Code of Practice
Irrigated Public Open Space
Operational Guide

For Sound Sports Ground Turf and Irrigation Management

Image Courtesy of FFSA

Acknowledgements

Funding Organisations

- Department of Environment Water and Natural Resources
- Adelaide and Mount Lofty Natural Resources Management Board
- SA Murray-Darling Basin Natural Resources Management Board

Project Steering Committee Representatives

- SA Water
- South Australian Turf and Irrigation Technical Working Group
- Department of Environment Water and Natural Resources
- Adelaide and Mount Lofty Natural Resources Management Board
- SA Murray-Darling Basin Natural Resources Management Board
- Office for Recreation and Sport
- Department of Education and Childhood Development
- Local Government Association
- Bureau of Meteorology
- Adelaide University

Authors

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The support and contribution of the organisations listed and the support of the Sports Turf Association and Irrigation Australia Limited, is greatly appreciated.

In addition, the input of the many industry representatives who attended industry workshops is much appreciated.

Published October 2015

The Operational Guide is designed to assist those who are responsible for the irrigation management of sports grounds but are not considered professional irrigation managers. Typically this situation applies to small local government councils, sports clubs and some schools.

Turf and irrigation management requires multiple skills and comprehensive knowledge of a wide range of areas. *The Code of Practice – Irrigated Public Open Space* details the principles of best practice in this area.

This guide provides a simplified version to assist in sound turf and irrigation management. The aim of this guide is to assist irrigation managers achieve acceptable standards of irrigation efficiency, effective cost management/monitoring, minimise wastage and provide a functional turf surface.

The following questions will be answered in this guide:

1. Does my irrigation system perform adequately?
2. What information do I need to irrigate efficiently?
3. How much water does the turf need and how often do I need to irrigate?
4. For how long do I need to run the irrigation system?
5. Should I adjust the irrigation program for variations in weather?
6. How do I monitor irrigation efficiency and the cost of water over the irrigation season?
7. How do I ensure the turf is maintained in a healthy condition?

1. Does my irrigation system perform adequately?

TIP Refer to Section 6.0 of the *Code of Practice* for more detailed information on irrigation system performance.

This guide assumes that the irrigation system performs adequately and is able to apply water at a reasonable consistency. If the irrigation system is obviously non-performing, advice from a qualified irrigation professional is advised. Examples of non-performance are irregular grass coverage during the summer periods and green rings of grass around individual sprinkler heads.

Important factors that contribute to irrigation system performance

Water Supply

A reliable water supply is critical. The water supply must have the capacity to meet the peak water demand of the turf in summer. Types of water supply include:

- SA Water mains
- ground water bore
- harvested stormwater
- treated wastewater
- combination of one or more of the above

Water Supply Infrastructure

Water supply infrastructure is required to deliver water at the necessary pressure and flow rate for the irrigation system to operate effectively. Types of water supply infrastructure include:

- mains water meter of adequate size (40-80 mm diameter)
- backflow prevention device
- holding tank of appropriate size to supply water demand (5 000-80 000 L)
- holding dam
- pump station.

A guide to the required pressure and flow is:

- operating pressure at sprinkler head: eg. 200–500 kPa
- operating flow (depends on the number of sprinklers) eg. 100-400 L/min.

Irrigation System Design and installation

Design – The irrigation system should be designed by a qualified irrigation design professional.

Installation – The irrigation system should be installed by a qualified irrigation installation contractor. The contractor should provide an as-constructed irrigation plan. In many cases irrigation plans are not available for older systems.

Pipe work – Pipe sizing should be adequate to supply water at appropriate pressure to the sprinklers.

Master valve – A master valve should be fitted to isolate water from the system in the event of a pipe burst, malfunction or to carry out maintenance.

Solenoid valves – The solenoid valves should be adequate to control the flow of water to the sprinklers.

Stations – Irrigation stations or zones should have the appropriate number of sprinklers according to the pressure and flow of the water supply. Generally each station will have 3-6 sprinklers. Half or part circle sprinklers should, where possible, be grouped on separate stations to full circle sprinklers. It is important that sprinklers with similar application rates are grouped and controlled together.

Sprinklers – Sprinklers should be installed upright, 10 mm below the ground surface.

Nozzles – Nozzles should be sized according to the pressure and flow of the water supply. It is important that nozzle size is consistent across each part of the system.

Sprinkler Layout and Spacing – Sprinklers should generally be set out in a square or triangular layout, with spacings of between 10-18 m depending on the pressure and flow of the water supply.

A guide to the required irrigation system performance is:

- application/distribution uniformity: 70-80 %
- application rate: 8-16 mm/hr

Basic Irrigation Maintenance

Basic irrigation system maintenance includes regular system checks where all stations are activated for 3 minutes and sprinkler operation is checked to ensure that:

- solenoid valves open and shut effectively

  TIP If solenoid valves fail, replacement or maintenance by an experienced irrigation technician is recommended.

- sprinkler pop-up is to full height; alignment is perpendicular to the turf surface; rotation is smooth and continuous; and water stream is not impeded by turf.

  TIP If sprinklers require replacement, they should be replaced with a like model with the same nozzle as the original sprinkler.

Assessment of Irrigation System Performance

It is recommended that the system performance is assessed by a qualified irrigation professional. This involves an irrigation audit that assesses all aspects of the system operation. An irrigation audit will also provide all information on the site, climate and irrigation system that is required to manage the irrigation of the sportsground efficiently.

TIP Information on the importance of an irrigation audit is available as part of SA Water's *Irrigation System Performance Guide*.

2. What information do I need to irrigate efficiently?

The following information is essential to operate and manage the irrigation of turf efficiently.

Site Details

Site area (m^2)

Measure the irrigated area of your site.

TIP You can use Google Earth to measure the irrigated area of your site.

Grass type/species

Generally grass type on local sports grounds and parks in SA is Kikuyu, a warm season grass.

TIP Refer to Section 7.3 of the *Code of Practice* for more information on turf species.

Quality/standard (TQVS Classification)

The Turf Quality Visual Standard (TQVS) system is used to classify turf.

TQVS 1 – Elite Sports Turf

TQVS 2 – Premier Sports Turf

TQVS 3 – Local Sports Turf

TQVS 4 – Passive Recreational Turf

The quality or standard of the turf has a significant impact on the water usage and maintenance costs. Not all sports grounds have to be at an elite or premier level. Generally local sports grounds will be TQVS 3 and passive recreation parks will be TQVS 4.

TIP Refer to Section 7.4 of the *Code of Practice* for more information on the TQVS classification of turf.

Root depth

Using a spade, take out a square of turf to depth of approximately 250 mm and measure the depth of the root system of the turf.

Tip Generally healthy Kikuyu turf will have root system depth of 100-200 mm and average root depth of 150 mm.

Soil type

Take a sample of soil from the root zone and use the Hand Bolus Method to determine the type of soil.

TIP Refer to Soil Type Test Information Sheet on the SA Water website for further detail on how to determine soil type. Soil type will be sand, sandy loam, loam, clay loam or clay.

Climate Details

Bureau of Meteorology (BoM) Region

The BoM has many weather stations located across the state. Choose the weather station from the list that is the nearest to the sports ground you are irrigating.

TIP A list of weather station locations can be found on the BoM website at www.bom.gov.au/watl/eto/

Evapotranspiration

The Evapotranspiration is the amount of water in mm depth used by the plant over a given period (day/month). This figure is calculated by the Bureau of Meteorology. The average evapotranspiration rate for the last 10 years is used.

Rainfall

Rainfall is measured in mm depth of rain for a given period (day/month). Rain replenishes the moisture in the soil. Where there is insufficient rain to meet the needs of the turf, irrigation must be applied to provide the required water for healthy plant growth. Rainfall is measured by the Bureau of Meteorology. The average rainfall for the last 10 years is used.

3. How much water does the turf need and how often do I need to irrigate?

TIP Refer to Section 8 of the *Code of Practice* for more information on plant water use.

TIP The *Basic Irrigation Management Toolkit* available on the SA Water website provides assistance in determining turf water requirement and developing a water budget.

To find out how much water needs to be applied to the sportsground, enter the above site and climate data into the SA Water *Basic Irrigation Management Toolkit*. The toolkit will then calculate how much water you need to apply at each optimal irrigation event and how many times in a month you will need to irrigate.

Optimal Irrigation Event

The toolkit will calculate the optimal irrigation event in millimeters. This is the depth of water (in millimetres) that should be applied at each irrigation event.

How often do I need to irrigate?

The toolkit will calculate how often you need to apply the optimal irrigation event.

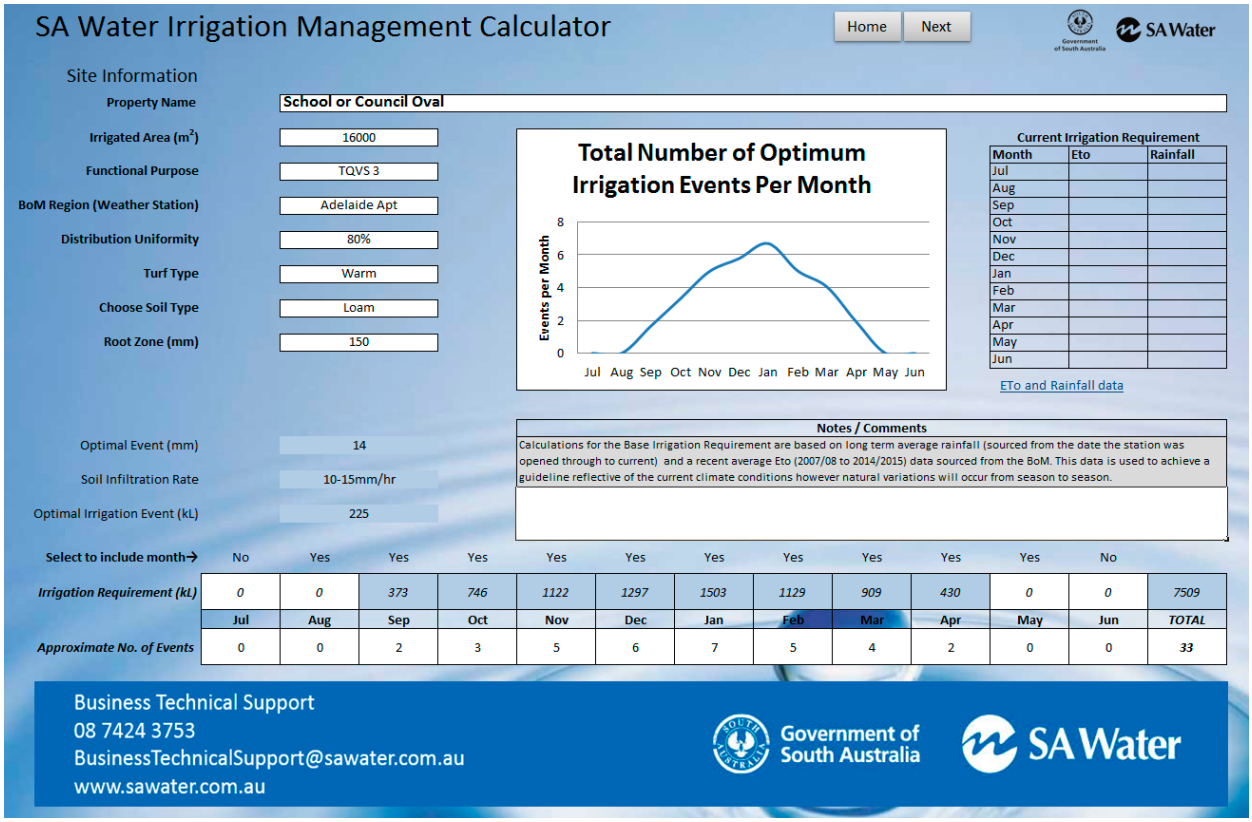
How much water will I use?

The toolkit will also calculate how much water you will use each time you irrigate for each month in the irrigation season and for the entire irrigation season.

SA Water – Irrigation Management Toolkit Example

The following is an example of the irrigation management information that is calculated using the SA Water *Basic Irrigation Management Toolkit*. The example is for a school or council oval located in the western suburbs of Adelaide using the site information detailed above. Enter the required information into the appropriate section and the toolkit will do all the calculations as in the example below.

Irrigated Area	16 000 m^2 (1.6 ha)
Functional Purpose (turf quality)	TQVS 3 (local sports ground)
BoM Region (weather station)	Adelaide Airport
Turf Type	Kikuyu (warm season turf)
Soil Type	Loam
Root Zone Depth	150 mm



The toolkit calculates the following information:

Optimal Irrigation Event (mm)	14 mm (to be applied each time the oval is irrigated)
Optimal Irrigation Event (kL)	225 kL (is applied each time the oval is irrigated)

Irrigation Schedule:

	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	Total
No of Irrigation Events	2	3	5	6	7	5	4	2	33
Irrigation Required (kL)	373	746	1,122	1,297	1,503	1,129	909	430	7,509

4. For how long do I need to run the irrigation system?

TIP Refer to Section 9.0 of the *Code of Practice* for more information on irrigation scheduling.

We now know that we need to apply 14 mm of water each time we irrigate and we also know how many times each month we need to irrigate. However, at this stage, we don't know how long we need to run the irrigation system to apply the required 14 mm.

To determine how long we need to run the irrigation system each time we irrigate, we need to know what the irrigation system application rate is in mm per hour.

TIP The system will have numerous stations or zones and stations will often have either full circle or half circle sprinklers. The general rule is that stations with half circle sprinklers will have double the application rate of stations with full circle sprinklers.

What is the irrigation system application rate?

Irrigation design plan – If the irrigation system is relatively new or if there is an irrigation system design plan, the application rate of each station should be recorded on the plan.

Often there is no irrigation plan available and other methods of determining the application rate must be used.

Catch can test – The application rate of the irrigation system can be measured using catch cans (100 mm diameter plastic food containers can be used) set out in a grid (between 10 – 20 cans set out evenly) between sprinklers on one or two stations to collect water while the system is running. Operate the stations for a minimum of 20 minutes. Measure the depth of water collected in the cans (in mm) using a ruler. The average depth of water in all the cans gives the application rate in mm per 20 minutes. Multiply the average by 3 to calculate the application rate in mm per hour.

An irrigation audit by an experienced irrigation professional will determine the application rate of the system as part of the audit.

Irrigation event test – If there is no irrigation design plan and you are not able to do a catch can test, you can calculate the irrigation application rate (millimetres per hour) by doing an irrigation event test. The irrigation event test should generally be done overnight as the entire system needs to operate for 20 minutes. This could take several hours and it is important that there is no other water use occurring during the test. To do an irrigation event test follow these steps:

1. Read the water meter before starting and record the meter reading.
2. Set the irrigation system to run for 20 minutes per station. If there are stations with half circle sprinklers set these stations to run for 10 minutes.
3. Activate the system to operate all stations.
4. When the irrigation has finished read the water meter and record the reading.
5. Subtract the second meter reading from the first and this will tell you how much water the system used in a 20 minute event. Then multiply the result by 3 to calculate how much water would be used if the system was to run for an hour.

1st read	2nd read	Water Used (kL)	Water used (L) 20 mins	Water used (L) 60 mins (1 hr)
		1st read – 2nd read	kL x 1000	Water used 20 mins x 3
43571.6	43637.2	65.6	65 600	196 800

6. We now know that the irrigation system applies 196,800 litres of water per hour. To convert the volume (L/hr) to mm per hour (mm/hr) we need to divide the total water used (L/hr) by the area irrigated (m^2).

Water Used (L/hr)	Irrigated Area (m2)	Irrigation System Application rate (mm/hr)
		(L/hr) / (m^2)
196 800	16 000	12.3

Irrigation system application rate – 12 mm/hr

What is the irrigation run time?

In this example we need to apply 14 mm per irrigation event and we know that the irrigation system will apply 12 mm/hr. If we divide the amount required or the optimal irrigation event (14 mm) by the application rate (12 mm/hr), we can calculate the system runtime in hours. We then divide this by 60 to calculate the irrigation system runtime in minutes.

Optimal Irrigation Event (mm)	Irrigation System Application rate (mm/hr)	Irrigation System Runtime (hrs)	Irrigation System Runtime (mins)
		(mm) / (mm/hr)	Runtime (hrs) x 60
14	12	1.2	70 (per station)

Irrigation System Runtime (minutes) – 70 min (to apply 14 mm)

5. Should I adjust the irrigation program for variations in weather?

This guide provides advice based on average weather conditions. However, weather patterns are changing and we are experiencing extreme events from prolonged heat waves to unseasonal high rainfall.

It is critical that the person responsible for the ground monitors the actual weather variations and responds by adjusting irrigation programs accordingly.

TIP One important principle is that the optimal irrigation event and irrigation system runtimes don't change. However, the frequency of irrigation events can be changed in response to varying weather patterns.

Heat waves - Where a region experiences extreme prolonged periods of hot weather, the irrigation events for that period should be increased to cater for higher water demand by the turf. If a prolonged heat wave was experienced in December, the number of irrigation events might be increased from 6 to 8.

High rainfall events - Where a region experiences unseasonal high rainfall events, the number of irrigation events for that period should be decreased as the water requirement has been reduced by the additional rain. If 60 mm of rain fell in January, the number of irrigation events might be reduced from 7 to 5.

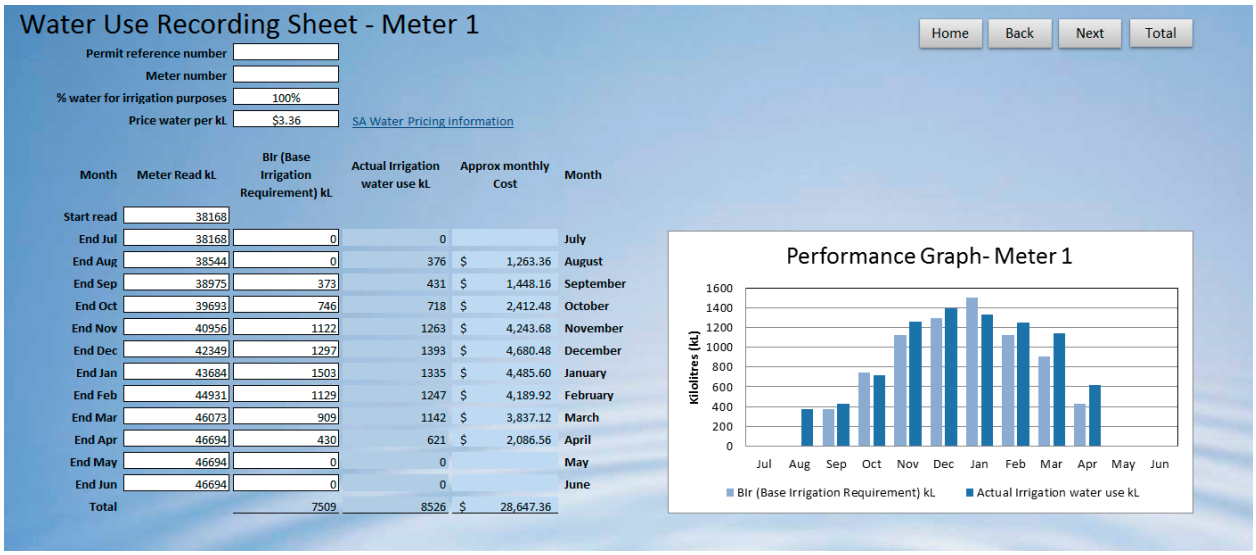
Monitor the health of the turf - It is important to monitor the health and vigour of the turf over the irrigation season to ensure that it is not suffering moisture stress. Irrigation events should be adjusted in response to the needs of the turf grass. Add an irrigation event if the turf is browning off or stop an irrigation event if the turf is lush.

6. How do I monitor irrigation efficiency and the cost of water over the irrigation season?

TIP refer to Section 12.0 of the *Code of Practice* for more information on irrigation efficiency reporting

Monitoring water use and irrigation efficiency is as simple as reading the water meter monthly during the irrigation season. The amount of water used should be compared to the amount of water required as calculated in the *Basic Irrigation Management Toolkit* in section 3 of this guide.

The *Basic Irrigation Management Toolkit* also provides a template which calculates the water use and cost per month. Simply enter the water meter readings into the appropriate section and the toolkit will do all the calculations as in the example below.



Water Use Recording Sheet - Meter 1

Home | Back | Next | Total

Permit reference number
Meter number
% water for irrigation purposes: 100%
Price water per kL: $3.36
SA Water Pricing information

Month	Meter Read kL	Blr (Base Irrigation Requirement) kL	Actual Irrigation water use kL	Approx monthly Cost	Month
Start read	38168				
End Jul	38168	0	0		July
End Aug	38544	0	376	$ 1,263.36	August
End Sep	38975	373	431	$ 1,448.16	September
End Oct	39693	746	718	$ 2,412.48	October
End Nov	40956	1122	1263	$ 4,243.68	November
End Dec	42349	1297	1393	$ 4,680.48	December
End Jan	43684	1503	1335	$ 4,485.60	January
End Feb	44931	1129	1247	$ 4,189.92	February
End Mar	46073	909	1142	$ 3,837.12	March
End Apr	46694	430	621	$ 2,086.56	April
End May	46694	0	0		May
End Jun	46694	0	0		June
Total		7509	8526	$ 28,647.36	

The toolkit has calculated the water usage per month, compared it to the forecast water requirement and calculated the cost per month of water used. It also calculates the total water usage and cost.

Total water used	8 526 kL
Total forecast water requirement	7 509 kL
Total cost of water used	$28 647.35

Monitoring water usage monthly enables you to identify over-usage early and take steps to manage the irrigation scheduling to remain within budget.

TIP In extremely hot summers the actual usage might be significantly higher than the forecast requirement. It is important to monitor turf health and vigour as well as water usage to ensure turf does not suffer moisture stress in hotter than normal conditions.

TIP Where the water meter supplies club rooms as well as irrigation, the total water usage is expected to be higher than the irrigation requirement. This however is generally not significant and would account for between 5 – 10% of water used.

7. How do I ensure the turf is maintained in a healthy condition?

Irrigation is only one of the inputs that need to be considered in maintaining the turf. The health and condition of the soil and the turf plant must also be considered.

The turf maintenance program should address the following issues:

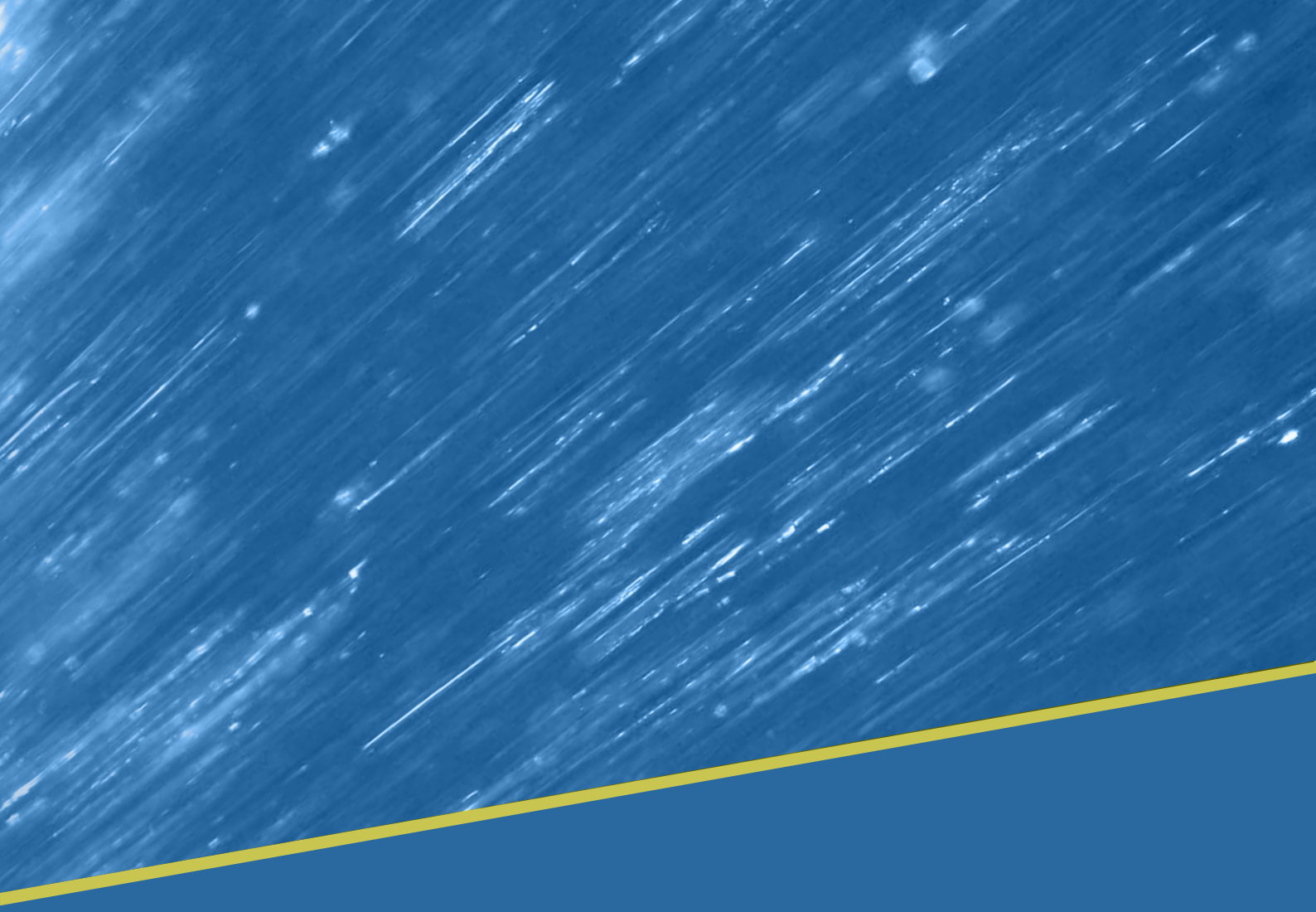
- maintaining and improving soil condition
- de-compaction and aeration works to relieve compaction
- mowing to ensure a functional and uniform surface
- fertiliser application to ensure nutrient requirement are met
- pest and weed control
- top-dressing
- turf re-establishment after wear

Where there are serious problems with the health of the turf, advice should be sought from qualified turf professionals.

TIP Section 11.4 of the *Code of Practice* provides further information in relation to turf maintenance.

TIP The *Sports Turf Maintenance Guide* available from the SA Water web page is a useful resource in developing a turf maintenance program.

TIP The Sports Turf Association SA is available to provide support and advice.



The support tools and resources referenced in this guide are available from the following organisations:

- SA Water – Irrigated Public Open Space Web Page
  - Basic Irrigation Management Toolkit
  - Advanced Irrigation Management Toolkit
  - Irrigation Efficiency Checklist
  - Sports Turf Maintenance Guide
  - Irrigation System Performance Guide
  - Water Efficiency Plan Toolkit
  - Soil Type Test Information Sheet

  www.sawater.com.au/business/products-and-services/irrigated-public-open-spaces-ipos/irrigation-management-toolkits
- Office for Recreation and Sport, South Australia.
  - STARCLUB Club Development Program : Sustainable Clubs

  www.ors.sa.gov.au
- Sports Turf Association SA (STASA)
  - Industry support and advice

  www.sportsturf.asn.au/
- Irrigation Australia Ltd (IAL)
  - Industry support and advice

  www.irrigation.org.au/

Government of South Australia

SA Water

Local Government Association of South Australia