IRRIGATION AND LANDSCAPE EFFICIENCY

Introduction

The Irrigation and Landscape Efficiency Project was carried out by the Sydney Water Corporation (Sydney Water). Services were offered to councils, educational institutions and golf courses that use potable water for open space irrigation within Sydney Water's area of operations. The project was delivered in three stages.

Stage 1 involved quantifying seasonal watering requirements by addressing a wide range of factors affecting watering demand, including:

- estimated annual potable water savings
- recommendations for seasonal watering schedules, practical modifications to irrigation systems, improvements to soil structure and better management practices
- recommendations for benchmarks to maintain the facility for its intended seasonal use.

Stage 2 involved implementing on-ground measures based on the recommendations made in Stage 1, subject to agreement with participating organisations.

Stage 3 involved a detailed review of the water savings achieved by the project.

The project was funded by the Australian Government under the *Water for the Future* initiative and received $5.6 million of the total $77.4 million allocated to the overarching Hawkesbury–Nepean River Recovery Program. In addition, participating organisations contributed $3.3 million.

The Irrigation and Landscape Efficiency Project aimed to make 1060 million litres per year of potable water savings through improved efficiency of water use in open space irrigation

Objectives

The Irrigation and Landscape Efficiency Project aimed to make 1060 million litres per year of potable water savings through improved efficiency of water use in open space irrigation using improved technology and land and site management practices. These savings were intended to increase environmental flows in the Hawkesbury–Nepean River.

Methods

Project governance

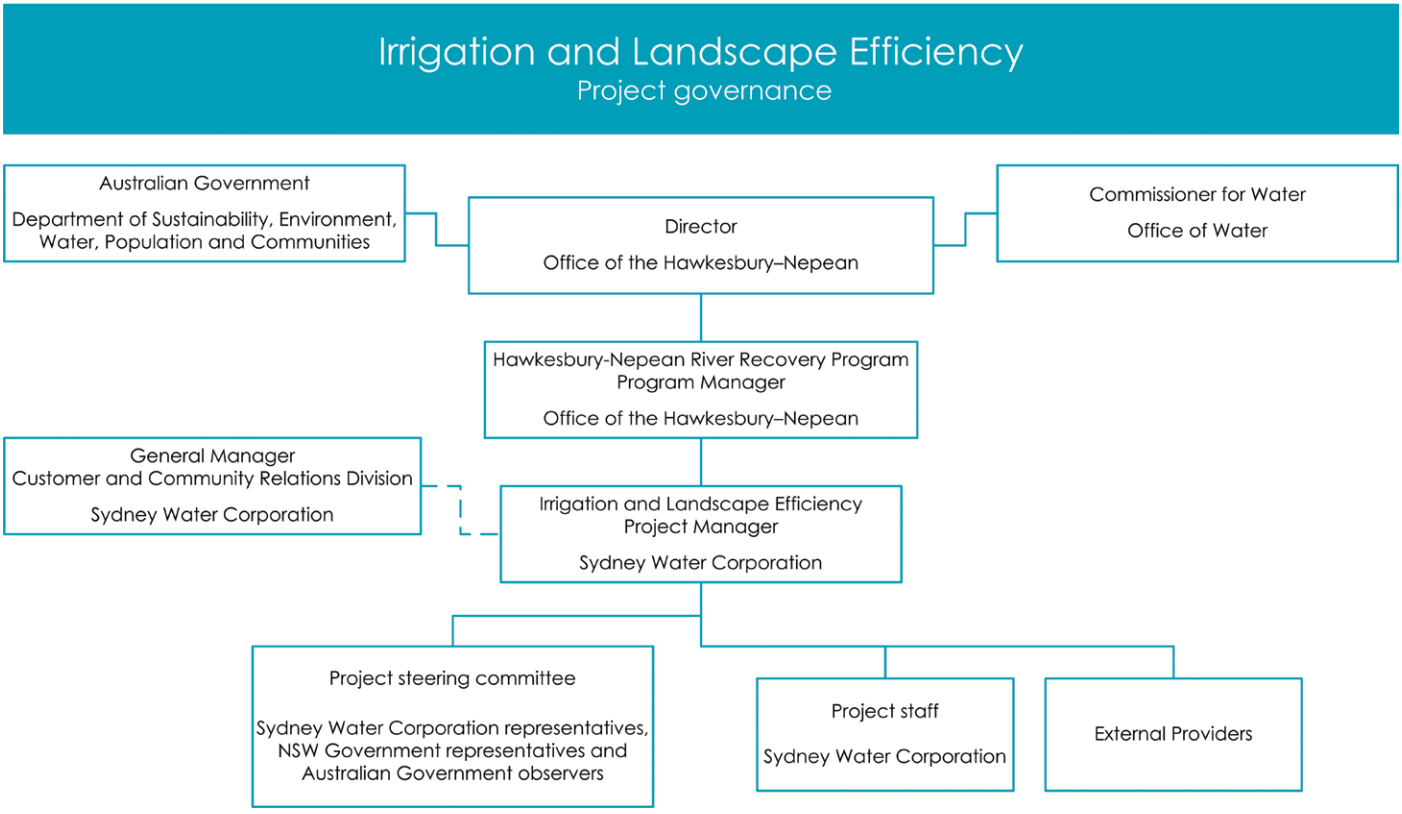
A team from Sydney Water, comprising managers from the Sustainability and Business Customer Services departments, came together to expand on Sydney Water's successful residential water efficiency program, Love Your Garden, and establish the Irrigation and Landscape Efficiency Project to cater to large open public spaces and sports facilities. Figure 35 illustrates the project governance.

The project was assigned to Sydney Water's Every Drop Counts Business Program as the team had experience and success in managing water efficiency projects and had existing relationships with potential participants.

A steering committee was established to drive the direction of the project and met every quarter, one week before the Hawkesbury–Nepean River Recovery Program Steering Committee meetings.

URS Australia Pty Ltd (URS) was engaged to carry out landscape investigation and reporting for Stage 1 and confirm water savings for Stage 3 of the project.

Figure 35. Irrigation and Landscape Efficiency Project governance



Stage 1 – Irrigation landscape assessment

The Irrigation and Landscape Efficiency Project built on methods developed under Sydney Water's existing Every Drop Counts Program, specifically for the Love Your Garden Residential Program. This program developed an irrigation landscape assessment as a method for calculating how much water a public open space requires to remain healthy. The assessment was adopted for the project and carried out during Stage 1.

The irrigation landscape assessment calculates seasonal water requirements by incorporating a wide range of factors affecting watering demand. These factors include:

- location within the six plant growth regions of Sydney (which each had specific turf irrigation requirements and variations in rainfall and evaporation)
- regional rainfall intensity
- irrigation system and delivery
- management practices
- turf species (type)
- degree of foot traffic
- soil texture, depth, chemistry and structure
- shade density and daily patterns
- wind protection
- site solar aspect and slope
- proximity to a radiation source
- mulch type and thickness.

The assessment process included preparing a report summarising historical water use (irrigation patterns) and inefficiencies and giving recommendations on how to improve water efficiency and turf surface. Recommendations included soil, irrigation, and turf improvement methods, and approximate capital costs and payback periods for improvements.

Several types of open spaces were identified as potential sites to participate in the project. These included:

- councils
- schools and universities
- government-owned irrigated spaces
- golf courses
- sporting grounds
- bowling greens
- other commercial irrigated sites.

The potential sites were all located within Sydney Water's area of operations which covers Sydney, the Illawarra and the Blue Mountains and spans 12,700 square kilometres. A map showing the area can be found by searching for 'area of operations map' on the Sydney Water website.

To engage potential participants, the project team contacted members of existing professional networks and Sydney Water databases. An introductory pack containing a letter and brochure explaining the benefits and processes of the project was sent to managers and staff of the potential sites. The project team then made telephone calls to the recipients to gauge interest in the project and provide further information.

In addition to this one-on-one communication, the project team launched a project website which featured the brochure, an application form, a fact sheet and answers to frequently asked questions. Potential participants were encouraged to contact the project team via a dedicated email address and 1800 telephone number.

Interested organisations were asked to fill in the application form identifying which sites they wished to put forward for participation and giving information about the sites' water sources, current irrigation practices, usage and conditions. Each organisation could nominate up to 10 sites.

The project team analysed the applications and used historical water-use data to determine whether each site would be suitable for the project. Selected sites had all or some of the following attributes:

- irrigation using potable water
- historically high water use
- anecdotal evidence of poor management practices
- dated, inefficient infrastructure.

Before the irrigation landscape assessments could go ahead, a signed Stage 1 agreement between Sydney Water and the participating organisation was required. The Stage 1 agreement outlined the roles and responsibilities of each party in carrying out the assessment on identified sites and, upon endorsement by both parties, was used to obtain necessary Hawkesbury–Nepean River Recovery Program funds. If the site was owned by an Australian state or local government entity, the assessment and associated report were carried out at Sydney Water's cost. If the site was not owned by an Australian state or local government entity, the cost was shared equally.

A contractor was required to investigate the physical characteristics of each nominated site, including soil profile, turf selection, management practices and irrigation infrastructure as part of the assessment. Sydney Water conducted a standard tendering process, identified URS as the highest evaluated tender response and awarded the Stage 1 contract to them.

Commencement meetings were held to introduce the participating organisations' staff to the URS contractors who would be conducting the assessments, organise access to sites and identify any possible occupational health and safety issues. Once they had seen the site, the contractors submitted a site health and safety evaluation plan to the project team. Project team members met with participating organisations and consultants regularly so that a common understanding was maintained and project milestones were met.

Before any work commenced and if suitable, Tinytag™ data loggers were installed on the sites' water meters for approximately one month to track water consumption patterns. The information from the Tinytags™ was used to identify unusual usage or concealed leaks. These graphs were included in a final Stage 1 report for each participating organisation.

Stage 2 – Implementation of recommendations

Stage 2 of the Irrigation and Landscape Efficiency Project focused on helping participants implement recommendations from Stage 1 by providing 50 per cent of the funding required.

The deliverables included in the Stage 2 agreements were derived from the Stage 1 irrigation landscape assessment recommendations. Sydney Water and the participating organisation reviewed the recommendations and came to an agreement on which recommendations could be funded with the available budget and completed by 30 September 2011. The agreement detailed the expected works, a generic cost estimate or quote if available, and an outline of cost sharing which was generally split evenly. The agreement also required the participating organisation to produce reports in order to claim funding. The Stage 2 agreement was based on standard Sydney Water contracts.

Sand slit drainage at Willoughby Oval

The Irrigation and Landscape Efficiency Project team presented at a number of council meetings to help departments within the councils secure additional funds for the Stage 2 works. The project team and councils also made presentations to sporting groups that would be affected by site upgrades to encourage community support.

Sydney Water asked potential contractors to submit expressions of interest by open tender to become a pre-qualified tenderer for the Stage 2 irrigation and landscape work. The applications were evaluated against the mandatory and weighted criteria set out in the approved tender evaluation plan. The plan identified the highest evaluated applications to form a panel of four pre-qualified Stage 2 tenderers:

- Landscape Solutions
- Sustainable Turf Renovations and Equipment (Manoeuvre Mow Pty Ltd)
- Green Horticultural Group
- Irrigation Management.

Each company showed it had the capacity to resource multiple works, with an adequate number of suitably skilled and experienced personnel available to meet Sydney Water's requirements.

It was envisaged that the majority of project participants would use their existing contracts with suppliers and contractors to complete Stage 2 work, rather than choosing to use Sydney Water's pre-qualified panel. This was proved correct with only Waverley Council using the pre-qualified panel for irrigation repairs and upgrades.

All agreed Stage 2 works were recorded in a spreadsheet which was given to contractors for use in Stage 3.

Stage 3 – Water savings analysis

As part of project requirements, the outcomes and water savings from Stages 1 and 2 needed to be assessed. Stage 3 revisited the sites to ensure recommendations had been carried out to standard and to verify the calculated water savings.

The projected water savings were calculated by comparing the site's water requirements at the time the irrigation landscape assessment was conducted with those after the recommended improvements were made. In order to measure water savings achieved by the project, URS was engaged to return to a selection of sites they assessed in Stage 1 to audit whether the recommendations had been implemented in Stage 2 as intended. As URS had not been involved in Stage 2 they provided an unbiased review of the completed works to obtain water savings. URS confirmed their water savings estimates based on the audits and developed a water savings forecast as the basis of the project's water savings claim.

Results

The Irrigation and Landscape Efficiency Project has exceeded its objective of making 1060 million litres per year of potable water savings through improved water-use efficiency in open space irrigation. The water savings have been achieved through using improved technology and a range of land and site management practices and will be used to increase environmental flows in the Hawkesbury–Nepean River.

Communications

Targeted communications were pivotal in securing the engagement with participating organisations needed to achieve the project objective. To develop relationships with potential participants, the project team put together a comprehensive marketing strategy.

At the beginning of the project, 194 information packs were sent out to organisations with sites that could benefit from the initiative. The pack included a letter and a questions-and-answers sheet with more detail about what the project involved. This was followed by a mail-out, which included a letter, fact sheet and application form, inviting organisations to express their interest.

A major focus of the strategy was one-to-one communication. This was done through face-to-face meetings, telephone calls, email and site visits and by targeting existing networks such as Every Drop Counts Business Program irrigation customers and ClubsNSW members.

This direct contact was supplemented by a variety of communications activities and material, including:

- a project website
- a project brochure
- a dedicated telephone line
- an advertisement and articles in Sydney Water's 'The Conserver' magazine
- articles in the Sydney Metropolitan Catchment Management Authority's newsletter 'Water Sensitive Urban Design', the Australian Water Association's newsletter 'Efficient Times', the ClubsNSW magazine 'Club Life' and the Hawkesbury–Nepean River Recovery Program's own newsletter 'HNRRP e-news'
- a presentation at an Every Drop Counts Business Program seminar for local councils
- a presentation at an urban irrigation masterclass run by the Cooperative Research Centre for Irrigation Futures which was attended by approximately 30 industry experts.

These communications activities resulted in the successful engagement of the 23 participating organisations.

The project had its official launch at ANZ stadium on 2 March 2010. ANZ stadium was chosen as the site for the launch because of its existing relationship with the Every Drop Counts Business Program and for its world-class standard while maintaining high levels of water efficiency, including the use of rainwater and stormwater harvesting. Those who received the introductory pack were invited to the launch with approximately 100 representatives accepting the invitation. The Member for Lindsay, David Bradbury, attended, representing the Australian Government.

Bruce Boyes, Program Manager, Hawkesbury–Nepean River Recovery Program, Office of the Hawkesbury–Nepean; Angela Tsoukatos, General Manager Customer and Community Relations Division, Sydney Water; David Bradbury MP, Federal Member for Lindsay; and Judi Hansen, General Manager Sustainability Division, Sydney Water at the Irrigation and Landscape Efficiency Project launch, March 2010

Irrigation landscape assessments and on-ground works

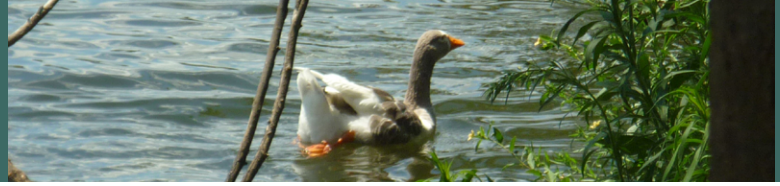
The 23 participating organisations engaged by the Irrigation and Landscape Efficiency Project facilitated works at 133 sites across Sydney.

When the Stage 1 irrigation landscape assessments were complete, field reports detailing preliminary results for 13 of the participating organisations were produced so that Stage 2 works could begin without delay. Subsequently, detailed reports including soil analysis results and global positioning system irrigation mapping were produced for all 23 participating organisations. The participating organisations, their sites and examples of the works carried out are listed in Table G1.

Table G1
Irrigation and Landscape Efficiency on-ground works summary

Participating organisation	Sites	Examples of work carried out
Blue Mountains City Council	• Glenbrook Oval • Blaxland Oval • Gloria Park • Katoomba Showground • Knapsack Park • Lapstone Oval • Pitt Park • Summerhayes Park • Tom Hunter Oval • Warrimoo Oval	• Tank, pump and irrigation system installation • Aerating soil profile • Returfing and topdressing • Installing irrigation controllers and back-to-base link
City of Canada Bay Council	• Rothwell Park • Powells Creek Reserve • Queen Elizabeth Park • Taplin Park and Drummoyne Oval • Concord Oval • Goddard Park • Nield Park • St Lukes Oval and Cintra Park	• Aerating soil profile • Adjusting, lifting, straightening or replacing sprinkler heads • Returfing and topdressing • Fixing a leak on the station • Purchasing aeration equipment
Fairfield City Council	• Carrawood Park • Chisholm Park • Adams Park • Emerson Reserve • Allambie Reserve • Parkes Reserve • Cabramatta Sportsground • Stockdale Reserve • Hartley Oval	• Purchasing aeration equipment • Aerating soil profile • Installing a new pump • Adjusting, lifting, straightening or replacing sprinkler heads
The Hills Shire Council	• North Rocks Park • Fred Caterson Reserve – fields 1, 2 and 3 • Fred Caterson Reserve – fields 4 and 6 • Fred Caterson Reserve – field 5 • Glenhaven Oval • George Thornton Reserve • Ted Horwood Reserve – fields 1, 2 and 3 • Ted Horwood Reserve – fields 4 and 5 • Crestwood Reserve • Francesco Oval • H. Whaling Memorial Reserve • Kingsdene Oval • Gooden Reserve	• Purchasing aeration equipment • Adjusting, lifting, straightening or replacing sprinkler heads • Returfing and topdressing
Holroyd City Council	• Monty Bennett Oval and Ringrose Park • CV Kelly Park • Girraween Park • Bathurst Street Park • Gipps Road Sporting Complex • King Park	• Aerating soil profile • Returfing and topdressing • Adjusting, lifting, straightening or replacing sprinkler heads
Kogarah City Council	• Harold Fraser Oval • Carss Park • Poulton Park • Merriman Reserve ('The Green') • Renown Park • Quarry Reserve • Todd Park • Claydon Reserve • Parkside Reserve	• Purchasing aeration equipment • Aerating soil profile • Weed control for couch (unwanted plant species) • Topdressing with additional organics • Renewing a 30-year-old system to link it to the water treatment storage tank in Claydon Reserve

Ku-ring-gai Council	• Bannockburn Oval • Primula Oval • Queen Elizabeth Reserve	• Aerating soil profile • Returfing and topdressing • Adjusting, lifting, straightening or replacing sprinkler heads
Lane Cove Council	• Pottery Green • Bob Campbell Oval • Tantallon Oval • Kingsford Smith Oval • Lane Cove Golf Course	• Aerating soil profile • Returfing and topdressing • Slit drainage • Upgrading the irrigation system
Liverpool City Council	• Rosedale Park • Australis Park	• Aerating soil profile • Topdresing • Adjusting, lifting, straightening or replacing sprinkler heads • Field renovation
Manly Council	• Bantry Reserve • Keirlie Park • Seaforth Oval	• Aerating soil profile • Mite and weed control • Adjusting, lifting, straightening or replacing sprinkler heads • Installing a submeter • Replacing the irrigation pump • Improving slit drainage • Topdressing
Marrickville Council	• Arlington Reserve • Camperdown Park	• Field regrading • Subsurface drainage • Irrigation • Irrigation control • Returfing and topdressing
Mosman Council	• Allan Border Oval • George's Heights Oval • Middle Head Oval • The Esplanade Reserve • Spit West Reserve	• Aerating soil profile • Improving drainage • Adjusting, lifting, straightening or replacing sprinkler heads • Returfing and standard topdressing • Applying recycling topdresser • Replacing irrigation controller
North Sydney Council	• Andersen Park • Bradfield Park • Primrose Park • Tunks Park • Waverton Park	• Purchasing aeration equipment • Installing sportsgrounds irrigation system • Topdressing for Andersen, Waverton and Bradfield parks
Palm Beach Golf Course	• Palm Beach Golf Course	• Aerating soil profile • Topdressing • Adjusting, lifting, straightening or replacing sprinkler heads
Pittwater Council	• Careel Bay • Avalon Golf Course	• Aerating soil profile • Sprinkler head replacement • Returfing • Purchasing aeration equipment • Applying fertiliser/herbicide • Bore water feasibility study • Establishing a bore hole



Randwick City Council	• Burrows Park • Cromwell Park • Maroubra Beachfront • Yarra Oval	• Aerating soil profile • Returfing and topdressing • Adjusting, lifting, straightening or replacing sprinkler heads • Installing a new pump • Installing a stormwater irrigation system
City of Ryde Council	• ELS Hall Park • Christie Park • Eastwood Park • Monash Park • Morrison Bay Park • Westminster Park • Magdala Park • Dunbar Park • Peel Park	• Aerating soil profile • Returfing and topdressing • Adjusting, lifting, straightening or replacing sprinkler heads • Installing a new pump
Strathfield Council	• Strathfield Park • Airey Park • Jim Begnall Reserve • Mason Park • Bark Huts Reserve • Hudson Park Oval • Hudson Park Golf Course	• Aerating soil profile • Topdressing • Irrigation and drainage improvements • Straightening sprinkler heads and replacing sprinkler heads and nozzles
Sutherland Shire Council	• Gwawley Park North • Gwawley Park South • Heritage Drive Oval • Barden Ridge Oval • Lilli Pilli Oval • Seymour Shaw Oval #2 • Solander Park • Hazelhurst Regional Gallery • Camellia Gardens • Grays Point Oval • Dunningham Park • Coachwood Crescent Oval • Apsley Field • Gymea Bay Oval • Marton Park • Captain Cook Oval • Peace Park	• Purchasing aeration equipment • Aerating soil profile – recycling topdressing • Top dressing
Sydney University	• University Oval No. 1 • University Oval No. 2 • The Square • Lawn Tennis	• Aerating soil profile • Adjusting, lifting, straightening or replacing sprinkler heads • Upgrading the irrigation system to an automatic system • Purchasing aeration equipment
Warringah Council	• Plateau Park • James Morgan Reserve • Beverley Job Park • Reub Hudson/Denzyl Joyce Oval	• Aerating soil profile • Returfing and topdressing • Adjusting, lifting, straightening or replacing sprinkler heads
Waverley Council	• Bondi Park • Waverley Park • Marks Park • Hugh Bamford Reserve	• Adjusting, lifting, straightening or replacing sprinkler heads • Building a stormwater harvesting tank • Upgrading the irrigation system
Willoughby City Council	• Willoughby Oval	• Contributing to synthetic pitch development • Aerating soil profile

The project's 50 per cent funding contribution provided many participating organisations with the opportunity to invest in aeration equipment which would normally have been beyond their budget. By purchasing this equipment, participating organisations will save water by ensuring better infiltration and water retention at participating sites. Further savings can also be made by using the equipment at other sites not originally part of the project.

Communication between the participating organisations' staff and the independent contractors carrying out the work was strong throughout the project. In the field, the contractors were able to share their knowledge of the processes and benefits of the work and the participating organisations' staff could transfer this knowledge to other sites they were managing, continually building their capability. This knowledge transfer will ensure the project leaves an ongoing legacy that will see additional water savings at sites not originally part of the project.

The knowledge acquired throughout the Irrigation and Landscape Efficiency Project has been used to help develop Sydney Water's best practice guidelines for holistic open space turf management in Sydney. This publication has been distributed to the participating organisations and other interested parties and is also available online. The guidelines will help the participating organisations to continue good management practices and ensure water savings are maintained. It is also hoped the guidelines will be adopted by other organisations so that open spaces in Sydney become more water efficient, strengthening the project's legacy.

The 50 per cent funding from the project provided opportunities for identified work and restoration to be completed often a few years in advance of estimated pre-funding completion dates.
Sites were able to achieve:

- slit drainage
- topdressing
- soil conditioning
- irrigation maintenance
- irrigation upgrades
- tank installation
- pump installation
- installation of remote irrigation controllers with weather station links.

The project was also able to help participating organisations implement larger scale works which may otherwise not have been possible. These works included:

- stormwater harvesting
- ground and bore water harvesting
- recycled water schemes
- artificial turf with rainwater harvesting and diversion
- trialling alternative turf species.

During Stage 3, consultants revisited sites to ensure works agreed in Stage 2 were completed to the appropriate standard and estimated water savings would be achieved. A short report, including a detailed list of all works was produced for each site.

Before (top), during (middle) and after (bottom) synthetic turf installation at Northbridge Oval in Willoughby City, Sydney.

The new type of turf does not require irrigation, resulting in a saving of 3.8 million litres of potable water per year. It features an impermeable, plastic membrane, followed by a thick layer of crushed stone aggregate to permit drainage under the synthetic grass.

Rain water run-off from the field is captured and sent to two dams on the adjacent golf course. This water is used to irrigate the golf course, resulting in further water savings.

The previously weather dependant oval can now take up to 100 playing hours per week in all conditions while other ovals in the area are 'rested' due to rain or general wear and tear.

Strathfield Council, who received funding through the Irrigation and Landscape Efficiency Project, received a Highly Commended award at the 2012 Local Government Excellence in the Environment Awards in the water conservation category for their Hudson Park Golf Course Sustainability Project. The project implemented major upgrades, including installing revolutionary new turf expected to deliver savings of up to 12 million litres of water and $40,000 per year.

Water savings

The Irrigation and Landscape Efficiency Project's primary objective was to save 1060 million litres per year of potable water by improving irrigation efficiency and management practices on sports fields and open spaces.

At the project's completion, actual water savings were calculated at 1090 million litres per year, exceeding the 1060 million litre per year objective. Water savings measurements were made during Stage 2 and verified as part of Stage 3 auditing. The water savings will be reserved for environmental flows in the Hawkesbury–Nepean river system.

Learnings

Learnings resulting from the Irrigation and Landscape Efficiency Project are:

- Grant funding opportunities such as the Hawkesbury–Nepean River Recovery Program provide significant incentive for organisations to invest in improving their water-use efficiency and to carry out work that would not otherwise be undertaken.
- Soil aeration and regular irrigation maintenance, which were found to be lacking at many participating sites prior to the project, provided the highest water savings.
- Using existing industry networks and pre-established relationships is an effective way to facilitate rapid acceptance of the project and associated benefits.
- Using independent auditors can increase the transparency and credibility of the auditing process.
- Analysis of the site findings identified the following common recommendations for improving open space management and realising water savings:
  - Ensuring high foot traffic on sports fields is managed effectively.
  - Avoiding turf that comes with a clay loam base as it causes a clay cap on the field and prevents water from penetrating the soil.
  - Maintaining regular communication between ground keepers and office-based staff to ensure common goals are reached.
  - Recognising the importance of soil management and the need for a decompacted soil profile.
  - Inspecting irrigation systems regularly.

An aerator in operation at Pittwater (above); a stormwater capture tank at Bondi Beach Reserve (below)