BITS CLUBS & DENNIS PARK SPORTS COMPLEX
DETAILED DESIGN IRRIGATION SYSTEM

CONCEPT DESIGN REPORT
KEY CRITERIA

GLADSTONE REGIONAL COUNCIL

HYDROPLAN

Client Name	Gladstone Regional Council
Project Name	BITS Clubs & Dennis Park Sports Complex – Detailed Design Irrigation System
Description	Concept Design Report
Project ID	15888
Revision	0

Revision No.	Date	Description	Author	Reviewed By
0	10/08/21	Final to Client	SJ	AP

HydroPlan
15 Bittern Avenue
BURLEIGH WATERS QLD 4220

Tel: +61 4 27 327 790
sj@hydroplan.com.au
http://hydroplan.com.au

Contents

1 INTRODUCTION

Stakeholder meetings were conducted from 18-19 May 2021 by GRC and HydroPlan with all clubs to outline plans, gather information and input for specific requirements or preferences for each site and individual fields or areas prior to the concept design development stage.

2 KEY CRITERIA & OPTIONS FOR CONCEPT DESIGNS

2.1 Scheduling Coefficient – interpretation & considerations

Scheduling Coefficient and uniformity are key criteria for design options.

Scheduling Coefficient (SC) is the ratio calculated by dividing the average precipitation on 100% of the area between sprinklers by the lowest precipitation on a sliding window equal to 10% of the area between the sprinklers. For example, if the average precipitation for the whole area was 13mm after an hour, and lowest 10% of area received 10mm during that period, the SC is 1.3. If it was essential that the driest 10% area received 13mm instead of 10mm, then the run-time would have to be increased by 30%, and that would increase the average and use more water - so a sprinkler system with the lowest SC will be the most water-efficient.

Distribution uniformity %, Coefficient of Uniformity % are other key performance indicators to establish sprinkler uniformity. Note that 'Space' testing is conducted under no wind conditions and whilst in some cases increased pressure can provide a higher theoretical uniformity, this produces a smaller droplet size more prone to wind drift. For the concept designs a range of 448 to 483 kPa has been selected to provide the optimum ration between ideal pressure for uniformity and scheduling coefficient with minimum wind drift.

Sprinkler systems with higher uniformity using less water can also impact:

- a range of design and operating considerations; hydraulic capacity (sizing), watering window (available time) and operating cost ($)
- plant health due to dry and saturated areas, which can impact other inputs - fertilizer efficiency, chemical applications (weeds/disease), and labour.

Consideration may also be given to lower operating pressures and precipitation rates being of value for benefits such as: lower energy/operating cost, less wind drift and less ponding.

2.2 Scheduling Coefficient (SC) - Options

The rotor design spacings and grid layout are largely dictated by the shapes and obstacles to determine the layout that best fits the site, then a pressure is selected to provide optimum performance in terms of distribution uniformity (%), coefficient of uniformity (%) and scheduling coefficient.

The SC performance is largely reliant on selecting the best products available to meet the target criteria as closely as possible.

In this case for each of the three sites two options for sports turf or golf rotors from the irrigation industries leading brands have been presented in the concept designs.

- BITS Sports Fields

  Option 1 – Rain Bird 8005SSNP SC = 1.1 (Soccer & AFL/Cricket)
  Option 2 – Toro T7P-SS-52-E SC = 1.2 (Soccer & AFL/Cricket)
  Comments: Option 1 (Rain Bird) offers best performance on all fields and spacings.

- BITS Golf Course

  Option 1 – Toro INF34/35-SM(E) SC = 1.1 (average-majority of spacings)
  Option 2 – Rain Bird 702/752(IC-NP) SC = 1.1 (average-majority of spacings)
  Comments: Options 1 & 2 have similar SC and uniformity performance however Option 1 (Toro) achieves this at a lower operating pressure with lower flow rates and precipitation rates which adds value. Control system is integral with each rotor option and may also influence selection.

- Dennis Park Sports Fields

  Option 1.1 – Rain Bird 8005SSNP SC = 1.2 (Rugby League, Junior & Senior)
  Option 1.2 – Toro T7P-SS-52-E SC = 1.3 (Rugby League, Junior & Senior)
  Comments: Option 1.1 (Rain Bird) offers best performance on all fields and spacings.
  Option 2 – Hunter I25 SC= 1.7 (Existing RL – retain & extend)
  Comments: Option 2 does not meet specification criteria; prior report recommends replacement.

2.3 Application rates

The resultant application rate is the outcome of the selection process above. The most significant variable for application rates is the arc (°) which is managed by adjustment of run times. To allow matching performance and precipitation rates the full circle or part circle rotors are controlled separately by either valves for the sports fields, or individual by top serviceable valve-in-head (VIH) rotors for the golf course.

Ideally the precipitation rate should not significantly exceed the soil infiltration rate, which does vary within an application cycle from start to finish as the soil moisture approaches field capacity. Where precipitation rate does exceed infiltration rate, then 'cycle and soak' programming is used to avoid ponding by limiting continuous run times, which is a feature the control systems require.

The sports field rotors selected have an application rate range of 12.5 to 20.5 mm/hr for the 360°, and 25 to 41 mm/hr for the 180°. The golf rotors selected have an application rate range of 8.6 to 27.5 mm/hr for the 360°, and 20 to 55 mm/hr for the 180°. Specific arcs such as 90° and 270° will have proportional values.

Within limits, generally the lower the application rate the better uniformity within the root zone and less risk of runoff, which can vary with slope. As a guide, sandy loam on 0-8% slope has a maximum application rate of 20mm/hr however can normally accept about double that within the 1st 30 minutes of a cycle and sports turf with a relatively shallow root depth is unlikely to require more than 10 to 15mm in a cycle. Application rates are more a consideration within the evaluation criteria rather than an option.

2.4 Pressure Variation

The pipe sizing will allow for pressure variation target for concept design as +/- 5% along the lateral and at the rotor, in line with option 1 criteria. The pressure for all sites will be adjustable and regulated by the variable speed drive (VFD) pump units to achieve optimum operating pressure in the field for both performance and operating costs.

The sports fields are relatively flat and with appropriate pipe sizing do not require pressure regulation valves to reduce operating cost. The golf course VIH rotors have built in pressure regulation as standard for both options to ensure design operating pressure is accurately maintained. Pressure variation and good hydraulic design is a consideration that will be detailed in detailed design – refer Hydraulic design.

3 IRRIGATION CONCEPT DESIGN

The concept design consists of 3 sites:

- BITS Sports Fields – Soccer & AFL/Cricket – dwg#: 15888-100 to 103 (A)
- BITS Golf Course – 13 holes – dwg #: 15888-200 to 212 & 15888-220 to 223 (A)
- Dennis Park Sports Fields – Rugby League, Junior & Senior – dwg #: 15888-300 to 303 (A)

Each site has 2 options for scheduling co-efficient, along with pump system options and applicable irrigation controller system.

The concept designs consider allowances for, current areas, proposed changes to existing fields, new fields and capacity for future areas for each site.

4 GRC REVIEW IRRIGATION MANAGEMENT PLAN

The time window available in the existing GRC Irrigation Management Plan (IMP) was identified as a critical limiting factor as part of the initial stakeholder engagement process, existing system assessment and draft concepts.

The IMP was due for review and in advance of the concept design the following hours were agreed by GRC, with stakeholder input:

- BITS Sports Fields – start time 8.30pm to finish 3.00am, time window 6.5 hr/dy
- BITS Golf Course – start time 7.00pm to finish 4.00am, time window 9.0 hr/dy
- Dennis Park Sports Fields – start time 8.30pm to finish 3.00am, time window 6.5 hr/dy

5 RECYCLED WATER USE BUDGET

The incoming flows available to the existing recycled water tanks is a potential limiting factor and needs to be carefully balanced to meet the existing areas including proposed changes or additions to the sports fields, however, excludes the future 5 holes for golf course at this stage.

The current inflow capacity of recycled water supply to tanks from STP is, as follows:

- BITS Clubs Tanks (3) 30 to 35 L/s
- Dennis Park Tans (2) 10 L/s
- Total Combined Capacity from STP 43 L/s

The peak flow demand for recycled water supply to irrigation areas is, as follows:

- BITS Sports Fields 10 L/s
- BITS Golf Course (13 holes) 22 L/s
- Dennis Park Sports Fields 10 L/s
- Total Combined Capacity to Irrig pumps 42 L/s

The average annual volume for recycled water supply to irrigation areas is, as follows:

- BITS Sports Fields 22 ML/yr
- BITS Golf Course (13 holes) 66 ML/yr
- Dennis Park Sports Fields 25 ML/yr
- Total Combined Average Volume 113 ML/yr

Consideration to upgrade existing flow and/or storage capacity to BITS clubs tanks would be required prior to future 5 holes at the golf course being constructed. For 18 holes the golf course pump flow rate increases to 30 L/s and estimated average annual water use is 92ML.

Refer appendix for estimated monthly water use budgets.

6 POTABLE WATER SUPPLY

6.1 Cricket Wicket

The cricket club has an existing DN40 metered potable water supply with backflow that services the irrigation (6 small rotors) to the cricket wicket, which will be either retained or minor upgraded to DN50 to service the new irrigation (4 larger rotors) system. The wicket rotors are currently controlled by the Cricket club, so there is the option to have a separate irrigation controller to operate these valves/rotors.

6.2 BITS CLUBS – Option 5 Part B

The BITS Clubs requested the option for potable water supply backup in the event of recycled water being unavailable for an extended period. An option has been included in the concept design to add a backflow and potable water pipe take off from the existing DN100 meter near the tennis courts on Jacaranda Drive to a new 50kL potable water tank near the proposed new pump station location. Details are shown on Dwg # 15888-103 & 15888-220 (A).

In the event of recycled water being unavailable the supply to pump suction inlets can be manually switched over to potable supply to operate at restricted flow of 10 L/s to all BITS Clubs. The golf course areas will be limited to tees and greens only (~2Ha) when using recycled water. This concept will allow each club limited access 2 nights per week each which will allow each club to apply at least 17mm/wk to the designated irrigation areas. One spare night is available if needed for the sports clubs which may be assigned based on seasonal demand and field condition, alternatively the time window may also be extended when using potable water supply if high seasonal demand.

The BITS Clubs are responsible to monitor and pay for potable water use. The irrigation flow meters and control system are capable of monitoring and reporting water use to help BITS Clubs apportion potable water costs when needed.

6.3 Dennis Park

No request or requirement for potable water supply backup at Dennis Park sports fields.

7 PUMP STATIONS AND FILTRATION

Pumps, vertical multistage – full 316 construction for recycled water, with variable speed drive control for constant pressure across a range of flows and maximum energy savings. Filters, auto screen – full 316SS construction for recycled water, auto flush with large capacity screen area to handle high loads.

7.1 BITS Clubs – Option 3 and 4

The existing BITS Clubs pump shed is deemed unsuitable to accommodate the new pump and filter systems required for the golf course and the sports fields due to space constraints (area and height), electrical and safety risks. Renovation or extension would not be feasible at the existing location and available space.

A new shed and pump/filter systems are proposed adjacent to the existing power supply distribution board and the recycled water supply rerouted to new pump station. There are two options for the pump/filter unit configurations.

- Option 3 – One pump unit and filter system with capacity to service the golf course and sports fields combined.
- Option 4 – Two separate pump units and filter systems, one for the golf course and one for the BITS sports fields.

Comments;

1. Option 3 offers capital and operating cost advantages, and reduce shed space required.
2. Option 3 would have separate flow meters and irrigation control systems for the BITS golf course and BITS sports fields so they operate independently.
3. Option 3 is a 4-pump unit, 3 for 18 golf course (30L/s) and 1 for sports fields (10 L/s). The third pump could be blanked off until future 5 holes of golf course are being constructed if cost saving required, or the pump unit has standby capacity.

7.2 Dennis Park – Options 3 and 4

There are two options for Dennis Park pump stations to be either retained or replaced.

- Option 3 – Replace with new surface mounted vertical multistage pump unit and auto filter system enclosed in an industrial colorbond steel shed.
- Option 4 - Retain existing, the existing Dennis Park pump units have the capacity and were recently replaced (~2YO) could potentially be retained if the wet well arrangement was considered acceptable by GRC. The existing filter system is unserviceable and would need to be replaced with a new auto filter system. There are no intelligent controls or communications between the pump and irrigation controls which require an upgrade by adding relays and sensors.

8 POWER SUPPLY

Electrical works to be referenced in detailed design as a performance specification to Gladstone Regional Council engineering standard for preferred electrical components doc # GRC-ES002(2).

8.1 BITS Clubs

The existing power supply capacity for current pump motors are summarised as follows:

- BITS sports fields 22kW/40FLA @ 415V
- BITS golf course (13 holes) 22kW/40FLA @ 415V
- Total BITS clubs PS 44kW/80FLA @ 415V

The proposed new pump motor requirements, for either options 3 or 4, are summarised as follows:

- BITS sports fields 11kW/20FLA @ 415V
- BITS golf course (18 holes) 33kW/60FLA @ 415V
- Total BITS clubs PS 44kW/80FLA @ 415V

Comment: The proposed new pump unit power requirements do include all proposed extended areas and future demand for extra 5 golf holes.

No requirement to upgrade existing power supply at Dennis Park other than a minor extension from existing distribution board to pump shed for new circuits.

8.2 Dennis Park

The existing power supply capacity for current pump motors are summarised as follows:

- Dennis Park sports fields 2x 9.2kW/22FLA ea @ 415V duty x st/by (sub pump)

The proposed new pump motor requirements, for options 3, are summarised as follows:

- Dennis Park sports fields 2x 5.5kW/22FLA total 415V 2x duty (surface pumps)

No requirement to upgrade existing power supply at Dennis Park, other than extend from the existing distribution board at the wet well to new pump shed for new circuits if required (pump option 3).

9 SCADA CONTROLS

Retain existing SCADA systems at both BITS Clubs and Dennis Park recycled water supply tanks complete with PLC, software, programming, communications, enclosures, flow meters, level sensors, valves, switches, I/O relays and controls.

The PLC logic is that the recycled water supply pump at STP starts on tank level switch then opens the control valve at the tanks on site, with flow meters to measure flows and record volumes. The logic was confirmed by GRC operators on site as suitable 'as is', no changes required. Any performance checks for SCADA would reference GRC SCADA standards, if further validation required.

10 IRRIGATION CONTROL SYSTEMS

There are 2 options for each site, each option will include a range of essential requirements, including:

- Central control – PC
- Maps module (for Golf)
- 2 wire control interface, min 1000 addresses, multiple wire paths
- Interface and field grounding
- Smart sensor module
- Pump station interface dashboard
- Flow meter
- Flow management and Hydraulic tree
- Weather station interface
- Seasonal scheduling (Et)
- Environmental sensors (moisture*)
- Diagnostics
- Remote communication & operations – Smart devices /mobile app
- OEM full service, updates & support plan, 3 years

Comment: (*) limited number of soil moisture sensors due to cost and reliability, primarily 1 per site to monitor a representative sample and raise an alert if excess moisture beyond field capacity (towards saturation point), used to raise an alert or shutdown alarm rather than a scheduling trigger.

For BITS sports fields and Dennis sports fields:

- Option 1: Rain Bird ESP-LX-IVM 2 wire field controller c/w IQ central software and remote
- Option 2: Toro Sentinel 2 wire decoder field controller c/w Sentinel software and remote

The controls for the sports fields are integral with the valves but not integral with the rotors. There may be extra value from extended warranty in a packaged system from manufacturers where available by combining controls, valves and rotors.

For BITS golf course;

- Option 1: Toro Lynx central control c/w 2 wire Smart hub, Smart modules and remote
- Option 2: Rain Bird Stratus II central control c/w 2 wire IC interface, IC-IN and remote

The controls for the golf course are integral with the rotors, so the control system may influence rotor option decision and visa-versa.

Control systems will have control cabling detailed at detailed design stage within acceptable voltage drop limits and meet manufacturers grounding requirements for lighting and surge protection.

It would be of value for the GRC operations staff and project managers to have an interactive demonstration from each manufacturer or at least the preferred option if unfamiliar with the central control operating systems. The likely agenda would be in the early stages of detailed design, 1 hour on hardware and 1 hour for software. Whilst GRC are currently responsible for the majority of irrigation operations the session may include stakeholders that have a hands-on capability where appropriate, in particular the golf course staff.

11 HYDRAULIC DESIGN

The pipe sizing and hydraulics will be further detailed in detailed design stage that meet target optimum pipe velocities to maintain design flows within acceptable pressure range, as follows:

- Suction & Main pipes (>100m & = or >90mm PE) Velocity = 1.0 to 1.2 m/s
- Sub-mains & Lateral pipes (<100m & <90mm PE) Velocity = 1.5 to 1.7 m/s

Exceptions may be made to increase velocities for short pipe lengths (e.g., <10m) for practical applications in construction methodology, or special requirements to maintain laminar flow paths for flow meter accuracy.

For underground pipework, HDPE PN12.5 (lilac stripe) will be specified as the standard best suited for recycled water pipe, other PE classes are generally not stocked by manufacturers and would need to be made to order. Large bore PE pipe BW or EF, small bore PE pipe EF or CF. Above ground pipework at pump station, 316SS schedule 10.

As noted above in Section 2 in Key Criteria and Options for Pressure Variation item, the field pressures for all sites are controlled by variable speed drive pumps to manage constant design pressure with +/- 5% along the lateral or at the rotor. The sports fields are relative flat and with optimum pipe sizing the pressure will remain within design range, with the option for fine tuning at individual flow control if required. In addition, for both options the proposed golf course rotors are valve-in-head type with integrated pressure regulation built in as standard, set to accurately maintain optimum design pressure.

12 CAPITAL COSTS

Summary of total capital cost budget estimates for all current, proposed areas and future areas, excluding GST, for new irrigation systems and pump stations are:

- BITS sports fields (opt 1 or 2, and opt 3 PS) $ 403,525
- BITS golf course, 18 holes (opt 1 or 2, and opt 3 PS) $1,420,900
- Dennis Park Sports Fields (opt 1 or 2, and opt 3 PS) $ 426,800
- Total all sites $2,251,225

Comments: Includes future 5 holes for golf course, estimated at $297,000.

Refer 'Construction Cost Estimates' for breakdown of each site and options - attachments sent previously.

13 OPERATING COSTS

Summary of total operating cost budget estimates for all current and proposed areas, excluding GST:

- BITS sports fields (opt 1 or 2, and opt 3 PS) $14,010
- BITS golf course, 18 holes (opt 1 or 2, and opt 3 PS) $22,350
- Dennis Park Sports Fields (opt 1 or 2, and opt 3 PS) $14,208
- Total all sites $50,568

Comments: Excludes future 5 holes for golf course, which may increase golf course operating cost estimates by up to 38% (add ~$8,600 increases golf course to $30,950 = total all sites $60,168) when built.

Refer 'Operating Cost Estimates' for breakdown of each site - attachments sent previously.

14 DESIGN LIFE & DEPRECIATION

The design life is variable depending on a number of factors, such as; annual hours used, maintenance, water quality and site conditions. The forecast design life for key irrigation components is:

- Pipework (HDPE PN12.5) 40-60 years
- Controls & ELV cables 15-25 years
- Rotors 15-25 years
- Pumps & filters (316SS) 10-20 years

A simple straight line depreciation of the entire asset to zero salvage value in 30 years (3.33%pa) is used to simulate the need for continuous funding of renewals. Significant refurbishment costs can be expected for mechanical and electrical equipment every 10-20 years, but well-constructed pipework (40% of CAPEX) can be expected to remain in service for in excess of 50 years with little maintenance costs. Straight line depreciation is conservative compared to a more complex analysis of discounting future costs to present-value terms.

The depreciation in this case to allow budgeting for full system renewal, is as follows:

SITE	CAPEX	DESIGN LIFE	DEPRECIATION	
• BITS sports fields	$403,525	30 years	3.33%	$13,438
• BITS golf course, 18 holes	$1,420,900	30 years	3.33%	$47,316
• Dennis Park sports fields	$426,800	30 years	3.33%	$14,212

Comments: CPI has not been introduced and CPI may be offset by interest gained on banked money set aside for replacement if being considered on these terms. In terms of financial management for asset write down purposes, council should consult GRC accountant for financial planning advice.

15 SUMMARY

HydroPlan and GRC to present concept design and explain options to stakeholders. Next round of meetings were scheduled for 11-13 August and has been postponed due to COVID lockdown and travel restrictions. Likely to reschedule in September pending travel restrictions and availability, or alternatively conduct MS Teams on-line meetings in the interim to allow detailed design to progress until further meetings are available.

GRC is to confirm concept approval and options to commence next stage of detailed design and documentation.

In summary the key options to be confirmed for detailed design to progress are:

SITE	IRRIGATION	PUMP & FILTER	POTABLE WS
• BITS sports	OPTION 1 or 2* & 3	Option 3 or 4	Option 5
• BITS golf course	OPTION 1 or 2*	Option 3 or 4	Option 5
• Dennis Park -new	OPTION 1.1 or 1.2*	Option 3 or 4	N/A
• Dennis Park– extend exist	OPTION 2	Option 3 or 4	N/A

Comment: In the cases (*) where the product make and model is the main irrigation option, we can base the detailed design on the preferred GRC option for a conforming bid in specification and nominate an approved equivalent (2nd option) may be considered in the tender process subject to GRC approval.

Recommend a MS Teams session with GRC project team to review concept design drawings and discuss options to facilitate decisions where further understanding is of value.

16 ATTACHMENTS – SENT PRIOR, NOT INCLUDED

16.1 Capital Costs

1. BITS Sports Fields
2. BITS Golf Course
3. Dennis Park Sports Fields
4. Summary – all sites

16.2 Operating Costs

1. BITS Sports Fields
2. BITS Golf Course
3. Dennis Park Sports Fields
4. Summary – all sites

16.3 Concept Design drawings

1. BITS Sports Fields
2. BITS Golf Course
3. Dennis Park Sports Fields

17 APPENDIX

17.1 Water Use Budget, Monthly Average

1. BITS Sports Fields
2. BITS Golf Course
3. Dennis Park Sports Fields

17.2 BOM climate statistics – Gladstone Radar BOM site # 039123

a) Mean monthly daily evaporation, mm
b) Mean monthly rainfall, mm

Client:	**Gladstone Regional Council**
Contact:	Farayi Kaisa
Project:	**BITS SPORTS**
Project #:	HP Ref: 15888
Total Irrigated Area (Ha)	**3.790** *
*** Includes proposed areas**	

SUMMARY IWMP DATA

Weather data, ave rainfall & evaporation:

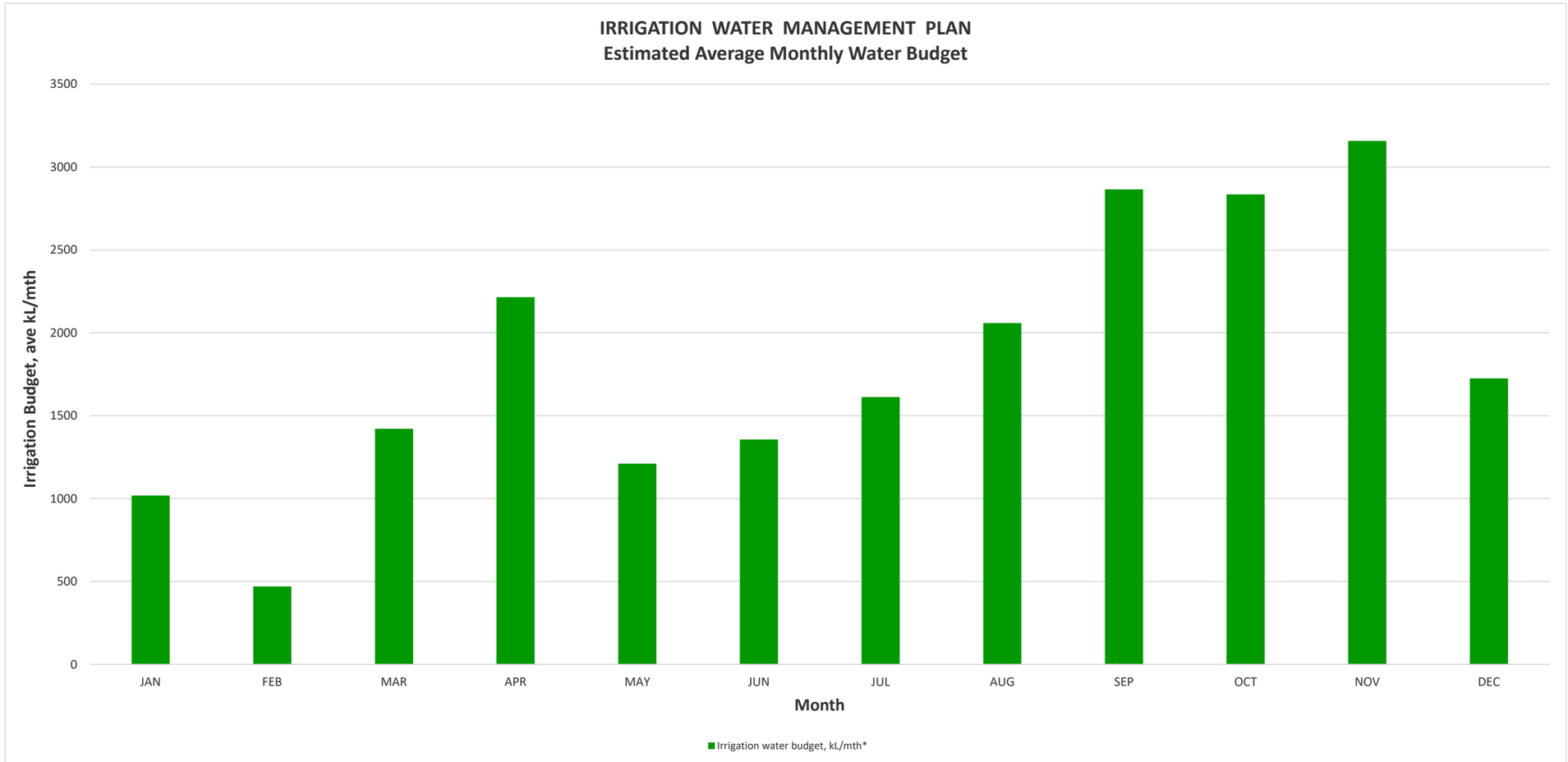
BOM Stn/Ref: Gladstone Radar 039123

BITS SPORTS - SOCCER & AFL-CRICKET

HYDROPLAN

Office: *15 Bittern Ave*
Burleigh Waters. Qld. 4220
M; 0427 327 790
E: sj@hydroplan.com.au

Date: **23/07/2021**
By: **S. Johnstone**
Sheet 2



MONTHLY AVERAGES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
Evaporation (Eo), ave mm/mth	195.3	165.2	164.3	132.0	105.4	90.0	96.1	108.5	132.0	170.5	183.0	195.3	**1738**
Mean rainfall, mm/mth	147.9	138.0	105.8	46.7	54.6	36.6	34.0	31.0	26.5	61.1	65.9	124.6	**873**
Irrigation water budget, kL/mth*	**1018**	**470**	**1421**	**2215**	**1211**	**1357**	**1612**	**2058**	**2866**	**2836**	**3158**	**1725**	**21947**
Potential IR, kL/mth (no rain)	5503	4655	4629	3719	2970	2536	2708	3057	3719	4804	5156	5503	

* Efficiency, Environ & Plant factors may vary,Effective rainfall adjusted for regional intensity. Refer detailed data tables for specific design or site values

Based On:

Plant/Soil Type:	Sports Turf, Loam
Comments:	High traffic, optimum growth

Key variable factors:

Scheduling Coefficient	1.10
Plant factor	0.80

Irrigation window **Design Duty:**

Time, hr/dy	6.50	Flow, l/s	10.0
Time, hr/wk	46	Head, m	65

Client: Gladstone Regional Council
Contact: Farayi Kaisa
Project: BITS GOLF (13 HOLES)
Project #: HP Ref: 15888
Total Irrigated Area (Ha) 11.370 *
*** Holes areas to be confirmed & does not include future 5 holes**

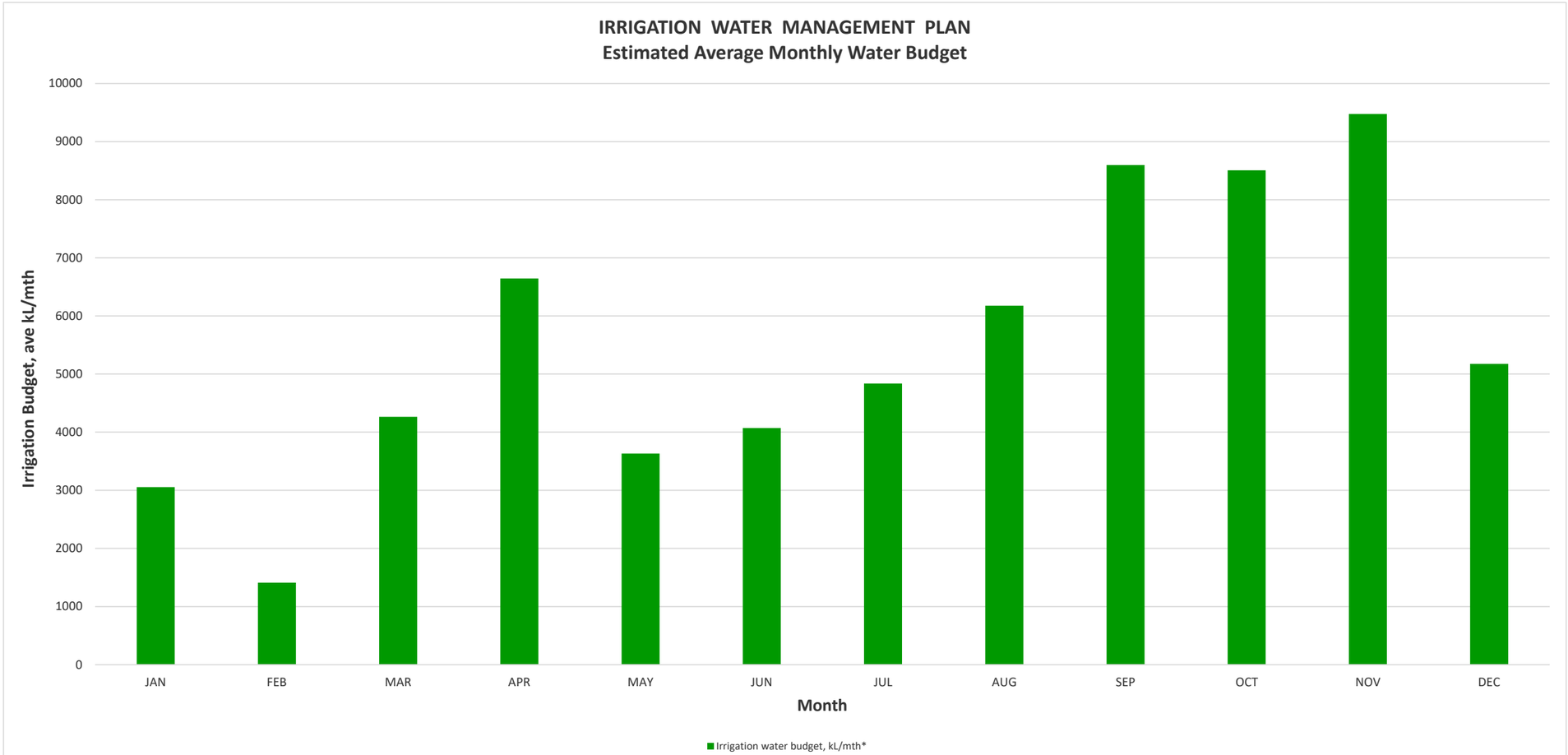
SUMMARY IWMP DATA

Weather data, ave rainfall & evaporation:
BOM Stn/Ref: Gladstone Radar 039123

BITS GOLF COURSE - 13 HOLES

HYDROPLAN
Office: *15 Bittern Ave*
Burleigh Waters. Qld. 4220
M; 0427 327 790
E: sj@hydroplan.com.au

Date: **23/07/2021**
By: **S. Johnstone**
Sheet 2



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Mean rainfall, mm/mth	147.9	138.0	105.8	46.7	54.6	36.6	34.0	31.0	26.5	61.1	65.9	124.6	**873**
Irrigation water budget, kL/mth*	**3055**	**1411**	**4264**	**6644**	**3632**	**4070**	**4837**	**6175**	**8597**	**8507**	**9474**	**5175**	**65842**
Potential IR, kL/mth (no rain)	16508	13964	13888	11158	8909	7607	8123	9171	11158	14412	15468	16508	

* Efficiency, Environ & Plant factors may vary,Effective rainfall adjusted for regional intensity. Refer detailed data tables for specific design or site values

Based On:

Plant/Soil Type:	Sports Turf, Loam
Comments:	High traffic, optimum growth

Key variable factors:

Scheduling Coefficient	1.10
Plant factor	0.80

Irrigation window **Design Duty:**

Time, hr/dy	9.00	Flow, l/s	22.0
Time, hr/wk	63	Head, m	70

CERTIFIED IRRIGATION DESIGNER — IRRIGATION AUSTRALIA — LTG3192 — LANDSCAPE/TURF GOLF

Client: Gladstone Regional Council
Contact: Farayi Kaisa
Project: DENNIS PARK SPORTS
Project #: HP Ref: 15888
Total Irrigated Area(Ha) 4.235 *
*** Includes proposed areas Junior NE2 & extensions**

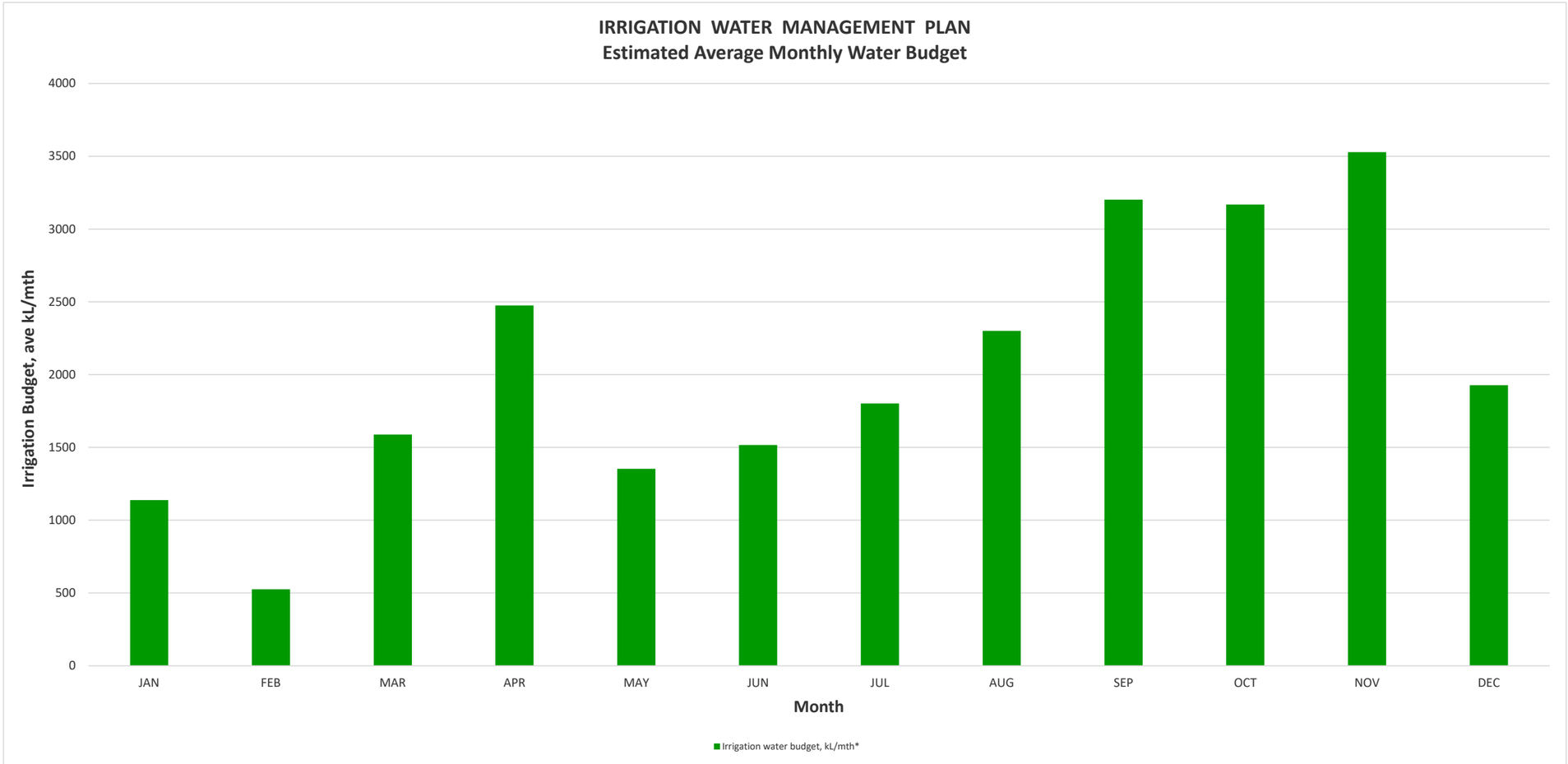
SUMMARY IWMP DATA

Weather data, ave rainfall & evaporation:
BOM Stn/Ref: Gladstone Radar 039123

DENNIS PARK SPORTS FIELDS - RUGBY LEAGUE, JUNIOR & SENIOR

HYDROPLAN
Office: *15 Bittern Ave*
Burleigh Waters. Qld. 4220
M; 0427 327 790
E: sj@hydroplan.com.au

Date: **23/07/2021**
By: **S. Johnstone**
Sheet 2



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Mean rainfall, mm/mth	147.9	138.0	105.8	46.7	54.6	36.6	34.0	31.0	26.5	61.1	65.9	124.6	**873**
Irrigation water budget, kL/mth*	**1138**	**526**	**1588**	**2475**	**1353**	**1516**	**1802**	**2300**	**3202**	**3169**	**3529**	**1927**	**24524**
Potential IR, kL/mth (no rain)	6149	5201	5173	4156	3318	2834	3026	3416	4156	5368	5762	6149	

* Efficiency, Environ & Plant factors may vary,Effective rainfall adjusted for regional intensity. Refer detailed data tables for specific design or site values

Based On:

Plant/Soil Type:	Sports Turf, Loam
Comments:	High traffic, optimum growth

Key variable factors:

Scheduling Coefficient	1.10
Plant factor	0.80

Irrigation window **Design Duty:**

Time, hr/dy	6.50	Flow, l/s	10.0
Time, hr/wk	46	Head, m	65

CERTIFIED IRRIGATION DESIGNER — IRRIGATION AUSTRALIA — LTG3192 — LANDSCAPE/TURF GOLF

Climate statistics for Australian locations

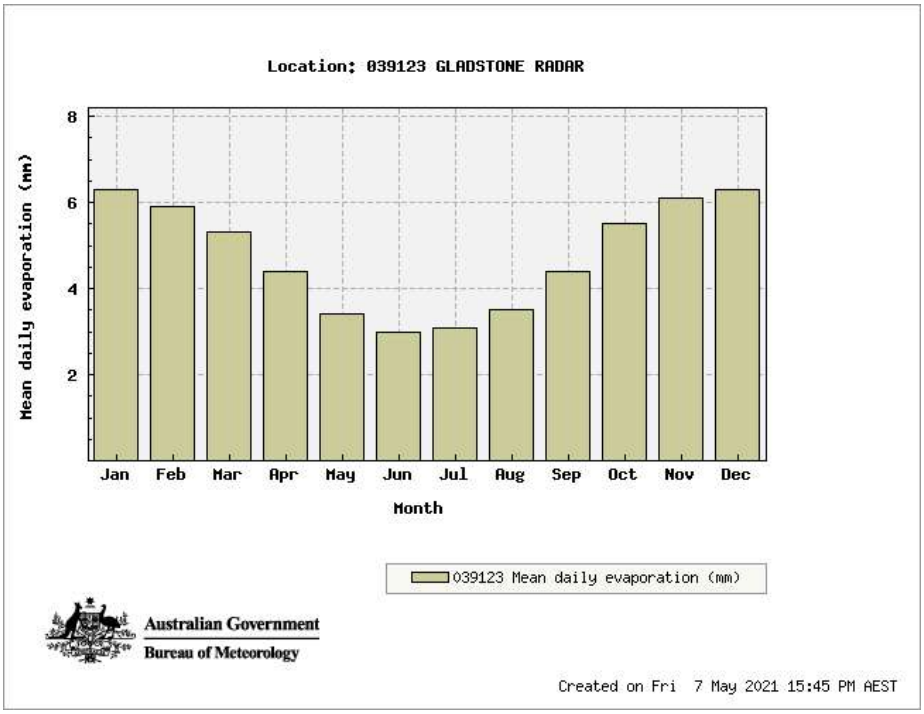
Monthly climate statistics - graph

GLADSTONE RADAR

Mean total evaporation (mm)

Site details

Site name: GLADSTONE RADAR **Site number:** 039123 **Commenced:** 1957
Latitude: 23.86 °S **Longitude:** 151.26 °E **Elevation:** 74 m **Operational status:** Still Open



Statistics	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Years
Mean daily evaporation (mm) for years 1966 to 1993	6.3	5.9	5.3	4.4	3.4	3.0	3.1	3.5	4.4	5.5	6.1	6.3	4.8	26

Additional information

Related Links

- Summary statistics and locational map for this site: http://www.bom.gov.au/climate/averages/tables/cw_039123.shtml
- About climate averages: http://www.bom.gov.au/climate/cdo/about/about-stats.shtml
- Definitions of the individual statistical elements: http://www.bom.gov.au/climate/averages/tables/definitions.shtml
- Climate Data Online home page URL: http://www.bom.gov.au/climate/data/index.shtml
- Bureau of Meteorology website: http://www.bom.gov.au

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Climate statistics for Australian locations

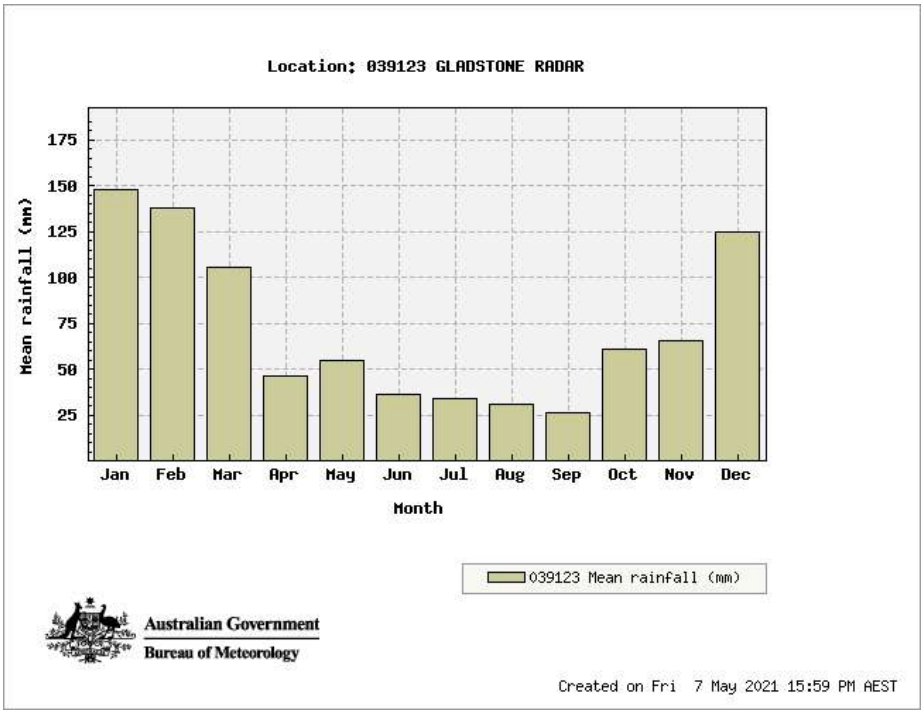
Monthly climate statistics - graph

GLADSTONE RADAR

Mean rainfall (mm)

Site details

Site name: GLADSTONE RADAR **Site number:** 039123 **Commenced:** 1957
Latitude: 23.86 °S **Longitude:** 151.26 °E **Elevation:** 74 m **Operational status:** Still Open



Statistics	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Years
Mean rainfall (mm) for years 1957 to 2021	147.9	138.0	105.8	46.7	54.6	36.6	34.0	31.0	26.5	61.1	65.9	124.6	872.6	62

Additional information

Related Links

- Summary statistics and locational map for this site: http://www.bom.gov.au/climate/averages/tables/cw_039123.shtml
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- Definitions of the individual statistical elements: http://www.bom.gov.au/climate/averages/tables/definitions.shtml
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