Grass Roots
The turf and irrigation research project

First year outcomes (2007)

What is Grass Roots?

Grass Roots, the Turf and Irrigation Research Project is a water conservation initiative that has transformed Rosary Primary School oval into a complex turf and irrigation monitoring site.

Grass Roots is part of ACTEW's commitment to promoting permanent water conservation throughout the ACT.

Through the project, ACTEW is working to develop best practice watering regimes for turf and in particular, large open spaces such as playing fields and other public areas, traditionally Canberra's largest users of water.

This report

This report outlines major findings from the first full year of Grass Roots data gathering, as well as other news and activities associated with the project. As the project progresses reports such as this will help benchmark water use requirements at similar sites and also complement and support other turf trials underway in the ACT.

First Year Outcomes

2.5 million litres of water saved

The turf at Grass Roots was established and completed in February 2006, during what turned out to be one of the driest and the third and fourth consecutive hottest years (2006 and 2007) on record in the ACT. These harsh conditions – with Stage 3 Water Restrictions in place and the threat of Stage 4 restrictions looming – presented possibly one of the most challenging times to maintain turf in ACT's history.

The challenge at Grass Roots was to learn how to spread less water even further, whilst maintaining the grass at an acceptable condition.

Data indicates that the extremely dry conditions resulted in an increase in water demand by both cool and warm season grasses by over 50 per cent.

Over the first year the project was running, Grass Roots achieved an approximate **40 per cent saving in water use**, in line with the Stage 3 Water Restrictions target of 35 per cent reduction. For an average sized soccer field, this would equate to a saving of approximately 2.5 megalitres for the year, or approximately 10 megalitres for a full sized 2 hectare cricket oval.

The lack of rain throughout the year required major adjustments to watering schedules which pushed many of the turf varieties to the limit. The result was significant water savings, along with many learning outcomes, including:

- the need for continual soil moisture and condition monitoring;
- turf production techniques; and
- the use of different irrigation systems.

Through this integrated approach, Grass Roots has started to identify what best suits the site and similar sites throughout the ACT.

Turf

Keeping the grass green

To fulfil the objectives, a program was developed involving ground preparation, irrigation equipment installation and the introduction of new turf.

Across the two irrigation layouts there were five different turf varieties (see **Figure 1**), selected on the basis of their drought tolerance.

The warm season grasses, namely Sir Walter Buffalo and Transcontinental Couch, performed very well with irrigation at 40 *per cent of evaporation* (i.e. at a crop factor of 0.4). With even further adjustments to the scheduling, these grasses survived at an even lower watering rate of 25-30 per cent of evaporation later in the season.

Summer 2007 - Division between Fescues (left) and Sir Walter Buffalo.

Application rate

The rate at which water is used to irrigate a lawn on a regular basis.

Per cent of evaporation

When evaporation is greater than rainfall, it creates a water deficit. This deficit is used when determining how much water is needed.

Therefore, water efficient grass can cope with a higher deficit for longer periods.

As opposed to the warm season grasses, the cool season grasses (fescues), like Rhizomatous Tall and Premium Tall needed double the amount of water to survive. However, some fescues performed better than others and proved that they can handle much lower *application rates* than anticipated.

Even though the warm season grasses used significantly less water than the other varieties, they took a long time to come out of *dormancy*.

During dormancy the growth rate of these grasses drops significantly resulting in full colour loss over the winter months. Full return of colour was not achieved until late October. The rhizome type fescues maintained a better colour throughout the year than any other turf.

In May 2007 a method was trialled that if successful would overcome colour loss in Couch grass over the winter months. An area within the Couch section was over-sown with a Transitional Rye grass which remains green during winter. The Rye performed well and gave the Couch section a nice green colour over the traditional "brown" effect that would have otherwise occurred. Once the Couch came out of dormancy, it competed with the Rye and became the dominant grass during the summer months.

Dormancy

Dormancy is a period of slowed plant growth. It is a survival strategy, which enables the grass to survive in climates where part of the year is unsuitable for growth, such as cold winters or dry seasons.

Growing season

The growing season is between the last frost and the first frost. At the beginning and the end of the growing season the turf is partially dormant, generally between September and May. It's the time of year that the turf requires or takes up more moisture as it grows.

Dormancy in the Buffalo and Couch sections brought with it another problem. Both sections required herbicide treatment prior to the *growing season* to reduce the weed load that occurred over the dormant winter months.

As a general rule of thumb, to maintain healthy grass, soil moisture levels should be maintained within 10-20cm range during establishment. Watering past this level can result in water wastage and leaching of soil nutrients. Core sampling at the oval has revealed that overall, roots had grown up to a depth of 40cm across all turf varieties. This indicated that water had reached a depth of 40cm during the establishment phase, contributing to the survival of the oval despite extreme conditions. After establishment, soil moisture levels have been maintained at 10-20cm, in line with best practice and to be efficient. Soil moisture sensors will continue to report this data.

A core soil sample demonstrating the depth of root growth.

Irrigation

Using sprinklers more efficiently

The Grass Roots project irrigates a total turf area of approximately 8000m^2. The irrigation is designed so that two distinct watering methodologies can be run and monitored separately. One half of the area is irrigated by pop-up sprinklers and the other with sub-surface drip irrigation.

A 'catch can' test measuring sprinkler efficiency.

Implementation of strategic watering regimes allowed the operator to continually change the watering schedule depending on daily *evapotranspiration* figures.

The ability to accurately "top up" water demand by the turf areas ensured that water consumption targets could be met. Benchmark volume figures were also built allowing to form a base point (www.actew.com.au/grassroots) for water scheduling in other similar turf sites throughout the ACT region.

Sprinkler efficiency was tested at the beginning of the season to determine how evenly and efficiently the sprinklers were delivering water to Section A (see **Figure 1**). A *distribution uniformity* of 71 per cent was achieved initially. Although a good result, this is below best practice minimum of 75 per cent. Following some adjustments, the test was repeated with uniformity increasing to 87 per cent - an excellent result.

The control area of the sprinkler section was maintained at irrigation rates similar to those traditionally used in the ACT, with the main sprinkler section irrigated at reduced rates. When compared, the two sprinkler sections, had little variation in grass condition across all turf varieties, indicating that a new, lower irrigation rate can be applied and can still achieve healthy grass.

At the end of the growing season in June, three soil moisture probes were installed at the oval to monitor soil moisture levels within the sprinkler sections. These probes further refine the irrigation scheduling to ensure that over watering at depth does not occur.

Evapotranspiration

The combination of *evaporation* which is the movement of water to air through surfaces such as water and soil and *transpiration* which is the movement of water in vegetation resulting in vapour lost through its leaves or stems in grass.

Distribution Uniformity (DU)

This is how efficiently and uniformly an area is watered. The lower the DU, the less efficient the distribution, and thus the more water which must be applied to meet the minimum requirement the irrigator has set for the particular type of grass.

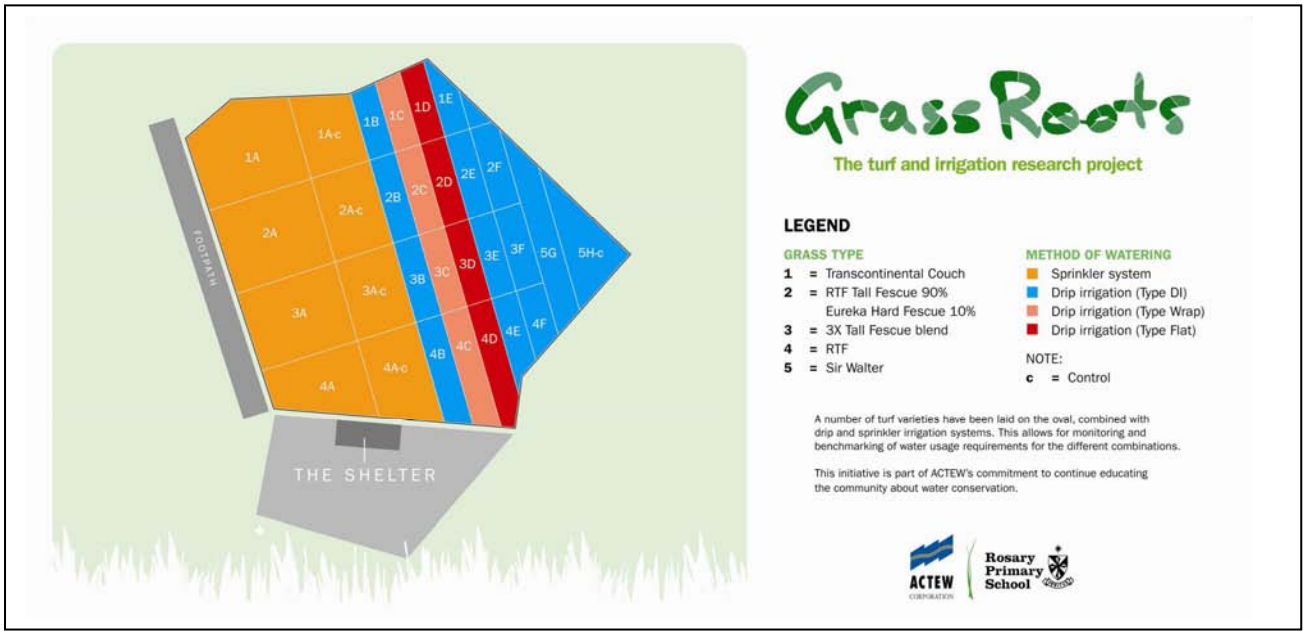

Figure 1 – Oval Sections – The lawn was separated into 8 sections, each with different grass type and irrigation methods used.

Subsurface drip sections performed well within expectations despite a striping effect in some sections, a result of water not spreading evenly through the soil between drip lines. Rather than being caused by the product itself, experimental irrigation scheduling across different soil and grass varieties resulted in this effect.

Irrigation scheduling

Cyclic watering most efficient

As a general rule, irrigation scheduling is calculated using evaporation and rainfall levels, turf crop factors and application efficiency percentages.

Cyclic watering

This is a watering method in which watering is undertaken for a short period of time, then the water is allowed to soak in before watering resumes. The benefits are that it does not cause excessive pooling or runoff, and helps water better penetrate the soil.

However, harsh weather conditions during the year presented a unique opportunity to learn more about how to irrigate even more efficiently. Only 27 mm of rain was recorded over a 12 week period in the middle of the growing season, most of which fell within a 24 hour period. Without the interruption of rain for such a long period, the benefits of cyclic or 'pulse' irrigation were tested.

Two types of irrigation were tested:

- once weekly applications of water; and
- multiple, but shorter applications of water throughout the week.

Both methods using the same amount of water in total. The best results were obtained with small applications of water several times a week, confirming that cyclic irrigation is a very efficient means of watering grass.

Typical sprinkler run times varied from 4 to 25 minute cycles, with drip sections varying from 15 to 44 minute cycles. During the height of the season, sprinklers were run twice weekly with multiple pulses, and drip systems used 2 to 4 times a week with 1 to 3 pulses.

To further refine the scheduling, three soil moisture probes that had been installed to assist in monitoring moisture levels at three sites within the sprinkler section. One probe monitored the sprinkler control section (see **Figure 1**, ctrlA), whilst the other two probes monitored Section A, one of which is in an area that was continually treated with a wetting agent.

The Soil

Helping the soil breathe

The soil at Grass Roots was tested several times throughout the year. Poor turf condition in certain areas indicated that there were soil moisture problems in some of the drip and sprinkler sections. One area of concern spread across the drip section on the eastern side of the oval, the other in the sprinkler section on the western side. Aerial photographs taken of the oval prior to the establishment of Grass Roots indicated longer term issues which may have been caused by soil compaction, thus restricting the flow of water through these areas.

Vertidrain machine

A machine that reduces compaction in the soil, enabling water to flow more readily between soil particles.

The use of a *vertidrain* machine has provided some compaction relief, with turf condition improving somewhat in the affected areas.

Activities

Monitoring

Monitoring and adjustment of water use by the various sections of turf was carried out remotely, with assessment and general wear of turf carried out by on site appraisal.

Maintenance

Throughout the year, a thorough turf and irrigation maintenance program was carried out to give the turf the best chance of survival given the extremely dry conditions, and experimental irrigation regime.

The turf maintenance program included continual monitoring and testing of the area, multiple applications of nutrient and herbicide, and scheduled mowing. Irrigation systems were monitored daily, and multiple flushing and sprinkler checks carried out before and during the growing season.

Education

Sharing learning outcomes

Grass Roots Live is a web based portal, which shows real time irrigation data from the oval. Current and historical data was available to the public, who could also access turf and irrigation updates from the website which received over a thousand hits throughout the year www.actew.com.au/grassroots.

Using Grass Roots as a case study ACTEW, in collaboration with turf and irrigation experts, conducted free workshops based at the Grass Roots site which focused on how to correctly establish and maintain water efficient grass.

Topics covered included:

- soils;
- ground preparation;
- turf varieties and maintenance;
- irrigation scheduling and system maintenance;

  and
- irrigation uniformity testing.

Turf workshops at Grass Roots help the wider community understand how to use less water on lawns.

Six workshops were held over the summer months with over 100 attendees. Due to Stage 3 Water Restrictions, further workshops have been postponed until further notice.

Guided tours of the oval were provided to groups such as school ground keepers and managers, students from CIT's School of Horticulture and a group seeking to apply lessons learned from Grass Roots to the ACT Government's Sustainable Schools Program.

Project stakeholders

As Grass Roots is a community project, representatives from the Rosary School, ACTEW, turf and irrigation experts had regularly meetings to discuss project progress and outcomes.

The Year Ahead

Improved scheduling

Over the next year, the soil moisture probes will be used to assist in fine tuning water requirements, monitor turf water usage and assess performance at different levels in the soil.

Key stakeholders are integral to the success of the project.

Sustainable Grass Roots

In late 2007, Rosary Primary School was successful in obtaining a Commonwealth Community Water Grant of $40, 977. The grant will be used to install rainwater tanks that can be used for irrigation.

Up-to-date information

Visit the Grass Roots website at www.actew.com.au/grassroots for up-to-date information on the project and to view real time irrigation data.

Contact

Please contact the Water Conservation Office for more information.

(02) 6248 3131
waterconservation@actew.com.au

Thank you

ACTEW thanks stakeholders and sponsors for their valuable contributions and ongoing support.