
COU-FLIN	ULE72	552977	6167776	Qpcb(CB-C	27/06/1967	02/06/2005
COU-FLIN	LKW42	543473	6168097		27/09/2002	02/06/2005
COU-FLIN	ULE109	552506	6152937	Tbw	23/01/1962	30/05/2005
COU-FLIN	ULE207	548078	6150372	Qpcb(US)	27/05/2004	30/05/2005
COU-FLIN	ULE208	547735	6153092	Qpcb(US)	27/05/2004	30/05/2005
COU-FLIN	ULE206	550117	6147799	Qpcb(US)	15/03/2004	30/05/2005
COU-FLIN	ULE205	549934	6147386	Qpcb(US)+	27/05/2004	30/05/2005
COU-FLIN	SLE69	551460	6145299	Qpcb(US)+	15/03/2004	22/04/2005
COU-FLIN	SLE62	572552	6147343	aq(SEDIME	09/02/1966	26/11/1996
COU-FLIN	SLE31	569972	6145197	aq(SEDIME	27/02/1958	18/11/1996
COU-FLIN	FLN4	574456	6143637	aq(SEDIME	11/02/1960	05/04/1990
COU-FLIN	FLN7	578749	6145249	aq(SEDIME	11/06/1958	27/11/1996
COU-FLIN	SLE5	554484	6143351	Qpcb(US)+	23/05/1962	19/11/1996
COU-FLIN	SLE48	568266	6147298	aq(SEDIME	03/09/1975	26/11/1996
COU-FLIN	ULE189	553516	6152207	Qpcb(US)	03/05/1991	30/05/2005
COU-FLIN	ULE105	549866	6150935		29/06/1961	09/11/1996
COU-FLIN	ULE71	553571	6168053	Qpcb(BRWT	27/06/1967	01/10/1988

NETWORK	OBS_N	EASTING	NORTHING	AQUIFER	START	END
COU-FLIN	ULE152	563440	6155036		23/05/1962	22/12/1969
COU-FLIN	ULE126	554070	6154700	Qpcb(US)	23/01/1962	30/05/2005
COU-FLIN	ULE22	560522	6166777	Qpcb(BRWT	11/11/1964	14/11/1996
COU-FLIN	LKW20	550411	6168503		27/06/1967	06/11/1996
COU-FLIN	LKW26	545988	6167132		27/06/1967	11/04/1984
COU-FLIN	WNL7	556896	6170040		11/11/1964	01/04/1988
COU-FLIN	FLN3	573710	6145641	aq(SEDIME	06/01/1959	02/10/1987
COU-FLIN	FLN26	582071	6143350	aq(SEDIME	04/11/1964	28/11/1996
COU-FLIN	ULE52	561200	6163462		11/11/1964	04/10/1990
COU-FLIN	WNL25	558136	6168312		11/11/1964	01/10/1988
COU-FLIN	ULE74	552321	6167517		27/06/1967	16/11/1996
COU-FLIN	SLE24	570369	6146850	aq(SEDIME	01/06/1976	18/11/1996
COU-FLIN	FLN23	580153	6145881	aq(SEDIME	06/01/1959	27/11/1996
COU-FLIN	ULE19	559558	6167098		11/11/1964	14/11/1996
COU-FLIN	ULE179	562456	6165502	Qpcb(UE)	03/11/1986	01/06/2005
COU-FLIN	FLN51	576011	6142717	aq(SEDIME	11/02/1960	01/10/1990
COU-FLIN	ULE17	556056	6167440		11/11/1964	13/11/1996
COU-FLIN	ULE108	551985	6153709	Qpcb(BRWT	28/07/1961	07/11/1974
COU-FLIN	ULE106	549866	6153489		30/05/1961	09/11/1996
COU-FLIN-C	ULE72	552977	6167776	Qpcb(CB-C	27/06/1967	02/06/2005
COU-FLIN-C	WNL44	560234	6168886	Qpcb(UW)	03/11/1986	02/06/2005
COU-FLIN-C	WNL35	553699	6169879	Qpcb(CB-C	27/06/1967	02/06/2005
COU-FLIN-C	LKW15	549746	6170793	Qpcb(CB-B	27/06/1967	02/06/2005
COU-FLIN-C	LKW22	548574	6166746	Tbw	27/06/1967	02/06/2005
COU-FLIN-C	LKW6	548957	6165677	Tbw	27/06/1967	02/06/2005
COU-FLIN-C	LKW8	550027	6163560	Tbw	27/06/1967	02/06/2005
COU-FLIN-C	LKW27	546343	6165870	Qpcb(CB-A	27/06/1967	02/06/2005
COU-FLIN-C	LKW37	544192	6167594	Qpcb(CB-A	07/11/1986	02/06/2005
COU-FLIN-C	LKW38	544106	6167428	Qpcb(CB-A	07/11/1986	02/06/2005
COU-FLIN-C	LKW39	544098	6167422	Qpcb(CB-A	07/11/1986	02/06/2005
COU-FLIN-C	LKW40	544296	6167304	Tbw	07/11/1986	02/06/2005
COU-FLIN-C	LKW43	543513	6167514	Qpcb(CB-A	07/11/1986	02/06/2005
COU-FLIN-C	LKW41	543913	6168652	Qpcb(CB-A	04/02/1987	02/06/2005
COU-FLIN-C	ULE176	555173	6160039	TpQau	25/02/1981	02/06/2005
COU-FLIN-C	ULE177	555766	6159315	TpQau	25/02/1981	02/06/2005
COU-FLIN-C	ULE173	558205	6156864	ALs	25/02/1981	02/06/2005
COU-FLIN-C	ULE172	558667	6156042	Qpcb(UE)	25/02/1981	02/06/2005
COU-FLIN-C	LKW42	543473	6168097		27/09/2002	02/06/2005
COU-FLIN-L	LNC2	570596	6150846	Qpcb(LB-A	31/07/1957	31/05/2005

NETWORK	OBS_N	EASTING	NORTHING	AQUIFER	START	END
COU-FLIN-L	LNC8	568800	6148180	Qpcb(LB-A	03/09/1975	31/05/2005
COU-FLIN-L	LNC15	569928	6147920	Qpcb(LB-A	02/05/1991	31/05/2005
COU-FLIN-L	SLE47	568000	6147410	Qpcb(LB-A	19/09/1957	31/05/2005
COU-FLIN-L	SLE52	569008	6147295	Qpcb(LB-A	27/02/1958	31/05/2005
COU-FLIN-L	SLE41	572755	6145020	Qpcb(LB-B	04/11/1964	05/10/1993
COU-FLIN-L	SLE35	571565	6146549	Qpcb(LB-B	06/01/1959	31/05/2005
COU-FLIN-L	SLE37	572070	6146760	Tbw	27/02/1958	31/05/2005
COU-FLIN-L	SLE68	571828	6147370	Qpcb(LB-B	02/05/1991	31/05/2005
COU-FLIN-L	SLE64	570999	6147670	Qpcb(LB-B	31/07/1957	31/05/2005
COU-FLIN-L	FLN8	579474	6145563	Qpcb(LB-C	09/04/1959	31/05/2005
COU-FLIN-L	FLN35	579799	6144235	Qpcb(LB-C	03/09/1975	31/05/2005
COU-FLIN-L	FLN25	580908	6144449	Qpcb(LB-C	11/06/1958	31/05/2005
COU-FLIN-L	FLN29	581386	6143376	Qpcb(LB-C	11/02/1960	31/05/2005
COU-FLIN-L	FLN56	578928	6143970	Qpcb(LB-C	02/05/1991	31/05/2005
COU-FLIN-L	FLN42	581209	6138237	Qpcb(LB-C	22/04/1958	31/05/2005
COU-FLIN-L	SLE30	569334	6144842	Qpcb(LB-B	06/01/1959	31/05/2005
COU-FLIN-U	ULE166	558926	6154778	Qpcb(UE)	25/02/1981	30/05/2005
COU-FLIN-U	ULE174	556752	6156486	ALs+Tbw	25/02/1981	30/05/2005
COU-FLIN-U	ULE163	555833	6157311	Tbw	25/02/1981	30/05/2005
COU-FLIN-U	ULE175	553391	6159216	Tbw	25/02/1981	30/05/2005
COU-FLIN-U	ULE169	553190	6158187	Tbw	25/02/1981	30/05/2005
COU-FLIN-U	ULE77	550671	6161942	Qpcb(US)	27/06/1967	30/05/2005
COU-FLIN-U	ULE92	550371	6156026	Qpcb(US)	19/01/1961	30/05/2005
COU-FLIN-U	LKW12	549182	6160076	Tbw	27/06/1967	30/05/2005
COU-FLIN-U	LKW34	549381	6158040	Tbw	19/01/1961	30/05/2005
COU-FLIN-U	ULE99	549244	6151804	Qpcb(US)	30/05/1961	30/05/2005
COU-FLIN-U	ULE194	547857	6151029	Qpcb(US)	03/05/1991	30/05/2005
COU-FLIN-U	ULE101	549563	6150501	Qpcb(US)	25/03/1966	30/05/2005
COU-FLIN-U	ULE196	551618	6149131	Qpcb(US)	03/05/1991	30/05/2005
COU-FLIN-U	ULE145	552601	6149494	Qpcb(US)	04/04/1961	30/05/2005
COU-FLIN-U	ULE193	551891	6150894	Qpcb(US)	03/05/1991	30/05/2005
COU-FLIN-U	ULE192	551672	6151480	Qpcb(US)	03/05/1991	30/05/2005
COU-FLIN-U	ULE114	550945	6151573	Qpcb(US)	25/03/1966	30/05/2005
COU-FLIN-U	ULE190	551425	6152066	Qpcb(US)	03/05/1991	30/05/2005
COU-FLIN-U	ULE188	551243	6152585	Qpcb(US)	03/05/1991	30/05/2005
COU-FLIN-U	ULE185	551131	6153174	Tbw	03/05/1991	30/05/2005
COU-FLIN-U	ULE184	551157	6153167	Qpcb(US)	03/05/1991	30/05/2005
COU-FLIN-U	ULE197	552506	6152937	Qpcb(US)	01/03/1991	30/05/2005
COU-FLIN-U	ULE127	552582	6154685	Tbw	30/05/1961	30/05/2005

NETWORK	OBS_N	EASTING	NORTHING	AQUIFER	START	END
COU-FLIN-U	ULE126	554070	6154700	Qpcb(US)	23/01/1962	30/05/2005
COU-FLIN-U	ULE147	552034	6147706	Qpcb(US)	23/05/1962	30/05/2005
COU-FLIN-U	ULE97	548796	6152874	Qpcb(US)	30/05/1961	30/05/2005
COU-FLIN-U	ULE204	551915	6147884	Qpcb(US)	02/01/2003	30/05/2005
COU-FLIN-U	ULE203	548740	6155231	Qpcb(US)	14/11/2002	30/05/2005
COU-FLIN-U	ULE201	550347	6150178	Qpcb(US)	04/07/2002	30/05/2005
COU-FLIN-U	ULE202	548850	6154438	Qpcb(US)	03/05/2001	30/05/2005
COU-FLIN-U	ULE89	557114	6154243	Tbw	23/05/1962	30/05/2005
COU-FLIN-U	ULE102	549893	6149686	Qpcb(US)	30/05/1961	30/05/2005
COU-FLIN-U	ULE109	552506	6152937	Tbw	23/01/1962	30/05/2005
COU-FLIN-U	ULE134	550991	6148604	Qpcb(US)	26/04/1961	30/05/2005
COU-FLIN-U	ULE135	551618	6149131	Tbw	26/04/1961	30/05/2005
COU-FLIN-U	ULE139	553492	6151286	Qpcb(US)	23/01/1962	30/05/2005
COU-FLIN-U	ULE141	556430	6151537	Tbw	23/01/1962	30/05/2005
COU-FLIN-U	ULE164	556751	6156486	Tbw	25/02/1981	30/09/2004
COU-FLIN-U	ULE167	560024	6153927	Qpcb(UE)	25/02/1981	06/07/1994
COU-FLIN-U	ULE186	551763	6153404	Qpcb(US)	03/05/1991	30/05/2005
COU-FLIN-U	ULE187	551844	6152819	Qpcb(US)	03/05/1991	30/05/2005
COU-FLIN-U	ULE189	553516	6152207	Qpcb(US)	03/05/1991	30/05/2005
COU-FLIN-U	ULE191	551985	6152055	Qpcb(US)	03/05/1991	30/05/2005
COU-FLIN-U	ULE96	548677	6153738	Qpcb(BRWT	01/09/1961	30/05/2005
COU-FLIN-U	ULE98	547745	6151751		30/05/1961	30/05/2005
COU-FLIN-U	SLE69	551460	6145299	Qpcb(US)+	15/03/2004	22/04/2005
COU-FLIN-U	ULE206	550117	6147799	Qpcb(US)	15/03/2004	30/05/2005
COU-FLIN-U	ULE205	549934	6147386	Qpcb(US)+	27/05/2004	30/05/2005
COU-FLIN-U	ULE207	548078	6150372	Qpcb(US)	27/05/2004	30/05/2005
COU-FLIN-U	ULE208	547735	6153092	Qpcb(US)	27/05/2004	30/05/2005
COU-FLIN-W	ULE179	562456	6165502	Qpcb(UE)	03/11/1986	01/06/2005
COU-FLIN-W	ULE20	559933	6166358	Qpcb(UW)	13/11/1956	01/06/2005
COU-FLIN-W	ULE18	556824	6167991	Qpcb(UW)	11/11/1964	06/11/2000
COU-FLIN-W	ULE36	557506	6166303	Qpcb(UW)	26/07/1950	01/06/2005
COU-FLIN-W	ULE34	558162	6166226	Qpcb(UW)	11/11/1964	01/06/2005
COU-FLIN-W	ULE178	555160	6164858	TpQau	03/11/1986	01/06/2005
COU-FLIN-W	ULE7	556968	6163983	Qpcb(UW)	09/03/1944	01/06/2005
COU-FLIN-W	ULE171	556266	6162440	Qpcb(UW)	25/02/1981	01/06/2005
COU-FLIN-W	ULE65	560347	6164090	Tbw	16/09/1968	01/06/2005
COU-FLIN-W	ULE198	562978	6164721	Tbw	03/05/1991	01/06/2005
COU-FLIN-W	ULE199	562978	6164721	Qpcb(UE)	03/05/1991	01/06/2005
COU-FLIN-W	ULE195	562978	6164721	Tbw	03/05/1991	01/06/2005

NETWORK	OBS_N	EASTING	NORTHING	AQUIFER	START	END
COU-FLIN-W	ULE180	564261	6163795	TpQau	03/11/1986	01/06/2005
COU-FLIN-W	ULE181	564263	6161250	Qpcb(UE)	03/11/1986	14/12/2000
COU-FLIN-W	ULE183	561968	6160579	Qpcb(UE)	03/11/1986	01/06/2005
COU-FLIN-W	ULE86	560447	6157304	Qpcb(UE)	23/05/1962	01/06/2005
COU-FLIN-W	WNL43	558929	6170053	Qpcb(UW)	03/11/1986	01/06/2005
COU-FLIN-W	WNL46	558830	6169787	Qpcb(UW)	02/05/1991	01/06/2005
COU-FLIN-W	WNL47	557484	6170105	Qpcb(UW)	02/05/1991	01/06/2005
COU-FLIN-W	WNL3	557939	6169101	Qpcb(UW)	18/12/1940	01/06/2005
COU-FLIN-W	ULE182	563330	6157649	Qpcb(UE)	03/11/1986	01/06/2005
COU-FLIN-W	ULE200	558290	6165412	Qpcb(UW)	03/05/1991	01/06/2005
COU-FLIN-W	WNL45	561794	6168057	Qpcb(UW)	03/11/1986	01/06/2005
COU-FLIN-W	WNL48	557523	6170019	Qpcb(UW)		
COU-MUSG	WAD3	499907	6280630	Qpcb(BRWT	15/03/1967	15/11/1995
COU-MUSG	TAA35	498730	6303381	Tbe(POEL-	15/11/1968	15/11/1995
COU-MUSG	TAA33	499975	6303724		15/11/1968	15/11/1995
COU-MUSG	TAA32	499822	6302156	Tbe(POEL-	15/11/1968	15/11/1995
COU-MUSG	TAA11	503531	6284847	Qpcb(BRWT	15/03/1967	15/11/1995
COU-MUSG	TAA61	502516	6284040	Qpcb(BRWT	12/12/1989	25/03/2005
COU-MUSG	TAA60	502516	6284040	Tbe(POEL-	12/12/1989	25/03/2005
COU-MUSG	TAA3	511054	6284132	Tbe(POEL-	24/10/1965	15/11/1995
COU-MUSG	TAA1	508348	6285826	Tbe(POEL-	02/11/1969	15/11/1995
COU-MUSG	TAA8	507388	6286215	Tbe(POEL-	30/04/1970	04/05/1982
COU-MUSG	TAA58	502139	6287618	Tbe(POEL-	12/12/1989	25/03/2005
COU-MUSG	TAA59	502139	6287618	Qpcb(BRWT	12/12/1989	25/03/2005
COU-MUSG	TAA21	502337	6288122	Qpcb(BRWT	01/04/1967	04/03/1994
COU-MUSG	TAA16	514698	6288684	Tbe(POEL-	01/10/1964	18/03/2005
COU-MUSG	TAA50	502190	6291150	Qpcb(BRWT	01/04/1967	15/11/1995
COU-MUSG	TAA14	514713	6291614	Qpcb(BRWT	01/10/1964	15/11/1995
COU-MUSG	TAA6	511657	6292194		04/09/1963	15/11/1995
COU-MUSG	TAA4	513238	6293330	Qpcb(BRWT	15/03/1967	04/05/1982
COU-MUSG	TIN60	514980	6286180	Tbe(POEL-	08/04/1980	22/04/1981
COU-MUSG	TIN57	517965	6285810	Tbe(POEL-	01/10/1964	15/11/1995
COU-MUSG	TIN50	516569	6290076	Qpcb(BRWT	01/10/1964	15/11/1995
COU-MUSG	TIN53	519126	6288746	Qpcb(BRWT	01/10/1964	15/11/1995
COU-MUSG	TIN45	516952	6291947	Qpcb(BRWT	15/03/1967	15/11/1995
COU-MUSG	TIN46	517729	6292337	Qpcb(BRWT	15/03/1967	15/11/1995
COU-MUSG	TIN62	521785	6291377	Tbe(POEL-	15/03/1967	15/11/1995
COU-MUSG	TIN14	515520	6293170	Qpcb(BRWT	15/03/1967	15/11/1995
COU-MUSG	TIN17	520553	6292734	Qpcb(BRWT	15/03/1967	15/11/1995

NETWORK	OBS_N	EASTING	NORTHING	AQUIFER	START	END
COU-MUSG	TIN18	522347	6292420	Qpcb(BRWT	15/03/1967	15/11/1995
COU-MUSG	WAD1	501940	6283820	Qpcb(BRWT	02/11/1969	15/11/1995
COU-MUSG	WAD2	500955	6282679	Qpcb(BRWT	15/03/1967	15/11/1995
COU-MUSG	WAD24	503200	6281069	Qpcb(BRWT	01/04/1967	15/11/1995
COU-MUSG	WAD21	504532	6282089	Tbe(POEL-	01/04/1967	15/11/1995
COU-MUSG	WAD22	504446	6281004	Qpcb(BRWT	01/04/1967	15/11/1995
COU-MUSG	WAD9	505548	6278447	Qpcb(BRWT	15/03/1967	15/11/1995
COU-MUSG	WAD19	500204	6278433	Qpcb(BRWT	01/04/1967	15/11/1995
COU-MUSG	WAD12	503550	6276348	Qpcb(BRWT	01/04/1967	10/05/1982
COU-MUSG	WAD17	501642	6275563	Qpcb(BRWT	01/04/1967	20/03/2005
COU-MUSG	WAD15	504455	6273568	Tbe(POEL-	01/04/1967	05/08/1989
COU-MUSG	HUD24	517276	6268713		15/04/1966	15/11/1995
COU-MUSG	HUD77	511244	6271052		14/10/1966	29/04/1982
COU-MUSG	HUD11	508126	6268610	Qpcb(BRWT	26/10/1965	11/11/1981
COU-MUSG	HUD12	509399	6268650	Qpcb(BRWT	26/10/1965	15/11/1995
COU-MUSG	HUD10	508104	6270993	Qpcb(BRWT	14/10/1966	15/11/1995
COU-MUSG	HUD13	511233	6268714	ALs(Basem	26/10/1965	15/11/1995
COU-MUSG	HUD52	514494	6271345	Qpcb(BRWT	15/04/1966	15/11/1995
COU-MUSG	HUD83	515473	6269694	Qpcb(BRWT	02/05/1974	29/04/1982
COU-MUSG	HUD60	513298	6282988	Tbe(POEL-	24/10/1965	15/11/1995
COU-MUSG	HUD65	513034	6283919	Tbe(POEL-	14/10/1966	29/04/1982
COU-MUSG	HUD68	510045	6283835		15/10/1966	15/11/1995
COU-MUSG	HUD3	508092	6280879	Qpcb(BRWT	14/10/1966	15/11/1995
COU-MUSG	HUD5	508088	6277660	Qpcb(BRWT	15/03/1967	15/11/1995
COU-MUSG	HUD6	508089	6276280	Qpcb(BRWT	14/10/1966	15/11/1995
COU-MUSG	HUD69	511246	6282755	Tbe(POEL-	15/04/1966	15/11/1995
COU-MUSG	HUD71	511249	6280616	Qpcb(BRWT	15/04/1966	15/11/1995
COU-MUSG	HUD72	511244	6278243	Tbe(POEL-	15/04/1966	18/03/2005
COU-MUSG	HUD73	511224	6276675		15/04/1966	15/11/1995
COU-MUSG	HUD7	508093	6274787	Qpcb(BRWT	14/10/1966	15/11/1995
COU-MUSG	HUD31	520458	6276874	Tbe(POEL-	14/10/1966	15/11/1995
COU-MUSG	HUD61	514515	6282796	Tbe(POEL-	24/10/1965	15/11/1995
COU-MUSG	HUD64	514361	6283816	Tbe(POEL-	14/10/1966	09/07/1993
COU-MUSG	HUD55	514456	6276828	Tbe(POEL-	15/04/1966	18/03/2005
COU-MUSG	HUD57	514423	6280030	Tbe(POEL-	15/04/1966	15/11/1995
COU-MUSG	HUD59	514416	6282609	Tbe(POEL-	15/04/1966	18/03/2005
COU-MUSG	HUD42	517135	6282436	Tbe(POEL-	15/04/1966	29/04/1982
COU-MUSG	HUD46	517172	6279687	Tbe(POEL-	15/04/1966	15/11/1995
COU-MUSG	HUD48	517178	6276559	Tbe(POEL-	15/04/1966	15/11/1995

NETWORK	OBS_N	EASTING	NORTHING	AQUIFER	START	END
COU-MUSG	HUD51	517255	6271708	Tbe(POEL-	13/12/1965	27/08/2003
COU-MUSG	HUD34	520471	6278189	Tbe(POEL-	14/10/1966	29/10/1994
COU-MUSG	HUD36	520452	6281306	Tbe(POEL-	15/04/1966	15/11/1995
COU-MUSG	HUD37	520453	6282593	Tbe(POEL-	15/04/1966	15/11/1995
COU-MUSG	HUD82	517382	6283801	ALs(Basem	26/10/1965	15/11/1995
COU-MUSG	HUD45	518522	6279455	Tbe(POEL-	26/10/1965	15/11/1995
COU-MUSG	HUD33	519452	6277795	Qpcb(BRWT	15/04/1966	08/07/1993
COU-MUSG	HUD18	520082	6271194	Qpcb(BRWT	15/04/1966	20/03/2005
COU-MUSG	HUD80	515721	6274777	Tbe(POEL-	26/10/1965	29/04/1982
COU-MUSG	HUD49	517191	6274784	Qpcb(BRWT	26/10/1965	15/11/1995
COU-MUSG	KPW3	522962	6283793	Tbe(POEL-	14/10/1966	15/11/1995
COU-MUSG	KPW63	521164	6277676	Qpcb(BRWT	15/03/1967	19/07/1993
COU-MUSG	HUD20	511279	6264941		15/04/1966	15/11/1995
COU-MUSG	HUD21	514465	6264985		15/04/1966	15/11/1995
COU-MUSG	HUD25	520508	6264962		10/10/1966	29/10/1994
COU-MUSG	WAY2	508914	6264893	ALs(Basem	15/11/1968	15/11/1995
COU-MUSG	WAY5	514803	6261604	Tbe(POEL-	15/11/1968	15/11/1995
COU-MUSG	WAY7	517316	6262941	Qpcb(BRWT	15/11/1968	15/11/1995
COU-MUSG	WAY10	519326	6260116	ALs(Basem	15/11/1968	15/11/1995
COU-MUSG	WAY56	520563	6258634	Qpcb(BRWT		
COU-MUSG	WAY12	520631	6258484	Tbe(POEL-	15/07/1967	08/04/1980
COU-MUSG	WAY53	517088	6257195	Qpcb(BRWT	15/11/1968	30/04/1982
COU-MUSG	WAY54	519245	6256475		15/11/1968	28/03/2005
COU-MUSG	WAY28	521517	6255133	Qpcb(BRWT	15/07/1967	15/11/1995
COU-MUSG	WAY31	517530	6253965	Qpcb(BRWT	06/11/1970	28/03/2005
COU-MUSG	WAY37	519169	6251684		15/11/1968	30/04/1982
COU-MUSG	WAY41	522439	6248183	Qpcb(BRWT	15/11/1968	15/11/1995
COU-MUSG	KPW45	523406	6264996	Tbe(POEL-	07/02/1966	15/11/1995
COU-MUSG	KPW21	529093	6264997	Tbe(POEL-	15/03/1967	15/11/1995
COU-MUSG	BLS12	535035	6265002	Tbe(POEL-	15/03/1967	23/04/1982
COU-MUSG	BLS13	537959	6264966	Qpcb(BRWT	15/03/1967	15/11/1995
COU-MUSG	BLS39	540925	6264952	Tbe(POEL-	15/03/1967	28/03/2005
COU-MUSG	BLS35	545951	6265025	Tbe(POEL-	15/03/1967	15/11/1995
COU-MUSG	WAY16	523280	6261532	Qpcb(BRWT	15/11/1968	15/11/1995
COU-MUSG	WAY19	529045	6262659		15/07/1967	15/11/1995
COU-MUSG	WAY22	526652	6257816	Qpcb(BRWT	15/11/1968	15/11/1995
COU-MUSG	WAY1	526236	6255821			
COU-MUSG	WAY26	524724	6254787	Qpcb(BRWT	15/07/1967	15/11/1995
COU-MUSG	WAY50	528382	6252896	Qpcb(BRWT	15/10/1972	03/07/1973

NETWORK	OBS_N	EASTING	NORTHING	AQUIFER	START	END
COU-MUSG	WAY44	529510	6246263	Qpcb(BRWT	15/11/1968	15/11/1995
COU-MUSG	WAY43	524828	6246815	ALs(Basem	15/11/1968	15/11/1995
COU-MUSG	PER36	530207	6248601	Qpcb(BRWT	15/11/1968	15/11/1995
COU-MUSG	PER35	530221	6252143	Qpcb(BRWT	15/11/1968	15/11/1995
COU-MUSG	PER15	530227	6254336	Qpcb(BRWT	15/07/1967	28/03/2005
COU-MUSG	PER6	533334	6252447	Qpcb(BRWT	02/11/1969	15/11/1995
COU-MUSG	PER5	535116	6252193	Tbe(POEL-	02/11/1969	27/03/1994
COU-MUSG	PER4	536636	6251656	Qpcb(BRWT	06/11/1970	15/11/1995
COU-MUSG	PER1	540598	6254256	Qpcb(BRWT	01/10/1964	28/03/2005
COU-MUSG	PER30	534531	6254404	Qpcb(BRWT	15/11/1968	28/03/2005
COU-MUSG	PER33	532767	6254771	Qpcb(BRWT	15/11/1968	15/11/1995
COU-MUSG	PER17	530253	6255929	Qpcb(BRWT	15/11/1968	15/11/1995
COU-MUSG	PER29	538134	6254565		15/11/1968	15/11/1995
COU-MUSG	PER26	536435	6254623	Tbe(POEL-	15/11/1968	15/11/1995
COU-MUSG	PER25	536139	6256847	Tbe(POEL-	15/11/1968	15/11/1995
COU-MUSG	PER21	540161	6256020	Qpcb(BRWT	15/11/1968	15/11/1995
COU-MUSG	PER24	535727	6258459	Qpcb(BRWT	15/11/1968	15/11/1995
COU-MUSG	PER32	533208	6257843	Qpcb(BRWT	15/11/1968	15/11/1995
COU-MUSG	PER19	530722	6259017	Qpcb(BRWT	15/11/1968	15/11/1995
COU-MUSG	PER13	532677	6262704	Qpcb(BRWT	15/11/1968	15/11/1995
COU-MUSG	PER8	539599	6260426	Qpcb(BRWT	15/07/1967	15/11/1995
COU-MUSG	PER31	539205	6262681	Qpcb(BRWT	15/11/1968	15/11/1995
COU-MUSG	PER10	536396	6260273	Qpcb(BRWT	15/07/1967	15/11/1995
COU-MUSG	TIN31	526567	6291074	Qpcb(BRWT	01/10/1964	15/11/1995
COU-MUSG	TIN30	527958	6291523	Qpcb(BRWT	01/10/1964	15/11/1995
COU-MUSG	TIN21	526295	6292003	Qpcb(BRWT	01/04/1963	15/11/1995
COU-MUSG	TIN35	524540	6290106	Qpcb(BRWT	01/10/1964	15/11/1995
COU-MUSG	TIN41	524665	6290475	Qpcb(BRWT	01/10/1964	19/03/2005
COU-MUSG	TIN37	523794	6291395	Qpcb(BRWT	01/10/1964	15/11/1995
COU-MUSG	TIN19	523488	6292212	Qpcb(BRWT	21/02/1967	15/11/1995
COU-MUSG	TIN20	524582	6291957	Qpcb(BRWT	21/02/1967	19/03/2005
COU-MUSG	TIN27	526810	6288150	Qpcb(BRWT	01/10/1964	15/11/1995
COU-MUSG	TIN68	523571	6284862	Tbe(POEL-	15/04/1968	15/11/1995
COU-MUSG	BLS10	535123	6267743	Qpcb(BRWT	15/03/1967	23/04/1982
COU-MUSG	BLS9	535134	6270077	ALs(Basem		
COU-MUSG	BLS16	538085	6273104	Tbe(POEL-	15/03/1967	15/11/1995
COU-MUSG	BLS15	538102	6271711	Tbe(POEL-	15/03/1967	15/11/1995
COU-MUSG	BLS34	545762	6266768	Tbe(POEL-	15/03/1967	15/11/1995
COU-MUSG	BLS8	535134	6271828	ALs(Basem	15/03/1967	23/04/1982

NETWORK	OBS_N	EASTING	NORTHING	AQUIFER	START	END
COU-MUSG	BLS20	539521	6277660	Tbe(POEL-	15/03/1967	15/11/1995
COU-MUSG	BLS22	540044	6282039	Tbe(POEL-	15/04/1980	23/04/1982
COU-MUSG	BLS18	538129	6274842	Tbe(POEL-	17/10/1966	23/04/1982
COU-MUSG	BLS19	539676	6274832	Tbe(POEL-	06/11/1970	23/04/1982
COU-MUSG	BLS38	541016	6274836	ALs(Basem	17/10/1966	23/04/1982
COU-MUSG	BLS25	542690	6274845	Tbe(POEL-	17/10/1966	15/11/1995
COU-MUSG	BLS41	546407	6277461	Tbe(POEL-	15/11/1968	01/11/1994
COU-MUSG	BLS42	546419	6278955	Tbe(POEL-	15/11/1968	12/11/1981
COU-MUSG	BLS43	546421	6280581	Tbe(POEL-	09/04/1980	12/11/1981
COU-MUSG	BLS44	546458	6283483	Tbe(POEL-	15/06/1965	01/11/1994
COU-MUSG	BLS23	540669	6283711	Tbe(POEL-	01/11/1977	12/11/1981
COU-MUSG	BLS3	535198	6279310	Tbe(POEL-	15/04/1968	10/11/1981
COU-MUSG	BLS1	535223	6282351	ALs	15/04/1968	10/11/1981
COU-MUSG	BLS37	541000	6271859	Qpcb(BRWT	15/03/1967	15/11/1995
COU-MUSG	BLS30	545742	6273312	Tbe(POEL-	06/11/1970	15/11/1995
COU-MUSG	BLS31	545753	6271792	Qpcb(BRWT	15/03/1967	15/11/1995
COU-MUSG	BLS24	542470	6276155	Tbe(POEL-	15/03/1967	15/11/1995
COU-MUSG	BLS40	544030	6276191	Tbe(POEL-	01/04/1967	15/11/1995
COU-MUSG	BLS28	545638	6276498	Tbe(POEL-	01/04/1967	15/11/1995
COU-MUSG	KPW32	528839	6282882	Tbe(POEL-	01/10/1964	08/07/1993
COU-MUSG	KPW33	527962	6281457	Tbe(POEL-	01/10/1964	15/11/1995
COU-MUSG	KPW6	527189	6283834	Qpcb(BRWT	14/10/1966	15/11/1995
COU-MUSG	KPW4	524239	6283835	Tbe(POEL-	02/11/1969	15/11/1995
COU-MUSG	KPW60	523464	6278274	Qpcb(BRWT	07/02/1966	15/11/1995
COU-MUSG	KPW53	523379	6273596	Qpcb(BRWT	07/02/1966	23/11/1981
COU-MUSG	KPW46	523390	6266546	Tbe(POEL-	07/02/1966	28/04/1982
COU-MUSG	KPW42	525933	6267889	Qpcb(BRWT	10/02/1966	23/11/1981
COU-MUSG	KPW40	525954	6271841	Qpcb(BRWT	10/02/1966	15/11/1995
COU-MUSG	KPW39	525941	6273097	Qpcb(BRWT	10/02/1966	15/11/1995
COU-MUSG	KPW27	529152	6276397	Qpcb(BRWT	14/10/1966	15/11/1995
COU-MUSG	KPW58	523809	6276179	Qpcb(BRWT	15/03/1967	28/04/1982
COU-MUSG	KPW51	523882	6272534	Qpcb(BRWT	26/10/1965	20/03/2005
COU-MUSG	KPW38	525953	6274663	Qpcb(BRWT	26/10/1965	19/03/2005
COU-MUSG	KPW26	529131	6274869	Qpcb(BRWT	15/03/1967	24/02/1994
COU-MUSG	KPW69	530587	6274880	Tbe(POEL-	17/10/1966	19/03/2005
COU-MUSG	KPW13	533618	6274877	Tbe(POEL-	14/10/1966	15/11/1995
COU-MUSG	KPW64	532512	6283839	Tbe(POEL-	06/11/1970	15/11/1995
COU-MUSG	KPW22	529147	6266983	ALs(Basem	17/04/1980	28/04/1982
COU-MUSG	KPW16	532064	6272476	Tbe(POEL-	15/03/1967	15/11/1995

NETWORK	OBS_N	EASTING	NORTHING	AQUIFER	START	END
COU-MUSG	KPW15	532095	6274018	Tbe(POEL-	15/03/1967	15/07/1993
COU-MUSG	KPW8	532185	6282489	Tbe(POEL-	15/03/1967	15/11/1995
COU-MUSG	KPW10	532124	6279537	Tbe(POEL-	15/03/1967	28/04/1982
COU-MUSG	KPW11	532117	6277991	Tbe(POEL-	15/03/1967	15/11/1995
COU-MUSG	SQR40	545238	6289593	Tbe(POEL-	01/10/1964	15/11/1995
COU-MUSG	SQR42	545902	6288090	Tbe(POEL-	01/10/1964	15/11/1995
COU-MUSG	SQR43	545639	6287263	Tbe(POEL-	27/02/1963	15/11/1995
COU-MUSG	SQR44	544944	6287250	Tbe(POEL-	01/10/1964	15/11/1995
COU-MUSG	SQR71	542331	6286126	Tbe(POEL-	08/04/1980	09/11/1981
COU-MUSG	SQR37	540632	6290623		28/02/1993	17/03/2005
COU-MUSG	SQR38	541831	6290055	Tbe(POEL-	28/02/1993	17/03/2005
COU-MUSG	SQR58	541939	6291407	Tbe(POEL-	01/10/1964	15/11/1995
COU-MUSG	SQR59	540867	6291610	Tbe(POEL-	01/10/1964	15/11/1995
COU-MUSG	SQR49	539329	6288456	Tbe(POEL-	01/04/1964	29/04/1982
COU-MUSG	SQR53	539582	6290416	Qpcb(BRWT	20/06/1963	15/11/1995
COU-MUSG	SQR69	535338	6288883		14/10/1966	15/11/1995
COU-MUSG	SQR92	537743	6283975	Tbe(POEL-	17/10/1966	15/11/1995
COU-MUSG	SQR91	539086	6283890	Tbe(POEL-	10/04/1980	09/11/1981
COU-MUSG	SQR20	536073	6289942	Tbe(POEL-	01/03/1993	17/03/2005
COU-MUSG	SQR21	536621	6290877	Qpcb(BRWT	01/03/1993	17/03/2005
COU-MUSG	SQR60	540080	6292398	Tbe(POEL-	01/10/1964	15/11/1995
COU-MUSG	SQR64	530723	6285546	Tbe(POEL-	02/11/1969	29/04/1982
COU-MUSG	SQR65	532386	6285227	Tbe(POEL-	15/11/1968	15/11/1995
COU-MUSG	SQR66	531867	6286803	Tbe(POEL-	06/11/1970	15/11/1995
COU-MUSG	SQR67	535265	6285841	Tbe(POEL-	15/04/1968	15/11/1995
COU-MUSG	SQR117	530994	6289309	Qpcb(BRWT	17/01/1992	19/03/2005
COU-MUSG	SQR2	531417	6292447	Qpcb(BRWT	26/12/1962	19/03/2005
COU-MUSG	SQR9	530425	6291595	Qpcb(Plda	04/12/1962	18/03/2005
COU-MUSG	SQR28	532375	6291590	Qpcb(Plda	04/12/1962	19/03/2005
COU-MUSG	SQR101	542882	6289861	Qpcb(BRWT	26/04/1989	17/03/2005
COU-MUSG	SQR105	537482	6291748	Tbe(POEL-	26/04/1989	17/03/2005
COU-MUSG	SQR98	537482	6291748	Tbe(POEL-	26/04/1989	17/03/2005
COU-MUSG	SQR99	531555	6290794	Tbe(POEL-	26/04/1989	17/03/2005
COU-MUSG	SQR96	531393	6292507	Tbe(POEL-	26/04/1989	17/03/2005
COU-MUSG	KPW71	523378	6267071	ALs(Basem	17/08/1989	25/11/1995
COU-MUSG	KPW70	526278	6276571		23/06/1989	19/03/2005
COU-MUSG	BLS47	535178	6275621	Tbe(POEL-	15/04/1981	18/03/2005
COU-MUSG	TIN98	529228	6291171	Tbe(POEL-	27/06/1989	17/03/2005
COU-MUSG	KPW73	526028	6273671	Qpcb(BRWT	07/08/1989	20/03/2005

NETWORK	OBS_N	EASTING	NORTHING	AQUIFER	START	END
COU-MUSG	SQR110	531228	6292471		09/08/1989	17/03/2005
COU-MUSG	TAA57	509878	6289721	Qpcb(BRWT	04/10/1989	25/03/2005
COU-MUSG	TAA56	507278	6291871	Tbe(POEL-	30/09/1989	25/03/2005
COU-MUSG	WAY55	512228	6256721	Qpcb(BRWT	15/12/1989	28/03/2005
COU-MUSG	SQR113	531428	6292921	Qpcb(BRWT	17/01/1992	17/03/2005
COU-MUSG	SQR115	535078	6292721	Tbe(POEL-	17/01/1992	17/03/2005
COU-MUSG	SQR78	536391	6299117	Qpcb(BRWT	18/06/1963	15/11/1995
COU-MUSG	SQR80	539250	6299757	Qpcb(BRWT	18/06/1963	15/11/1995
COU-MUSG	SQR61	540059	6293724	Tbe(POEL-	01/04/1963	15/11/1995
COU-MUSG	SQR62	539181	6294259	Tbe(POEL-	01/04/1963	15/11/1995
COU-MUSG	SQR63	538285	6293381	Qpcb(BRWT	01/04/1963	15/11/1995
COU-MUSG	SQR11	531415	6294092	Tbe(POEL-	04/12/1962	17/03/2005
COU-MUSG	SQR73	531067	6295967	Qpcb(BRWT	01/04/1963	17/03/2005
COU-MUSG	SQR84	535020	6296275	Tbe(POEL-	01/05/1963	17/03/2005
COU-MUSG	SQR82	536639	6296282	Qpcb(BRWT	18/06/1963	15/11/1995
COU-MUSG	SQR81	537379	6297518	Tbe(POEL-	18/06/1963	17/03/2005
COU-MUSG	SQR83	535679	6297086	Qpcb(BRWT	18/06/1963	09/11/1981
COU-MUSG	SQR85	534295	6297455	Qpcb(BRWT	18/06/1963	17/03/2005
COU-MUSG	SQR88	533217	6297627	Qpcb(BRWT	18/06/1963	17/03/2005
COU-MUSG	SQR76	533834	6299714	Tbe(POEL-	18/06/1963	17/03/2005
COU-MUSG	TIN89	529164	6299700	Qpcb(BRWT	01/04/1963	15/11/1995
COU-MUSG	TIN90	529519	6298475	Qpcb(BRWT	01/04/1963	15/11/1995
COU-MUSG	TIN86	527756	6298546	Qpcb(BRWT	17/06/1963	15/11/1995
COU-MUSG	TIN87	529256	6300356	Qpcb(BRWT	18/06/1963	15/11/1995
COU-MUSG	TIN73	525367	6295538	Tbe(POEL-	01/04/1963	07/05/1982
COU-MUSG	TIN70	525264	6293876	Tbe(POEL-	01/04/1963	17/03/2005
COU-MUSG	TIN74	526721	6295570	Qpcb(BRWT	01/04/1963	15/11/1995
COU-MUSG	TIN76	528610	6295088	Qpcb(BRWT	01/04/1963	15/11/1995
COU-MUSG	TIN78	528276	6296359	Tbe(POEL-	01/04/1963	15/11/1995
COU-MUSG	TIN81	525465	6298379	Qpcb(BRWT	01/04/1963	15/11/1995
COU-MUSG	TIN6	516727	6307214	Tbe(POEL-	04/10/1963	15/11/1995
COU-MUSG	TIN4	516718	6303542	Tbe(POEL-	04/10/1963	15/11/1995
COU-MUSG	TIN95	515566	6300209	Tbe(POEL-	10/04/1980	22/04/1981
COU-MUSG	TIN1	515452	6298401	Tbe(POEL-	15/10/1973	07/05/1982
COU-MUSG	TIN10	521881	6305466	Qpcb(BRWT	04/10/1963	15/11/1995
COU-MUSG	TAA41	506233	6306789	Tbe(POEL-	15/11/1968	25/03/2005
COU-MUSG	TAA42	506013	6308224	Tbe(POEL-	15/11/1968	15/11/1995
COU-MUSG	TAA39	502591	6305714	Tbe(POEL-	15/11/1968	15/11/1995
COU-MUSG	TAA40	504692	6306377	Tbe(POEL-	15/11/1968	15/11/1995

NETWORK	OBS_N	EASTING	NORTHING	AQUIFER	START	END
COU-MUSG	TAA44	502785	6309295		15/11/1968	15/11/1995
COU-MUSG	TAA28	501346	6302443	Tbe(POEL-	15/11/1968	15/11/1995
COU-MUSG	TAA29	503726	6302439	Qpcb(BRWT	15/11/1968	25/03/2005
COU-MUSG	TAA31	503783	6304489	Tbe(POEL-	15/11/1968	15/11/1995
COU-MUSG	TAA24	504382	6298151	Tbe(POEL-	15/11/1968	15/11/1995
COU-MUSG	TAA54	504367	6300521	Qpcb(BRWT	15/11/1968	15/11/1995
COU-MUSG	TAA23	509732	6295245		23/04/1976	16/11/1981
COU-MUSG	TAA13	514701	6296678	Tbe(POEL-	04/09/1963	15/11/1995
COU-MUSG	TAA17	514717	6302005	Tbe(POEL-	01/10/1964	15/11/1995
COU-MUSG	TAA64	510779	6307347			
COU-MUSG	SQR104	537680	6297211	Tbe(POEL-	26/04/1989	17/03/2005
COU-MUSG	SQR95	531850	6293909	Tbe(POEL-	26/04/1989	17/03/2005
COU-MUSG	SQR100	532530	6294267	Qpcb(BRWT	26/04/1989	17/03/2005
COU-MUSG	SQR109	539678	6293871	Tbe(POEL-	02/08/1989	17/03/2005
COU-MUSG	SQR111	531628	6295621		26/04/1989	17/03/2005
COU-MUSG	SQR119	531428	6294121	Tbe(POEL-	17/01/1992	17/03/2005
COU-MUSG	TIN43	514868	6292503	Qpcb(BRWT	12/04/1965	15/11/1995
COU-MUSG	HUD62	516307	6283479	Tbe(POEL-	24/10/1965	15/11/1995
COU-MUSG	HUD58	514394	6281457	Tbe(POEL-	15/04/1966	15/11/1995
COU-MUSG	HUD27	520540	6268299	Tbe(POEL-	14/10/1966	18/03/2005
COU-MUSG	HUD30	520478	6274787	Qpcb(BRWT	26/10/1965	15/11/1995
COU-MUSG	WAY45	513711	6260349	Qpcb(BRWT		
COU-MUSG	WAY20	529217	6259851		15/11/1968	30/04/1982
COU-MUSG	WAY24	523660	6257174	Qpcb(BRWT	15/11/1968	15/11/1995
COU-MUSG	PER16	531717	6253524	Tbe(POEL-	15/07/1967	15/11/1995
COU-MUSG	PER27	533430	6259891	Tbe(POEL-	15/11/1968	15/11/1995
COU-MUSG	PER9	538091	6260277	Qpcb(BRWT	15/11/1968	15/11/1995
COU-MUSG	BLS7	535150	6273326	Qpcb(BRWT	15/03/1967	23/04/1982
COU-MUSG	BLS26	544198	6274844	ALs(Basem	17/10/1966	15/11/1995
COU-MUSG	BLS32	545752	6270291	Qpcb(BRWT	15/03/1967	15/11/1995
COU-MUSG	KPW36	526315	6277163	Tbe(POEL-	01/10/1964	15/11/1995
COU-MUSG	KPW37	526164	6276147	Qpcb(BRWT	26/10/1965	19/03/2005
COU-MUSG	KPW18	532040	6269015	ALs(Basem	15/03/1967	18/03/2005
COU-MUSG	SQR45	544731	6288285	Qpcb(BRWT	01/10/1964	15/11/1995
COU-MUSG	SQR50	537909	6289083	Tbe(POEL-	20/06/1963	15/11/1995
COU-MUSG	SQR30	530445	6292345	Qpcb(BRWT	04/12/1962	17/03/2005
COU-MUSG	SQR87	533292	6296896	Tbe(POEL-	18/06/1963	17/03/2005
COU-MUSG	SQR75	532021	6298503	Tbe(POEL-	18/06/1963	17/03/2005
COU-MUSG	TIN83	527308	6300117	Qpcb(BRWT	18/06/1963	15/11/1995

NETWORK	OBS_N	EASTING	NORTHING	AQUIFER	START	END
COU-MUSG	TIN11	523042	6306698	Tbe(POEL-	04/10/1963	15/11/1995
COU-MUSG	TAA51	505634	6297155	Tbe(POEL-	15/11/1968	15/11/1995
COU-MUSG	WAD31	499758	6279981	Qpcb(BRWT	12/12/1989	20/03/2005
COU-MUSG	TIN56	518009	6287110	Tbe(POEL-	12/04/1965	15/11/1995
COU-MUSG	WAY36	522047	6253314	Qpcb(BRWT	15/11/1968	15/11/1995
COU-MUSG	TIN32	526053	6290043	Qpcb(BRWT	01/10/1964	15/11/1995
COU-MUSG	KPW72	525978	6274721	Tbe(POEL-	23/06/1989	19/03/2005
COU-MUSG	SQR12	531728	6294971	Tbe(POEL-	04/12/1962	17/03/2005
COU-MUSG	TAA53	513027	6300730			
COU-MUSG	HUD19	511243	6266729	Qpcb(BRWT	15/04/1966	15/11/1995
COU-MUSG	HUD79	512896	6274772	Tbe(POEL-	26/10/1965	29/04/1982
COU-MUSG	KPW49	521175	6271295	Qpcb(BRWT	15/03/1967	15/11/1995
COU-MUSG	WAY21	528699	6257228		15/11/1968	30/04/1982
COU-MUSG	SQR79	537866	6299454	Qpcb(BRWT	18/06/1963	17/03/2005
COU-MUSG	TIN5	517089	6305410	Tbe(POEL-	04/10/1963	15/11/1995
COU-MUSG	WAD4	499300	6279517		15/03/1967	15/11/1995
COU-MUSG	HUD28	520520	6270051	ALs(Basem	10/10/1966	15/11/1995
COU-MUSG	HUD44	518267	6280483	Tbe(POEL-	01/10/1964	15/11/1995
COU-MUSG	WAY8	509912	6260812	Qpcb(BRWT	15/11/1968	15/11/1995
COU-MUSG	PER34	532268	6251370	Qpcb(BRWT	15/11/1968	15/11/1995
COU-MUSG	BLS27	545727	6274853	Tbe(POEL-	17/10/1966	12/11/1981
COU-MUSG	BLS4	535177	6277799	Tbe(POEL-	15/03/1967	15/11/1995
COU-MUSG	BLS33	545756	6268573	Tbe(POEL-	15/03/1967	15/11/1995
COU-MUSG	KPW7	528583	6283822	Tbe(POEL-	14/10/1966	15/11/1995
COU-MUSG	KPW47	523365	6267961	Qpcb(BRWT	07/02/1966	15/11/1995
COU-MUSG	KPW9	532135	6281070	Tbe(POEL-	15/04/1968	10/04/1979
COU-MUSG	TIN84	527882	6300602	Qpcb(BRWT	18/06/1963	15/11/1995
COU-MUSG	TAA26	501196	6299086	Qpcb(BRWT	15/11/1968	15/11/1995
COU-MUSG	TAA34	499149	6305159	Tbe(POEL-	15/11/1968	25/03/2005
COU-MUSG	TAA9	505148	6285524	Qpcb(BRWT	02/11/1969	15/11/1995
COU-MUSG	TIN47	519235	6292309	Qpcb(BRWT	01/04/1964	15/11/1995
COU-MUSG	WAD6	501084	6279588	Tbe(POEL-	15/03/1967	15/11/1995
COU-MUSG	WAD16	503118	6274635	Tbe(POEL-	01/04/1967	15/11/1995
COU-MUSG	HUD1	508073	6283824	Qpcb(BRWT	14/10/1966	15/11/1995
COU-MUSG	HUD38	519662	6283801	Tbe(POEL-	14/10/1966	15/11/1995
COU-MUSG	HUD17	518419	6270699	Qpcb(BRWT	15/04/1966	29/04/1982
COU-MUSG	WAY29	520897	6256626	Qpcb(BRWT	15/07/1967	30/04/1982
COU-MUSG	WAY25	526067	6255255	Tbe(POEL-	15/07/1967	15/11/1995
COU-MUSG	PER2	539662	6253453	Qpcb(BRWT	06/11/1970	15/11/1995

NETWORK	OBS_N	EASTING	NORTHING	AQUIFER	START	END
COU-MUSG	TIN42	525551	6289857	Qpcb(BRWT	01/10/1964	19/03/2005
COU-MUSG	TIN36	525047	6291263	Qpcb(BRWT	01/10/1964	15/11/1995
COU-MUSG	BLS11	535114	6266543	Tbe(POEL-	15/03/1967	15/11/1995
COU-MUSG	BLS14	538029	6268401	Tbe(POEL-	15/03/1967	23/04/1982
COU-MUSG	SQR57	543888	6291011	Tbe(POEL-	01/10/1964	15/11/1995
COU-MUSG	SQR52	537753	6290712	Qpcb(BRWT	20/06/1963	29/04/1982
COU-MUSG	SQR103	531186	6288504	Tbe(POEL-	26/04/1989	19/03/2005
COU-MUSG	SQR106	533128	6292171	Qpcb(BRWT	27/06/1989	17/03/2005
COU-MUSG	SQR77	534853	6299356	Qpcb(BRWT	18/06/1963	17/03/2005
COU-MUSG	TAA12	514689	6295419	Tbe(POEL-	28/04/1970	15/11/1995
COU-MUSG	TIN99	528428	6298471	Tbe	09/08/1989	17/03/2005
COU-MUSG	WAY47	515044	6257210	Qpcb(BRWT		
COU-MUSG	PER38	535116	6252193	Qpcb(BRWT		
COU-MUSG	PER39	535116	6252193	Tbe(POEL-		
COU-MUSG	TIN101	529674	6294419	Qpcb(BRWT	09/08/1993	17/03/2005
COU-MUSG	TIN102	529674	6294419	Tbe(POEL-	09/08/1993	17/03/2005
COU-MUSG	KPW74	525753	6274471	Tbe(POEL-	28/07/1995	20/03/2005
COU-MUSG	SQR122	530428	6289151	Tbe(POEL-	28/06/1993	18/03/2005
COU-MUSG	SQR123	530438	6290221	Tbe(POEL-	28/06/1993	18/03/2005
COU-MUSG	KPW75	528528	6276046	Tbe(POEL-		
COU-MUSG	KPW77	523878	6276871	Qpcb(BRWT		
COU-MUSG	KPW79	524548	6276871	Tbe(POEL-		
COU-MUSG	KPW78	522378	6275221	Tbe(POEL-		
COU-MUSG	PER40	536478	6249621	Tbe(POEL-		
COU-MUSG	PER41	536478	6249621	Tbe(POEL-		
COU-MUSG	PER42	536478	6249621	J-o(POLD-		
COU-MUSG	PER43	531318	6254246	Tbe(POEL-		
COU-MUSG	PER44	531318	6254246	Tbe(POEL-		
COU-MUSG	SQR121	530553	6296021	Tbe(POEL-	28/06/1993	17/03/2005
COU-MUSG	SQR120	531428	6294121	Qpcb(BRWT	17/01/1992	29/01/2005
COU-MUSG	TAA19	501451	6284721	Qpcb(BRWT	01/04/1967	22/02/1977
COU-MUSG	TIN65	520622	6289143	Qpcb(BRWT	01/10/1964	15/11/1995
COU-MUSG	WAD11	506443	6281953	Tbe(POEL-	15/11/1968	20/03/2005
COU-MUSG	HUD2	508052	6282274	Qpcb(BRWT	14/10/1966	15/11/1995
COU-MUSG	HUD8	508082	6273349	Qpcb(BRWT	14/10/1966	15/11/1995
COU-MUSG	HUD50	517230	6273323	Qpcb(BRWT	13/12/1965	29/10/1994
COU-MUSG	HUD40	518106	6283083	Tbe(POEL-	13/04/1978	15/11/1995
COU-MUSG	WAY52	516452	6258798	Qpcb(BRWT		
COU-MUSG	TIN22	529047	6292350	Qpcb(BRWT	01/04/1963	15/11/1995

NETWORK	OBS_N	EASTING	NORTHING	AQUIFER	START	END
COU-MUSG	BLS6	535131	6274841	Tbe(POEL-	06/11/1970	31/10/1994
COU-MUSG	BLS5	535148	6276295	Tbe(POEL-	15/04/1968	10/11/1981
COU-MUSG	BLS29	546395	6275982	Tbe(POEL-	09/04/1980	15/04/1981
COU-MUSG	BLS45	544087	6283313	Tbe(POEL-	15/06/1965	23/04/1982
COU-MUSG	BLS36	541000	6268586	Qpcb(BRWT	15/03/1967	15/11/1995
COU-MUSG	KPW34	526938	6280097	Tbe(POEL-	01/10/1964	19/03/2005
COU-MUSG	KPW43	525936	6266529	Qpcb(BRWT	10/02/1966	15/11/1995
COU-MUSG	KPW68	527406	6274828	Qpcb(BRWT	17/10/1966	19/03/2005
COU-MUSG	KPW25	529122	6271867	Qpcb(BRWT	17/10/1966	24/12/2001
COU-MUSG	KPW17	532062	6270674	Tbe(POEL-	15/03/1967	28/04/1982
COU-MUSG	KPW12	532122	6276494	Tbe(POEL-	15/03/1967	28/04/1982
COU-MUSG	SQR86	533964	6296442	Tbe(POEL-	18/06/1963	17/03/2005
COU-MUSG	TAA45	508196	6307218	Tbe(POEL-	15/11/1968	15/11/1995
COU-MUSG	TAA25	502552	6298763	Tbe(POEL-	15/11/1968	25/03/2005
COU-MUSG	HUD41	517907	6281429	Tbe(POEL-	01/10/1964	18/03/2005
COU-MUSG	WAY48	514713	6255288	Qpcb(BRWT	08/04/1980	20/11/1981
COU-MUSG	WAY17	525985	6261993	Qpcb(BRWT	15/07/1967	15/11/1995
COU-MUSG	BLS46	535250	6283841	Tbe(POEL-	06/11/1970	12/11/1981
COU-MUSG	TAA43	504229	6308891	Tbe(POEL-	15/11/1968	15/11/1995
COU-MUSG	KPW55	523400	6274832	Qpcb(BRWT	26/10/1965	19/03/2005
COU-MUSG	SQR74	532144	6299987	Qpcb(BRWT	18/06/1963	17/03/2005
COU-MUSG	PER20	530385	6260670	ALs(Basem	15/11/1968	15/11/1995
COU-MUSG	KPW76	526853	6278351	Tbe(POEL-		
COU-MUSG	TAA22	502139	6287618	Qpcb(BRWT	09/01/1990	13/02/1990
COU-MUSG	TAA49	502773	6289826	Qpcb(BRWT	01/04/1967	15/11/1995
COU-MUSG	TIN61	520332	6291713	Qpcb(BRWT	15/03/1967	18/03/2005
COU-MUSG	WAD10	506590	6280947	Tbe(POEL-	15/03/1967	15/11/1995
COU-MUSG	HUD15	514491	6269241	ALs(Basem	15/04/1968	15/11/1995
COU-MUSG	HUD4	508082	6279241	Qpcb(BRWT	14/10/1966	15/11/1995
COU-MUSG	HUD54	514470	6274766	Qpcb(BRWT	26/10/1965	15/11/1995
COU-MUSG	HUD39	517988	6283809	Tbe(POEL-	25/10/1967	15/11/1995
COU-MUSG	WAY35	523204	6252061	Qpcb(BRWT	15/11/1968	15/11/1995
COU-MUSG	KPW44	526054	6264999	Qpcb(BRWT	15/04/1966	01/03/1994
COU-MUSG	WAY15	524583	6260669	Qpcb(BRWT	15/07/1967	28/03/2005
COU-MUSG	WAY33	529056	6255478	Qpcb(BRWT	15/07/1967	25/02/1994
COU-MUSG	TIN33	525850	6288617	Qpcb(BRWT	01/10/1964	15/11/1995
COU-MUSG	TIN38	523352	6290365	Qpcb(BRWT	01/10/1964	15/11/1995
COU-MUSG	BLS21	539326	6280027	Tbe(POEL-	15/03/1967	15/11/1995
COU-MUSG	SQR41	546466	6289590	Tbe(POEL-	01/10/1964	15/11/1995

NETWORK	OBS_N	EASTING	NORTHING	AQUIFER	START	END
COU-MUSG	SQR46	543337	6288723	Tbe(POEL-	01/10/1964	15/11/1995
COU-MUSG	SQR54	540479	6289385	Tbe(POEL-	01/04/1964	15/11/1995
COU-MUSG	SQR36	539339	6291201		01/03/1993	24/04/2004
COU-MUSG	SQR10	530735	6293225	Qpcb(BRWT	02/01/1963	17/03/2005
COU-MUSG	SQR1	530994	6289309	Qpcb(Plda		
COU-MUSG	SQR3	531417	6292447	Qpcb(BRWT	04/12/1962	19/03/2005
COU-MUSG	SQR31	530438	6290049	Qpcb(BRWT	04/12/1962	17/03/2005
COU-MUSG	SQR102	531046	6289173	Tbe(POEL-	26/04/1989	19/03/2005
COU-MUSG	SQR97	531983	6291966	Tbe(POEL-	26/04/1989	19/03/2005
COU-MUSG	SQR107	546378	6290421	Tbe(POEL-	27/06/1989	29/08/1993
COU-MUSG	SQR116	546328	6290571	Tbe(POEL-	10/05/1992	17/03/2005
COU-MUSG	TIN77	529674	6294419	Tbe(POEL-	01/05/1963	17/12/1992
COU-MUSG	TIN79	526841	6297390	Qpcb(BRWT	01/04/1963	17/03/2005
COU-MUSG	TIN7	518042	6302506	Tbe(POEL-	04/10/1963	15/11/1995
COU-MUSG	KPW48	523371	6270030	Qpcb(BRWT	07/02/1966	15/11/1995
COU-MUSG	SQR118	530994	6289309	Qpcb(BRWT	17/01/1992	19/03/2005
COU-MUSG	TIN93	530162	6297702	Tbe(POEL-	01/04/1963	15/11/1995
COU-MUSG	TIN40	529776	6284085	Tbe(POEL-	01/10/1964	15/11/1995
COU-MUSG	SQR93	536171	6284141	Tbe(POEL-	15/03/1967	15/11/1995
COU-MUSG	KPW20	532087	6265003	Qpcb(BRWT	15/03/1967	15/11/1995
COU-MUSG	TIN63	523651	6291312	Qpcb(BRWT	01/10/1964	15/11/1995
COU-MUSG	TIN2	516238	6300169	Tbe(POEL-	04/09/1963	15/11/1995
COU-MUSG	WAD30	499758	6279981	Tbe(POEL-	12/12/1989	20/03/2005
COU-MUSG	TAA2	509587	6285175	Tbe(POEL-	06/11/1970	20/03/2005
COU-MUSG	TAA5	512221	6293038	Qpcb(BRWT	15/03/1967	20/03/2005
COU-MUSG	TIN96	527694	6292289	Qpcb(BRWT	01/04/1963	17/03/2005
COU-MUSG	SQR68	535295	6287360	Tbe(POEL-	15/03/1967	15/11/1995
COU-MUSG	SQR23	536523	6293720	Tbe(POEL-	01/03/1993	17/03/2005
COU-MUSG	TIN100	522878	6299321	Tbe(POEL-	30/09/1989	25/03/2005
COU-MUSG	TAA30	502600	6303623	Tbe(POEL-	15/11/1968	15/11/1995
COU-MUSG	KPW80	526853	6278351	Qpcb(BRWT		
COU-MUSG	HUD16	516751	6269965		26/10/1965	29/04/1982
COU-MUSG	HUD47	517178	6278131	Tbe(POEL-	15/04/1966	15/11/1995
COU-MUSG	HUD56	514416	6278372	Tbe(POEL-	15/04/1966	28/10/1994
COU-MUSG	HUD63	515843	6283811	Tbe(POEL-	14/10/1966	15/11/1995
COU-MUSG	HUD67	511344	6283831	Tbe(POEL-	15/04/1966	08/07/1993
COU-MUSG	HUD70	511275	6282200	Tbe(POEL-	15/04/1966	15/11/1995
COU-MUSG	HUD74	511252	6274754	Tbe(POEL-	14/10/1966	29/04/1982
COU-MUSG	HUD78	509514	6274763	Qpcb(BRWT	14/10/1966	15/11/1995

NETWORK	OBS_N	EASTING	NORTHING	AQUIFER	START	END
COU-MUSG	HUD81	518837	6274782	Tbe(POEL-	26/10/1965	15/11/1995
COU-MUSG	KPW2	521004	6283798	Tbe(POEL-	14/10/1966	15/11/1995
COU-MUSG	KPW14	532099	6274848	Qpcb(BRWT	15/03/1967	30/08/1989
COU-MUSG	KPW19	532038	6266930	Qpcb(BRWT	15/03/1967	15/11/1995
COU-MUSG	KPW24	529119	6270364		17/10/1966	28/04/1982
COU-MUSG	KPW29	529174	6279381	Tbe(POEL-	14/10/1966	15/11/1995
COU-MUSG	KPW30	529195	6280849	Tbe(POEL-	15/10/1966	15/11/1995
COU-MUSG	KPW31	529211	6282325	Tbe(POEL-	14/10/1966	15/11/1995
COU-MUSG	KPW35	526699	6278399	Tbe(POEL-	01/10/1964	15/11/1995
COU-MUSG	KPW41	525938	6269858	Qpcb(BRWT	10/02/1966	28/04/1982
COU-MUSG	KPW52	524895	6273723	Qpcb(BRWT	26/10/1965	15/11/1995
COU-MUSG	KPW54	522152	6274790	Qpcb(BRWT	26/10/1965	23/11/1981
COU-MUSG	KPW57	525448	6275334	Qpcb(BRWT	02/11/1969	15/11/1995
COU-MUSG	KPW59	522733	6277745	Qpcb(BRWT	14/10/1966	15/11/1995
COU-MUSG	KPW61	523476	6279726	Tbe(POEL-	07/02/1966	28/04/1982
COU-MUSG	KPW65	531321	6283842	Tbe(POEL-	30/04/1970	15/11/1995
COU-MUSG	KPW66	530093	6283820	Tbe(POEL-	15/07/1965	15/11/1995
COU-MUSG	PER7	540920	6260695		19/04/1972	15/11/1995
COU-MUSG	PER11	535166	6261139		15/07/1967	15/11/1995
COU-MUSG	PER14	530785	6262781	Qpcb(BRWT	15/07/1967	05/03/1994
COU-MUSG	PER18	530177	6257371	Qpcb(BRWT	15/11/1968	15/11/1995
COU-MUSG	PER22	538705	6257120	Qpcb(BRWT	15/11/1968	15/11/1995
COU-MUSG	PER23	536440	6257699	Qpcb(BRWT	15/11/1968	15/11/1995
COU-MUSG	PER28	531523	6259044		13/04/1972	15/11/1995
COU-MUSG	PER37	539799	6258634	Qpcb(BRWT	15/11/1968	15/11/1995
COU-MUSG	SQR47	541026	6288586	Tbe(POEL-	01/04/1964	15/11/1995
COU-MUSG	SQR48	540033	6288672	Tbe(POEL-	01/04/1964	15/11/1995
COU-MUSG	SQR55	545111	6292093	Tbe(POEL-	01/10/1964	15/11/1995
COU-MUSG	SQR70	541201	6284962	Tbe(POEL-	12/07/1966	15/11/1995
COU-MUSG	SQR72	543311	6287284	Tbe(POEL-	13/10/1965	15/11/1995
COU-MUSG	SQR89	531989	6297214	Qpcb(BRWT	18/06/1963	15/11/1995
COU-MUSG	TAA7	508724	6287949	Qpcb(BRWT	25/10/1967	15/11/1995
COU-MUSG	TAA18	513486	6302308	Tbe(POEL-	01/10/1964	15/11/1995
COU-MUSG	TAA20	501718	6286539	Qpcb(BRWT	01/04/1967	15/11/1995
COU-MUSG	TAA27	500175	6300707	Tbe(POEL-	15/11/1968	15/11/1995
COU-MUSG	TAA37	501237	6307059	Qpcb(BRWT	20/04/1972	15/11/1995
COU-MUSG	TAA38	500853	6308360	Tbe(POEL-	15/11/1968	29/10/1980
COU-MUSG	TAA46	501133	6296894	Qpcb(BRWT	03/11/1968	15/11/1995
COU-MUSG	TAA47	502358	6294481	Qpcb(BRWT	15/10/1973	15/11/1995

NETWORK	OBS_N	EASTING	NORTHING	AQUIFER	START	END
COU-MUSG	TIN8	519153	6303595	Tbe(POEL-	04/10/1963	15/11/1995
COU-MUSG	TIN13	523585	6309912	Tbe(POEL-	04/10/1963	15/07/1993
COU-MUSG	TIN15	517352	6293081	Qpcb(BRWT	15/03/1967	15/11/1995
COU-MUSG	TIN16	519176	6292841	Qpcb(BRWT	15/03/1967	15/11/1995
COU-MUSG	TIN23	529212	6291377	Qpcb(BRWT	01/10/1964	15/11/1995
COU-MUSG	TIN24	529427	6290140	Qpcb(BRWT	01/10/1964	15/11/1995
COU-MUSG	TIN25	528809	6288821	Qpcb(BRWT	01/10/1964	15/11/1995
COU-MUSG	TIN28	527226	6289161	Qpcb(BRWT	01/10/1964	15/11/1995
COU-MUSG	TIN29	527640	6290593	Qpcb(BRWT	01/10/1964	15/11/1995
COU-MUSG	TIN34	524308	6288553	Qpcb(BRWT	01/10/1964	15/11/1995
COU-MUSG	TIN44	515864	6292072	Qpcb(BRWT	15/03/1967	15/11/1995
COU-MUSG	TIN48	516300	6291141	Qpcb(BRWT	01/10/1964	15/11/1995
COU-MUSG	TIN51	517600	6290204	Tbe(POEL-	01/10/1964	15/11/1995
COU-MUSG	TIN54	517515	6288537	Tbe(POEL-	01/10/1964	15/11/1995
COU-MUSG	TIN55	519129	6287933	Qpcb(BRWT	01/10/1964	15/11/1995
COU-MUSG	TIN59	516173	6286026	Tbe(POEL-	11/04/1978	15/11/1995
COU-MUSG	TIN64	521282	6289231	Qpcb(BRWT	01/10/1964	15/11/1995
COU-MUSG	TIN66	520811	6288102	Qpcb(BRWT	01/10/1964	15/11/1995
COU-MUSG	TIN67	523582	6286421	Tbe(POEL-	14/10/1966	01/03/1994
COU-MUSG	TIN72	523845	6295636	Qpcb(BRWT	30/04/1962	15/11/1995
COU-MUSG	TIN75	528104	6294485	Qpcb(BRWT	01/04/1963	15/11/1995
COU-MUSG	TIN80	525791	6297657	Qpcb(BRWT	01/04/1963	15/11/1995
COU-MUSG	TIN85	526920	6299484	Qpcb(BRWT	18/06/1963	15/11/1995
COU-MUSG	TIN88	530441	6299955	Qpcb(BRWT	01/04/1963	15/11/1995
COU-MUSG	TIN91	530445	6298490	Qpcb(BRWT	01/04/1963	15/11/1995
COU-MUSG	TIN92	528631	6298047	Qpcb(BRWT	01/04/1963	15/11/1995
COU-MUSG	WAD7	502531	6279823	Qpcb(BRWT	15/03/1967	28/02/1994
COU-MUSG	WAD8	504081	6279134	Qpcb(BRWT	15/03/1967	15/11/1995
COU-MUSG	WAD13	506969	6271905	Qpcb(BRWT	01/04/1967	15/11/1995
COU-MUSG	WAD14	505639	6272747	Tbe(POEL-	01/04/1967	10/05/1982
COU-MUSG	WAD18	500708	6276791	Qpcb(BRWT	01/04/1967	15/11/1995
COU-MUSG	WAD20	505187	6283815	Qpcb(BRWT	01/04/1967	15/11/1995
COU-MUSG	WAD23	503225	6282295	Tbe(POEL-	15/11/1968	15/11/1995
COU-MUSG	WAD26	499067	6276281		01/04/1967	15/11/1995
COU-MUSG	WAD27	502036	6277268	Qpcb(BRWT	01/04/1967	15/11/1995
COU-MUSG	WAD29	506862	6278293	Qpcb(BRWT	15/03/1967	15/11/1995
COU-MUSG	WAY3	510167	6263073	Tbe(POEL-	15/11/1968	15/11/1995
COU-MUSG	WAY6	516889	6260579	ALs(Basem	15/11/1968	15/11/1995
COU-MUSG	WAY11	518606	6259165	ALs(Basem	15/11/1968	15/11/1995

NETWORK	OBS_N	EASTING	NORTHING	AQUIFER	START	END
COU-MUSG	WAY13	521991	6259101	Qpcb(BRWT	15/07/1967	15/11/1995
COU-MUSG	WAY14	523521	6259706	Qpcb(BRWT	15/07/1967	15/11/1995
COU-MUSG	WAY18	527395	6262365	Qpcb(BRWT	30/04/1969	20/11/1981
COU-MUSG	WAY23	527687	6255681	ALs(Basem	15/11/1968	15/11/1995
COU-MUSG	WAY27	522996	6254988	Qpcb(BRWT	15/11/1968	30/04/1982
COU-MUSG	WAY30	519794	6254917	Qpcb(BRWT	15/11/1968	15/11/1995
COU-MUSG	WAY32	515931	6252671	Qpcb(BRWT	23/04/1976	15/11/1995
COU-MUSG	WAY38	519510	6249694	Qpcb(BRWT	15/11/1968	15/11/1995
COU-MUSG	WAY39	517994	6248055	Qpcb(BRWT	15/11/1968	15/11/1995
COU-MUSG	WAY42	523549	6249902	Qpcb(BRWT	15/11/1968	30/04/1982
COU-MUSG	WAY46	511380	6259138	Qpcb(BRWT		
COU-MUSG	KPW23	529126	6268762	ALs(Basem	15/04/1966	15/11/1995
COU-MUSG	SQR33	530508	6286959	Qpcb(BRWT	06/11/1970	23/01/1978
COU-MUSG	TIN58	517967	6285984		01/11/1963	28/10/1976
COU-MUSG	TAA55	506559	6283910	Tbe(POEL-	15/03/1967	15/11/1995
COU-MUSG	TIN52	519046	6290290	Qpcb(BRWT	01/10/1964	15/11/1995
COU-MUSG	WAD25	501547	6280980	Qpcb(BRWT	01/04/1967	15/11/1995
COU-MUSG	HUD22	514517	6267409	ALs(Basem	15/04/1966	15/11/1995
COU-MUSG	HUD75	511242	6274073	Qpcb(BRWT	15/04/1966	29/04/1982
COU-MUSG	HUD35	520460	6279714	Tbe(POEL-	15/04/1966	19/07/1993
COU-MUSG	HUD23	517360	6264964	Qpcb(BRWT	15/04/1966	15/11/1995
COU-MUSG	WAY9	507908	6260040	Qpcb(BRWT	15/11/1968	28/03/2005
COU-MUSG	KPW28	529157	6277869	Tbe(POEL-	14/10/1966	15/11/1995
COU-MUSG	HUD14	512435	6268765	Qpcb(BRWT	12/04/1965	29/04/1982
COU-MUSG	SQR114	535078	6292721	Qpcb(Plda	17/01/1992	17/03/2005
COU-MUSG	TIN12	523438	6308609	Tbe(POEL-	04/10/1963	15/11/1995
COU-MUSG	TIN71	524100	6294298	Qpcb(BRWT	01/04/1963	15/11/1995
COU-MUSG	TIN3	516521	6301746	Qpcb(BRWT	04/09/1963	15/11/1995
COU-MUSG	TAA36	500924	6305299	Tbe(POEL-	15/11/1968	15/11/1995
COU-MUSG	TAA15	514703	6290250	Qpcb(BRWT	01/10/1964	15/11/1995
COU-MUSG	TIN49	517317	6290857		01/10/1964	15/11/1995
COU-MUSG	WAD28	503406	6277974	Qpcb(BRWT	01/04/1967	15/11/1995
COU-MUSG	HUD66	512514	6283682	Tbe(POEL-	24/10/1965	15/11/1995
COU-MUSG	HUD76	511232	6272388	Qpcb(BRWT	15/04/1966	15/11/1995
COU-MUSG	HUD29	520500	6273274	Qpcb(BRWT	14/10/1966	15/11/1995
COU-MUSG	KPW50	522668	6271768	Qpcb(BRWT	26/10/1965	15/11/1995
COU-MUSG	WAY4	512674	6262355	Tbe(POEL-	15/11/1968	28/03/2005
COU-MUSG	WAY40	520173	6247174	Qpcb(BRWT	15/11/1968	15/11/1995
COU-MUSG	WAY34	524657	6253319	Qpcb(BRWT	30/04/1969	15/11/1995

NETWORK	OBS_N	EASTING	NORTHING	AQUIFER	START	END
COU-MUSG	PER3	537741	6252411	Qpcb(BRWT	06/11/1970	15/11/1995
COU-MUSG	PER12	533967	6262174		15/07/1967	15/11/1995
COU-MUSG	TIN26	528610	6287115	Qpcb(BRWT	01/10/1964	15/11/1995
COU-MUSG	BLS17	536662	6274856	Tbe(POEL-	15/04/1968	23/04/1982
COU-MUSG	BLS2	535211	6280833	Tbe(POEL-	15/04/1968	10/11/1981
COU-MUSG	KPW5	525509	6283838	Tbe(POEL-	14/10/1966	28/04/1982
COU-MUSG	KPW56	525082	6274818	Tbe(POEL-	26/10/1965	15/11/1995
COU-MUSG	SQR56	544510	6292606	Qpcb(BRWT	01/10/1964	15/11/1995
COU-MUSG	SQR51	536077	6289040	Tbe(POEL-	20/06/1963	29/04/1982
COU-MUSG	SQR8	531391	6290820	Qpcb(BRWT	27/02/1963	19/03/2005
COU-MUSG	SQR108	546378	6290421	Tbe(POEL-	27/06/1989	17/03/2005
COU-MUSG	SQR26	535066	6294209	Tbe(POEL-		
COU-MUSG	TIN82	525270	6299251	Qpcb(BRWT	18/06/1963	15/11/1995
COU-MUSG	TIN9	520220	6304787	Tbe(POEL-	04/10/1963	25/03/2005
COU-MUSG	TAA52	502946	6296538	Tbe(POEL-	15/11/1968	15/11/1995
COU-MUSG	HUD9	508097	6272136	Qpcb(BRWT	14/10/1966	29/04/1982
COU-MUSG	TIN39	530203	6284636	Tbe(POEL-	02/11/1969	08/07/1993
COU-MUSG	TIN69	526623	6293960	Tbe(POEL-	01/04/1963	15/11/1995
COU-MUSG	HUD26	520548	6266680	Qpcb(BRWT	14/10/1966	15/11/1995
COU-MUSG	KPW67	529132	6273447	Qpcb(BRWT	17/10/1966	15/11/1995
COU-MUSG	HUD43	517140	6281263	Tbe(POEL-	15/04/1966	15/11/1995
COU-MUSG	KPW62	523516	6282206	Tbe(POEL-	07/02/1966	15/11/1995
COU-MUSG	HUD53	514482	6272925	Qpcb(BRWT	15/04/1966	18/03/2005
COWELL	MLT10	669576	6288982		14/07/1992	01/04/2004
COWELL	MLT2	668988	6285177		27/09/1978	14/04/2003
COWELL	MLT8	664923	6282953		02/11/1988	15/01/1992
COWELL	HWK6	656022	6271329		22/02/1979	02/12/1992
COWELL	HWK2	661199	6276003		27/09/1978	22/10/2001
COWELL	HWK5	658470	6273735		16/07/1991	17/10/1994
COWELL	HWK1	660920	6270913		21/02/1979	01/04/2004
COWELL	MLT5	657921	6284595		09/03/1979	17/10/1994
COWELL	MNG4	652302	6283749		10/11/1988	01/04/2004
COWELL	MLT13	669352	6286293		01/02/1989	01/04/2004
COWELL	MIB2	675874	6288836		27/06/1984	01/04/2004
COWELL	MNG2	649103	6289954			
COWELL	MLT3	665127	6279341		04/11/1988	01/04/2004
COWELL	MIB5	672331	6280235		22/11/1989	01/04/2004
COWELL	MLT16	669528	6287921		22/11/1989	14/04/2003
COWELL	YAL1	652450	6316062		12/09/1978	09/08/1990

NETWORK	OBS_N	EASTING	NORTHING	AQUIFER	START	END
COWELL	HGT1	650719	6309780		12/09/1978	01/04/2004
COWELL	JMS4	662769	6309886		18/11/1988	16/01/1992
COWELL	JMS1	663281	6309404		08/11/1988	01/04/2004
COWELL	JMS3	666959	6300664		09/11/1988	01/04/2004
COWELL	WRR1	690741	6293196		20/05/1985	01/04/2004
COWELL	MNG7	652320	6282601		01/02/1989	01/04/2004
COWELL	MLT9	668708	6284809		22/11/1989	01/04/2004
COWELL	MLT14	665010	6282949		08/08/1989	01/04/2004
COWELL	GLN3	682027	6295479		04/11/1988	01/04/2004
COWELL	HWK3	656998	6274339		08/03/1977	01/04/2004
COWELL	GLN1	672806	6297424		18/06/1979	01/04/2004
COWELL	GLN2	672733	6297114		10/06/1979	01/04/2004
COWELL	HWK12	661605	6270175		21/02/1979	01/04/2004
COWELL	JMS2	666254	6307019		09/11/1988	01/04/2004
COWELL	JMS5	661257	6309530		08/11/1988	01/04/2004
COWELL	MIB1	674529	6289068		09/01/1988	01/04/2004
COWELL	MIB3	672419	6283274		31/01/1989	01/04/2004
COWELL	MIB4	672441	6282993		19/01/1979	09/08/1990
COWELL	MLT4	665010	6282949		02/11/1988	15/04/2003
COWELL	MLT6	656181	6285469		03/12/1978	15/07/1992
COWELL	MLT15	664428	6280821		08/08/1989	02/11/1997
COWELL	MNG1	648531	6286165		19/01/1979	18/10/1999
COWELL	RBT1	638213	6258088			
COWELL	BTB1	640405	6255390			
COWELL	BTB3	643874	6258273			
COWELL	HWK4	657183	6274392		27/09/1978	01/04/2004
COWELL	MNG3	652233	6289165		10/11/1988	01/04/2004
COWELL	BTB2	643909	6259480			
CUMMINS	WNL59	555003	6176270		07/06/1990	15/04/2004
CUMMINS	WNL61	552908	6175871		09/06/1990	15/04/2004
CUMMINS	WNL58	555078	6176770		07/06/1990	29/10/1996
CUMMINS	WNL63	555103	6174070		09/06/1990	15/04/2004
CUMMINS	WNL64	557359	6175551		14/06/1990	15/04/2004
CUMMINS	WNL66	551478	6173470		11/06/1990	15/04/2004
CUMMINS	WNL68	557978	6180771		13/06/1990	15/04/2004
CUMMINS	WNL49	552028	6181621		19/11/1991	15/04/2004
CUMMINS	LKW48	547828	6177681		19/11/1991	15/04/2004
CUMMINS	LKW52	546978	6181820		19/11/1991	15/04/2004
CUMMINS	LKW54	547258	6171591		19/11/1991	16/04/2003

NETWORK	OBS_N	EASTING	NORTHING	AQUIFER	START	END
CUMMINS	WNL52	561578	6172870		29/01/1992	15/04/2004
CUMMINS	WNL53	560878	6170970		19/02/1992	24/10/2001
CUMMINS	LKW45	548659	6174271		19/11/1991	15/04/2004
CUMMINS	MTK10	561396	6184771		01/06/1990	15/04/2004
CUMMINS	MTK11	560259	6184771		01/06/1990	15/04/2004
CUMMINS	MTK13	567489	6191920		01/06/1990	15/04/2004
CUMMINS	WNL55	555459	6184781		23/10/1991	15/04/2004
CUMMINS	WNL56	555459	6184781		23/10/1991	15/04/2004
CUMMINS	MTK7	555868	6195621		19/11/1991	15/04/2004
CUMMINS	MTK8	560128	6196170		19/11/1991	15/04/2004
CUMMINS	MTK9	565428	6197920		23/10/1991	15/04/2004
CUMMINS	CUM2	562748	6201361		23/10/1991	15/04/2004
CUMMINS	CUM4	553069	6206930		23/10/1991	15/04/2004
CUMMINS	CUM6	562158	6209300		19/11/1991	15/04/2004
CUMMINS	WRW1	546728	6185020		19/11/1991	15/04/2004
CUMMINS	MTK3	563428	6187120		19/03/1992	15/04/2004
CUMMINS	LKW47	547828	6177681		19/11/1991	15/04/2004
CUMMINS	MTK6	557778	6191060		23/10/1991	15/04/2004
CUMMINS	WNL67	553499	6181371		11/06/1990	15/04/2004
CUMMINS	WNL57	555138	6179091		06/06/1990	15/04/2004
CUMMINS	WNL54	556478	6171870		19/02/1992	15/04/2004
CUMMINS	MTK14	569378	6200170		01/06/1990	19/10/1999
CUMMINS	MTK5	557778	6191060		23/10/1991	15/04/2004
CUMMINS	SHN2	564628	6234671		26/07/1991	17/03/1994
CUMMINS	CUM3	557999	6204940		23/10/1991	15/04/2004
CUMMINS	WRW2	550429	6185721		23/10/1991	15/04/2004
CUMMINS	SHN1	567127	6221421			
CUMMINS	MTK12	563728	6192261		01/06/1990	15/04/2004
CUMMINS	WNL51	561578	6172870		29/01/1992	15/04/2004
CUMMINS	LKW44	546929	6173270		09/12/1992	15/04/2004
CUMMINS	MTK2	563428	6187120		19/03/1992	15/04/2004
CUMMINS	LKW50	543888	6176931		28/10/1991	15/04/2004
CUMMINS	LKW51	546978	6181820		19/11/1991	15/04/2004
CUMMINS	WNL70	560259	6179771		14/06/1990	15/04/2004
CUMMINS	WNL62	551438	6176971		09/06/1990	15/04/2004
CUMMINS	STK1	573353	6203846			
CUMMINS	LKW53	547529	6171590		19/11/1991	16/04/2003
CUMMINS	MTK4	552518	6190200		23/10/1991	15/04/2004
CUMMINS	LKW49	545028	6175661		26/10/1991	15/04/2004

NETWORK	OBS_N	EASTING	NORTHING	AQUIFER	START	END
CUMMINS	CUM5	565129	6205500		23/10/1991	15/04/2004
CUMMINS	WNL50	561578	6175171		29/01/1992	15/04/2004
CUMMINS	WNL60	554358	6174871		07/06/1990	15/04/2004
CUMMINS	BRK1	579926	6224352			
CUMMINS	BRK2	581891	6221659			
CUMMINS	BRK3	581578	6229216			
CUMMINS	BRK4	581115	6231809			
CUMMINS	WNL65	555178	6172170		14/06/1990	15/04/2004
CUMMINS	LKW46	548659	6174271		19/11/1991	15/04/2004
CUMMINS	WNL69	559128	6180270		13/06/1990	15/04/2004
DARKPEAK	JME2	627431	6301065		18/07/1991	12/05/1998
DARKPEAK	JME5	627336	6300958		14/05/1990	05/02/1997
DARKPEAK	JME7	627178	6300803		14/05/1990	23/10/2001
DARKPEAK	JME8	627088	6300692		09/03/1993	07/05/1993
DARKPEAK	JME11	626926	6301260		14/05/1990	07/04/2005
DARKPEAK	JME12	626789	6301058		09/08/1990	23/08/1996
DARKPEAK	JME15	626749	6301350		14/05/1990	07/04/2005
DARKPEAK	JME17	626663	6301480		14/05/1990	07/04/2005
DARKPEAK	JME18	627428	6300521		18/07/1991	07/04/2005
DARKPEAK	JME19	627228	6301721		13/08/1991	15/04/2003
DARKPEAK	JME16	626663	6301480		14/05/1990	01/10/2002
DARKPEAK	JME13	626749	6301350		14/05/1990	26/08/1997
DARKPEAK	JME14	626749	6301350		14/05/1990	07/10/2000
DARKPEAK	JME9	626926	6301260		14/05/1990	18/10/1999
DARKPEAK	JME10	626926	6301260		14/05/1990	23/10/2001
DARKPEAK	JME6	627178	6300803		14/05/1990	26/08/1997
DARKPEAK	JME21	626478	6301421		18/07/1991	07/04/2005
DARKPEAK	JME1	627409	6300676		06/07/1990	05/02/1997
DARKPEAK	JME20	626928	6301571		13/06/1991	07/04/2005
PENONG	BGN8	310819	6464504		27/08/1980	01/07/2005
PENONG	BGN5	312537	6465818		27/08/1980	01/07/2005
PENONG	BGN4	312400	6465806		27/08/1980	01/07/2005
PENONG	BGN1	312485	6465688		23/09/1980	01/07/2005
PENONG	BGN2	312482	6465581		27/08/1980	01/07/2005
PENONG	BGN12	312693	6465492		21/12/1982	01/07/2005
PENONG	BGN6	312650	6465792		27/08/1980	01/07/2005
PENONG	BGN3	312367	6465575		27/08/1980	01/07/2005
PENONG	BGN14	312463	6465276		21/12/1982	01/07/2005
PENONG	BGN7	312612	6465609		27/08/1980	01/07/2005

NETWORK	OBS_N	EASTING	NORTHING	AQUIFER	START	END
PENONG	BGN10	312370	6465488		26/11/1980	01/07/2005
PENONG	BGN11	312537	6465462		30/10/1981	01/07/2005
PENONG	BGN15	312251	6465590		21/12/1982	01/07/2005
PENONG	BGN9	312313	6465714		26/11/1980	01/07/2005
PENONG	BGN16	308576	6467992		15/06/1987	01/07/2005
STREAKY	RIP5	430157	6367342		20/04/1978	30/09/2004
STREAKY	RIP7	431718	6363521		20/04/1978	30/06/2005
STREAKY	FOR12	437367	6368882		02/06/1978	01/03/1993
STREAKY	FOR13	434556	6368513		14/02/1978	01/03/1993
STREAKY	FOR14	435139	6366174		20/04/1978	27/08/2003
STREAKY		436803	6365116	Tbp	08/12/1932	12/10/1950
STREAKY	FOR11	436967	6365853	Tbp	02/06/1978	30/09/1997
STREAKY	FOR16	432164	6366030		14/02/1978	30/06/2005
STREAKY	FOR31	432002	6361280		06/11/1978	30/06/2005
STREAKY	FOR3	434349	6364646	Qpcb(Rbn)	20/04/1978	30/06/2005
STREAKY	FOR2	431824	6365384		20/04/1978	30/06/2005
STREAKY	FOR4	431898	6363632		20/04/1978	30/06/2005
STREAKY	FOR17	433135	6365674		06/11/1978	30/06/2005
STREAKY	FOR21	432227	6364088		06/11/1978	30/06/2005
STREAKY	FOR22	432446	6365327		06/11/1978	30/06/2005
STREAKY	FOR26	432036	6364879		06/11/1978	30/06/2005
STREAKY	FOR27	433492	6363809		06/11/1978	30/06/2005
STREAKY	FOR25	432451	6364473		06/11/1978	30/06/2005
STREAKY	FOR6	434290	6358768		14/02/1978	30/06/2005
STREAKY	FOR7	436212	6361799		14/02/1978	28/12/1988
STREAKY	RIP1	428222	6367386		20/04/1978	30/06/2005
STREAKY	RIP3	426647	6361763		14/02/1978	30/06/2005
STREAKY	RIP12	427949	6361025		06/11/1978	30/06/2005
STREAKY	FOR57	433701	6364619	aq(SEDIME	06/03/1985	30/06/2005
STREAKY	FOR59	433505	6364877	aq(SEDIME	06/03/1985	30/06/2005
STREAKY	FOR60	434057	6364384	aq(SEDIME	06/03/1985	30/06/2005
STREAKY	FOR64	432770	6363634	aq(SEDIME	06/03/1985	30/06/2005
STREAKY	RIP10	431000	6363211		06/11/1978	30/06/2005
STREAKY	FOR19	432594	6364704		25/09/1978	30/06/2005
STREAKY	FOR28	433550	6363862		06/11/1978	30/06/2005
STREAKY	RIP4	429103	6363177		14/02/1978	30/06/2005
STREAKY	FOR61	432610	6365482	aq(SEDIME	06/03/1985	30/06/2005
STREAKY	FOR65	433789	6364066	aq(SEDIME	06/03/1985	30/06/2005
STREAKY	FOR9	436576	6363802	Qpcb(Rbn)	14/07/1949	27/08/2003

NETWORK	OBS_N	EASTING	NORTHING	AQUIFER	START	END
STREAKY	RIP8	431592	6367000		02/08/1978	30/06/2005
STREAKY	FOR20	432923	6364174		06/11/1978	30/06/2005
STREAKY	FOR29	433525	6363759		06/11/1978	30/06/2005
STREAKY	RIP11	431719	6361901		06/11/1978	30/06/2005
STREAKY	FOR10	436414	6365226	Tbp	14/02/1978	30/06/2005
STREAKY	FOR63	431833	6364097	aq(SEDIME	06/03/1985	30/11/2004
STREAKY	FOR18	432933	6365086		06/11/1978	30/06/2005
STREAKY	FOR5	433439	6360718		14/02/1978	30/06/2005
STREAKY	FOR23	432536	6364476	Qpcb(Rbn)	06/11/1978	30/06/2005
STREAKY	FOR8	437562	6362428		14/02/1978	30/06/2005
STREAKY	FOR67	433142	6364748	aq(SEDIME	01/08/1985	30/06/2005
STREAKY	FOR55	432923	6364184	Tbp	19/03/1982	30/06/2005
STREAKY	FOR41	439441	6369781		06/11/1978	01/03/1993
STREAKY	RIP13	429760	6361057		06/11/1978	30/06/2005
STREAKY	FOR56	432923	6364199	Tbp	06/01/1983	30/11/2000
STREAKY	FOR30	433586	6363708		06/11/1978	29/08/1983
STREAKY	FOR32	435304	6360569		06/11/1978	30/06/2005
STREAKY	FOR58	433515	6365294	aq(SEDIME	02/07/1986	01/06/1993
STREAKY	FOR62	431847	6365057	aq(SEDIME	06/03/1985	30/06/2005
STREAKY	FOR66	432608	6365081	aq(SEDIME	06/03/1985	30/06/2005
STREAKY	RIP2	427413	6364871		20/04/1978	30/06/2005
STREAKY	RIP6	430471	6368022		20/04/1978	30/06/2005
STREAKY	RIP9	430419	6365279	Qpcb(Rbn)	06/11/1978	30/06/2005
STREAKY	FOR75	431808	6364671	Qpcb(Rbn)		
STREAKY	FOR24	432436	6364381		06/11/1978	30/06/2005
STREAKY	FOR15	436551	6365108	Qpcb(Rbn)	20/04/1978	18/06/2002
TODRIVER	WNL71	570128	6183470	aq(Baseme	11/11/1991	07/10/2000
TODRIVER	KPP2	572828	6186871	aq(Baseme	11/11/1991	07/10/2000
TODRIVER	KPP3	573128	6185920	aq(Baseme	11/11/1991	07/10/2000
TODRIVER	MTK16	570728	6184820	aq(Baseme	11/11/1991	07/10/2000
TODRIVER	KPP11	573128	6185920	aq(Baseme	15/04/1999	07/10/2000
TODRIVER	MTK15	570728	6184820	aq(Baseme	11/11/1991	07/10/2000
TODRIVER	KPP7	575428	6185970	aq(Baseme	11/11/1991	07/10/2000
TODRIVER	KPP8	575428	6185970	aq(Baseme	11/11/1991	07/10/2000
TODRIVER	KPP4	573978	6184820	aq(Baseme	11/11/1991	29/04/2000
TODRIVER	KPP6	575428	6185970	aq(Baseme	11/11/1991	07/10/2000
TODRIVER	KPP9	572828	6186871	aq(Baseme	27/05/1991	07/10/2000
TODRIVER	KPP10	572828	6186871	aq(UNKNOW	27/05/1991	07/10/2000
TODRIVER	KPP5	573978	6184820	aq(Baseme	11/11/1991	29/04/2000

NETWORK	OBS_N	EASTING	NORTHING	AQUIFER	START	END
TOOLILLI	KPP2	572828	6186871	aq(Baseme	11/11/1991	07/10/2000
TOOLILLI	KPP3	573128	6185920	aq(Baseme	11/11/1991	07/10/2000
TOOLILLI	KPP4	573978	6184820	aq(Baseme	11/11/1991	29/04/2000
TOOLILLI	KPP5	573978	6184820	aq(Baseme	11/11/1991	29/04/2000
TOOLILLI	KPP6	575428	6185970	aq(Baseme	11/11/1991	07/10/2000
TOOLILLI	KPP7	575428	6185970	aq(Baseme	11/11/1991	07/10/2000
TOOLILLI	KPP8	575428	6185970	aq(Baseme	11/11/1991	07/10/2000
TOOLILLI	KPP9	572828	6186871	aq(Baseme	27/05/1991	07/10/2000
TOOLILLI	KPP10	572828	6186871	aq(UNKNOW	27/05/1991	07/10/2000
TOOLILLI	KPP11	573128	6185920	aq(Baseme	15/04/1999	07/10/2000
TOOLILLI	MTK15	570728	6184820	aq(Baseme	11/11/1991	07/10/2000
TOOLILLI	MTK16	570728	6184820	aq(Baseme	11/11/1991	07/10/2000
TOOLILLI	WNL71	570128	6183470	aq(Baseme	11/11/1991	07/10/2000
VENUSBAY	WRT14	460973	6342378		27/06/1986	21/12/1998
VENUSBAY	WRT1	466971	6331637		18/12/1981	25/03/2005
VENUSBAY	WRT2	467078	6331516		18/12/1981	25/03/2005
VENUSBAY	WRT8	470898	6322599		27/08/1982	25/03/2005
VENUSBAY	WRT9	470625	6321715		27/08/1982	25/03/2005
VENUSBAY	WRT10	471002	6321791		27/08/1982	25/03/2005
VENUSBAY	WRT12	470670	6322253		27/08/1982	25/03/2005
VENUSBAY	WRT15	467333	6331591		27/06/1986	25/03/2005
VENUSBAY	WRT16	466750	6331743		27/01/1987	25/03/2005
VENUSBAY	WRT17	466846	6331215		21/12/1985	25/03/2005
VENUSBAY	WRT23	466717	6331683		21/12/1985	25/03/2005
VENUSBAY	WRT20	467647	6331201		27/01/1987	25/03/2005
VENUSBAY	WRT21	467433	6332048		27/01/1987	25/03/2005
VENUSBAY	WRT7	470694	6322055		18/12/1981	25/03/2005
VENUSBAY	WRT19	461279	6344129		27/06/1986	25/03/2005
VENUSBAY	WRT3	466857	6331469		18/12/1981	31/10/2003
VENUSBAY	WRT11	470936	6321387		27/08/1982	25/03/2005
VENUSBAY	WRT6	471304	6321997		15/09/1981	25/03/2005
VENUSBAY	WRT5	470178	6322308		15/09/1981	25/03/2005
VENUSBAY	WRT18	461525	6344331		21/12/1985	24/11/2004
VENUSBAY	WRT4	466507	6330803		18/12/1981	25/03/2005
WANILLA	WNL74	564850	6177420		10/04/1990	05/04/2005
WANILLA	WNL76	564385	6177485		13/06/1990	05/04/2005
WANILLA	WNL78	564321	6177331		10/04/1990	22/06/1994
WANILLA	WNL81	564809	6177182		10/04/1990	05/04/2005
WANILLA	WNL85	564281	6177188		24/06/1991	31/10/1996

NETWORK	OBS_N	EASTING	NORTHING	AQUIFER	START	END
WANILLA	WNL88	563860	6177169		10/04/1990	05/04/2005
WANILLA	WNL92	563410	6176932		24/06/1991	05/04/2005
WANILLA	WNL95	564798	6176870		10/04/1990	05/04/2005
WANILLA	WNL98	564151	6176665		10/04/1990	05/04/2005
WANILLA	WNL100	563945	6176720		10/04/1990	05/04/2005
WANILLA	WNL114	563878	6177770		27/03/1992	05/04/2005
WANILLA	WNL117	563228	6177170		10/05/1991	22/06/1994
WANILLA	WNL115	563528	6177920		10/05/1991	05/04/2005
WANILLA	WNL111	563951	6177483		10/05/1991	22/06/1994
WANILLA	WNL118	562878	6176770		10/05/1991	22/06/1994
WANILLA	WNL105	564228	6176870		10/05/1991	22/06/1994
WANILLA	WNL104	564178	6177170		10/05/1991	22/06/1994
WANILLA	WNL108	564428	6176270		10/05/1991	22/06/1994
WANILLA	WNL112	564978	6177770		10/05/1991	21/12/1993
WANILLA	WNL120	565128	6177070		24/06/1991	22/06/1994
WANILLA	WNL126	562348	6176870		01/06/1992	28/08/1997
WANILLA	WNL124	566958	6176670		01/06/1992	22/06/1994
WANILLA	WNL109	563978	6176220		10/05/1991	05/04/2005
WANILLA	WNL102	563415	6176700		10/04/1990	22/06/1994
WANILLA	WNL101	563415	6176700		06/07/1990	22/06/1994
WANILLA	WNL99	563782	6176686		06/07/1990	29/05/1996
WANILLA	WNL97	564151	6176665		10/04/1990	22/08/1996
WANILLA	WNL96	564151	6176665		06/07/1990	22/08/1996
WANILLA	WNL93	564798	6176870		08/08/1990	22/08/1996
WANILLA	WNL91	563410	6176932		10/04/1990	05/04/2005
WANILLA	WNL89	563410	6176932		10/04/1990	05/04/2005
WANILLA	WNL87	563860	6177169		10/04/1990	05/04/2005
WANILLA	WNL84	564281	6177188		10/04/1990	04/05/2005
WANILLA	WNL83	564281	6177188		10/04/1990	05/04/2005
WANILLA	WNL80	564809	6177182		10/04/1990	05/04/2005
WANILLA	WNL79	564809	6177182		10/04/1990	22/08/1996
WANILLA	WNL75	564385	6177485		06/07/1990	01/10/1992
WANILLA	WNL73	564850	6177420		15/05/1990	15/04/2003
WANILLA	WNL121	566395	6176722		01/10/1992	31/10/1996
WANILLA	WNL122	566395	6176722		27/03/1992	05/04/2005
WANILLA	WNL72	564850	6177420		12/12/1990	22/08/1996
WANILLA	WNL77	564321	6177331		06/07/1990	18/08/1993
WANILLA	WNL82	564281	6177188		06/07/1990	28/08/1997
WANILLA	WNL86	563860	6177169		10/04/1990	05/04/2005

NETWORK	OBS_N	EASTING	NORTHING	AQUIFER	START	END
WANILLA	WNL90	563410	6176932		10/04/1990	05/04/2005
WANILLA	WNL94	564798	6176870		10/04/1990	05/04/2005
WANILLA	WNL103	563415	6176700		10/04/1990	22/06/1994
WANILLA	WNL106	563778	6176870		10/05/1991	22/06/1994
WANILLA	WNL107	564465	6176418		10/05/1991	22/08/1996
WANILLA	WNL110	563978	6176220		27/03/1992	05/04/2005
WANILLA	WNL113	563878	6177770		10/05/1991	05/04/2005
WANILLA	WNL116	563478	6177570		10/05/1991	22/06/1994
WANILLA	WNL119	565128	6177070		26/08/1992	02/02/1993
WANILLA	WNL123	566395	6176722		27/03/1992	05/04/2005
WANILLA	WNL125	566328	6176620		01/06/1992	19/05/1994

APPENDIX D - WATER MONITORING IN THE EPNRM REGION BY BoM

Agency Mission

The overall mission of BoM is to observe and understand Australian weather and climate and to provide meteorological, hydrological and oceanographic services in support of Australia's national needs and international obligations.

This overall mission involves four separate basic missions:

Monitoring: Observation and data collection to meet the needs of future generations for reliable homogeneous national climatological data

Research: Research directed to the advancement of meteorological science and the development of a comprehensive description and scientific understanding of Australia's weather and climate

Services: Provision of meteorological and related data, information, forecast, warning, investigation and advisory services on a national basis

International: Coordination of Australia's involvement in international meteorology.

Monitoring Sites

SITE	NAME	LAT	LON	1st Record	Last Record	Parameters	A
18001	ARNO BAY	-33.9118	136.5697	Aug 1907	Jan 2006	Rn	N
18002	PENONG (Pennalumba)	-31.8310	132.6262	Sep 1898	Dec-2005	Rn	N
18003	BRAMFIELD POST OFFICE	-33.6250	135.9983	Oct 1886	Dec-1969	Rn	N
18004	BREEZER PLAINS (Koolballa Hill)	-33.1000	135.0550	Sep-1917	Jun-1947	Rn	N
18005	YEELANA (Brimpton Lake)	-34.0582	135.5042	Oct-1907	Dec-2005	Rn	N
18007	YEELANA (BROOKER)	-34.1003	135.8415	Oct-1913	Dec-2005	Rn	N
18008	Buclkeboo Post Office	-32.9200	136.2133	Jan-1933	Aug-1986	Rn	N
18009	CARAWA	-32.3683	134.2300	Dec 1898	Dec-1950	Rn	N
18010	CARPA	-33.7600	136.6867	Jan-1933	Dec-1990	Rn	N
18011	CEDUNA POST OFFICE	-32.1267	133.6725	May-1906	Sep-1990	Rn	N
18012	CEDUNA AMO	-32.1297	133.6976	Mar-1939	Feb-2006	Rn*, Ev	Y
18013	CHANDADA POST OFFICE	-32.7592	134.6717	Jan-1929	Dec-1968	Rn	N
18014	CLEVE	-33.7011	136.4937	Feb 1896	Feb-2006	Rn	N
18016	COLTON (BOOLA BOOLA)	-33.5317	134.9017	Mar 1892	Apr-1965	Rn	N
18017	PORT LINCOLN (BIG SWAMP)	-34.6266	135.6992	May 1897	Dec-2005	Rn	N
18018	KIMBA (Cortlinye Rocks Stn)	-33.0100	136.2933	Jul-1916	Oct-1991	Rn	N
18019	COULTA	-34.3853	135.4697	Jan 1878	Feb-2006	Rn	N
18020	COULTA (THE GLEN)	-34.3650	135.5717	Aug-1934	Jan-1962	Rn	N
18021	COURELA (CHALLNER)	-32.5350	134.4367	Jan-1911	Dec-1966	Rn	N
18022	COWELL	-33.6772	136.9116	Dec 1885	Feb-2006	Rn	N
18023	CUMMINS	-34.2644	135.7266	Jul-1914	Feb-2006	Rn	N
18024	DARKE PEAK	-33.4678	136.2113	Jul-1914	Feb-2006	Rn	N

SITE	NAME	LAT	LON	1st Record	Last Record	Parameters	A
18025	DENIAL BAY	-32.1028	133.5767	Oct-1920	Feb-1975	Rn	N
18030	FOWLERS BAY	-31.9833	132.4500	Jan 1878	May-1967	Rn	N
18032	GLEN BOREE	-31.8817	132.5100	Aug-1902	Feb-1971	Rn	N
18033	CEDUNA (GOODE)	-31.9674	133.7658	Oct-1908	Dec-2005	Rn	N
18035	KAPPAWANTA	-33.6686	135.2767	Jun-1906	Dec-1986	Rn	N
18036	KARCULTABY	-32.7357	134.9709	Jan-1922	Dec-2005	Rn	N
18037	KIMBA (CURTINYE)	-33.1861	136.5590	Jul-1918	Dec-2005	Rn	N
18038	BALUMBAH	-33.3058	136.4175	Sep-1950	Jan-1973	Rn	N
18039	KIELPA	-33.5883	136.2233	Jan-1928	Apr-1986	Rn	N
18040	KIMBA	-33.1394	136.4209	Nov-1920	Feb-2006	Rn	N
18041	KIMBA (THE PINES)	-33.1167	136.4167	Apr-1915	Dec-1966	Rn	N
18042	CEDUNA (Koonibba Reserve)	-31.9017	133.4217	Aug-1910	Nov-1989	Rn	N
18043	KOPPIO	-34.4139	135.8224	Dec 1897	Dec-2005	Rn	N
18044	KYANCUTTA	-33.1332	135.5552	Jan-1930	Feb-2006	Rn, Ev	N
18045	SHERINGA (LAKE HAMILTON)	-33.9534	135.2682	Nov 1877	Nov-2005	Rn	N
18046	LOCK	-33.5679	135.7571	Jan-1915	Dec-2005	Rn	N
18047	CEDUNA (MALTEE)	-32.0865	133.9082	Jun-1929	Dec-2005	Rn	N
18048	CLEVE (MANGALO)	-33.5322	136.6242	Jul-1906	Dec-1999	Rn	N
18049	BUTLER TANKS (North Parnda)	-34.1201	136.1609	Jun-1905	Oct-2005	Rn	N
18050	MILTALIE (POODRA)	-33.5983	136.8433	Sep 1886	May-1927	Rn	N
18051	MILTALIE (HILLVIEW)	-33.5900	136.8567	Apr-1904	Dec-1960	Rn	N
18052	Minnipa Agricultural Centre	-32.8361	135.1500	Jun-1919	Jun-2001	Rn*	N
18053	MINNIPA	-32.8552	135.1555	Oct-1914	Feb-2006	Rn, Ev	N
18054	PORT KENNY (Mount Cooper)	-33.0314	134.7015	Jan-1939	Nov-2005	Rn	N
18055	MOUNT HOPE	-34.1058	135.3550	Nov-1932	May-1987	Rn	N
18056	MT WEDGE (MOUNT WEDGE)	-33.4839	135.1592	Jul 1884	Dec-2005	Rn	N
18057	MOUNT WUDINNA	-32.9916	135.5482	Jan-1907	Dec-2005	Rn	N
18058	WHYALLA (MULLAQUANA)	-33.2122	137.3623	Oct-1910	Dec-2005	Rn	N
18059	WHYALLA (NONOWIE)	-33.1258	137.3639	Mar-1903	Oct-2005	Rn	N
18060	NUNDROO	-31.7782	132.2034	Oct-1932	Feb-2006	Rn	N
18061	WIRRULLA (NUNJIKOMPITA)	-32.2694	134.3364	Jan-1929	Jul-1986	Rn	N
18062	PEACHNA	-33.7778	135.7150	Sep-1933	Jul-1952	Rn	N
18063	PENONG	-31.9320	133.0056	Feb 1893	Feb-2006	Rn	N
18064	WIRRULLA (PETINA)	-32.4792	134.3917	Jul-1904	Mar-1993	Rn	N
18065	CLEVE (PINESIDE)	-33.8663	136.3833	Mar-1909	Aug-2004	Rn	N
18066	POINT LOWLY LIGHTHOUSE	-33.0028	137.7850	Sep-1900	Mar-1973	Rn	N
18067	PONDOOMA POST OFFICE	-33.5217	137.0192	Jul-1901	Feb-1977	Rn	N
18068	POOCHERA	-32.7229	134.8373	Apr-1919	Feb-2006	Rn	N
18069	ELLISTON	-33.6501	134.8880	Feb 1882	Feb-2006	Rn	N
18070	PORT LINCOLN	-34.7225	135.8558	Feb 1870	Mar-2002	Rn	N

SITE	NAME	LAT	LON	1st Record	Last Record	Parameters	A
18071	Port Lincoln Aerodrome	-34.6017	135.8732	May-1946	Dec-2005	Rn	N
18072	PORT NEILL	-34.1187	136.3508	Jan-1912	Feb-2006	Rn	N
18073	SMOKY BAY (PUNTABIE)	-32.2021	134.1307	Jul-1916	May-2005	Rn	N
18075	RUDALL	-33.6900	136.2683	Jan-1925	Dec-1996	Rn	N
18076	SHERINGA	-33.8492	135.2308	Apr-1915	Oct-1989	Rn	N
18077	SMOKY BAY	-32.3764	133.9369	Jul-1912	Feb-2006	Rn	N
18078	STOKES	-34.2942	135.9267	Jul 1889	Sep-1983	Rn	N
18079	STREAKY BAY	-32.7963	134.2116	Jan 1878	Feb-2006	Rn	N
18080	TALIA	-33.3167	134.8667	Aug-1906	Dec-1977	Rn	N
18081	LOCK (TERRE)	-33.5399	135.4759	Jan-1907	Aug-2002	Rn	N
18082	THISTLE ISLAND	-35.0100	136.1767	Sep-1936	Nov-1963	Rn	N
18083	WUDINNA AERO	-33.0430	135.4519	Apr-1999	Feb-2006	Rn*	Y
18084	LOCK (NINAMANIMA)	-33.7857	135.8435	Dec-1929	Nov-2005	Rn	N
18085	WHYALLA (TREGALANA)	-32.8774	137.5637	Mar-1930	Dec-2004	Rn	N
18086	TUMBY BAY	-34.3756	136.1026	Oct-1906	Feb-2006	Rn	N
18087	TUMBY BAY (HILLVIEW)	-34.3308	136.0800	Nov 1892	Nov-1999	Rn	N
18088	UNGARRA	-34.1806	136.0490	Sep-1909	Feb-2006	Rn	N
18089	WADDIKEE	-33.3173	136.2515	Jul-1927	Dec-2005	Rn	N
18090	WARRAMBOO	-33.2421	135.5978	Nov-1924	Dec-2005	Rn	N
18091	TUMBY BAY (WARRATTA VALE)	-34.2617	136.2092	Dec 1876	Dec-2005	Rn	N
18093	BUTLER (ANONA)	-34.1216	136.2421	Sep-1909	Jan-2004	Rn	N
18094	WIRRULLA	-32.4035	134.5323	Jun-1922	Feb-2006	Rn	N
18095	WUDINNA	-33.0460	135.4601	Jan-1927	Jan-2006	Rn	N
18096	CLEVE (PINEVIEW)	-33.6824	136.6831	Jun-1938	Dec-2005	Rn	N
18097	PORT KENNY (YANDRA)	-32.9615	134.5952	Jul 1891	Dec-2005	Rn	N
18098	YANINEE	-32.9475	135.2754	Apr-1919	Dec-2005	Rn	N
18099	YEELANNA	-34.1413	135.7300	Jul-1911	Dec-2005	Rn	N
18100	KIMBA (YELTANA)	-32.8633	136.4346	Jan-1929	Aug-2003	Rn	N
18101	KOONGAWA (RETAWON)	-33.1718	135.9117	Aug-1951	Jan-2006	Rn	N
18102	WHYALLA DAIRY	-32.9900	137.5767	Jan-1949	Dec-1955	Rn	N
18103	WHYALLA (NORRIE)	-33.0303	137.5328	Aug-1906	Jul-2001	Rn	N
18104	CUMMINS (GLENREATH)	-34.3383	135.8701	Jan-1911	Dec-2005	Rn	N
18105	DENIAL BAY (NADIA)	-32.0819	133.4725	Mar 1897	Jul-1939	Rn	N
18107	PORT LINCOLN (WOOLGA)	-34.5911	135.7572	Jun 1891	Dec-2005	Rn	N
18109	THE WEDGE	-35.1533	136.4667	Feb-1949	Feb-1962	Rn	N
18113	WHARMINDA	-33.9650	136.2472	Aug-1913	Feb-2006	Rn	N
18115	NEPTUNE ISLAND	-35.3365	136.1174	Nov-1957	Feb-2006	Rn*	Y
18116	CLEVE AERODROME	-33.7081	136.5026	Jan-1963	Feb-2006	Rn*	Y
18118	HASLAM	-32.5086	134.2138	Sep-1928	Dec-2005	Rn	N
18119	HASLAM 2	-32.5200	134.2342	Aug-1929	Apr-1967	Rn	N

SITE	NAME	LAT	LON	1st Record	Last Record	Parameters	A
18120	WHYALLA AERO	-33.0540	137.5206	Jan-1979	Feb-2006	Rn*, Ev	Y
18121	BARNA	-33.1928	136.6336	Jan-1925	Oct-1940	Rn	N
18122	BURKO	-32.9992	134.2517	Aug-1920	Nov-1934	Rn	N
18123	BUTLER	-34.1350	136.1383	Nov-1905	Dec-1928	Rn	N
18124	CHINTULDA (ROBERTSVALE)	-31.9142	132.1658	Oct-1909	Aug-1933	Rn	N
18125	CUNGENA	-32.5825	134.7089	Dec-1918	Nov-1993	Rn	N
18126	FOUNTAIN FOREST RESERVE	-34.6100	135.5906	Jul 1891	Apr-1928	Rn	N
18127	GLYNN	-33.4333	137.0167	Sep-1903	Dec-1929	Rn	N
18128	KARCULTABY	-32.7656	134.9750	Feb 1886	Dec-1911	Rn	N
18129	KERNILLA	-34.6283	135.8400	Sep-1904	Dec-1926	Rn	N
18130	MITCHELVILLE	-33.5850	137.2183	Oct-1902	Jan-1941	Rn	N
18131	MUDAMUCKLA	-32.1658	134.0083	Sep-1924	Mar-1932	Rn	N
18132	MUNYEROO	-33.3617	137.3767	Sep-1916	Oct-1923	Rn	N
18133	NUNONG	-31.9650	133.0133	Sep 1892	Nov-1939	Rn	N
18134	PENONG 2	-31.8933	132.8950	Jan-1913	Mar-1938	Rn	N
18135	PILE PUDLA	-32.9500	136.4217	Sep-1933	Nov-1944	Rn	N
18136	POONINDIE	-34.5833	135.8833	May 1891	Nov-1928	Rn	N
18137	PORT LINCOLN (WESTMERE)	-34.8344	135.6975	Nov-1906	Dec-2005	Rn	N
18138	WATCHANNIE	-33.5683	136.7336	Apr-1907	Sep-1927	Rn	N
18139	POLDA (GUM VIEW)	-33.5085	135.2928	Sep-1966	May-2005	Rn*, Ev	N
18141	WILTON (SHOAL VIEW)	-33.6550	137.1717	Aug-1903	Dec-1939	Rn	N
18142	YALATA	-31.9311	132.3650	Feb 1882	Oct-1926	Rn	N
18143	YELDULKNIE	-33.6933	136.5483	Jan-1916	Apr-1927	Rn	N
18144	WANILLA	-34.5433	135.6997	Jul-1964	Dec-2005	Rn	N
18149	WHARMINDA (GLEN HAZE)	-33.8550	136.1694	May-1966	Aug-1975	Rn	N
18150	PORT KENNY	-33.1683	134.6844	Sep-1966	Dec-2005	Rn	N
18151	CHILLAMURRA	-34.7333	135.5444	Dec 1892	Jul-1904	Rn	N
18152	CORNUBIA	-34.0203	136.3567	Apr-1908	Oct-1922	Rn	N
18154	COURTABIE	-33.2067	134.8550	May 1892	Dec 1898	Rn	N
18155	LAKE WANGARY	-34.5517	135.4933	Jan 1885	Dec-1911	Rn	N
18159	WANGARALEEDNIE	-33.6833	136.6183	Mar 1883	Dec-1915	Rn	N
18160	YADNARIE	-33.7167	136.4175	Jan 1884	Dec 1895	Rn	N
18162	COURELA (LINDARNOE)	-32.5423	134.3852	Jan-1967	Dec-2005	Rn	N
18163	NUNDROO (COORABIE)	-31.9027	132.2988	Sep-1968	Jan-2005	Rn	N
18164	MURDINGA (MUNGALA)	-33.6992	135.9239	Mar-1969	Dec-2005	Rn	N
18165	LOCK (KERIODY)	-33.5629	135.6144	Mar-1969	Jan-2006	Rn	N
18166	WIRRULLA (PIMBENA)	-32.2811	134.4714	Jan-1969	Jan-2006	Rn	N
18167	WUDINNA (ILLALANGI)	-33.0981	135.3531	Mar-1969	Dec-2005	Rn	N
18168	MIDGEE ROCKS	-33.4228	137.1517	Mar-1969	Dec-1972	Rn	N
18169	WIRRULLA (KANKAPPIE)	-32.3903	134.6983	Mar-1969	Feb-1978	Rn	N

SITE	NAME	LAT	LON	1st Record	Last Record	Parameters	A
18170	KYANCUTTA (KYANBRAE)	-33.1394	135.7271	Apr-1969	Dec-2005	Rn	N
18171	MOUNT HOPE (FAIRVIEW)	-34.1361	135.3319	Feb-1913	Feb-2006	Rn	N
18172	BUCKLEBOO (HI-VIEW)	-32.9211	135.9996	Apr-1969	Dec-2005	Rn	N
18173	MANGALO	-33.5684	136.6473	Feb-1999	Dec-2005	Rn	N
18174	RUDALL (SWAFFPRO)	-33.7234	136.1511	Apr-1969	Dec-2005	Rn	N
18175	BUTLER (MOODY VALE)	-34.0386	136.0107	Mar-1969	Dec-2005	Rn	N
18176	COWELL (WINTER SPRINGS)	-33.3433	136.7506	Nov-1969	Feb-2006	Rn	N
18177	KIMBA (MELALEUCA)	-33.0750	136.0918	Apr-1969	Aug-2005	Rn	N
18178	WANILLA FOREST	-34.5967	135.6450	Sep-1970	Jul-1993	Rn	N
18179	WANILLA SECTION 126	-34.5433	135.7008	Jan-1971	Mar-1986	Rn	N
18180	MILTALIE POST OFFICE	-33.5500	136.8417	Jan-1928	Jun-1956	Rn	N
18181	PORT LINCOLN (TOD RIVER)	-34.4906	135.8511	Jan-1968	Dec-1996	Rn*, Ev	N
18182	CEDUNA (UWORRA)	-31.9664	133.3317	Jan-1973	Dec-2005	Rn	N
18183	WIRRULLA (TARANAKI)	-32.4175	134.6758	Jan-1973	Dec-1996	Rn	N
18184	CLEVE (NINGANA)	-33.6106	136.3729	Aug-1973	Dec-2005	Rn	N
18187	KIMBA (CHURINGA)	-32.9587	136.4891	Dec-1940	Sep-2004	Rn	N
18188	COFFIN BAY	-34.6333	135.4486	May-1984	Feb-2006	Rn	N
18189	ELLISTON (LAMBING STATION)	-33.7516	135.1863	Jan-1987	Dec-2005	Rn	N
18190	BUCKLEBOO (KARINYA)	-32.9003	136.1858	Aug-1987	Feb-2006	Rn	N
18191	COULTA (COLES POINT)	-34.3749	135.3741	Jun-1994	Feb-2006	Rn*	Y
18192	Port Lincoln AWS	-34.5993	135.8784	Jun-1994	Feb-2006	Rn*	Y
18193	KIMBA (CORTLINYE)	-33.0267	136.3171	May-1925	Dec-2005	Rn	N
18194	KYANCUTTA (KEVENDALE)	-33.2775	135.8486	Jan-1995	Aug-1996	Rn	N
18195	MINNIPA DPI	-32.8427	135.1515	Jul-1996	Feb-2006	Rn	Y
18196	CUMMINS (TUMBY BAY ROAD)	-34.2610	135.7310	Sep-1995	Jan-2006	Rn	N
18197	WIRRULLA (GAWLER VIEW)	-32.3885	134.6994	May-1997	Jun-2005	Rn	N
18198	CLEVE (HEGGATON)	-33.4138	136.5989	Jan-1999	Jan-2006	Rn	N
18202	MITCHELLVILLE (ESSENDEE)	-33.6110	137.0951	Sep-2000	Oct-2005	Rn	N
18203	TUMBY BAY (YADNARIE)	-34.3440	136.0471	Jan-1964	Dec-2005	Rn	N
18204	ELLISTON (THREE LAKES)	-33.5879	134.8859	May-2001	Jan-2006	Rn	N
18205	PORT LINCOLN WEST	-34.7405	135.8450	Jan-2004	Feb-2006	Rn	N
18208	KYANCUTTA (BILLABOWIE)	-33.2310	135.4095	Jul-2005	Dec-2005	Rn	N
18209	OAKDALE	-33.8189	135.4857	Jul-2005	Dec-2005	Rn	N
18210	MINNIPA (MOONLIGHT FLAT)	-33.0200	135.0450	Jul-2005	Oct-2005	Rn	N
18211	MINNIPA (WISTILLERE)	-32.9392	135.0780	Jul-2005	Dec-2005	Rn	N
18213	ELLISTON (OAKLANDS)	-33.7412	135.0804	Jul-2005	Dec-2005	Rn	N

APPENDIX E - WATER MONITORING IN THE EPNRM REGION BY EPA

Agency's Mission

The EPA's mission is to protect and restore the environment as the basis for a sustainable future.

Water Quantity Data

The EPA is involved in the collection of water quantity data in only very rare circumstances.

Water Quality Data

The EPA monitors the State's waters to provide information on their condition and to identify important trends and issues through its Ambient Water Quality Monitoring Programs (AWQMP). The EPA also undertakes 'hot spot' monitoring to determine whether there has been a breach of the *Environment Protection Act 1993* (particularly the general environmental duty). In addition, many licensed activities that discharge to water bodies are required as a condition of licence to undertake monitoring of the discharge and report the results to the EPA.

Data Storage Method and Accessibility

Water quality data on rivers and streams, groundwaters, lakes, marine and estuarine waters are stored in the Environmental Data Management System (EDMS), which the EPA is planning to make Internet-accessible in the near future. Information held in EDMS is used to prepare the *State Water Plan*, the *State of Environment* Report, and other reports published by the Department for Environment and Heritage (DEH) assessing the state and condition of the water body.

The Septic Tank Effluent Drainage System (STEDS) stores water quality and quantity data under licence reported to EPA. Other datasets held by the EPA include information on environmental authorisations, frog surveys, riparian assessments, sea grass coverages, reef condition and information on marine biota (e.g. heavy metals in mussels and dolphins).

Table 19. Water quantity parameters, frequency and geographic scope of collection by EPA.

	Geographic Scope			Frequency of Collection			
Data Type	Regional	Catchment	Project-specific	Continuously	Monthly	Other	Not Collected
Chemical							
Pesticides			√		√	√	
Organics			√		√	√	
Metals	√	√	√		√		
Nutrients	√	√	√		√		
DO	√	√	√		√		
Physical							
pH	√	√	√		√	√	
Temperature	√	√	√		√	√	
Salinity (GW)	√	√	√		√	√	
Salinity (SW)	√	√	√	√	√	√	
Turbidity	√	√	√	√	√	√	
Biological							
Structure of aquatic communities							√
Habitat			√			√	
Macro-invertebrates	√	√	√			√	
Indictor bacteria			√			√	

AusRivAS Sampling Sites

SITE	Year	EASTING	NORTHING
Ponto Creek	1998	617500	6212500
Coonta Ck, 9km W of Tumby Bay	1998	592250	6196400
Pillaworta Ck at Diversion Weir	1994	580600	6190350
Tod R White Flat	1994	576850	6179650
Tod R at Koppio	1994	577700	6190800
Toolillie Ck at Toolillie Gully	1994	572900	6185600
Salt Ck at Mangalo	1994	650600	6287900
Dutton R	1994	611850	6233000
Salt Creek, Yorkies Crossing	1997	549500	6181750
Unnamed Creek, road crossing ds Gr	1997	571150	6167700
Tod River, at Lincoln Highway	1997	580250	6172300
Meadows Creek, Lincoln Highway	1997	580000	6171400
Rock Valley Creek, ds Koppio Mine	1997	581850	6188400
Tod River, ds Yallunda Flat	1997	580300	6197700
Mine Creek, Stirlings Road	1997	596650	6199000
Salt Creek, Muntoburrowie Ford	1997	609100	6208250
Yeldulknie Creek, ds Yeldulknie Re	1997	642970	6270600
Salt Creek, opp. Kimba-Cowell Rd	1997	670550	6298200
Minniribbie Creek, Katies Lane	1998	544200	6175450
Waterfall Creek, Wallenda Falls Rd	1998	593400	6201650
Salt Creek at rocky ford	1998	678200	6304000
Pokalalie Creek	1998	651850	6286000
Tod R, u/s reservoir	1998	579300	6185650
Millalee Creek, Lincoln Highway	1998	590300	6188700
Edililie Creek, Tod Hwy d/s reserv	1998	564950	6194650
Driver River	1998	622300	6257750

Ambient Water Quality Monitoring Sites

Site name	Easting	Northing	Frequency	Parameters
Dutton River	611850	6233000	Monthly	Chemical, macro
Tod River: Koppio	577700	6190800	Monthly	Chemical, macro
Tod River: White Flat	576850	6199650	Monthly	Chemical, macro

APPENDIX F - WATER MONITORING IN THE EP BY SA WATER

Agency's Mission

SA Water's mission is to provide innovative water and wastewater solutions that:

- Safeguard public health
- Sustain water resources and the environment for the future
- Deliver increasing value for customers, the Government and the community
- Foster our people's talent and commitment

Water Quantity Data

SA Water collects water quantity data (as shown in Table 21 largely in association with its water distribution projects. For example, it keeps track of rainfall amounts, reservoir storage, and inflow and outflow as part of operating specific projects.

Table 20. Water quantity parameters, frequency and geographic scope of collection by SA Water.

	Geographic scope			Frequency of Collection			
Data Type	Regional	Catchment	Project-specific	Continuously	Monthly	Other	Not Collected
Water availability							
Runoff							√
Streamflow	√	√	√	√			
Water level	√	√	√	√			
Water storage			√			√	
Aquifer recharge			√			√	
Groundwater levels	√	√	√		√		
Precipitation	√		√	√			
Evapo-transpiration		√					
Soil moisture							√
Water Withdrawal							
Withdrawal		√				√	
Consumptive use		√				√	
Return flow							√

Water Quality Data

SA Water has a comprehensive water quality monitoring program which covers the system from catchment through to customer taps. It comprises both routine and event-based monitoring programs. Routine monitoring is based on the guidelines outlined in the *Australian Drinking Water Guidelines* and incorporates regular monitoring and subsequent assessment of all aspects of the system. Event-based sampling detects potential water quality problems, arising from weather or rainfall triggered events.

Table 21. Water quality parameters, frequency and geographic scope of collection by SA Water.

	Geographic scope			Frequency of Collection			
Data Type	Regional	Catchment	Project-specific	Continuously	Monthly	Other	Not Collected
Chemical							
Pesticides			√			√	
Organics			√			√	
Metals			√		√	√	
Nutrients			√		√	√	
DO			√		√	√	
Physical							
pH			√	√			
Temperature			√	√			
Salinity (GW)			√	√		√	
Salinity (SW)			√	√			
Turbidity			√		√		
Biological							
Structure of aquatic communities							√
Habitat							√
Macro-invertebrates							√
Indictor bacteria			√		√	√	

Data Storage Method and Accessibility

There is an informal arrangement with DWLBC to store surface water quantity information in the HYDSTRA database (but not in the Surface Water Archive). The groundwater levels data are stored in Obswell.

All water quality data collected by SA Water is held in a central database administrated by the Australian Water Quality Centre (AWQC), and publicly available as annual reports. In addition, as a condition of licence, SA Water is required to monitor the quality and quantity of discharges from sewage treatment works to receiving water bodies. Results are reported to the EPA and Department of Human Services (DHS) and are publicly available via the EPA.

Monitoring Sites

See list at APPENDIX C.

APPENDIX G - WATER MONITORING IN THE EP BY EPCWMB

Agency's Mission

The EPCWMB has a stated mission:

To assist Eyre Peninsula communities understand, manage and be confident about their future access to water (permitting social and economic growth) while protecting the water resources on which they rely.

Water monitoring data

Currently, the board relies on State agencies, chiefly DWLBC, SA Water, and EPA, for water monitoring data and information.