

# Wattle Grove South

## 2019-2020 Water monitoring report

Prepared for City of Kalamunda

By Urbaqua

December 2020

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## 1 INTRODUCTION

The City of Kalamunda engaged Urbaqua to undertake water monitoring and reporting to inform the future planning of Wattle Grove South. The purpose of this monitoring program is to assess and characterise the existing hydrological conditions of the study area to inform the future implementation of Water Sensitive Urban Design (WSUD) principles, and thus ensure protection of downstream environments following development.

This report summarises the results of two years (2019-2020) of water quality and flow monitoring undertaken at Wattle Grove South.

### 1.1 Study area background

The study area (Wattle Grove South) is approximately 310 ha and is located within the City of Kalamunda (the City) in the suburb of Wattle Grove. It is generally bound by Tonkin Highway to the west, Welshpool Road East to the north, and Kelvin Road, Judith Road, Fontano Road and the City's border with the City of Gosnells to the east. It is also characterised by its location at the base of the Darling Scarp

Landuse across the study area is generally rural, with most properties containing residences and a small number comprising local businesses. The Maddington Kenwick Strategic Employment Area (MKSEA) is located directly west of the study area, opposite Tonkin Highway. It comprises a mixture of industrial areas, Bush Forever sites and Conservation Category Wetlands (CCW).

The Western Australian Planning Commission's (WAPC) North-East Sub-Regional Planning Framework (the Framework), adopted in March 2018, identifies the majority of Wattle Grove South as Urban Expansion. An eastern portion of Wattle Grove South is identified as Urban Investigation. The City's Local Planning Strategy 2010 identifies Wattle Grove South as an investigation area.

Two natural watercourses traverse the study area: Yule Brook, which flows west through the northern corner of the study area, and Crystal Brook which runs from the east of the study area from the steep edge of the Darling Scarp, and flows west to intersect with Yule Brook in the north (see Figure 1).

In addition to the Yule Brook and Crystal Brook, local drainage is also managed by informal open roadside swales. No pits, pipes, or sub soil drainage is utilised within the study area. Both flows from the study area contained by the Yule Brook and Crystal Brook, and by local roadside drainage, discharge west via culverts under Tonkin Highway and into the MKSEA precinct.

Surface geology of the study area is comprised of three main soil types: Thin Bassendean Sand over sandy clay/clayey sand of the Guildford Formation in the west and north of the study area; Yoganup Formation sand throughout the central and southern areas of the study area; and colluvial gravelly silt in the north east and east of the study area where it meets the Darling Scarp. In addition, alluvial sandy silts are also located around the Yule Brook, downstream of its intersection with the Crystal Brook (Jordan, 1986).

Regional groundwater mapping indicates that groundwater flows directly west from the Darling Scarp, with minimum groundwater levels occurring between approximately 10-20 m



below ground level across the study area. Shallow groundwater associated with perched systems has been found in wetlands west of the study area.

## 1.2 Scope of works

The original scope of works for this water monitoring project included the monitoring and analysis of both groundwater quality and levels, and surface water quality and flows based on Better Urban Water Management (BUWM) requirements and that reasonably required by the Department of Water and Environmental Regulation (DWER).

A groundwater investigation was undertaken on 3 September 2019 in order to investigate the potential interaction of groundwater with Yule Brook and Crystal Brook as well as the wetlands to the west of the site. Two boreholes were drilled along the western boundary of the site to a depth of 8 m, and a borehole adjacent to Crystal Brook was drilled to 3 m below the invert of the natural channel. The outcomes of this investigation were as follows:

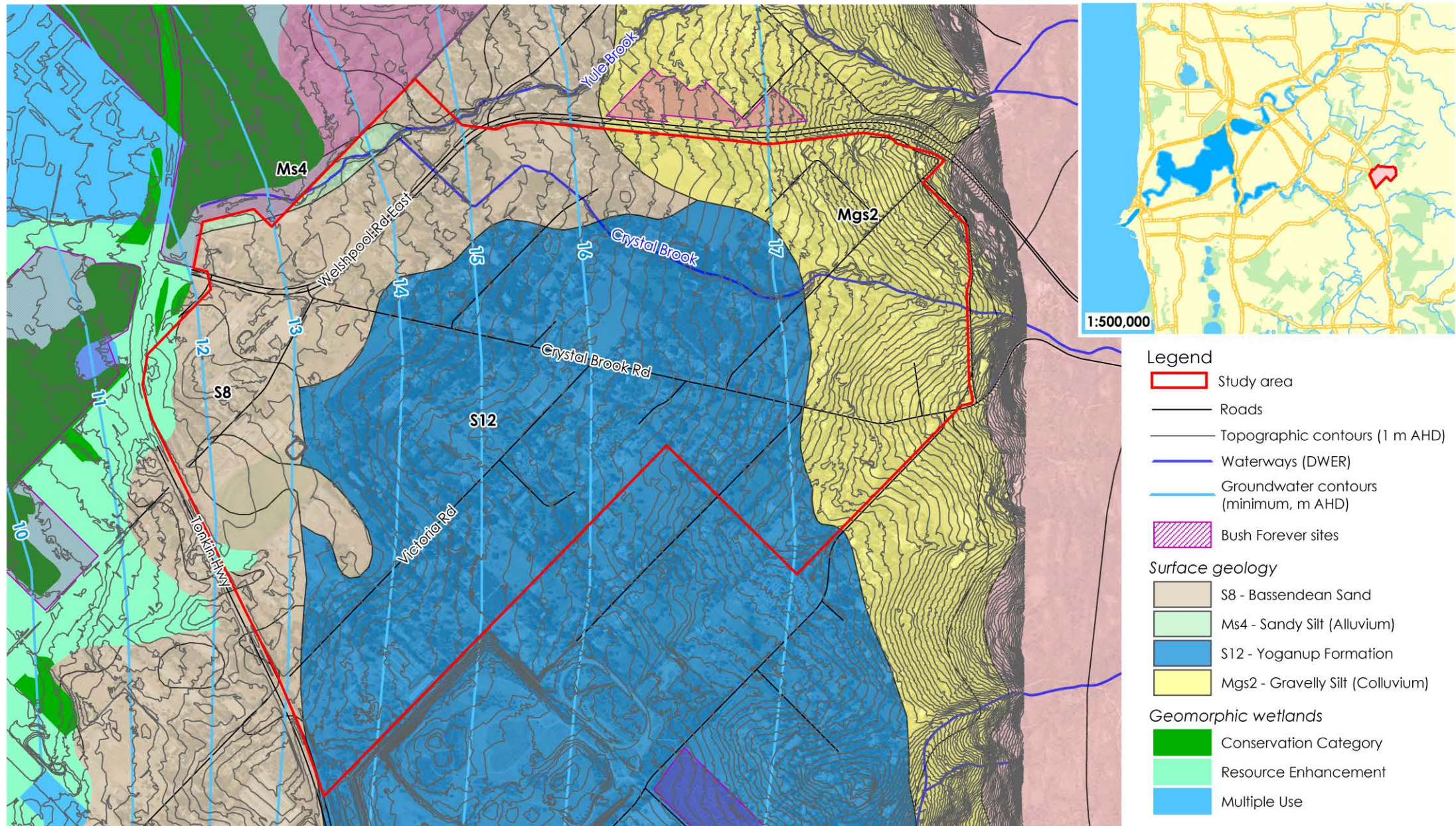
- Groundwater was not encountered in the south western bore hole, nor in the borehole adjacent to Crystal Brook;
- Groundwater was encountered at the north western bore at a depth of 5.5 m BGL; and
- Soils encountered during the borehole drilling were mostly clayey sands with some clay banding throughout, however, soil at Crystal Brook was predominantly indurated laterite clay.

Given the soil type and depth to groundwater established by the investigation, significant interaction between the groundwater at the study area and the surface water in the Yule Brook/Crystal Brook and the wetlands to the west was considered unlikely. Therefore, Urbaqua did not consider it necessary to continue the investigation of groundwater at the study area and recommended that only surface water quality and flow monitoring be undertaken as part of this project. This determination was supported by the Department of Water and Environmental Regulation (DWER) (see Appendix 1 for further details).



# City of Kalamunda - Wattle Grove South Water Monitoring Report

## Figure 1 - Environmental features



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## 2 METHODOLOGY

A total of six (6) surface water monitoring sites were established to assess the quality of water entering and exiting the site through Crystal Brook and Yule Brook, as well as to measure water quality discharging from the site through the Tonkin Highway culvert (Figure 2).

Sites SW1 and SW2 are located within the Yule Brook and are approximately 1000 m apart. Site SW2 is upstream of the confluence of Crystal Brook and Yule Brook. Sites SW3, SW4 and SW5 are located with the Crystal Brook and have been spaced evenly across the approximately 2 km of stream length within the study area. Site SW6 is an open drain containing local runoff just before discharging through culverts under Tonkin Highway in the west of the study area, south of Welshpool Road East (Figure 2).

Surface water monitoring was undertaken over 13 events in 2019-2020. This included intensive sampling over the winter period of each year and one event in March 2020 to capture low-flow summer conditions, as presented in Table 1 below.

**Table 1: Sampling schedule**

Month	Sampling event
July 2019	1 x surface water sampling event
August 2019	1 x surface water sampling event
September 2019	2 x surface water sampling events
October 2019	1 x surface water sampling event
March 2020	1 x surface water sampling event (including with metals & major ions)
July 2020	2 x surface water sampling events
August 2020	2 x surface water sampling events
September 2020	2 x surface water sampling events

Surface water samples were submitted to a NATA-accredited laboratory (Analytical Reference Laboratories WA) for analysis of parameters presented in Table 2. Sampling, including field refrigeration, and the use of additional blank and duplicate samples for quality control purposes, was completed in accordance with the Australian Standards (AS/NZS 5667.4:1998 and AS/NZS 5667.11:1998) and Better Urban Water Management (WAPC, 2008).

A multi-parameter metre was also used to measure in situ pH, dissolved oxygen (DO), electrical conductivity (EC) and temperature.

**Table 2: Monitoring parameters**

Analyte group	Parameters
Physico-chemical	<i>In situ:</i> pH, electrical conductivity (EC), Eh, (reduction potential), dissolved oxygen (DO), salinity, temperature, turbidity <i>Laboratory analysis:</i> Total suspended solids (TSS)
Nutrients	Total Nitrogen (TN), Total Kjeldahl Nitrogen (TKN), Ammonia (NH <sub>4</sub> ), Nitrate (NO <sub>3</sub> -N), Nitrite (NO <sub>2</sub> -N), Nitrogen oxides (NO <sub>x</sub> -N = NO <sub>3</sub> -N + NO <sub>2</sub> -N), Total Phosphorus (TP) and Filterable Reactive Phosphorus (FRP)
Metals & major ions (once annually)	Bromide (Br), Chloride (Cl), Sulfate (SO <sub>4</sub> ), Aluminium (Al), and Iron (Fe)

In addition to water quality sampling, flow monitoring was undertaken to inform the design of stormwater management features on site. Flow monitoring also allowed for calculation of flow volumes and thus estimates of nutrient loads being exported from the study area.

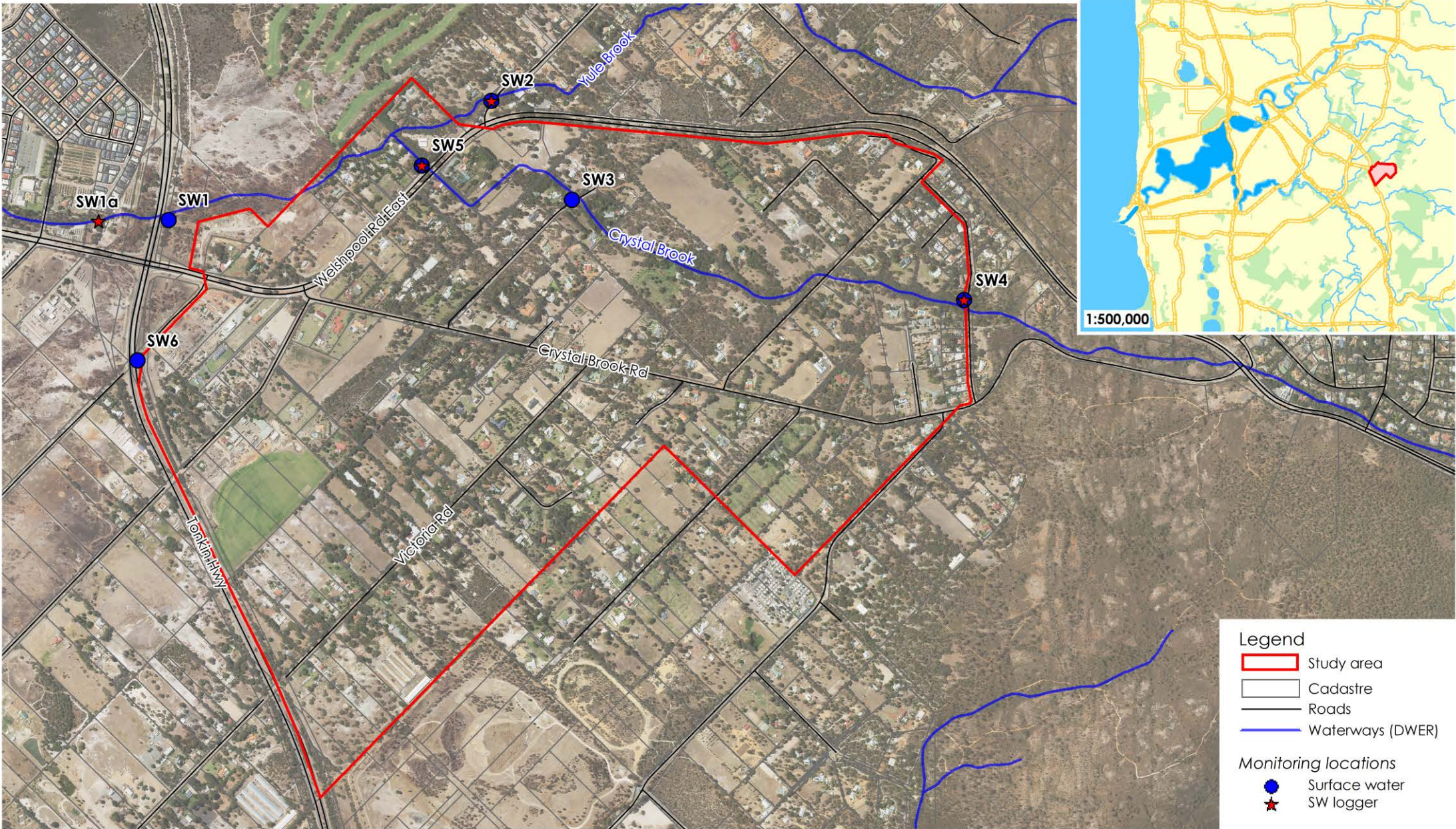
To gauge surface water flow to and from the study area Urbaqua installed hydrostatic pressure loggers at four (4) sites; SW1, SW2, SW4, and SW5 (Figure 2). The pressure logger to measure flows discharging from Yule Brook at the study area at the Tonkin Highway culverts (SW1) was installed just downstream of the culverts and outside of the study area (labelled site SW1a), due to logistical constraints at SW1 itself. Results from SW1a are considered to reflect flows at SW1.

The pressure probes were set up to record the water level in the channels at 10-minute intervals in September 2019. Water levels were recorded in spring 2019 (September – December) and in winter 2020 (July – September). Additional in situ flow and water level measurements recorded in 2020 during sampling events were used to develop ratings curves for each site. These ratings curves were then used to convert pressure probe readings into approximate flow rates to estimate total flow volumes over the period of measurement. Further details on this methodology is provided in Appendix 4.



# City of Kalamunda - Wattle Grove South Water Monitoring Report

## Figure 2 - Monitoring sites



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### 3 RESULTS

A summary of 2019-2020 surface water quality results at the study area are presented below (see Appendix 2 for full results). Laboratory reports for each round of sampling are presented in Appendix 3. Surface water quality results have been assessed against ANZG (2018) (previously ANZECC & ARMCANZ, 2000) freshwater quality guidelines for slightly disturbed lowland river systems in south-west Australia. DGVs refer to default guideline values, previously known as 'trigger values'. Mean nutrient results are presented in Table 3.

#### 3.1 Surface water quality

Key results from the 2019-2020 monitoring program are as follows:

- Water was present at sites SW1 and SW3 during all 2019-2020 events. However, water was only available for sampling in the summer March 2020 event at three of six sites (SW1, SW3, and SW5). Only very low flows were observed where water was present in March 2020. Water was also not available for sampling at sites SW5 and SW6 in July 2019, and at SW6 in June 2020;
- Water quality was generally neutral, fresh and clear at most sites except SW6 where water was brackish (EC: 1,130 – 1,812  $\mu\text{S}/\text{cm}$ ) and slightly basic (pH: 7.86 – 9.01) in quality. However, all results were greater than the ANZG (2018) guideline range for lowland rivers (120-300  $\mu\text{S}/\text{cm}$ ). EC results correlated with salinity;
- Suspended sediments were found to occur at SW6 throughout the year (TSS: 7 - 44 mg/L). Some suspended sediments were observed at all other sites, but only during two to four of the 13 events;
- The lowest oxygen levels and highest temperatures were observed during the March 2020 summer event, as expected;
- Dissolved oxygen was recorded within the ANZG (2018) guideline range (80 – 120%) at all sites, during most events. Site SW6 recorded oxygen levels higher than the ANZG (2018) range in half of the events where water was available for sampling;
- Nutrient concentrations were generally highest at site SW6 with total nitrogen (TN: 1.6 – 3.9 mg/L) and total phosphorus (TP: 0.05 – 0.21 mg/L) concentrations exceeding the ANZG (2018) Default Guideline Values (DGVs, previously 'trigger values') during all events for TN and most events for TP (see Table 3 and Appendix 2). SW6 is the site of a culvert connecting a local drainage system crossing beneath Tonkin Highway. It is not located on either Yule Brook nor Crystal Brook;
- Exceedances of the TN ANZG (2018) DGV (1.2 mg/L) was also observed during two to four events at all other sites except SW5;
- Exceedances of the TP ANZG (2018) DGV (0.065 mg/L) was also observed at sites SW1 - SW5 during two or more events;
- The highest TP concentrations occurred during the summer March 2020 event, where water was present;
- Ammonium ( $\text{NH}_4\text{-N}$ ), nitrite ( $\text{NO}_2\text{-N}$ ), and filtrable reactive phosphorus (FRP) concentrations were less than the limit of reporting and ANZG (2018) DGVs at most sites and most events. Nitrate ( $\text{NO}_3\text{-N}$ ) concentrations were less than the ANZG (2018) DGV at all sites and during most events (with the exception of site SW6 where the DGV was exceeded during July and August 2020 events);
- In comparison to  $\text{NO}_3\text{-N}$ , nitrogen oxide ( $\text{NO}_x\text{-N} = \text{NO}_3 + \text{NO}_2$ ) concentrations exceeded the ANZG (2018) DGV at all sites during most sampling events. This may be explained by the significantly higher new DGV defined for  $\text{NO}_3\text{-N}$  (2.4 mg/L) in the ANZG (2018) guidelines compared to the original DGV for  $\text{NO}_x\text{-N}$  (0.15 mg/L); and
- Indication of elevated metals occurred at site SW1 (Al = 0.22 mg/L) in March 2020 only. No elevated aluminium concentrations were recorded in September 2020. No elevated

iron concentrations were recorded at any site during both the March and September 2020 events.

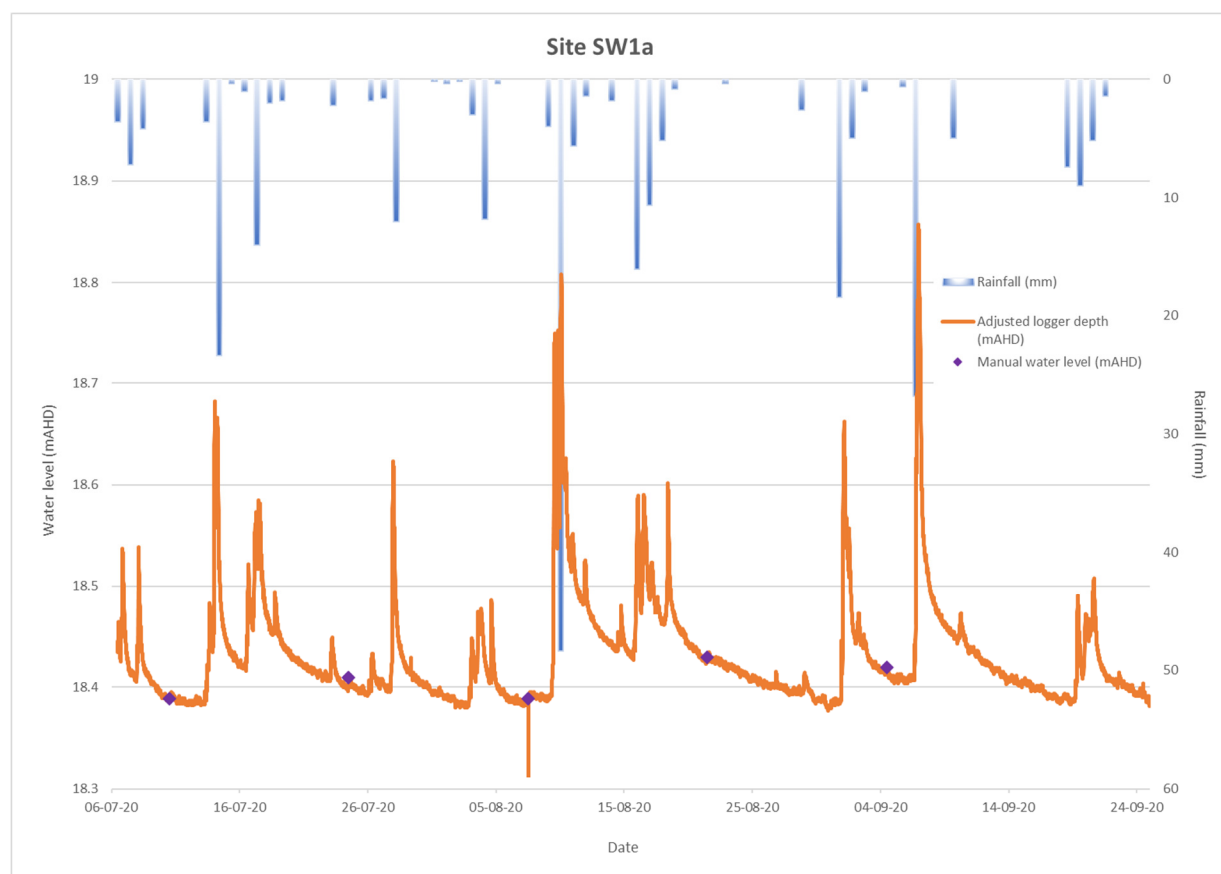
**Table 3: 2019-2020 Wattle Grove South water monitoring program - mean nutrient concentrations (shaded where exceeding ANZG (2018) guideline DVGs, less than symbol indicates mean concentrations less than laboratory limit of reporting)**

Site	Mean TN (mg/L)	Mean NH4 (mg/L)	Mean NO3 (mg/L)	Mean TP (mg/L)	Mean FRP (mg/L)
SW1	1.1	<0.02	0.70	0.05	<0.01
SW2	1.2	<0.02	0.92	0.05	<0.01
SW3	0.9	0.03	0.32	0.068	<0.01
SW4	0.8	<0.02	0.44	0.06	<0.01
SW5	0.6	0.04	0.29	0.08	<0.01
SW6	2.5	0.04	1.7	0.13	0.01

### 3.2 Surface water flow

Urbauqua installed hydrostatic pressure loggers at four (4) sites; SW1a, SW2, SW4, and SW5 (Figure 2 to record the water level in the channels of the sites at 10-minute intervals in spring 2019 (96 days between September and early December), and in winter 2020 (82 days between July and September). Samples to measure water quality in flows from Yule Brook at the study area were taken just upstream of the culverts at Tonkin Highway discharging (site SW1, see Figure 2). However, the pressure probe measuring water levels at this site was installed just downstream of the culverts (site SW1a) due to logistical constraints at SW1 itself. Results from SW1a are considered to reflect flows at SW1.

Additional in situ manual flow and water level measurements recorded in 2020 during sampling events were used to develop ratings curves for each site, which were then used to convert recorded water level measurements into flow rates. Measurements recorded by the pressure probe installed at site SW1a, manual water level measurements, and rainfall are presented in Figure 3 below. Results demonstrate that changes in water level and flows reflected rainfall patterns with significant peak flows occurring throughout the winter period, and that logger results correlated with those measured manually during sampling events. Results from surface water level measurements at four sites (upstream site SW4, midway sites SW2 and SW5, and discharge site SW1/SW1a), and details regarding ratings curve development and conversions into flow rates are presented in Appendix 4.



**Figure 3: Logger and manual water level measurements recorded at site SW1a in winter 2020**

Nutrient loads exported from each site over the 2019 and 2020 monitoring periods were calculated based on mean concentrations of TN and TP from each and estimated total flow volumes during each period.

A summary of results is presented in Table 4 and Table 5 below.

**Table 4: Spring 2019 estimated flow rates and nutrient load calculations**

Site	Flow rate range (m <sup>3</sup> /s)	Total flow volume (ML) (Sept – Nov 2019) (96 days)	Mean TN (mg/L)	TN load (tonne)	Mean TP (mg/L)	TP load (tonne)
SW1/SW1a	0.0955 – 0.4073	1,040	1.0	1.00	0.06	0.060
SW2	0.0465 – 0.4805	450	1.2	0.52	0.07	0.032
SW4	0.0338 – 0.6567	559	0.6	0.36	0.07	0.039
SW5	0.0165 – 0.1760	267	0.6	0.16	0.09	0.023



**Table 5: Winter 2020 estimated flow rates and nutrient load calculations**

Site	Flow rate range	Total flow volume (Jul – Sept 2020) (82 days)	Mean TN (mg/L)	TN load (tonne)	Mean TP (mg/L)	TP load (tonne)
SW1/SW1a	0.09551 – 0.90659	931	1.1	0.98	0.04	0.034
SW2	0.0465 – 1.8388	825	1.2	1.01	0.04	0.029
SW4	0.0338 – 0.9292	509	1.0	0.49	0.06	0.031
SW5	0.0165 – 0.2735	204	0.6	0.13	0.06	0.012

Flow volumes and nutrient loads calculated provide an indication of the relative export of nutrients throughout the study area (note that 14 additional days of measurements were recorded in 2019 compared to 2020, contributing to overall higher flows recorded in 2019). These results indicate that the greatest flows and highest nitrogen and phosphorus loads occurred at the discharge point of the site in Yule Brook at the Tonkin Highway culverts (SW1/SW1a), as expected. On the basis of initial flow results the relative contribution of Crystal Brook (site SW5) to Yule Brook (SW1/SW1a) within the study area (Table 4 and Table 5) may be up to approximately 25% of flows, up to approximately 15% of nitrogen, and up to approximately 40% of phosphorus. This will vary significantly depending on time of year, rainfall patterns, and any changes to landuse or drainage within the catchment.

## 4 DISCUSSION AND CONCLUSIONS

Results from the 2019-2020 Wattle Grove South monitoring program monitoring program have been used to characterise the existing hydrological conditions of the Wattle Grove South study area. This includes water quality and flow volumes within and discharging west from the study area.

Drainage within the study area is currently managed by two natural watercourses Yule Brook, and Crystal Brook, in addition to local drainage in the form of informal open roadside swales, which discharge runoff west via culverts under Tonkin Highway and into the Maddington Kenwick Strategic Employment Area (MKSEA) (a mixture of industrial areas, Bush Forever sites and Conservation Category Wetlands).

A groundwater investigation undertaken in 2019 suggests that significant interaction between the groundwater at the study area and the surface water in the Yule Brook/Crystal Brook and the wetlands to the west is considered unlikely. On this basis no additional groundwater monitoring was undertaken at the study area, and support by the Department of Water and Environmental Regulation.

Results obtained from surface water monitoring indicate that the quality of water within the study area in both the Yule Brook and Crystal Brook waterways are generally neutral, fresh and clear, and low in nutrients (particularly the inorganic, dissolved forms of both nitrogen and phosphorus) and heavy metals. This indicates that flows entering the adjacent MKSEA and wetlands from the study area to the west are generally of high quality.

However site SW6, the site of a culvert connecting a local drainage system discharging west from the study area beneath Tonkin Highway south of Yule Brook (Figure 2), was found to have significantly different water quality; brackish, slightly basic, consistent suspended sediments, and slightly elevated levels of nutrients. Water was also not present for sampling at SW6 during three events (compared to only once at sites SW2, SW4, and SW5). This suggests that localised runoff into this site is more concentrated due to lower volumes of runoff and/or reflects landuse within the sub-catchment, which incorporates local landscaping businesses compared to a rural landuse in the majority of the study area.

Results from flow monitoring within both Yule Brook and Crystal undertaken during the 2019 spring and 2020 winter demonstrates variation in runoff expected with seasonal rainfall patterns, with significant peak flows occurring throughout the winter period. Flow volumes and nutrient loads calculated for four sites (upstream site SW4, midway sites SW2 and SW5, and discharge site SW1/SW1a) provide an indication of the relative export of nutrients throughout the study area. Results indicate that the greatest flows and highest nitrogen and phosphorus loads occurred at the discharge point of the site in Yule Brook at the Tonkin Highway culverts, as expected. On the basis of initial flow results recorded in spring 2019 and winter 2020 the relative contribution of Crystal Brook to Yule Brook within the study area may be up to approximately 25% of flows, up to approximately 15% of nitrogen, and up to approximately 40% of phosphorus. This will vary significantly depending on time of year, rainfall patterns, and any changes to landuse or drainage within the catchment.

Additional flow monitoring may be considered in the future to develop the accuracy of the initial ratings curves and to provide further detail as to current relative contributions of runoff and nutrients from the study area under different rainfall conditions.

## 5 REFERENCES

- ANZECC & ARMCANZ 2000, *Australian and New Zealand guidelines for fresh and marine water quality*, Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand, Canberra.
- ANZG 2018, *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*, Australian and New Zealand Governments and Australian state and territory governments, Canberra. Available at: <[www.waterquality.gov.au/anz-guidelines](http://www.waterquality.gov.au/anz-guidelines)> [4<sup>th</sup> October 2020]
- Jordan J.E. 1986, *Armada, part sheets 2033 I and 2133 IV, Perth Metropolitan Region, Environmental Geology Series*, Geological Survey of Western Australia (GSWA), Perth
- Commonwealth of Australia 2020b, *Toxicant default guideline values for aquatic ecosystem protection: Total iron in fresh water. Technical brief, June 2020*, Australian Government Department of Agriculture, Water and the Environment, Canberra

## **APPENDIX 1: CORRESPONDENCE WITH DWER**

25<sup>th</sup> September 2019

Jim Mackintosh  
Department of Water and Environmental Regulation  
Program Manager  
Swan Avon Region

Dear Jim,

### **Re: City of Kalamunda – Wattle Grove South monitoring plan**

Following the response from DWER Urbaqua has undertaken an initial investigation and implemented a monitoring plan at the Wattle Grove south study area.

A plan of the monitoring sites as well as the borehole logs are attached to this letter.

#### *Surface water monitoring*

A total of six (6) surface water monitoring sites have been established to assess the quality of water entering and exiting the site through Crystal Brook and Yule Brook, as well as to measure water quality discharging from the site through the Tonkin Highway culvert (Figure 1).

Sites SW1 and SW2 are located within the Yule Brook and are approximately 1000 m apart. Sites SW3, SW4 and SW5 are located with the Crystal Brook and have been spaced evenly across the approximately 2 km of stream length within the study area (approximately 1000 m average spacing).

Hydrostatic pressure probes have been installed at SW1, SW2, SW4 and SW5 to measure the stream water level at 10-minute intervals. This can be converted to flow volumes and nutrient loads.

#### *Groundwater monitoring*

To investigate the potential interaction of groundwater with Yule Brook and Crystal Brook as well as the wetlands to the west of the site three (3) boreholes were drilled on the 3<sup>rd</sup> of September 2019 (following approximately 62 mm of rain in the preceding fortnight). The boreholes along the western boundary of the site were drilled to a depth of 8 m and a monitoring bore was installed if groundwater was encountered. The borehole adjacent to Crystal Brook was drilled to 3 m below the invert of the natural channel.

- Groundwater was encountered at GW1 at a depth of 5.5 m BGL and a monitoring bore was installed; and,
- Groundwater was not encountered in boreholes GW2 and GW3, monitoring bores were not installed.

The soils encountered during the borehole drilling were mostly clayey sands with some clay banding throughout, however SW3 was predominantly indurated laterite clay (bore logs attached).

As no perched groundwater was identified and the depth to groundwater is deep (consistent with the regional mapping) it is therefore considered unlikely that there is any interaction between the groundwater in the study area and the surface water in the Yule Brook/Crystal Brook and/or the wetlands to the west.

Based on these findings, Urbaqua does not plan to continue the investigation of groundwater in the study area to address the BUWM requirements.

Should you consider that further groundwater monitoring is required, please do not hesitate to contact me on (08) 9328 4663 or at [ross@urbaqua.org.au](mailto:ross@urbaqua.org.au) should you have any questions. I look forward to hearing from you with regards to this proposal.

Yours sincerely,

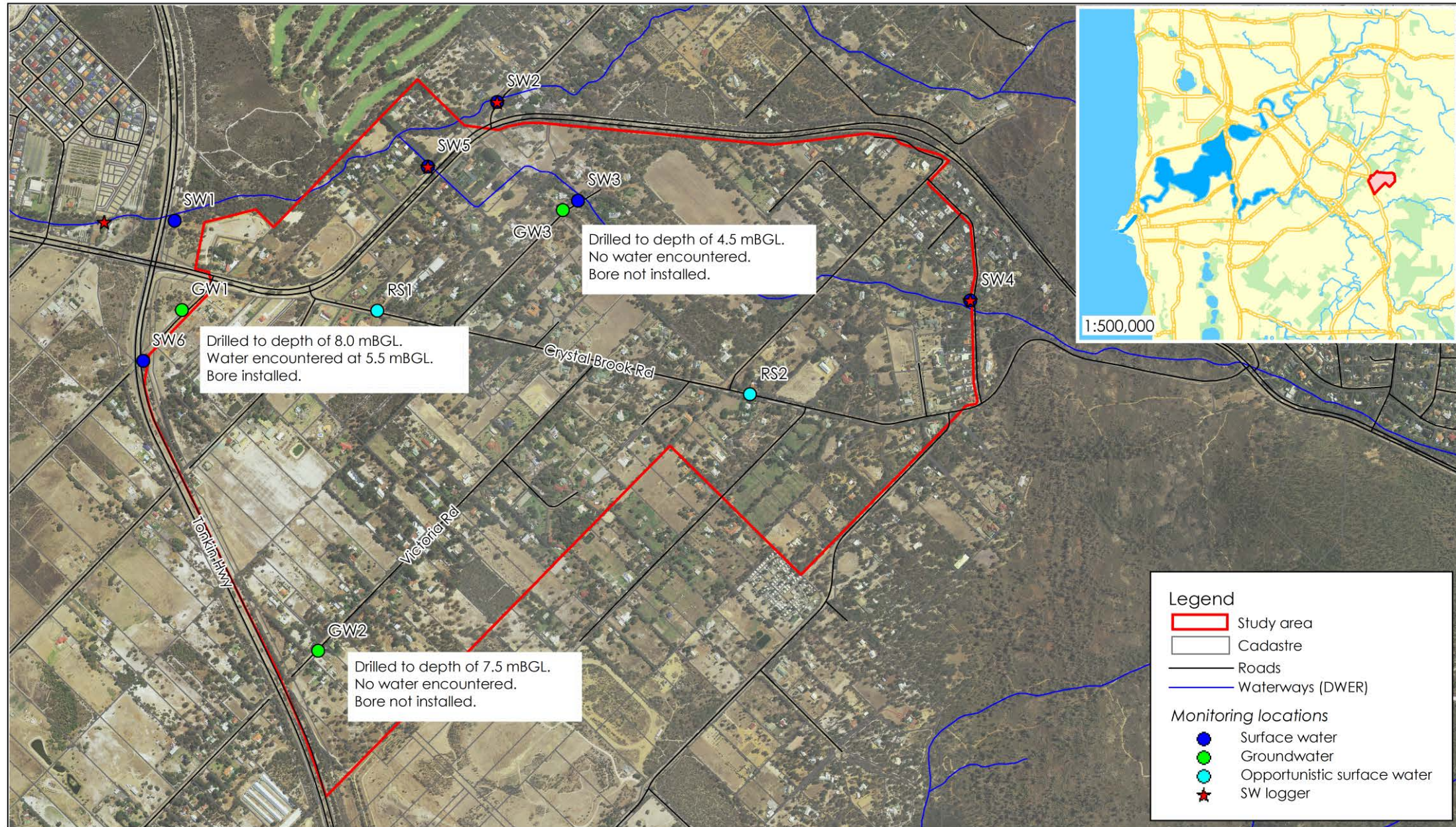
A handwritten signature in black ink, appearing to read 'RNP', followed by a long horizontal flourish.

Ross Perrigo  
Senior Engineer  
URBAQUA



# City of Kalamunda - Wattle Grove South Monitoring

## Figure 1 - Monitoring sites



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Data source: DWER, MRWA, DPLH, CoK, Created by: AT., Projection: MGA: zone 50.









0 500  
metres  
Scale 1:16,000 @ A4

**urbaqua**  
land and water solutions



**NOTE:**

	Monitor Well Screen		Water encountered
	Gravel Pack		
	Bentonite Layer		
	Sand Fill		
	Cement Grout		





**Figure 1: Samples collected at 0.5 m intervals during drilling**



**Figure 2: Drill rig on location**









**Figure 1: Samples collected at 0.5 m intervals during drilling**



**Figure 2: Drill rig on location**





# BOREHOLE LOG

Bore ID: GW3

<b>CLIENT:</b>	City of Kalamunda	<b>DATE COMMENCED:</b>	3/9/2019
<b>PROJECT:</b>	Wattle Grove Monitoring	<b>DATE COMPLETED:</b>	3/9/2019
<b>LOCATION:</b>	Johnson Place, Wattle Grove	<b>LOGGED BY:</b>	AT
<b>CONTRACTOR:</b>	eDrill	<b>INSTALLATION METHOD:</b>	Rotary drill
<b>HORIZONTAL DATUM:</b>	GDA94 Zone 50	<b>R.L. SURFACE (m AHD):</b>	~36
<b>EASTING:</b>	406,645.4	<b>TOTAL DEPTH (m):</b>	4.5
<b>NORTHING:</b>	6,458,437.8	<b>DIAMETER (mm):</b>	50

Depth BGL (m)	Sample Taken	Water	Lithology	Observations
			0 - 0.2 m: Sand, grey, medium grained, moderately sorted, damp	
			0.2 - 0.5 m: Loose gravelly-sand, coarse grained, poorly sorted, damp	
			0.5 - 1.5 m: Laterite, yellow/red, clayey-sand, damp	
1.0				
			1.5 - 4.5 m: Indurated clay, red/orange, dry	
2.0				
3.0				
4.0				
5.0				

NOTE:

- Monitor Well Screen
- Gravel Pack
- Bentonite Layer
- Sand Fill
- Cement Grout
- Water encountered





**Figure 1: Samples collected at 0.5 m intervals during drilling**



**Figure 2: Drill rig on location**



## Halinka Lamparski

---

**From:** Jim MacKintosh <jim.mackintosh@dwer.wa.gov.au>  
**Sent:** Monday, October 19, 2020 9:30 AM  
**To:** Halinka Lamparski  
**Cc:** Ross Perrigo  
**Subject:** RE: City of Kalamunda – Wattle Grove South monitoring plan

Dear Halinka,

The Department of Water and Environmental Regulation (DWER) supports the early cessation of monitoring.

Regards

**Jim Mackintosh**

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**Department of Water and Environmental Regulation**

**Program Manager**

**Swan Avon Region**

**Planning Advice Section**

T 08 6250 8043 |

E [jim.mackintosh@dwer.wa.gov.au](mailto:jim.mackintosh@dwer.wa.gov.au)

Visit our website [www.dwer.wa.gov.au](http://www.dwer.wa.gov.au)

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**From:** Halinka Lamparski <halinka@urbaqua.org.au>  
**Sent:** Friday, 2 October 2020 9:16 AM  
**To:** Jim MacKintosh <jim.mackintosh@dwer.wa.gov.au>  
**Cc:** Ross Perrigo <ross@urbaqua.org.au>  
**Subject:** RE: City of Kalamunda – Wattle Grove South monitoring plan

Dear Jim,

Urbaqua have been undertaking surface water monitoring for the City of Kalamunda in Wattle Grove South since 2019. The proposed scope was confirmed with DWER (attached and email below) and works to date have included:

- Sampling at six monitoring sites across Yule Brook and Crystal Brook (and under Tonkin Highway)
- Sampling at a fortnightly frequency over the 2019 and 2020 winters, and one summer baseline sample was taken in March 2020
- Flow monitoring data collected using hydrostatic pressure probes and complementary channel surveys at four in-stream sites over the 2019 spring/summer and 2020 winter seasons

The monitoring data will be used to determine flow volumes and nutrient loads at key locations.

The program was going to run until April 2021, however, in recent discussions with the City there is a preference to wrap up the project and provide a final report ahead of a council meeting in early November. From the program this effectively removes further spring and summer flow monitoring.

We'd just like to confirm that the program to date satisfies DWER pre-development (baseline) monitoring requirements and there are no objections to ending the monitoring this month. Last summer we saw very little summer flow, so there appears little value in continuing the monitoring.

Don't hesitate to call should you wish to discuss.

Regards,

Halinka Lamparski  
Senior Environmental Engineer  
m: 0478 766 959 | p: 9328 4663 | f: 6316 1431

Please note I only work part time, on Wednesdays, Thursday & Fridays.

## Urbaqua

### *land & water solutions*

4/226 Carr Place Leederville 6007  
[www.urbaqua.org.au](http://www.urbaqua.org.au)

Please follow our blog The Essential Current at:  
<http://essentialenvironmental.wordpress.com/>

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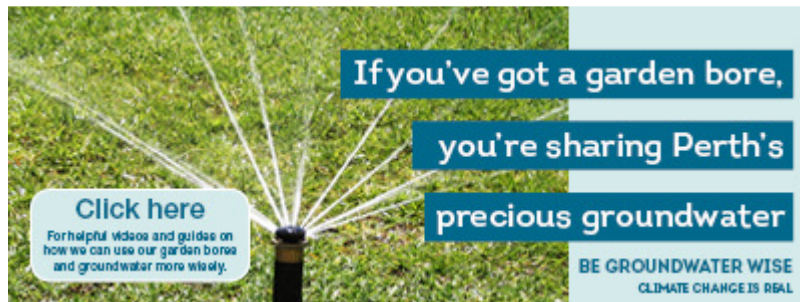
**From:** Jim MacKintosh <[jim.mackintosh@dwer.wa.gov.au](mailto:jim.mackintosh@dwer.wa.gov.au)>  
**Sent:** Wednesday, October 2, 2019 12:59 PM  
**To:** Ross Perrigo <[ross@urbaqua.org.au](mailto:ross@urbaqua.org.au)>  
**Cc:** Urbaqua <[info@urbaqua.org.au](mailto:info@urbaqua.org.au)>  
**Subject:** Re: City of Kalamunda – Wattle Grove South monitoring plan

Dear Ross,

Thank you for your letter dated 25 September 2019 regarding the above proposal. The Department of Water and Environmental Regulation (DWER) supports the proposed monitoring plan.

Regards

**Jim MacKintosh**



**Department of Water and Environmental Regulation**  
**Program Manager**

**Swan Avon Region**

**Planning Advice Section**

T 08 6250 8043 |  
E [jim.mackintosh@dwer.wa.gov.au](mailto:jim.mackintosh@dwer.wa.gov.au)  
Visit our website [www.dwer.wa.gov.au](http://www.dwer.wa.gov.au)

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## **APPENDIX 2: 2019-2020 WATER QUALITY MONITORING RESULTS**





Wattle Grove South surface water quality monitoring results – 2019-2020

				IN SITU								LABORATORY								
				pH	EC (µS/cm)	Eh (mV)	DO (%)	DO (mg/L)	Salinity (ppt)	Temp (°C)	Turbidity (NTU)	TSS (mg/L)	TKN (mg/L)	TN (mg/L)	NH4 (mg/L)	NO3-N (mg/L)	NO2-N (mg/L)	NOx-N (mg/L)	TP (mg/L)	FRP (mg/L)
SITE	Sampling date	Schedule	LoR ANZG (2018)*	-	-	-	-	-	-	-	<5	<5	<0.2	<0.2	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01
				6.5 - 8.0	120 - 300	-	80 - 120	-	-	-	10-20	-	-	1.2	0.08	2.4	-	0.15	0.065	0.04
SW1	25-Jul-19	Jul	2019	8.07	558	180	105	10.7	0.27	14.6	-0.04	<5	<0.2	1.0	<0.02	0.86	<0.01	0.86	0.06	<0.01
	20-Aug-19	Aug	2019	7.82	519	38	101	10.6	0.25	14.1	-1.51	<5	0.4	1.2	<0.02	0.82	<0.01	0.82	0.07	<0.01
	3-Sep-19	Sept	2019	7.65	468	-279	78	7.8	0.23	15.3	-	6	<0.2	1.0	<0.02	0.82	<0.01	0.82	0.06	<0.01
	17-Sep-19	Sept	2019	7.46	549	-188	118	11.2	0.27	16.5	-	<5	<0.2	0.8	<0.02	0.75	0.01	0.76	0.05	<0.01
	1-Oct-19	Oct	2019	6.73	511	131	102	9.8	0.25	17.0	-0.57	<5	<0.2	0.8	<0.02	0.67	<0.01	0.67	0.05	<0.01
	20-Mar-20	Mar	2020	6.52	445	-39	26	2.3	0.21	21.5	-	<5	1.6	1.6	0.03	<0.01	<0.01	<0.01	0.11	<0.01
	19-Jun-20	Jun	2020	7.26	439	161	97	10.3	0.21	13.4	1.04	<5	0.3	0.5	<0.02	0.19	<0.01	0.19	0.06	<0.01
	10-Jul-20	Jul	2020	7.31	523	90	102	10.9	0.25	12.3	0.60	10	0.9	1.8	<0.02	0.91	<0.01	0.91	0.03	<0.01
	24-Jul-20	Jul	2020	7.29	541	194	102	10.8	0.26	13.1	0.70	<5	0.2	1.1	<0.02	0.88	<0.01	0.88	0.05	<0.01
	7-Aug-20	Aug	2020	7.43	552	161	105	11.4	0.26	12.1	0.80	<5	0.3	0.9	<0.02	0.62	<0.01	0.62	0.05	<0.01
	21-Aug-20	Aug	2020	7.65	540	139	104	10.7	0.26	13.7	1.43	<5	<0.2	1.2	<0.02	1.10	<0.01	1.10	0.05	<0.01
	4-Sep-20	Sept	2020	7.33	516	170	104	10.4	0.25	15.8	3.10	9	<0.2	0.9	0.02	0.81	<0.01	0.81	0.01	<0.01
	25-Sep-20	Sept	2020	7.65	514	251	106	10.2	0.25	16.9	6.53	<5	0.3	1.0	0.09	0.69	<0.01	0.69	<0.01	<0.01
SW2	25-Jul-19	Jul	2019	7.80	547	103	103	10.5	0.27	14.5	0.06	<5	0.2	1.2	<0.02	1.00	<0.01	1.00	0.05	<0.01
	20-Aug-19	Aug	2019	7.70	507	-34	101	10.4	0.24	14.7	-3.42	<5	0.4	1.4	0.06	0.99	<0.01	0.99	0.11	<0.01
	3-Sep-19	Sept	2019	7.48	468	20	76	7.6	0.23	15.2	-	8	<0.2	1.1	<0.02	0.95	<0.01	0.95	0.07	<0.01
	17-Sep-19	Sept	2019	7.65	543	-217	109	10.7	0.26	16.4	-	6	<0.2	1.1	<0.02	0.97	0.01	0.98	0.07	<0.01
	1-Oct-19	Oct	2019	7.20	490	125	100	9.7	0.24	16.7	-0.57	6	<0.2	1.0	<0.02	0.88	<0.01	0.88	0.06	<0.01
	20-Mar-20	Mar	2020	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	19-Jun-20	Jun	2020	7.01	452	177	97	10.3	0.22	13.0	0.52	<5	0.3	0.6	<0.02	0.31	<0.01	0.31	0.05	<0.01
	10-Jul-20	Jul	2020	7.31	529	93	102	10.8	0.26	12.5	2.60	8	1.1	2.0	<0.02	0.86	<0.01	0.86	0.02	<0.01
	24-Jul-20	Jul	2020	7.21	535	151	101	10.6	0.26	13.5	1.60	<5	0.3	1.3	<0.02	0.99	0.01	1.00	0.06	<0.01
	7-Aug-20	Aug	2020	7.27	553	165	102	11.1	0.27	11.9	2.40	<5	0.2	1.0	<0.02	0.83	<0.01	0.83	0.05	<0.01
	21-Aug-20	Aug	2020	7.59	535	116	101	10.4	0.26	13.8	2.38	<5	<0.2	1.4	<0.02	1.30	<0.01	1.30	0.05	<0.01
	4-Sep-20	Sept	2020	7.27	514	125	102	10.1	0.25	15.8	1.80	<5	<0.2	1.1	0.03	1.00	<0.01	1.00	<0.01	<0.01
	25-Sep-20	Sept	2020	7.54	568	275	105	10.2	0.25	16.4	1.61	<5	0.3	1.2	<0.02	0.93	<0.01	0.93	0.01	<0.01
SW3	25-Jul-19	Jul	2019	7.83	586	136	105	10.7	0.29	14.6	0.82	<5	0.2	0.6	<0.02	0.40	<0.01	0.40	0.06	<0.01
	20-Aug-19	Aug	2019	7.73	548	-39	103	10.7	0.26	14.4	-1.45	<5	0.4	0.8	0.06	0.44	<0.01	0.44	0.13	<0.01
	3-Sep-19	Sept	2019	6.70	457	-73	80	8.1	0.22	14.9	-	8	0.2	0.8	<0.02	0.58	<0.01	0.58	0.06	<0.01
	17-Sep-19	Sept	2019	7.59	542	-225	111	10.9	0.26	17.2	-	<5	0.3	0.6	<0.02	0.33	<0.01	0.33	0.06	<0.01
	1-Oct-19	Oct	2019	7.32	531	129	103	9.7	0.26	18.3	-0.26	<5	2.3	2.5	0.03	0.25	<0.01	0.25	0.07	<0.01
	20-Mar-20	Mar	2020	7.43	569	-3	96	8.0	0.29	21.9	-	27	0.9	1.1	0.05	0.23	<0.01	0.23	0.16	0.01
	19-Jun-20	Jun	2020	6.14	407	220	89	9.3	0.20	13.5	6.00	<5	0.5	0.6	0.04	0.07	<0.01	0.07	0.04	<0.01
	10-Jul-20	Jul	2020	7.33	495	107	98	10.5	0.24	12.1	2.32	8	1.2	1.4	0.04	0.21	<0.01	0.21	0.02	<0.01
	24-Jul-20	Jul	2020	7.21	563	155	98	10.4	0.27	12.9	1.50	<5	0.3	0.7	0.03	0.38	<0.01	0.38	0.08	<0.01
	7-Aug-20	Aug	2020	7.30	537	93	98	10.7	0.26	11.9	1.50	<5	0.2	0.4	0.02	0.17	<0.01	0.17	0.10	<0.01
	21-Aug-20	Aug	2020	7.74	549	135	101	10.6	0.27	13.1	1.67	<5	<0.2	0.7	<0.02	0.67	<0.01	0.67	0.08	<0.01
	4-Sep-20	Sept	2020	7.37	529	180	101	10.1	0.25	15.4	1.10	<5	<0.2	0.4	0.04	0.30	<0.01	0.30	0.01	<0.01
	25-Sep-20	Sept	2020	7.30	530	249	99	9.8	0.26	15.8	1.96	<5	0.5	0.6	0.04	0.15	<0.01	0.15	0.02	<0.01
SW4	25-Jul-19	Jul	2019	7.81	585	160	101	10.1	0.29	15.2	0.82	<5	0.2	0.7	<0.02	0.50	<0.01	0.50	0.06	<0.01
	20-Aug-19	Aug	2019	7.58	537	-53	99	9.9	0.26	15.3	-2.21	<5	0.3	0.8	0.05	0.50	<0.01	0.50	0.09	<0.01
	3-Sep-19	Sept	2019	7.32	495	-41	73	7.3	0.24	15.4	-	<5	<0.2	0.8	<0.02	0.68	<0.01	0.68	0.08	<0.01
	17-Sep-19	Sept	2019	7.48	530	-205	153	15.1	0.26	17.2	-	<5	<0.2	0.5	<0.02	0.48	<0.01	0.48	0.04	<0.01
	1-Oct-19	Oct	2019	7.14	492	124	96	9.2	0.24	17.6	-0.43	6	<0.2	0.4	<0.02	0.36	<0.01	0.36	0.08	<0.01
	20-Mar-20	Mar	2020	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	19-Jun-20	Jun	2020	6.56	527	188	88	9.5	0.60	14.0	0.32	<5	0.6	0.6	<0.02	0.05	<0.01	0.05	0.09	<0.01
	10-Jul-20	Jul	2020	6.93	556	31	95	9.9	0.27	13.4	2.06	16	1.1	1.4	<0.02	0.34	<0.01	0.34	0.02	<0.01
	24-Jul-20	Jul	2020	6.85	559	34	96	9.8	0.27	14.4	0.60	<5	0.2	0.7	<0.02	0.50	0.01	0.51	0.10	<0.01
	7-Aug-20	Aug	2020	6.75	568	126	98	10.4	0.27	12.5	0.50	<5	<0.2	0.4	<0.02	0.30	<0.01	0.30	0.12	<0.01
	21-Aug-20	Aug	2020	7.51	552	111	97	9.9	0.27	14.4	4.04	<5	<0.2	0.8	<0.02	0.80	<0.01	0.80	0.07	0.03
	4-Sep-20	Sept	2020	7.06	541	92	95	9.4	0.26	16.1	0.60	<5	1.7	2.1	0.04	0.43	<0.01	0.43	<0.01	<0.01
	25-Sep-20	Sept	2020	6.96	532	252	98	9.6	0.26	15.9	1.12	<5	0.4	0.7	0.03	0.31	<0.01	0.31	0.02	<0.01

				IN SITU							LABORATORY										
SITE	Sampling date	Schedule	LoR ANZG (2018)*	pH	EC (µS/cm)	Eh (mV)	DO (%)	DO (mg/L)	Salinity (ppt)	Temp (°C)	Turbidity (NTU)	TSS (mg/L)	TKN (mg/L)	TN (mg/L)	NH4 (mg/L)	NO3-N (mg/L)	NO2-N (mg/L)	NOx-N (mg/L)	TP (mg/L)	FRP (mg/L)	
				-	-	-	-	-	-	-	<5	<5	<0.2	<0.2	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
				6.5 - 8.0	120 - 300	-	80 - 120	-	-	-	10-20	-	-	1.2	0.08	2.4	-	0.15	0.065	0.04	
SW5	25-Jul-19	Jul	2019	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	20-Aug-19	Aug	2019	7.71	550	-40	101	10.5	0.26	14.1	0.35	<5	0.3	0.7	0.05	0.42	0.01	0.43	0.13	<0.01	
	3-Sep-19	Sept	2019	7.74	477	-175	76	7.6	0.23	15.4	-	8	0.2	0.8	<0.02	0.60	<0.01	0.60	0.08	<0.01	
	17-Sep-19	Sept	2019	7.61	522	-205	101	9.7	0.25	17.2	-	<5	<0.2	0.5	<0.02	0.33	0.01	0.34	0.04	<0.01	
	1-Oct-19	Oct	2019	7.07	511	132	98	9.3	0.25	18.0	4.22	20	0.2	0.4	0.03	0.20	<0.01	0.20	0.09	<0.01	
	20-Mar-20	Mar	2020	6.56	561	-37	46	3.9	0.27	19.4	-	<5	0.5	0.6	0.03	0.11	<0.01	0.11	0.21	0.05	
	19-Jun-20	Jun	2020	6.84	407	121	81	8.6	0.20	12.9	4.28	<5	0.5	0.5	<0.02	0.04	<0.01	0.04	0.06	<0.01	
	10-Jul-20	Jul	2020	7.23	497	94	100	10.6	0.24	12.5	1.97	<5	1.0	1.2	0.03	0.17	<0.01	0.17	0.04	0.01	
	24-Jul-20	Jul	2020	7.22	562	153	101	10.6	0.27	13.6	1.20	<5	0.2	0.6	<0.02	0.35	0.01	0.36	0.09	<0.01	
	7-Aug-20	Aug	2020	7.58	528	224	106	11.5	0.25	12.2	1.80	<5	0.2	0.3	<0.02	0.13	<0.01	0.13	0.09	<0.01	
	21-Aug-20	Aug	2020	7.85	549	135	105	10.9	0.27	13.7	2.43	<5	<0.2	0.7	<0.02	0.63	<0.01	0.63	0.08	<0.01	
	4-Sep-20	Sept	2020	7.41	528	130	103	10.2	0.25	15.9	3.40	<5	<0.2	0.4	0.05	0.27	<0.01	0.27	0.01	<0.01	
	25-Sep-20	Sept	2020	7.28	535	270	101	9.5	0.26	17.5	2.07	<5	0.5	0.7	0.04	0.19	<0.01	0.19	0.05	0.03	
SW6	25-Jul-19	Jul	2019	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	20-Aug-19	Aug	2019	8.41	1,542	-67	122	11.6	0.77	18.5	7.01	<5	0.7	1.7	0.05	0.94	0.03	0.97	0.16	0.02	
	3-Sep-19	Sept	2019	7.86	1,130	-166	82	7.7	0.56	17.6	-	14	0.8	1.6	<0.02	0.84	<0.01	0.84	0.18	0.03	
	17-Sep-19	Sept	2019	9.01	1,405	-206	152	13.3	0.70	22.1	-	11	1.4	2.3	<0.02	0.97	0.01	0.98	0.09	0.01	
	1-Oct-19	Oct	2019	8.11	1,325	136	148	12.3	0.66	24.3	2.25	16	0.6	2.1	0.08	1.50	0.03	1.50	0.15	<0.01	
	20-Mar-20	Mar	2020	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	19-Jun-20	Jun	2020	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	10-Jul-20	Jul	2020	8.08	1,438	94	137	13.1	0.73	17.5	4.04	22	1.2	2.9	0.03	1.70	0.01	1.70	0.08	<0.01	
	24-Jul-20	Jul	2020	7.35	1,684	228	113	10.9	0.85	17.5	1.60	7	0.4	3.9	0.03	3.50	0.03	3.50	0.16	<0.01	
	7-Aug-20	Aug	2020	7.04	1,617	71	82	8.5	0.81	14.1	20.0	44	0.6	2.8	0.07	2.20	0.03	2.20	0.21	<0.01	
	21-Aug-20	Aug	2020	7.60	1,743	162	132	12.7	0.89	16.9	6.76	13	0.4	3.3	<0.02	2.90	0.01	2.90	0.13	0.02	
	4-Sep-20	Sept	2020	7.46	1,812	214	107	10.0	0.92	18.6	5.20	10	0.7	2.2	<0.02	1.50	0.01	1.50	0.05	<0.01	
	25-Sep-20	Sept	2020	7.37	1,575	255	107	10.0	0.80	18.2	11.4	8	1.2	2.0	0.06	0.81	0.01	0.82	0.06	<0.01	

				LABORATORY				
SITE	Sampling date	Schedule	LoR ANZG (2018)*	Br (mg/L)	Cl (mg/L)	SO4 (mg/L)	Al (mg/L)	Fe (mg/L)
				<0.1	<5	<1	<0.01	<0.01
				-	-	-	0.055 (pH>6.5)	0.7**
SW1	20-Mar-20	Mar	2020	0.2	82	28	0.22	0.67
	25-Sep-20	Sept	2020	0.4	110	27	0.02	0.07
SW2	20-Mar-20	Mar	2020	-	-	-	-	-
	25-Sep-20	Sept	2020	0.3	110	29	0.01	0.05
SW3	20-Mar-20	Mar	2020	1.0	310	34	<0.01	0.08
	25-Sep-20	Sept	2020	0.3	110	23	0.03	0.18
SW4	20-Mar-20	Mar	2020	-	-	-	-	-
	25-Sep-20	Sept	2020	0.3	130	24	0.03	0.09
SW5	20-Mar-20	Mar	2020	0.4	150	26	0.02	0.08
	25-Sep-20	Sept	2020	0.3	140	24	0.04	0.15
SW6	20-Mar-20	Mar	2020	-	-	-	-	-
	25-Sep-20	Sept	2020	0.9	360	120	<0.01	0.09

\*ANZG 2018, *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*, Australian and New Zealand Governments and Australian state and territory governments, Canberra. Available at: <[www.waterquality.gov.au/anz-guidelines](http://www.waterquality.gov.au/anz-guidelines)>

Trigger values are for slightly disturbed lowland river systems in south-west Australia. NO3-N value is the Grading nitrate concentration as based on Hickey (2013). The ANZECC & ARMCANZ (2000) was erroneous (ANZG, 2018).

(Previously ANZECC & ARMCANZ 2000, *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*, Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand, Canberra)

\*\*ANZG (2018) trigger levels for: Al=0.055 mg/L trigger value applicable for pH>6.5, Al=0.0008 mg/L trigger value applicable for pH<6.5; New Fe DGV for 95% protection (see June 2020 Technical brief for Total Iron in freshwater).

## APPENDIX 3: LABORATORY RESULTS

## LABORATORY REPORT

**Job Number:** 19-12083  
**Revision:** 00  
**Date:** 4 August 2019

**ADDRESS:** Urbaqua  
4/226 Carr PI  
Leederville WA 6007

**ATTENTION:** Alex Towler

**DATE RECEIVED:** 25/07/2019

**YOUR REFERENCE:** Wattle Grove South Monitoring

**PURCHASE ORDER:**

**APPROVALS:**



Sean Sangster  
Inorganics Supervisor

### REPORT COMMENTS:

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Samples are analysed on an as received basis unless otherwise noted.

### METHOD REFERENCES:

Methods prefixed with "ARL" are covered under NATA Accreditation Number: 2377  
Methods prefixed with "PM" are covered under NATA Accreditation Number: 2561  
Methods prefixed with "EDP" are covered under NATA Accreditation Number: 19290

Method ID	Method Description
ARL No. 330	Persulfate Method for Simultaneous Determination of TN & TP
ARL No. 308	Total Phosphorus in Water by Discrete Analyser
ARL No. 309	Filterable Reactive Phosphorus in Water by Discrete Analyser
ARL No. 303	Ammonia in Water by Discrete Analyser
ARL No. 313/319	NOx in Water by Discrete Analyser
ARL No. 311	Nitrite in Water by Discrete Analyser
ARL No. 016	Total Suspended Solids



WORLD RECOGNISED  
**ACCREDITATION**

Accredited for compliance with  
ISO/IEC 17025 - Testing

Urbaqua  
Job No: 19-12083

LABORATORY REPORT  
Revision: 00

Date: 4/08/19

Total Nitrogen in Water			Sample No	19-12083-1	19-12083-2	19-12083-3	19-12083-4
Sample Description				SW1	SW2	SW3	SW4
Sample Date				25/07/2019	25/07/2019	25/07/2019	25/07/2019
ANALYTE	LOR	Units	Result	Result	Result	Result	Result
Total Nitrogen	0.2	mg/L	1.0	1.2	0.6	0.7	
Total Kjeldahl Nitrogen	0.2	mg/L	<0.2	0.2	0.2	0.2	

Total Phosphorus in Water			Sample No	19-12083-1	19-12083-2	19-12083-3	19-12083-4
Sample Description				SW1	SW2	SW3	SW4
Sample Date				25/07/2019	25/07/2019	25/07/2019	25/07/2019
ANALYTE	LOR	Units	Result	Result	Result	Result	Result
Total Phosphorus	0.01	mg/L	0.06	0.05	0.06	0.06	

Ions by Discrete Analyser			Sample No	19-12083-1	19-12083-2	19-12083-3	19-12083-4
Sample Description				SW1	SW2	SW3	SW4
Sample Date				25/07/2019	25/07/2019	25/07/2019	25/07/2019
ANALYTE	LOR	Units	Result	Result	Result	Result	Result
Filterable Reactive Phosphorus	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	
Ammonia-N	0.02	mg/L	<0.02	<0.02	<0.02	<0.02	
Nitrate-N	0.01	mg/L	0.86	1.0	0.40	0.50	
NOx-N	0.01	mg/L	0.86	1.0	0.40	0.50	
Nitrite-N	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	

Physical Parameters			Sample No	19-12083-1	19-12083-2	19-12083-3	19-12083-4
Sample Description				SW1	SW2	SW3	SW4
Sample Date				25/07/2019	25/07/2019	25/07/2019	25/07/2019
ANALYTE	LOR	Units	Result	Result	Result	Result	Result
Total Suspended Solids	5	mg/L	<5	<5	<5	<5	

#### Result Definitions

LOR Limit of Reporting [NT] Not Tested [ND] Not Detected at indicated Limit of Reporting  
\* Denotes test not covered by NATA Accreditation

FOR MICROBIOLOGICAL TESTING - The data in this report may not be representative of a lot, batch or other samples and may not necessarily justify the acceptance or rejection of a lot or batch, a product recall or support legal proceedings. Tests are not routinely performed as duplicates unless specifically requested. Changes occur in the bacterial content of biological samples. Samples should be examined as soon as possible after collection, preferably within 6 hrs and must be stored at 4 degrees Celsius or below. Samples tested after 24 hrs cannot be regarded as satisfactory because of temperature abuse and variations.

## LABORATORY REPORT

**Job Number:** 19-13697  
**Revision:** 00  
**Date:** 28 August 2019

**ADDRESS:** Urbaqua  
4/226 Carr Pl  
Leederville WA 6007

**ATTENTION:** Alex Towler

**DATE RECEIVED:** 20/08/2019

**YOUR REFERENCE:** Wattle Grove South

**PURCHASE ORDER:**

**APPROVALS:**



Sean Sangster  
Inorganics Supervisor

### REPORT COMMENTS:

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Methods prefixed with "PM" are covered under NATA Accreditation Number: 2561  
Methods prefixed with "EDP" are covered under NATA Accreditation Number: 19290

Method ID	Method Description
ARL No. 330	Persulfate Method for Simultaneous Determination of TN & TP
ARL No. 308	Total Phosphorus in Water by Discrete Analyser
ARL No. 309	Filterable Reactive Phosphorus in Water by Discrete Analyser
ARL No. 303	Ammonia in Water by Discrete Analyser
ARL No. 313/319	NOx in Water by Discrete Analyser
ARL No. 311	Nitrite in Water by Discrete Analyser
ARL No. 016	Total Suspended Solids



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### ARL GROUP

46-48 Banksia Road, Welshpool, Western Australia 6106  
Telephone: 08 6253 4444 Facsimile: 08 6253 4440 [www.arlgroup.com.au](http://www.arlgroup.com.au)

Urbaqua  
Job No: 19-13697

LABORATORY REPORT  
Revision: 00

Date: 28/08/19

Total Nitrogen in Water			Sample No	19-13697-1	19-13697-2	19-13697-3	19-13697-4	19-13697-5
Sample Description				SW1	SW2	SW3	SW4	SW5
Sample Date				20/08/2019	20/08/2019	20/08/2019	20/08/2019	20/08/2019
ANALYTE	LOR	Units	Result	Result	Result	Result	Result	Result
Total Nitrogen	0.2	mg/L	1.2	1.4	0.8	0.8	0.7	
Total Kjeldahl Nitrogen	0.2	mg/L	0.4	0.4	0.4	0.3	0.3	

Total Nitrogen in Water			Sample No	19-13697-6
Sample Description				SW6
Sample Date				20/08/2019
ANALYTE	LOR	Units	Result	
Total Nitrogen	0.2	mg/L	1.7	
Total Kjeldahl Nitrogen	0.2	mg/L	0.7	

Total Phosphorus in Water			Sample No	19-13697-1	19-13697-2	19-13697-3	19-13697-4	19-13697-5
Sample Description				SW1	SW2	SW3	SW4	SW5
Sample Date				20/08/2019	20/08/2019	20/08/2019	20/08/2019	20/08/2019
ANALYTE	LOR	Units	Result	Result	Result	Result	Result	Result
Total Phosphorus	0.01	mg/L	0.07	0.11	0.13	0.09	0.13	

Total Phosphorus in Water			Sample No	19-13697-6
Sample Description				SW6
Sample Date				20/08/2019
ANALYTE	LOR	Units	Result	
Total Phosphorus	0.01	mg/L	0.16	

Ions by Discrete Analyser			Sample No	19-13697-1	19-13697-2	19-13697-3	19-13697-4	19-13697-5
Sample Description				SW1	SW2	SW3	SW4	SW5
Sample Date				20/08/2019	20/08/2019	20/08/2019	20/08/2019	20/08/2019
ANALYTE	LOR	Units	Result	Result	Result	Result	Result	Result
Filterable Reactive Phosphorus	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Ammonia-N	0.02	mg/L	<0.02	0.06	0.06	0.05	0.05	
Nitrate-N	0.01	mg/L	0.82	0.99	0.44	0.50	0.42	
NOx-N	0.01	mg/L	0.82	0.99	0.44	0.50	0.43	
Nitrite-N	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	0.01	

Ions by Discrete Analyser			Sample No	19-13697-6
Sample Description				SW6
Sample Date				20/08/2019
ANALYTE	LOR	Units	Result	
Filterable Reactive Phosphorus	0.01	mg/L	0.02	
Ammonia-N	0.02	mg/L	0.05	
Nitrate-N	0.01	mg/L	0.94	
NOx-N	0.01	mg/L	0.97	
Nitrite-N	0.01	mg/L	0.03	

Urbaqua

Job No: 19-13697

LABORATORY REPORT

Revision: 00

Date: 28/08/19

Physical Parameters			Sample No	19-13697-1	19-13697-2	19-13697-3	19-13697-4	19-13697-5
Sample Description				SW1	SW2	SW3	SW4	SW5
Sample Date				20/08/2019	20/08/2019	20/08/2019	20/08/2019	20/08/2019
ANALYTE	LOR	Units		Result	Result	Result	Result	Result
Total Suspended Solids	5	mg/L		<5	<5	<5	<5	<5

Physical Parameters			Sample No	19-13697-6
Sample Description				SW6
Sample Date				20/08/2019
ANALYTE	LOR	Units		Result
Total Suspended Solids	5	mg/L		<5

**Result Definitions**

LOR Limit of Reporting

[NT] Not Tested

[ND] Not Detected at indicated Limit of Reporting

\* Denotes test not covered by NATA Accreditation

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## LABORATORY REPORT

Job Number: 19-14559  
Revision: 00  
Date: 10 September 2019

ADDRESS: **Urbaqua**  
4/226 Carr Pl  
Leederville WA 6007

ATTENTION: Alex Towler

DATE RECEIVED: 3/09/2019

YOUR REFERENCE: Wattle Grove South

PURCHASE ORDER:

APPROVALS:



Sam Becker  
Inorganics Manager

Sean Sangster  
Inorganics Supervisor

### REPORT COMMENTS:

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### METHOD REFERENCES:

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Methods prefixed with "PM" are covered under NATA Accreditation Number: 2561  
Methods prefixed with "EDP" are covered under NATA Accreditation Number: 19290

Method ID	Method Description
ARL No. 330	Persulfate Method for Simultaneous Determination of TN & TP
ARL No. 308	Total Phosphorus in Water by Discrete Analyser
ARL No. 309	Filterable Reactive Phosphorus in Water by Discrete Analyser
ARL No. 303	Ammonia in Water by Discrete Analyser
ARL No. 313/319	NOx in Water by Discrete Analyser
ARL No. 311	Nitrite in Water by Discrete Analyser
ARL No. 016	Total Suspended Solids



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### ARL GROUP

46-48 Banksia Road, Welshpool, Western Australia 6106  
Telephone: 08 6253 4444 Facsimile: 08 6253 4440 [www.arlgroup.com.au](http://www.arlgroup.com.au)

Urbaqua

Job No: 19-14559

LABORATORY REPORT

Revision: 00

Date: 10/09/19

Total Nitrogen in Water			Sample No	19-14559-1	19-14559-2	19-14559-3	19-14559-4	19-14559-5
Sample Description				SW1	SW2	SW3	SW4	SW5
Sample Date				3/09/2019	3/09/2019	3/09/2019	3/09/2019	3/09/2019
ANALYTE	LOR	Units	Result	Result	Result	Result	Result	Result
Total Nitrogen	0.2	mg/L	1.0	1.1	0.8	0.8	0.8	0.8
Total Kjeldahl Nitrogen	0.2	mg/L	<0.2	<0.2	0.2	<0.2	<0.2	0.2

Total Nitrogen in Water			Sample No	19-14559-6
Sample Description				SW6
Sample Date				3/09/2019
ANALYTE	LOR	Units	Result	Result
Total Nitrogen	0.2	mg/L	1.6	
Total Kjeldahl Nitrogen	0.2	mg/L	0.8	

Total Phosphorus in Water			Sample No	19-14559-1	19-14559-2	19-14559-3	19-14559-4	19-14559-5
Sample Description				SW1	SW2	SW3	SW4	SW5
Sample Date				3/09/2019	3/09/2019	3/09/2019	3/09/2019	3/09/2019
ANALYTE	LOR	Units	Result	Result	Result	Result	Result	Result
Total Phosphorus	0.01	mg/L	0.06	0.07	0.06	0.08	0.08	0.08

Total Phosphorus in Water			Sample No	19-14559-6
Sample Description				SW6
Sample Date				3/09/2019
ANALYTE	LOR	Units	Result	Result
Total Phosphorus	0.01	mg/L	0.18	

Ions by Discrete Analyser			Sample No	19-14559-1	19-14559-2	19-14559-3	19-14559-4	19-14559-5
Sample Description				SW1	SW2	SW3	SW4	SW5
Sample Date				3/09/2019	3/09/2019	3/09/2019	3/09/2019	3/09/2019
ANALYTE	LOR	Units	Result	Result	Result	Result	Result	Result
Filterable Reactive Phosphorus	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Ammonia-N	0.02	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Nitrate-N	0.01	mg/L	0.82	0.95	0.58	0.68	0.60	0.60
NOx-N	0.01	mg/L	0.82	0.95	0.58	0.68	0.60	0.60
Nitrite-N	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Ions by Discrete Analyser			Sample No	19-14559-6
Sample Description				SW6
Sample Date				3/09/2019
ANALYTE	LOR	Units	Result	Result
Filterable Reactive Phosphorus	0.01	mg/L	0.03	
Ammonia-N	0.02	mg/L	<0.02	
Nitrate-N	0.01	mg/L	0.84	
NOx-N	0.01	mg/L	0.84	
Nitrite-N	0.01	mg/L	<0.01	

**ARL GROUP**

46-48 Banksia Road, Welshpool, Western Australia 6106  
 Telephone: 08 6253 4444 Facsimile: 08 6253 4440 [www.arlgroup.com.au](http://www.arlgroup.com.au)

Urbaqua

Job No: 19-14559

LABORATORY REPORT

Revision: 00

Date: 10/09/19

Physical Parameters			Sample No	19-14559-1	19-14559-2	19-14559-3	19-14559-4	19-14559-5
Sample Description				SW1	SW2	SW3	SW4	SW5
Sample Date				3/09/2019	3/09/2019	3/09/2019	3/09/2019	3/09/2019
ANALYTE	LOR	Units		Result	Result	Result	Result	Result
Total Suspended Solids	5	mg/L		6	8	8	<5	8

Physical Parameters			Sample No	19-14559-6
Sample Description				SW6
Sample Date				3/09/2019
ANALYTE	LOR	Units		Result
Total Suspended Solids	5	mg/L		14

**Result Definitions**

LOR Limit of Reporting

[NT] Not Tested

[ND] Not Detected at indicated Limit of Reporting

\* Denotes test not covered by NATA Accreditation

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## LABORATORY REPORT

Job Number: 19-15431  
Revision: 00  
Date: 24 September 2019

ADDRESS: **Urbaqua**  
4/226 Carr Pl  
Leederville WA 6007

ATTENTION: Alex Towler

DATE RECEIVED: 17/09/2019

YOUR REFERENCE: Wattle Grove South

PURCHASE ORDER:

APPROVALS:



Sean Sangster  
Inorganics Supervisor

Sam Becker  
Inorganics Manager

### REPORT COMMENTS:

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### METHOD REFERENCES:

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Methods prefixed with "PM" are covered under NATA Accreditation Number: 2561  
Methods prefixed with "EDP" are covered under NATA Accreditation Number: 19290

Method ID	Method Description
ARL No. 330	Persulfate Method for Simultaneous Determination of TN & TP
ARL No. 308	Total Phosphorus in Water by Discrete Analyser
ARL No. 309	Filterable Reactive Phosphorus in Water by Discrete Analyser
ARL No. 303	Ammonia in Water by Discrete Analyser
ARL No. 313/319	NOx in Water by Discrete Analyser
ARL No. 311	Nitrite in Water by Discrete Analyser
ARL No. 016	Total Suspended Solids



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Telephone: 08 6253 4444 Facsimile: 08 6253 4440 [www.arlgroup.com.au](http://www.arlgroup.com.au)



Urbaqua

Job No: 19-15431

## LABORATORY REPORT

Revision: 00

Date: 24/09/19

Total Nitrogen in Water			Sample No	19-15431-1	19-15431-2	19-15431-3	19-15431-4	19-15431-5
Sample Description				SW1	SW2	SW3	SW4	SW5
Sample Date				17/09/2019	17/09/2019	17/09/2019	17/09/2019	17/09/2019
ANALYTE	LOR	Units	Result	Result	Result	Result	Result	Result
Total Nitrogen	0.2	mg/L	0.8	1.1	0.6	0.5	0.5	0.5
Total Kjeldahl Nitrogen	0.2	mg/L	<0.2	<0.2	0.3	<0.2	<0.2	<0.2

Total Nitrogen in Water			Sample No	19-15431-6
Sample Description				SW6
Sample Date				17/09/2019
ANALYTE	LOR	Units	Result	Result
Total Nitrogen	0.2	mg/L	2.3	
Total Kjeldahl Nitrogen	0.2	mg/L	1.4	

Total Phosphorus in Water			Sample No	19-15431-1	19-15431-2	19-15431-3	19-15431-4	19-15431-5
Sample Description				SW1	SW2	SW3	SW4	SW5
Sample Date				17/09/2019	17/09/2019	17/09/2019	17/09/2019	17/09/2019
ANALYTE	LOR	Units	Result	Result	Result	Result	Result	Result
Total Phosphorus	0.01	mg/L	0.05	0.07	0.06	0.04	0.04	0.04

Total Phosphorus in Water			Sample No	19-15431-6
Sample Description				SW6
Sample Date				17/09/2019
ANALYTE	LOR	Units	Result	Result
Total Phosphorus	0.01	mg/L	0.09	

Ions by Discrete Analyser			Sample No	19-15431-1	19-15431-2	19-15431-3	19-15431-4	19-15431-5
Sample Description				SW1	SW2	SW3	SW4	SW5
Sample Date				17/09/2019	17/09/2019	17/09/2019	17/09/2019	17/09/2019
ANALYTE	LOR	Units	Result	Result	Result	Result	Result	Result
Filterable Reactive Phosphorus	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Ammonia-N	0.02	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Nitrate-N	0.01	mg/L	0.75	0.97	0.33	0.48	0.33	0.33
NOx-N	0.01	mg/L	0.76	0.98	0.33	0.48	0.34	0.34
Nitrite-N	0.01	mg/L	0.01	0.01	<0.01	<0.01	0.01	0.01

Ions by Discrete Analyser			Sample No	19-15431-6
Sample Description				SW6
Sample Date				17/09/2019
ANALYTE	LOR	Units	Result	Result
Filterable Reactive Phosphorus	0.01	mg/L	0.01	
Ammonia-N	0.02	mg/L	<0.02	
Nitrate-N	0.01	mg/L	0.97	
NOx-N	0.01	mg/L	0.98	
Nitrite-N	0.01	mg/L	0.01	

### ARL GROUP

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Urbaqua

Job No: 19-15431

LABORATORY REPORT

Revision: 00

Date: 24/09/19

Physical Parameters			Sample No	19-15431-1	19-15431-2	19-15431-3	19-15431-4	19-15431-5
Sample Description				SW1	SW2	SW3	SW4	SW5
Sample Date				17/09/2019	17/09/2019	17/09/2019	17/09/2019	17/09/2019
ANALYTE	LOR	Units		Result	Result	Result	Result	Result
Total Suspended Solids	5	mg/L		<5	6	<5	<5	<5

Physical Parameters			Sample No	19-15431-6
Sample Description				SW6
Sample Date				17/09/2019
ANALYTE	LOR	Units		Result
Total Suspended Solids	5	mg/L		11

**Result Definitions**

LOR Limit of Reporting

[NT] Not Tested

[ND] Not Detected at indicated Limit of Reporting

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**LABORATORY REPORT**

**Job Number:** 19-16374  
**Revision:** 00  
**Date:** 14 October 2019

**ADDRESS:** **Urbaqua**  
4/226 Carr Pl  
Leederville WA 6007

**ATTENTION:** Alex Towler

**DATE RECEIVED:** 1/10/2019

**YOUR REFERENCE:** Wattle Grove South

**PURCHASE ORDER:**

**APPROVALS:**



Sean Sangster  
Inorganics Supervisor

**REPORT COMMENTS:**

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Methods prefixed with "EDP" are covered under NATA Accreditation Number: 19290

Method ID	Method Description
ARL No. 330	Persulfate Method for Simultaneous Determination of TN & TP
ARL No. 308	Total Phosphorus in Water by Discrete Analyser
ARL No. 309	Filterable Reactive Phosphorus in Water by Discrete Analyser
ARL No. 303	Ammonia in Water by Discrete Analyser
ARL No. 313/319	NOx in Water by Discrete Analyser
ARL No. 311	Nitrite in Water by Discrete Analyser
ARL No. 016	Total Suspended Solids



**WORLD RECOGNISED  
ACCREDITATION**

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Urbaqua  
Job No: 19-16374

LABORATORY REPORT  
Revision: 00

Date: 14/10/19

Total Nitrogen in Water			Sample No	19-16374-1	19-16374-2	19-16374-3	19-16374-4	19-16374-5
Sample Description				SW1	SW2	SW3	SW4	SW5
Sample Date				1/10/2019	1/10/2019	1/10/2019	1/10/2019	1/10/2019
ANALYTE	LOR	Units	Result	Result	Result	Result	Result	Result
Total Nitrogen	0.2	mg/L	0.8	1.0	2.5	0.4	0.4	0.4
Total Kjeldahl Nitrogen	0.2	mg/L	<0.2	<0.2	2.3	<0.2	0.2	0.2

Total Nitrogen in Water			Sample No	19-16374-6
Sample Description				SW6
Sample Date				1/10/2019
ANALYTE	LOR	Units	Result	Result
Total Nitrogen	0.2	mg/L	2.1	
Total Kjeldahl Nitrogen	0.2	mg/L	0.6	

Total Phosphorus in Water			Sample No	19-16374-1	19-16374-2	19-16374-3	19-16374-4	19-16374-5
Sample Description				SW1	SW2	SW3	SW4	SW5
Sample Date				1/10/2019	1/10/2019	1/10/2019	1/10/2019	1/10/2019
ANALYTE	LOR	Units	Result	Result	Result	Result	Result	Result
Total Phosphorus	0.01	mg/L	0.05	0.06	0.07	0.08	0.09	0.09

Total Phosphorus in Water			Sample No	19-16374-6
Sample Description				SW6
Sample Date				1/10/2019
ANALYTE	LOR	Units	Result	Result
Total Phosphorus	0.01	mg/L	0.15	

Ions by Discrete Analyser			Sample No	19-16374-1	19-16374-2	19-16374-3	19-16374-4	19-16374-5
Sample Description				SW1	SW2	SW3	SW4	SW5
Sample Date				1/10/2019	1/10/2019	1/10/2019	1/10/2019	1/10/2019
ANALYTE	LOR	Units	Result	Result	Result	Result	Result	Result
Filterable Reactive Phosphorus	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Ammonia-N	0.02	mg/L	<0.02	<0.02	0.03	<0.02	0.03	0.03
Nitrate-N	0.01	mg/L	0.67	0.88	0.25	0.36	0.20	0.20
NOx-N	0.01	mg/L	0.67	0.88	0.25	0.36	0.20	0.20
Nitrite-N	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Ions by Discrete Analyser			Sample No	19-16374-6
Sample Description				SW6
Sample Date				1/10/2019
ANALYTE	LOR	Units	Result	Result
Filterable Reactive Phosphorus	0.01	mg/L	<0.01	
Ammonia-N	0.02	mg/L	0.08	
Nitrate-N	0.01	mg/L	1.5	
NOx-N	0.01	mg/L	1.5	
Nitrite-N	0.01	mg/L	0.03	

Urbaqua

Job No: 19-16374

LABORATORY REPORT

Revision: 00

Date: 14/10/19

Physical Parameters			Sample No	19-16374-1	19-16374-2	19-16374-3	19-16374-4	19-16374-5
Sample Description				SW1	SW2	SW3	SW4	SW5
Sample Date				1/10/2019	1/10/2019	1/10/2019	1/10/2019	1/10/2019
ANALYTE	LOR	Units		Result	Result	Result	Result	Result
Total Suspended Solids	5	mg/L		<5	6	<5	6	20

Physical Parameters			Sample No	19-16374-6
Sample Description				SW6
Sample Date				1/10/2019
ANALYTE	LOR	Units		Result
Total Suspended Solids	5	mg/L		16

**Result Definitions**

LOR Limit of Reporting

[NT] Not Tested

[ND] Not Detected at indicated Limit of Reporting

\* Denotes test not covered by NATA Accreditation

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## LABORATORY REPORT

**Job Number:** 20-05371  
**Revision:** 00  
**Date:** 30 March 2020

**ADDRESS:** Urbaqua  
4/226 Carr Pl  
Leederville WA 6007

**ATTENTION:** Halinka Lamparski

**DATE RECEIVED:** 20/03/2020

**YOUR REFERENCE:** Wattle Grove South

**PURCHASE ORDER:**

**APPROVALS:**



Sean Sangster  
Inorganics Supervisor

Sam Becker  
Inorganics Manager

### REPORT COMMENTS:

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### METHOD REFERENCES:

Methods prefixed with "ARL" are covered under NATA Accreditation Number: 2377  
Methods prefixed with "PM" are covered under NATA Accreditation Number: 2561  
Methods prefixed with "EDP" are covered under NATA Accreditation Number: 19290

Method ID	Method Description
ARL No. 29/402/403	Metals in Water by AAS/ICPOES/ICPMS
ARL No. 330	Persulfate Method for Simultaneous Determination of TN & TP
ARL No. 308	Total Phosphorus in Water by Discrete Analyser
ARL No. 014	pH in Water
ARL No. 016	Total Suspended Solids
ARL No. 309	Filterable Reactive Phosphorus in Water by Discrete Analyser
ARL No. 303	Ammonia in Water by Discrete Analyser
ARL No. 313/319	NOx in Water by Discrete Analyser
ARL No. 305	Chloride in Water by Discrete Analyser
ARL No. 301	Sulfate in Water by Discrete Analyser
ARL No. 311	Nitrite in Water by Discrete Analyser
ARL No. 323	Bromide in Water by Discrete Analyser



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ACCREDITATION

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### ARL GROUP

46-48 Banksia Road, Welshpool, Western Australia 6106  
Telephone: 08 6253 4444 Facsimile: 08 6253 4440 [www.arlgroup.com.au](http://www.arlgroup.com.au)



Urbaqua

Job No: 20-05371

## LABORATORY REPORT

Revision: 00

Date: 30/03/20

Metals in Water			Sample No	20-05371-1	20-05371-2	20-05371-3
Sample Description				SW3	SW5	SW1
Sample Date				20/05/2020	20/05/2020	20/05/2020
ANALYTE	LOR	Units	Result	Result	Result	Result
Aluminium - Dissolved	0.01	mg/L	<0.01	0.02	0.22	0.22
Iron - Dissolved	0.01	mg/L	0.08	0.08	0.67	0.67

Total Nitrogen in Water			Sample No	20-05371-1	20-05371-2	20-05371-3
Sample Description				SW3	SW5	SW1
Sample Date				20/05/2020	20/05/2020	20/05/2020
ANALYTE	LOR	Units	Result	Result	Result	Result
Total Nitrogen	0.2	mg/L	1.1	0.6	1.6	1.6
Total Kjeldahl Nitrogen	0.2	mg/L	0.9	0.5	1.6	1.6

Total Phosphorus in Water			Sample No	20-05371-1	20-05371-2	20-05371-3
Sample Description				SW3	SW5	SW1
Sample Date				20/05/2020	20/05/2020	20/05/2020
ANALYTE	LOR	Units	Result	Result	Result	Result
Total Phosphorus	0.01	mg/L	0.16	0.21	0.11	0.11

Physical Parameters			Sample No	20-05371-1	20-05371-2	20-05371-3
Sample Description				SW3	SW5	SW1
Sample Date				20/05/2020	20/05/2020	20/05/2020
ANALYTE	LOR	Units	Result	Result	Result	Result
pH	0.1	pH units	7.5	7.0	6.8	6.8
Total Suspended Solids	5	mg/L	27	<5	<5	<5

Ions by Discrete Analyser			Sample No	20-05371-1	20-05371-2	20-05371-3
Sample Description				SW3	SW5	SW1
Sample Date				20/05/2020	20/05/2020	20/05/2020
ANALYTE	LOR	Units	Result	Result	Result	Result
Filterable Reactive Phosphorus	0.01	mg/L	0.01	0.05	<0.01	<0.01
Ammonia-N	0.02	mg/L	0.05	0.03	0.03	0.03
NOx-N	0.01	mg/L	0.23	0.11	<0.01	<0.01
Chloride	5	mg/L	310	150	82	82
Sulfate	1	mg/L	34	26	28	28
Nitrate-N	0.01	mg/L	0.23	0.11	<0.01	<0.01
Nitrite-N	0.01	mg/L	<0.01	<0.01	<0.01	<0.01
Bromide	0.1	mg/L	1.0	0.4	0.2	0.2

### Result Definitions

LOR Limit of Reporting

[NT] Not Tested

[ND] Not Detected at indicated Limit of Reporting

\* Denotes test not covered by NATA Accreditation

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## LABORATORY REPORT

**Job Number:** 20-10755  
**Revision:** 00  
**Date:** 29 June 2020

**ADDRESS:** Urbaqua  
4/226 Carr Pl  
Leederville WA 6007

**ATTENTION:** Halinka Lamparski

**DATE RECEIVED:** 19/06/2020

**YOUR REFERENCE:** Wattle Grove South

**PURCHASE ORDER:**

**APPROVALS:**



Sean Sangster  
Inorganics Supervisor

### REPORT COMMENTS:

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Samples are analysed on an as received basis unless otherwise noted.

### METHOD REFERENCES:

Methods prefixed with "ARL" are covered under NATA Accreditation Number: 2377  
Methods prefixed with "PM" are covered under NATA Accreditation Number: 2561  
Methods prefixed with "EDP" are covered under NATA Accreditation Number: 19290

Method ID	Method Description
ARL No. 330	Persulfate Method for Simultaneous Determination of TN & TP
ARL No. 308	Total Phosphorus in Water by Discrete Analyser
ARL No. 309	Filterable Reactive Phosphorus in Water by Discrete Analyser
ARL No. 303	Ammonia in Water by Discrete Analyser
ARL No. 313/319	NOx in Water by Discrete Analyser
ARL No. 311	Nitrite in Water by Discrete Analyser
ARL No. 016	Total Suspended Solids



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### ARL GROUP

46-48 Banksia Road, Welshpool, Western Australia 6106  
Telephone: 08 6253 4444 Facsimile: 08 6253 4440 [www.arlgroup.com.au](http://www.arlgroup.com.au)

Urbaqua  
Job No: 20-10755

LABORATORY REPORT  
Revision: 00

Date: 29/06/20

Total Nitrogen in Water			Sample No	20-10755-1	20-10755-2	20-10755-3	20-10755-4	20-10755-5
Sample Description				SW1a	SW2	SW3	SW4	SW5
Sample Date				19/06/2020	19/06/2020	19/06/2020	19/06/2020	19/06/2020
ANALYTE	LOR	Units	Result	Result	Result	Result	Result	Result
Total Nitrogen	0.2	mg/L	0.5	0.6	0.6	0.6	0.6	0.5
Total Kjeldahl Nitrogen	0.2	mg/L	0.3	0.3	0.5	0.6	0.6	0.5

Total Phosphorus in Water			Sample No	20-10755-1	20-10755-2	20-10755-3	20-10755-4	20-10755-5
Sample Description				SW1a	SW2	SW3	SW4	SW5
Sample Date				19/06/2020	19/06/2020	19/06/2020	19/06/2020	19/06/2020
ANALYTE	LOR	Units	Result	Result	Result	Result	Result	Result
Total Phosphorus	0.01	mg/L	0.06	0.05	0.04	0.09	0.09	0.06

Ions by Discrete Analyser			Sample No	20-10755-1	20-10755-2	20-10755-3	20-10755-4	20-10755-5
Sample Description				SW1a	SW2	SW3	SW4	SW5
Sample Date				19/06/2020	19/06/2020	19/06/2020	19/06/2020	19/06/2020
ANALYTE	LOR	Units	Result	Result	Result	Result	Result	Result
Filterable Reactive Phosphorus	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Ammonia-N	0.02	mg/L	<0.02	<0.02	0.04	<0.02	<0.02	<0.02
Nitrate-N	0.01	mg/L	0.19	0.31	0.07	0.05	0.05	0.04
NOx-N	0.01	mg/L	0.19	0.31	0.07	0.05	0.05	0.04
Nitrite-N	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Physical Parameters			Sample No	20-10755-1	20-10755-2	20-10755-3	20-10755-4	20-10755-5
Sample Description				SW1a	SW2	SW3	SW4	SW5
Sample Date				19/06/2020	19/06/2020	19/06/2020	19/06/2020	19/06/2020
ANALYTE	LOR	Units	Result	Result	Result	Result	Result	Result
Total Suspended Solids	5	mg/L	<5	<5	<5	<5	<5	<5

#### Result Definitions

LOR Limit of Reporting [NT] Not Tested [ND] Not Detected at indicated Limit of Reporting  
\* Denotes test not covered by NATA Accreditation

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## LABORATORY REPORT

**Job Number:** 20-12022  
**Revision:** 00  
**Date:** 23 July 2020

**ADDRESS:** Urbaqua  
4/226 Carr Pl  
Leederville WA 6007



**ATTENTION:** Halinka Lamparski

**DATE RECEIVED:** 10/07/2020

**YOUR REFERENCE:** Wattle Grove South Monitoring

**PURCHASE ORDER:**

**APPROVALS:**

Sam Becker      Sean Sangster  
Inorganics Manager      Inorganics Supervisor

### REPORT COMMENTS:

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Samples are analysed on an as received basis unless otherwise noted.

### METHOD REFERENCES:

Methods prefixed with "ARL" are covered under NATA Accreditation Number: 2377  
Methods prefixed with "PM" are covered under NATA Accreditation Number: 2561  
Methods prefixed with "EDP" are covered under NATA Accreditation Number: 19290

Method ID	Method Description
ARL No. 330	Persulfate Method for Simultaneous Determination of TN & TP
ARL No. 308	Total Phosphorus in Water by Discrete Analyser
ARL No. 309	Filterable Reactive Phosphorus in Water by Discrete Analyser
ARL No. 303	Ammonia in Water by Discrete Analyser
ARL No. 313/319	NOx in Water by Discrete Analyser
ARL No. 311	Nitrite in Water by Discrete Analyser
ARL No. 016	Total Suspended Solids



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Urbaqua  
Job No: 20-12022

LABORATORY REPORT  
Revision: 00

Date: 23/07/20

Total Nitrogen in Water			Sample No	20-12022-1	20-12022-2	20-12022-3	20-12022-4	20-12022-5
Sample Description				SW6	SW3	SW7	SW4	SW2
Sample Date				10/07/2020	10/07/2020	10/07/2020	10/07/2020	10/07/2020
ANALYTE	LOR	Units		Result	Result	Result	Result	Result
Total Nitrogen	0.2	mg/L		2.9	1.4	0.9	1.4	2.0
Total Kjeldahl Nitrogen	0.2	mg/L		1.2	1.2	0.9	1.1	1.1

Total Nitrogen in Water			Sample No	20-12022-6	20-12022-7	20-12022-8
Sample Description				SW1	SW8	SW5
Sample Date				10/07/2020	10/07/2020	10/07/2020
ANALYTE	LOR	Units		Result	Result	Result
Total Nitrogen	0.2	mg/L		1.8	2.2	1.2
Total Kjeldahl Nitrogen	0.2	mg/L		0.9	1.1	1.0

Total Phosphorus in Water			Sample No	20-12022-1	20-12022-2	20-12022-3	20-12022-4	20-12022-5
Sample Description				SW6	SW3	SW7	SW4	SW2
Sample Date				10/07/2020	10/07/2020	10/07/2020	10/07/2020	10/07/2020
ANALYTE	LOR	Units		Result	Result	Result	Result	Result
Total Phosphorus	0.01	mg/L		0.08	0.02	<0.01	0.02	0.02

Total Phosphorus in Water			Sample No	20-12022-6	20-12022-7	20-12022-8
Sample Description				SW1	SW8	SW5
Sample Date				10/07/2020	10/07/2020	10/07/2020
ANALYTE	LOR	Units		Result	Result	Result
Total Phosphorus	0.01	mg/L		0.03	0.04	0.04

Ions by Discrete Analyser			Sample No	20-12022-1	20-12022-2	20-12022-3	20-12022-4	20-12022-5
Sample Description				SW6	SW3	SW7	SW4	SW2
Sample Date				10/07/2020	10/07/2020	10/07/2020	10/07/2020	10/07/2020
ANALYTE	LOR	Units		Result	Result	Result	Result	Result
Filterable Reactive Phosphorus	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01
Ammonia-N	0.02	mg/L		0.03	0.04	<0.02	<0.02	<0.02
Nitrate-N	0.01	mg/L		1.7	0.21	<0.01	0.34	0.86
NOx-N	0.01	mg/L		1.7	0.21	<0.01	0.34	0.86
Nitrite-N	0.01	mg/L		0.01	<0.01	<0.01	<0.01	<0.01

Ions by Discrete Analyser			Sample No	20-12022-6	20-12022-7	20-12022-8
Sample Description				SW1	SW8	SW5
Sample Date				10/07/2020	10/07/2020	10/07/2020
ANALYTE	LOR	Units		Result	Result	Result
Filterable Reactive Phosphorus	0.01	mg/L		<0.01	<0.01	0.01
Ammonia-N	0.02	mg/L		<0.02	<0.02	0.03
Nitrate-N	0.01	mg/L		0.91	1.1	0.17
NOx-N	0.01	mg/L		0.91	1.1	0.17
Nitrite-N	0.01	mg/L		<0.01	0.01	<0.01

Urbaqua

Job No: 20-12022

LABORATORY REPORT

Revision: 00

Date: 23/07/20

Physical Parameters			Sample No	20-12022-1	20-12022-2	20-12022-3	20-12022-4	20-12022-5
Sample Description				SW6	SW3	SW7	SW4	SW2
Sample Date				10/07/2020	10/07/2020	10/07/2020	10/07/2020	10/07/2020
ANALYTE	LOR	Units		Result	Result	Result	Result	Result
Total Suspended Solids	5	mg/L		22	8	<5	16	8

Physical Parameters			Sample No	20-12022-6	20-12022-7	20-12022-8
Sample Description				SW1	SW8	SW5
Sample Date				10/07/2020	10/07/2020	10/07/2020
ANALYTE	LOR	Units		Result	Result	Result
Total Suspended Solids	5	mg/L		10	35	<5

**Result Definitions**

LOR Limit of Reporting

[NT] Not Tested

[ND] Not Detected at indicated Limit of Reporting

\* Denotes test not covered by NATA Accreditation

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## LABORATORY REPORT

**Job Number:** 20-12863  
**Revision:** 00  
**Date:** 5 August 2020

**ADDRESS:** Urbaqua  
4/226 Carr Pl  
Leederville WA 6007



**ATTENTION:** Halinka Lamparski

**DATE RECEIVED:** 24/07/2020

**YOUR REFERENCE:** Wattle Grove South Monitoring

**PURCHASE ORDER:**

**APPROVALS:**

Sam Becker      Sean Sangster  
Inorganics Manager      Inorganics Supervisor

### REPORT COMMENTS:

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### METHOD REFERENCES:

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Methods prefixed with "PM" are covered under NATA Accreditation Number: 2561  
Methods prefixed with "EDP" are covered under NATA Accreditation Number: 19290

Method ID	Method Description
ARL No. 330	Persulfate Method for Simultaneous Determination of TN & TP
ARL No. 308	Total Phosphorus in Water by Discrete Analyser
ARL No. 309	Filterable Reactive Phosphorus in Water by Discrete Analyser
ARL No. 303	Ammonia in Water by Discrete Analyser
ARL No. 313/319	NOx in Water by Discrete Analyser
ARL No. 311	Nitrite in Water by Discrete Analyser
ARL No. 016	Total Suspended Solids



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**ACCREDITATION**

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Urbaqua  
Job No: 20-12863

LABORATORY REPORT  
Revision: 00

Date: 5/08/20

Total Nitrogen in Water			Sample No	20-12863-1	20-12863-2	20-12863-3	20-12863-4	20-12863-5
Sample Description				SW1	SW2	SW3	SW4	SW5
Sample Date				24/07/2020	24/07/2020	24/07/2020	24/07/2020	24/07/2020
ANALYTE	LOR	Units	Result	Result	Result	Result	Result	Result
Total Nitrogen	0.2	mg/L	1.1	1.3	0.7	0.7	0.6	
Total Kjeldahl Nitrogen	0.2	mg/L	0.2	0.3	0.3	0.2	0.2	

Total Nitrogen in Water			Sample No	20-12863-6
Sample Description				SW6
Sample Date				24/07/2020
ANALYTE	LOR	Units	Result	
Total Nitrogen	0.2	mg/L	3.9	
Total Kjeldahl Nitrogen	0.2	mg/L	0.4	

Total Phosphorus in Water			Sample No	20-12863-1	20-12863-2	20-12863-3	20-12863-4	20-12863-5
Sample Description				SW1	SW2	SW3	SW4	SW5
Sample Date				24/07/2020	24/07/2020	24/07/2020	24/07/2020	24/07/2020
ANALYTE	LOR	Units	Result	Result	Result	Result	Result	Result
Total Phosphorus	0.01	mg/L	0.05	0.06	0.08	0.10	0.09	

Total Phosphorus in Water			Sample No	20-12863-6
Sample Description				SW6
Sample Date				24/07/2020
ANALYTE	LOR	Units	Result	
Total Phosphorus	0.01	mg/L	0.16	

Ions by Discrete Analyser			Sample No	20-12863-1	20-12863-2	20-12863-3	20-12863-4	20-12863-5
Sample Description				SW1	SW2	SW3	SW4	SW5
Sample Date				24/07/2020	24/07/2020	24/07/2020	24/07/2020	24/07/2020
ANALYTE	LOR	Units	Result	Result	Result	Result	Result	Result
Filterable Reactive Phosphorus	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Ammonia-N	0.02	mg/L	<0.02	<0.02	0.03	<0.02	<0.02	<0.02
Nitrate-N	0.01	mg/L	0.88	0.99	0.38	0.50	0.35	
NOx-N	0.01	mg/L	0.88	1.0	0.38	0.51	0.36	
Nitrite-N	0.01	mg/L	<0.01	0.01	<0.01	0.01	0.01	

Ions by Discrete Analyser			Sample No	20-12863-6
Sample Description				SW6
Sample Date				24/07/2020
ANALYTE	LOR	Units	Result	
Filterable Reactive Phosphorus	0.01	mg/L	<0.01	
Ammonia-N	0.02	mg/L	0.03	
Nitrate-N	0.01	mg/L	3.5	
NOx-N	0.01	mg/L	3.5	
Nitrite-N	0.01	mg/L	0.03	

Urbaqua

Job No: 20-12863

LABORATORY REPORT

Revision: 00

Date: 5/08/20

Physical Parameters			Sample No	20-12863-1	20-12863-2	20-12863-3	20-12863-4	20-12863-5
Sample Description				SW1	SW2	SW3	SW4	SW5
Sample Date				24/07/2020	24/07/2020	24/07/2020	24/07/2020	24/07/2020
ANALYTE	LOR	Units	Result	Result	Result	Result	Result	Result
Total Suspended Solids	5	mg/L	<5	<5	<5	<5	<5	<5

Physical Parameters			Sample No	20-12863-6
Sample Description				SW6
Sample Date				24/07/2020
ANALYTE	LOR	Units	Result	Result
Total Suspended Solids	5	mg/L	7	

**Result Definitions**

LOR Limit of Reporting

[NT] Not Tested

[ND] Not Detected at indicated Limit of Reporting

\* Denotes test not covered by NATA Accreditation

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## LABORATORY REPORT

**Job Number:** 20-13678  
**Revision:** 00  
**Date:** 13 August 2020

**ADDRESS:** Urbaqua  
4/226 Carr Pl  
Leederville WA 6007

**ATTENTION:** Halinka Lamparski

**DATE RECEIVED:** 7/08/2020

**YOUR REFERENCE:** Wattle Grove South

**PURCHASE ORDER:**

**APPROVALS:**



Sean Sangster  
Inorganics Supervisor

Sam Becker  
Inorganics Manager

### REPORT COMMENTS:

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Samples are analysed on an as received basis unless otherwise noted.

### METHOD REFERENCES:

Methods prefixed with "ARL" are covered under NATA Accreditation Number: 2377  
Methods prefixed with "PM" are covered under NATA Accreditation Number: 2561  
Methods prefixed with "EDP" are covered under NATA Accreditation Number: 19290

Method ID	Method Description
ARL No. 330	Persulfate Method for Simultaneous Determination of TN & TP
ARL No. 308	Total Phosphorus in Water by Discrete Analyser
ARL No. 309	Filterable Reactive Phosphorus in Water by Discrete Analyser
ARL No. 303	Ammonia in Water by Discrete Analyser
ARL No. 313/319	NOx in Water by Discrete Analyser
ARL No. 311	Nitrite in Water by Discrete Analyser
ARL No. 016	Total Suspended Solids



WORLD RECOGNISED  
**ACCREDITATION**

Accredited for compliance with  
ISO/IEC 17025 - Testing

Urbaqua  
Job No: 20-13678

LABORATORY REPORT  
Revision: 00

Date: 13/08/20

Total Nitrogen in Water			Sample No	20-13678-1	20-13678-2	20-13678-3	20-13678-4	20-13678-5
Sample Description				SW1	SW2	SW3	SW4	SW5
Sample Date				4/08/2020	4/08/2020	4/08/2020	4/08/2020	4/08/2020
ANALYTE	LOR	Units	Result	Result	Result	Result	Result	Result
Total Nitrogen	0.2	mg/L	0.9	1.0	0.4	0.4	0.3	
Total Nitrogen (Filtered)	0.2	mg/L	0.8	0.9	0.4	0.4	0.3	
Total Kjeldahl Nitrogen	0.2	mg/L	0.3	0.2	0.2	<0.2	0.2	
Dissolved Organic Nitrogen	0.2	mg/L	0.2	<0.2	0.2	<0.2	0.2	

Total Nitrogen in Water			Sample No	20-13678-6
Sample Description				SW6
Sample Date				4/08/2020
ANALYTE	LOR	Units	Result	
Total Nitrogen	0.2	mg/L	2.8	
Total Nitrogen (Filtered)	0.2	mg/L	2.3	
Total Kjeldahl Nitrogen	0.2	mg/L	0.6	
Dissolved Organic Nitrogen	0.2	mg/L	<0.2	

Total Phosphorus in Water			Sample No	20-13678-1	20-13678-2	20-13678-3	20-13678-4	20-13678-5
Sample Description				SW1	SW2	SW3	SW4	SW5
Sample Date				4/08/2020	4/08/2020	4/08/2020	4/08/2020	4/08/2020
ANALYTE	LOR	Units	Result	Result	Result	Result	Result	Result
Total Phosphorus	0.01	mg/L	0.05	0.05	0.10	0.12	0.09	

Total Phosphorus in Water			Sample No	20-13678-6
Sample Description				SW6
Sample Date				4/08/2020
ANALYTE	LOR	Units	Result	
Total Phosphorus	0.01	mg/L	0.21	

Ions by Discrete Analyser			Sample No	20-13678-1	20-13678-2	20-13678-3	20-13678-4	20-13678-5
Sample Description				SW1	SW2	SW3	SW4	SW5
Sample Date				4/08/2020	4/08/2020	4/08/2020	4/08/2020	4/08/2020
ANALYTE	LOR	Units	Result	Result	Result	Result	Result	Result
Filterable Reactive Phosphorus	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Ammonia-N	0.02	mg/L	<0.02	<0.02	0.02	<0.02	<0.02	<0.02
Nitrate-N	0.01	mg/L	0.62	0.83	0.17	0.30	0.13	
NOx-N	0.01	mg/L	0.62	0.83	0.17	0.30	0.13	
Nitrite-N	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Ions by Discrete Analyser			Sample No	20-13678-6
Sample Description				SW6
Sample Date				4/08/2020
ANALYTE	LOR	Units	Result	
Filterable Reactive Phosphorus	0.01	mg/L	<0.01	
Ammonia-N	0.02	mg/L	0.07	
Nitrate-N	0.01	mg/L	2.2	
NOx-N	0.01	mg/L	2.2	
Nitrite-N	0.01	mg/L	0.03	



Urbaqua

Job No: 20-13678

LABORATORY REPORT

Revision: 00

Date: 13/08/20

Physical Parameters		Sample No	20-13678-1	20-13678-2	20-13678-3	20-13678-4	20-13678-5
Sample Description			SW1	SW2	SW3	SW4	SW5
Sample Date			4/08/2020	4/08/2020	4/08/2020	4/08/2020	4/08/2020
ANALYTE	LOR	Units	Result	Result	Result	Result	Result
Total Suspended Solids	5	mg/L	<5	<5	<5	<5	<5

Physical Parameters		Sample No	20-13678-6
Sample Description			SW6
Sample Date			4/08/2020
ANALYTE	LOR	Units	Result
Total Suspended Solids	5	mg/L	44

**Result Definitions**

LOR Limit of Reporting

[NT] Not Tested

[ND] Not Detected at indicated Limit of Reporting

\* Denotes test not covered by NATA Accreditation

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## LABORATORY REPORT

**Job Number:** 20-14546  
**Revision:** 00  
**Date:** 28 August 2020

**ADDRESS:** Urbaqua  
4/226 Carr Pl  
Leederville WA 6007



**ATTENTION:** Halinka Lamparski

**DATE RECEIVED:** 21/08/2020

**YOUR REFERENCE:** Wattle Grove South

**PURCHASE ORDER:**

**APPROVALS:**

   
Douglas Todd      Sean Sangster  
Laboratory Manager      Inorganics Supervisor

### REPORT COMMENTS:

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Samples are analysed on an as received basis unless otherwise noted.

### METHOD REFERENCES:

Methods prefixed with "ARL" are covered under NATA Accreditation Number: 2377  
Methods prefixed with "PM" are covered under NATA Accreditation Number: 2561  
Methods prefixed with "EDP" are covered under NATA Accreditation Number: 19290

Method ID	Method Description
ARL No. 330	Persulfate Method for Simultaneous Determination of TN & TP
ARL No. 308	Total Phosphorus in Water by Discrete Analyser
ARL No. 309	Filterable Reactive Phosphorus in Water by Discrete Analyser
ARL No. 303	Ammonia in Water by Discrete Analyser
ARL No. 313/319	NOx in Water by Discrete Analyser
ARL No. 311	Nitrite in Water by Discrete Analyser
ARL No. 016	Total Suspended Solids



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ACCREDITATION

Accredited for compliance with  
ISO/IEC 17025 - Testing

Urbaqua  
Job No: 20-14546

LABORATORY REPORT  
Revision: 00

Date: 28/08/20

Total Nitrogen in Water			Sample No	20-14546-1	20-14546-2	20-14546-3	20-14546-4	20-14546-5
Sample Description				SW1	SW2	SW3	SW4	SW5
Sample Date				21/08/2020	21/08/2020	21/08/2020	21/08/2020	21/08/2020
ANALYTE	LOR	Units	Result	Result	Result	Result	Result	Result
Total Nitrogen	0.2	mg/L	1.2	1.4	0.7	0.8	0.7	
Total Kjeldahl Nitrogen	0.2	mg/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2

Total Nitrogen in Water			Sample No	20-14546-6
Sample Description				SW6
Sample Date				21/08/2020
ANALYTE	LOR	Units	Result	
Total Nitrogen	0.2	mg/L	3.3	
Total Kjeldahl Nitrogen	0.2	mg/L	0.4	

Total Phosphorus in Water			Sample No	20-14546-1	20-14546-2	20-14546-3	20-14546-4	20-14546-5
Sample Description				SW1	SW2	SW3	SW4	SW5
Sample Date				21/08/2020	21/08/2020	21/08/2020	21/08/2020	21/08/2020
ANALYTE	LOR	Units	Result	Result	Result	Result	Result	Result
Total Phosphorus	0.01	mg/L	0.05	0.05	0.08	0.07	0.08	

Total Phosphorus in Water			Sample No	20-14546-6
Sample Description				SW6
Sample Date				21/08/2020
ANALYTE	LOR	Units	Result	
Total Phosphorus	0.01	mg/L	0.13	

Ions by Discrete Analyser			Sample No	20-14546-1	20-14546-2	20-14546-3	20-14546-4	20-14546-5
Sample Description				SW1	SW2	SW3	SW4	SW5
Sample Date				21/08/2020	21/08/2020	21/08/2020	21/08/2020	21/08/2020
ANALYTE	LOR	Units	Result	Result	Result	Result	Result	Result
Filterable Reactive Phosphorus	0.01	mg/L	<0.01	<0.01	<0.01	0.03	<0.01	
Ammonia-N	0.02	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Nitrate-N	0.01	mg/L	1.1	1.3	0.67	0.80	0.63	
NOx-N	0.01	mg/L	1.1	1.3	0.67	0.80	0.63	
Nitrite-N	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Ions by Discrete Analyser			Sample No	20-14546-6
Sample Description				SW6
Sample Date				21/08/2020
ANALYTE	LOR	Units	Result	
Filterable Reactive Phosphorus	0.01	mg/L	0.02	
Ammonia-N	0.02	mg/L	<0.02	
Nitrate-N	0.01	mg/L	2.9	
NOx-N	0.01	mg/L	2.9	
Nitrite-N	0.01	mg/L	0.01	

Urbaqua

Job No: 20-14546

LABORATORY REPORT

Revision: 00

Date: 28/08/20

Physical Parameters		Sample No	20-14546-1	20-14546-2	20-14546-3	20-14546-4	20-14546-5
Sample Description			SW1	SW2	SW3	SW4	SW5
Sample Date			21/08/2020	21/08/2020	21/08/2020	21/08/2020	21/08/2020
ANALYTE	LOR	Units	Result	Result	Result	Result	Result
Total Suspended Solids	5	mg/L	<5	<5	<5	<5	<5

Physical Parameters		Sample No	20-14546-6
Sample Description			SW6
Sample Date			21/08/2020
ANALYTE	LOR	Units	Result
Total Suspended Solids	5	mg/L	13

**Result Definitions**

LOR Limit of Reporting

[NT] Not Tested

[ND] Not Detected at indicated Limit of Reporting

\* Denotes test not covered by NATA Accreditation

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## LABORATORY REPORT

**Job Number:** 20-15385  
**Revision:** 00  
**Date:** 10 September 2020

**ADDRESS:** Urbaqua  
4/226 Carr Pl  
Leederville WA 6007

**ATTENTION:** Halinka Lamparski

**DATE RECEIVED:** 4/09/2020

**YOUR REFERENCE:** Wattle Grove South Monitoring

**PURCHASE ORDER:**

**APPROVALS:**



Sean Sangster  
Inorganics Supervisor

### REPORT COMMENTS:

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### METHOD REFERENCES:

Methods prefixed with "ARL" are covered under NATA Accreditation Number: 2377  
Methods prefixed with "PM" are covered under NATA Accreditation Number: 2561  
Methods prefixed with "EDP" are covered under NATA Accreditation Number: 19290

Method ID	Method Description
ARL No. 330	Persulfate Method for Simultaneous Determination of TN & TP
ARL No. 308	Total Phosphorus in Water by Discrete Analyser
ARL No. 309	Filterable Reactive Phosphorus in Water by Discrete Analyser
ARL No. 303	Ammonia in Water by Discrete Analyser
ARL No. 313/319	NOx in Water by Discrete Analyser
ARL No. 311	Nitrite in Water by Discrete Analyser
ARL No. 016	Total Suspended Solids



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**ACCREDITATION**

Accredited for compliance with  
ISO/IEC 17025 - Testing

Urbaqua  
Job No: 20-15385

LABORATORY REPORT  
Revision: 00

Date: 10/09/20

Total Nitrogen in Water			Sample No	20-15385-1	20-15385-2	20-15385-3	20-15385-4	20-15385-5
Sample Description				SW1	SW2	SW3	SW4	SW5
Sample Date				4/09/2020	4/09/2020	4/09/2020	4/09/2020	4/09/2020
ANALYTE	LOR	Units	Result	Result	Result	Result	Result	Result
Total Nitrogen	0.2	mg/L	0.9	1.1	0.4	2.1	0.4	
Total Kjeldahl Nitrogen	0.2	mg/L	<0.2	<0.2	<0.2	1.7	<0.2	

Total Nitrogen in Water			Sample No	20-15385-6
Sample Description				SW6
Sample Date				4/09/2020
ANALYTE	LOR	Units	Result	
Total Nitrogen	0.2	mg/L	2.2	
Total Kjeldahl Nitrogen	0.2	mg/L	0.7	

Total Phosphorus in Water			Sample No	20-15385-1	20-15385-2	20-15385-3	20-15385-4	20-15385-5
Sample Description				SW1	SW2	SW3	SW4	SW5
Sample Date				4/09/2020	4/09/2020	4/09/2020	4/09/2020	4/09/2020
ANALYTE	LOR	Units	Result	Result	Result	Result	Result	Result
Total Phosphorus	0.01	mg/L	0.01	<0.01	0.01	<0.01	0.01	

Total Phosphorus in Water			Sample No	20-15385-6
Sample Description				SW6
Sample Date				4/09/2020
ANALYTE	LOR	Units	Result	
Total Phosphorus	0.01	mg/L	0.05	

Ions by Discrete Analyser			Sample No	20-15385-1	20-15385-2	20-15385-3	20-15385-4	20-15385-5
Sample Description				SW1	SW2	SW3	SW4	SW5
Sample Date				4/09/2020	4/09/2020	4/09/2020	4/09/2020	4/09/2020
ANALYTE	LOR	Units	Result	Result	Result	Result	Result	Result
Filterable Reactive Phosphorus	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Ammonia-N	0.02	mg/L	0.02	0.03	0.04	0.04	0.05	
Nitrate-N	0.01	mg/L	0.81	1.0	0.30	0.43	0.27	
NOx-N	0.01	mg/L	0.81	1.0	0.30	0.43	0.27	
Nitrite-N	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Ions by Discrete Analyser			Sample No	20-15385-6
Sample Description				SW6
Sample Date				4/09/2020
ANALYTE	LOR	Units	Result	
Filterable Reactive Phosphorus	0.01	mg/L	<0.01	
Ammonia-N	0.02	mg/L	<0.02	
Nitrate-N	0.01	mg/L	1.5	
NOx-N	0.01	mg/L	1.5	
Nitrite-N	0.01	mg/L	0.01	

Urbaqua

Job No: 20-15385

LABORATORY REPORT

Revision: 00

Date: 10/09/20

Physical Parameters		Sample No	20-15385-1	20-15385-2	20-15385-3	20-15385-4	20-15385-5
Sample Description			SW1	SW2	SW3	SW4	SW5
Sample Date			4/09/2020	4/09/2020	4/09/2020	4/09/2020	4/09/2020
ANALYTE	LOR	Units	Result	Result	Result	Result	Result
Total Suspended Solids	5	mg/L	9	<5	<5	<5	<5

Physical Parameters		Sample No	20-15385-6
Sample Description			SW6
Sample Date			4/09/2020
ANALYTE	LOR	Units	Result
Total Suspended Solids	5	mg/L	10

**Result Definitions**

LOR Limit of Reporting

[NT] Not Tested

[ND] Not Detected at indicated Limit of Reporting

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## LABORATORY REPORT

**Job Number:** 20-16819  
**Revision:** 00  
**Date:** 7 October 2020

**ADDRESS:** Urbaqua  
4/226 Carr Pl  
Leederville WA 6007

**ATTENTION:** Halinka Lamparski

**DATE RECEIVED:** 25/09/2020

**YOUR REFERENCE:** Wattle Grove South Monitoring

**PURCHASE ORDER:**

**APPROVALS:**

  
Sean Sangster  
Inorganics Supervisor

### REPORT COMMENTS:

This report is issued by Analytical Reference Laboratory (WA) Pty Ltd. The report shall not be reproduced except in full without written approval from the laboratory.

Samples are analysed on an as received basis unless otherwise noted.

### METHOD REFERENCES:

Methods prefixed with "ARL" are covered under NATA Accreditation Number: 2377  
Methods prefixed with "PM" are covered under NATA Accreditation Number: 2561  
Methods prefixed with "EDP" are covered under NATA Accreditation Number: 19290

Method ID	Method Description
ARL No. 29/402/403	Metals in Water by AAS/ICPOES/ICPMS
ARL No. 330	Persulfate Method for Simultaneous Determination of TN & TP
ARL No. 308	Total Phosphorus in Water by Discrete Analyser
ARL No. 305	Chloride in Water by Discrete Analyser
ARL No. 301	Sulfate in Water by Discrete Analyser
ARL No. 309	Filterable Reactive Phosphorus in Water by Discrete Analyser
ARL No. 303	Ammonia in Water by Discrete Analyser
ARL No. 313/319	NOx in Water by Discrete Analyser
ARL No. 311	Nitrite in Water by Discrete Analyser
ARL No. 323	Bromide in Water by Discrete Analyser
ARL No. 016	Total Suspended Solids



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**ACCREDITATION**

Accredited for compliance with  
ISO/IEC 17025 - Testing



Urbaqua  
Job No: 20-16819

LABORATORY REPORT  
Revision: 00

Date: 7/10/20

Metals in Water			Sample No	20-16819-1	20-16819-2	20-16819-3	20-16819-4	20-16819-5
Sample Description				SW1	SW2	SW3	SW4	SW5
Sample Date				25/09/2020	25/09/2020	25/09/2020	25/09/2020	25/09/2020
ANALYTE	LOR	Units	Result	Result	Result	Result	Result	Result
Aluminium - Dissolved	0.01	mg/L	0.02	0.01	0.03	0.03	0.03	0.04
Iron - Dissolved	0.01	mg/L	0.07	0.05	0.18	0.09	0.09	0.15

Metals in Water			Sample No	20-16819-6	20-16819-7
Sample Description				SW6	DUP
Sample Date				25/09/2020	25/09/2020
ANALYTE	LOR	Units	Result	Result	Result
Aluminium - Dissolved	0.01	mg/L	<0.01	0.03	0.03
Iron - Dissolved	0.01	mg/L	0.09	0.15	0.15

Total Nitrogen in Water			Sample No	20-16819-1	20-16819-2	20-16819-3	20-16819-4	20-16819-5
Sample Description				SW1	SW2	SW3	SW4	SW5
Sample Date				25/09/2020	25/09/2020	25/09/2020	25/09/2020	25/09/2020
ANALYTE	LOR	Units	Result	Result	Result	Result	Result	Result
Total Nitrogen	0.2	mg/L	1.0	1.2	0.6	0.7	0.7	0.7
Total Kjeldahl Nitrogen	0.2	mg/L	0.3	0.3	0.5	0.4	0.5	0.5

Total Nitrogen in Water			Sample No	20-16819-6	20-16819-7
Sample Description				SW6	DUP
Sample Date				25/09/2020	25/09/2020
ANALYTE	LOR	Units	Result	Result	Result
Total Nitrogen	0.2	mg/L	2.0	0.8	0.8
Total Kjeldahl Nitrogen	0.2	mg/L	1.2	0.6	0.6

Total Phosphorus in Water			Sample No	20-16819-1	20-16819-2	20-16819-3	20-16819-4	20-16819-5
Sample Description				SW1	SW2	SW3	SW4	SW5
Sample Date				25/09/2020	25/09/2020	25/09/2020	25/09/2020	25/09/2020
ANALYTE	LOR	Units	Result	Result	Result	Result	Result	Result
Total Phosphorus	0.01	mg/L	<0.01	0.01	0.02	0.02	0.02	0.05

Total Phosphorus in Water			Sample No	20-16819-6	20-16819-7
Sample Description				SW6	DUP
Sample Date				25/09/2020	25/09/2020
ANALYTE	LOR	Units	Result	Result	Result
Total Phosphorus	0.01	mg/L	0.06	0.05	0.05

Ions by Discrete Analyser			Sample No	20-16819-1	20-16819-2	20-16819-3	20-16819-4	20-16819-5
Sample Description				SW1	SW2	SW3	SW4	SW5
Sample Date				25/09/2020	25/09/2020	25/09/2020	25/09/2020	25/09/2020
ANALYTE	LOR	Units	Result	Result	Result	Result	Result	Result
Chloride	5	mg/L	110	110	110	130	140	140
Sulfate	1	mg/L	27	29	23	24	24	24
Filterable Reactive Phosphorus	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	0.03
Ammonia-N	0.02	mg/L	0.09	<0.02	0.04	0.03	0.04	0.04
Nitrate-N	0.01	mg/L	0.69	0.93	0.15	0.31	0.19	0.19
NOx-N	0.01	mg/L	0.69	0.93	0.15	0.31	0.19	0.19
Nitrite-N	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Urbaqua

Job No: 20-16819

## LABORATORY REPORT

Revision: 00

Date: 7/10/20

Ions by Discrete Analyser			Sample No	20-16819-1	20-16819-2	20-16819-3	20-16819-4	20-16819-5
Sample Description				SW1	SW2	SW3	SW4	SW5
Sample Date				25/09/2020	25/09/2020	25/09/2020	25/09/2020	25/09/2020
Bromide	0.1	mg/L		0.4	0.3	0.3	0.3	0.3

Ions by Discrete Analyser			Sample No	20-16819-6	20-16819-7
Sample Description				SW6	DUP
Sample Date				25/09/2020	25/09/2020
ANALYTE	LOR	Units	Result	Result	
Chloride	5	mg/L	360	160	
Sulfate	1	mg/L	120	24	
Filterable Reactive Phosphorus	0.01	mg/L	<0.01	0.03	
Ammonia-N	0.02	mg/L	0.06	0.05	
Nitrate-N	0.01	mg/L	0.81	0.18	
NOx-N	0.01	mg/L	0.82	0.18	
Nitrite-N	0.01	mg/L	0.01	<0.01	
Bromide	0.1	mg/L	0.9	0.3	

Physical Parameters			Sample No	20-16819-1	20-16819-2	20-16819-3	20-16819-4	20-16819-5
Sample Description				SW1	SW2	SW3	SW4	SW5
Sample Date				25/09/2020	25/09/2020	25/09/2020	25/09/2020	25/09/2020
ANALYTE	LOR	Units	Result	Result	Result	Result	Result	Result
Total Suspended Solids	5	mg/L	<5	<5	<5	<5	<5	<5

Physical Parameters			Sample No	20-16819-6	20-16819-7
Sample Description				SW6	DUP
Sample Date				25/09/2020	25/09/2020
ANALYTE	LOR	Units	Result	Result	
Total Suspended Solids	5	mg/L	8	<5	

### Result Definitions

LOR Limit of Reporting

[NT] Not Tested

[ND] Not Detected at indicated Limit of Reporting

\* Denotes test not covered by NATA Accreditation

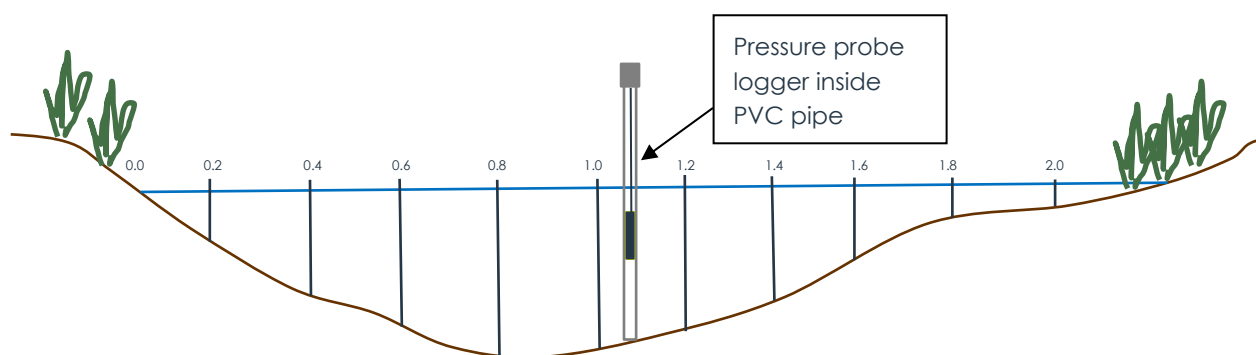
FOR MICROBIOLOGICAL TESTING - The data in this report may not be representative of a lot, batch or other samples and may not necessarily justify the acceptance or rejection of a lot or batch, a product recall or support legal proceedings. Tests are not routinely performed as duplicates unless specifically requested. Changes occur in the bacterial content of biological samples. Samples should be examined as soon as possible after collection, preferably within 6 hrs and must be stored at 4 degrees Celsius or below. Samples tested after 24 hrs cannot be regarded as satisfactory because of temperature abuse and variations.

## APPENDIX 4: 2019-2020 RATINGS CURVES, WATER LEVEL MEASUREMENTS & FLOW MONITORING RESULTS

### Methodology

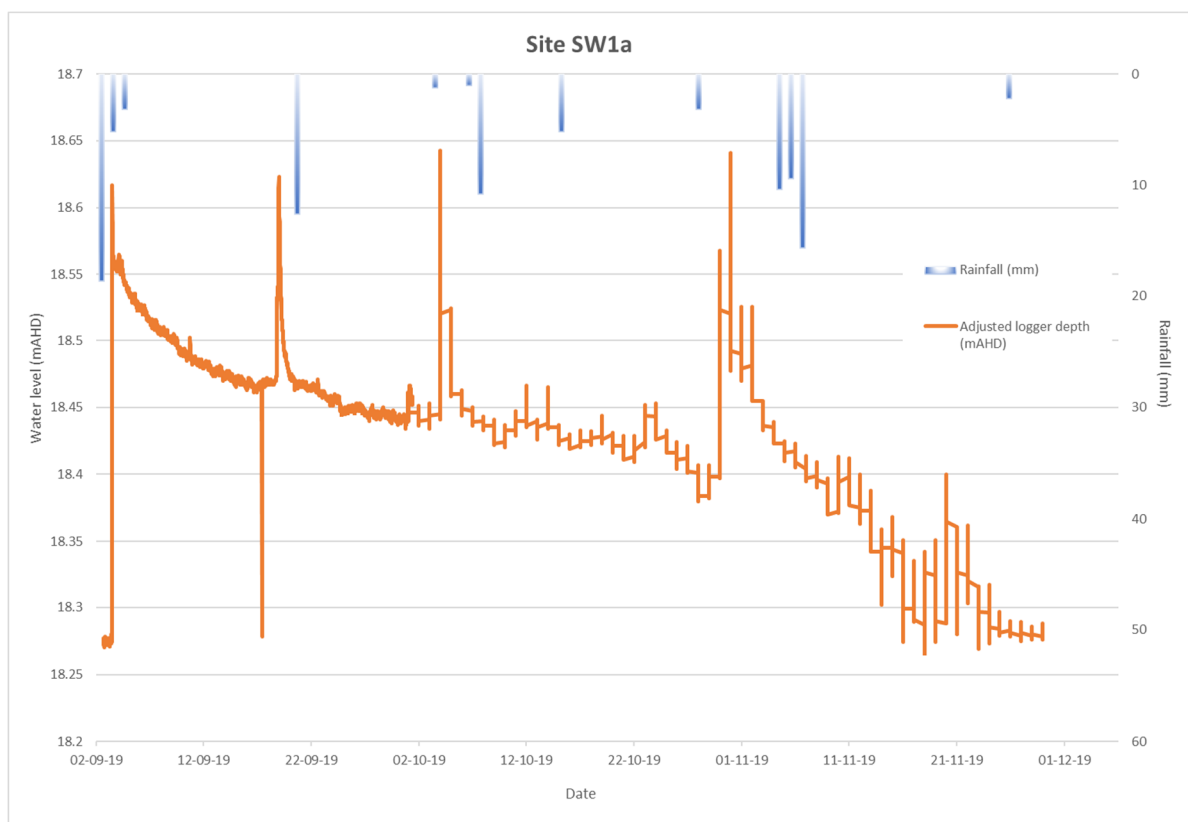
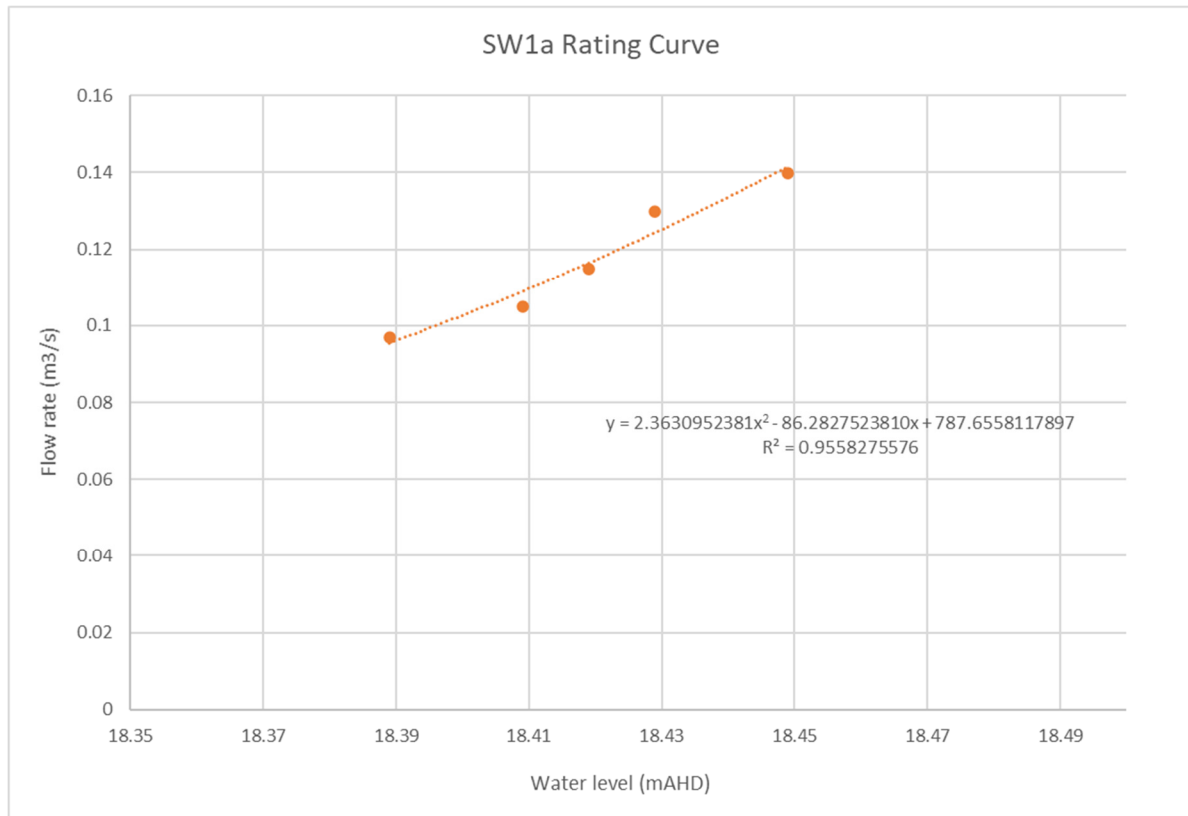
Ratings curves were developed for sites SW1a, SW2, SW4, and SW5 (Figure 2) on the basis of manual measurements taken during the six (6) water quality sampling events during the winter of 2020 (see Appendix 3). Manual water levels and flow measurements were recorded at 0.2 m intervals over a cross-section, where the PVC pipe (pressure probe loggers) was installed. The configuration is shown in the cross-section below. Manual water levels measurements in the channel were adjusted to the local datum, the PVC pipe and pressure probe logger that had been surveyed for location and elevation (mAHD). Logger water level readings were also adjusted to the datum (mAHD) using manual water level readings, either in July or August 2020 where flows were near their peak. The manual water level readings used for the logger adjustment are italicized in each table below.

Given the limited set of measurements used to develop the ratings curves, flow results were adjusted within the measured range manual flow measurements to better reflect approximate flow rates at each site corresponding with logger water level data.

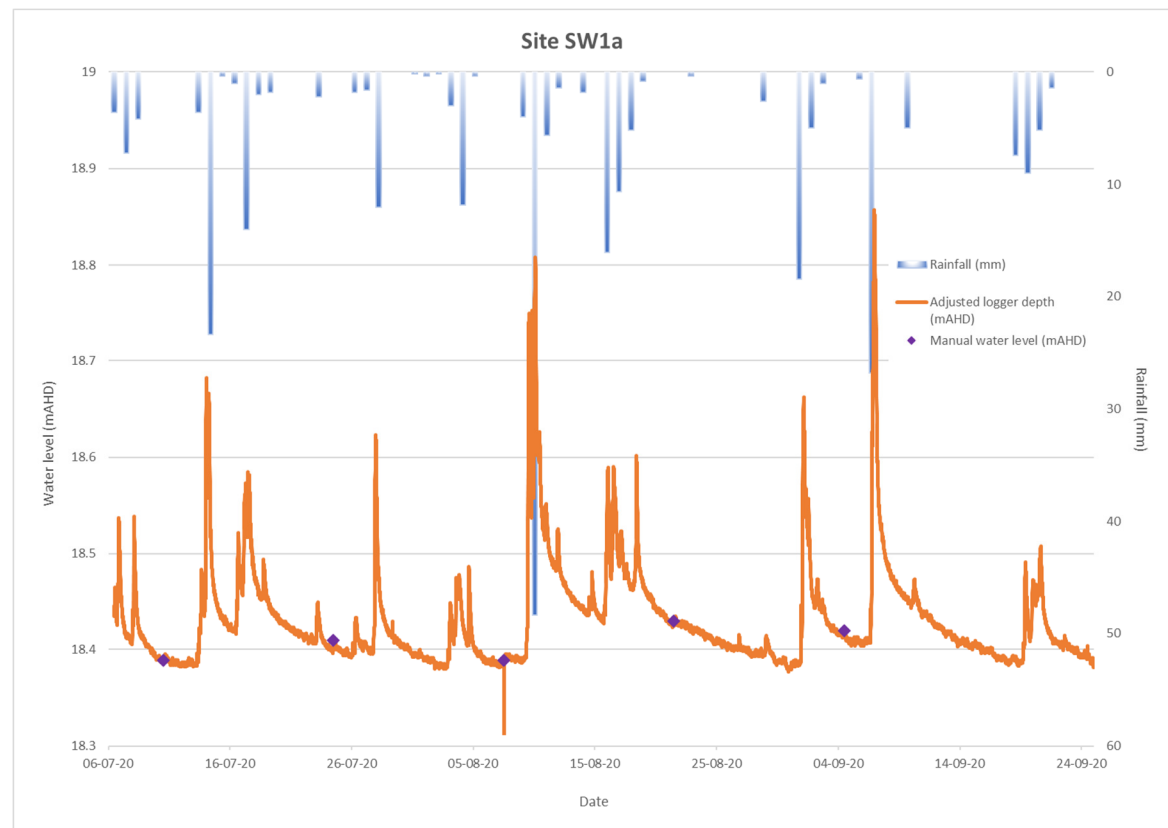


Ratings curves developed on the basis of manual water levels measurements and adjusted flow rates are presented for each site below.

## Site SW1a





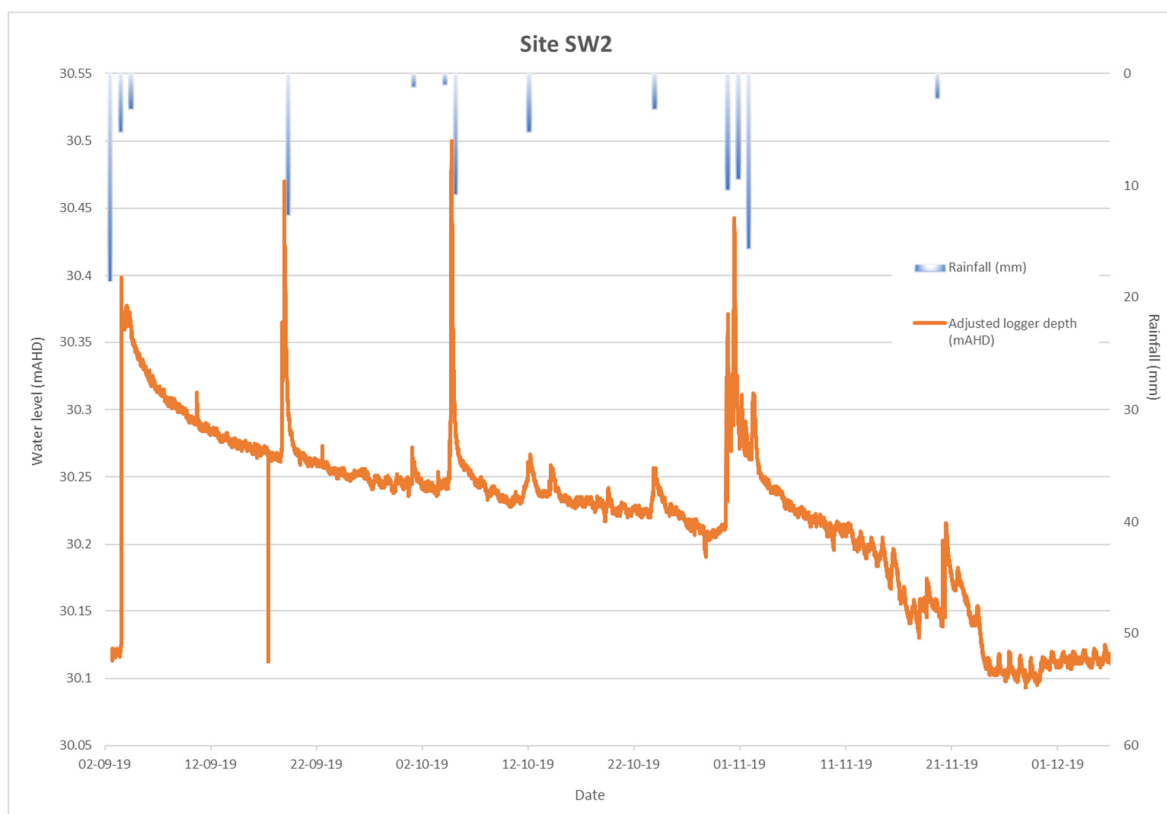
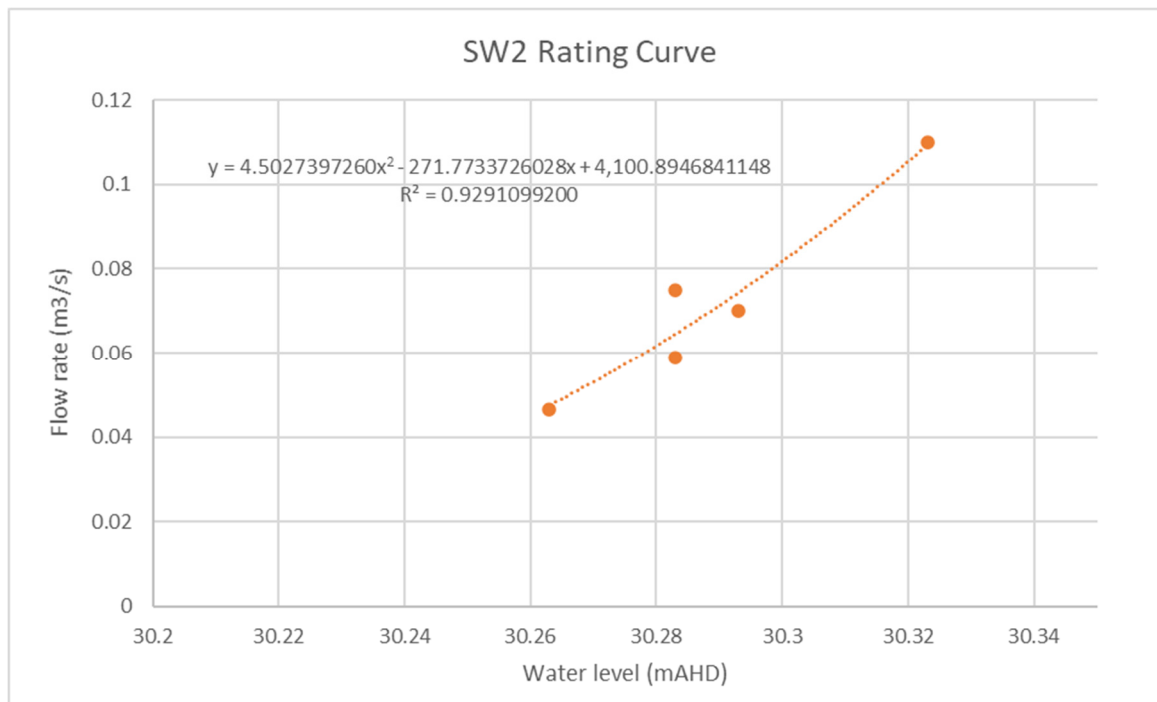


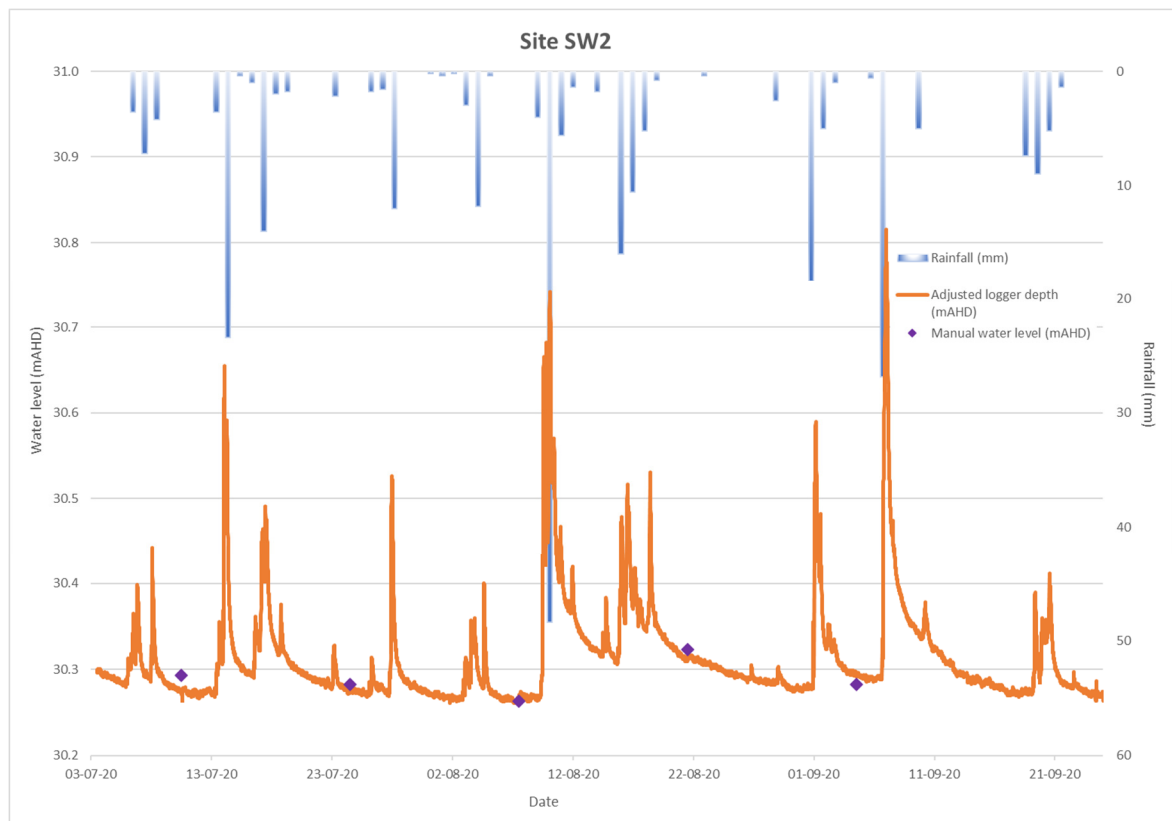
Date	Manual water level (m AHD)	Manual flow volume (m3/s)	Logger measurement (m)
25-09-20	18.449	0.07796	0.076
04-09-20	18.419	0.13995	0.101
21-08-20	18.429	0.13995	0.111
07-08-20	18.389	0.09702	0.069
24-07-20	18.409	0.0517	0.092
10-07-20	18.389	0.03475	0.075



Site SW1a pressure probe

## Site SW2



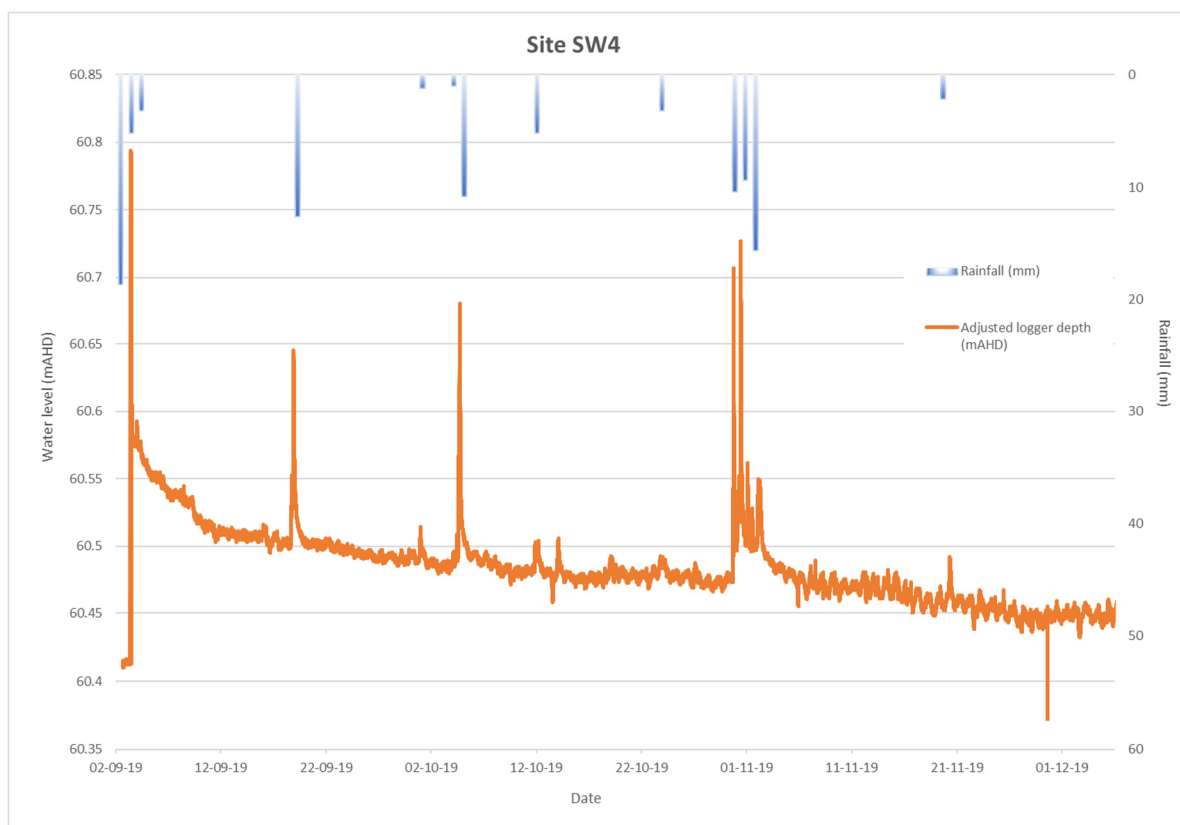
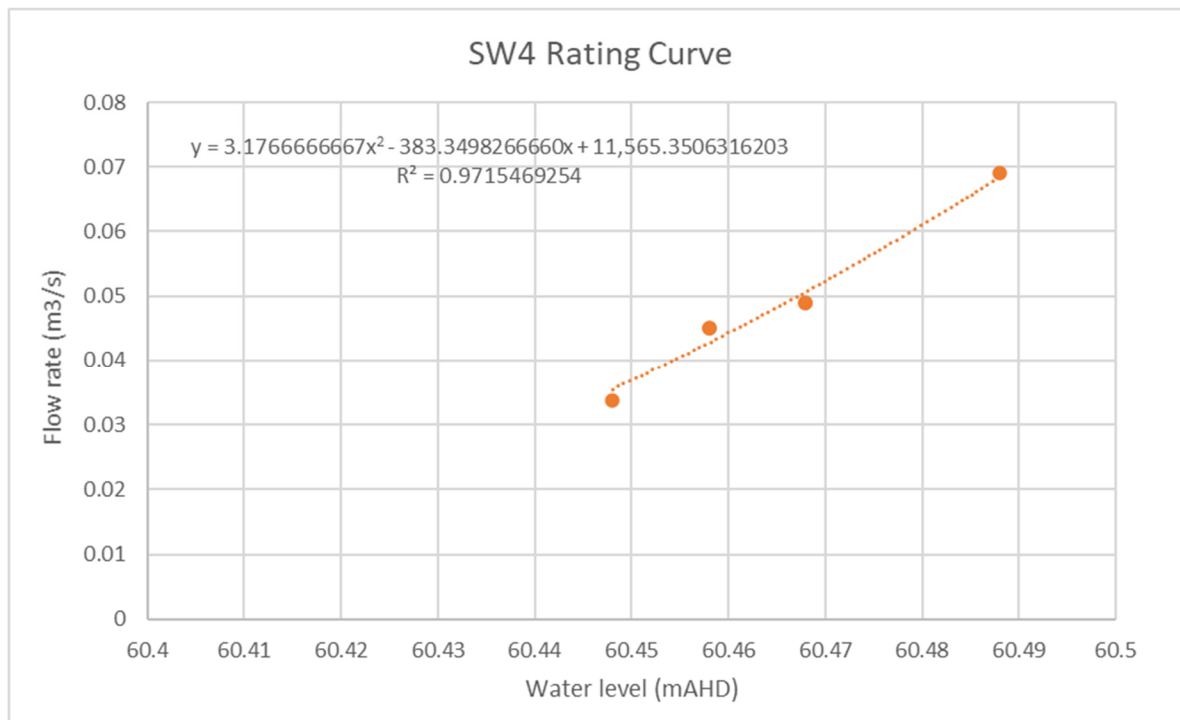


Date	Manual water level (m AHD)	Manual flow volume (m3/s)	Logger measurement (m)
25-09-20	30.263	0.069785	0.107
04-09-20	30.283	0.10987	0.133
21-08-20	30.323	0.10987	0.149
07-08-20	30.263	0.13348	0.101
24-07-20	30.283	0.08845	0.117
10-07-20	30.293	0.04645	0.115

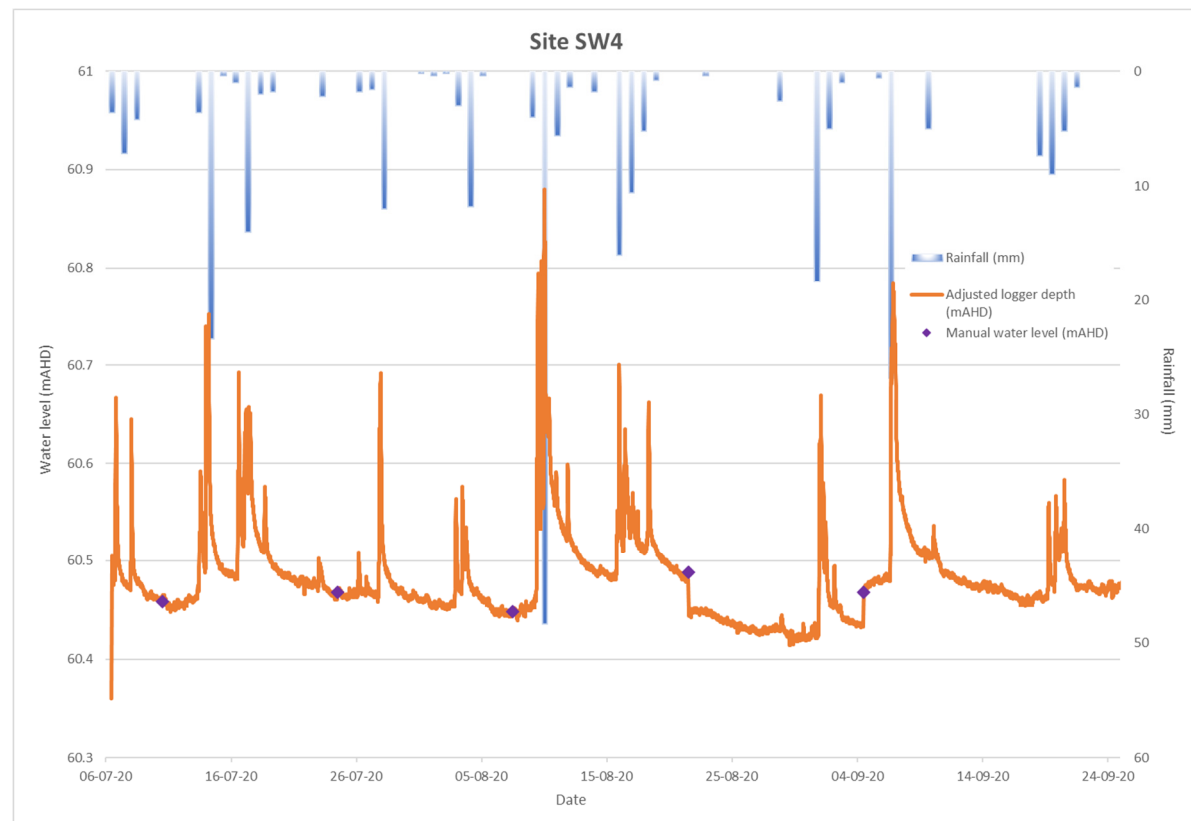


Site SW2 pressure probe

## Site SW4







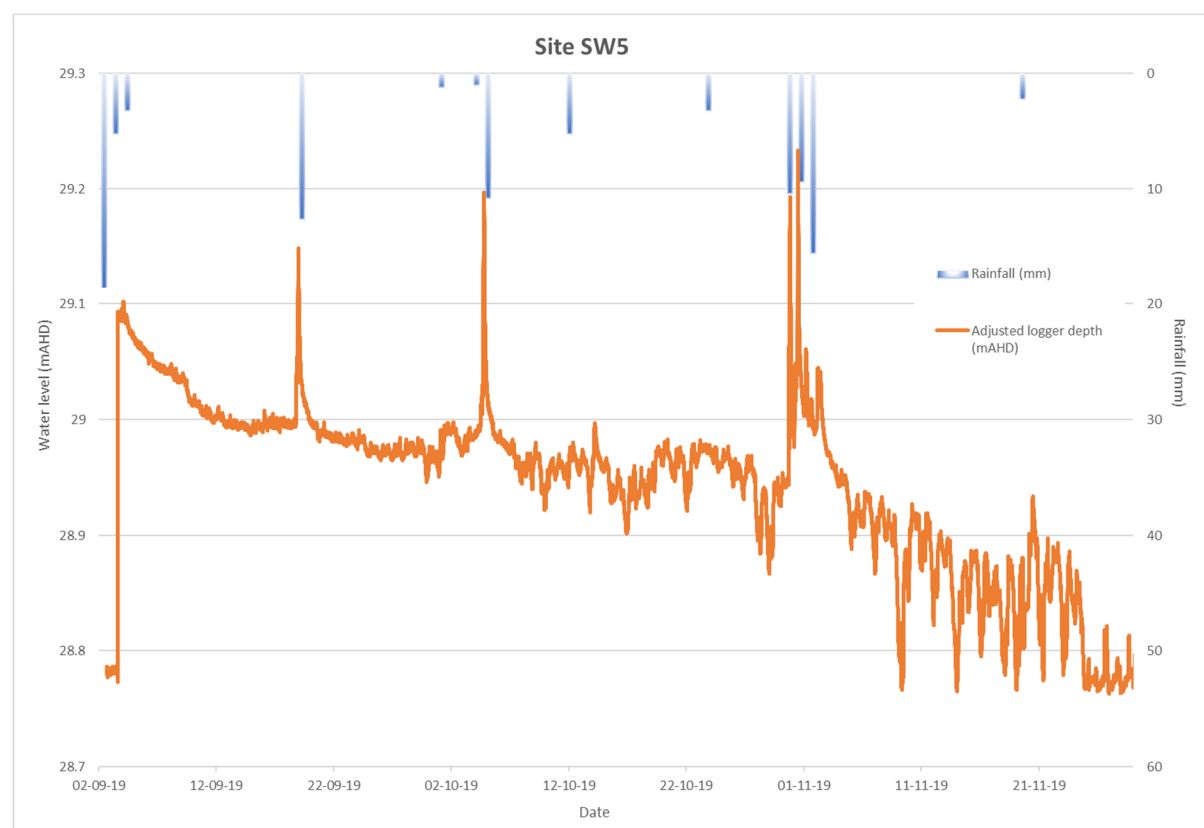
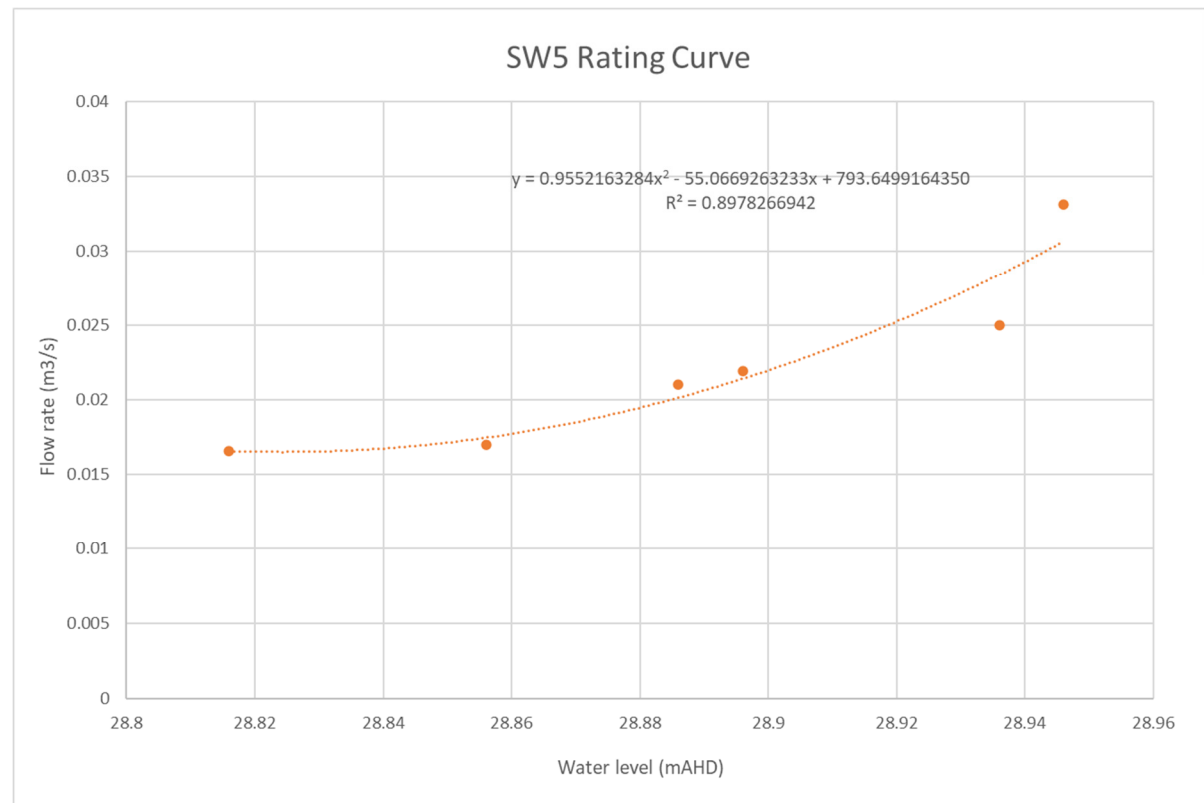
Date	Manual water level (m AHD)	Manual flow volume (m3/s)	Logger measurement (m)
25-09-20	60.458	0.05864	0.02
04-09-20	60.468	0.06898	-0.011
21-08-20	60.488	0.06898	0.035
07-08-20	60.448	0.05324	0.002
24-07-20	60.468	0.0722	0.021
10-07-20	60.458	0.0338	0.017

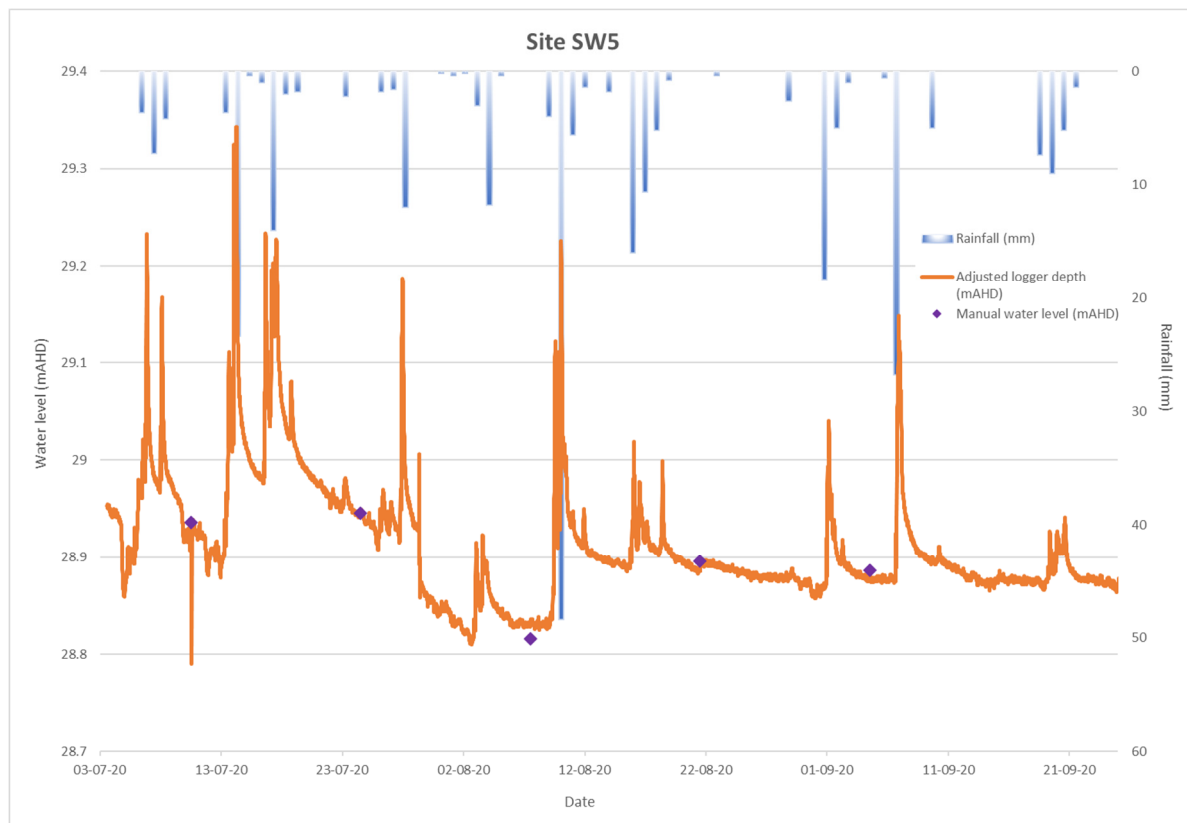


Site SW4 pressure probe



Site SW5





Date	Manual water level (m AHD)	Manual flow volume (m3/s)	Logger measurement (m)
25-09-20	28.856	0.03315	0.06
04-09-20	28.886	0.02195	0.055
21-08-20	28.896	0.02195	0.067
07-08-20	28.816	0.01655	0.013
24-07-20	28.946	0.0191	0.126
10-07-20	28.936	0.0114	0.112



Site SW5 pressure probe



**Client: City of Kalamunda**

Report	Version	Prepared by	Reviewed by	Submitted to Client	
				Copies	Date
Preliminary draft	V1	HL	HB	Electronic	November 2020
Final	V2	HL	HB	Electronic	3 December 2020

**Urbaqua**

**land & water solutions**

Suite 4/226 Carr Place

p: 08 9328 4663 | f: 08 6316 1431

e: [info@urbaqua.org.au](mailto:info@urbaqua.org.au)

[www.urbaqua.org.au](http://www.urbaqua.org.au)