Best Practice Guidelines for Functional Open Space

A walk through

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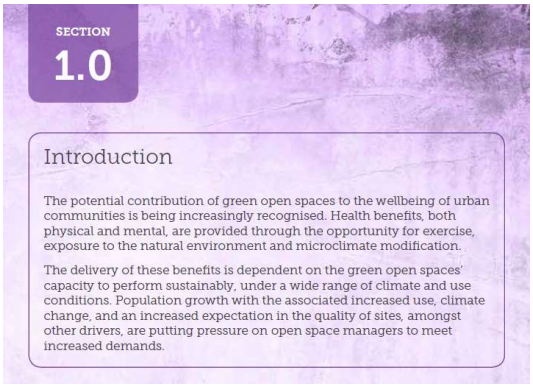

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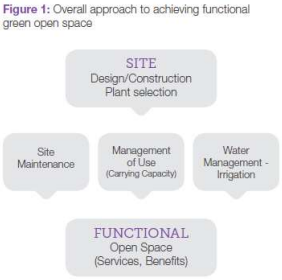
<u>Aim</u>
Knowledge, tools to deliver services with optimum use of resources.



SECTION
2.0

What is green space?

Open space is any open piece of land that has largely no buildings or other built structures and is accessible to the public. Green open space can include:

- Green space (land that is partly or completely covered with grass, trees, shrubs, or other vegetation, including parks, community gardens, and cemeteries)
- Schoolyards • Playgrounds • Public areas • Sports fields
- Golf courses • Streetscapes

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- **Functional space**
- **Turf visual standards**
- **Water requirements**

Turf surface standards

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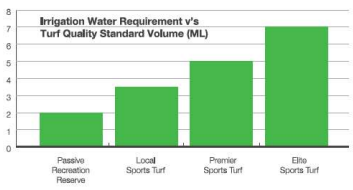
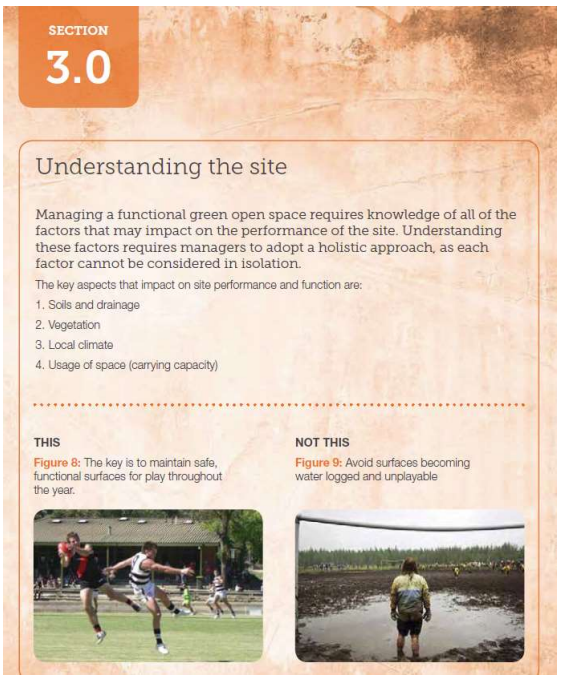
Standard	Turf Appearance	Example
Elite Sports Turf (State/National Competition)		MCG AAMI Park MOPT
Premier Sports Turf		District/Regional Competition Regional Cricket Football Athletics etc
Local Sports Turf		Local Competition Local Sports Grounds Community Parks Shared Use Facilities
Passive Recreation Reserve		Non-Sports Turf Neighbourhood Park Passive Reserve

Figure 4: Demonstrates that the higher standard and demand on a space the higher the water consumption to keep the space functional.

Other classifications, such as Very High, High, Medium and Low and A, B, C and D can be used so long as they reflect a range of surface performance standards and are irrigated accordingly.




SECTION
3.0

Understanding the site

Managing a functional green open space requires knowledge of all of the factors that may impact on the performance of the site. Understanding these factors requires managers to adopt a holistic approach, as each factor cannot be considered in isolation.

The key aspects that impact on site performance and function are:

1. Soils and drainage
2. Vegetation
3. Local climate
4. Usage of space (carrying capacity)

THIS

Figure 8: The key is to maintain safe, functional surfaces for play throughout the year.

NOT THIS

Figure 9: Avoid surfaces becoming water logged and unplayable

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- **Soils and drainage**
- **Soil properties – soil tests**
- **Ground construction**
- **Vegetation**
- **Climate**

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- **Soils and drainage**
- **Soils and soil properties**

Ground construction

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Table 3: Functional open space/sports grounds construction types

	Open Spaces				
	Open Space Venue Types - By Construction	Uses	Carrying Capacity / Usage	Capital cost	Annual cost of maintenance
1	Native soil – natural surface	Parkland/Neighbourhood park	Low	$0	$3,000 - $5,000
2	Native soil – graded/formed – no subsurface drainage	Local sports/General recreation	Low – Medium	$120,000-$150,000	$6,000 – $10,000
3	Native soil – graded/formed – subsurface drainage	Local sports/District sports	Medium	$140,000-$175,000	$10,000 - $15,000
4	Native soil based – sand layer (e.g.200 mm) - subsurface drainage	District/Elite sports	High	$250,000-$400,000	$20,000 - $30,000
5	Full sand profile – perched water table and drainage	Elite sports	High	$500,000-$800,000	$40,000 - $80,000

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Plant water requirements

Case Study 2: Oversowing with ryegrass

A recent study on over sowing couch based fields with perennial rye grass in Sydney by Dr Phillip Ford (PGG Wrightson Turf Australia) and Dr Jim Hull (Independent Turf Consultants, Sydney) highlighted the value of over sowing in maintaining a functional sports surface on high use areas.

http://www.pggwrightsonturf.com.au/assets/files/Assesment%20of%20football%20surface%20qulaity.pdf

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- **Principles of efficient irrigation**
- **Irrigation design**
- **Irrigation scheduling**
- **Technology to assist efficiency**

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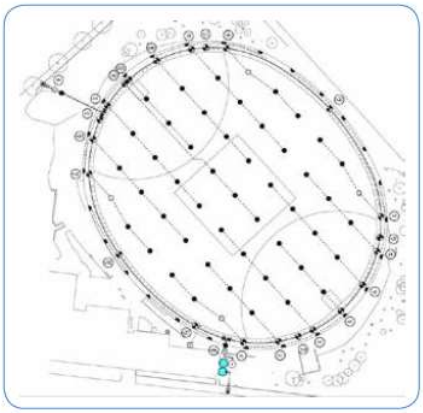
Irrigation design

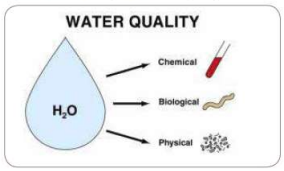
Best Practice Design example

Figure 15: Best Practice irrigation design for a sports ground



- **Design parameters**
- **Costs**
- **Issues**
- **Technology**

Figure 18: Main categories of water quality



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- **Sustainable water sources**
- **Water source characteristics**
- **Water quality**

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- **Maintenance tasks**
- **Turf surfaces**
- **Grass management**
- **Soil management**
- **Ground conditions - playability**

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Turf surface assessment

Table 14: Various limits for site limiting components and testing ranges (Sports Turf Institute 2011)

Component	Test Method	Comments	Limits (Indicative Guide)
Surface Evenness	3 meter straight edge and/or 5 meter string line	Surface unevenness can impact on player safety and surface playability	<100 mm variation under a 5 meter string line <20 mm over 3 meter straight edge (Premium surface) <30 mm over 3 meter straight edge (Lower standard)
Ground Cover	Visual assessment – Use of a 0.25 sqm	Relates to surface appearance, stability and uniformity;	High wear areas of the ground total turf cover to be > 98% start of season; >than 85% mid-season (end May) No bare patches > than 200mm diameter start of season; < 10 bare areas >200 mm diameter per field mid-season
Sward height (mm) (Grass height)	Use of a floating disk	Grass height relates to performance in relation to ball bounce and roll, as well as impacting on surface hardness and traction. Sward height will be sport and species/cultivar specific. Mowing height should be adjusted for turf types and sport requirements	• Hockey - 8mm to 20mm • Cricket (excluding wicket) - 10mm to 35mm • Soccer - 20mm to 40mm • AFL - 20mm to 50mm • Rugby Union / League - 40mm to 55mm
Surface hardness (g)	2.25 kg Clegg Hammer® for player/ surface interaction	Hardness relates to injury potential after impact with the ground Gmax readings above 150 indicate cause for concern, the absolute upper limit is 200 Gmax	• Clegg hammer readings should fall between 50 to 120 g 3rd drop • Above 150 is considered at high risk
Traction (Nm)	Use of studded disk apparatus	Relates to surface stability and injury riskdue to insufficient or excessive traction	Test values to ball between 30 – 50 Nm

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Maintenance equipment and techniques

Table 15: Details provided by Sydney Water
– Best Practice Guidelines for holistic open space turf management in Sydney

Management Technique	Comments	Depth	Issues
Deep Slitting or Knifing	Traction-driven machines are attached behind a tractor at speed to facilitate tine or blade entry into the soil	100 – 300 mm	Blade penetration limited in tight compact soil. Some machines are designed so that blade travel through the soil in an offset way, which creates a more effective disturbance
Deep Slicing or 'Earthquaking'	Tines gently lift and shatter the compacted soil sideways and downward. Ideal for dry hard soils and for soils with many stones, as they do not harvest materials to the surface	100 – 300mm	This machine is not suitable for wet soils or soils high in clay, because the soil aways to and fro as the blades pass, becoming smeared rather than fractured
Hollow Tined Corers	Self driven or powered by a tractor. Hollow tines 10 to 25mm in diameter punch vertical holes in the topsoil, with the spacing between holes varying from 60 to 160 mm on a square pattern, depending on the machine brand.	100 – 200 mm	Continued use of hollow tine machines in and around the same depth in medium to heavy textured soils can cause a hardpan to develop at the bottom of the tine 'punch'. This action of the tine in penetrating finer textured soils can also cause soil glazing and compaction around the individual holes, resulting in long term soil structure degradation
Solid Tine Forking	Solid tines punch vertical holes in the topsoil, with the spacing between holes varying from 60 to 150 mm on a square pattern, depending on the machine brand	100 – 200 mm	This is not regarded as an effective long term de compaction technique because it aggravates the problems of glazing and perimeter compaction
Solid Tine Aeration	Similar to solid tine forking, except with 'kick' action at the bottom of the downward thrust. Aeration is similar to putting a garden fork into the soil and rocking it back and forth, which forms a cavity underground. This action overcomes many of the disadvantages of standard solid tine forking	100 – 200 mm	Operators of solid tine forking machines must use the 'kick' feature. If contractors do not use this feature, they may provide cheaper quotes but it will not improve the playing surface as much.
Vibrating Tines and Knives	Uses a tractor operated powe take-off to drive a rotary drum with numerous tine boots attached, that independently vibrate as the rotary drum travels forward over the ground. Each boot has a number of tines in a square pattern that penetrate the soil while vibrating, shaking and fracture the soil. This leave holes in the soil allowing water to penetrate	100 – 200 mm	Continual use can still cause a hardpan to develop at the bottom of the tine 'punch'.
Recycling Top Dresser	A European tractor-attached machine that decompacts, mixes and incorporates soils. Soils are aerated by a high speed rotor which drives a 10 mm wide tungsten tipped blades into the soil. The blades are spaced 180 mm apart. These blades saw trenches into the soil profile, harvesting soil and depositing into a conveyor attachment that distributes the soil evenly at the rear of the machine, thus aerating and top dressing in one press	110 – 180 mm	Will not improve the lack of topsoil depth. For this you will need to add material. The top–dress material generated by the machine will have a texture that matches the soil profile as it is derived from the underlying soil. So, if you have unsuitable subsoil, this is not the best option to use

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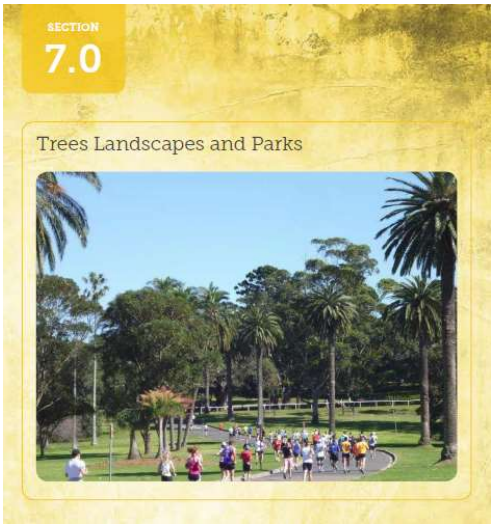
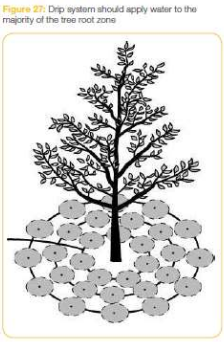


- **Tree establishment**
- **Watering of trees**



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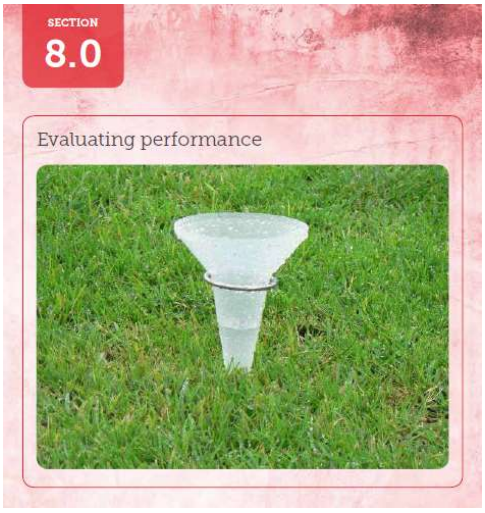

- **Services provided by the space**
- **Water performance - Key indicators**
- **Water volumes**

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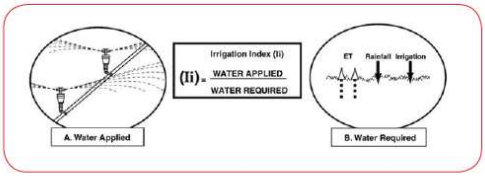

Table 17: Guide to irrigation index values

Irrigation I (Ii)ndex	Performance rating	What does it mean?
>1.3	Poor to very poor	Very wasteful irrigation, much overwatering
1.1–1.3	Medium	Significant over-watering
0.9–1.1	Good to very good	Watering close to optimum
0.7–0.9	Medium	Under-watering, landscape quality may be affected
<0.7	Poor to very poor	Serious under-watering, landscape at risk, sports surface may be unsafe (too hard)

- **Irrigation efficiency**
- **Distribution Uniformity (DU)**
- **Irrigation Index (Ii)**

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<u>Appendices</u>

1. **Case study –Upgrade of playing surfaces**
2. **Water quality guide**
3. **Best Practice Irrigation**

Managing Irrigation Infrastructure.

12 July 2016

- System performance including uniformity of application
- Maintaining irrigation systems
- Auditing of irrigation systems
- Irrigation investment including technology

System performance including uniformity of application

- DU (Distribution Uniformity) RATING: Excellent 80%,Very good 70%, Good 65%, Fair 60%, Poor 50%
- New systems minimum of >85%
- Determined by a catch can test on existing systems

System performance including uniformity of application

- Uniformity of Application Results
- No. of catch cans used in test: 25
- Test run-time: 2 x 10 min per station = 20 minutes
- Average value of all catch can readings: 14.2 mL
- Average value of lowest 25% of catch can readings: 5.8 mL
- Distribution of Uniformity (DU) (%): 41%

System performance including uniformity of application

RECORDED IRRIGATION SYSTEM DU	CURRENT IRRIGATION RATING	RECORDED PRECIPITATION RATE (mm/h)	CURRENT PRECIPITATION RATING ‡	POTENTIAL IRRIGATION RATING	NEW WORKS SUMMARY	COST ESTIMATE	% WATER SAVING ESTIMATE *	RECOMMENDATION
54%	Poor	9.2	Fair	Fair (60%)	Minor	< $2,000	28.0%	Repair sprinklers & test
				Good (65%)	Medium	$ 10,000 ±		Standardise all sprinklers to one (1) type & nozzle only; repair elec. control valves; investigate & carry out repairs of water connection point
				Very good (75%)	Major	> $ 20,000		Install new tank(s) and booster pump system

Maintaining irrigation systems

- Average cost to maintain a oval/ large open space $2000, includes labour/ materials etc., smaller sites much less, i.e.100 systems (33 central control) = +$200,000, 3 staff + materials plus average water costs, AFL ground 1.5 Ha ($18K), soccer 0.8 Ha ($9K).
- Not maintaining systems = poor performing system = increase water use = higher costs
- Case study 4, page 29, key findings
- Irrigation Lifespan approx. 20 years
- 65 – 75% Repair or adjust the current irrigation system to achieve the acceptable performance range
- 50 – 64% Upgrade the current irrigation system components to achieve the acceptable performance range
- < 50% Replace the current irrigation system & design a new system to achieve the acceptable performance
- Business case for change, $60-80,000 best design irrigation system for AFL ground

Auditing of irrigation systems

Preventative audits

- On site, visual, labour intensive
- Minor maintenance <$2000/ system
- Frequency, pre summer service and overhaul, monthly spring/ summer audit, once in autumn & winter
- Benefits - immediate, increase uniformity
- What to audit? Various formats, check with irrigation suppliers, system is functioning correctly, leaks, boxes, backflow,

Preventative audits

- Rotation i.e. not rotating to desired degree (continuous 360° for full-circle sprinkler); slow rotation; no rotation
- Damaged i.e. wiper seal damaged/broken; rubber top damaged/removed; riser stem damaged/broken; nozzle damaged/broken
- Vertical alignment i.e. riser stem ‘tilt’ or angle affecting performance of sprinkler
- Clear Clearance i.e. riser stem not clearing surrounding ground/turf level due to sprinkler too low in ground
- Grass obstruction i.e. grass/turf interfering with nozzle stream (clearance would be good if grass height was maintained)
- Arc adjustment i.e. part-circle sprinklers over-spraying outside of turf area

Auditing of irrigation systems

Detailed audits

- Irrigation Performance Evaluation Report
- Can catch versus Desktop aerial (near maps, drone?)
- Labour intensive/ high cost, $1400-$1500 full can catch versus desktop
- Pressure at base sprinkler/ (meter) static, dynamic pressure
- Internal versus external, training?
- One off audit?

- **Irrigation investment including technology**

- Central Control Systems

1. System requirements (80% similar to other councils, slight changes)
2. Procurement (tender, direct discussion)
3. Capital Cost (high up front cost)
4. Maintenance Costs (on going operational costs)

Central Control Systems

System requirements (80% similar to other council, slight changes)

- Remote control of system, reduction in labour costs on site
- Stand alone Desktop PC versus web based (software uploads, PC upgrades)
- Mobile applications, plug in devices to controller, I-pad, I-phone
- Recording usage (flow meters)
- Detecting faults (flow parameters, high/ low flow)
- User friendly, use the system, others using
- Weather stations (minor/ major), 20-40% over watering irrigation not change due to varying weather conditions
- Reports, exporting data, highlighting issues/ capital funds

Central Control Systems

Procurement (funding, tender, direct discussion)

- Gaining capital funding, constraints, good business case, savings approx. on labour costs 30%, i.e. 3 days for 3 staff to switch off on site controllers, approx. 100 sites
- Tender EOI/ contract, long process/ costly, evaluation panel
- Direct discussion, shorter process/ less cost, 2 recent examples of inviting companies, using the system, referees, speak to other councils
- Deal with one of the larger suppliers

Central Control Systems

Capital Cost (high up front cost, tender?)

- (guidelines page 33, case study 5), replacing payback 2 years, 10% water efficiency, 30% reduction in labour costs
- Approx. cost installation depending on system complexity (flow meters, standard system)
- Standard system, cost / system, wiring/ trenches, flow meter, master valve etc. = $4000 (retrofit)
- Flow meters, cost / system = $4,000-7,000
- Weather station, $5,000-20,000
- Staged roll out over multiple years due to high cost
- Elite/ high end system cost more to install and to maintain, i.e. $5300 / annum compared to standard, $5000/ 33 sites

Central Control Systems

Maintenance (upfront plan less hassle, cost later)

- Maintenance, faults, 24 hour hotline, overseas
- Technical support, upfront plan, 24hrs access via phone = $150-200/ site
- Upgrade PC's, obsolete = included in plan ($1300/ every 3 years)
- Data plans (sim cards) 1-3 years. More data transfer (flow meters sending faults, higher usage) 3-5MG= $300/ site
- Upgrading telecommunications by Dec 2016 (2G to 3G) cost to upgrade = $7000, other councils paying even more

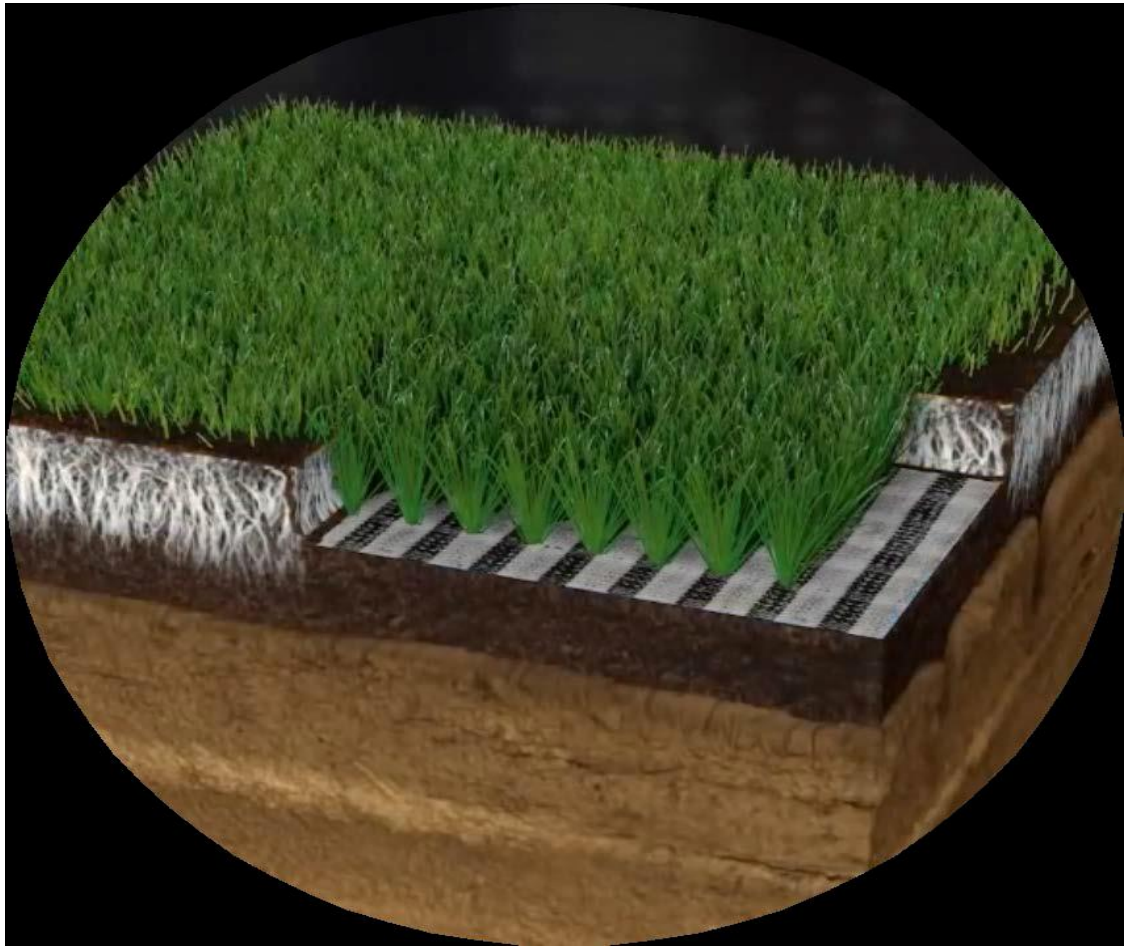
Other Technology

- Moisture Sensors - Stand alone versus incorporated into Central control system, cost $6000-7000, limited maintenance, $800/ 3 years (data), 20mm = moisture depth, alter irrigation to needs, small top up for turf, more for trees.
- Smart meters, stand alone, portable, $1000 purchase, $100 maintenance cost/ annum (website, calibration), high use water sites, pools, large building large open spaces
- Recycled water - slightly cheaper Kl cost, high upfront cost infrastructure paid off over years, funded by water authorities, can use storm water, water from recycling waste water etc.
- iiri smart controller, uses Bluetooth/ I-phone, retrofits most valves, battery (no power), must be near site, sim card?

Other Technology

- Hybrid Turf - New to Australia, 40% more usage, 2 products, injected fibre or a woven mat (XtraGrass)100% recycled, breaks down in months
- In-situ or pre grown large rolls
- On-going Costs – Once installed, XtraGrass costs no more than a standard grass pitch to maintain. Ultimately, with less divots there will be less maintenance = less water/ costs, provides a support for grass roots to anchor
- Full synthetic versus Hybrid, half the cost to install, can combine hybrid and natural turf, i.e. hybrid in goal squares, remainder of oval natural turf
- Can be used with no natural turf present
- Promotes grass establishment by shading the seedlings during summer

Hybrid Turf



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Hybrid Turf

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Main Messages

- Don’t reinvent the wheel, lots of information, talk to open space managers/ coordinators from other councils, suppliers (advice for free), consultants

- Doing Something is better than nothing! Investment = payback/ savings (i.e. preventative/ DU audits, upgrading system, central control, etc.)

- What’s the future of irrigation in open spaces?

Management of functional open space at Hume City Council

Jason Summers

Manager Parks & Open Space

HUME CITY COUNCIL

Introduction

- Hume City background & conditions
- Summary of Hume's Water management
- Planning
- Monitoring
- Managing
- Summary
- Question time

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N
To Sydney and the Goulburn Valley
To Northern Victoria
Sunbury
HUME
Kalkallo
Mt Ridley
Craigieburn
Roxburgh Park
Somerton
Bulla
Greenvale
Campbellfield
Melbourne Airport
Broadmeadows
Gladstone Park
Tullamarine
TULLAMARINE FWY
CALDER FWY
HUME HWY
30 kilometres
15 kilometres
To Adelaide and Western Victoria
WESTERN HWY
RING RD
WESTERN
CITYLINK
EASTERN FWY
MELBOURNE CBD
WEST GATE FWY
MONASH FWY
Port of Melbourne
PRINCES

City Profile

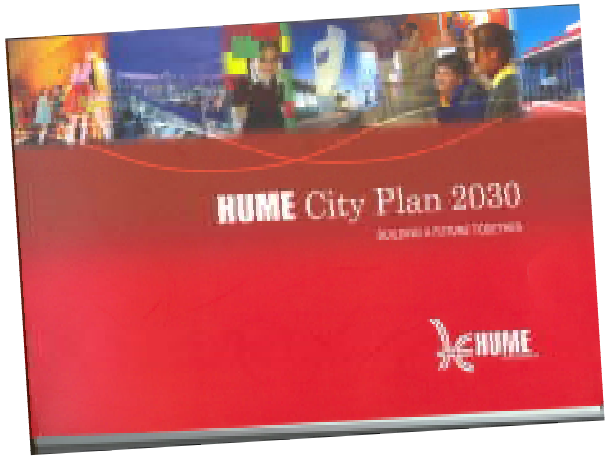
- **Area:** 503 sq.km
- **Population:** 183,263
- **Growth rate:** 3.7% pa
- **Aged 17 & under:** 27.8%
- **Born Overseas:** 29.2%
- **Country of origin:** Turkey(3.9%)
  Iraq (3.0%)
  UK (2.7%)
  Italy (1.7%)
  Lebanon (1.5%)
  Malta (1.2%)

(as at August 2012)

HUME CITY COUNCIL

KEY OUTCOMES OF COUNCIL'S 2030 PLAN

- To use recycled and Grey-water where available.
- To ensure that the predominant source for irrigation is recycled water.
- To create a sustainable city whilst reducing the impacts on the local environment.



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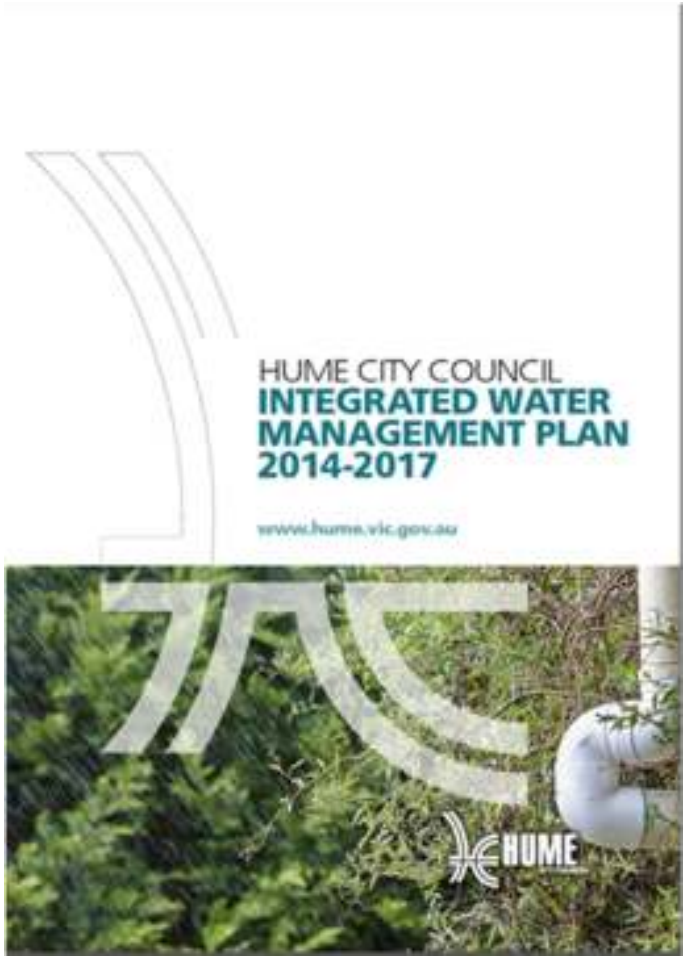

Hume Integrated Water Management Plan

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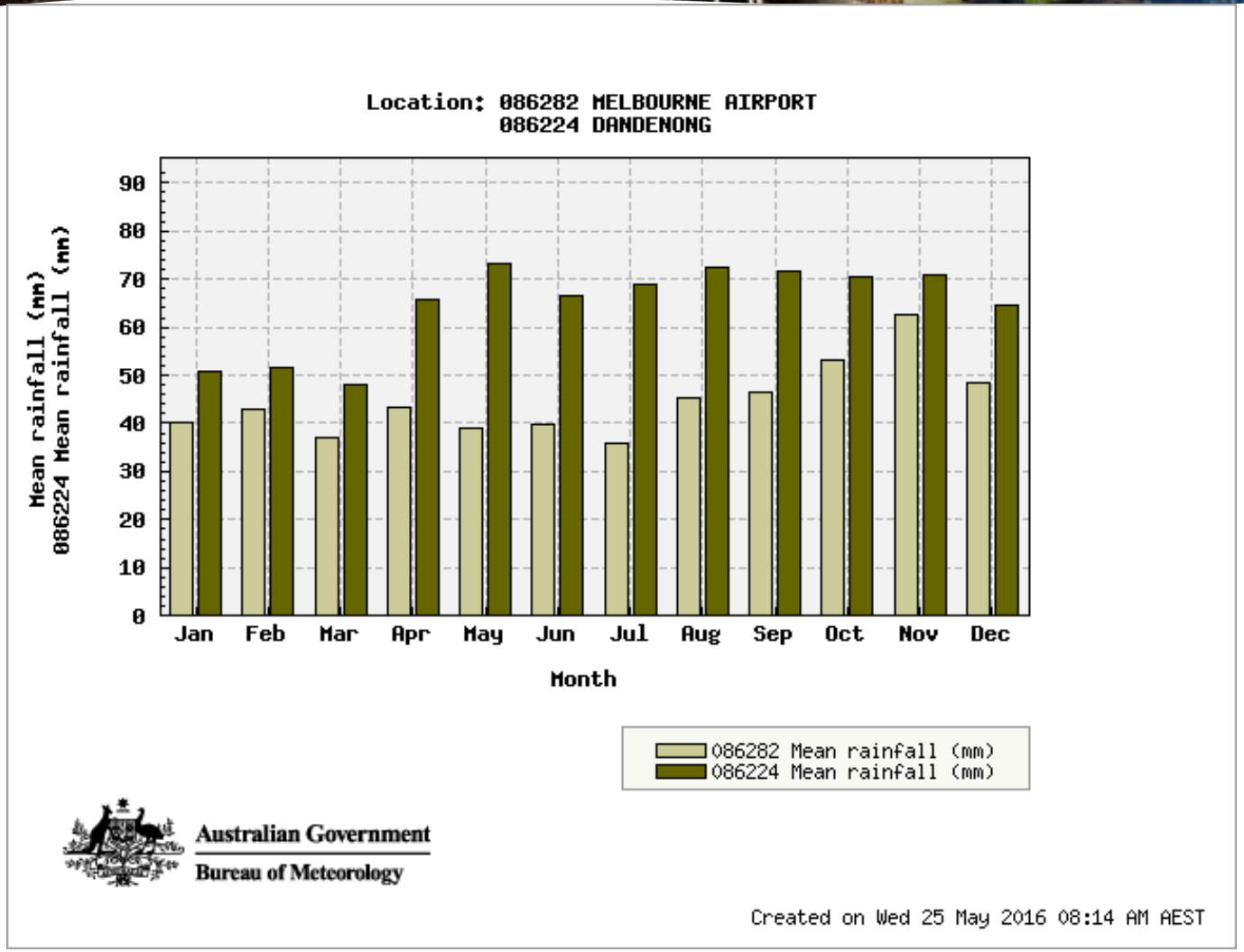

Rainfall Comparison

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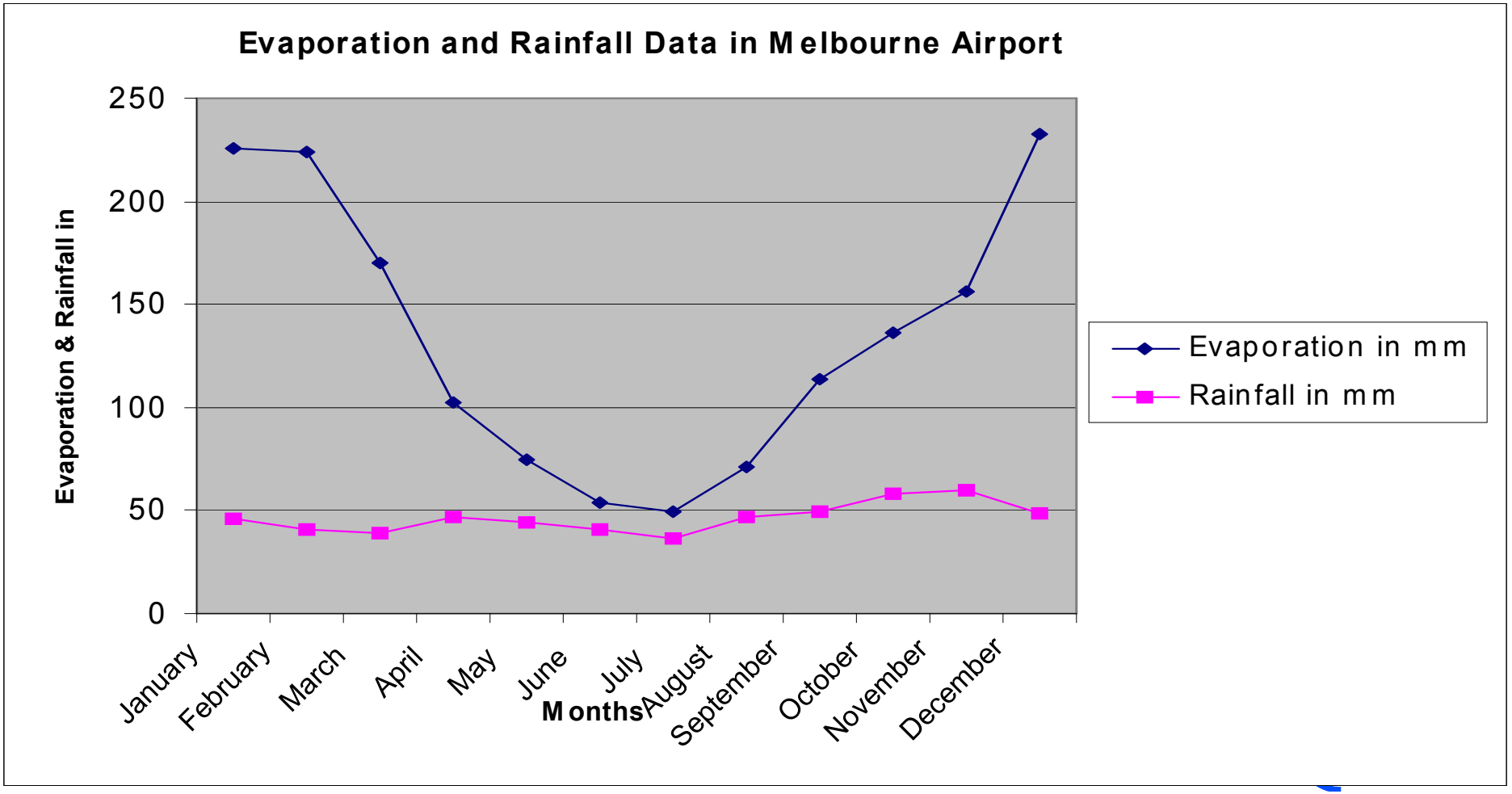
Evaporation Vs Rainfall in Hume



Hume's Approach

- Long history of using recycled water
- We have two local treatment plants in our city
- 2 golf courses over 30 years
- Started Sunbury program in 2003
- Currently have 90 ML used for recycled water irrigation
- Recently have class A recycled water in Craigieburn
- Started storm water harvesting in 2009 16ML

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Summary of Hume's Water sources

- Sunbury Class B Recycled water scheme
- Craigieburn linked to Aurora Class A recycled water scheme
- Bore water
- Potable water – Mains
- Stormwater lake Mc Ivor, Section road Greenvale & Merlynston Creek

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Turf Maintenance Budget

- Turf Mowing and Materials $415,748 p/a
- Premier Sports Grounds $256,248 p/a
- Turf Renovation $122,000 p/a
  - Top dressing
  - Seeding
- Water Conservation $101,000 p/a
  - Seeding
  - Line planting
  - Sodding
  - Wetting agent
  - Fertilisers
- Capital Works $90,000 p/a 2009 - 2013

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Additional Irrigation Sources – Recycled Water Clarke Reserve Sunbury

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Additional Irrigation Sources – Recycled Water Clarke Reserve Sunbury

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Stormwater Greenvale Rec Reserve

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Stormwater Greenvale Rec Reserve

HUME
CITY COUNCIL

Boardman Reserve tank 240,000lts

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CITY COUNCIL

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CITY COUNCIL

Highgate – AFL, TAC cup, VFL

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John Ilhan – Premier League soccer

Premier league Cricket – Greenvale Kangaroos

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What are we irrigating

- 58 sports fields:
- Football and Cricket,
- Soccer,
- Rugby,
- 2 synthetic one soccer one Hockey (no irrigation)
- Total Area: 82.5 hectares
- Budget 1,164 million
- Plus 12 passive irrigation areas approx 5.5ha

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Monitoring Program 2015/16

- Weekly site audits whilst mowing
- Twice yearly independent condition assessments
- Water quality testing of storm and recycled systems annually
- Soil tests Yearly
- Full Irrigation audits once a year
- Operational audits throughout the irrigation period
- Measure water use monthly and report to water authorities

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Soil Analysis

SOIL ANALYSIS REPORT

CLIENT	Hume City Council C/- Peter Budge Roxburgh Pk No.2 East	Date No. of samples	5/08/09 1 of 1

Sample No: 20987363		LOW			MED			HIGH			IDEAL	COMMENTS
pH (water)	5.6	X	X	X							6.0-7.0	moderately acid
Elect Cond. (mS/cm)	0.23	X	X	X	X	X					< 0.27	moderate
Total Salts (ppm)	683	X	X	X	X	X					< 800	moderate
Phosphorus (ppm) Col. P.	85	X	X	X	X	X	X				50 - 80	good
Cations (meq%)												
Potassium	0.9	X	X	X	X	X	X	X	X	X	0.5-0.6	good
Calcium	8.0	X	X	X	X	X	X				> 3.5	good
Magnesium	2.1	X	X	X	X	X	X	X			0.8-1.0	slightly high
Ca/Mg Ratio	3.8	X	X	X	X	X					2 - 5	in balance
Sum of Cations (meq%)	11.3	X	X	X	X	X	X	X	X	X	> 5	good nutrient retention
% of C.E.C.												
Potassium	8	X	X	X							> 10%	low
Calcium	71	X	X	X	X	X	X				60-70%	good
Magnesium	18	X	X	X							20-23%	low
Sodium	3	X	X	X	X						< 5%	moderate
Trace elements (ppm)												
Sulphur	84	X	X	X	X	X	X	X	X	X	10 - 50	very high
Zinc	5.1	X	X	X	X						1 - 10	ok
Copper	0.6	X	X								1 - 10	low
Manganese	41.0	X	X	X	X	X	X	X	X	X	0.1- 4	very high
Iron	240	X	X	X	X	X	X	X	X	X	10 - 60	very high
Boron	1.0	X	X	X	X	X	X				0.3 - 1.0	ok
Chloride	51	X	X	X							< 100	low, good
Organic Carbon (%)												

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Figure 1: Ground Condition & Surface Hardness

Sportsground	Ground Condition	Surface Hardness
Anderson Reserve No. 1 (west)	90%	90
Anderson Reserve No. 2 (east)	93%	72
Barrymore Road Reserve - East	90%	115
Barrymore Road Reserve - West	87%	121
Boardman Reserve - Athletics infield	92%	75
Boardman Reserve - Athletics track	83%	123
Boardman Reserve - No. 1 (west)	91%	106
Boardman Reserve - No. 2 (middle)	93%	99
Bradford Ave (Greenvale)	53%	131
Broadmeadows Valley Park - Athletics Infield	85%	135
Broadmeadows Valley Park - Athletics Track	88%	119
Broadmeadows Valley Park - Soccer 1 (west)	93%	86
Broadmeadows Valley Park - Soccer 2 (east)	82%	102
Bulla Reserve	79%	117
D.S Aitken Reserve	90%	96
Donnybrook Reserve No. 1 (John Laffan)	81%	71
Donnybrook Reserve No. 2	86%	90
Drummond St (Greenvale)	89%	96
Gibb Reserve - Football	87%	115
Gibb Reserve - Rugby	80%	123
Gladstone Park - Soccer East	87%	83
Gladstone Park - Soccer West	88%	95
Goonawarra Rec. Reserve	94%	79
Goonawarra Softball North	93%	80
Goonawarra Softball South	93%	80
Greenvale Rec. Reserve No. 1	93%	94
Greenvale Rec. Reserve No. 2	93%	89
Greenvale Rec. Reserve No. 4	91%	70
Highgate Oval No. 1	93%	55
Highgate Oval No. 2	91%	84
Hothlyn Reserve	86%	109
Jacana Reserve - No 1	94%	85

75% 40 120

Acceptable Condition
Marginal Condition
Unacceptable Condition

Acceptable - no issues with hardness
Hard / Soft patch(es) - acceptable hardness but hard or soft areas are present
Unacceptable - excessively hard or soft

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Figure 1: Ground Condition & Surface Hardness

Sportsground	Ground Condition	Surface Hardness
Jacana Reserve - No 2	93%	75
Jack Ginifer Reserve	87%	87
Jack Roper Reserve	88%	141
Langama Park - Soccer Main	93%	89 *
Langama Park Playing Fields - Rugby East	88%	91
Langama Park Playing Fields - Rugby West	87%	101 *
Langama Park Playing Fields - Soccer East	88%	104 *
Langama Park Playing Fields - Soccer West	83%	124
Laura Douglas Reserve - Soccer 1	87%	101 *
Laura Douglas Reserve - Soccer 2	83%	102 *
Laura Douglas Reserve - Soccer 3	83%	101 *
Malcolm Creek Reserve	56%	129
McEwen Drive (Sunbury)	70%	123
Melrose Dr. (Tullamarine)	93%	79
Patulous Lane	77%	97 *
Progress Reserve - No. 1 (east)	71%	102 *
Progress Reserve - No. 2 (west)	89%	112 *
Roxburgh Park - Homestead School	69%	125
Roxburgh Park - No. 1 (west)	93%	85
Roxburgh Park - No. 2 (east)	90%	94
Seabrook Reserve	85%	99 *
Seth Raistrick Reserve	93%	85
Spring St. (Tullamarine)	93%	90
Sunbury Rec. Reserve (Clarke)	94%	105 *
Tulsa Drive (Sunbury)	87%	99 *
Vic Foster Reserve	74%	133
Westmeadows Reserve	90%	126
Willowbrook Reserve	94%	85

75% 40 120 150

Acceptable Condition
Marginal Condition
Unacceptable Condition

Acceptable - no issues with hardness
* Hard / Soft patch(es) - acceptable hardness but hard or soft areas are present
Unacceptable - excessively hard or soft

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Soil Nutrient Analysis - Results

City of Hume

May 2016

	Ideal Range	Langama Soccer	Langama Play. Fields		Greenvale No. 1	Greenvale No. 2	Greenvale No. 4		Lakeside No. 1 west	Lakeside No. 2 east
pH (water 1:5)	6.0 - 7.0	6.3	6.1		6.2	6.6	7.2		6.1	5.3
Electrical Conductivity (mS/cm) (water 1:5)	< 0.27	0.19	0.37		0.15	0.16	0.08		0.08	0.55
Total salts (ppm) (water 1:5)	< 800	564	1099		446	475	238		238	1634
Phosphorus (Colwell) (ppm)	50 - 80	71	50		30	30	48		62	120
Exchangeable cations										
Potassium (meq /100g)	0.5 - 0.6	0.5	1.2		0.3	0.3	0.2		0.3	0.7
Calcium (meq /100g)	> 3.5	2.9	4.7		1.8	2.1	2.1		1.2	6.5
Magnesium (meq /100g)	0.8 - 1.0	1.7	3.7		0.8	0.8	0.9		0.5	1.3
Calcium Magnesium Ratio	2 - 5	1.7	1.3		2.2	2.5	2.4		2.3	5.0
Sum of Cations (CEC) (meq%)	> 5	5.6	11.1		3.2	3.4	3.4		2.3	8.9
% of CEC (Base Saturation)										
Potassium (%)	> 10	8	11		10	8	6		14	7
Calcium (%)	60 - 70	51	42		56	61	63		53	73
Magnesium (%)	18 - 23	30	33		26	24	27		23	15
Sodium (%)	< 5	8	13		5	3	2		6	3
Trace Elements										
Sulphur (ppm)	10 - 50	31	84		45	30	13		9	320
Zinc (ppm)	1 - 10	6.7	5.5		2.1	2.1	8.5		3.7	3.9
Copper (ppm)	1 - 10	0.5	0.5		0.2	0.1	1.9		0.3	0.4
Manganese (ppm)	1 - 4	10.0	6.5		1.9	2.2	1.8		7.3	12.0
Iron (ppm)	10 - 75	290	440		92	54	33		140	280
Boron (ppm)	0.3 - 1.0	0.7	1.2		0.4	0.3	0.3		0.3	0.6
Chloride (ppm)	< 100	65	170		38	34	20		24	62
Organic carbon (%)	1.2 - 2.5									
Sample Number		*21777401*	*21777402*		*21777496*	*21777497*	*21777498*		*21777403*	*21777404*

low
medium
high

DISCLAIMER: Results are based on the analysis of the samples as received.
Because of the variability of the sampling procedures, environmental and managerial conditions, the Company does not accept liability for lack of performance based on these recommendations.
Recommendations are made in good faith based on the sample and information supplied.

SportsTurf Consultants (Aust.) Pty Ltd
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Soil Nutrient Analysis - Recommendations

City of Hume

May 2016

MATERIALS (rate / ha)	Langama Soccer	Langama Play. Fields		Greenvale No. 1	Greenvale No. 2	Greenvale No. 4		Lakeside No. 1 west	Lakeside No. 2 east
Immediate Remedial Action									
Agricultural Lime		1 tonne		1 tonne				1 tonne	2 tonne
Dolomite Lime									
Superphosphate				250 kg	250 kg	150 kg			
Potassium Sulphate	200 kg			200 kg	200 kg	200 kg		200 kg	
Gypsum	2 tonne			2 tonne	2 tonne	2 tonne		2 tonne	
Magnesium Sulphate				200 kg	200 kg	200 kg		200 kg	
Trace Element Mix									
Maintenance Program									
NK (20:0:16) Every 6-8 weeks to premier grounds or as desired at 200kg/ha. Twice a year to less important grounds at 300 kg/ha	✓	✓							✓
NPK (22:5:17) Every 6-8 weeks to premier grounds or as desired at 200kg/ha. Twice a year to less important grounds at 300 kg/ha				✓	✓	✓		✓	

NOTE: Multiple applications of a product should be separated by 4 to 6 weeks.
Ensure all products are well watered in or applied prior to rainfall.

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Water Nutrient Analysis - Results

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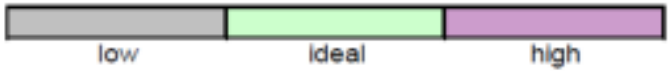
May 2016

	Ideal Range	GREENVALE DAM	HIGHGATE	LAKE MCIVOR
pH (water)	*5.5 - 7.5*	7.5	6.7	7.8
Electrical Conductivity (mS/cm)	*< 0.80*	0.26	0.12	0.19
Total salts (ppm)	*< 500*	170	80	130
Nitrate Nitrogen (mg/L)	*< 10*	1.9	1.0	1.0
Phosphorus (mg/L)	*< 0.2*	0.1	0.1	0.1
Potassium (mg/L)	*0.5 - 15*	5	1	3
Calcium (mg/L)	*20 - 50*	13	6	10
Magnesium (mg/L)	*< 100*	8	3	4
Sodium (mg/L)	*< 200*	27	11	25
Chloride (mg/L)	*< 200*	22	18	22
Carbonate (meq/L)	*0*	0	0	0
Bicarbonate (meq/L)	*< 2.0*	2.0	2.0	2.0
Sulphur (mg/L)	*< 100*	7	3	2
Iron (mg/L)	*< 1.0*	0.3	< 0.1	1.2
Boron (mg/L)	*< 0.5*	< 0.1	< 0.1	< 0.1
Copper (mg/L)	*< 0.2*	< 0.1	< 0.1	< 0.1
Zinc (mg/L)	*< 2*	< 0.1	< 0.1	< 0.1
Manganese (mg/L)	*< 0.2*	< 0.1	< 0.1	< 0.1
Aluminium (mg/L)	*< 5*	0.7	< 0.1	0.6
Salinity Class	*1*	1	1	1
Sodicity Class	*0*	0	5	0
Sodium Adsorption Ratio (SAR)	*< 6*	1.5	0.9	1.7
Residual Sodium Carbonate (RSC) (meq/L)	*< 1.25*	0.7	1.5	1.2
Water Hardness	*< 150*	64	26	40

mg/L = ppm



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Water Quality

Infiltration Rates (mm/hr)

Oval 1 West	mm/hr
1 Nth	122
2 East	140
3 South	98
4 West	136
Average	**124**

Oval 2 East	mm/hr
1 North	22
2 East	40
3 South	48
4 West	16
Average	**32**

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How do we use the data

- We take all the reports and decide which sites need works
- Some works directed to the top dressing and general maintenance programs
- Large jobs like warm season conversion and irrigation upgrades are funded from Capital Works funding
- We also work with Leisure to determine priorities from club feedback and future demands from certain sports.
- We plan and build a new subdistrict site every two years from the rapid development occurring in the city.

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Renovation & Capital Program 2015/16

- Top dressing 23 Ha 2,140 m3
- Seeding- Rye Grass 8 Ha 1,600kg
- Seeding- Couch Grass 13.8 Ha/ 966kg
- Fertilising 126 Ha/ 19,000kg
- Verti-draining 70.5Ha
- Mowing – 80.1 Ha Weekly
- Broadleaf 62.6Ha 323 litres chemical
- Warm season conversion
- 4 grounds 6.2 H/a conversion to warm season
- Capital Works funding for warm season conversion and drainage at two grounds

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DAKOTA

Warm Season Grass

- Warm season grass roll-out program since 2008 – 2016 has converted over 54 Ha on 45 sites
- Warm season transition involving:
  - Selective spraying cool season
  - Scarify surface/verti-drain
  - Top dress/level
  - Seeding/sprigging and muck racking
  - Fertilise/wetting agent
  - Irrigating
  - Takes two years to get full conversion
  - We do over sow our premier grounds with cool season grasses

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Water Allocation 2015/16

Water Type	Month (March)	Usage to date	Total Allocation
Potable	17.691 ML	127.250 ML	186 ML
Recycled	8.754 ML	56.594 ML	60 ML
Dam	1.973 ML	13.203 ML	-
Bore	1.232 ML	15.112 ML	-
Lake allocation	2.654 ML	11.084 ML	16 ML
Highgate (stand-alone allocation)	3.839 ML	21.198 ML	20 ML

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Water Allocation 2015/16

- 111 ML with potable water
  - 38 Sports fields
- 60 ML with recycled water
  - 20 Sports Fields
- 30 ML with Alternative Water sources
  - Dam Water- 10 ML 2 Sports fields
  - Storm Water- 8 ML 2 Sports fields
  - Bore Water- 6 ML 2 Sports fields
- Total Grounds Watered- 58

Water Conservation in Hume

- Long history of using recycled water
- We have two local wastewater treatment plants in our city
- 2 golf courses using recycled water for over 30 years
- Started Sunbury program in 2003
- Currently have 60 ML used for recycled water irrigation
- Recently have class A recycled water in Craigieburn
- Started storm water harvesting in 2009 16ML

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Summary of Hume's Water sources

- Sunbury Class B Recycled water scheme
- Craigieburn linked to Aurora Class A recycled water scheme
- Bore water
- Potable water – Mains
- Storm water lake Mc Ivor Greenvale Merlynston creek
- 30% of ovals use an alternative water source

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Lakeside Drive Stormwater

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Lakeside Drive Stormwater project

- To further realise council's water reduction target by saving up to 8 ML per year for two AFL ovals
- Council also converted the grass to warm season grasses to save even more water.
- Council received funding from the Smart water fund to use this as a demonstration site

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Passive Park Irrigation Program

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Creating sustainable landscapes

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Trees growing in filter media two years after planting

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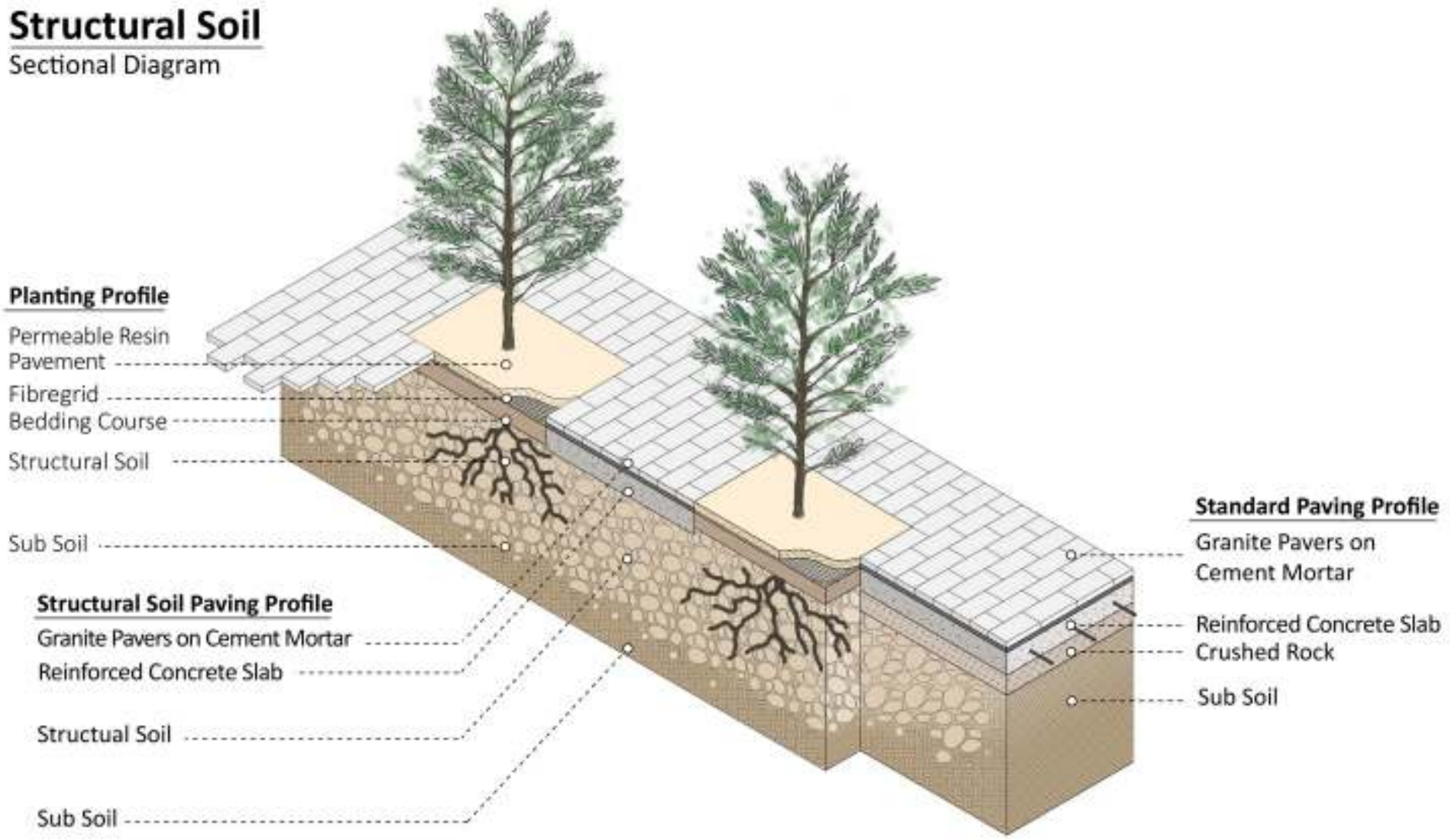
Trees growing in filter media four years after planting

Trees growing in filter media seven years after planting

Tanderrum Way Stage 2 -
Broadmeadows

Structural Soil

Sectional Diagram



Summary

Three main points

1.know you assets

2.Measure your performance

3.Adjust and manage your programs with accurate data

- Our City is growing and the estate is expanding
- Our Irrigated landscapes both active and passive are important assets in out city
- We try to produce resilient landscapes
- Looking at ways to reduce inputs and maximise outcomes
- Happy to share any information!

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Thanks for your time!
Questions?

Best Practice Guidelines for Functional Open Space

Using Water Data to Improve Irrigation Performance

Richard Dilena
City of Greater Geelong
rdilena@geelongcity.vic.gov.au

References to applicable sections of the Best Practice Guidelines are made during the presentation.

Why monitor?
Data is everything!

Refer: Section 4.7.2, page 32

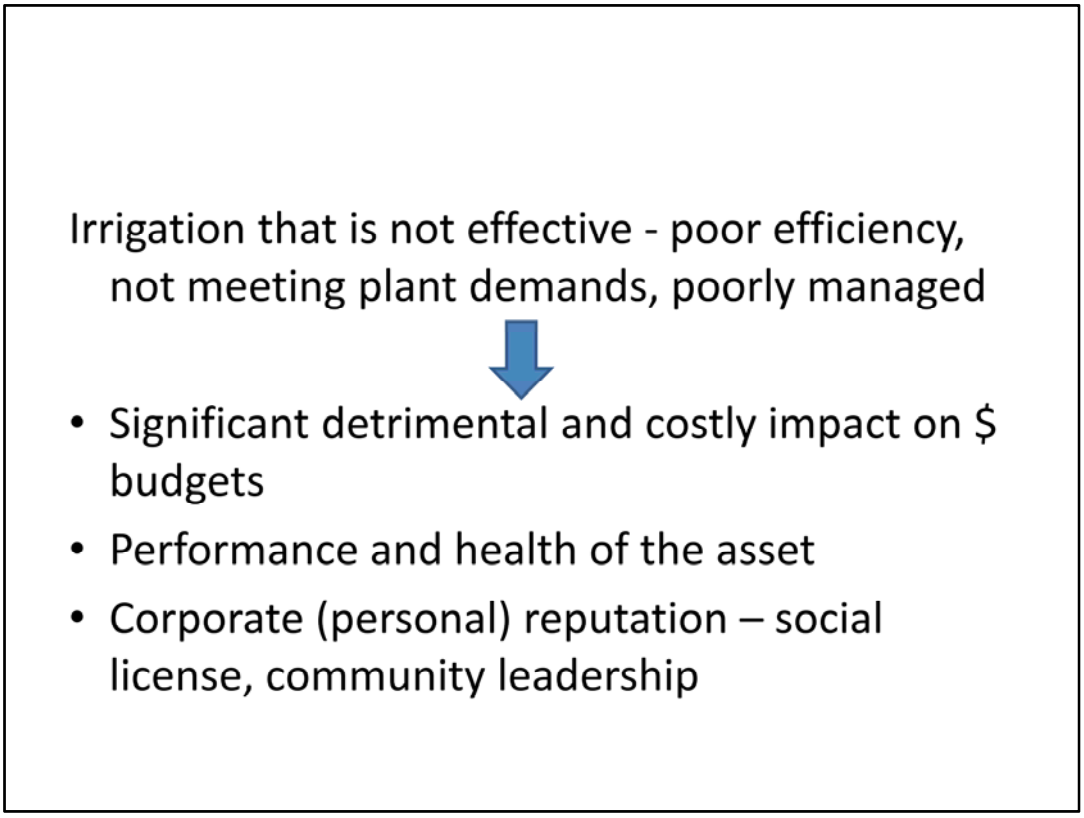
- Detect leaks, faults (automated system responses)
- Water supply issues
- Asset management – reduction in system efficiency through wear
- Advanced scheduling - Et, flow management

Data on water use is essential for managing irrigated assets, and can provide a wealth of information. It is probably the easiest to obtain that can have the greatest benefits/outcomes.

Data provides opportunities for key efficiency outcomes – simple to complex - Detecting leaks in a system, water supply issues, though to advanced precision irrigation schedules.

Effective irrigation

Effective irrigation = applying the right amount of water at the right time and place to meet a plants water requirement for healthy growth.



Irrigation that is not effective will result in wasted maintenance resources, and impact on the health and useability of the asset. E.g. overwatering/under watering will result in increased stress in turf and therefore less playing capacity, increased weeds and disease. As leaders in our field, there is an expectation that we irrigate effectively to minimise waste, act as a role model to the community, and to ensure equitable outcomes across the community.

Obtaining data

Data via:

Flow sensors – connected to controllers - real time data

Water meters – manual read, data loggers

Two main sources of data:
•Flow sensors that are part of irrigation systems and control systems.
•Water meters that are manually read once per week by maintenance staff, or connected to data loggers which supply reports on a weekly basis.

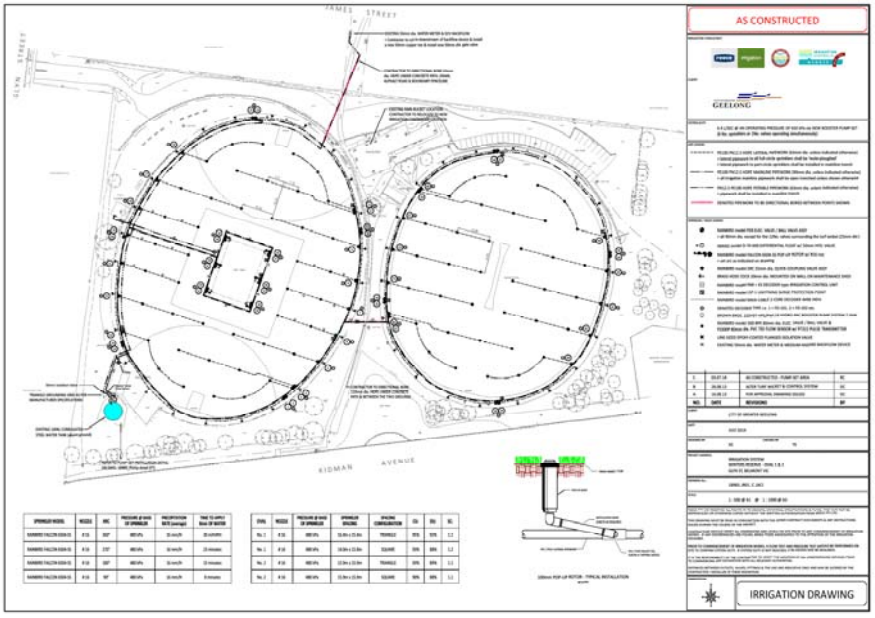
+90% of our irrigation systems use flow sensors.

Setting up a site
Three step process

- Determine a seasonal water/irrigation budget
- Determine system capacity – audit and testing
- Monitor water use and adjust controller settings to meet required outcome (sports grounds 8mm/irrigation cycle)

A basic three step process to setting up a site for effective irrigation:
•Determine the volume of water required for a season to maintain the asset to the required standard
•Test and determine the how much the irrigation system can apply
•Monitor water use and adjust the system to meet the required outcomes.

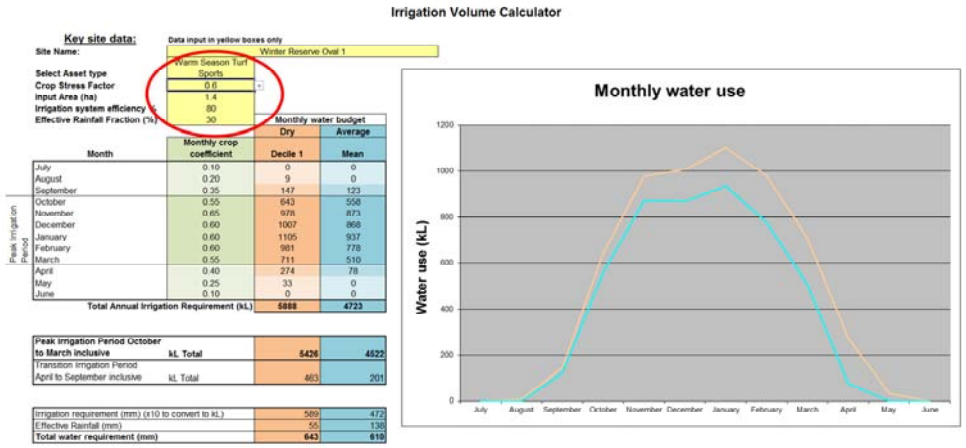
Case Study – Winter Reserve



A site that has had a new irrigation system installed on both ovals.
Previous irrigation system had an overall total of 13 stations across both grounds – was not effective at maintaining the site.
New system designed to 91%DU and scheduling coefficient of 1.1.
Uses a pump to boost pressure as town water supply problematic.

Step 1 - Season Irrigation Budget

Refer: Section 3



Irrigation Volume Calculator

Key site data: Data input in yellow boxes only

Site Name: Winter Reserve Oval 1

Select Asset type: Warm Season Turf / Sports

Crop Stress Factor: 0.6

Input Area (ha): 1.4

Irrigation system efficiency %: 80

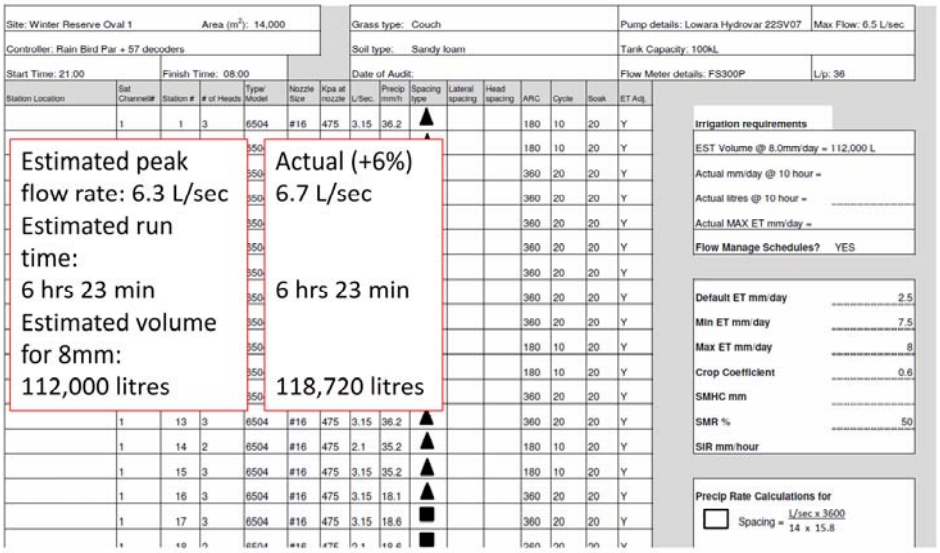
Effective Rainfall Fraction (%): 30

Month	Monthly crop coefficient	Monthly water budget Dry Decile 1	Average Mean
July	0.10	0	0
August	0.20	9	0
September	0.35	147	123
October	0.55	643	558
November	0.65	976	873
December	0.60	1007	868
January	0.60	1105	937
February	0.60	981	778
March	0.55	711	510
April	0.40	274	78
May	0.25	33	0
June	0.10	0	0
Total Annual Irrigation Requirement (kL)		5888	4723
Peak Irrigation Period October to March inclusive kL Total		5426	4522
Transition Irrigation Period April to September inclusive kL Total		463	201
Irrigation requirement (mm) (x10 to convert to kL)		589	472
Effective Rainfall (mm)		55	138
Total water requirement (mm)		643	610

Irrigation budget for oval 1.
Based on:
•Type of grass (warm season – kikuyu)
•Crop stress factor – standard we want the site maintained to. 0.6 equates to a local football ground with high use.
•The size of the oval – 1.4Ha
•Irrigation system efficiency – estimated at 80% (pending catch can test)
•Effective rainfall – how much rainfall is beneficial to the grass (generally 40%)
Two water use scenarios given – average rainfall season and low rainfall season.

Step 2 – Determine System Capacity

Refer: Section 4



Site: Winter Reserve Oval 1 Area (m^2): 14,000 | Grass type: Couch | Pump details: Lowara Hydrovar 22SV07 | Max Flow: 6.5 L/sec

Controller: Rain Bird Par + 57 decoders | Soil type: Sandy loam | Tank Capacity: 100kL

Start Time: 21.00 | Finish Time: 08.00 | Date of Audit: | Flow Meter details: FS300P | L/p: 36

Station Location	Sat Channel#	Station #	# of Heads	Type/ Model	Nozzle Size	Kpa at nozzle	L/Sec	Precip mm/h	Spacing type	Lateral spacing	Head spacing	ARC	Cycle	Soak	ET Adj
	1	1	3	6504	#16	475	3.15	36.2	▲			180	10	20	Y
				350								180	10	20	Y
				350								360	20	20	Y
				350								360	20	20	Y
				350								360	20	20	Y
				350								360	20	20	Y
				350								360	20	20	Y
				350								360	20	20	Y
				350								180	10	20	Y
				350								180	10	20	Y
	1	13	3	6504	#16	475	3.15	36.2	▲			360	20	20	Y
	1	14	2	6504	#16	475	2.1	35.2	▲			180	10	20	Y
	1	15	3	6504	#16	475	3.15	35.2	▲			180	10	20	Y
	1	16	3	6504	#16	475	3.15	18.1	▲			360	20	20	Y
	1	17	3	6504	#16	475	3.15	18.6	■			360	20	20	Y

Estimated peak flow rate: 6.3 L/sec

Estimated run time: 6 hrs 23 min

Estimated volume for 8mm: 112,000 litres

Actual (+6%) 6.7 L/sec

6 hrs 23 min

118,720 litres

Irrigation requirements

EST Volume @ 8.0mm/day = 112,000 L

Actual mm/day @ 10 hour =

Actual litres @ 10 hour =

Actual MAX ET mm/day =

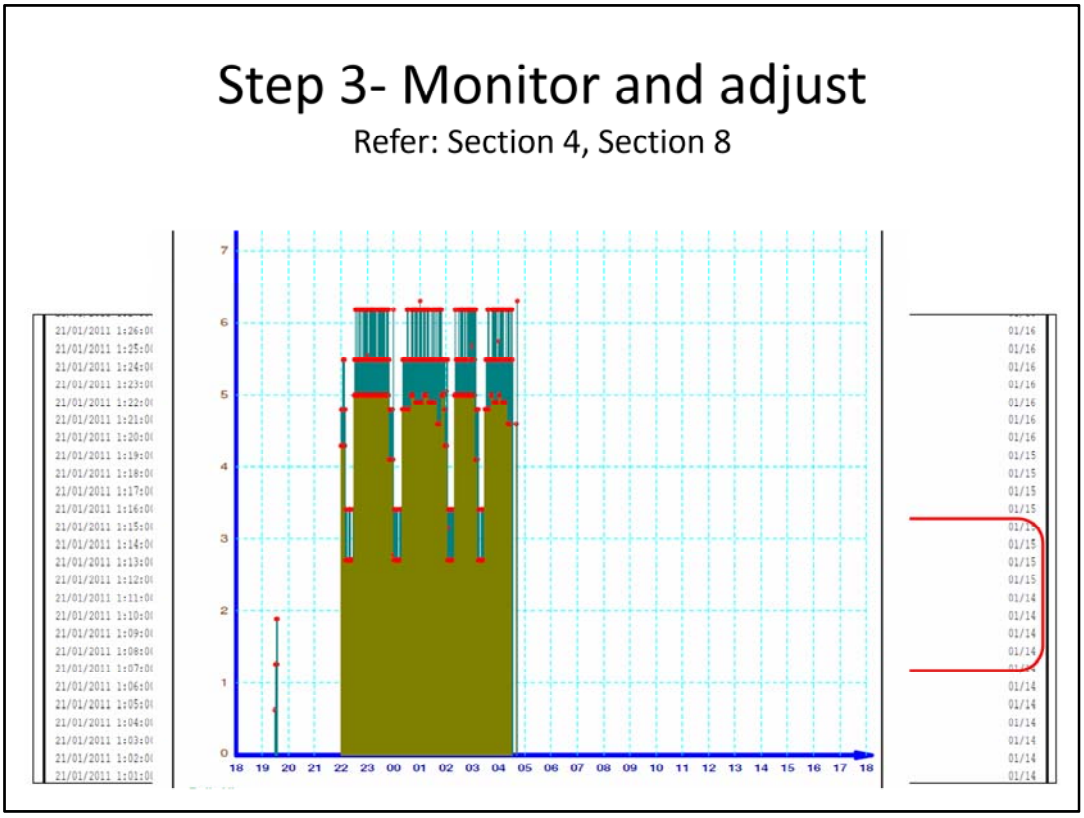
Flow Manage Schedules? YES

Default ET mm/day	2.5
Min ET mm/day	7.5
Max ET mm/day	8
Crop Coefficient	0.6
SMHC mm	
SMR %	50
SIR mm/hour	

Precip Rate Calculations for

☐ Spacing = $\frac{L/sec \times 3600}{14 \times 15.8}$

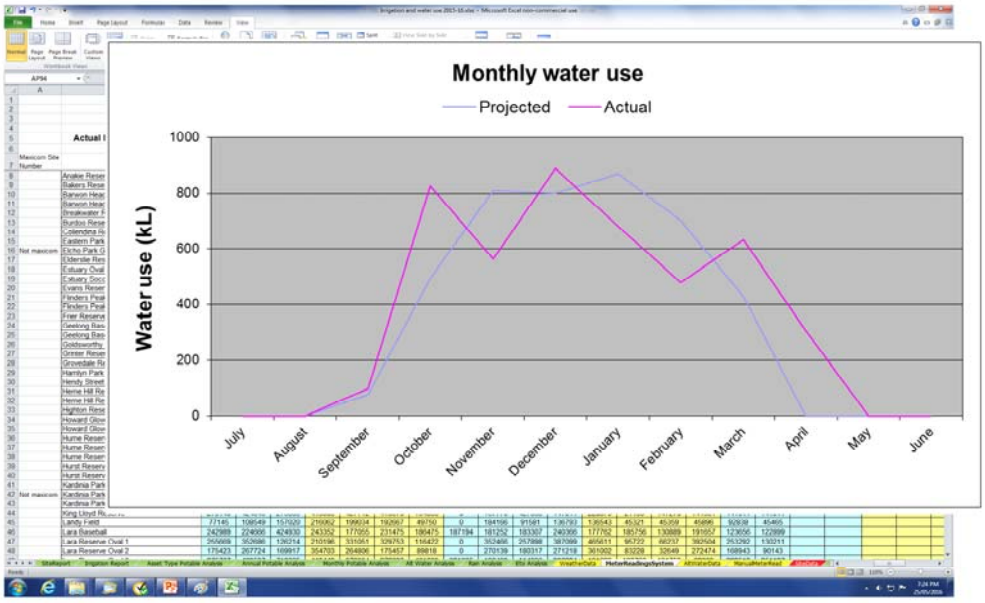
Audit of the system carried out to determine the system capacity.
Audit sheet uses estimated data from plans/designs as the starting point.
Test schedules run to determine actual system data.
In this case it was found that the system was applying 6% more water than estimated.
At a site level this equates to $400/annum.
For all our irrigated sites 6% >$75k/annum.
For many of our sites actual water use compared to estimated use varied by over 12%!
Catch can tests will be used to confirm/update data.



Use of flow reports and charts to monitor water use.

Tracking Water Use

Refer: Section 8.0, page 53



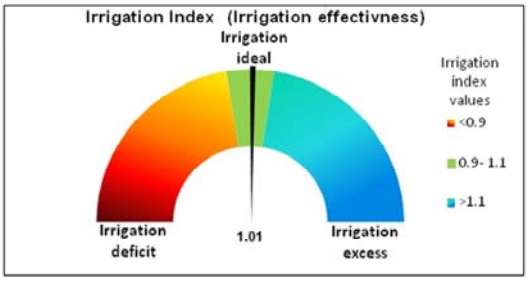
All water use data collated weekly and entered into a spreadsheet.
Enables tracking of actual water use against projected.
Helps highlight seasonal variations, faults, impacts of increased maintenance requirements.

Measuring Efficiency

Refer: Section 8.0, page 53

Irrigation Index (Ii) = Actual volume / Estimated volume

Estimated volume from daily weather data, site parameters (crop type and coefficient, crop stress factor, area, irrigation system efficiency)



< 0.9 = increasing irrigation deficit (under watering)

0.9 to 1.1 = irrigation ideal

> 1.1 = increasing excess of irrigation (over watering)

Reporting on water use and efficiency essential not only from a maintenance perspective, but also as a business requirement , and educational within and external to council.

Two key measures of efficiency used are Irrigation index, and Water Use Variation.

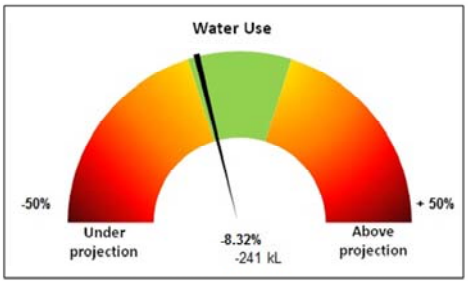
Results provided on simple fuel gauge type graphs which convey a readily understood concept.

Irrigation index uses key words used to help sell the message of irrigation efficiency.

Measuring efficiency

Refer: Section 8.0, page 53

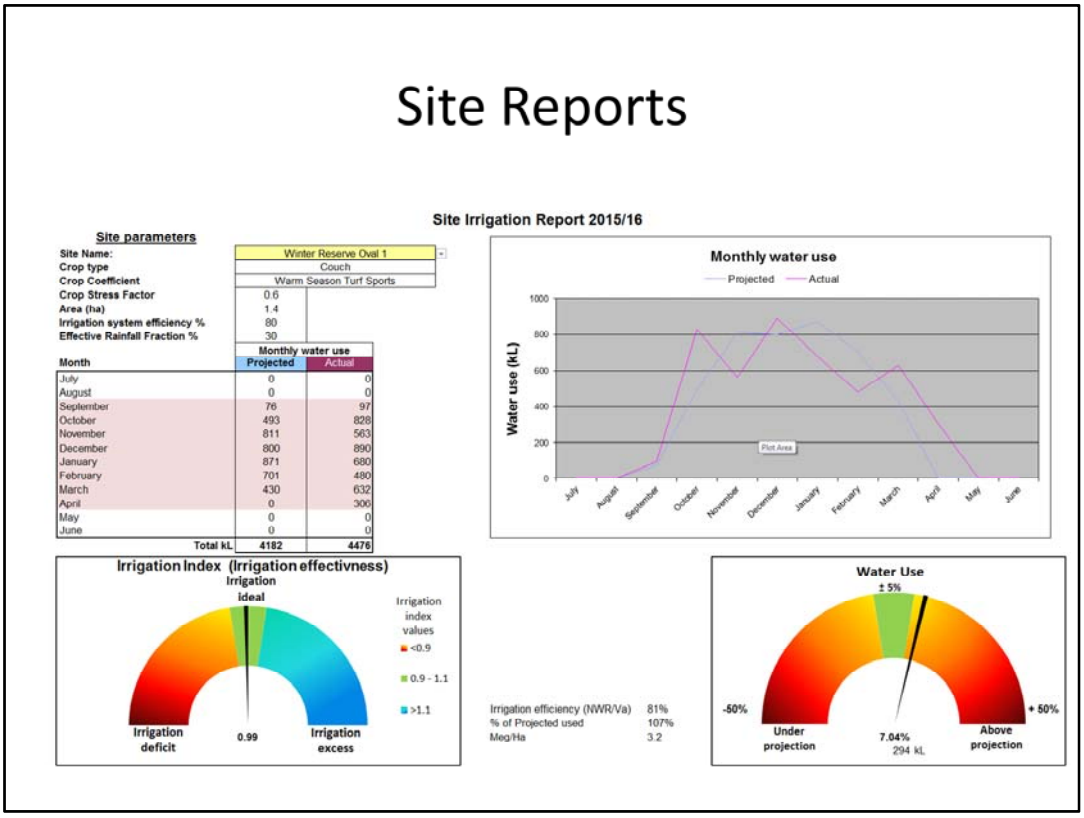
Water Use Variation (W_{var}) = Actual volume / Estimated volume



- Buffer to cater for renovation works
- Seasons with reduced irrigation demand – under projection
- Seasons with increased irrigation demand – over projection
- If Ii and W_{var} out of ideal/buffer zones – issues!

Water Use Variation read in conjunction with the Ii graph.
Key message is that weather has a major influence on water use. In dry seasons can demonstrate that the additional cost for water is not being wasted.

Site Reports



Example of a Site Report for this season for oval 1.
Key message is that Irrigation index showing irrigation is ideal, however water use is above projection as a result of low rainfall.

Key outcomes/successes

- Understanding poor plant performance is not always related to volume of irrigation applied – soil condition, pest/disease, fertiliser, etc. also critical. More water does not always fix the problem
- Understanding that irrigation is carried out effectively during seasonal variations
- Understanding of the volume of water required to maintain an asset to different standards, different turf types, etc. Cool season used more water than warm season, Class A ground uses more water than a Class C ground.

- Understanding of the effects poor efficiency can have on an irrigation system and water use
- Understanding the effects of weather variation on water use and supported in maintain operations/budgets
- Water use reduction of 49% since 2003

Water use reduction (not saving) is a result of:
•Eliminating waste due to breaks/bursts
•Knowing the capacity and performance of irrigation systems
•Setting a maintenance standard for irrigated assets – not all sites are AFL/botanic gardens standard.
•Precision irrigation scheduling.

References

- Code of Practice for Irrigated Public Open Space (IPOS), SA Water
- Water Use Efficiency for Irrigated Turf and Landscape, G Connellan
- Functional Open Space Best Practice Guidelines, City West Water & Smart Water Fund
- Irrigation Australia, Urban Irrigation Best Management Practices, May 2006