

Research & Innovation



Research & Development



Knowledge Management

Innovation



**Annual Report
2004/05**

OVERVIEW

The past year has seen a period of intense activity for the Technology and Research Management Branch (T&RM). Responding to the Corporation's Security through Diversity Strategy the Branch managed a significant program of strategic research with particular emphasis on water sourcing, water recycling and aquifer recharge.

During the course of the year the Corporation introduced a new Accountability Framework. Using this Framework T&RM undertook a realignment of policies and procedures with an aim to improving processes and emphasizing strategic leadership and working with key stakeholders.

There have been significant achievements in the area of stakeholder engagement and in particular with CSIRO, Centre for Water Research, Curtin University, Premier's Water Foundation and a number of community groups.

As part of the stakeholder activities T&RM continued to develop relationships with research institutions, government agencies and industry bodies in order to increase the effectiveness of the Water Corporation's research dollar.

In 2004/2005, T&RM working jointly with the Water Cycle Group, successfully obtained \$1.5 million in grant funding over three years from the Premier's Water Foundation in collaboration with CSIRO, Curtin University, the Centre for Groundwater Studies and University of Western Australia. In partnering with the Department of Health, Department of Environment, Curtin University, CSIRO and the Chemistry Centre another \$1 million over 3 years has been achieved from the Premier's Collaborative Research Program.

The Branch continued to develop and strengthen the strategic alliance between the Corporation and Curtin University through collaboration and launch of the Curtin Water Quality Research Centre.

Knowledge Management has continued to present the highly successful Technology Transfer Talks and Peer Group Knowledge Sharing Sessions. These sessions have covered a wide variety of topics and have received very positive feedback from participants and stakeholders alike.

The Knowledge Management Business Case for the supporting IT enablers has been endorsed and work is well underway in developing the technical solutions for the Knowledge Communities, the Expertise Locator and Key Learnings. These initiatives, known as KnowledgeNet, aim to support and enable the accountability framework. Three business areas (Water Treatment Process Expertise Group, Wastewater Process Expertise Group and Northwest Region) are currently involved as pilot groups for KnowledgeNet.

During 2005, T&RM completed the handover of the "Involve" portion of the Innovation Scheme to Human Resources Branch and the transfer of improvement ideas to the Corporate Improvement System Register. The next phase of the Innovation Program will be to develop a process for the management of breakthrough ideas and an innovation framework that integrates into business practise.

In September 2004, T&RM coordinated the Innovation Expo with the theme of "Simplify, Standardise, Share and Sustain". Over 700 hundred people attended this highly successful event including visitors from the EPA, Dept of Premier & Cabinet, Premier's Water Foundation, Local government, FESA, CSIRO, Curtin University, University of Western Australia, Chamber of Commerce and Industry, Conservation Council, Western Power and Curriculum Council and others.

In conjunction with the Australian Innovation Festival and as a response to various expressions of interest, two mini Expos were held in Albany and Bunbury in May 2005 with attendance by regional stakeholders.

This Annual Report outlines achievements in research and innovation for 2004/05.



Keith Cadee
General Manager
Water Technologies Division

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1. RESEARCH & INNOVATION 2004/05 AT A GLANCE

Research and Development

The purpose of the research and development (R&D) program is to ensure that the Corporation's strategic planning makes the best possible use of innovative solutions to "over the horizon" issues through structured research.

Of the 53 projects budgeted within the 2004/05 R&D program, 22 have been completed. Nine new projects commenced in the research themes of Drinking Water Quality, Water Source Management and Customer Service.

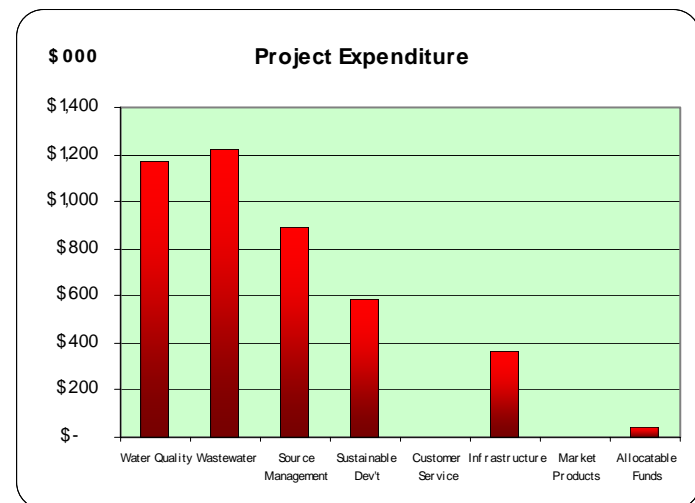
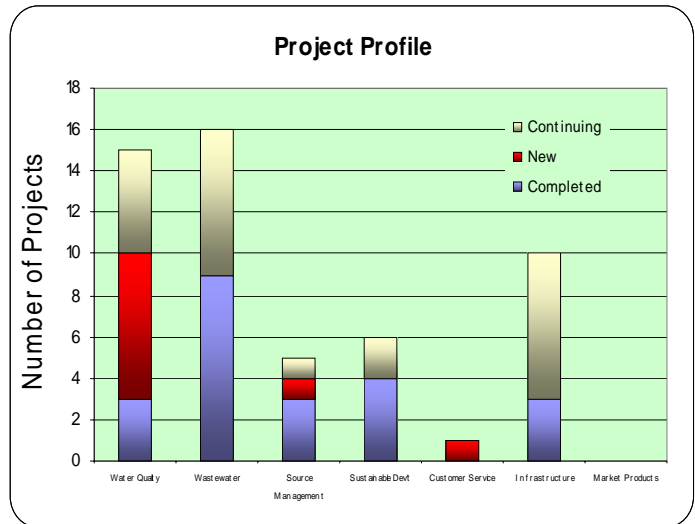
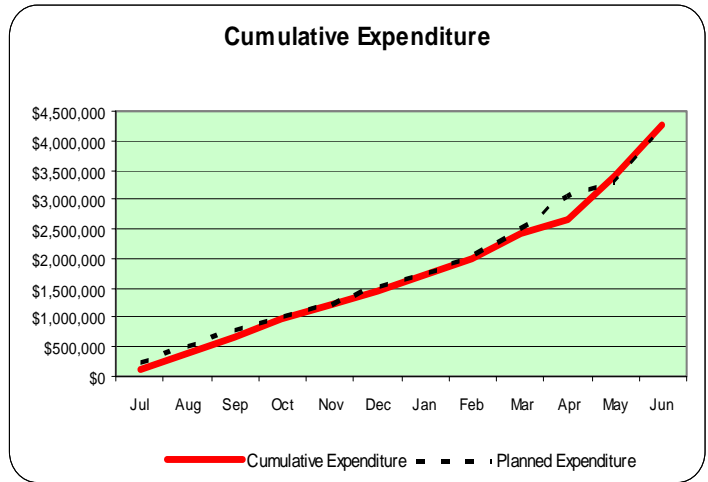
Funding allocation to each of the research themes is based on corporate priorities and identified business needs. The proportional allocation of budget in each area varies from year to year.

The total R&D budgeted and managed funds for 2004/05 was \$4.163M. Expenditure at 30 June 2005 was \$4.249M.

In the past 12 months, the Corporation's R&D has assisted the business to be environmentally sound, socially responsible, realise efficiencies and reduce risks.

The knowledge acquired will be applied to planning, design, operations and service delivery to either reduce or avoid costs.

Completed R&D projects have provided improvements to the Corporation's asset planning process, the inspection of buried assets and condition assessment, as well as improvements to the monitoring of the quality of drinking water sources.



1. RESEARCH & INNOVATION 2004/05 AT A GLANCE (Cont)

Knowledge Management

Development of a corporate knowledge management system, KnowledgeNet, continued during 2004-05. Intensive stakeholder consultation was undertaken to demonstrate KM system concepts and elicit feedback on business requirements.

KnowledgeNet is an extension of existing corporate information systems and incorporates the three elements essential to support the business and leverage knowledge throughout the Corporation:

Expertise locator - a means by which employees can locate key contacts with the required expertise.

Key learnings system - a repository of key lessons learned.

Knowledge communities - improving the benefits of collaboration amongst experts groups and sharing technical know-how.

Implementation of a KnowledgeNet pilot with 3 corporate groups is scheduled to commence in July 2005.

Technology Transfer Talks (TTT) continued to be conducted to communicate the learnings of various research projects to stakeholders and industry partners. This year the focus of the TTT was on technology to provide safe drinking water.

Twelve Peer Group Forums were conducted during the year. Peer Group Forums are a popular and effective means by which employees and their stakeholders can be informed of key issues and projects in the Corporation.

Innovation Program

The new Innovation Program aims to identify and nurture significant innovations which have the potential to provide substantial benefits to the Corporation.

This is a move away from the function of the previous Involvement Scheme, which was largely concerned with recognising employees for their Company One behaviour and their contribution to generating ideas and solving problems.

More than 1000 recognition and idea submissions have been received since the scheme was launched in 2000. Only a small number of submissions were received during 2004-05 due to the change of focus.

Achievements this year were:

- Separation of continual improvement ideas and innovation. 75 ideas were transferred to the Corporate Improvement System
- Creation of a simplified webpage
- Innovation issues identified by a cross-divisional stakeholder workshop

Full implementation of the Innovation Program has been delayed due to competing organisational priorities and resource availability.

The Chairman's Award Scheme is the means by which the best employee contributions are formally acknowledged. In 2004 the gold Chairman's Award was awarded to the BuilderNet team. BuilderNet is a system which enables builders to submit plans and gain immediate approval via the internet. It is viewed by the building industry as one of the most significant advances in customer service in 30 years.

The Chairman's Award Scheme is to be transferred to Human Resources Branch and may take on a different form in future years.

2. MANAGEMENT OF RESEARCH AND INNOVATION

Technology and Research Management Branch (T&RM) is accountable for corporate research and innovation processes. These processes are:

- Manage Research and Development
- Manage Knowledge
- Manage Innovation

Management decisions in the three areas are guided by specific strategy directions and are reviewed regularly.

T&RM is also the principal stakeholder contact point for the Corporation for the CSIRO, UWA, Curtin University and Premier's Water Foundation.

Manage Research and Development

Strategy and Program Development

Research and development must be aligned with corporate strategy to ensure effective use of R&D resources.

This year T&RM conducted a review of the R&D strategy and a comprehensive R&D strategic framework was developed which will guide R&D in future years.

Strategic reviews were conducted involving intensive consultation with various stakeholders to identify the technical challenges which may be resolved by R&D work. The outcomes of the reviews flow on into development of the R&D Program of projects each year.

Ensuring the optimum project portfolio composition is a key challenge. This year, with the intensive stakeholder involvement and the use of a rigorous new project prioritisation methodology, a well balanced program of projects was assembled.

Alliances

Increased attention is being brought to developing strong, productive alliances with national and international industry and research organisations such as CSIRO, Curtin University, Water Environment Research Foundation (WERF), and Water Services Association of Australia (WSAA).

These alliances improve access to technology, knowledge and expertise, and leverage R&D funding.

Curtin Strategic Alliance

The Corporation has entered into a significant strategic alliance with Curtin University. The Curtin Water Quality Research centre (CWQRC) was launched on November 2004. This powerful new research centre is focused on Western Australia's needs in water quality and treatment and involves appropriate partners and collaborations to ensure the delivery of world class practical solutions.

A key feature of the CWQRC is the ability to further leverage Water Corporation funding through Australian Research Council Linkage (ARC) Grants and Linkage Infrastructure Equipment and Facilities (LEIF) Grants, to achieve significantly enhanced scope and funding level.

In 2004-05 the Water Corporation provided around \$360,000 for the following projects:

- biofiltration trial
- characterising KWRP treated wastewater for drinking water purposes
- discoloured water scoping study
- chlorinous tastes and odours scoping study
- excessive water temperatures in some regional water distribution systems

2. MANAGEMENT OF RESEARCH AND INNOVATION (Cont)

- effects of blending desalinated water in Perth distribution system
- turbidity effect on disinfection outcomes.

Funding sources

An investigation of potential sources of external funding was commenced during the year. Funding opportunities are available for collaborative research involving linkages between business, educational, research and government agencies. The objective is to stimulate innovation and maximise the economic benefits for all parties. The investigation will be completed within the first quarter 2005-06.

Premier's Collaborative Research Program

The Premier's Collaborative Research Program seeks to enhance research collaboration between Western Australian Government agencies, industry and academe to stimulate significant growth in knowledge in areas of importance to the State. Funding is available for comprehensive scientific investigations involving two or more State Government agencies and at least one external partner from academe, industry or federal research agencies.

In 2004-05 the Water Corporation in collaboration with Department of Health, Department of Environment, Curtin University, CSIRO and the Chemistry Centre (WA) was successful in obtaining \$1M over 3 years.

Premier's Water Foundation

The aim of the Premier's Water Foundation (PWF) is to promote and enhance water-related research and development in Western Australia. Funding is available for candidate projects considered to provide a significant benefit and which is not being achieved through current

programs.

PWF funding of \$1.5M over 3 years has become available for aquifer recharge studies and to investigate techniques to better manage WA's non-potable water resources.

Knowledge Management

The aim of the Corporation's Knowledge Management Strategy is to foster a knowledge culture which recognises the attributes and value of knowledge and to develop the Corporation's knowledge base and systems. The Knowledge Management Strategy includes an evolving framework of practical development initiatives.

Under the Strategy a number of activities are being progressed in consultation with process managers and other key stakeholders. These are focused on delivering the enablers and the support tools for processes in the Accountability Framework. The main activities are the development and implementation of a corporate knowledge management system, operation of Peer Group Knowledge Forums and Technology Transfer Talks.

Innovation

The aim of the Innovation program, facilitated by T&RM, is to improve the business through identifying and nurturing innovation. Innovations take many forms and require the vision and support of a diverse range of people to foster their development, particularly those innovations that challenge current methods or conventional wisdom.

The innovation program has taken various forms over the years. It has had a large promotional component and has encouraged

2. MANAGEMENT OF RESEARCH AND INNOVATION (Cont)

idea generation, employee recognition and innovativeness in general. Many innovative suggestions have been made by employees, and there has been a small number of outstanding innovations which have delivered significant bottom line benefits.

A new strategy for innovation has been developed. The employee recognition elements of the current Involvement Scheme are being removed, and there will be a sharper focus on identifying and nurturing innovations which offer significant positive business impacts. This new strategy will eliminate the need for innovation coordinators throughout the business as the focus shifts from employees to innovations.

A multi-disciplinary group is being established to ensure that suitable innovations are identified and are progressed to achieve better business outcomes.

The types of innovations accepted onto the new Innovation Program will be those which offer significant benefits to the business but need help to succeed, as they do not comfortably fit into other programs such as the capital or R&D programs.

3. RESEARCH AND DEVELOPMENT PROGRAM

For many years the Corporation has been conducting research and development in areas of core business and supporting the philosophy of security through diversity. To maintain effective research goals, both the internal and external environments are constantly scanned, using indicators such as Government policy, the Corporation's Statement of Corporate Intent and the Strategic and Accountability frameworks.

To support the Corporation's values as outlined in the Statement of Corporate Intent, research is concentrated in five major focus areas of:

- Drinking water quality
- Water supply security
- Water recycling
- Assets
- Wastewater

The Program's goal is to assist the Corporation to "innovate to improve", providing solutions to business needs.

As an indicator of the importance of research and development to solving critical water issues, the WA Government has launched a number of initiatives associated with the State Water Strategy. These initiatives include the Premier's Water Foundation and the Premier's Research Program which promote or fund water related research.

To address the five research focus areas, individual projects within the R&D Program have been undertaken in the following research themes:

- Drinking water quality
- Wastewater treatment, disposal & reuse
- Water source management

- Sustainable development
- Customer service
- Pipelines and infrastructure
- Market driven products and services.

In 2004-05, the Program had a budget of \$3.920M. In addition to this budget, various projects were undertaken that were funded from sources external to the Program, such as the Australian Drinking Water Guidelines projects and the Seawater Desalination project. The inclusion of these projects raised the R&D managed funds to \$4.163M. Total expenditure to 30 June 2005 was \$4.249M and indicates the high demand for R&D that meets the Corporation's strategic needs.

The 2004-05 R&D program comprised of 53 diverse projects varying in size, duration, subject matter, stakeholders and risks. The R&D program manager works closely with individual project managers to ensure projects achieve milestones and desired outcomes within the approved budget. As the volume of proposed projects always exceeds the available budget, projects are subjected to a rigorous evaluation methodology to ensure that the resulting project portfolio best supports the Corporate strategic direction.

In an effort to improve the quality of project reporting and assist program management, an initiative was introduced late in the financial year to train project managers in the use of the Corporation's financial system (SAP) and project management reporting system (PMRS). It will bring R&D project management into line with the Corporation's Project Management Branch, and is recognised as best practice. The full benefit of this improvement will be felt in the 2005-06 financial year.

3.1 DRINKING WATER QUALITY

The supply of high quality drinking water that is safe and aesthetically pleasing for customers is fundamental to the ongoing viability of the Water Corporation. To ensure this, ongoing research and development is essential, especially in a climate of increasing regulatory control.

During 2004/05 the drinking water quality research focused on the follow core areas:

- Ways to improve disinfection processes without compromising taste and odour qualities
- Alternative treatment technologies which have the potential to further improve drinking water quality
- Improvements to water treatment operations by optimising existing technologies

The following information highlights areas of research being conducted.

Disinfection

Chloramination

Chloramination provides better disinfection in pipelines over long distances than chlorine but has problems of nitrification. Trials of a particular nitrification inhibitor have been encouraging and a full scale trial is planned in a real environment. Perfecting the use of this inhibitor has the potential to significantly reduce infrastructure and operating costs.

Turbidity

Research is also being completed on the effects of turbidity on shielding micro-organisms from disinfection. The increased likelihood of more turbid water from surface water sources has increased the need for a better understanding of these effects.

Desalination Plant

The Perth Seawater Desalination Plant will provide a secure high quality water source, much of which is expected to be blended with existing groundwater and surface water sources. Blending of different source waters into the Integrated Water Supply System may lead to the remobilisation of the existing biofilms within distribution systems leading to an increase in dirty water occurrences.

Research has commenced on investigating the implications of mixing reverse osmosis derived drinking water with hills and groundwater sources, and determining the impact of the mixed water on the distribution system.

Alternative Water Treatment Technologies

The Corporation continues to explore and develop alternative water treatment technologies to produce high water quality.

Biological Filtration

Biological filtration is currently used throughout the world to remove dissolved organic carbon (DOC). Removal of DOCs improves water quality by reducing disinfection by-product formation, reducing taste and odour compounds, and producing biologically stable water which does not promote biological growth causing water quality deterioration.

Biological filtration technology is being evaluated and may provide the Corporation with another treatment option to further improve the quality of drinking water.

A pilot scale biological filtration trial completed during 2004/05, using biologically active granular activated carbon (GAC), demonstrated

3.1 DRINKING WATER QUALITY (Cont)

that this technology significantly improves water quality. A full-scale trial will be conducted.

Calcite

All surface water sources and some ground water sources require pH and alkalinity correction. This has traditionally been achieved by lime and carbon dioxide dosing. Research on the use of calcite pellets, a water treatment by-product from Neerabup Groundwater Treatment Plant, successfully demonstrated that calcite is a cost effective alternative to the use of lime in achieving pH and alkalinity targets. A full scale trial of the pellets is planned and production of a more suitable pellet is progressing.

From the calcite research an innovative concept was explored in which filters incorporating calcite may be used as a unique single step process to remove contaminants. A patent application is pending.

MIEX®

The MIEX® process technology is an advanced water treatment process in use at the Corporation since 2001. Customer perception of water quality has improved since implementation of MIEX®.

The Wanneroo Plant operation is continuing to be optimised with work this year focussing on minimising the loss of the MIEX® resin. Results have demonstrated that a significant operational saving in resin can be expected. Further optimisation studies are continuing in a number of areas.

Management Tools for Distribution Systems

The Corporation has participated with the Cooperative Research Centre for Water Quality and Treatment (CRC-WQT) in the development of management tools for modelling key aspects of distribution systems. The Corporation has provided water samples and monitoring data.

One study is investigating the origins and characteristics of particulate matter that causes dirty water complaints. The results are expected to yield valuable management and design improvements.

Another project conducted by the CRC-WQT is the development of a software tool for the reliable prediction of disinfection performance. Data and water samples provided by the Corporation this year will assist with calibration of the tool which incorporates flow, disinfection and biofilm formation models. Application of the tool will improve water treatment and distribution system management by providing a means to reliably predict disinfection performance.

3.2 WATER SUPPLY SECURITY

The security of our traditional water sources – dams and groundwater - is threatened by uncertainty about our climate. Declining rainfall has reduced stream flow into our dams by two thirds over the past 30 years. The past four years have been the driest on record in the South West of Western Australia. Research and development work supports several directions in the development of new water sources and the protection of existing water sources.

The following information highlights areas of research being conducted.

Climate Research

Climate Change

Climate change is a world wide phenomenon and changes have taken place in Western Australia's climate over recent decades. The changes are particularly evident in the South West where rainfall decrease is impacting severely on soil moisture conditions and water resources.

The Water Corporation, together with State and Federal organisations, is contributing to the Indian Ocean Climate Initiative (IOCI) whose research program is investigating climate change and climate prediction.

The Corporation's involvement in this world leading research will enable more confident planning decisions to be made.

Preliminary results from the initiative are encouraging with progress being made on understanding aspects of climate change. Findings from the first phase of this second 5 year stage will be presented at a seminar in mid-August 2005.

Rainfall Model

Another project conducted this year has delivered a complete rainfall data model for use by hydrologists in estimating rare and extreme rainfall in WA, and thus flooding potential. This is a significant improvement on current rainfall estimation methods. This project has provided a better method of estimating design floods for dams. This enables improved assessment of dam safety flood risks and determination of the need for dam safety remedial works.

Increasing Surface Run-off

As part of a long term research program to improve surface water run-off and forest amenity in our catchments, a project will be conducted at Wungong catchment which is expected to yield an average increased run-off of 4 to 6GL per annum over the 12 year life of the project. The project will also deliver an approach to forest management which can be applied to the high rainfall parts of the other metropolitan catchments and is estimated to yield around 40GL per annum.

Over the year, intensive stakeholder consultation with a diverse range of stakeholders, including community groups, the Conservation Commission, Department of Conservation and Land Management, Alcoa, Department of Environmental Protection, and the WA Conservation Council was completed. Subject to the EPA's advice, the project will now progress to the forest thinning stage.

Groundwater

Groundwater will continue to be a source of up to 50% of Perth's water supply. Current planning estimates are that 40% of additional water sources will be from groundwater by 2020.

3.2 WATER SUPPLY SECURITY (Cont)

The Gnangara Groundwater Mound is the major current and future source of Perth's groundwater. A project to understand the impacts of water abstraction from the Gnangara Groundwater Mound reached a major milestone this year with completion of detailed studies of terrestrial vegetation water use at a range of depths to groundwater. This has greatly increased our understanding of vegetation groundwater dependency and is building a more robust model for environmental risk assessment. These results together with results from other field studies have now enabled the Department of Environment to review licence and operating criteria.

Further to this project, trials investigating the effects of bore drawdown on vegetation stress are producing important results. This may lead to an increase in yield from our bores.

Gnangara Alliance Program

The purpose of this project was to help resolve the issues of water use by pine plantations. The program's focus has been on improving the groundwater recharge model developed by the Water Corporation and CSIRO, particularly in the area of direct groundwater uptake by the pine plantation. This major outcome is another example of the provision of scientific information to key stakeholders and decision making.

3.3 WATER RECYCLING

Water recycling is a key initiative of the State Water Strategy. The Water Corporation has a goal of 20% of wastewater reuse by 2012. A number of projects are in progress which will enhance knowledge in water recycling:

- Wastewater reuse
- Aquifer storage and recovery
- Groundwater modelling
- Use of reclaimed water for irrigation

Wastewater Reuse

The Corporation's Water Cycle Project is being supported by T&RM research and development. Initially the 20% reuse target will be met through projects in the industrial and the green space categories.

The following projects are investigating health and environmental effects of the use of treated wastewater.

Kwinana Wastewater Reclamation Plant

The Kwinana Wastewater Reclamation Plant, an initiative of the State Water Strategy, was established to provide high quality treated wastewater for industrial purposes. The establishment of the plant provides an opportunity to monitor and analyse the input and product waters for a wide variety of microbial and trace contaminants. This is now being undertaken. This groundwork will provide valuable benchmark data to support future treated wastewater uses.

Horticultural Reuse

Water sourcing and reuse has a national focus as it has a direct impact on the community, and requires acceptance by the various stakeholders, including lobbyists and farmers. The Corporation has entered into a partnership with the Australian Rural Research and Innovation

Science group (ARRIS), an Australia wide research cooperative driving the national research agenda whose function is to facilitate sustainable management of reused water in horticulture. Key research is being conducted on the use of treated wastewater for agricultural and horticultural purposes.

The Corporation receives regular reports from this research and results are encouraging. A final report is due in 2007.

Aquifer Storage and Recovery, Groundwater Modelling

Aquifer Storage and Recovery (ASR) is a process whereby excess water is stored in underground aquifers for later recovery. It has significant potential for augmentation of water supplies and is an essential element of water recycling.

A number of ASR-related research projects are in progress or planned to commence which will provide valuable knowledge in applicable recharge methodologies, technologies, geochemical aspects, water quality, and overcoming various technical difficulties.

Jandakot ASR (potable water)

The Jandakot ASR project, in its final year, involved conducting a series of aquifer recharge and recovery cycles by bore injection of potable hills surface water. It is providing valuable information and methods for application of ASR to the Perth Scheme and incorporation into the planning process. The project has provided models of water movement, understanding of iron solubility, and information supporting operational strategies. The project has demonstrated successful clogging management and aquifer injection and recovery potential of up to 1 GL/year. A patent is pending for the

3.3 WATER RECYCLING (Cont)

technology developed for this project.

System benefits delivered to date include salinity management, disinfection by-product management and peak demand management, and has allowed the Jandakot WTP to operate at peak capacity to facilitate an extended shutdown period for essential work this year. Further work will focus on operational performance and knowledge transfer to operational management.

Managed Aquifer Recharge Using Infiltration Galleries

Managed aquifer recharge is being trialled at two sites on the Swan Coastal Plain - Halls Head and Floreat - in conjunction with CSIRO and partly funded by the Premier's Water Foundation.

The aim is to understand the attenuation of microbial pathogens, nutrients and chemicals of concern using infiltration via infiltration galleries. The project follows on from previous groundwater pathogen studies.

The project will provide valuable information which will support the effective design and operation of aquifer recharge systems. The sampling results from Hall's Head so far indicate that the impact of wastewater recharge on aquifer water chemistry is negligible.

Non-Potable Reuse

An investigation has also commenced into sustainable aquifer recharge using treated wastewater in the Mosman Peninsula. The aim of the research is understand the hydrogeological aspects of the aquifer and its suitability for storing winter wastewater for summer non-potable reuse in the western suburbs where groundwater levels have been

declining. The project will provide further input to groundwater modelling decisions. Successful recharging of the aquifer may provide a reliable supply for green space irrigation which will assist in meeting the 20% wastewater reuse target.

Another water cycle project, funded partly by a Premier's Water Foundation grant, commenced this year to investigate techniques to better manage WA's non-potable water resources to deliver water services which recognise the environmental and social value of water in a greenfield setting.

The project seeks to identify a suite of viable best management practices for different types of urban landscape and adapt them to local conditions.

The first stage of the project is investigating the usage of stormwater runoff for treatment, aquifer injection and subsequent non-potable reuse in the Southern River catchment. Hydrogeological modelling and a user attitudes survey have been conducted.

3.4 ASSETS

The Water Corporation manages over \$9.9 billion of assets. Performance of the Corporation's assets is a key driver of success in delivering water and wastewater services. Assets must be managed to achieve increasingly higher standards of performance, utilisation and profitability. Much of the asset-related research work produces benefits in multiple areas such as water quality, customer service, worker safety, capital efficiency, or operational cost savings.

The major areas of research attention are:

Pipeline Condition Assessment

Since 1996 the Corporation has been conducting research in asset refurbishment, the most significant aspect being technology for inspecting and relining pipelines. This technology has extended the life of the Kalgoorlie Pipeline.

Asset condition information is a primary driver of infrastructure renewal, refurbishment and maintenance. The ongoing development of high quality, cost-effective technology for condition assessment of live water mains continues to deliver advanced pipeline diagnostic capability providing multiple benefits in terms of cost, quality, safety and operational aspects.

The effectiveness of the pipeline inspection program is dependent on technology developed by the Corporation. The inspection technology has proven itself on several occasions. Its application in pinpointing the location of a sewer main burst at Caversham resulted in faster incident recovery than if the technology had not been available.

A floating inspection trolley, which can be launched into a live sewer main for inspection of internal linings is about to go into production

The continued enhancement and application of these condition assessment technologies is enabling us to better understand the internal condition of our pipelines. They are a vital part of asset risk management supporting timely renewal or replacement decisions.

Pipeline Technologies

Preliminary desktop research was conducted to identify pipeline stopping and leak detection technologies which can be rapidly deployed in the event of pressure main bursts or to detect other leaks & bursts.

Preliminary research was also conducted into practical pipeline condition assessment approaches and technologies available in Australia. The research will support strategic asset management planning and decisions on condition assessment techniques to be employed.

Other Projects

Three small asset management related research projects are being conducted and funded outside the R&D Program.

- Investigating maintenance approaches in the Water Corporation.
- Protocols for assessing asset condition and performance.
- Prediction and control of pipe facilities.

3.5 WASTEWATER

R&D objectives in the wastewater area are:

- optimise the reuse or disposal of treatment by-products
- improve the performance of wastewater processes to meet discharge regulations, environmental, health and water reuse requirements

Wastewater By-products

The by-products of treated wastewater have many reuse options which are currently being researched. They include biosolids which are a highly beneficial and renewable natural resource for agricultural and horticultural use.

Sludge from treatment plants must be stabilised to remove hazardous micro-organisms and chemicals before it can be used for a soil amendment. Once stabilised the sludge is classified as biosolids. The Water Corporation applied in excess of 65 000 tonne of biosolids to agricultural land during 2004/05.

The Water Corporation is leading research into the potential health impacts of grain crops fertilised with biosolids. Currently there is minimal information available. Curtin University (Muresk Institute) investigated the presence of



pathogens in harvested wheat following application of biosolids. The results support continued use of biosolids in this application.

This project has been closely watched by other organisations and has gained endorsement as a priority project by the Cooperative Research Centre for Water Quality and Treatment (CRC-WQT). The Water Corporation, CRC-WQT, and South Australian Water will jointly fund a 3 year project to further examine pathogens on a national level.

The ongoing research in the area of biosolids attractiveness to flies has gained interest from international agencies such as Greater Vancouver Regional District BC. The latest study showing that biosolids aged greater than 10 weeks do not facilitate fly breeding.

The final stage of this research is currently underway and is anticipated to have significant savings for the Corporation's Biosolids Storage Facility, the only one known nationally and internationally.

Perth's Long Term Ocean Outlet Research Program (PLOOM)

The Water Corporation disposes of 300 ML per day of treated wastewater to the coastal waters off Perth. The aim of the PLOOM program is to determine the impact of treated wastewater on the environment and to provide a scientific basis for setting sustainable discharge criteria and defending the ocean disposal option for treated wastewater.

The program is currently in the 10th year of monitoring metropolitan ocean wastewater outlets and will be extended for at least several more years. Program results have been effective

3.5 WASTEWATER (Cont)

in improving regulator and community confidence in the sustainability of ocean disposal of treated wastewater.

PLOOM results were successfully used to confirm the sustainability of an increase in the daily discharge of phosphorus from the Beenyup WWTP, equating to an estimated NPV capital and operational cost avoidance of \$9.1M.



Improving the Performance of Wastewater Ponds

Wastewater ponds are used to hold and treat wastewater through microbial action. Two issues in the management of wastewater ponds requiring research relate to the management of sludge and the control of algae.

Sludge Collection Technology

An on-line sludge collection technology is being adapted for operational use in circumstances where operational configuration prevents isolation of a pond. Around 40-50 ponds throughout the state will require desludging in the next 5 years.

Trials have been successful and work is continuing to improve the application of the technology to the various pond situations.

The technology will provide an alternative to expensive desludging options.

Algal Control

Other projects are being undertaken to address the control of algae in ponds. Algae blooms can affect the operation of infiltration ponds and impact wastewater reuse options. This is a common problem throughout the state. A method for controlling algae, by progressively dosing with copper ions as an alternative to bulk dosing, has been successfully trialled and provides the Corporation with another treatment option for smaller plants.

Water mixing is another method of algal control. Wind driven mixers for use in remote locations have been evaluated with limited success; however wind driven mixers show promise for other applications such as prevention of stratification and stagnation.

4. KNOWLEDGE MANAGEMENT

Implementation of knowledge management initiatives and system development continued during 2004-05. An intensive roadshow and workshop program successfully engaged 40 key business groups and 3 committed pilot communities as stakeholders in applying the proposed Knowledge Management System and its three enablers. The Knowledge Management Strategy, working hand-in-hand with Technology Transfer Talks, Peer Group Knowledge Sharing initiatives and the proposed System, will deliver a capacity to support and improve current and future knowledge sharing and collaboration.

Stakeholder Engagement

T&RM conducted an intensive stakeholder engagement program to demonstrate the proof of concept and prototype system to divisional lead teams and business groups. This program provided opportunities to engage the business about the application of the system, achieve close alignment with relevant corporate projects, and obtain valuable feedback from the participants.

Knowledge Management System (KnowledgeNet)

T&RM has commenced development and implementation of a knowledge management system with three key components:

- **Expertise locator** - a means by which employees can locate key contacts with the required expertise
- **Key learnings system** - a repository of key lessons learned
- **Knowledge communities** - Improving the benefits of collaboration amongst experts groups and sharing technical know-how.

This project will leverage on the newly developed Cascade portal infrastructure and

will be integrated with other IT projects. A staged approach is being adopted to delivering a pilot system, commencing with analysis and design and resulting in construction, production and deployment.

The system will host three business groups:

- Water Treatment Process Expertise Group
- Wastewater Process Expertise Group
- North West Customer Services Group

These pilot communities were involved in a series of workshops to refine needs, policies, business rules and technologies. Valuable feedback was obtained which has been incorporated into the design requirements.

A Communication Plan has been developed to support the project.

Implementation is scheduled to commence in July 2005 followed by corporate deployment in January 2006. An online Starter Kit will be developed based on the Knowledge Community Methodology to facilitate and support the implementation.

R&D Technology Transfer Talks

Technology Transfer Talks (TTT) continued to be conducted during the year to inform stakeholders in the Water Corporation and industry partners about the learnings of various projects.

This year's TTT program emphasised the Corporation's continuous efforts in using new technology to provide safe drinking water. i.e.:

- Treatment options to improve community lifestyle and preserve our community
- Biofiltration - a treatment option for improving water quality

4. KNOWLEDGE MANAGEMENT (Cont)

- Water quality through the Wanneroo treatment and distribution system— effects of MIEX versus alum coagulation

Peer Group Forums

The Peer Group Knowledge Sharing Forums have continued as a popular and effective means by which employees and their stakeholders can be informed of key issues and projects in the Corporation. A recent employee survey indicated that the forum is an effective communications event.

Examples of subjects addressed at this year's Forums are:

- Kwinana Water Reclamation Plants
- Mobile Computing Project
- Coral Bay Water Treatment Project
- Metropolitan Integrated Water Supply System Operating Strategy
- Wastewater overflows
- Recent dams projects
- Wastewater management

In future, regional employees involved in key projects will be invited to present at Forums.

5. INNOVATION PROGRAM

The Corporation's Innovation Program has been in operation for several years. Its aim was to mobilise the creative intellect and experience of employees in improving the business.

Involvement Scheme

The Involvement Scheme encouraged and rewarded good ideas and outstanding employee behaviours consistent with the Corporate vision and values. Over the life of the Scheme over 1000 submissions were received.

Chairman's Awards

Flowing from the Involvement Scheme is the Chairman's Award Scheme, which is a high profile employee recognition vehicle. Silver and gold awards are awarded annually to those employees or teams considered to be deserving of special recognition. A Chairman's Award presentation event was conducted in September 2004. The gold Chairman's Award was awarded to the BuilderNet team.

BuilderNet is a system which enables builders to submit plans and gain immediate approval via the internet. It is viewed by the building industry as one of the most significant advances in customer service in 30 years.

T&RM is working with HR Branch to assist with transferring the Chairman's Awards and the employee recognition aspects to the Corporate Employee Recognition Framework. The format of any future high profile employee recognition vehicle is still being planned.

Innovation Expos

The Innovation Expo is a corporate wide promotional and educational event, run over the course of two days every two years, showcasing Corporation achievements and innovativeness. The Expo conducted in September 2004

demonstrated the theme of Simplify, Standardise, Share and Sustain. This was aimed at simplifying the business, standardising how we operate, and demonstrating sustainability in all aspects of the business.

The Expo was very well received by employees and visitors. Around 700 people either viewed or directly participated in the Expo. For the first time key external stakeholders from industry and government were invited with around 85 attending. Mini expos conducted subsequently in Great-Southern and South-West regions were similarly well received.

The mini-expos were incorporated into the Australian Innovation Festival 2005 promotion, the purpose of which is to increase public awareness of the importance of innovation and entrepreneurship.

New Innovation Strategy

The approach to innovation is being reviewed. Proposed changes will result in some significant improvements in the way innovation is managed.

The main areas of change in the new Innovation Strategy are:

- Focussing attention on nurturing the more significant innovations and ideas which offer a greater corporate impact
- Transferring activities which do not directly support innovation to more appropriate parts of the business eg. employee recognition to HR Branch

Improvement ideas submitted to the Involvement Scheme have been transferred to the Corporate Improvement System which will enable employees to monitor the progress of their idea.

4. INNOVATION PROGRAM (Cont)

T&RM will be establishing a multi-disciplinary group of stakeholders, the Innovation Breakthrough Group (IBG), whose sole focus will be to identify and nurture high-potential innovations.

Further work is being undertaken to develop innovation as a process. Business requirements for an innovation framework that can be applied to alliance contracts and processes is currently under consideration for inclusion in the Accountability Framework.

Appendix 1: Research and Development Projects 2004/05

PROJECT TITLE	OBJECTIVES	2004/05 PROGRESS	Status
Drinking Water Quality			
The Indian Ocean Climate Initiative - Informed adaptation to climate variability and change in south-west WA D-O01002	Determine physical processes for climate change and variability with a variety of application based solutions.	Research into the South-West of WA's continuous reduction in rainfall and subsequent run-off providing valuable, ongoing information aiding the Corporation's infrastructure planning process.	⊙
Research Contribution to WSAA D-W00006	Water Resource & Environmental Sustainability, Asset Management, Drinking Water, Industry Performance, Industry & Regulatory Reform	Annual membership fees and research contribution to the WSAA. This is the water portion of the two part contribution.	⊙
Inhibition of Nitrification in Chloraminated Systems D-W00063	Develop a stable chloramination process in the Goldfields & Agricultural Water Supply System and others, by using a nitrification inhibitor.	Merredin field trials completed and data validation expected July 2005. Approval process for full-scale trials expected October 2006 with trials commencing March 2007.	⊙
Pesticide Treatment Technologies D-W00059	Develop pesticide treatment technologies to enable quick emergency response for potential pesticide contamination of water schemes.	This project has been postponed due to a review of objectives and a major change in scope.	⊘
Investigation of Turbidity Effect on Disinfection D-W00061	Understand the relationship between turbidity, microbiological water quality and disinfection effectiveness, in relation to providing disinfected drinking water within the ADWGs.	Project commenced late in 2004/05. Work has commenced on preparing an agreed methodology & project proposal for a full scale Investigation.	⚠
Management Tools for Distribution System D-W00050	Develop a modular software framework (toolkit) incorporating existing models of flow, disinfection and biofilm formation.	Many sites for biomonitors have been trialled, including the use of biomonitors from Sydney Water.	✓
Swampy Odour (DMTS) Control in Perth's Northern Groundwater D-W00002	Assess the impacts of MIEX treated water in and entering the distribution system. Optimise biological filtration processes.	Some of the original objectives of this project have been re-scoped. A detailed report is expected late 2005.	⊙
Magnetic Ion Exchange Process (MIEX) Resin Loss Minimisation D-W00004	Develop mechanisms in the full scale MIEX Plant to minimise MIEX resin loss.	All objectives to be reached including Initial CFD modelling, Advanced CFD, MIEX settler concentration and Magnetic drum separator. Reports expected late 2005.	✓
Research Contribution to CRC on Water Quality & Treatment D-W00005	Involvement in peer forums of the major researchers in water quality to share information.	Annual research contribution to the CRC on WQT is proving invaluable in sharing leading edge research results from other similar utilities.	⊙
Discoloured Water Scoping Study D-W00069	Define the extent and quantify the discoloured water issue, summarise literature on causes of discoloured (water and prepare a proposal for a full scale research project.	Literature proposal is 90% complete. Root Cause Analysis and full research proposal are in progress. This will lead to a full research project in 2005/06.	⚠
Chlorine Taste & Odours Scoping Study D-W00070	Define the extent and quantify the chlorinous taste issue, perform literature review of causes of chlorinous off-flavours in water supplies and prepare full scale research proposal.	Scoping project (including root cause analysis) completed. A full scale research proposal submitted as a leveraged ARC Linkage Proposal. The new full scale project has commenced.	✓

Appendix 1: Research and Development Projects 2004/05

PROJECT TITLE	OBJECTIVES	2004/05 PROGRESS	Status
<i>Drinking Water Quality (cont.)</i>			
Water Temperature Scoping Study D-W00071	Define the extent of and quantify, the water temperature issue in WA drinking waters. Prepare conceptual solutions and possible trials Summer 05/06 .	Literature review in progress. Early field investigations carried out. Report due October 2005.	⊙
Desalinated water mixing investigations D-W00073	Define possible impacts the distribution of high quality desalinated water will have on the quality of water delivered to the customer.	Results from this preliminary investigational work are an input to operative planning and handover.	✓
Water Mains pH + Alkalinity Stabilisation D-W00051	Determine effect of pH stabilisation on cement lining deterioration, corrosion of mild steel cement lined pipes and deterioration on asbestos cement pipes.	Final report in draft form has been delivered and is waiting peer review.	⊙
<i>Wastewater Treatment, Disposal & Reuse</i>			
Aquifer Recharge by Infiltration Gallery Assessment (MAR) D-S00566	Develop methodology and management practices to allow sustainable infiltration, monitor changes in aquifer water quality. This project is funded by the Premier's Water Foundation.	Two sites have been chosen for initial research. Halls Head has been operational for over 12 months and monitoring is yielding pleasing results. The Floreat site is about to be commissioned.	⊙
Wind Driven Aerators for Jurien Bay WWTP Algae Control D-S00567	Devise an efficient, economical and environmentally sound method of cyanobacteria (blue-green algae) removal in wastewater treatment ponds.	The mixers are on site and are currently being assessed. Report expected September 2005	✓
Research Contribution to Water Environment Research Foundation (WERF) D-S00558	To use a world wide network of researchers to develop a cooperative synergistic approach to water issues.	Organisation is dedicated to advancing science and technology addressing water quality issues as they impact water resources, the atmosphere, the land and quality of life.	⊙
Research Contribution to WSAA D-S00506	Water Resource & Environmental Sustainability, Asset Management, Drinking Water, Industry Performance, Industry & Regulatory Reform	Annual membership fees and research contribution to the Water Services Association of Australia. The wastewater portion of the two part contribution.	⊙
<i>Water Source Management</i>			
Artificial recharge of potable water to the confined aquifers beneath the Perth Metro Region (Janadakot) D-W00023	Investigate methods to recharge confined aquifers with potable water and overcome identified problems such as clogging, quality of source water, pre treatment and post recovery treatment.	Injection tests show encouraging results and potential for broad application to the Perth integrated water scheme. System benefits delivered to date include salinity management, disinfection by-product management and peak demand management.	⊙
Management of WQ in Harvey Dam & other reservoirs D-O01034	Research behaviour of water inflows, nutrients and sediments carried to the reservoir to reduce damaging cyanobacterial blooms each summer.	Analysis of nutrient cycles indicates the settling of particulate organic nutrients represents a major sink for catchment-derived nutrients. Investigation and data collection in continuing to determine possible sources of nutrients to the reservoir.	⊙
Physical Control of Mosquito and Non-Biting Midge in Constructed Wetlands D-S00507	Research to quantify midge egg laying and emergence over 24 hours to more accurately assess the effectiveness of spray reticulation for midge control.	Extensive investigations into the breeding life cycle of the midges was undertaken. A detailed report has been prepared and delivered to the client.	✓

Appendix 1: Research and Development Projects 2004/05

PROJECT TITLE	OBJECTIVES	2004/05 PROGRESS	Stat us
<i>Sustainable Development</i>			
Sources of Natural Organic Matter (NOM) Quickup Dam D-W00075	Investigate the source of the NOM at Quickup and management option/s in the reservoir to improve water quality and reduce treatment cost.	Two site visits ascertaining sampling points now determined. Literature re-search review in progress, delivery to project manager by September 2005.	⊙
Gnangara Mound - Environmental Water Use Limits (Phreatophytic Vegetation) D-W00025	Significance of groundwater levels to Phreatophytic vegetation (banksia woodland) and use this knowledge in new PGM for production plans.	Drawdown experiments continue to yield encouraging results on the stress limits of the surface vegetation. The first stakeholder reference group meeting is expected to July 2005.	⊙
Gnangara Alliance Program (Pine water use) D-W00065	Investigate how pines use water, how much, what water sources are accessed, how LAI relates to pine water use & timber production and the treatments necessary to maximise water use efficiency.	This project reached a major milestone this year with completion of detailed studies of terrestrial vegetation water use at a range of depths to groundwater. This has greatly increased our understanding of vegetation groundwater dependency and is building a more robust model for environmental risk assessment.	⊙
Determining Survival Rates of Pathogenic Micro-organisms in Western Australian Coastal Sand Aquifers D-W00044	Determine the ability of various microbial pathogens to survive in WA coastal sand aquifers. Determine the residence time required for removal of the pathogens and dominant factors controlling pathogen survival/inactivation.	This has been a collaborative research project with CSIRO. A final report is expected late 2005.	✓
Improvement of Rare Extreme Rainfall Estimation For Areas of Western Australia D-O01019	Develop an approach to assist in more effective asset management of the Corporation's infrastructure subject to flood risk.	This project developed a web-based software that can be used for rainfall estimation. The software is now installed on the Department of Environment web site for general use.	✓
Stygofauna Exmouth Monitoring Review D-O01033	Ongoing data collection and analysis of a well field in the Exmouth region to determine the conservation status of threatened stygofauna communities.	Procurement of necessary laboratory equipment is now complete, and monitoring techniques are about to be re-searched.	⊙
Management of WA's Non-potable Water Resources D-O01035	Investigate techniques to better manage WA's non-potable water resources to deliver water services. This project is funded through the Premier's Water Foundation.	Potential buyers in the Southern River area were surveyed for the provision of non-potable services and reaction towards the scheme proposed in Ranford Rd. CSIRO are performing a hydro-geological survey to ascertain groundwater movement.	⊙
<i>Customer Service</i>			
Social Research focusing on wastewater reuse D-S00563	To understand community issues related to treated wastewater and other non-potable water sources.	This project was rescheduled to the 2005/06 financial year.	Ⓜ
<i>Pipelines and Infrastructure</i>			
Alternative Trunk Main Inspection Methods D-O01005	Develop a long-range inspection and diagnostic system for condition assessment of trunk mains.	The trolley has been fitted with an improved camera system and more refined strobe lighting system. Imagery software is currently being trialled.	⊙
Semi Automatic Welding of Pipe Joints D-O01026	Develop and trial the capabilities of mechanised welding of pipes and produce an internal training video.	Equipment was trialled in workshop and field conditions. Rail guides were modified, welding heads changed and control box shifted for easy setup in field conditions.	✓

Appendix 1: Research and Development Projects 2004/05

PROJECT TITLE	OBJECTIVES	2004/05 PROGRESS	Status
<i>Pipelines and Infrastructure (cont.)</i>			
Development of a Corporation-Wide Automatic Meter Reading System D-001029	Develop automatic collection for meter reading data a central point allowing water use information being available to customers and regional staff.	Relevant hardware purchased & installed for two pilot sites (Kalgoorlie & Wooroloo). Initial data collection is commencing and a systems management consultant is working with suppliers to define a corporate standard.	✓
Leak Detection in Pressure Pipelines D-001031	Investigate and trial the feasibility of utilising leak detection technology for early detection and location of leaks on wastewater pressure pipes.	A comprehensive report was delivered on the worldwide availability of leak detection methods and information systems.	✓
Manned Sewer Inspection Trolley D-001032	Design and develop a lightweight and energy efficient manned trolley carrying personnel to inspect large diameter sewer mains.	A newly designed prototype is about to commence field trials. New features include lighter weight, more efficient transport method and higher speed for emergency evacuation.	✓
Strategic Assets Management Process to Manage Pressure Mains D-001040	Determine the management practices adopted in other utilities to identify potential failure points along a pressure mains and assessing asset condition.	This desktop study and literature search delivered an interim report on appropriate condition assessment techniques, as well as the methodologies and approaches used by other utilities.	✓
Line Stopper Investigation D-S00568	Assemble sufficient information assisting with determination of options for plugging pipelines to minimise wastewater loss and repair downtime.	Extensive desktop investigation and document searches revealed several practices that are used world-wide, but none meeting the fast incident reaction time criteria.	✓
Wastewater Pump Station Reliability Modelling D-S00572	Optimise the reliability of Mechanical & Electrical pump station assets in order to achieve a level of service/risk that is appropriate to the Corporation's business needs	Software specification has been developed and license procured. Development work continuing; monitoring expected to conclude early 2006 with report expected mid 2006.	⊙
Service Reservoir & Tank Mixing Model D-W00074	Define the optimum geometry of inlet/outlet pipes for service reservoirs and tanks, producing maximum mixing to minimise chlorine decay.	Draft design guide produced by GHD for unstratified and stratified tanks has been received. Analysis of proposed models soon to commence.	⊙

LEGEND

- | | |
|---|---|
| <p>⊙ Project on target</p> <p>✓ Project completed</p> | <p>⊘ Project suspended</p> <p>⚠ Project alert</p> |
|---|---|