ATTACHMENT NO. 6

Date Submitted	ID	Water Corporation Drainage Basins and Open Drain locations	Submissions received
10/03/2017 14.33	1	9982 bounded by Reid St, Clarke way and Hamilton St	In 2013, Clarke Way Reserve, which is adjacent to that drain, was earmarked by the Council to be sold off. A group of local residents, myself included, objected to this as we felt that park had more value to the Town as a park than as a development site, and also potential to benefit from rehabilitation of the adjacent drain. We successfully lobbied for the park to be retained, and instead two residential blocks were sold. Around this time, drain "maintenance" work occurred. An excavator was used to remove several truckloads of black sludge from the drain. Some of it was spread on the ground alongside the drain while truckloads of it were carted away. I assume the sludge that was placed near the drain would have ended up back in the drain after heavy rains. A group of Bassendean locals attended a workshop held by SERCUL, Perth NRM and the water corp on "Drains to Living Streams". We were shown a map depicting all the drains that they had identified as being suitable for conversion to living streams. We were pleased to see drain #9982 on that map. A group of us arranged for the CEO of SERCUL to visit the drain to assess whether it could be done. She described it as "ideally suited" for rehabilitation and said we were very lucky in Bassendean to have so much natural open space near the river. By converting the drain, the water quality and habitat corridors could be vastly improved. The drain was then given a makeover in the form of a brand new cyclone fence and new warning signs to keep people out. Many local people found this utterly stupid. Where they had once been walking their dogs etc was suddenly no longer accessible. While it is commonplace with gov depts for the left hand to not know what the right hand is doing, sometimes we can still be surprised. I think it is wonderful that the ToB is now, finally, seriously considering WSUD improvements and would suggest that drain #9982 be considered for this proposal. Its location and proximity to Open Green Space makes it an ideal candidate to be rehabilitated into a living stream and become part of a linear park connecting Clarke Way Reserve, Ashfield Flats and Hamilton & Reid St via walk and cycle paths. Attached below is an image of a partially converted drain in Bodkin Park Waterford. This situation is very similar to drain #9982, being adjacent to Open Green Space and flowing into river flats. Well worth a visit to see what can be done with some imagination and planning.
10/03/2017 20:38	2	9994 between Second Ave and Third Ave	More trees and shrubs, especially at the eastern end to provide shade for the footpath and a screen/windbreak. Would love to see more use of the reserves, where safety and maintaining watercolour access allows.
10/03/2017 20:34	3	9984 between Third Ave and Fourth Ave	I'd like to buy/lease part of the north west corner for gardening, fruit trees, chickens etc. For the south eastern side, space for community gardens, maybe beekeeping (if sufficient setbacks). More trees, more greenery, more community benefits please.

10/03/2017 16:04	4	9985 North Road	I have already made a submission but forgot to include in it drain 9985 between North Rd and the Swan River. I think this area should be cleaned up, weeds controlled and local native plants understorey planted. It would be good if the drain could be re-formed to make it more natural and vegetated with riparian plants. Some sort of access pathway from foreshore reserve to North Street could be built as an informal goat path exists already that many people do use. There are already some sizeable, healthy flooded gums (Eucalyptus rudis) on the reserve adjacent to the drain. Not sure if this reserve is also Water Corp tenure as it isn't fenced off like the actual drain.
10/03/2017 15:41	5	9994 between Second Ave and Third Ave	My ideas apply to all drains if applicable. I would be happy to start a local 'Friends of' group to look after drain areas between 2nd & 4th Aves. Through the Basso Vollie Centre you could have an over arching Wetlands Carers group with little local affiliate groups. I've discussed with a few neighbours who are keen. It is essential that neighbours are involved in any developments or changes to usage of these wonderful resources. They can be used for: passive recreation - observing nature; through walk trails; wildlife habitat (frogs, birds etc.), natural reed filter beds for runoff, means to increase tree and general vegetation cover and improve local microclimate; improve community cohesiveness through sharing; improve water quality of Swan River; act as environmental education resource for local kids; provide pleasant new walking routes; Of special additional interest to me are 9984 & 9994 that should together be re-contoured, landscaped and revegetated with local native riparian plants. 9987 integrate with landscaping and appropriate local plantings into adjacent park and simultaneously improve 9986 like 9984 above. This is a really exciting program worth lots of potential to improve sustainability of the Town's environment while at the same time decolonizingsolidarity.org strong community input and ownership. I would love to be involved.
8/03/2017 16:52	6	9984 between Third Ave and Fourth Ave	We would love to see the drainage channel developed into a mini nature park. Children in the street already enjoy playing around the edges of the drain and improving access to and safety of the drain would be beneficial. The large grassed area is "wasted" space as it currently serves no purpose other than to provide work for the mower man! Some suggestions would be: Medium size native trees for shade; Native flowering plants; Smaller grassed area and seating /table beneath trees, even large rocks to sit on would be ok! Possibly raised beds that could be developed in future into shared community garden if there was local interest. Use of vegetation, natural or recycled landscaping materials vs current chain link fence / metal fencing / concrete - Improved drain / stream health to encourage biodiversity. Keep it simple. Does not need playground equipment or built shade structures or picnic areas. Just somewhere for kids to play locally in a more natural environment, for people to enjoy sitting outside, for wildlife (eg birds & frogs) to have some much-needed habitat|

5/03/2017 14:17	7	9983 bounded by Hardy Rd, Iveson Pl, Reid St, Hamilton St, Whitfield St and West Rd	Revisit existing complex of drainage plans to repair the Ashfield Flats system, corrected and altered to allow consideration of the latest predicted drainage and river flows relevant to climate change. Immediate positive action would be to reduce or cease the vegetation removal from the various drains running through the Flats into the river. I live closest to the drain system and associated wetland, and have observed the systems behaviour daily for 17 years. I would expect an uncleared drain would naturally filter and biologically cleanse the water flow through it. Mosquitoes have rarely been a problem, and more recently, less so despite the latest summer rains. A more natural ecosystem, with the reestablishment of natural predators should keep mosquitoes controlled. Rubbish sumps/filters may need to be installed to catch bottles etc. The 100 yr flood plain level is now a historical fiction. Allowing water flow into this natural catchment would be predicted never to coincide with tides and previous winter flow levels to ever produce the 100 year predicted levels. A new natural relationship would connect the urban water flow to the river with biological cleansed water. Existing vegetation would need to be improved in keeping with the slightly dryer and I suspect more saline ecology. DoW and Perth NRM both have extensive expertise to monitor, plan and advise.
1/03/2017 21:35	8	Ireland Way Compensating Basin	I would like to see the drains throughout Bassendean become community gardens based on permaculture and organic gardening principles, to ensure in particular no additional fertilizer/nutrient overload. Each garden area could have, a starter kit of specific types of fruit trees, with local community members invited to take up veggie plots (perhaps raised self-watering). A security pass gate system could help ensure safety and access for local or registered applicants. This would help to regeneration our urban tree scape and help build community. Link s with community gardening workshop providers could help to develop local know how. Some investment to bring the right elements together but think it could become self-sustaining in a short time frame and add much to living here in Bassendean.
28/02/2017 12:00	**9**	9984 between Third Ave and Fourth Ave	I would like to see this area become a park area for community use.
28/02/2017 11:59	10	9994 between Second Ave and Third Ave	I would like to see this area become a park area for community use.
28/02/2017 11:58	11	9994 between Second Ave and Third Ave	I would like to see this area become a park area for community use.
28/02/2017 11:56	12	9984 between Third Ave and Fourth Ave	I would like to see this area become a park area for community use.

28/02/2017 11:38	13	9984 between Third Ave and Fourth Ave	I would like to see this area become a park area for community use.
25/02/2017 16:59	14	Chapman Street North Compensating Basin	I would like to select both north and south Chapman St options, plus the drainage channels down to the Swan River know as the Chapman St Main Drain. There was an attempt 10 years ago to rehabilitate the North basin. However, it was not very successful due to poor environmental planning, and inappropriate practises by maintenance contractors. This resulted in re-establishment of the kikuyu grass and the death of most of the native vegetation. However, there has been some improvement in the reduction of mosquitoes, an increase in frog numbers and some plants have survived making it a more visually appealing and habitable for local fauna. I would like to see this implemented across the whole of the metro area to create a chain of micro-ecosystems to enable the survival of our remaining urban birds, frogs, etc and to combat mosquitoes, weeds etc, using natural methods.
24/02/2017 13:39	15	9984 between Third Ave and Fourth Ave	That the Water Corporation make the drain and surrounding land available to the Council to make it suitable for public use such as small park or community walkway.
18/02/2017 14:46	16	9984 between Third Ave and Fourth Ave	The vacant lot on Fourth Ave south of the open drain 9984 be utilised as Public Open Space and developed as a local pocket park in association with ground works and planting to create a living stream through to Third Ave. Ground works to create a seasonal wetland compensation basin with softer accessible embankments utilising the expanded available land. This is located in an area destined for multi residential development that lacks accessible open space.

13/02/2017 12:12	17	WATER CORPORATION OPEN DRAINS IN GENERAL	I would love to see some, if not all of these drainage sites revegetated with local, native species suitable for a wetland/swamp-like environment. I live one house away from drains 9994 and 9984 on Third Ave and have often thought how nice it would be to see these sites lush, green and teeming with bird life. I work as a horticulturist at Kings Park, so I have a very keen interest in native species for many different reasons, but most importantly their uniqueness to our state (we should be proud of these species!) and their suitability to our harsh conditions, not to mention the habitat they provide for frogs and birds. Our streets are getting quieter and quieter as more and more mature trees are removed as subdivisions increase. I feel it is our duty to reinstate some form of natural area where feasible and these drainage sites are the perfect opportunity. Imagine sedges lining the water with Melaleuca species (Paperbark) gracefully growing along the edges along with Eucalyptus rudis (Flooded Gum). On higher, dryer ground a mixture of shrubs, Banksia and the odd Jarrah and Marri. There is so much potential here for TOB to demonstrate initiative and intelligent planning in a time when we are at risk of losing so much of our natural heritage. It is also in keeping with the Town's commitment to the 202020 vision as outlined in the Draft Urban Forest Strategy. I am more than willing to assist/volunteer in any way I can and I applaud the Town for making this opportunity possible. Well done. Below is a link of what is possible with revegetation in Perth: https://www.facebook.com/natural.area.wa/photos/a.356627551163110.1073741830.354313331394532/729702053855656/?type=3
9/02/2017 20:58	18	9994 between Second Ave and Third Ave	It would be great to see some Australian native trees planted in the space next to the drain. We have lost some incredible gum trees and other varieties with all the subdivisions happening. This space and others could replace the lost trees. Also, a hedge on third ace that is the same as the one on Second Ave would hide the ugly fence.
21/01/2017 7:24	19	9994 between Second Ave and Third Ave	Opportunity is definitely there to transform it into a useable and more aesthetically pleasing green space for the local community. Seating, edible garden gardens and some nifty natural play element for young children - different play components and gardens at each site encouraging connection and movement amongst the various drains.
26/02/201 7 11:43	20	Submission received by email and comments on drains in general.	1. Stormwater pits are ideal collection and cleaning points with simple, low cost and regular cleaning systems like STORMBIN. 2 . By owning and using a horizontal boring system like a Ditchwitch or Vermeer trenchless system, (not necessarily as shown above), then the Town of Bassendean can install 'long tanks of connected PVC ducting' under roads, ovals, reserves and street verges to store the cleaned stormwater. (This is not aquifer recharge, although this may also be considered with surplus overflow water) 1km of 150mm diam ducting would hold around 18,000 litres of water. Depending on location and water management, a km of ducting could result in the reuse of some 100,000 litres of water per year. (EG: 6 fill, use & refill cycles). 3. Stormwater is retrieved by gravity, solar powered submersible low voltage pumps and/or suction pumps to refill watering trucks to use the stored water on a demand basis, where required. 4. The same horizontal boring system can also be used for underground power, broadband, sewer expansion etc, so speeding up the process at substantially reduced costs. 5. If there was a serious emergency and water supplies were lost, the SES could support the 15,000+ people in Bassendean with the distributed tanked water storage.

Water quality in the Bassendean Drainage Network 2016

Prepared by the Department of Parks and Wildlife (DPAW) in conjunction with the Department of Water – Water Science Branch for DPAW

Photo Location: Chapman Street Compensation Basin (site 17 looking back at site 7, July 2016)

City of Bayswater

Government of Western Australia
Department of Water

Department of
Parks and Wildlife

TOWN OF
BASSENDEAN
Home by the Swan

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1.0. Executive Summary

Three main drainage lines exist within the Town of Bassendean, all of which were constructed during the development of the suburbs to lower the groundwater table, enabling the swampy land to be suitable for development. These three main drains (Kitchener St drain, Chapman Street drain and Guildford Rd drain) all have both open and closed sections and discharge into the Swan River. Numerous local authority drains which drain stormwater runoff from the surrounding residential and industrial areas also discharge into these main drains, meaning the surface water within these main drains can be a mixture of groundwater and stormwater.

The Kitchener St drain is the smallest of the three main drains. It receives groundwater and stormwater from a mainly residential catchment area and discharges into the river at Ashfield, after flowing in an open channel through the Ashfield flats reserve.

The Chapman St Drain discharges into the river upstream of the Kitchener Street drain within the Ashfield Flats reserve. This drain receives stormwater and groundwater inputs from a catchment area which is predominantly residential; however it is also connected to a large industrial area (Bassendean (Tonkin Park) industrial precinct).

Bindaring creek forms part of Bindaring Park which follows a linear shape and discharges into the Swan River. This particular site is valuable to wildlife such as tortoises, purple swamphens and black swans which use the creek and associated wetlands.

In 2007, a water quality monitoring program was conducted every second month, beginning after the first rains. The objective was to gather baseline information regarding the quality of water entering the Swan River via the main drains of Bassendean, including Kitchener St Drain and Chapman St Drain, and also to determine the location of any pollution hotspots throughout the catchment area. This was repeated in 2010 then every year thereafter.

This report highlights the findings of the 2016 water quality monitoring program and will help to determine management actions that should be targeted in the catchment. The report provides further information to determine the extent of pollution upstream of the site of highest concern (site 7), and to do so 4 new sites were added to the program in 2013, and a further 5 new sites were added in 2015.

An additional 2 sites (23 and 24) were also included in the 2015 program at Bindaring Creek to assist the Town of Bassendean with their plans to restore the wetland. The additional samples to be analysed by the laboratory (total dissolved salts, salinity and cations) were repeated in the 2016 sampling program, however were not included in the 2015 or 2016 reports, as the results were provided to the Town of Bassendean separately.

1.1. Key Findings

Surface Water

- Physical:
  - The pH values did not meet the acceptable range at site 18 during August and September, sites 15 and 17 during July and August, site 16 during July and site 19 during August.
  - The dissolved oxygen saturations in the surface waters of the Bassendean catchment recorded low or very low concentrations at sites 7, 14, 18, 15, 16, 17, 13, 23 and 24. It should be noted that sites 14, 18, 15 and 16 are closed drains and these low levels are to be expected.
  - Electrical conductivity exceeded the ANZECC guidelines upper limit (0.3 ms/cm) for freshwater lowland rivers at sites 7, 18, 15, 16, 17, 20, 21, 6, 8, 13, 23 and 24 on all sampling occasions.
  - Total suspended solids were high within the industrial area and exceeded the interim guideline at sites 7, 14, 18, 15, 16, 19, 17, 20 and 21 on one or more sampling occasions.

- Nutrients:
  - Sites 7, 20 and 21 exceeded the ANZECC guideline (1.2 mg/L) for total nitrogen on all sampling occasions, with site 21 being of particular concern. Sites 14, 18, 16, 17, 6, 8, 13, 23 and 24 exceeded the guideline on at least one sampling occasion.

- Sites 7, 14, 18, 15, 16 and 17 exceeded the ANZECC guideline (0.065 mg/L) for total phosphorus on all sampling occasions, with site 18 being of particular concern. Sites 19, 20, 21, 22, 6, 8, 13, 23 and 24 also exceeded the trigger value on at least one sampling occasion.

- Metals:
  - The industrial sites 7, 14, 18 and 17 were of most concern as they recorded the greatest number of instances where the ANZECC guidelines were exceeded.
  - Site 17 is of particular concern given it not only recorded the greatest number of exceedances, but the highest concentrations exceeding the guidelines of arsenic, cadmium, cobalt, copper, iron and zinc, and it also recorded concentrations of aluminium and chromium.
  - Site 14 and 18 both recorded concentrations exceeding the guidelines of aluminium, arsenic, chromium, copper, iron, lead and zinc.
  - Site 7 was not sampled for the full suite of metals as the other sites, but it did record concentrations exceeding the guidelines of aluminium, copper, iron and zinc.
  - It is interesting to note that cadmium was below the detection limits at site 7, however sites 21 and 22 also exceeded the hardness modified trigger values and these sites feed into site 17.

1.2. Summary comparison of water quality results against guidelines

Table 1: Number of samples exceeding the guidelines

		Water Quality Trigger Value			DOW Interim Guideline
Measurement	**Parameter**	**Lowland River**	**Freshwater 95% Protection**	**Recreational**	
WATER					
Physical[1]	pH	8	NA	NA	NA
	Dissolved Oxygen	28	NA	5	NA
	Total Suspended Solids	NA	NA	NA	6
	Conductivity	29	NA	NA	NA
Nutrients[1]	Total nitrogen	22	NA	NA	NA
	Total oxidised nitrogen	17	NA	NA	NA
	Ammonia- Ammonium	14	NA	NA	NA
	Total phosphorus	29	NA	NA	NA
	Soluble reactive phosphorus	26	NA	NA	NA
Soluble Metals[2]	Aluminium	NA	8	5	NA
	Cadmium*	NA	0	NA	NA
	Copper*	NA	5	NA	NA
	Iron	NA	8	0	NA
	Zinc*	NA	8	NA	NA
Total Metals[3]	Aluminium	NA	17	9	NA
	Arsenic	NA	8	3	NA
	Cadmium*	NA	4	NA	NA
	Chromium*	NA	12	NA	NA
	Cobalt	NA	3	NA	NA
	Copper*	NA	24	NA	NA
	Iron	NA	17	5	NA
	Lead*	NA	9	NA	NA
	Manganese	NA	0	0	NA
	Zinc*	NA	18	NA	NA

KEY

1	Number of water samples equal or exceeding trigger value out of 33
2	Number of water samples equal or exceeding trigger value out of 8
3	Number of water samples equal or exceeding trigger value out of 25
NA	Not applicable
*	Compared to adjusted trigger value for water hardness

2.0. Sampling and Analysis Procedures

2.1. Changes to the project

This project started in winter of 2007 (see sampling and analysis plan for that year for project details).

In 2008 the following changes were made:

- One new site (BASS09) was added to the project at the request of the town of Bassendean to capture drainage entering the Swan River at Success Hill.
- Soluble metals analysis (Al, As, Cd, Cr, Cu, Pb, Zn) was added based on the recommendations from the previous year's results.
- Total mercury and nickel were deleted from the list of total heavy metals analysed due to limited budget (to allow for analysis of key soluble heavy metals) and as they were always below detection limits in 2007.
- Analysis for PAH, BTEX, TPH and TRH was discontinued as they were always below detection limits in 2007 and to free up money in the budget for new sites and other analytes.
- Analysis for total organic carbon and dissolved organic carbon was discontinued (from sites 1, 5 and 8).

No sampling was conducted during 2009.

In 2010 the following changes were made:

- Kitchener St drain was highlighted as a major concern within the 2008 report and was therefore selected to monitor more thoroughly.
- Two new sites were added to the Kitchener St drainage network (BASS11 and BASS12) to highlight any potential sources of pollutants at the start of the drainage system.
- Analysis of total chromium and lead were deleted from the list for Kitchener St due to limited budget (to allow for analysis of key soluble heavy metals) and as they were always below the detection limits in 2008.
- Analysis of soluble chromium, iron and lead were deleted from the list for Kitchener St due to limited budget (to allow for analysis of key soluble heavy metals) and as they were always below the detection limits in 2008.
- Analysis for PAH, BTEX and TPH in water samples was discontinued for Kitchener St as they were always below detection limits in 2007 and to free up money in the budget for new sites and other analytes.
- Analysis for total organic carbon and dissolved organic carbon was discontinued for Kitchener St as they were below detection limits in 2007 and were not analysed in 2008.
- Sites BASS06 and BASS07 within the 2008 report (Chapman St Drain) were highlighted as a concern and were therefore selected to be monitored more thoroughly.
- Within the 2008 report, BASS05 was not chosen to be further monitored in this report as this is most likely influenced from the estuarine waters.
- Analysis of total and soluble metals that were highlighted as an issue within the 2008 report were selected for the Chapman St Drainage network including (Al, As, Cd, Cr, Cu, Pb, Zn).
- A new sampling site was added at Bindaring Creek (BASS13) to capture a snapshot of the potential nutrient pollutants entering the Swan River.

In 2011 the following changes were made:

- Sampling frequency was decreased from 5 to 3 times a year, but more parameters were included.
- Site 7- analysis for PAH, BTEX and TPH in water samples were included as a snapshot due to the proximity to industrial area.
- Site 13- thorough investigation for soluble and total metals (Al, As, Cd, Cr, Co, Cu, Fe, Hg, Pb, Mn, Mo, Ni, Se, Zn) in water samples was included as only nutrients were analysed in 2010.
- Site 6, 7, 8- analysis for total metals was excluded from all sample sites and only the soluble metals that were seen as an issue from the 2010 results were monitored.
- Site 11 and 12 were excluded from the program as they were the closed stormwater drainage system and could never be sampled due to lack of water and access.

In 2012 the following changes were made:

- PAH, BTEX and TPH were discontinued at site 7 as concentrations were below the detection limits in 2011.
- Total metals at site 13 were discontinued.
- Soluble metals (Al, Cd, Cu, Fe, Zn) were sampled in surface water at all sites on all sampling occasions.
- Analysis of nutrients (TN, TP) and metals (Al, Cd, Cu, Fe, Zn) in sediment were included as a snapshot at all sites during July.

In 2013 the following changes were made:

- 4 new sites (14, 15, 16 and 17) were added upstream of site 7 to try and assess the water quality entering the sump where site 7 is situated.
- The suite of 14 total metals was sampled at these 4 new sites.
- The soluble metals previously identified as being potentially problematic (Al, Cd, Cu, Fe and Zn) were continued at the original sites.
- Sites 6, 8 and 13 were only sampled as a snapshot in July.
- Sediment sampling was only continued at site 7.

In 2014 the following changes were made:

- Sediment sampling was discontinued at site 7, as there are currently no appropriate trigger values to compare the concentrations to and there is now baseline data from previous years monitoring.
- Analysis for total metals (Cd, Hg, Mo, Ni and Se) in water samples was discontinued due to being below the relevant guidelines or detection limits.

In 2015 the following changes were made:

- 2 new sites (18 and 19) were added to the program, to provide a better representation of the drainage line around existing sites 14 and 16.
- 3 new sites (20, 21 and 22) were added to the program at the inlets to a compensation basin upstream of site 7.
- 2 new sites (23 and 24) were added to Bindaring Creek as per a request from the Town of Bassendean Environmental Officer.
- Total dissolved salts, salinity and cations (Ca, Mg, Na and K) were added to the suite of parameters to be sampled at the Bindaring sites.
- All 3 Bindaring sites are to be sampled once in winter and once in summer and this data will be provided separately to the Town of Bassendean (in reality these sites were only able to be sampled in winter as the sites were dry in summer).

In 2016 the following changes were made:

- Sites 23 and 24 were sampled as a once off in July, and the data was provided to the Town of Bassendean separately to the 2016 report.

2.2. Selection of Sample Sites

The 15 sites across the catchment area were selected such that:

- They are representative of a small sub-catchment area;
- They are up and downstream of likely pollutant sources; and
- They are located up and downstream of rehabilitation projects.

2.3. Site Location

Samples were collected from 15 sites throughout the catchment. Table 2 below provides a description of each of the sites.

Table 2: Location of sampling sites in the Bassendean catchment

WIN Site code	Drain Section	Location	Easting	Northing	Priority
OPEN SECTIONS OF DRAIN FLOWING INTO RIVER					
BASS06	Chapman St Drain	Open drain south of Reid St	400676.4	6468548.0	Low
BASS08	Kitchener St drain	Ashfield flats reserve, opening of pipe into parkland, adjacent to Hardy St	399914.3	6468166.7	Low
COMPENSATION BASIN NEAR RAILWAY					
BASS07	Chapman St Drain	Compensating basin, adjacent to intersection of May Holman Dve and Railway Pde. Sample from most downstream (eastern) point.	399786.4	6469190.5	High
BASS17	Chapman St Drain	Open drain entering site 7	399680.15	6469156.90	High
INDUSTRIAL SITES					
BASS14	Chapman St Drain	Closed drain at the intersection of Yelland Way and Dyer Road, outside 'StrickForce'	399688.97	6469296.21	High
BASS15	Chapman St Drain	Closed drain at May Holman Drive, outside 'Australian Convenience Foods Group'	399735.58	6469395.49	High
BASS16	Chapman St Drain	Closed drain at McDonald Crescent, outside 'Bytecraft'	399834.46	6469334.82	High
BASS18	Chapman St Drain	Closed drain on Yelland Way, outside 'number 1: Total Catering Solutions' (near sign on fence)	399688	6469301	New
BASS19	Chapman St Drain	Closed drain at corner of McDonald Crescent and Colgoola Brace	399908	6469400	New
COMPENSATION BASIN NEAR CSBP					
BASS20	Chapman St Drain	Northern inlet to compensation basin	399256	6469113	New
BASS21	Chapman St Drain	Western inlet to compensation basin	399247	6469110	New
BASS22	Chapman St Drain	Southernmost inlet to compensation basin	399252	6469105	New
BINDARING CREEK					
BASS13	Bindaring Creek	The southern section of the creek over the small foot bridge, where the creek begins to narrow	401480.95	6468875	Low
BASS23	Bindaring Creek	Culvert at Hyland Street	401304	6469040	New
BASS24	Bindaring Creek	Next to the bridge at the end of Lovelock Street	401262	6469167	New

Low	Sampled 1x year
High	Sampled 3x year
New	Added to program 2015

Figure 1: Location of sampling sites

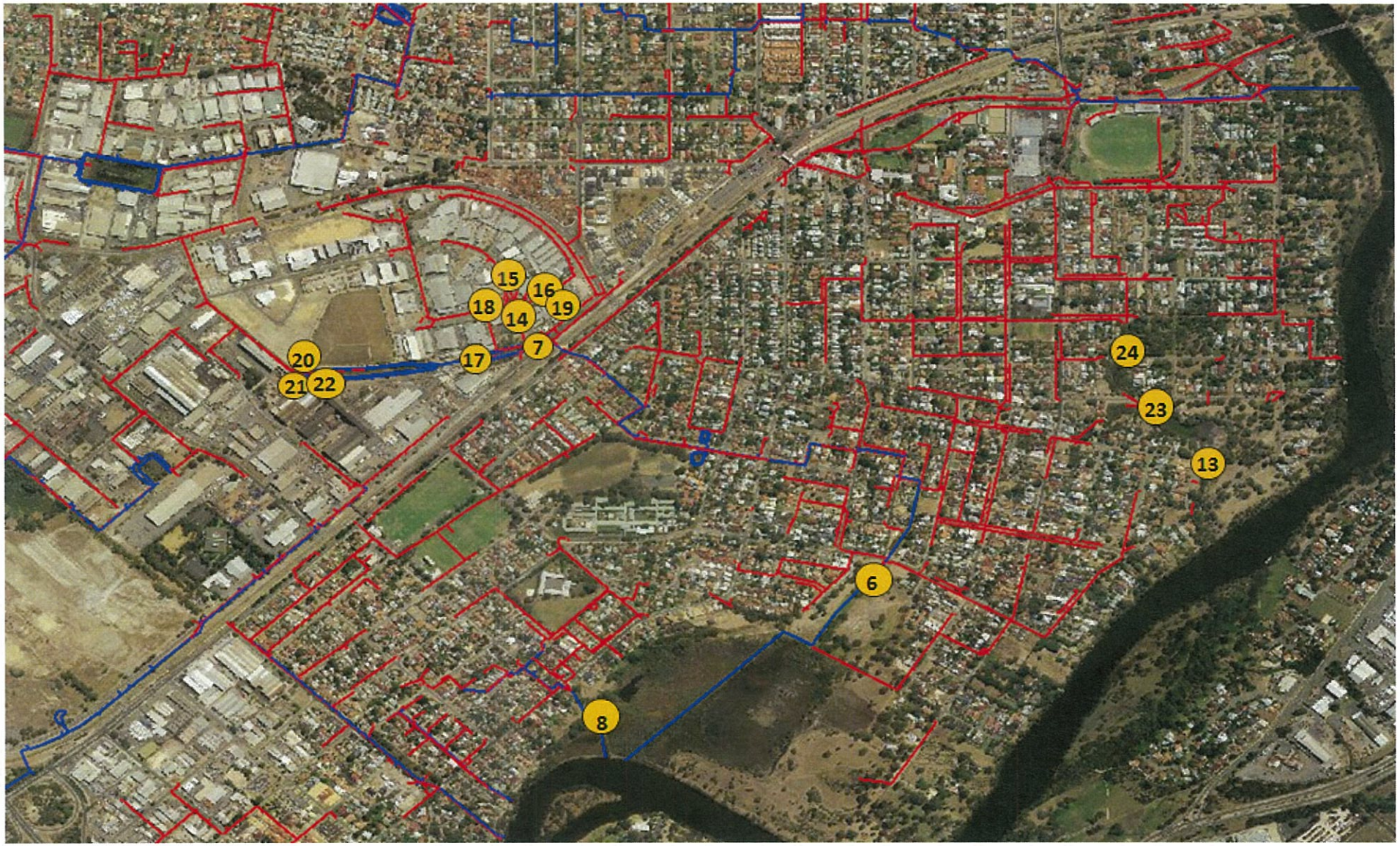


Figure 2: Schematic Diagram of Town of Bassendean Drains

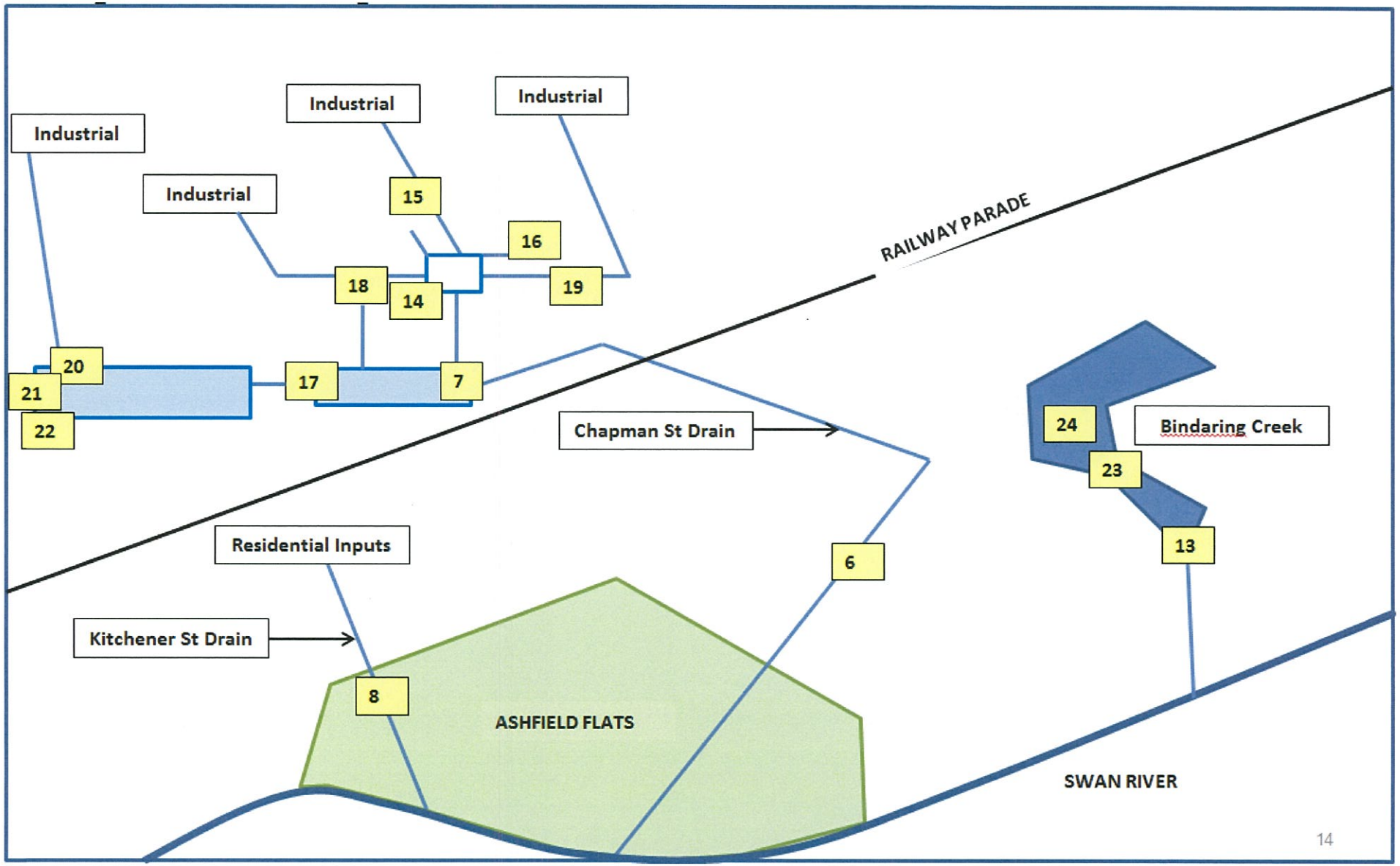
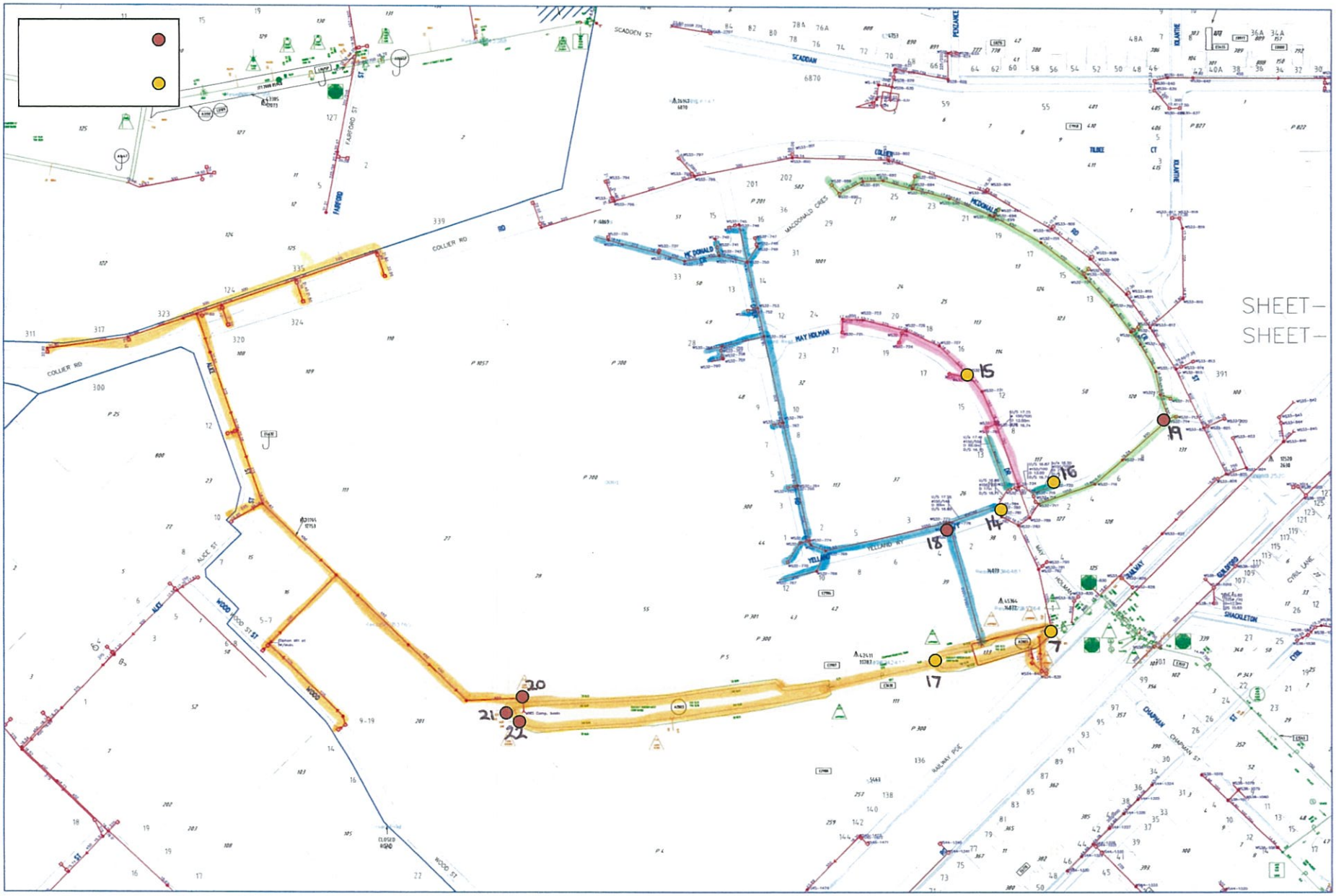


Figure 3: Industrial sites and drainage lines



2.4. Sampling

Sampling was conducted on the 22nd of July, 18th of August and 15th of September 2016. Field observation forms were filled out at the time of sample collection and all water samples were transported under "chain of custody" to the laboratory and analysed in accordance with the laboratory methods. All samples collected from the Bassendean Drainage Network were analysed by the National Measurement Institute (NMI), which is a National Association of Testing Authorities (NATA) accredited laboratory and independently audited by the Department of Water. Samples were collected in accordance with the Bassendean Drainage Network sampling and analysis plan 2016 (DPAW, 2016), and in accordance with Department of Water standards and protocols.

Water in the Bassendean Drainage Network was measured *in situ* for physical properties from all sites, including:

- Temperature;
- Dissolved oxygen;
- pH; and
- Electrical conductivity.

Water samples were collected from sites 6, 7 and 8 during July and from site 7 during August and September and analysed in a laboratory for the following parameters:

- Total suspended solids (TSS);
- Nutrients - total nitrogen (TN), total phosphorus (TP), total organic nitrogen (TOrgN), soluble reactive phosphorus (SRP), Nitrogen as ammonia (NH_3-N), total oxidised nitrogen (NOx), dissolved organic nitrogen (DOrgN);
- Soluble heavy metals – aluminium, cadmium, copper, iron and zinc; and
- Total water hardness (as Ca and Mg).

Water samples were collected from sites 14, 15, 16, 17, 18, 19, 20, 21 and 22 during July, August and September and analysed in a laboratory for the following parameters:

- Total suspended solids (TSS);
- Nutrients - total nitrogen (TN), total phosphorus (TP), total organic nitrogen (TOrgN), soluble reactive phosphorus (SRP), Nitrogen as ammonia (NH_3-N), total oxidised nitrogen (NOx), dissolved organic nitrogen (DOrgN);
- Total heavy metals – aluminium, arsenic, cadmium, chromium, cobalt, copper, iron, lead, manganese and zinc; and
- Total water hardness (as Ca and Mg).

Water samples were collected from sites 13, 23 and 24 once during July (winter) and analysed in a laboratory for the following parameters:

- Total suspended solids;
- Total dissolved salts and salinity;
- Cations (Ca, Mg, Na and K);
- Nutrients - total nitrogen (TN), total phosphorus (TP), total organic nitrogen (TOrgN), soluble reactive phosphorus (SRP), Nitrogen as ammonia (NH_3-N), total oxidised nitrogen (NOx), dissolved organic nitrogen (DOrgN);
- Soluble heavy metals – aluminium, cadmium, copper, iron and zinc; and
- Total water hardness (as Ca and Mg).

Please note:

- Site 22 wasn't able to be sampled during July or September as it wasn't flowing.
- The results from the additional analyses completed at Bindaring wetland (sites 23 and 24) will be sent separately to the Town of Bassendean as this is outside the scope of this report.

3.0. Results and Discussion

3.1. Comparison of results with guidelines

To provide a general frame of reference as to the state of water quality in the Bassendean Drainage Network, this report compares the results of sampling with trigger levels from the ANZECC guidelines that are most applicable to this water body. To select which set of guidelines to use, the environmental value (EV) and level of protection of a water resource (including its receiving environment) needs to be determined and agreed upon between all key stakeholders. The guidelines recognise three levels of protection for aquatic ecosystem; those with high conservation value, slightly to moderately disturbed ecosystems and highly disturbed ecosystems. To assess the level of toxicant contamination in aquatic ecosystems, trigger values were developed from data using toxicity testing on a range of test species. The trigger values (99%, 95%, 90% and 80%) approximately correspond to the levels of protection described above. An exceedence of the referenced trigger level does not indicate that "standards" are not being met, but is an indication that further consideration should be given to the situation.

Nutrient concentrations and physical parameter results of the surface water of the Bassendean catchment were compared to the statistically derived trigger values for slightly disturbed ecosystems of southwest Australia (ANZECC & ARMCANZ 2000). The results were compared to the 'lowland rivers' ecosystem type, as this is considered to be the most applicable to the catchment and its receiving environment (Swan River). ANZECC trigger values and other guidelines used in this data analysis are displayed in Appendix C.

Urban and industrial catchments tend to be highly modified where the risk of toxicant contamination is high and current environmental value is low. On that basis many of the waterways in the Bassendean Drainage Network would be compared to the 80% level based on ANZECC guidance. However, the Bassendean Drainage Network flows directly into the Swan River where environmental values are high and for this reason, the toxicant results will be compared to the trigger values for 95% protection levels. Where no guidelines currently exist, results will be compared to interim or low-reliability guidelines provided by ANZECC (2000) or by other agencies e.g. the interim TSS guideline of 6 mg/L, WRC (2000).

From a human-use perspective, the Bassendean Drainage Network is not a source of drinking water but can be accessed by the public, despite signage that prohibits public access to the drain, and therefore it is reasonable to compare the toxicant results to recreational guidelines that take into account risks to public health. It is important to note that there has been a change in the recreational guidelines for water. The recreational guidelines in chapter 5 of the ANZECC & ARMCANZ (2000) have been superseded and replaced with the NHMRC guidelines (2008) for managing risks in recreational waters. These guidelines state that to get the recreational guideline, multiply the drinking water guideline by ten. These new trigger values have been included in Appendix C.

The guideline trigger values are the concentrations (or loads) of the key performance indicators, below which there is a low risk that adverse biological effects will occur. They are the values that trigger two possible responses. The first response, to continue monitoring, occurs if the test site value is less than the trigger value, showing that there is a 'low risk' that a problem exists. The alternative response, management/remedial action or further site-specific investigations, occurs if the trigger value is exceeded, exists a 'potential risk'. The aim with further site-specific investigations is to determine whether or not there is an actual problem (ANZECC 2000).

3.2. Temperature and rainfall data

The Bassendean Drainage Network receives stormwater from an industrial and residential catchment area. Samples were collected once a month on the 22nd of July, 18th of August and 15th of September 2016. Figure 2 highlights the sampling date and the daily rainfall received in the Perth metro area at this time. The following information was supplied on the Bureau of Meteorology website (BOM, 2016).

During July, a cold front moved across southwest WA on the 8th and most locations in the west of WA observed their coolest day of the month in the upcoming days. Rainfall was below average, and sampling was undertaken on the 22nd of July, 5 days after the highest rainfall recording (32.8 mm on the 17th of July).

It rained during the sampling event on the 18th of August, recording 17.4mm and days were mainly cool. The peak rainfall event was not until the 27th of August recording 31 mm.

During September, no rainfall was recorded on the sampling event on the 15th. The highest rainfall event was experienced on the 25th of September, recording 15.6mm.

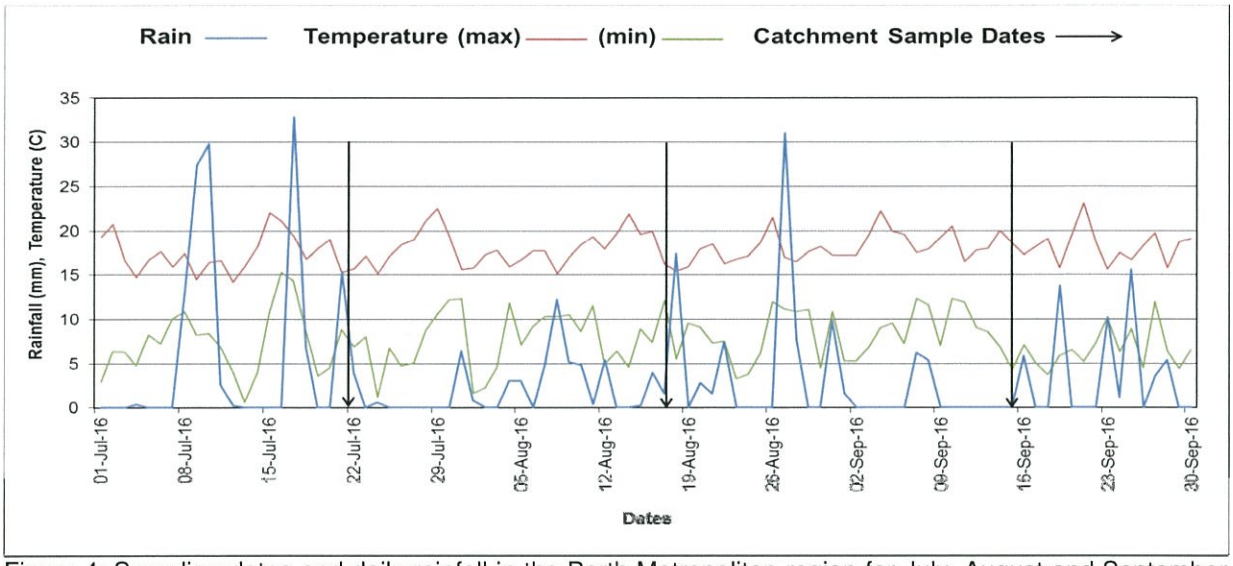


Figure 4: Sampling dates and daily rainfall in the Perth Metropolitan region for July, August and September 2016. (Source: Data from the Commonwealth of Australia – Bureau of Meteorology website 2017)

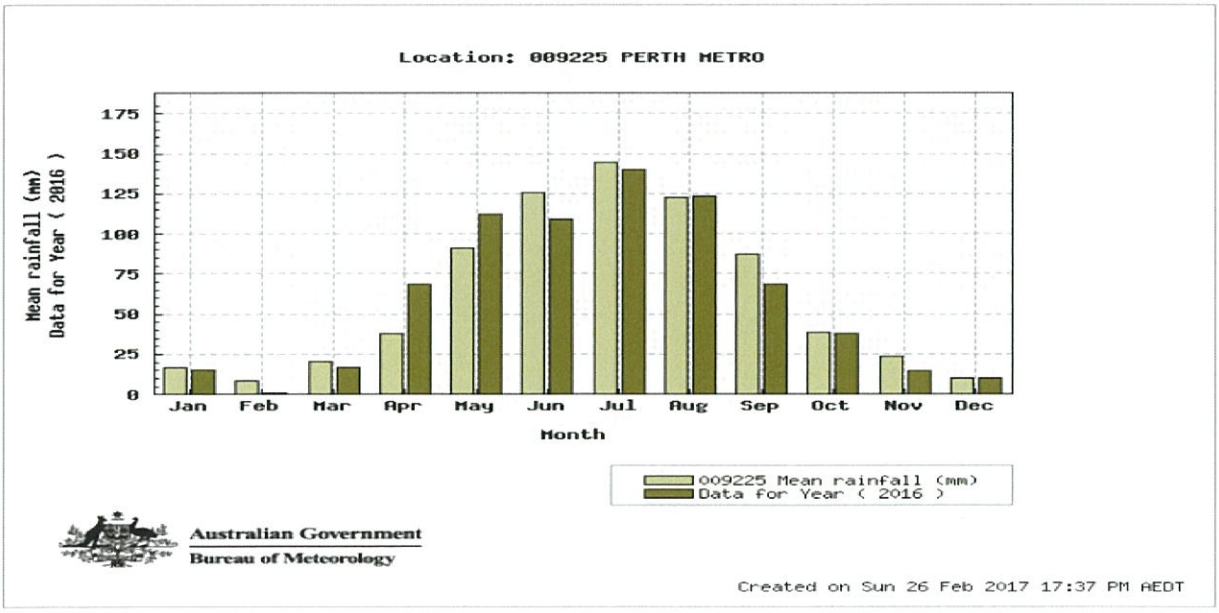


Figure 5: average monthly rainfall in the Perth Metropolitan region for 2016. (Source: Data from the Commonwealth of Australia – Bureau of Meteorology website 2017)

3.3. Physical parameters in water

Refer to tables in Appendix A for all physical parameter data (pH, dissolved oxygen, electrical conductivity, total suspended solids and temperature) for the Bassendean 2016 sampling events.

3.3.1. Temperature

The water temperature of a water body is an important physico-chemical parameter within a water body as it directly affects many physical, biological and chemical characteristics.

Water temperature is affected by the air temperature, the amount of exposure to sunlight, the turbidity of the water, depth and vegetation. Large rivers generally have fluctuations in temperature. Discharges can also affect temperature e.g. cooling water.

Since the solubility of oxygen (DO) decreases with increasing water temperature, high water temperatures limit the availability of DO for aquatic life. Therefore, the distribution and number of aquatic species also changes as temperature varies. As aquatic species have evolved to function efficiently at an optimum temperature, if the water becomes too cold the organisms become more vulnerable to toxic wastes, parasites and diseases. However if the water temperature rises, the organisms metabolic rate also increases, which increases their demand for oxygen.

The temperature variations within the Bassendean catchment ranged between 12°C and 19°C. There were no dramatic fluctuations in temperature at any sites. Generally the temperature fluctuated with the seasons in response to environmental factors.

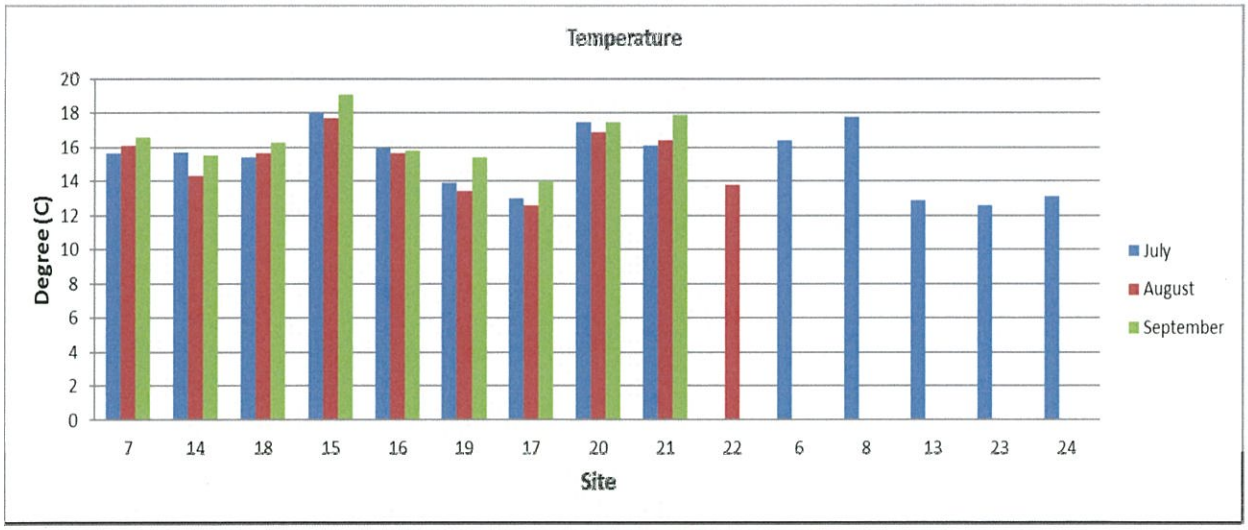


Figure 6: Temperature variations within the Bassendean catchment surface waters.

Table 3: Temperatures recorded in the Bassendean catchment from 2010 - 2016

	Min	Max																					
Temperature	2010					2011			2012			2013			2014			2015			2016		
Site Number	Jul	Aug	Sep	Oct	Nov	Jul	Aug	Sep	Jul	Aug	Sep	Jul	Aug	Sep	Aug	Sep	Oct	Jul	Aug	Sep	Jul	Aug	Sep
7	12.33	13.2	15.73	14.65	20.11	16.26	17.4	18.69	13.98	15.36	12.51	14.1	17	16.1	13.8	14.1	21.1	12.2	13.6	12.3	15.6	16.1	16.6
14												15.3	16.8	17.1	17.3	17.7	21.3	16.7	15.7	16.2	15.7	14.3	15.5
18																		16.3	16.3	16.6	15.4	15.6	16.3
15												16.6	19.7	19.4	19.3	20.2	22.9	16.7	18.2	19.2	18	17.7	19.1
16												15	16.9	17.4	16.7	17.8	21.9	14.5	15.5	15.6	16	15.6	15.8
19																		dry	dry	15.3	13.9	13.4	15.4
17												13.8	14.6	13.7	14.5	14.7	18.3	14	13.7	13.2	13	12.6	14
20																		14.7	16.5	17.1	17.5	16.9	17.5
21																		13.2	15.7	17.3	16.1	16.4	17.9
22																		dry	dry	dry	dry	13.8	dry
6	14.48	19.35	20.43	17.45	20.29	16.44	17.24	20.16	14.68	15.66	15.99	18			17.3			16			16.4		
8	17.74	17.95	18.29	19.79	21.37	18.83	18.65	19.11	18.38	18.21	18.22	18.5			18.5			18.7			17.8		
13	11.76	14.22	14.85			13.61	14.64	21.95	9.17	11.82	11.8	16.1			14.3			12.6			12.9		
23																		11.6			12.6		
24																		11.5			13.1		

3.3.2. Dissolved Oxygen

Dissolved oxygen (DO) is a measure of the quantity of oxygen present in water and is often used as an indication of the 'general health' of a water body. DO concentrations are affected by a number of different factors including; the temperature of the water, salinity, depth, photosynthesis, respiration, decomposition of organic matter and many other factors. Colder water can carry more DO than warmer water.

Low DO levels in water leads to several environmental problems including the stressing of the aquatic community and the facilitation of chemical reactions (IEA 2003); including the release of sediment-bound nutrients and toxicants back onto the water column. Low DO concentrations are normally a result of the decay of organic matter, but can also be caused by the oxidation of hydrocarbons, the reduction of metals, bacterial activity and through the process of nitrification. Plants photosynthesis during the day which increases DO concentrations. DO is used up in the water by bacteria, animals and by plants/algae at night.

As DO can fluctuate greatly over a diurnal cycle, it is preferable to measure DO over a full diurnal cycle for a few days (ANZECC & ARMCANZ, 2000). Differences can be noted between morning concentrations where only aeration has introduced oxygen to the ecosystem and late afternoon where the process of photosynthesis has also introduced oxygen to the system during the day.

DO can be expressed either as a concentration (in mg/L), which is an absolute value, or as percentage saturation, which is an expression of the proportion of DO in the water relative to the maximum concentration of oxygen that water at a particular temperature, pressure, and salinity can dissolve (Department of Water, 2009).

A DO concentration of between 80 – 120% saturation is required to sustain aquatic life in lowland rivers (ANZECC & ARMCANZ 2000). The DO saturations in the surface waters of the Bassendean catchment were within the guidelines acceptable range site 19 during July and August, site 22 during August and sites 6 and 8 during July.

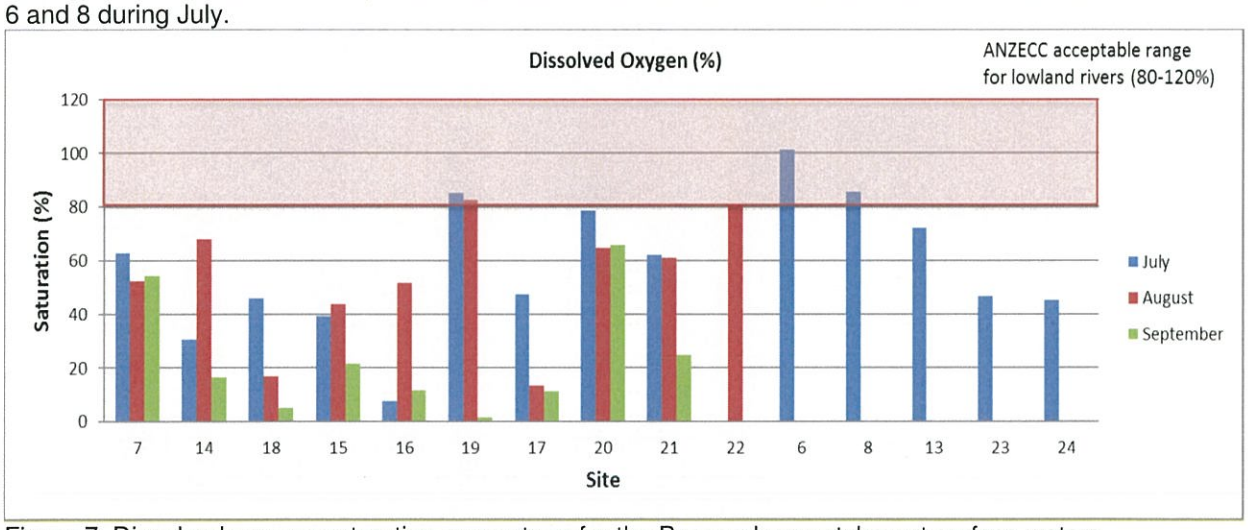


Figure 7: Dissolved oxygen saturation percentage for the Bassendean catchment surface waters.

Table 4: DO saturation percentages recorded in the Bassendean catchment from 2010 - 2016

	< 80	ANZECC Lowland Rivers (2000) 80-120																					
DO %	2010						2011			2012			2013			2014			2015			2016		
Site Number	Jul	Aug	Sep	Oct	Nov		Jul	Aug	Sep	Jul	Aug	Sep	Jul	Aug	Sep	Aug	Sep	Oct	Jul	Aug	Sep	Jul	Aug	Sep
7	42.7	9.1	24.1	50.4	11.2		65.6	64.1		57.4	45.9	2.2	7.8	52.7	49.8	1.3	41.4	44.1	6.1	37.3	15.9	62.8	52.4	54.4
14													31.8	31.6	20.4	16.7	24.6	0.7	48.9	29.4	28.1	30.5	67.9	16.5
18																			1.7	1.9	3.2	45.9	16.8	5
15													51	34.3	29.6	32.2	28.3	23.6	29.9	16.3	21.5	39.1	44	21.5
16													48.5	31.1	48.6	20.5	28.1	8.4	9.7	42.5	28.4	7.6	51.8	11.7
19																			dry	dry	53.2	85.2	82.7	1.5
17													25.3	13.3	26.5	31.4	34.8	14.4	40.2	46.1	38.9	47.4	13.4	11.2
20																			77.5	71.9	74.1	78.7	64.5	65.8
21																			67.3	72.1	86.2	62.3	61.1	25
22																			dry	dry	dry	dry	80.6	dry
6	86.3	113.3	112.3	92.5	83		86.3	87.7		80.8	84	88.4	66.6			88.1			70.3			101.1		
8	82.8	87.2	88	82.6	81.2		84.4	84.2		82.5	85	85.9	79.7			79.3			73.3			85.5		
13	40.2	45.7	26.2				60.6	34.2		56.8	60.1	46.1	61.9			73.2			14.5			72		
23																			37.1			46.8		
24																			21.2			45.2		

If DO levels in the water drop below 4.0 mg/L, it cause stress, disease, slow growth rates, and in severe cases, death of aquatic organisms. When oxygen levels reach around 1-2 mg/L and are sustained for a few hours, large fish kills can result.

Sites 20, 22, 6, 8 and 13 were all healthy recording concentrations in the moderate to good range during all sampling events. Sites 19 and 21 were generally healthy, recording good and moderate concentrations during the July and August sampling events, however both sites recorded very low DO concentrations during September. Sites 7, 14, 18, 15, 16, 17, 13, 23 and 24 generally recorded low or very low concentrations. It should be noted that sites 14, 18, 15 and 16 are closed drains and these low levels are to be expected as they are not natural systems and have little scope for water oxygenation by natural means such as plants, mixing, organisms etc.

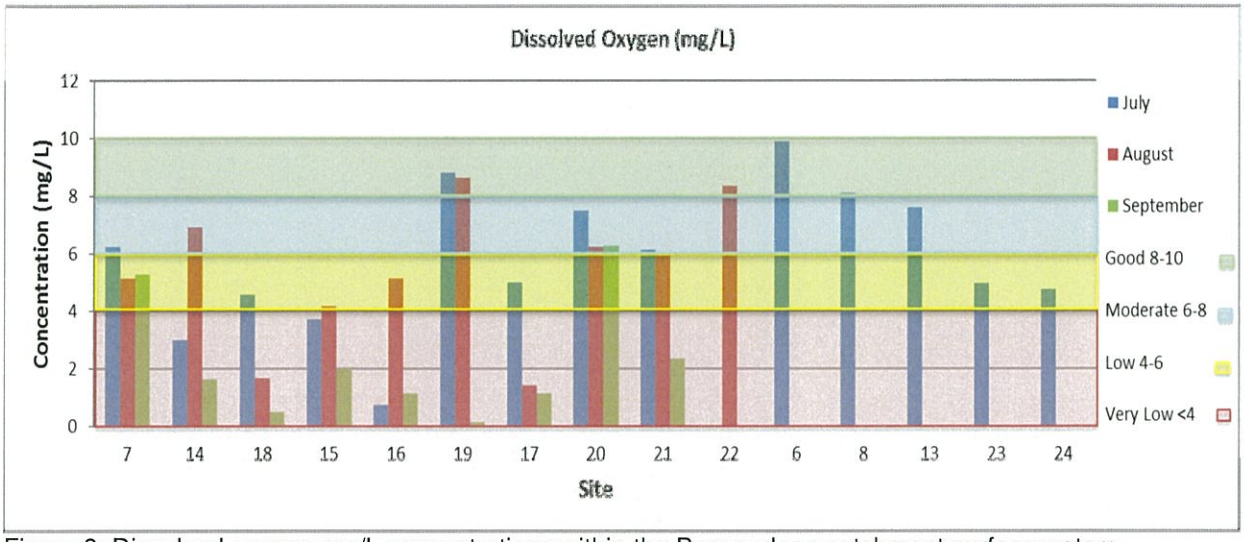


Figure 8: Dissolved oxygen mg/L concentrations within the Bassendean catchment surface waters.

Table 5: DO mg/L concentrations recorded in the Bassendean catchment from 2010 - 2016

	very low: <4.0			low: 4.0-6.0			moderate: 6.0-8.0			good: 8.0-10.0			hyperoxic: >10											
DO mg/L	2010					2011			2012			2013			2014			2015			2016			
Site Number	Jul	Aug	Sep	Oct	Nov	Jul	Aug	Sep	Jul	Aug	Sep	Jul	Aug	Sep	Aug	Sep	Oct	Jul	Aug	Sep	Jul	Aug	Sep	
7	4.56	0.95	2.39	5.11	1.03	6.43	6.13		5.9	4.59	0.23	0.8	5.08	4.89	0.14	4.25	3.92	0.65	3.88	1.69	6.24	5.15	5.29	
14												3.17	3.06	1.97	1.6	2.34	0.06	4.74	2.92	2.76	3.01	6.94	1.64	
18																		0.17	0.19	0.32	4.58	1.67	0.49	
15												4.97	3.13	2.72	2.96	2.56	2.03	2.9	1.53	1.98	3.7	4.19	1.99	
16												4.88	3	4.65	1.99	2.67	0.73	0.98	4.22	2.82	0.75	5.15	1.16	
19																		dry	dry	5.33	8.8	8.63	0.15	
17												2.62	1.35	2.75	3.19	3.53	1.35	4.13	4.78	4.07	4.99	1.42	1.15	
20																		7.84	7	7.12	7.51	6.24	6.28	
21																		7.05	7.16	8.27	6.13	5.97	2.37	
22																		dry	dry	dry	dry	8.34	dry	
6	8.78	10.41	10.1	8.83	7.49	8.42	8.41		8.2	8.32	8.7	6.3			8.45			6.93			9.88			
8	7.85	8.24	8.26	7.52	7.17	7.83	7.84		7.73	7.99	8.08	7.45			7.41			6.83			8.1			
13	4.34	4.67	2.64			6.18	3.43		6.4	6.46	4.96	6.02			7.44			1.52			7.59			
23																		4			4.97			
24																		2.3			4.75			

3.3.3. pH

pH is a measure of the acidity (or alkalinity) of a water body. pH is measured on a logarithmic scale, with a pH of 7.0 being neutral, a pH of less than 7 being acidic, and a pH of greater than 7 being alkaline or basic.

The pH of a water body can be affected by many factors including; rainfall, time of day, water temperature, amount of algal or plant growth, salinity, photosynthesis and respiration and many other external factors.

The importance of pH on water quality lies mainly in its effect on other water quality parameters and on chemical reactions. pH can also affect the solubility of a wide range of metallic contaminants (IEA 2003). Alkaline conditions can also increase the toxicity of other pollutants such as ammonia.

A pH between 6.5 and 8.0 is required to sustain aquatic life in lowland rivers (ANZECC & ARMCANZ 2000).

The pH of the surface waters of the Bassendean catchment did not meet the acceptable range at site 18 during August and September, sites 15 and 17 during July and August, site 16 during July and site 19 during August. Acceptable pH values were within the ANZECC guidelines at sites 7,14, 20, 21, 22, 6, 8, 13, 23 and 24 on all sampling occasions.

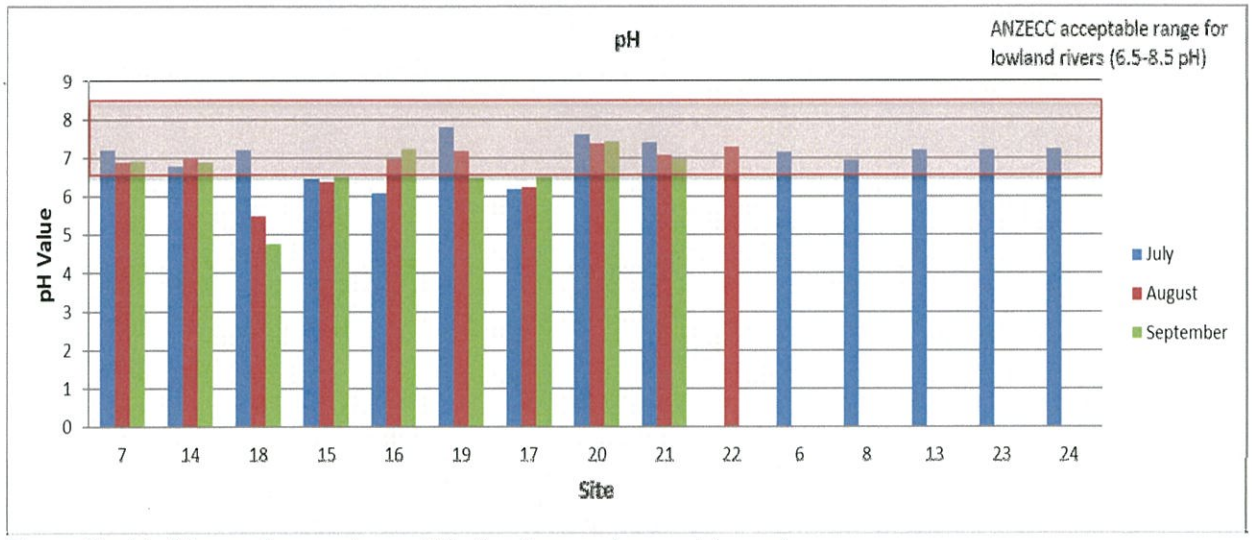


Figure 9: pH of the surface waters within the Bassendean catchment.

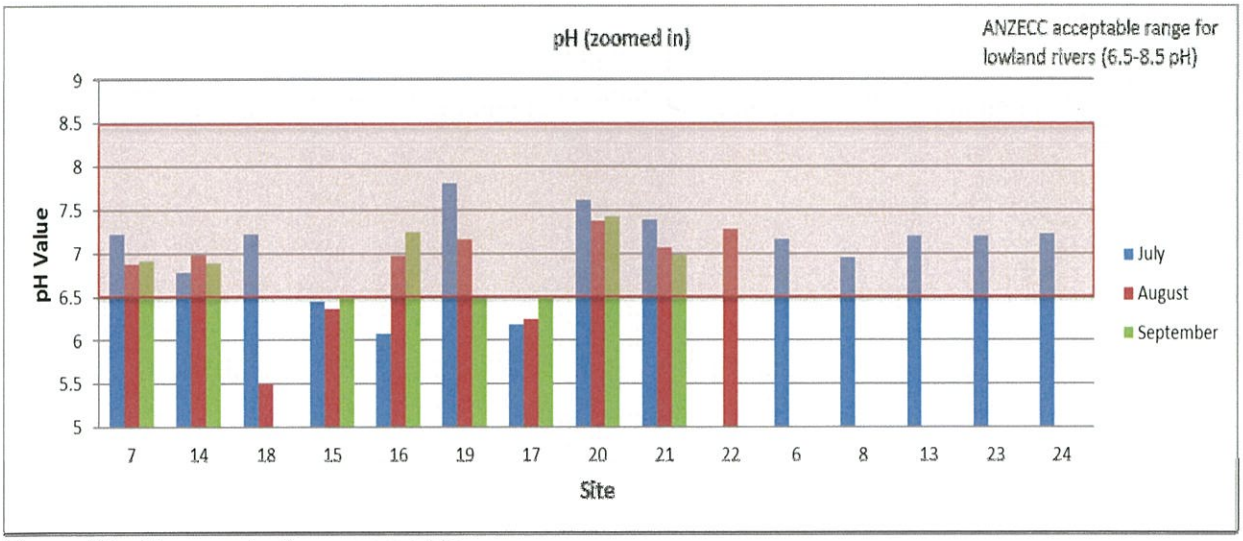


Figure 10: pH concentrations zoomed in.

Table 6: pH concentrations recorded in the Bassendean catchment from 2010 - 2016

	< 6.5	ANZECC Lowland Rivers (2000) 6.5-8.0				ANZECC Recreational (2000) 6.5-8.5																
pH	2010					2011			2012			2013			2014			2015			2016		
Site Number	Jul	Aug	Sep	Oct	Nov	Jul	Aug	Sep	Jul	Aug	Sep	Jul	Aug	Sep	Aug	Sep	Oct	Jul	Aug	Sep	Jul	Aug	Sep
7	7.73	7.03	6.64	7.56	6.53	8.04	7.33	6.78	7	6.88	6.6	6.25	7	6.42	6.35	NA	6.87	6.34	6.48	6.09	7.22	6.88	6.91
14												6.76	6.53	6.47	6.08	NA	6.23	5.57	6.59	6.52	6.78	6.99	6.89
18																		6.11	6.05	5.6	7.22	5.5	4.75
15												6.83	6.46	6.42	6.49	NA	6.54	6.45	6.69	6.25	6.45	6.37	6.52
16												7.48	7.28	7.12	7.33	NA	7.46	7.45	7.45	7.26	6.08	6.97	7.25
19																		dry	dry	7.36	7.81	7.17	6.48
17												5.94	5.76	5.88	5.42	NA	5.95	6.01	5.96	5.91	6.18	6.24	6.5
20																		8.33	8.18	7.72	7.62	7.38	7.43
21																		7.56	7.77	6.98	7.39	7.07	6.98
22																		dry	dry	dry	dry	7.29	dry
6	7.92	7.83	7.71	7.69	7.63	7.61	7.4	7.34	7.42	7.38	7.44	7.32			7.35			7.32			7.16		
8	7.58	7.63	7.39	7.45	7.53	7.41	7.31	6.65	7.23	7.3	7.35	7.26			7.08			7.2			6.95		
13	7.9	7.68	7.31			7.53	7.5	6.78	7.2	7.32	7.35	6.96			7.16			6.62			7.2		
23																		6.87			7.2		
24																		6.85			7.23		

3.3.4. Electrical Conductivity

Electrical conductivity is the ability of water or soil to conduct an electric current. It is commonly used as a measure of salinity or total dissolved salts. As salt water conducts electricity better than pure water, electrical conductivity is used to measure salinity. Electrical conductivity (EC) is the total concentration of inorganic ions (particularly sodium, chlorides, carbonates, magnesium, calcium, potassium and sulphates).

Conductivity is affected by temperature, land use, run-off, geology, soils and many other factors. It is also affected differently by different discharges that enter the waterway as sewage contamination increases the conductivity, whilst oil spills would lower it. Many species can only survive in a certain conductivity range so slight changes can affect the species present.

Low values are characteristic of high-quality, low-nutrient waters. High values of conductance can be indicative of salinity problems but also are observed in eutrophic waterways where plant nutrients (fertiliser) are in greater abundance. Very high values are good indicators of possible polluted sites. A sudden change in electrical conductivity can indicate a direct discharge or other source of pollution into the water. However, electrical conductivity readings do not provide information on the specific ionic composition and concentrations in the water (Department of Water, 2009).

According to the ANZECC guidelines the lower limit of 0.12 ms/cm and upper limit of 0.3 ms/cm for freshwater lowland rivers should not be exceeded. Electrical conductivity in the surface waters of the Bassendean catchment exceeded the ANZECC guidelines upper limit (0.3 ms/cm) for freshwater lowland rivers at sites 7, 18, 15, 16, 17, 20, 21, 6, 8, 13, 23 and 24 on all sampling occasions. Site 14 and 22 were within the acceptable range during August, and site 19 was also within the acceptable range during August and September. Whilst the majority of sites exceeded the guideline, they do not pose a concern at this point.

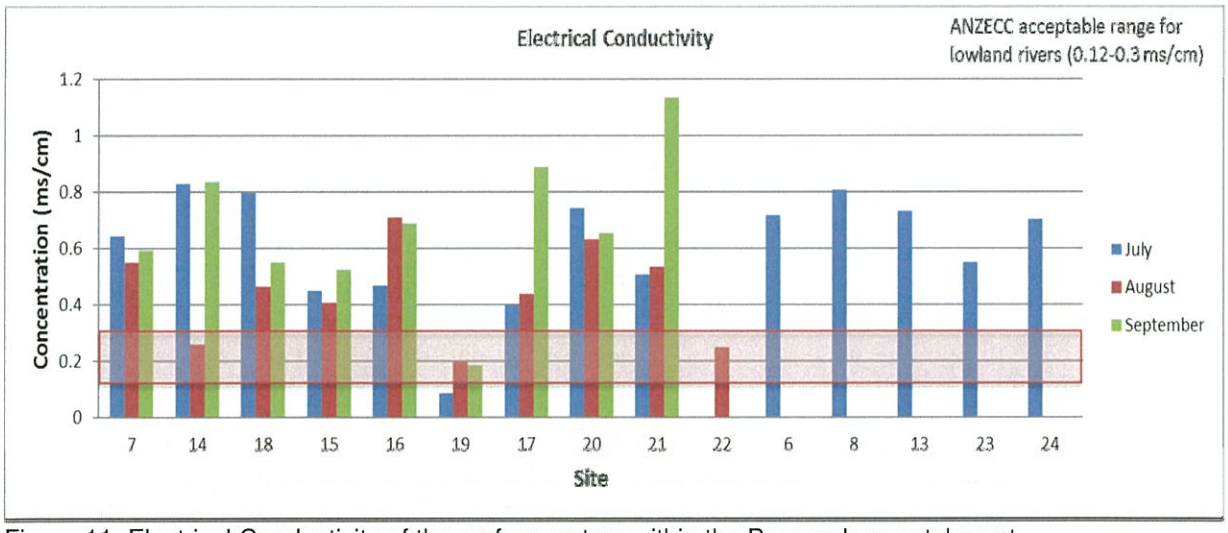


Figure 11: Electrical Conductivity of the surface waters within the Bassendean catchment.

Table 7: Electrical conductivity concentrations recorded in the Bassendean catchment from 2010 - 2016

	Fresh: <0.965			Marginal: 0.965 - 1.952			Brackish: 1.953 - 8.835			Saline: >8.835											
SpC (ms/cm)	2010					2011			2012			2013			2014			2015			2016		
Site Number	Jul	Aug	Sep	Oct	Nov	Jul	Aug	Sep	Jul	Aug	Sep	Jul	Aug	Sep	Aug	Sep	Oct	Jul	Aug	Sep	Jul	Aug	Sep
7	0.255	0.71	0.588	0.7	0.539	0.362	0.623	0.523	0.698	0.593	0.486	0.277	0.61	0.396	0.785	0.696	0.603	0.637	0.654	0.712	0.643	0.55	0.593
14												0.957	0.725	0.672	0.593	0.682	0.62	0.808	0.814	0.779	0.827	0.262	0.836
18																		0.635	0.603	0.496	0.796	0.463	0.55
15												0.407	0.467	0.451	0.573	0.534	0.573	0.493	0.569	0.478	0.45	0.407	0.525
16												0.611	0.762	0.578	0.774	0.756	0.688	0.86	0.854	0.802	0.467	0.712	0.689
19																		dry	dry	0.191	0.086	0.2	0.186
17												0.297	0.828	0.588	1.027	0.85	0.729	0.744	0.613	0.775	0.399	0.441	0.89
20																		1.016	0.968	0.935	0.743	0.632	0.652
21																		0.49	0.468	0.483	0.506	0.535	1.134
22																		dry	dry	dry	dry	0.25	dry
6	0.59	0.828	0.793	0.832	0.638	0.741	0.799	0.719	0.836	0.795	0.745	0.627			0.854			0.89			0.717		
8	0.857	0.789	0.775	0.79	0.784	0.878	0.776	0.686	0.809	0.771	0.744	0.882			0.818			0.838			0.806		
13	0.589	0.807	0.878			5.11	3.54	6.48	5.61	2.21	1.55	3.939			2.15			4.668			0.731		
23																		2.153			0.551		
24																		1.013			0.703		

3.3.5. Total Suspended Solids

Total Suspended Solids (TSS) is the total amount of material suspended in the water that can be removed from a water sample by filtration. TSS can include a wide variety of material (such as silt, sand, algae, micro-organisms, decaying plant and animal matter, industrial wastes and sewage) from a variety of sources including erosion by wind and water, construction and demolition operations and the wear of roads and vehicles. Nutrients and other contaminants are often adsorbed to the surface of the particles of suspended solids, and therefore high suspended solid concentrations often coincide with high nutrient or contaminant concentrations.

High concentrations of particulate matter can cause increased sedimentation and turbidity in a waterbody, limiting light penetration and can have an adverse effect on fish and other aquatic life. There is also an association between suspended solids and many other pollutants including hydrocarbons, heavy metals and phosphorus (Recycled Organics Unit, 2007).

The WRC interim guideline of 6 mg/L should not be exceeded. The concentrations of TSS in the surface waters of the Bassendean catchment were high within the industrial area and exceeded the WRC interim guideline at sites 7, 14, 18, 15, 16, 19, 17, 20 and 21 on one or more sampling occasions. All other sites (6, 8, 13, 23 and 24) were acceptable.

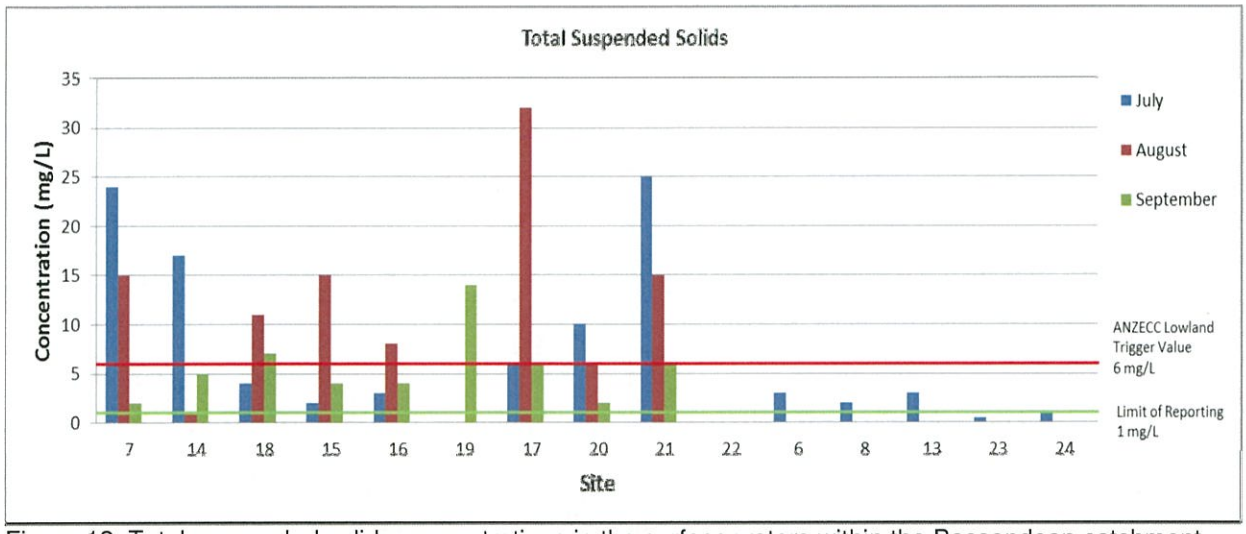


Figure 12: Total suspended solids concentrations in the surface waters within the Bassendean catchment.

Table 8: TSS concentrations recorded in the Bassendean catchment from 2010 - 2016

	LOR: 1 mg/L		WRC Interim: 6 mg/L																					
Total Suspended Solids	2010					2011			2012			2013			2014			2015			2016		
Site Number	Jul	Aug	Sep	Oct	Nov	Jul	Aug	Sep	Jul	Aug	Sep	Jul	Aug	Sep	Aug	Sep	Oct	Jul	Aug	Sep	Jul	Aug	Sep
7	7	3	2	1	12	6	5	1	2	2	8	10	3	5	6	9	2	24	15	2	0.5	1	2
14												1	3	1	7	6	133	17	1	5	1	21	8
18																		4	11	7	2	10	8
15												5	5	2	5	3	2	2	15	4	0.5	0.5	3
16												3	4	4	4	5	4	3	8	4	4	5	5
19																		dry	dry	14	5	4	9
17												3	54	9	5	4	21	6	32	6	2	5	102
20																		10	6	2	1	3	1
21																		25	15	6	0.5	4	2
22																		dry	dry	dry	dry	3	dry
6	2	1	1	0.5	0.5	3	1	1	0.5	0.5	0.5	16			2			3					
8	0.5	1	0.5	3	0.5	2	1	2	0.5	1	0.5	0.5			1			2					
13	0.5	7	8			3	3	6	5	5	14	2			8			3					
23																		0.5					
24																		1					

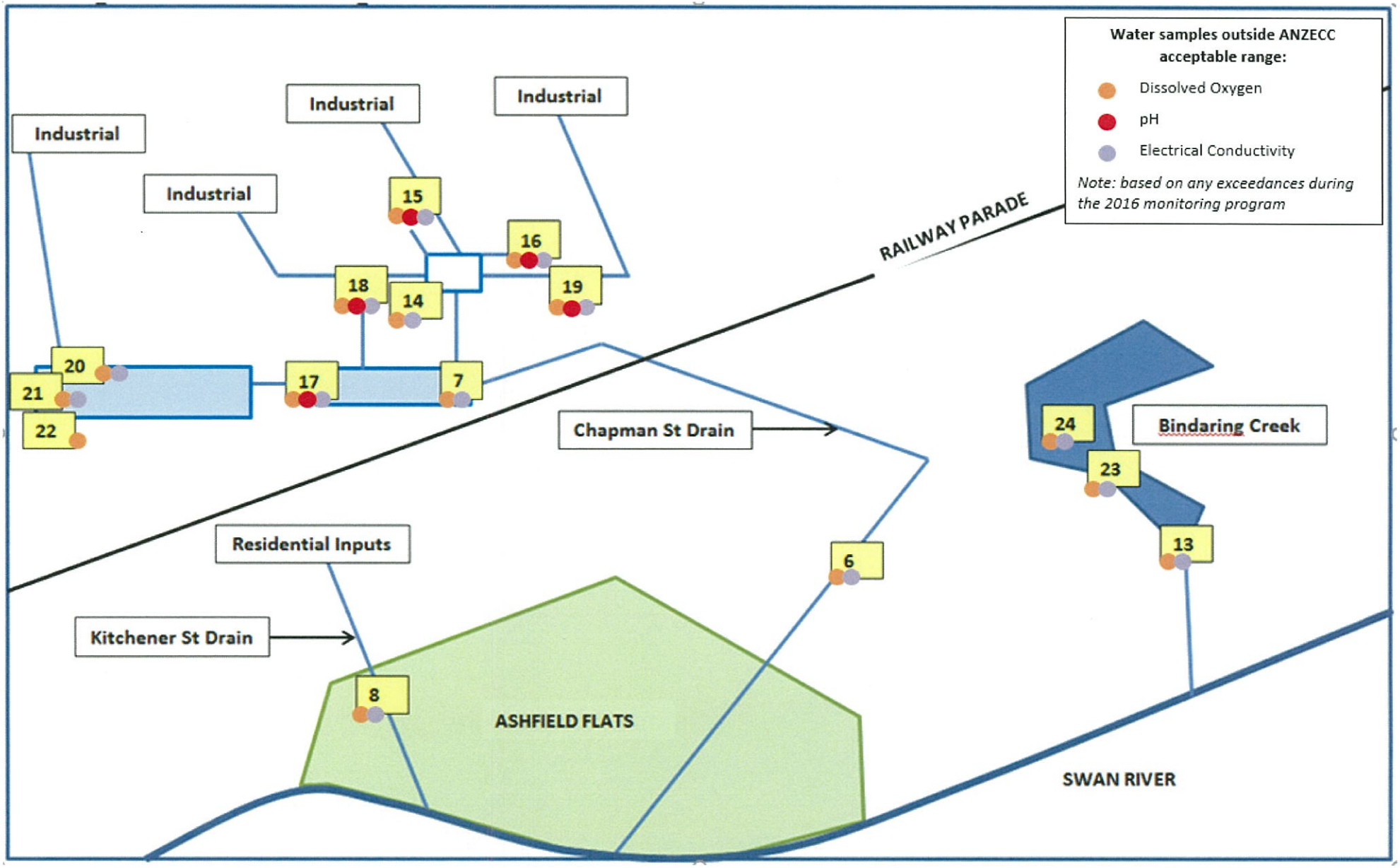


Figure 13: Water samples where physical parameters were outside the appropriate ANZECC guidelines in 2016

3.3.6. Summary of Results

Monitoring of the physical parameters within the Bassendean catchment occurred during July, August, and September at sites 7, 14, 15, 16 17, 18, 19, 20, 21 and 22, during July only at sites 6, 8, 13, 23 and 24. The results from the additional analyses completed at Bindaring wetland will be sent separately to the Town of Bassendean as this is outside the scope of this report. Site 22 was dry during July and September.

The pH values did not meet the acceptable range at site 18 during August and September, sites 15 and 17 during July and August, site 16 during July and site 19 during August.

The dissolved oxygen saturations in the surface waters of the Bassendean catchment recorded low or very low concentrations at sites 7, 14, 18, 15, 16, 17, 13, 23 and 24. It should be noted that sites 14, 18, 15 and 16 are closed drains and these low levels are to be expected.

Electrical conductivity exceeded the ANZECC guidelines upper limit (0.3 ms/cm) for freshwater lowland rivers at sites 7, 18, 15, 16, 17, 20, 21, 6, 8, 13, 23 and 24 on all sampling occasions.

Total suspended solids were high within the industrial area and exceeded the interim guideline at sites 7, 14, 18, 15, 16, 19, 17, 20 and 21 on one or more sampling occasions.

3.3.7. Discussion

Maintaining dissolved oxygen concentrations helps to stabilise aquatic chemistry, as many chemical reactions involve the presence of oxygen. Low DO levels in water leads to several environmental problems including the stressing of the aquatic community and the facilitation of chemical reactions, including the release of sediment-bound nutrients and toxicants back into the water column. This relationship is reflected at the industrial sites in particular, which recorded low dissolved oxygen concentrations and elevated concentrations of nutrients and numerous metals within the water column.

Sites 14, 15, 16, 18 and 19 are street drains located in the Bassendean industrial area, therefore low dissolved oxygen readings are to be expected. Whilst they all recorded low dissolved oxygen concentrations, the concern of releasing sediment bound nutrients back into the water column fortunately isn't applicable here due to the base of the drain being concrete not sediment. However, the concern remains if these low concentrations continue further downstream. Whilst sites 6 and 8 appear relatively healthy, site 17 recorded low dissolved oxygen levels, low pH and high TSS. This is concerning as site 17 is the inlet to an open compensating basin.

The importance of pH on water quality lies mainly in its effect on other water quality parameters and on chemical reactions. It also has a direct effect on invertebrate and fish/crayfish communities which only have certain pH tolerances. pH can affect the solubility and toxicity of a wide range of metallic contaminants. Alkaline conditions can increase the toxicity of pollutants such as ammonia, whilst acidic waters can mobilise metals. Shenyu (2006) found that changes in sediment oxidation/reduction status and pH influenced solubility of both metals and nutrients. When redox potential decreases, pH increases. Shenyu found that the increase in sediment acidity upon oxidation resulted in the release of the Pb, Ca, Mg, Al, and Zn into solution. Unfortunately redox was not a component of this study therefore this relationship can't be explored.

Generally the physical parameter readings at site 17 (the inlet to site 7) indicate very poor water quality, including low dissolved oxygen, low pH and high total suspended solids, the same as what was recorded in previous years. Whilst all the industrial sites generally showed results of poor water quality, sites 14, 15, 16, 18 and 19 are closed drains. Site 7 is the outlet to the compensation basin and site 17 is the inlet, therefore both have more of an environmental impact on wildlife than the closed drains and are of most concern. However, this compensation basin is influenced by these other sites (14, 15, 16, 18 and 19) as they flow into the basin.

3.3.8. Recommendations

Further Monitoring as recommended in previous reports (2010 - 2015), however this is dependent on the type of monitoring program to be implemented:

- Dissolved Oxygen: Temperature changes can influence dissolved oxygen concentrations. Oxygen is more soluble as temperature decreases, whilst higher temperatures increase the metabolic rate of organisms, resulting in an increased consumption of oxygen (EPA 2010). Therefore, water temperature can have a significant influence on dissolved oxygen levels, causing it to fluctuate greatly over a 24 hour period. It is preferable to measure dissolved oxygen over a full diurnal cycle for a few days (ANZECC & ARMCANZ 2000). This type of monitoring was not conducted as part of this program. If more intense sampling is to occur, this should be taken into account. In addition, if any runoff events occur during the sampling program, more intensive sampling is advisable.
- pH: pH is variable throughout the day, thus if any extremes are observed this should be investigated over a 24 hour period. At this stage the pH levels are not of a major concern, therefore no additional monitoring is required.

3.4. Nutrient concentrations in water

Refer to tables in Appendix A for all nutrients concentration data (total nitrogen, nitrogen as ammonia/ammonium, total oxidised nitrogen, total organic nitrogen, dissolved organic nitrogen, total phosphorous and soluble reactive phosphorous) for water samples of the Bassendean catchment.

3.4.1. Total Nitrogen

Total nitrogen (TN) is a measure of all forms of nitrogen in the water, such as (in order of decreasing oxidation state) nitrate, nitrite, ammonia and organic nitrogen (Department of Water, 2009). The concentration of nitrogen can be used to assess nutrient status in waterways.

Sources of nitrogen include fertilisers, animal droppings, combustion of fossil fuels, plant debris, industrial cleaning operations, feed lots, windblown pollen, spores, bacteria, and dust (IEA 2003; Recycled Organics Unit 2007). Nitrates in excess can cause water problems such as eutrophication. During wet weather nitrate concentrations can increase due to increased runoff.

The ANZECC trigger value for total nitrogen is 1.2 mg/L. Concentrations of total nitrogen were relatively high within the catchment, and of most concern was site 21, which exceeded the ANZECC trigger value on all sampling occasions (over 8 times the trigger value during August and September). Sites 7 and 20 also exceeded the trigger value on all sampling occasions, whilst sites 18, 16 and 17 exceeded the ANZECC trigger value on at least one sampling occasion. Site 14 equaled the trigger value during August and September, and site 19 equaled the trigger value during September. Sites 6, 8, 23 and 24 exceeded the trigger value during the snapshot monitoring in July, whilst site 13 equaled the trigger value. Sites 15 and 22 were the only sites that were below the trigger value on all sampling occasions.

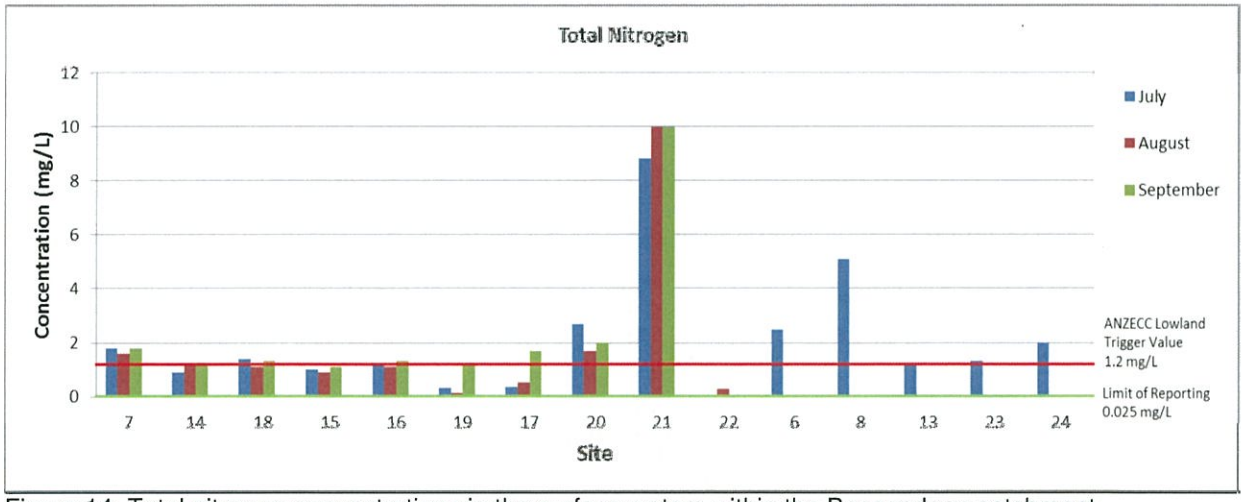


Figure 14: Total nitrogen concentrations in the surface waters within the Bassendean catchment.

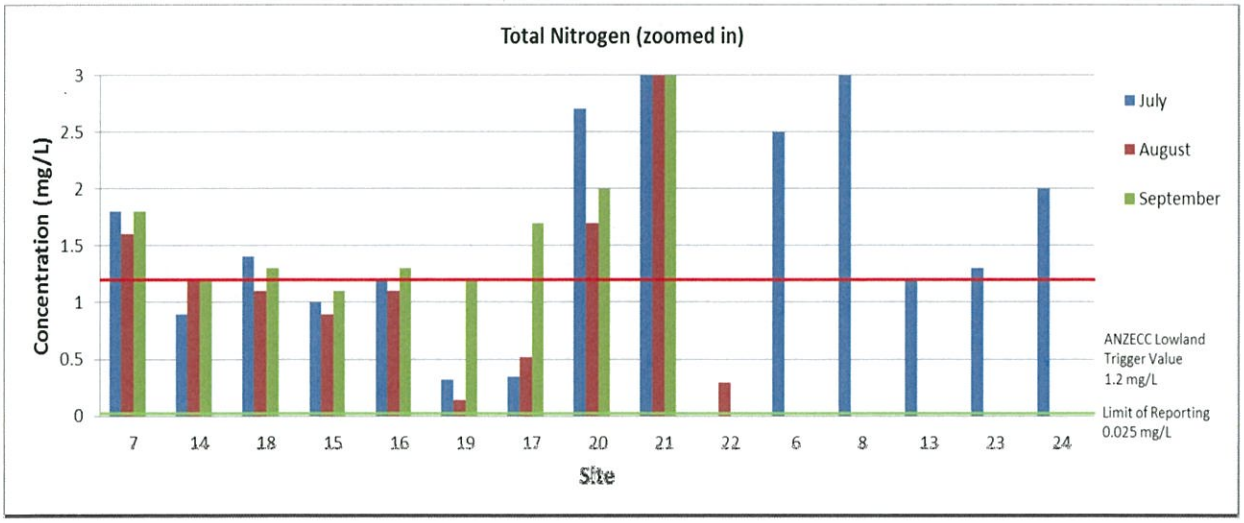


Figure 15: Total nitrogen concentrations zoomed in.

Table 9: Total nitrogen concentrations recorded in the Bassendean catchment from 2010 – 2016

	LOR: 0.025 mg/L			ANZECC Lowland Rivers: 1.2 mg/L					Max													
Total Nitrogen	2010					2011			2012			2013			2014			2015			2016		
Site Number	Jul	Aug	Sep	Oct	Nov	Jul	Aug	Sep	Jul	Aug	Sep	Jul	Aug	Sep	Aug	Sep	Oct	Jul	Aug	Sep	Jul	Aug	Sep
7	0.51	0.93	0.82	1.2	1.1	0.67	1.4	1.2	0.99	1.3	1.1	0.6	1.1	0.73	1.3	0.86	1.4	0.94	1.1	1.1	1.8	1.6	1.8
14												1.1	1.2	1.2	1.6	1.3	2.2	2	1.2	1.2	0.9	1.2	1.2
18																		2.1	1.5	1.1	1.4	1.1	1.3
15												0.79	1	1.2	1	0.91	1.1	1	1.2	1.1	1	0.9	1.1
16												0.64	1.1	1.1	1.3	1	1.6	1.4	1.1	1.2	1.2	1.1	1.3
19																		dry	dry	0.25	0.32	0.14	1.2
17												0.28	1.2	0.81	0.78	0.68	1.3	0.66	0.72	0.81	0.35	0.52	1.7
20																		1.9	2.8	2.9	2.7	1.7	2
21																		1.1	0.82	0.93	8.8	10	10
22																		dry	dry	dry	dry	0.29	dry
6	1.8	2	1.7	1.7	1.1	1.9	2.7	2.1	1.4	1.9	1.6	1.3			1.9			1.7			2.5		
8	4.8	1.7	1.4	1.3	1.1	3.3	3.8	2.3	2	3.2	2.4	2.4			2.6			2.2			5.1		
13	0.99	1.3	1.4			1.2	1.1	1.4	1.1	1.1	1	0.8			1.4			2.2			1.2		
23																		1.4			1.3		
24																		0.87			2		

3.4.2. Nitrogen as Ammonia/Ammonium

This measures the portion of nitrogen present as ammonia (NH3) or ammonium ($NH4^+$). Ammonium ($NH4^+$) is a non-toxic nutrient, whilst Ammonia (NH3) is a potentially hazardous and toxic substance. Ammonium and ammonia species are determined using the same analytical method. In alkaline solutions the predominant species is ammonia (NH3), while ammonium ($NH4^+$) dominates at lower pH. During the analysis the pH is adjusted to alkaline, thereby converting almost all the ammonia to ammonium (Department of Water, 2009).

Ammonia is readily available to plants. Sources include household and industrial cleaners, bleaching agents and disinfectants, the preparation of synthetic fibres, plastics and explosives, resins, medicines, fertilisers, chemical compounds, fuel cells, rocket fuel, dyes, metal treating operations, refrigeration, and in the petroleum industry (Australian Government 2010). The decomposition of organic waste produces ammonia, which is useful as an indicator of the amount of organic matter present (IEA 2003).

Concentrations in the Bassendean catchment were above the ANZECC guideline for lowland rivers (0.08 mg/L) at sites 7, 18 and 15 on all sampling occasions. However, the highest concentration (1.5 mg/L) was recorded at site 21 during August, which was more than 18 times the trigger value. Sites 14, 17 and 13 exceeded the trigger value on at least one sampling occasion. No site exceeded the recreational trigger value of 5 mg/L.

Nitrogen as ammonia/ammonium was not a dominant component of TN at any sites. In general, most sites were low, with the highest recordings at site 18; representing 37.14, 40.19 and 48.46 % and site 15; representing 44, 43.33 and 38.18 % during July, August and September respectively,

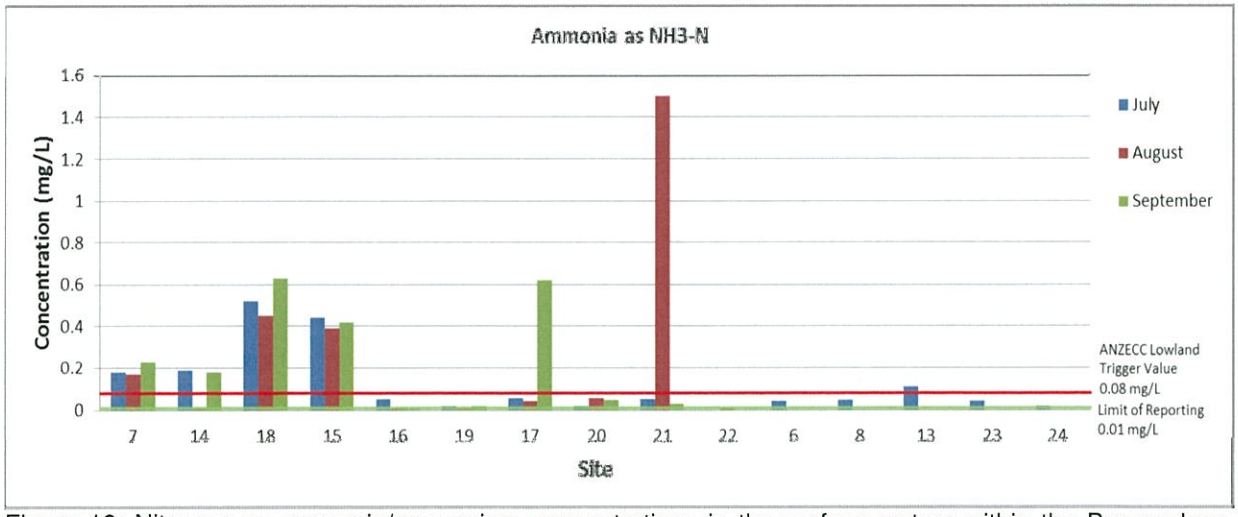


Figure 16: Nitrogen as ammonia/ammonium concentrations in the surface waters within the Bassendean catchment.

Table 10: Nitrogen as ammonia/ammonium concentrations recorded in the Bassendean catchment from 2010 – 2016

	LOR: 0.01 mg/L			ANZECC Lowland Rivers: 0.08 mg/L					Max															
Ammonia	2010					2011			2012			2013			2014			2015			2016		
Site Number	Jul	Aug	Sep	Oct	Nov	Jul	Aug	Sep	Jul	Aug	Sep	Jul	Aug	Sep	Aug	Sep	Oct	Jul	Aug	Sep	Jul	Aug	Sep
7	0.052	0.15	0.12	0.033	0.12	0.06	0.18	0.23	0.23	0.29	0.23	0.033	0.3	0.14	0.25	0.14	0.31	0.035	0.17	0.17	0.18	0.17	0.23
14												0.14	0.34	0.36	0.81	0.72	0.74	0.94	0.25	0.21	0.19	0.013	0.18
18																		1.4	0.97	0.47	0.52	0.45	0.63
15												0.16	0.45	0.4	0.46	0.52	0.4	0.4	0.29	0.49	0.44	0.39	0.42
16												0.005	0.046	0.029	0.037	0.034	0.27	0.26	0.087	0.017	0.052	0.013	0.005
19																		dry	dry	0.05	0.021	0.005	0.021
17												0.005	0.63	0.45	0.14	0.23	0.52	0.23	0.21	0.16	0.057	0.041	0.62
20																		0.013	0.022	0.035	0.019	0.055	0.046
21																		0.036	0.23	0.23	0.053	1.5	0.03
22																		dry	dry	dry	dry	0.005	dry
6	0.041	0.024	0.034	0.021	0.005	0.025	0.005	0.02	0.023	0.015	0.023	0.02			0.012			0.13			0.042		
8	0.098	0.06	0.067	0.049	0.01	0.046	0.043	0.069	0.035	0.039	0.036	0.03			0.028			0.037			0.045		
13	0.15	0.089	0.27			0.1	0.005	0.04	0.16	0.17	0.059	0.18			0.12			0.93			0.11		
23																		0.4			0.04		
24																		0.022			0.02		

3.4.3. Total Oxidised Nitrogen

Total oxidised nitrogen (NOx) is the sum of the oxidised forms of nitrogen and includes nitrite (NO_2) and nitrate (NO_3) (Evans 2009). NOx is a stimulant for algal growth and is a common ingredient in fertilisers.

Nitrite is an intermediate form of nitrogen and is generally short-lived as it is rapidly oxidised to nitrate (Department of Water, 2009). However, nitrite is toxic to humans and other animals.

Nitrate is an essential plant nutrient and its levels in natural waterways are typically low (less than 1 mg/L). Excessive amounts of nitrate can cause water quality problems and accelerate eutrophication, altering the densities and types of aquatic plants found in affected waterways. Some bacteria mediate the conversion of nitrate into gaseous nitrogen through a process known as denitrification, and this can be a useful process reducing levels of nitrate in waterways (Department of Water, 2009).

NOx concentrations exceeded the ANZECC guideline for lowland rivers (0.15 mg/L) at sites 7, 18, 20 and 21 on all sampling occasions, with site 21 being a clear standout. Sites 6, 8, 13, 23 and 24 exceeded the trigger value during the snapshot monitoring during July. Site 22 equalled the trigger value, whilst sites 14, 15, 16, 19 and 17 did not exceed the trigger value on any sampling occasion.

NOx was a significant component of the TN at; site 7 representing 51.67, 53.75 and 54.44 % of TN during July, August and September respectively; site 20 representing 81.48, 82.35 and 75 % of TN during July, August and September respectively; and site 21 representing 90.91, 75 and 91 % of TN during July, August and September respectively. Sites 22, 6, 8 and 24 also represented percentages above 50 %. All other sites (14, 18, 15, 16, 19, 17, 13 and 23) were low and generally did not reach 30 %.

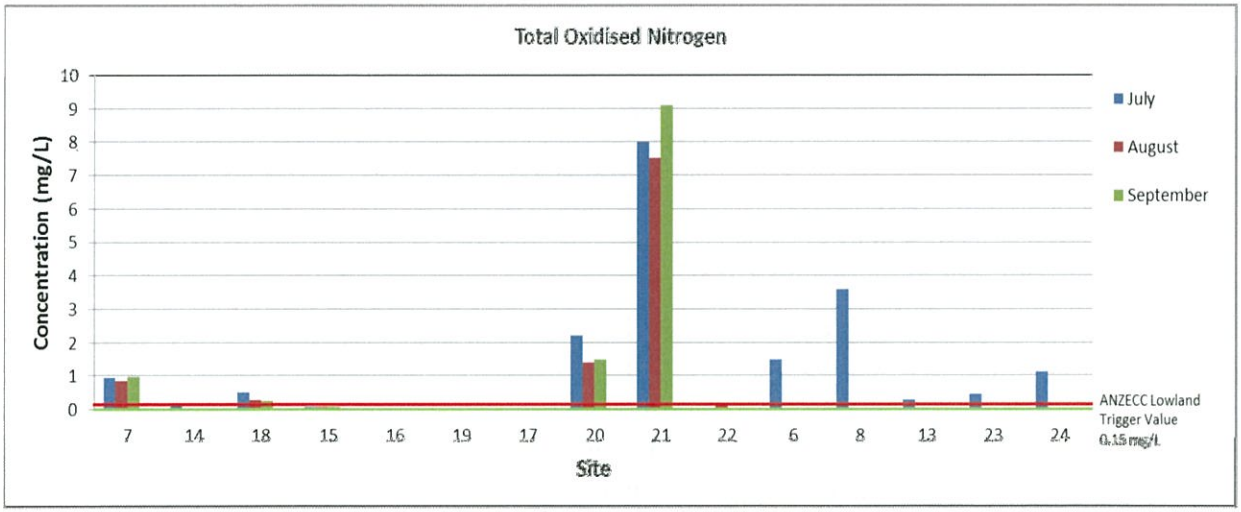


Figure 17: Total oxidised nitrogen concentrations in the surface waters within the Bassendean catchment.

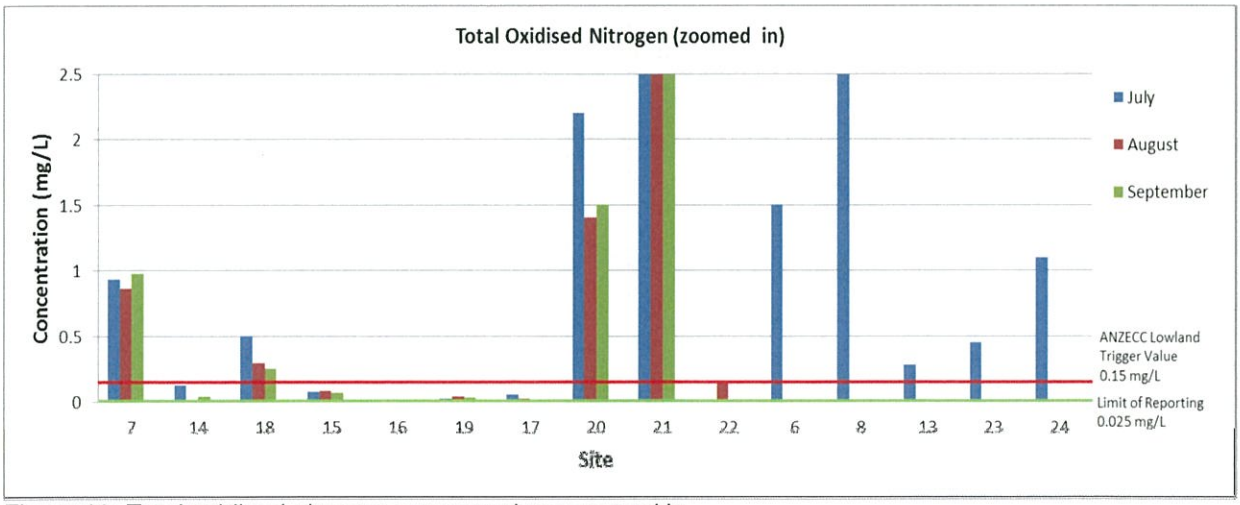


Figure 18: Total oxidised nitrogen concentrations zoomed in.

Table 11: Total oxidised nitrogen concentrations recorded in the Bassendean catchment from 2010 - 2016

	LOR: 0.01 mg/L			ANZECC Lowland Rivers: 0.15 mg/L					Max															
Total Oxidised Nitrogen	2010					2011			2012			2013			2014			2015			2016		
Site Number	Jul	Aug	Sep	Oct	Nov	Jul	Aug	Sep	Jul	Aug	Sep	Jul	Aug	Sep	Aug	Sep	Oct	Jul	Aug	Sep	Jul	Aug	Sep
7	0.058	0.13	0.075	0.3	0.1	0.14	0.35	0.28	0.26	0.31	0.25	0.089	0.41	0.25	0.36	0.1	0.3	0.094	0.3	0.31	0.93	0.86	0.98
14												0.1	0.11	0.12	0.026	0.094	0.034	0.3	0.59	0.29	0.13	0.005	0.037
18																		0.011	1.7	0.22	0.5	0.29	0.25
15												0.14	0.13	0.28	0.054	0.044	0.086	0.076	0.32	0.045	0.079	0.084	0.071
16												0.037	0.011	0.024	0.017	0.022	0.034	0.065	0.18	0.005	0.016	0.021	0.005
19																		dry	dry	0.059	0.028	0.044	0.032
17												0.023	0.005	0.043	0.25	0.2	0.013	0.053	1.2	0.27	0.054	0.023	0.005
20																		1.4	0.052	2.5	2.2	1.4	1.5
21																		0.32	0.04	0.29	8	7.5	9.1
22																		dry	dry	dry	dry	0.15	dry
6	1.1	1.1	1.1	1.2	0.57	1.3	1.6	1.3	0.92	1.2	0.89	0.65			1.1			1			1.5		
8	3.5	0.82	0.52	0.23	0.19	2.2	2.3	1.1	0.8	2	1.4	1.6			1.6			1.1			3.6		
13	0.11	0.023	0.005			0.022	0.019	0.005	0.07	0.074	0.019	0.067			0.14			0.018			0.28		
23																		0.043			0.45		
24																		0.074			1.1		

3.4.4. Dissolved Organic Nitrogen

Dissolved organic nitrogen (DON) includes all organically bound nitrogen e.g. urea and amino acids in the filtrate of a water sample through a 0.45 µm filter (Evans 2009). It can be utilised directly by algae.

Dissolved organic nitrogen (DOrgN) is calculated by analysing TN in a filtered sample and then subtracting the NH3-N/NH4-N and NOx-N (i.e. the dissolved inorganic fractions of nitrogen) from the result.

As no guideline currently exists for DON it is difficult to assess this concentration in terms of threats to ecosystem and/or human health. All sites exceed the limit of reporting value (0.025 mg/L).

DON was a significant component of the total nitrogen at two sites on all sampling occasions, with site 14 representing 62.22, 91.67 and 64.17 % of TN and site 16 representing 91.67, 90.91 and 72.31 % of TN during July, August and September respectively. DON at site 17 also represented a dominant component of TN during July and August; 65.71 and 69.23 %. At sites 13 and 23 DON represented 66.67 and 55.38 % of TN during July respectively. All other sites (7, 18, 15, 19, 20, 21, 22, 6, 8 and 24) recorded low percentages and DON was not a significant component of the TN at those sites.

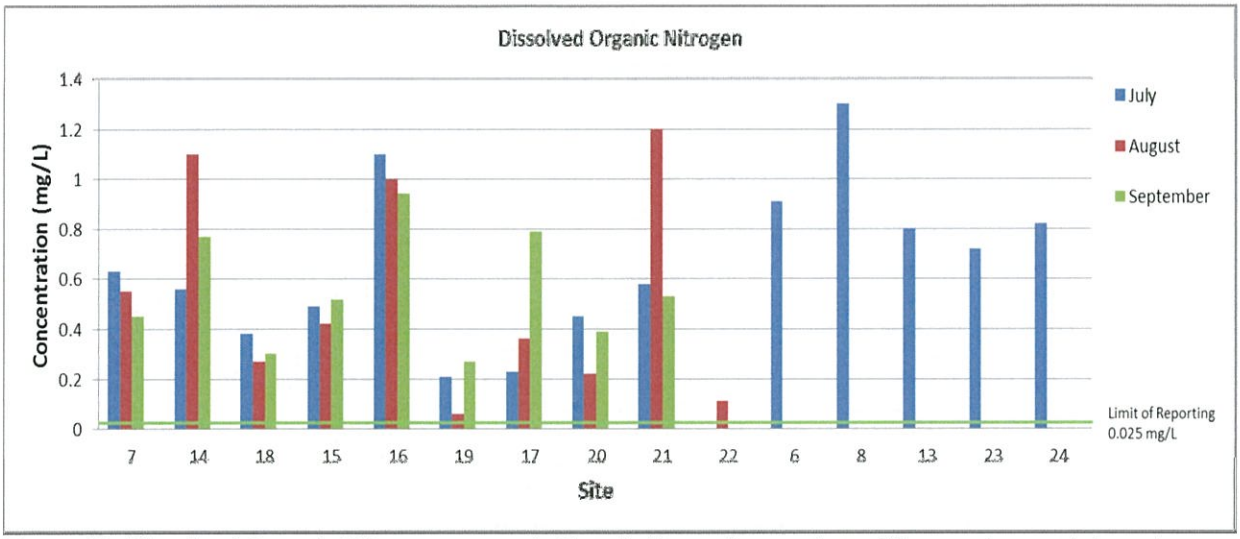


Figure 19: Dissolved Organic Nitrogen concentrations in the surface waters of Bassendean catchment.

Table 12: Dissolved organic nitrogen concentrations recorded in the Bassendean catchment from 2010 – 2016

	LOR: 0.025 mg/L			Max																				
Dissolved Organic Nitrogen	2010					2011			2012			2013			2014			2015			2016		
Site Number	Jul	Aug	Sep	Oct	Nov	Jul	Aug	Sep	Jul	Aug	Sep	Jul	Aug	Sep	Aug	Sep	Oct	Jul	Aug	Sep	Jul	Aug	Sep
7	0.27	0.55	0.59	0.8	0.58	0.39	0.73	0.57	0.43	0.59	0.56	0.43	0.35	0.33	0.61	0.43	0.6	0.6	0.54	0.53	0.63	0.55	0.45
14												0.83	0.55	0.66	0.72	0.38	0.62	0.45	0.6	0.63	0.56	1.1	0.77
18																		0.55	0.34	0.34	0.38	0.27	0.3
15												0.43	0.42	0.55	0.5	0.31	0.57	0.54	0.62	0.52	0.49	0.42	0.52
16												0.55	0.9	0.94	1.1	0.83	1	0.92	0.93	1.1	1.1	1	0.94
19																		dry	dry	0.14	0.21	0.057	0.27
17												0.2	0.4	0.27	0.33	0.18	0.63	0.32	0.26	0.32	0.23	0.36	0.79
20																		0.39	0.55	0.34	0.45	0.22	0.39
21																		0.38	0.31	0.36	0.58	1.2	0.53
22																		dry	dry	dry	dry	0.11	dry
6	0.52	0.61	0.52	0.52	0.52	0.54	0.98	0.67	0.45	0.71	0.67	0.43			0.72			0.56			0.91		
8	1	0.76	0.75	0.89	0.81	0.99	1.3	0.91	1	0.94	0.93	0.84			0.96			1.1			1.3		
13	0.7	1	0.85			0.95	0.95	1.1	0.74	0.73	0.75	0.5			1			1.1			0.8		
23																		0.9			0.72		
24																		0.71			0.82		

3.4.5. Total Organic Nitrogen

Total organic nitrogen (TON) is less available to plant uptake than dissolved organic nitrogen. Oxidising conditions in the water may similarly alter the proportions as would the presence or absence of certain nitrification/denitrification bacteria.

Total organic nitrogen may be calculated from the concentrations of total nitrogen, nitrite, nitrate and ammonium nitrogen, by subtracting the concentrations of inorganic fractions of nitrogen, namely nitrite and nitrate (NOx) and ammonium nitrogen (NH_3- N/NH_4-N) from the total nitrogen (TN) concentration:
i.e. TOrgN = TN – (NOx + NH_3-N/NH_4-N).

As no guideline currently exists for TON it is difficult to assess this concentration in terms of threats to ecosystem and/or human health. All sites exceed the limit of reporting value (0.025 mg/L).

TON was a dominant component of the total nitrogen represented at all sites. All sites recorded percentages between 53 and 100 % on all sampling occasions.

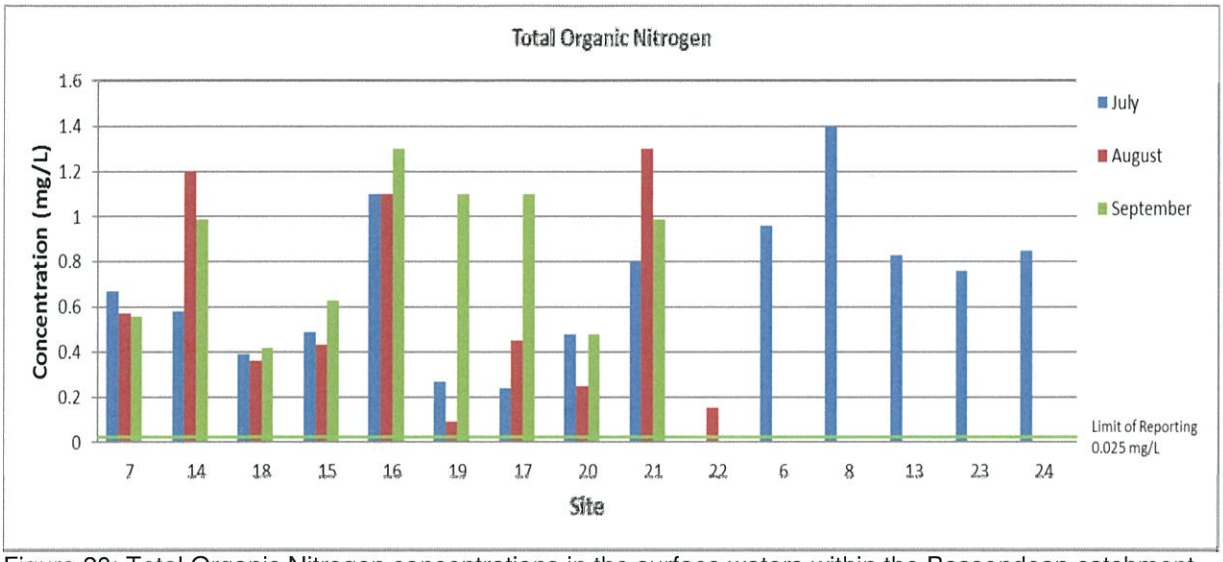


Figure 20: Total Organic Nitrogen concentrations in the surface waters within the Bassendean catchment.

Table 13: Total organic nitrogen concentrations recorded in the Bassendean catchment from 2010 – 2016

	LOR: 0.025 mg/L			Max																				
Total Organic Nitrogen	2010					2011			2012			2013			2014			2015			2016		
Site Number	Jul	Aug	Sep	Oct	Nov	Jul	Aug	Sep	Jul	Aug	Sep	Jul	Aug	Sep	Aug	Sep	Oct	Jul	Aug	Sep	Jul	Aug	Sep
7	0.4	0.64	0.62	0.86	0.85	0.47	0.83	0.65	0.5	0.75	0.61	0.48	0.38	0.33	0.67	0.62	0.75	0.81	0.59	0.59	0.67	0.57	0.56
14												0.85	0.79	0.66	0.74	0.48	1.4	0.73	0.66	0.65	0.58	1.2	0.99
18																		0.68	0.49	0.38	0.39	0.36	0.42
15												0.48	0.46	0.56	0.53	0.35	0.65	0.57	0.73	0.53	0.49	0.43	0.63
16												0.6	1.1	1.1	1.2	0.97	1.3	1.1	0.98	1.2	1.1	1.1	1.3
19																		dry	dry	0.15	0.27	0.09	1.1
17												0.26	0.58	0.32	0.39	0.25	0.81	0.38	0.39	0.38	0.24	0.45	1.1
20																		0.47	0.55	0.36	0.48	0.25	0.48
21																		0.73	0.49	0.42	0.8	1.3	0.99
22																		dry	dry	dry	dry	0.15	dry
6	0.64	0.94	0.53	0.55	0.56	0.55	1.1	0.72	0.49	0.76	0.73	0.67			0.77			0.57			0.96		
8	1.2	0.81	0.78	1.1	0.88	1	1.4	1	1.2	1.1	0.94	0.85			1			1.1			1.4		
13	0.73	1.2	1.1			1.1	1.1	1.3	0.85	0.88	0.92	0.55			1.2			1.2			0.83		
23																		0.98			0.76		
24																		0.78			0.85		

3.4.6. Nitrogen Speciation

Nitrogen speciation has been discussed sections 3.4.2 to 3.4.5 above as it is easier to see the percentage concentrations represented at each site when referring to the graphs. When referring to figure 18 below it is clear to see that total organic nitrogen is the dominant component of total nitrogen at all sites, the same as in previous years.

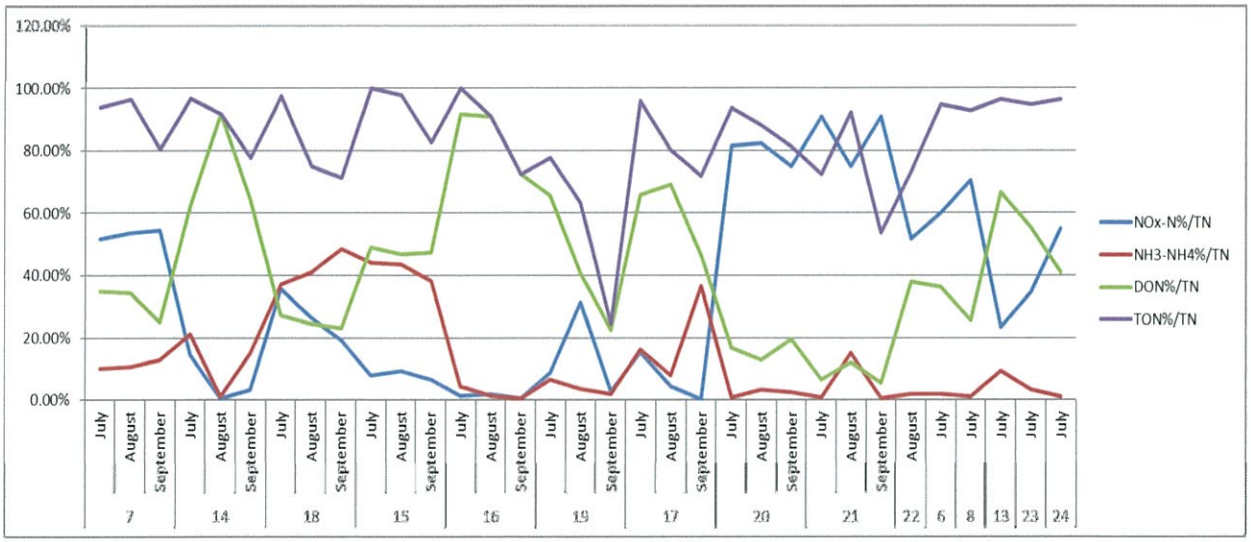


Figure 21: Nitrogen speciation (%) in the surface waters within the Bassendean catchment.

3.4.7. Total Phosphorus

Total phosphorus (TP) is a measure of all the forms of phosphorus in the water including the available (soluble reactive phosphorus – SRP) and unavailable (or potentially available) forms. Phosphate naturally occurs in water bodies through the decomposition of organic matter and the weathering of rocks. Additional sources of phosphorus include domestic and agricultural fertilisers, plant debris, detergents, animal and human wastes, geology, industrial wastes and lubricants (IEA 2003).

High levels of phosphorus and/or other key nutrients may lead to related problems such as nuisance or toxic algal blooms, although some waterways are naturally eutrophic (nutrient enriched) (Department of Water, 2009). Due to the disruption of the phosphorus cycle by humans, increasing phosphorus concentrations in surface waters are influencing the accelerated growth of phosphate dependent organisms such as algae and duckweed.

The ANZECC trigger value for lowland rivers for TP is 0.065 mg/L. The concentrations of total phosphorus (TP) in the Bassendean catchment were high and exceeded the trigger value at sites 7, 14, 18, 15, 16 and 17 on all sampling occasions. Of particular concern were sites 18 and 17 recording the highest concentrations during the September sampling events (1.2 mg/L) which was over 18 times the trigger value. Sites 19, 20, 21 and 22 also exceeded the trigger value on one or more sampling occasions, whilst sites 6, 8, 13, 23 and 24 also exceeded the trigger value during the one off July sampling event.

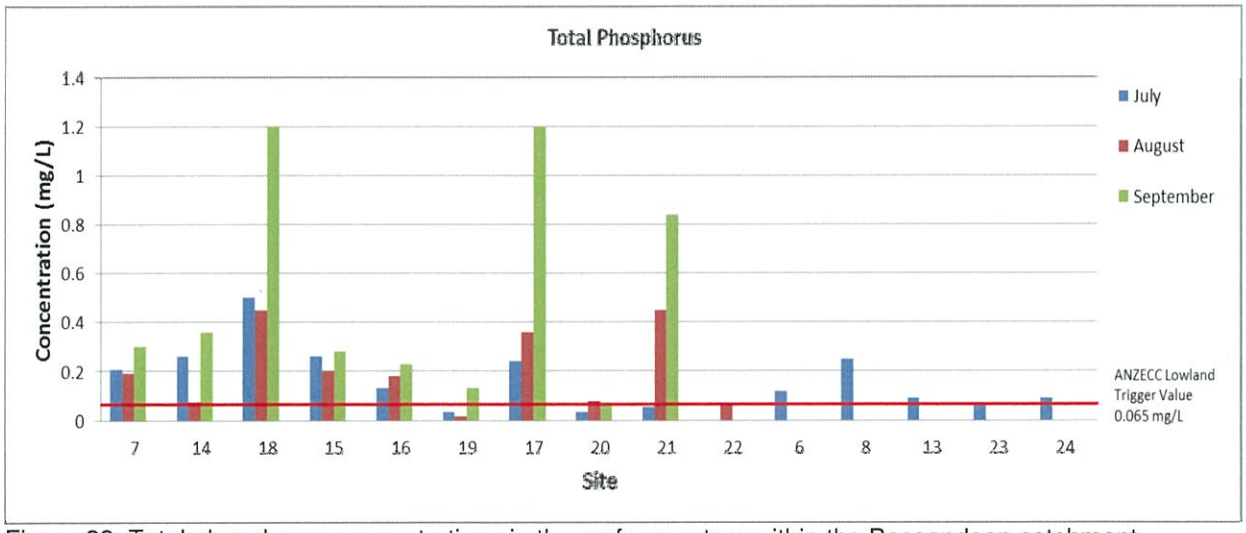


Figure 22: Total phosphorus concentrations in the surface waters within the Bassendean catchment.

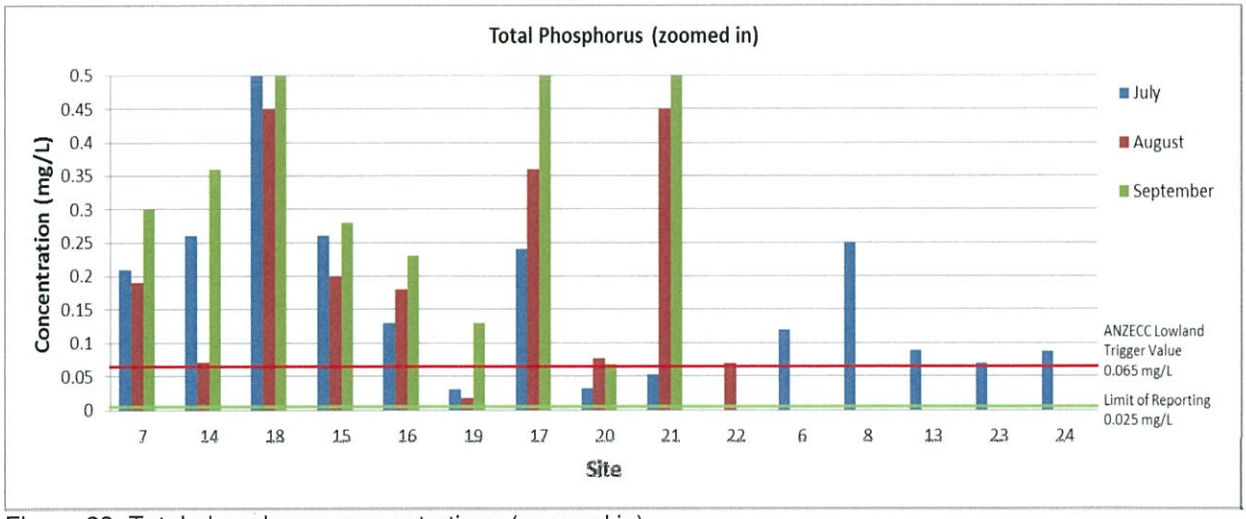


Figure 23: Total phosphorus concentrations (zoomed in).

Table 14: Total phosphorus concentrations recorded in the Bassendean catchment from 2010 - 2016

	LOR: 0.005 mg/L			ANZECC Lowland Rivers: 0.065 mg/L					Max														
Total Phosphorus	2010					2011			2012			2013			2014			2015			2016		
Site Number	Jul	Aug	Sep	Oct	Nov	Jul	Aug	Sep	Jul	Aug	Sep	Jul	Aug	Sep	Aug	Sep	Oct	Jul	Aug	Sep	Jul	Aug	Sep
7	0.24	0.54	0.63	0.31	0.36	0.22	0.33	0.4	0.44	0.44	0.5	0.13	0.32	0.18	0.35	0.45	0.68	0.78	0.45	0.33	0.21	0.19	0.3
14												0.22	0.49	0.51	0.7	0.63	4.8	1.2	0.59	0.37	0.26	0.072	0.36
18																		2.8	1.7	0.69	0.5	0.45	1.2
15												0.17	0.34	0.4	0.28	0.35	0.31	0.26	0.32	0.26	0.26	0.2	0.28
16												0.075	0.17	0.33	0.29	0.22	0.4	0.27	0.18	0.13	0.13	0.18	0.236
19																		dry	dry	0.016	0.031	0.017	0.13
17												0.16	0.61	0.32	0.28	0.37	1	0.28	1.2	0.39	0.24	0.36	1.2
20																		0.061	0.052	0.043	0.032	0.077	0.069
21																		0.094	0.04	0.028	0.052	0.45	0.84
22																		dry	dry	dry	dry	0.07	dry
6	0.1	0.17	0.13	0.088	0.074	0.086	0.14	0.14	0.084	0.11	0.14	0.15			0.16			0.18			0.12		
8	0.2	0.09	0.098	0.096	0.087	0.11	0.16	0.17	0.093	0.15	0.1	0.087			0.13			0.1			0.25		
13	0.14	0.32	0.24			0.1	0.1	0.18	0.12	0.13	0.15	0.058			0.13			0.098			0.089		
23																		0.085			0.07		
24																		0.078			0.088		

3.4.8. Soluble Reactive Phosphorus

Soluble reactive phosphorus (SRP) measures only the dissolved phosphorus in water and provides a measure of the immediately available phosphate in the system at the time of sampling; it is also referred to as orthophosphate. As this form is readily available for biological uptake, it is more likely to stimulate algal blooms of rapid growth in aquatic flora. This can lead to more decaying vegetation which alters river characteristics, including elevated temperature, reduced oxygen and fish kills. Sources include natural cycling of phosphorus but also fertilisers, detergents and soil erosion, which can carry particulate bound phosphate into waterways.

SRP describes the concentration of phosphates that pass through a 0.45 µm filter and respond to colorimetric tests without preliminary hydrolysis or oxidative digestions of the sample. SRP is largely a measure of orthophosphate ($PO4^{3-}$), however a small fraction of any condensed phosphate present is usually hydrolysed unavoidably in the analytical procedure. Reactive phosphorus occurs in both dissolved and suspended phosphorus (Department of Water, 2009).

The ANZECC trigger value for lowland rivers for SRP is 0.04 mg/L. The concentrations of soluble reactive phosphorus in the Bassendean catchment were high and exceeded the ANZECC trigger value at sites 7, 18, 15, 16 and 17 on all sampling occasions. Sites 14, 20, 21 and 22 also exceeded the trigger value during on one or more sampling occasions. Of particular concern was site 18 recording the highest concentration during the September sampling event (0.66 mg/L) which was over 16 times the trigger value. Sites 6, 8, 13, 23 and 24 exceeded the trigger value during the snapshot monitoring in July. Site 19 was the only site to record concentrations below the trigger value on all sampling occasions.

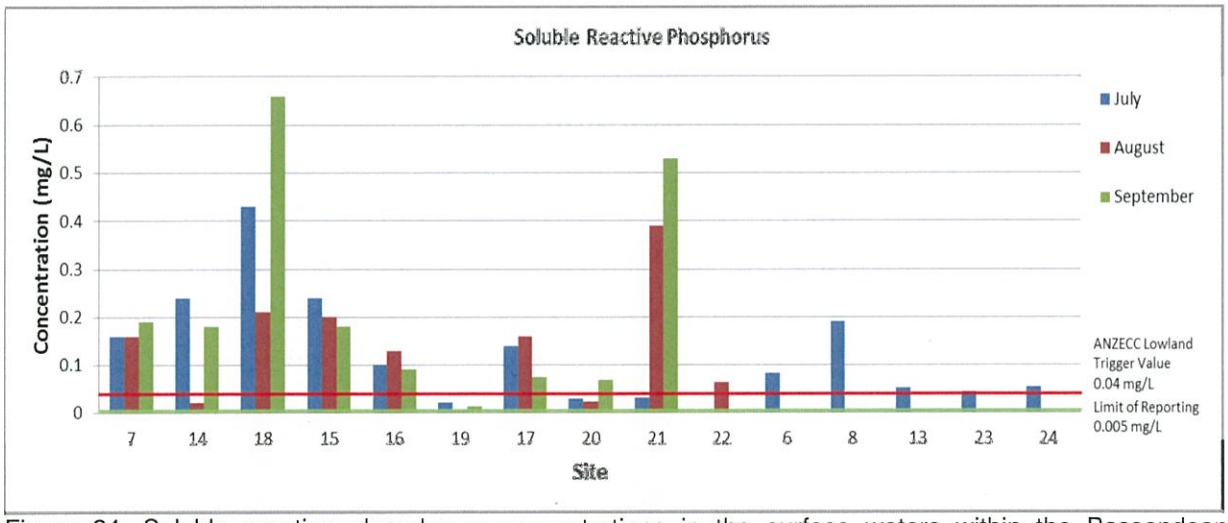


Figure 24: Soluble reactive phosphorus concentrations in the surface waters within the Bassendean catchment.

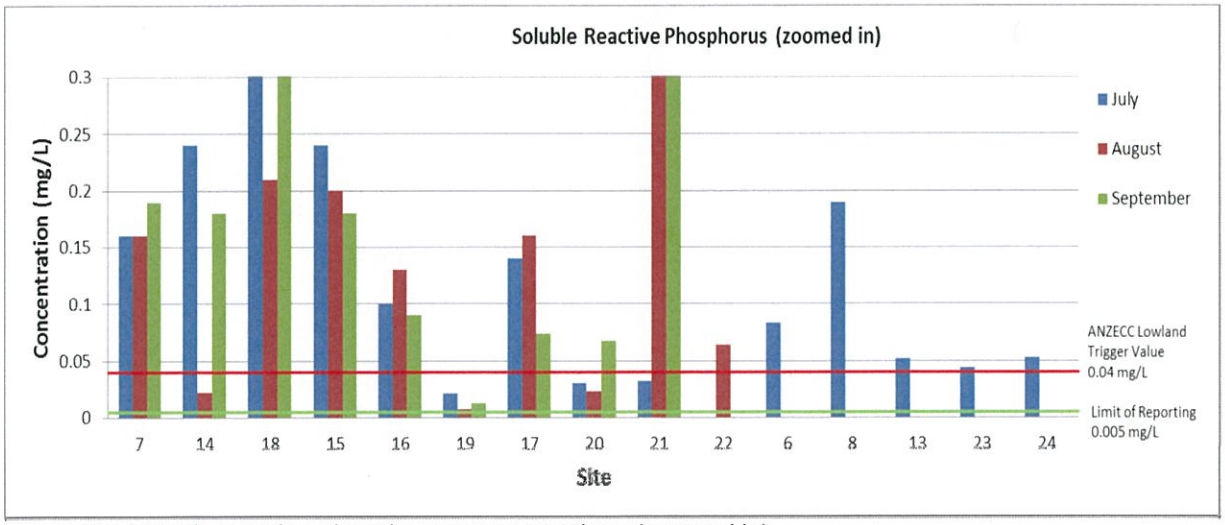


Figure 25: Soluble reactive phosphorus concentrations (zoomed in)

Table 15: Soluble reactive phosphorus concentrations recorded in the Bassendean catchment from 2010 – 2016

	LOR: 0.005 mg/L			ANZECC Lowland Rivers: 0.04 mg/L					Max															
SRP	2010					2011			2012			2013			2014			2015			2016			
Site Number	Jul	Aug	Sep	Oct	Nov	Jul	Aug	Sep	Jul	Aug	Sep	Jul	Aug	Sep	Aug	Sep	Oct	Jul	Aug	Sep	Jul	Aug	Sep	
7	0.11	0.51	0.45	0.17	0.15	0.13	0.22	0.29	0.27	0.29	0.32	0.056	0.2	0.13	0.25	0.19	0.41	0.28	0.21	0.19	0.16	0.16	0.19	
14												0.17	0.33	0.42	0.47	0.44	0.54	0.35	0.24	0.32	0.24	0.022	0.18	
18																		2.5	0.77	0.55	0.43	0.21	0.66	
15												0.13	0.25	0.35	0.18	0.26	0.18	0.15	0.072	0.22	0.24	0.2	0.18	
16												0.054	0.11	0.25	0.16	0.11	0.25	0.17	0.11	0.08	0.1	0.13	0.09	
19																		dry	dry	0.016	0.021	0.007	0.013	
17												0.085	0.35	0.11	0.062	0.12	0.42	0.085	0.083	0.14	0.14	0.16	0.074	
20																		0.052	0.041	0.039	0.03	0.023	0.068	
21																		0.028	0.011	0.011	0.032	0.39	0.53	
22																		dry	dry	dry	dry	0.064	dry	
6	0.058	0.12	0.72	0.053	0.032	0.045	0.08	0.074	0.041	0.063	0.071	0.055			0.078			0.076			0.083			
8	0.13	0.06	0.051	0.045	0.051	0.058	0.097	0.086	0.05	0.09	0.055	0.059			0.076			0.065			0.19			
13	0.084	0.26	0.13			0.072	0.065	0.1	0.043	0.075	0.06	0.032			0.057			0.057			0.052			
23																		0.054			0.044			
24																		0.032			0.053			

3.4.9. Phosphorus speciation

Phosphorus speciation has been discussed section 3.4.8 above as it is easier to see the percentage concentrations represented at each site when referring to the graph.

When referring to figure 23 below it is notable that soluble reactive phosphorus is the dominant component of TP at sites 7, 15, 21, 22 on all sampling occasions, and sites 6, 8, 13, 23 and 24 during the one off July sampling occasion. Sites 18, 16 and 20 also displayed this relationship, but only on two sampling occasions. Sites 14, 19 and 17 recorded higher particulate levels on two sampling occasions.

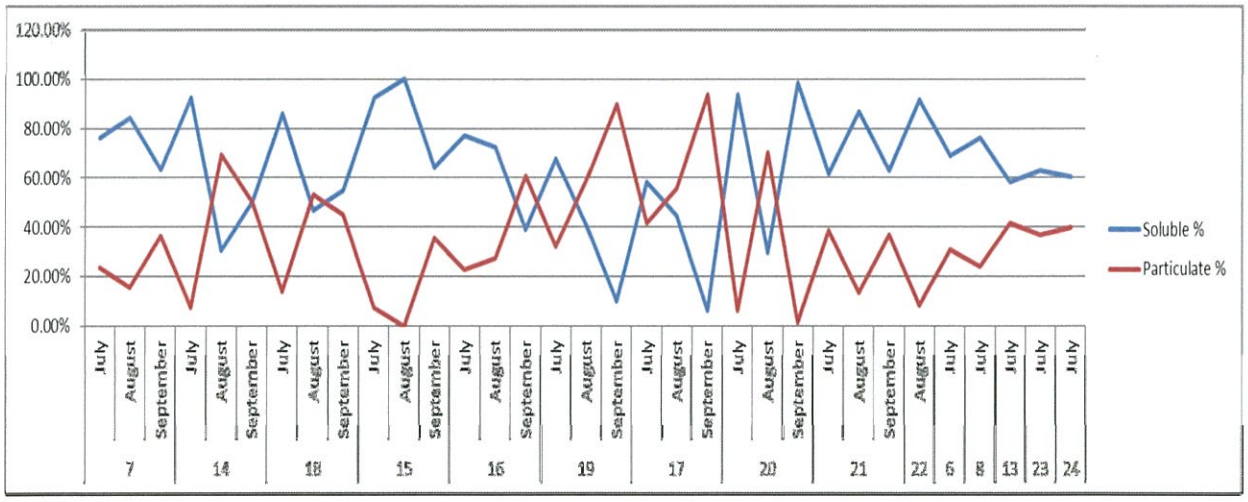


Figure 26: Phosphorus speciation (%) in the surface waters within the Bassendean catchment.

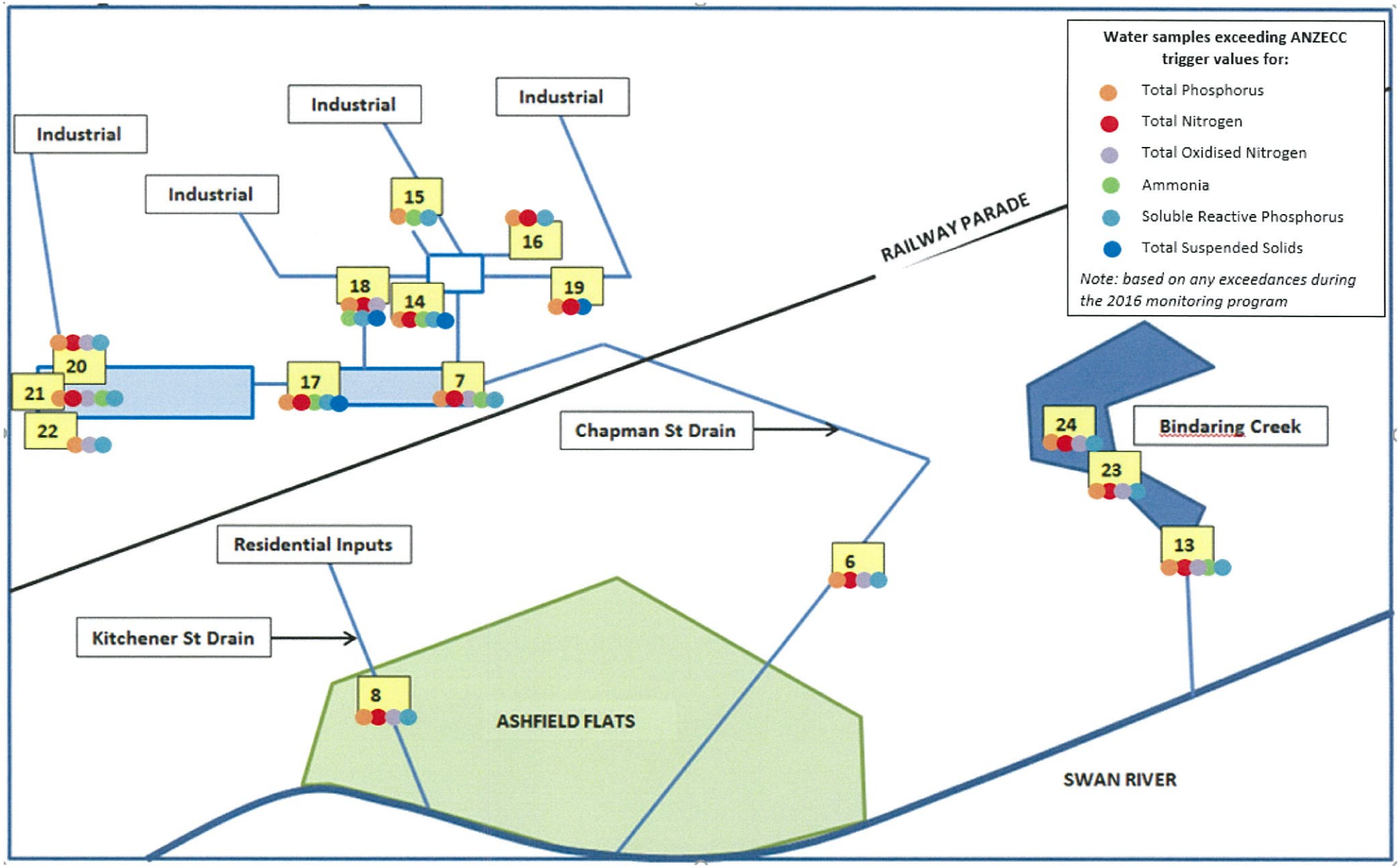


Figure 27: Water samples where nutrient concentrations exceeded the appropriate ANZECC trigger values in 2016

3.4.10. Summary of Results

Monitoring of the nutrient concentrations within the Bassendean catchment occurred during July, August and September at sites 7, 14, 15, 16 17, 18, 19, 20, 21 and 22, and during July only at sites 6, 8, 13, 23 and 24. The results from the additional analyses completed at Bindaring wetland will be sent separately to the Town of Bassendean as this is outside the scope of this report. Site 22 was dry during July and September.

Nutrients are an issue for the Bassendean catchment. Site 7 is of concern as the trigger values (where appropriate) for the nutrients monitored were exceeded on every single sampling event (15 exceedances out of a possible 15). However, site 18 and 21 also recorded a high number of exceedances (14 and 11 exceedances out of a possible 15, respectively). It is important to note that site 18 recorded the highest concentration of soluble reactive phosphorus and total phosphorus during September (site 17 also equalled the highest TP during September). Site 21 recorded by far the highest concentration of ammonia during August, and the highest concentrations of total oxidised nitrogen and total nitrogen during all sampling occasions.

In general, phosphorus concentrations (TP and SRP) were high and exceeded the trigger value at all sites on one or more sampling occasions (the only exception was site 19). The industrial sites were of most concern, particularly sites 7, 14, 18, 15, 16, 17 and 21. The existing sites 6, 8 and 13, and the new sites 23 and 24 also exceeded the trigger values, however they recorded distinctly lower concentrations than the industrial sites upstream of railway parade (like site 18 mentioned above).

Sites 7, 14, 18, 16, 19, 17, 20, 21, 6, 8, 13, 23 and 24 recorded TN concentrations above the ANZECC trigger value (the only exceptions were sites 19 and 22). Whilst these sites recorded at least one exceedance, not all stood out as of major concern. Those sites that did included site 21 as mentioned above, which recorded the highest concentration not only for 2016, but across all sites since the project started, recording 10 mg/L during August and September (over 8 times the trigger value). Sites 6 and 8 have also consistently recorded TN concentrations above the trigger value in previous sampling years, which was consistent with this year's results.

Ammonia was of concern at sites 7, 14, 18, 15, 16, 17, 21 and 13. Whilst site 18 recorded the highest concentration during July and September, site 21 was a clear standout and recorded the highest overall concentration of 1.5 mg/L (more than 18 times the trigger value) during August. Site 21 also recorded the highest concentrations by far of total oxidised nitrogen on all sampling occasions, however sites 7, 18, 20, 6, 8, 13, 23 and 24 were also elevated.

3.4.11. Discussion

Given the natural variability of nutrients within the catchment and the nature of periodic sampling, whether a site is recording better or worse concentrations in terms of the overall health of the environment cannot be said with certainty. Instead, exceedances to the guidelines can only be interpreted.

Sites 6 and 8 are bordered by recreational parks, therefore management practices should be looked at closely to try and reduce the constant elevated levels at these listed sites. Fertilising regimes could play a large role in providing excess nitrogen into the system as total oxidised nitrogen (nitrate and nitrite) are commonly found in commercial fertilisers. Fertiliser application that does not adhere to the best management practices for reserves in close proximity to water bodies, i.e. timing and rate of application, could be contributing to these elevated levels. Concentrations of total oxidised nitrogen have historically been the highest at site 8 then site 6, and whilst they were elevated during July, site 21 recorded the highest concentrations peaking at 9.1mg/L in September (over 60 times the trigger value). The history of the site should be taken into consideration, however in 2015 the results were not this elevated, suggesting a new source of nutrients to the catchment.

Animal droppings can also represent an important input of nutrients to the system, especially in the open drains, compensation basins and wetlands. As the dominant percentage of the nitrogen was in an organic form, it is likely to be contributed to the stormwater system from natural sources such as leaf litter.

Ammonia is toxic to fish and aquatic organisms, even in very low concentrations. When levels reach 0.06 mg/L, fish can suffer gill damage. Sites 7, 14, 18, 15, 17, 21 and13 exceeded this value on one or more sampling occasions. Prior to 2013 site 7 always recorded the highest concentration of ammonia (with the exception of 2010), and then in 2013 site 17 recorded the highest concentration. During 2014 site 14 had

the highest concentration over all sampling months, suggesting that the source of ammonia to site 7 is external via these new industrial sites. The addition of site 18 to the 2015 program has shown that ammonia is generally the highest at this site, however in 2016 the highest concentration of ammonia (1.5 mg/L) was recorded at site 21 during August which was more than 18 times the trigger value. It is interesting to note however that concentrations did not exceed the trigger value during July or September at site 21, whilst site 18 was consistently high over all sampling occasions. Bindaring Creek (site 13) also recorded an elevated concentration during July, the same as previous years.

Concentrations of soluble reactive phosphorus and total phosphorus were high and exceeded the trigger value at all sites on one or more sampling occasions, except for site 19. Sites 18 and 17 recording the highest TP concentrations during the September sampling events (1.2 mg/L) which was over 18 times the trigger value. During the sampling regime in 2012 site 7 was of most concern for phosphorus, however since the new sites have been added to the program, it indicates that the source of phosphorus to site 7 is external. In 2014 site 14 recorded the highest SRP concentration; in 2015 site 18 recorded the highest SRP concentration; then in 2016 site 18 recorded the highest concentration of SRP again (exceeding the trigger value 16 times during September). Excessive concentrations of phosphorus are the most common cause of eutrophication in freshwater lakes, reservoirs, streams, and headwaters of estuarine systems (Correll, 1998).

Site 7 may have the highest number of exceedances (15 out of 15 as mentioned earlier), however the very high concentrations of nitrogen and phosphorus upstream (particularly sites 18 and 21) indicates that site 7 is not the source of nutrients (i.e. not where it originates), but more likely where these nutrients end up.

3.4.12. Recommendations

During 2014, further monitoring was recommended more intensively upstream of railway parade. In 2015 sites 18, 19, 20, 21 and 22 were added to the program. It is recommended that these sites continue to be monitored.

In addition to routine monitoring, the following recommendations should be considered and implemented if possible. Due to the financial climate we live in it is understood that not every action can be implemented at once. Therefore, in agreement with the *Town of Bassendean Council Local Planning Policy No 3. Water Sensitive Design* (December 2008) this report reiterates the proposals from the previous Bassendean Monitoring Reports (2010 – 2015).

The following examples of structural best management practices be incorporated into management plans where appropriate:

- Onsite detention;
- Stormwater infiltration systems;
- Buffer strips;
- Pollutant traps;
- Grass or reed swale drains;
- Broken or flush kerbing;
- Pervious paving materials;
- Native landscaping; and
- Ponds and wetlands including; Implementation of living streams with the involvement of the community to provide multiple positive effects by increasing public awareness and further improving water quality.

The following examples of non-structural best management practices be incorporated into management plans where appropriate:

- Education of residents on appropriate plant species, fertiliser and water use potentially via pamphlets, workshops, newsletters etc;
- Street sweeping regimes;
- Improved waste and stormwater management for industrial premises;
- The Town of Bassendean review current turf management practices and measures should be taken to reduce fertiliser impact on waterways, including the use of phosphate-free or no fertiliser around water bodies and soil or leaf analysis prior to fertilising; and
- Appropriate staff to undertake fertiliser wise training.

Existing activities- The management of urban drainage and water bodies continues to be improved by:

- The Town of Bassendean has already implemented works to improve the water quality in the catchment including; soil amendments at site 6, replacing exotic and largely deciduous vegetation with indigenous species and community education;
- The Water Corporation undertakes de-silting and typha removal in compensating basins.

Further investigation into a number of options for improving stormwater quality flowing to the drainage system is looked at closer, in particular the recommendations put forward in previous reports:

- All sites should continue to be monitored with the Town of Bassendean committing funds to the project for 2017.
- The nutrient and pollutant contribution of urban stormwater to the system and what strategies could be implemented to reduce the amount of contaminants moving into and consequently through the system.
- The Town of Bassendean undertake a desktop review of businesses near the industrial sites.
- The Town of Bassendean look into committing funds (if necessary) to continue to conduct industrial audits of the surrounding businesses near the industrial sites and work with the DER officer who will be conducting these audits.
- The town of Bassendean look into committing funds to restore the health of site 7 and 17. If this compensating basin is turned into a nutrient stripping wetland it will help to treat some of the nutrients prior to discharging into site 6 and ultimately the Swan River.
- The restoration of site 7 and 17 should not be done in isolation, instead the source of nitrogen upstream potentially from site 21 and the source of phosphorus upstream potentially from site 18 should also be looked into.

3.5. Metal Concentrations in Water

Sites 7, 6, 8, 13, 23 and 24 were monitored in 2016 for soluble metals. Sites 6, 8, 13, 23 and 24 were only monitored as a snapshot during July; and site 7 was sampled on all occasions as it was of most concern based on previous year's results. The results from the additional analyses completed at Bindaring wetland will be sent separately to the Town of Bassendean as this is outside the scope of this report.

To try and determine the sources of pollution upstream of site 7, sites 14, 15, 16 and 17 were added to the program in 2013. In 2015 sites 18, 19, 20, 21 and 22 were added to the program. These sites were sampled for total metals on all sampling occasions in 2016, not soluble metals.

Refer to tables in the Appendix for all metal concentration data for water samples of the Bassendean catchment. For all graphs, a value half the limit of reporting was substituted for those occasions where concentrations were recorded as 'below the laboratory limit of reporting', to enable graphing of results.

3.5.1. Water Hardness

Total Hardness is a measure of the sum of the concentrations of calcium and magnesium ions in water, both expressed as mg/L calcium carbonate ($CaCO_3$) equivalent. It is the combined concentration of earth-alkali metals, predominantly magnesium (Mg^{2+}) and calcium (Ca^{2+}), and some strontium (Sr^{2+}) in water. The source of this hardness is limestone dissolved by water that is rich in carbon dioxide.

The ANZECC guidelines classified the water hardness into five categories: soft (<59 mg/L), moderate (60 to 119 mg/L), hard (120 to 179 mg/L), very hard (180 to 240 mg/L) and extremely hard (>240 mg/L). Soft waters (hardness values <100 mg/L) generally have low alkalinities and little calcium and magnesium, and consequently, are susceptible to acidification. Hard waters (hardness >100 mg/L) usually have high calcium and are less susceptible to acidification (Helfrich, et.al. 2009). The ANZECC recreational guideline of 500 mg/L should not be exceeded.

Increasing water hardness and alkalinity reduces the uptake and toxicity, to freshwater organisms, of several metals such as cadmium, chromium (III), copper, lead, nickel and zinc, to freshwater organisms. An increase in water hardness (i.e. calcium and/or magnesium concentration) is frequently associated with an increase in alkalinity (as calcium and/or magnesium carbonate), and thus, pH (ANZECC 2000).

Water samples with higher concentrations of water hardness need to have the trigger values for these metals increased by a certain multiplication factor, as recommended in ANZECC (2000) guidelines. As water hardness is variable at each site, the trigger values for certain metals can be different for each site. Trigger values for these metals have been corrected based on the concentration of water hardness for each site, using the hardness-dependent algorithm provided in the ANZECC guidelines (ANZECC & ARMCANZ 2000). The calculated site-specific trigger values are displayed on the graphs for these metals, where applicable. For the details and calculations see appendix B.

It is important to note that water hardness concentrations were very low and within the 'soft' range during August. These really low concentrations resulted in very low hardness modified trigger values that are much more sensitive to exceedances. In the figures this can be noticed as the trigger values adjusted for water hardness during August are commonly below the limit or reporting.

Water hardness in the surface waters of the Bassendean catchment varied from a minimum of 2.5 mg/L recorded at sites 19 and 22 during August, to a maximum of 330 mg/L recorded at site 21 and 280 mg/L recorded at site 17 both during September. There is no ANZECC guideline regarding water hardness and ecosystem health, however all sites were within the ANZECC recreational guideline of 500 mg/L.

Sites 7, 14, 18, 15, 16, 19, 17, 20, 21 and 22 all recorded concentrations within the soft range during August, as did site 19 during July. Sites 7, 14, 18, 15, 17, 8, 13 and 23 were within the moderate range during July, and sites 18, 15 and 19 returned to the moderate range during September.

Sites 7 and 14 were within the hard range during September, and sites 16, 20, 21, 6 and 24 were also within the hard range during July. Sites 16, 17 and 21 were within the extremely hard range during September.

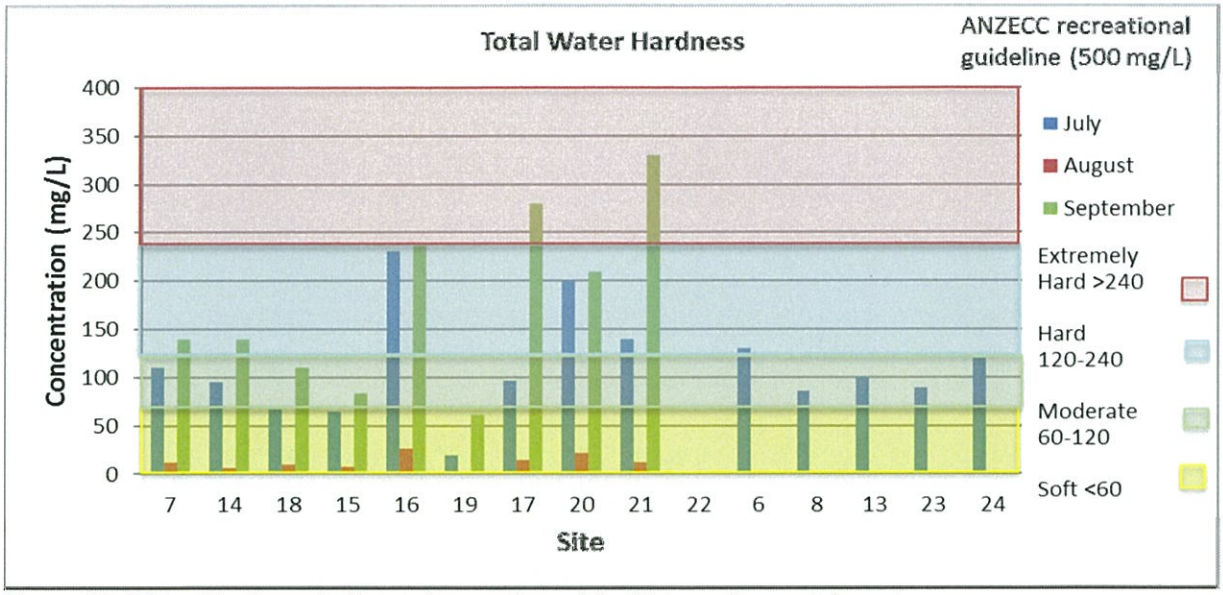


Figure 28: Water Hardness in the surface waters of the Bassendean catchment.

Table 16: Water hardness concentrations recorded in the Bassendean catchment from 2010 - 2016

	Soft: 0-59		Moderate: 60-119			Hard: 120-240			Very Hard: >240			Max		>500 mg/L									
Water Hardness	2010					2011			2012			2013			2014			2015			2016		
Site Number	Jul	Aug	Sep	Oct	Nov	Jul	Aug	Sep	Jul	Aug	Sep	Jul	Aug	Sep	Aug	Sep	Oct	Jul	Aug	Sep	Jul	Aug	Sep
7	57	160	150	120	130	67	140	130	130	120	110	48	130	87	150	150	130	150	140	140	110	12	140
14												130	120	100	120	110	120	88	110	110	95	6	140
18																		90	100	85	67	10	110
15												80	81	72	93	86	100	83	110	75	65	7	83
16												200	270	230	280	270	290	260	280	270	230	26	240
19																		DRY	DRY	49	19	2.5	61
17												70	280	200	360	280	220	210	170	220	96	14	280
20																		250	320	300	200	21	210
21																		88	80	88	140	12	330
22																		DRY	DRY	DRY	DRY	2.5	DRY
6	110	180	170	160	140	150	180	190	160	160	160	120			170			150					
8	110	110	100	91	87	110	110	100	90	89	88	110			100			92					
13						490	290	450	550	230	160	400			290			360					
23																		250					
24																		170					

3.5.2. Aluminium

Aluminum is toxic to aquatic organisms and its toxicity increases as pH decreases (Australian Government, 2010). Aluminium may be present in water through natural leaching from soil and rock, and is increased in soluble groundwater concentrations under acidic conditions and can therefore be influenced by the action of Acid Sulphate Soils (ASS). Many aluminum salts are readily soluble; however, there are some that are very insoluble. Those that are insoluble will not exist long in surface water, but will precipitate and settle.

The bioavailability and toxicity of aluminium is generally greatest in acid solutions. Aluminium in acid habitats has been observed to be toxic to fish, amphibians and phytoplankton. Aluminium is generally more toxic over the pH range 4.4 – 5.4, with a maximum toxicity occurring around pH 5.0 - 5.2 (ANZECC 2000).

The ANZECC recreational trigger value of 0.2 mg/L and the trigger value of 0.055 mg/L for freshwater lowland rivers (when the pH is greater than 6.5) should not be exceeded. The concentrations that exceed the trigger values are highlighted in table 18 below.

Table 17: Comparison of pH values with aluminium concentrations

Month	Site	Soluble Aluminium (mg/L)	Total Aluminium (mg/L)	pH
7	July	0.22		7.22
	August	0.18		6.88
	September	0.23		6.91
14	July		0.2	6.78
	August		0.36	6.99
	September		0.18	6.89
18	July		0.45	7.22
	August		1.1	5.5
	September		2.6	4.75
15	July		0.54	6.45
	August		0.42	6.37
	September		0.49	6.52
16	July		0.31	6.08
	August		0.39	6.97
	September		0.19	7.25
19	July		0.36	7.81
	August		0.15	7.17
	September		0.03	6.48
17	July		0.16	6.18
	August		0.15	6.24
	September		0.1	6.5
20	July		0.59	7.62
	August		0.52	7.38
	September		0.64	7.43
21	July		0.096	7.39
	August		0.15	7.07
	September		0.11	6.98
22	August		0.07	7.29
6	July	0.21		7.16
8	July	0.77		6.95
13	July	0.19		7.2
23	July	0.23		7.2
24	July	0.18		7.23

ANZECC Recreational: 0.2 mg/L
ANZECC Lowland Rivers: 0.055 mg/L
pH > 6.5

The concentrations of total aluminium exceeded the freshwater lowland rivers trigger value (0.055 mg/L) at all sites on one or more sampling occasions. Sites 14, 18, 15, 16, 19 and 20 also exceeded the recreational trigger value (0.02 mg/L) on one or more sampling occasions. The concentrations of soluble aluminium exceeded the freshwater lowland rivers trigger value (0.055 mg/L) at all sites, whilst site 7 also exceeded the recreational trigger value (0.02 mg/L) during July and September, and sites 6, 8 and 23 exceeded the trigger value of 0.02 mg/L during July.

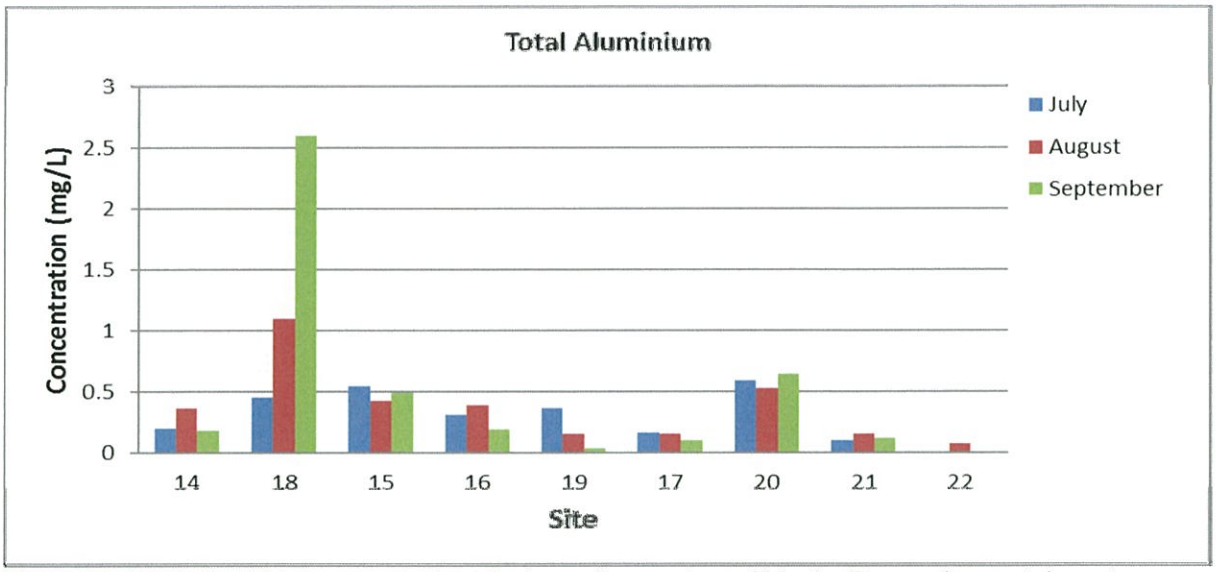


Figure 29: Total aluminium concentrations in the surface waters within the Bassendean catchment.

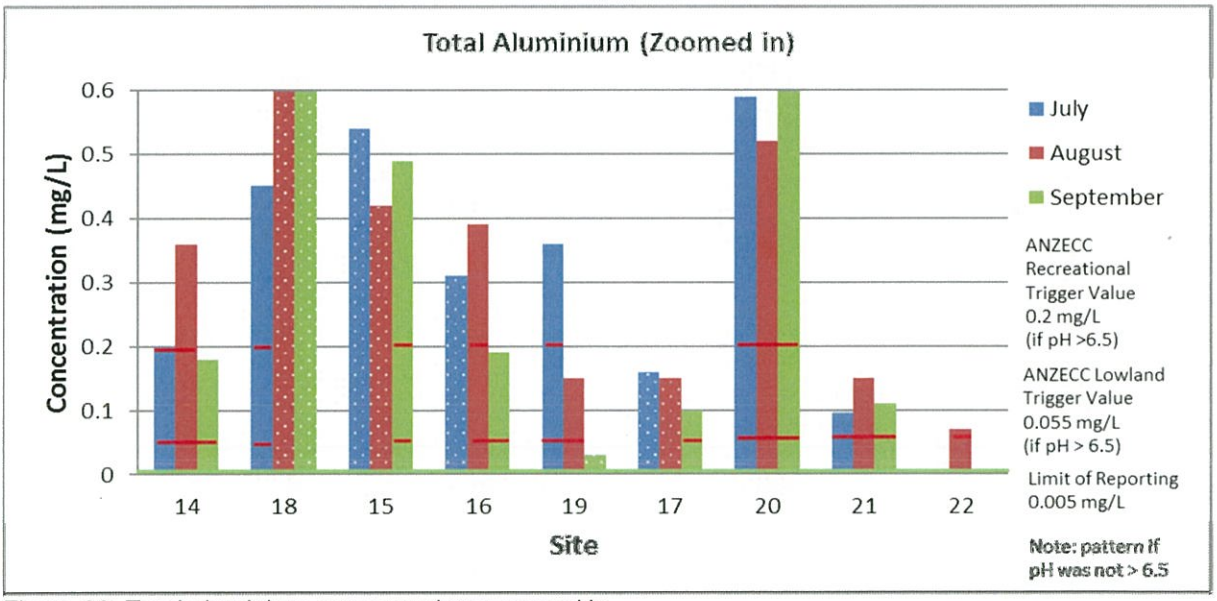


Figure 30: Total aluminium concentrations zoomed in.

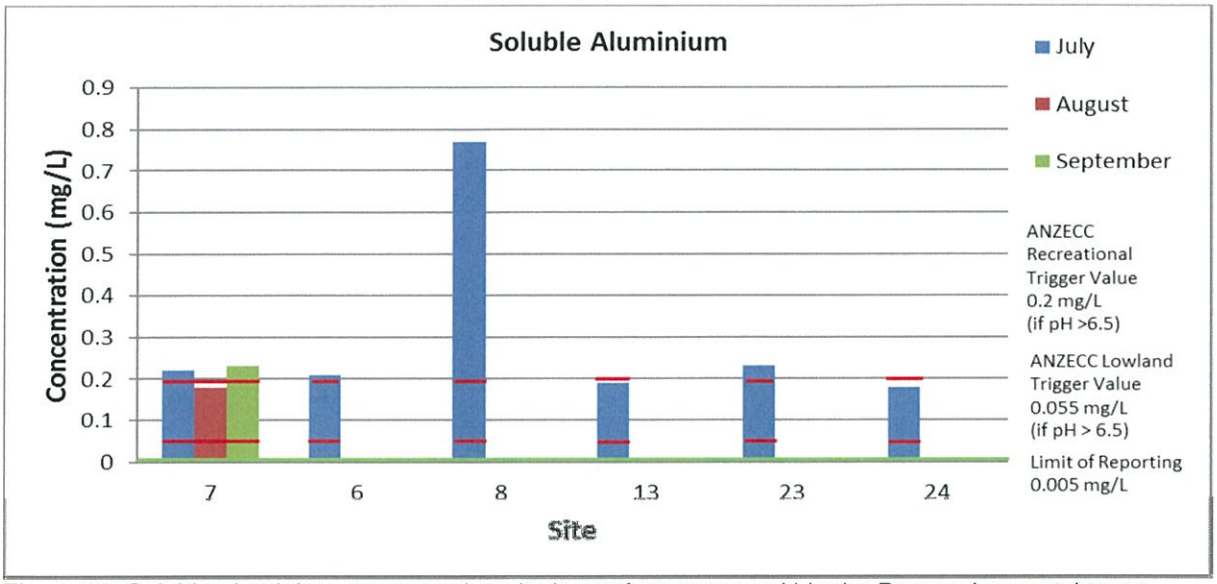


Figure 31: Soluble aluminium concentrations in the surface waters within the Bassendean catchment.

Table 18: Total aluminium concentrations recorded in the Bassendean catchment from 2010 - 2016

	LOR: 0.005 mg/L			ANZECC Recreational: 0.2 mg/L					ANZECC Lowland Rivers: 0.055 mg/L						Min	Max	Note: only if pH >6.5					
Total Aluminium	2010					2011			2012			2013			2014			2015			2016		
Site Number	Jul	Aug	Sep	Oct	Nov	Jul	Aug	Sep	Jul	Aug	Sep	Jul	Aug	Sep	Aug	Sep	Oct	Jul	Aug	Sep	Jul	Aug	Sep
7	0.2	0.35	0.31	0.15	0.26																		
14												0.31	0.31	0.34	0.45	0.33	0.35	2.3	0.13	0.18	0.2	0.36	0.18
18																		0.47	0.66	0.6	0.45	1.1	2.6
15												0.56	0.55	0.72	0.44	0.42	0.41	0.5	1.1	0.48	0.54	0.42	0.49
16												0.13	0.26	0.79	0.18	0.24	0.12	0.1	0.005	0.42	0.31	0.39	0.19
19																		DRY	DRY	0.51	0.36	0.15	0.03
17												0.3	0.18	0.13	1.2	0.77	0.18	0.23	0.5	0.29	0.16	0.15	0.1
20																		0.18	0.17	0.21	0.59	0.52	0.64
21																		0.73	0.47	0.21	0.096	0.15	0.11
22																		DRY	DRY	DRY	DRY	0.07	DRY
6	0.38	0.23	0.2	0.12	0.097																		
8	0.83	0.66	0.65	0.64	0.45																		
13						0.01	0.12	0.1															

Table 19: Soluble aluminium concentrations recorded in the Bassendean catchment from 2010 - 2016

	LOR: 0.005 mg/L			ANZECC Recreational: 0.2 mg/L					ANZECC Lowland Rivers: 0.055 mg/L						Min	Max	Note: only if pH >6.5					
Soluble Aluminium	2010					2011			2012			2013			2014			2015			2016		
Site Number	Jul	Aug	Sep	Oct	Nov	Jul	Aug	Sep	Jul	Aug	Sep	Jul	Aug	Sep	Aug	Sep	Oct	Jul	Aug	Sep	Jul	Aug	Sep
7	0.084	0.25	0.24	0.12	0.1	0.13	0.22	0.21	0.21	0.2	0.19	0.063	0.22	0.15	0.2	0.095	0.28	0.15	0.17	0.17	0.22	0.18	0.23
6	0.2	0.13	0.11	0.07	0.052	0.091	0.16	0.13	0.077	0.087	0.1	0.076			0.099			0.15			0.21		
8	0.54	0.49	0.43	0.46	0.35	0.44	0.52	0.46	0.36	0.43	0.43	0.52			0.4			0.52			0.77		
13						0.028	0.058	0.033	0.032	0.07	0.092	0.053			0.036			0.12			0.19		
23																		0.038			0.23		
24																		0.027			0.18		

3.5.3. Arsenic

Arsenic is a naturally occurring mineral that is widely distributed throughout the world's soils. Arsenic is highly toxic to aquatic life and bioaccumulates in some animals. Arsenic is very persistent in the environment and can inhibit plant growth. Sources of arsenic include the combustion of fossil fuels, primary production of iron, steel, copper, nickel and zinc, use of pesticides, weed killers and fungicides, wood treatment products and burning of treated wood (Australian Government 2010). High arsenic concentrations can also be caused by acidic groundwater.

The ANZECC recreational trigger value of 0.07 mg/L and the trigger value of 0.024 mg/L for freshwater lowland rivers should not be exceeded. The concentrations of total arsenic at site 17 were very concerning and exceeded the recreational ANZECC trigger value (0.07 mg/L), and consequently the lower trigger value of (0.024 mg/L) during August and September, whilst concentrations exceeded the lowland trigger value during July. Concentrations of total arsenic also exceeded both trigger values at site 18 during September, and the lowland trigger value of 0.024 mg/L during July and August. During July and August site 14 exceeded the lowland trigger value. Sites 19, 21 and 22 were below the detection level.

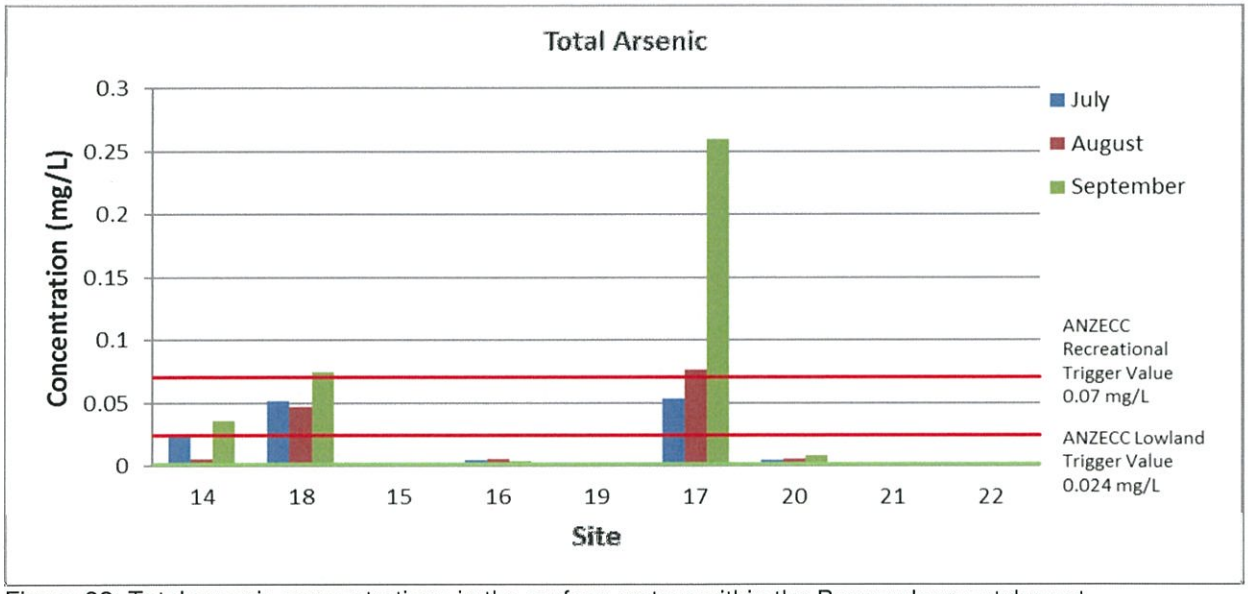


Figure 32: Total arsenic concentrations in the surface waters within the Bassendean catchment.

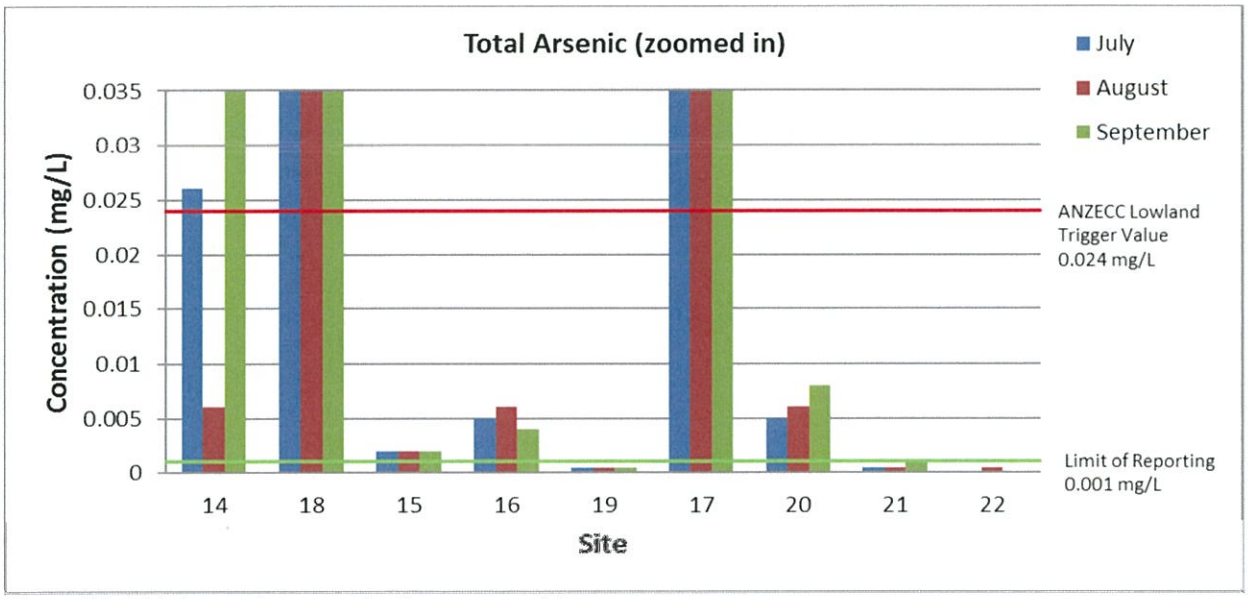


Figure 33: Total arsenic concentrations zoomed in.

Table 20: Total arsenic concentrations recorded in the Bassendean catchment from 2010 - 2016

	LOR: 0.001 mg/L			ANZECC Recreational: 0.07 mg/L			ANZECC Lowland: 0.024 mg/L			Min	Max											
Total Arsenic	2010					2011			2012			2013			2014			2015			2016		
Site Number	Jul	Aug	Sep	Oct	Nov	Jul	Aug	Sep	Jul	Aug	Sep	Jul	Aug	Sep	Aug	Sep	Oct	Jul	Aug	Sep	Jul	Aug	Sep
7	0.014	0.011	0.011	0.01	0.008																		
14												0.025	0.044	0.053	0.042	0.05	0.036	0.15	0.041	0.03	0.026	0.006	0.036
18																		0.15	0.069	0.058	0.051	0.047	0.074
15												0.002	0.0031	0.003	0.002	0.004	0.003	0.002	0.003	0.002	0.002	0.002	0.0025
16												0.001	0.004	0.009	0.004	0.004	0.003	0.002	0.003	0.004	0.005	0.006	0.004
19																		DRY	DRY	0.0005	0.0005	0.0005	0.0005
17												0.052	0.21	0.05	0.095	0.089	0.1	0.026	0.0005	0.074	0.053	0.076	0.26
20																		0.007	0.007	0.014	0.005	0.006	0.008
21																		0.0005	0.0005	0.0005	0.0005	0.0005	0.001
22																		DRY	DRY	DRY	DRY	0.0005	DRY
6	0.005	0.002	0.002	0.002	0.002																		
8	0.001	0.0005	0.0005	0.0005	0.0005																		
13						0.0005	0.0005	0.0005															

3.5.4. Chromium

Chromium is an essential trace element which occurs naturally in the environment in the air, water, rocks and soil in very low concentrations. Sources include the chemical manufacturing industry (e.g. dyes for paints, rubber and plastic products), the metal finishing industry, manufacturers of pharmaceuticals, wood, stone, clay, glass, electrical and aircraft products, steam and air conditioning supply services, cement producing plants, incineration of refuse and sewage sludge and combustions of oil and coal (Australian Government 2010). Chromium in storm water is mostly associated with suspended solids (IEA 2003).

The two most common forms are chromium VI and chromium III, which depend on pH levels. Whilst it has been proven that chromium VI is toxic to aquatic organisms and a carcinogen to animals and humans, and chromium III is considered to be practically non-toxic and not associated with these effects, the dominant component of chromium in the environment is Cr III unless a nearby source is contributing significant sources of Cr VI. However, the only way to know the speciation of chromium for certain is through a thorough laboratory analysis. Plants and animals do not bioaccumulate chromium, therefore the potential impact of high levels in the environment is acute toxicity, which is expressed as skin lesions or rashes and kidney and liver damage.

The ANZECC recreational trigger value for chromium (VI) of 0.5 mg/L and the trigger value (0.001 mg/L) for freshwater lowland rivers should not be exceeded. As the trigger values are affected by water hardness, the trigger values shown on the graph vary depending on the water hardness recorded at each site. For the details and calculations see appendix B. It is important to note that water hardness concentrations were very low and within the 'soft' range during August. These really low concentrations resulted in very low hardness modified trigger values that are much more sensitive to exceedances. In the figure this can be noticed as the trigger values adjusted for water hardness during August are below the limit or reporting, and always exceeded.

The concentrations of total chromium exceeded the hardness adjusted trigger values at sites 14, 18, 15, 16, 19, 17, 20, 21 and 22 during August. Site 19 also equaled the hardness adjusted trigger value during July.

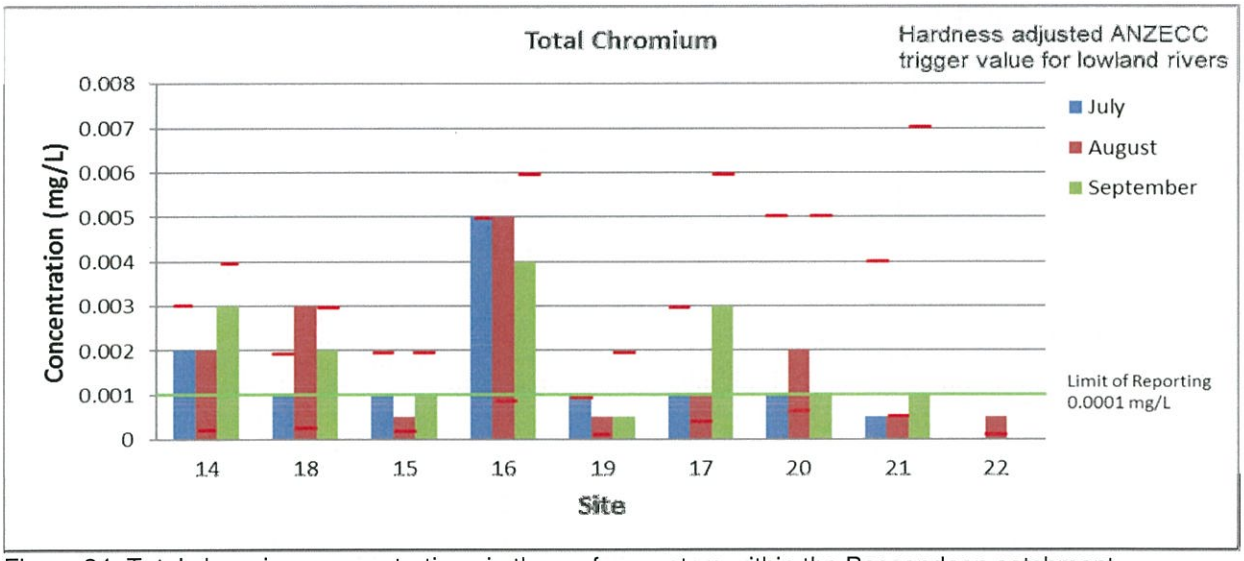


Figure 34: Total chromium concentrations in the surface waters within the Bassendean catchment.

Table 21: Total chromium concentrations recorded in the Bassendean catchment from 2010 - 2016

	LOR: 0.001 mg/L					Exceeds adjusted trigger value for water hardness																	
Total Chromium	2010					2011			2012			2013			2014			2015			2016		
Site Number	Jul	Aug	Sep	Oct	Nov	Jul	Aug	Sep	Jul	Aug	Sep	Jul	Aug	Sep	Aug	Sep	Oct	Jul	Aug	Sep	Jul	Aug	Sep
7	0.002	0.003	0.003	0.002	0.002																		
14												0.003	0.003	0.004	0.004	0.004	0.003	0.006	0.0005	0.002	0.002	0.002	0.003
18																		0.004	0.002	0.001	0.001	0.003	0.002
15												0.002	0.0019	0.002	0.001	0.001	0.001	0.001	0.003	0.001	0.001	0.0005	0.001
16												0.002	0.005	0.007	0.004	0.005	0.003	0.002	0.003	0.005	0.005	0.005	0.004
19																		DRY	DRY	0.0005	0.001	0.0005	0.0005
17												0.001	0.0005	0.001	0.002	0.002	0.003	0.001	0.0005	0.002	0.001	0.001	0.003
20																		0.001	0.0005	0.0005	0.001	0.002	0.001
21																		0.003	0.002	0.001	0.0005	0.0005	0.001
22																		DRY	DRY	DRY	DRY	0.0005	DRY
6	0.002	0.0005	0.001	0.0005	0.0005																		
8	0.002	0.0005	0.001	0.001	0.0005																		
13						0.0005	0.0005	0.0005															

3.5.5. Cadmium

Cadmium is a non-essential element and it diminishes plant growth. Cadmium is highly toxic and accumulates in the liver and kidneys of animals, and is a known carcinogen (WHO 2004). It is widely distributed in the environment at low concentrations and can be found in fairly high concentrations in wastewater and sewage sludge. Primary industrial uses for cadmium are steel plating, battery manufacture, pigments, and plastics. Other sources of cadmium include combustion, wear of tyres and brake pads, possible combustion of lubricating oils, industrial emissions, fertilisers and pesticides, corrosion of galvanised metals and landfill leachate (presumably contaminated by discarded rechargeable batteries) (IEA 2003). Fertilisers produced from phosphate ores constitute a major source of diffuse cadmium pollution. The solubility of cadmium in water is influenced by its acidity; suspended or sediment-bound cadmium may dissolve when there is an increase in acidity (WHO 2004). In natural waters, cadmium is found mainly in bottom sediments and suspended particles (WHO 2004).

The ANZECC recreational trigger value of 0.02 mg/L and the trigger value of 0.0002 mg/L for freshwater lowland rivers should not be exceeded. As the trigger values are affected by water hardness, the trigger values shown on the graph vary depending on the water hardness recorded at each site. For the details and calculations see appendix B. It is important to note that water hardness concentrations were very low and within the 'soft' range during August. These really low concentrations resulted in very low hardness modified trigger values that are much more sensitive to exceedances. In the figure this can be noticed as the trigger values adjusted for water hardness during August are commonly below the limit or reporting.

The concentrations of total cadmium exceeded the hardness adjusted trigger values at site 17 during July and August, and sites 21 and 22 during August. Sites 14, 15, 16, 19 and 20 were below the limit of reporting on all sampling occasions. Site 6 was the only site to exceed the limit of reporting for soluble cadmium, although the concentrations were still well below the hardness adjusted trigger values. All other sites were below the limit of reporting.

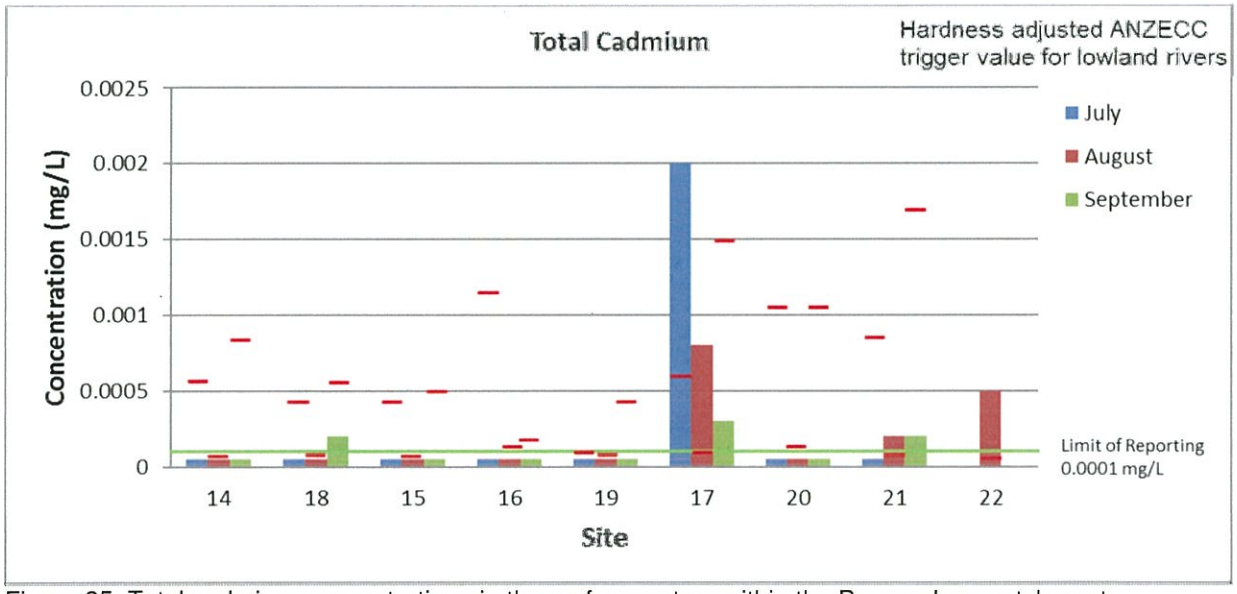


Figure 35: Total cadmium concentrations in the surface waters within the Bassendean catchment.

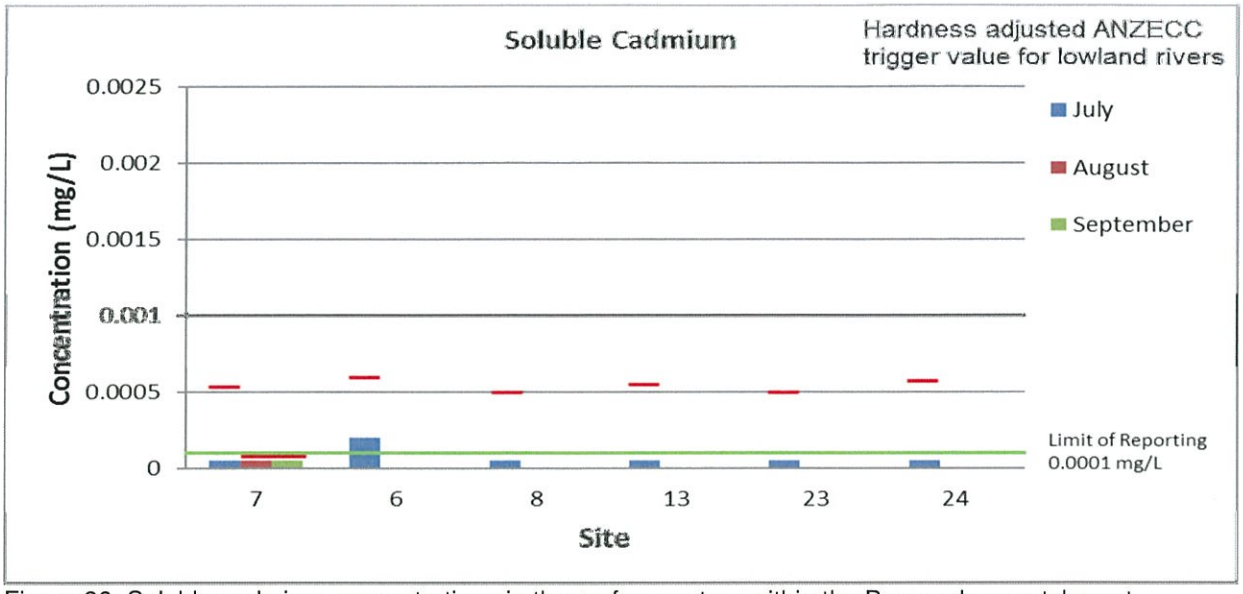


Figure 36: Soluble cadmium concentrations in the surface waters within the Bassendean catchment.

Table 22: Total cadmium concentrations recorded in the Bassendean catchment from 2010 - 2016

	LOR: 0.0001 mg/L			Exceeds adjusted trigger value for water hardness																			
Total Cadmium	2010					2011			2012			2013			2014			2015			2016		
Site Number	Jul	Aug	Sep	Oct	Nov	Jul	Aug	Sep	Jul	Aug	Sep	Jul	Aug	Sep	Aug	Sep	Oct	Jul	Aug	Sep	Jul	Aug	Sep
7	0.0003	0.00005	0.00005	0.00005	0.0012																		
14												0.0002	0.0001	0.00005		0.00005	0.00005	0.0001	0.00005	0.00005	0.00005	0.00005	0.00005
18																		0.00005	0.00005	0.00005	0.00005	0.00005	0.0002
15												0.0001	0.00005	0.0002		0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
16												0.00005	0.00005	0.00005		0.00005	0.00005	0.00005	0.00005	0.0005	0.00005	0.00005	0.00005
19																		DRY	DRY	0.00005	0.00005	0.00005	0.00005
17												0.0013	0.0003	0.0003		0.005	0.00005	0.003	0.00005	0.002	0.002	0.0008	0.0003
20																		0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
21																		0.0002	0.00005	0.00005	0.00005	0.0002	0.0002
22																		DRY	DRY	DRY	DRY	0.0005	DRY
6	0.0002	0.00005	0.00005	0.00005	0.0003																		
8	0.00005	0.00005	0.00005	0.00005	0.00005																		
13						0.00005	0.00005	0.00005															

Table 23: Soluble cadmium concentrations recorded in the Bassendean catchment from 2010 - 2016

	LOR: 0.0001 mg/L			Exceeds adjusted trigger value for water hardness																			
Soluble Cadmium	2010					2011			2012			2013			2014			2015			2016		
Site Number	Jul	Aug	Sep	Oct	Nov	Jul	Aug	Sep	Jul	Aug	Sep	Jul	Aug	Sep	Aug	Sep	Oct	Jul	Aug	Sep	Jul	Aug	Sep
7	0.0001	0.00005	0.00005	0.00005	0.0003	0.00012	0.00005	0.00005	0.00031	0.00005	0.00005	0.0001	0.00005	0.00005		0.00005	0.00005	0.0002	0.0002	0.0002	0.00005	0.00005	0.00005
6	0.0002	0.00005	0.00005	0.00005	0.00005	0.00012	0.00005	0.00005	0.00022	0.00005	0.00005	0.00005						0.00005			0.0002		
8	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005						0.00005			0.00005		
13						0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005						0.00005			0.00005		
23																		0.00005			0.00005		
24																		0.00005			0.00005		

3.5.6. Cobalt

Cobalt exists most commonly as Co^{2+} or Co^{3+}, in water. It is adsorbed to suspended particles and sediment but its solubility may be increased by complexing with organic matter, such as from sewage works (ANZECC & ARMCANZ 2000). Cobalt and its compounds are highly persistent in water and the environment. They have an acute (short-term) and chronic (long-term) toxicity on aquatic life, where they can bioaccumulate in the tissues of some aquatic organisms and plants. For humans, cobalt can have both beneficial and harmful effects, where small amounts are essential but larger doses can be harmful (Australian Government 2010).

Sources of cobalt include the chemical manufacturing industry (e.g. additives of paint, ceramics, glass, ink, enamels and fertiliser), automotive repair shops (e.g. batteries) and metal industry (in the production of steel and other alloys) (Australian Government 2010). Small amounts have been found in motor vehicle exhausts as it is used as a catalyst in the petroleum industry. The concentration of total cobalt in freshwaters is generally low. Higher concentrations are generally associated with industrialised or mining areas.

Currently no recreational trigger value or guideline exists for cobalt in surface waters, however the ANZECC trigger values for freshwater lowland rivers is 0.0028 mg/L. The concentrations of total cobalt exceeded the ANZECC trigger value at site 17 during all sampling events. All other sites did not exceed the limit of reporting.

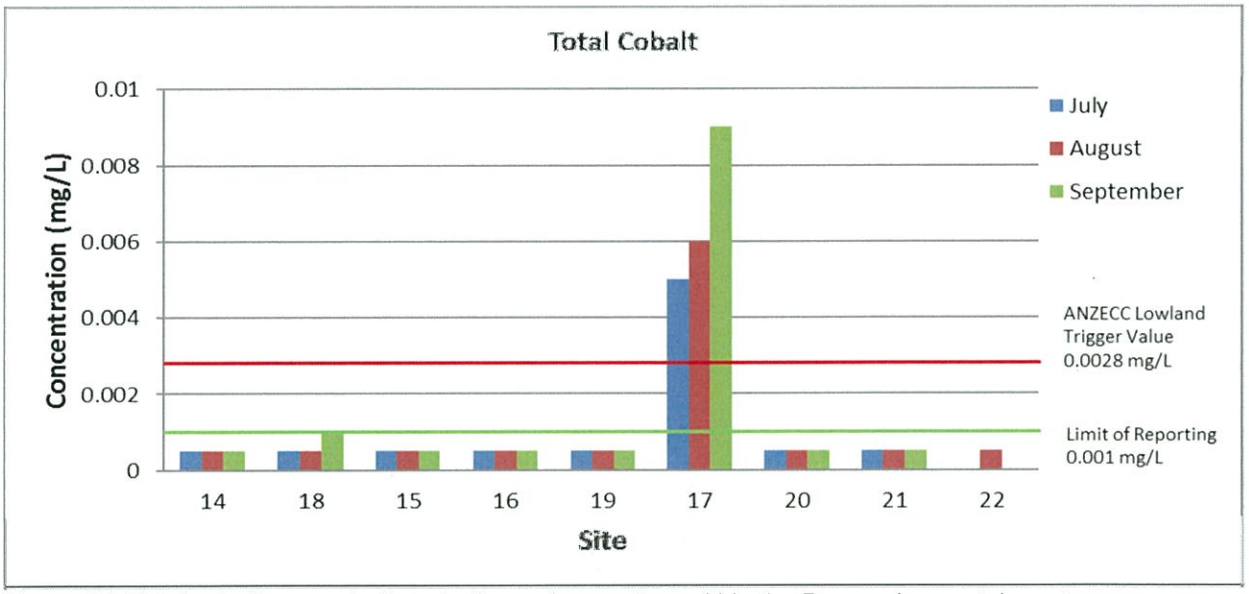


Figure 37: Total cobalt concentrations in the surface waters within the Bassendean catchment.

Table 24: Total cobalt concentrations recorded in the Bassendean catchment from 2010 - 2016

	LOR: 0.001 mg/L					ANZECC Lowland Rivers: 0.0028 mg/L			Min														
Total Cobalt	2010					2011			2012			2013			2014			2015			2016		
Site Number	Jul	Aug	Sep	Oct	Nov	Jul	Aug	Sep	Jul	Aug	Sep	Jul	Aug	Sep	Aug	Sep	Oct	Jul	Aug	Sep	Jul	Aug	Sep
7																							
14												0.0005	0.001	0.0005	0.001	0.001	0.001	0.003	0.0005	0.0005	0.0005	0.0005	0.0005
18																		0.0005	0.0005	0.0005	0.0005	0.0005	0.001
15												0.0005	0.0011	0.001	0.001	0.001	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
16												0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
19																		DRY	DRY	0.0005	0.0005	0.0005	0.0005
17												0.0037	0.015	0.006	0.034	0.025	0.013	0.016	0.0005	0.013	0.005	0.006	0.009
20																		0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
21																		0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
22																		DRY	DRY	DRY	DRY	0.0005	DRY
6																							
8																							
13						0.0005	0.0005	0.0005															

3.5.7. Copper

Copper is an abundant naturally occurring trace element found in the earth's crust that is also found in surface water as Cu^{2+} (Australian Government 2010). Copper is a micronutrient at low concentrations and is essential to virtually all plants and animals. At higher concentrations copper can become toxic to aquatic life (IEA 2003). The toxicity of copper greatly increases with decreasing water hardness and dissolved oxygen concentrations (Australian Government 2006). Sources of copper include wear of vehicle tyres and brake pads, metal industry and domestic products, mining, leather products, corrosion of brass and copper pipes, sewage treatment plant effluent, electroplating wastes, pesticides, fungicides and algicides.

The ANZECC recreational trigger value of 20 mg/L and the trigger value for freshwater lowland rivers of 0.0014 mg/L should not be exceeded. The trigger values for copper are affected by water hardness. Therefore the trigger values shown on the graph vary, dependant on the water hardness concentration recorded at each site. For the details and calculations see appendix B. It is important to note that water hardness concentrations were very low and within the 'soft' range during August. These really low concentrations resulted in very low hardness modified trigger values that are much more sensitive to exceedances. In the figure this can be noticed as the trigger values adjusted for water hardness during August are commonly below the limit or reporting and always exceeded.

Total copper was prevalent throughout the catchment and concentrations of total copper exceeded the site specific trigger value at all sites on all sampling occasions, with the exception of site 19 during September. The concentrations of soluble copper exceeded the site specific trigger value at site 7 on all sampling occasions, and at sites 6 and 8 during the snapshot monitoring in July. Sites 13, 23 and 24 exceeded the limit of reporting but did not exceed the adjusted trigger values.

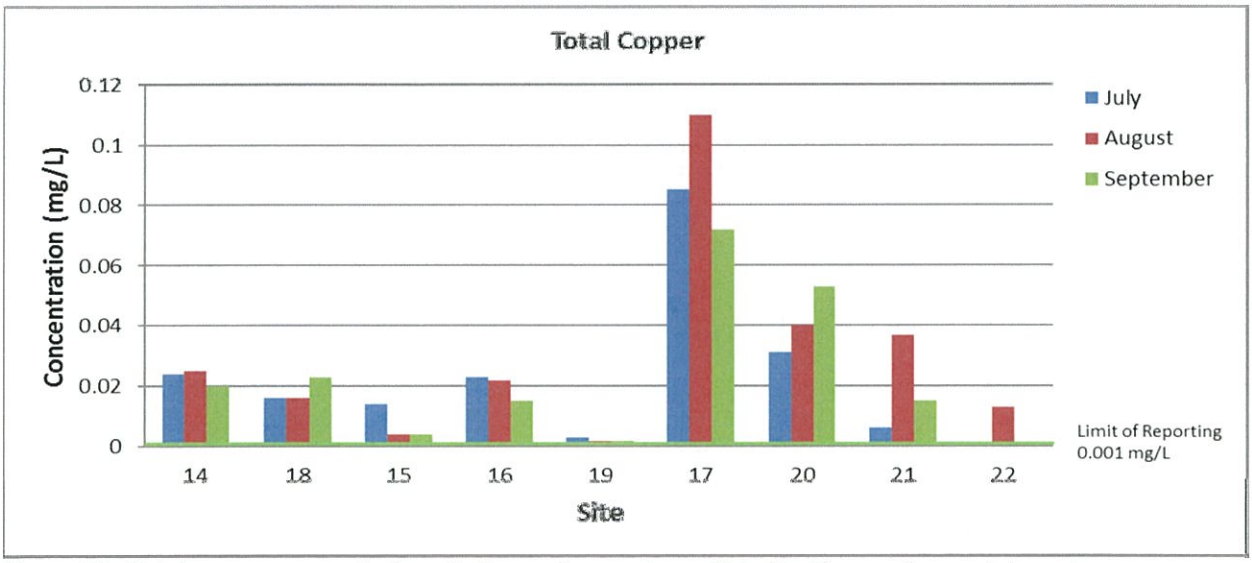


Figure 38: Total copper concentrations in the surface waters within the Bassendean catchment.

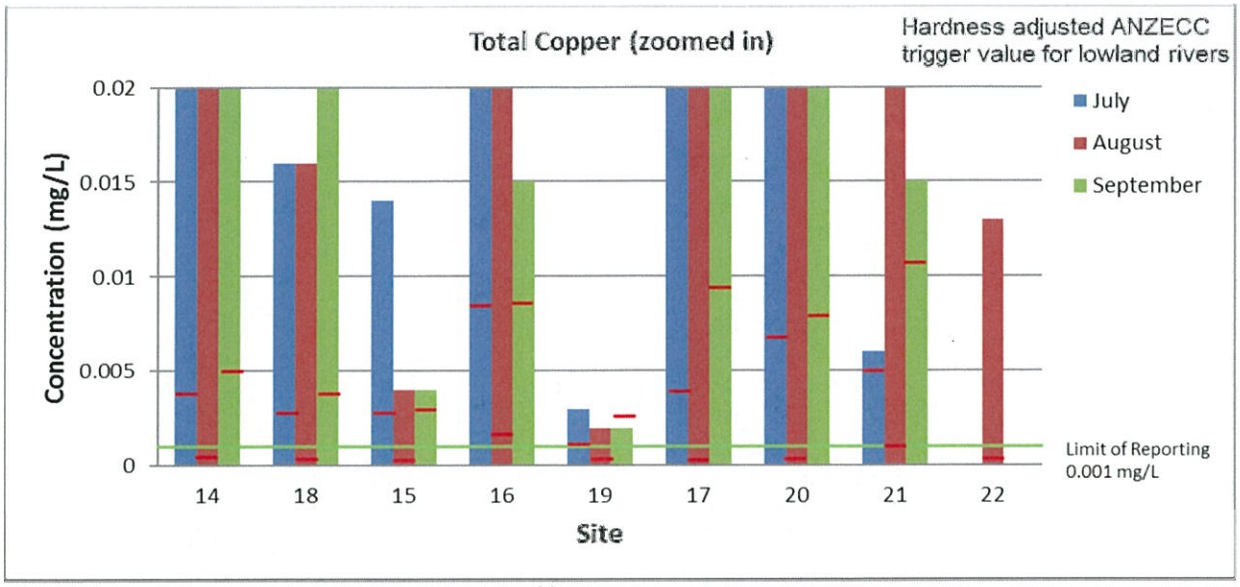


Figure 39: Total copper concentrations zoomed in.

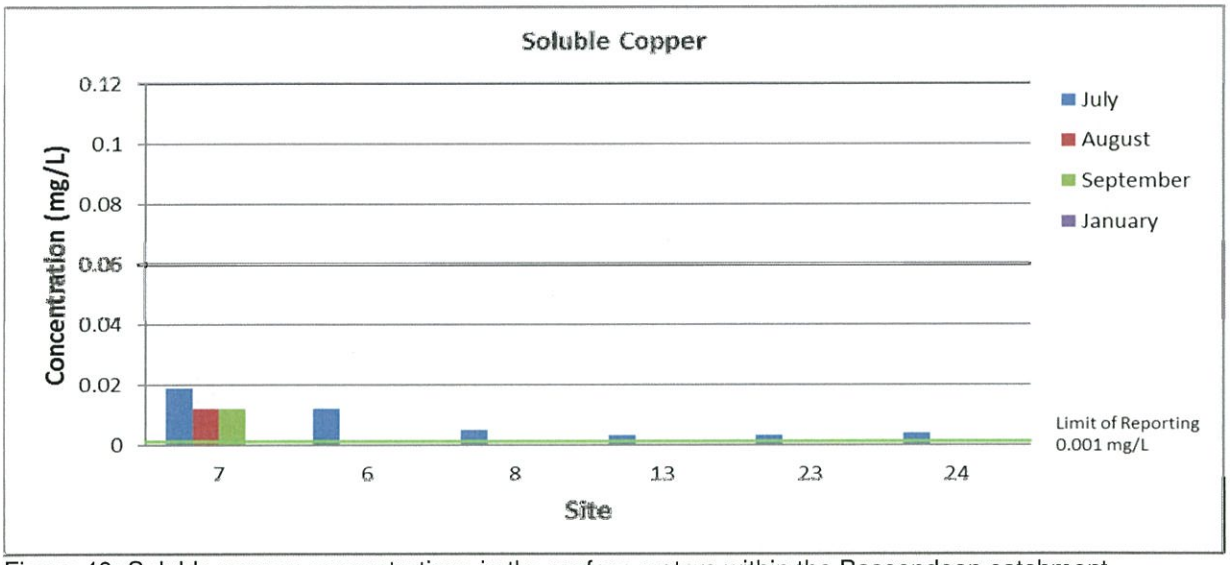


Figure 40: Soluble copper concentrations in the surface waters within the Bassendean catchment.

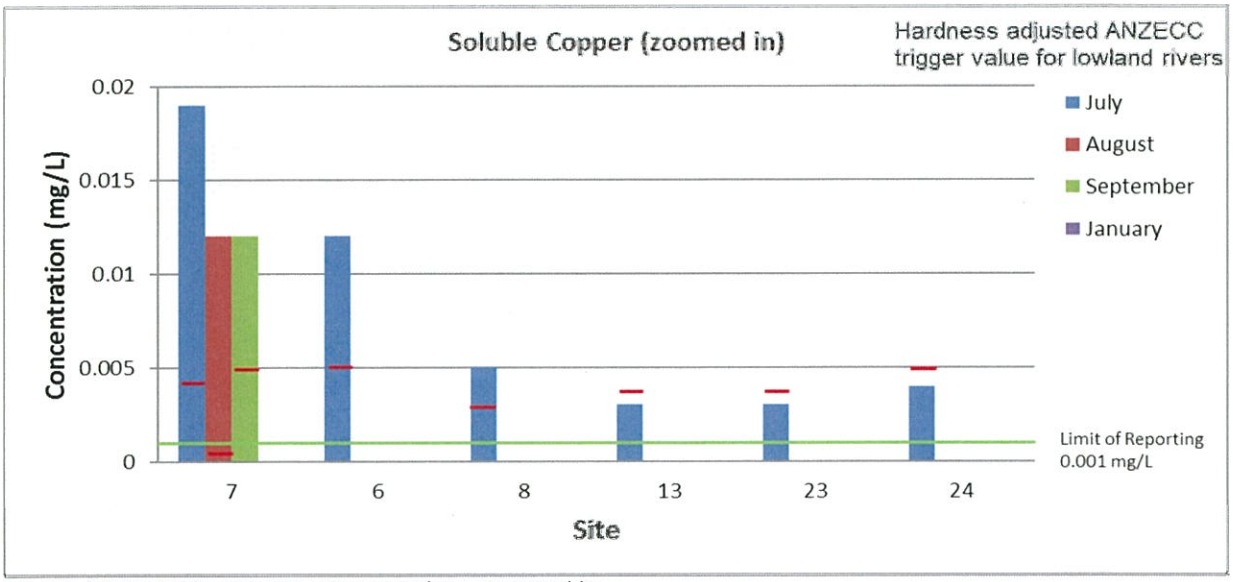


Figure 41: Soluble copper concentrations zoomed in.

Table 25: Total copper concentrations recorded in the Bassendean catchment from 2010 – 2016

	LOR= 0.001 mg/L			Exceeds adjusted trigger value for water hardness		Max																
Total Copper	2010					2011			2012			2013			2014			2015			2016		
Site Number	Jul	Aug	Sep	Oct	Nov	Jul	Aug	Sep	Jul	Aug	Sep	Jul	Aug	Sep	Aug	Sep	Oct	Jul	Aug	Sep	Jul	Aug	Sep
7	0.024	0.019	0.013	0.05	0.045																		
14												0.077	0.058	0.037	0.043	0.028	0.011	0.034	0.025	0.022	0.024	0.025	0.02
18																		0.006	0.006	0.007	0.016	0.016	0.023
15												0.031	0.032	0.049	0.01	0.015	0.004	0.013	0.013	0.017	0.014	0.004	0.004
16												0.007	0.015	0.022	0.013	0.017	0.003	0.004	0.01	0.018	0.023	0.022	0.015
19																		DRY	DRY	0.005	0.003	0.002	0.002
17												0.069	0.065	0.03	0.5	0.34	0.066	0.064	0.0005	0.011	0.085	0.11	0.072
20																		0.024	0.021	0.023	0.031	0.04	0.053
21																		0.029	0.011	0.005	0.006	0.037	0.015
22																		DRY	DRY	DRY	DRY	0.013	DRY
6	0.015	0.007	0.006	0.006	0.016																		
8	0.005	0.002	0.002	0.002	0.001																		
13						0.002	0.002	0.0005															

Table 26: Soluble copper concentrations recorded in the Bassendean catchment from 2010 - 2016

	LOR= 0.001 mg/L			Exceeds adjusted trigger value for water hardness		Max																
Soluble Copper	2010					2011			2012			2013			2014			2015			2016		
Site Number	Jul	Aug	Sep	Oct	Nov	Jul	Aug	Sep	Jul	Aug	Sep	Jul	Aug	Sep	Aug	Sep	Oct	Jul	Aug	Sep	Jul	Aug	Sep
7	0.001	0.01	0.023	0.04	0.011	0.017	0.017	0.016	0.023	0.011	0.008	0.011	0.019	0.007	0.015	0.009	0.011	0.015	0.025	0.021	0.019	0.012	0.012
6	0.001	0.005	0.004	0.005	0.008	0.019	0.007	0.006	0.009	0.0089	0.005	0.005			0.005			0.005			0.012		
8	0.004	0.002	0.002	0.002	0.002	0.003	0.004	0.003	0.002	0.002	0.003	0.003			0.002			0.002			0.005		
13						0.002	0.003	0.0005	0.002	0.0017	0.002	0.002			0.002			0.002			0.003		
23																		0.002			0.003		
24																		0.002			0.004		

3.5.8. Iron

Iron is a trace element required by both plants and animals. It may be present in natural waters in varying quantities depending upon the geology of the area and the chemical components of the waterway (ANZECC & ARMCANZ 2000). Iron is generally present in the soluble ferrous state (Fe2+) in reducing waters or insoluble ferric (Fe3+) state in surface waters, which are the primary forms of concern in the aquatic environment (ANZECC & ARMCANZ 2000). In the presence of oxygen, iron is often found as Fe3+, which may remain suspended in water or settle onto sediments and aquatic plants, which can cause problems with turbidity, decreased light penetration and smothering of benthic organisms (ANZECC & ARMCANZ 2000). The ferrous form (Fe2+) can persist in anaerobic waters and usually originates from groundwater.

Iron in domestic water supply systems stains laundry and porcelain and is more of a nuisance than a health hazard. Sources of iron in stormwater include corrosion of vehicles and drains, burning of coal, iron and steel industry emissions, landfill leachate, silt and clay particles and potable water supplies (Recycled Organics Unit 2007).

The ANZECC recreational trigger value of 3 mg/L and the environmental protection trigger value for freshwater lowland rivers of 0.3 mg/L should not be exceeded. The total iron concentrations in the surface waters of the Bassendean catchment were high with sites 14, 15, 16 and 17 exceeding the freshwater lowland trigger value on all sampling occasions, and at sites 18, 19, 20 and 21 exceeding it on one or more sampling occasions. The higher ANZECC recreational trigger value was also exceeded at sites 14, 18, 16 and 17 exceeding the recreational trigger value on one or more sampling occasions. Of particular concern was site 17 recording concentrations more than 10 and 13 times the lowland trigger value during August and September respectively, whilst site 22 was on the other end of the scale and did not exceeded the trigger value. Concentrations of soluble iron exceeded the ANZECC lowland trigger value at all sites and sampling occasions, but did not exceed the recreational trigger value.

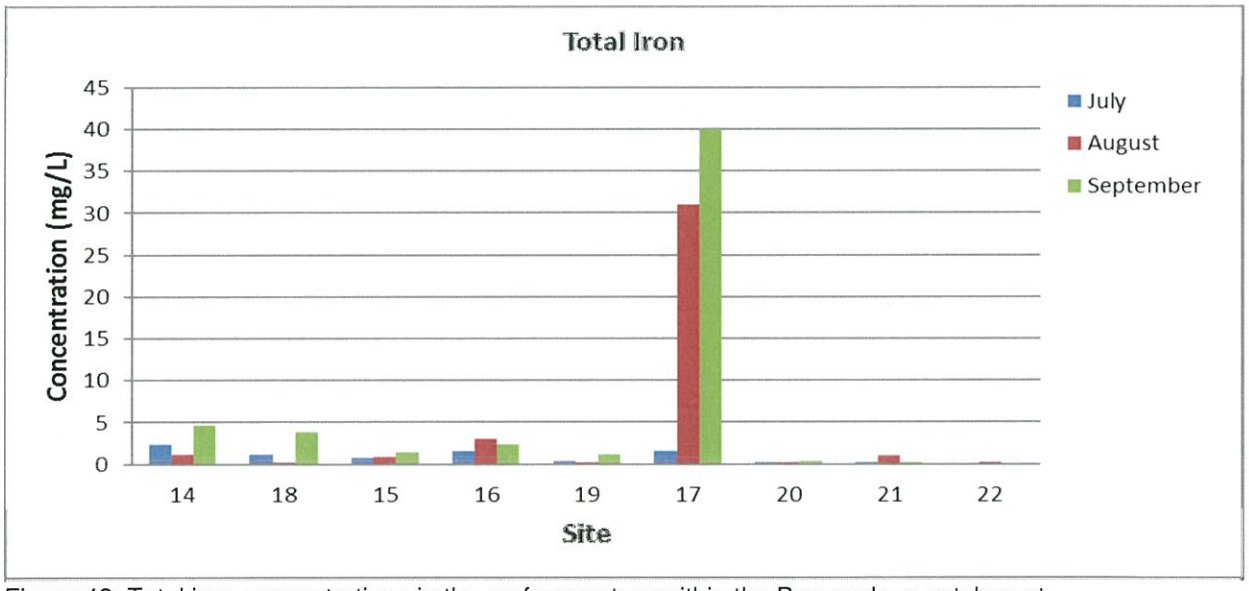


Figure 42: Total iron concentrations in the surface waters within the Bassendean catchment.

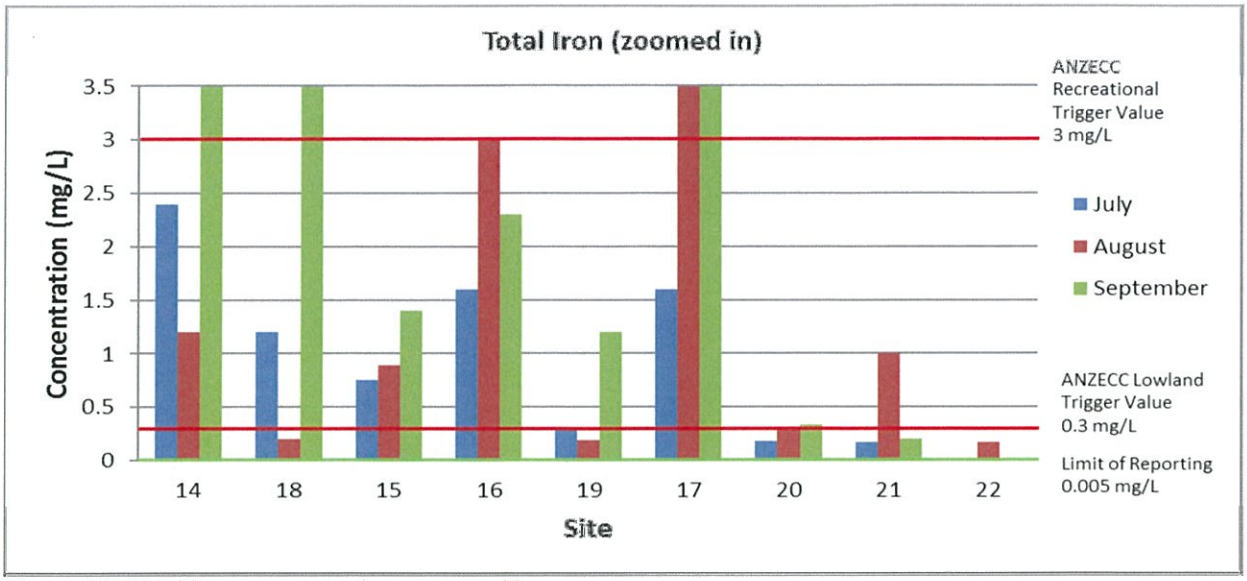


Figure 43: Total iron concentrations zoomed in.

Figure 44: Soluble iron concentrations in the surface waters within the Bassendean catchment.

Table 27: Total iron concentrations recorded in the Bassendean catchment from 2010 - 2016

	LOR: 0.005 mg/L			ANZECC Freshwater: 0.3 mg/L					ANZECC Recreational: 3 mg/L					Min	Max								
Total Iron	2010					2011			2012			2013			2014			2015			2016		
Site Number	Jul	Aug	Sep	Oct	Nov	Jul	Aug	Sep	Jul	Aug	Sep	Jul	Aug	Sep	Aug	Sep	Oct	Jul	Aug	Sep	Jul	Aug	Sep
7	4	8.3	6.6	2.3	3.2																		
14												3.1	4.7	3.5	8.8	7.1	7.9	10	2.9	3.3	2.4	1.2	4.6
18																		9.4	3.4	2.8	1.2	0.2	3.8
15												0.97	1.1	0.92	1.1	1.5	0.67	1	2.6	1.2	0.75	0.89	1.4
16												0.3	1.1	3.9	1.3	1.5	0.77	0.91	0.033	1.6	1.6	3	2.3
19																		DRY	DRY	0.31	0.29	0.19	1.2
17												1.1	19	5.1	2.9	2.1	4.3	1.9	9.8	4.2	1.6	31	40
20																		0.19	0.097	0.24	0.18	0.28	0.34
21																		1.5	1.5	1.1	0.17	1	0.2
22																		DRY	DRY	DRY	DRY	0.17	DRY
6	1.2	2.1	1.3	0.72	0.6																		
8	0.87	0.92	1	1.2	1.1																		
13						2.6	2.2	2.6															

Table 28: Soluble iron concentrations recorded in the Bassendean catchment from 2010 - 2016

	LOR: 0.005 mg/L			ANZECC Freshwater: 0.3 mg/L					ANZECC Recreational: 3 mg/L					Min	Max								
Soluble Iron	2010					2011			2012			2013			2014			2015			2016		
Site Number	Jul	Aug	Sep	Oct	Nov	Jul	Aug	Sep	Jul	Aug	Sep	Jul	Aug	Sep	Aug	Sep	Oct	Jul	Aug	Sep	Jul	Aug	Sep
7	1.8	6.8	5	1.3	3.4	0.97	2.8	3.3	3	3.7	3.8	0.48	2.3	1.5	4	4.2	3.9	4.5	2.7	2	1.5	2.2	2.3
6	0.84	1	0.63	0.44	0.34	0.61	0.94	0.64	0.43	0.52	0.59	0.54			1			0.61			0.55		
8	0.5	0.48	0.52	0.57	0.63	0.46	0.61	0.62	0.59	0.54	0.56	0.46			0.51			0.6			0.45		
13						1.9	1.7	1.8	1.6	1.8	1.4	0.75			3			3.5			1.1		
23																		2.7			0.68		
24																		0.93			0.44		

3.5.9. Lead

Lead is not an essential element as it bioaccumulates in animals and plants and is highly poisonous. Lead persists in the environment for long periods and does not readily breakdown (Australian Government 2010). Lead reaches water bodies either through urban runoff or discharges such as sewage treatment plants and industrial plants. It may also be transferred from the air to surface water through precipitation.

Major modern day uses of lead are for batteries, pigments, and other metal products. In the past lead was used as an additive in gasoline and became dispersed throughout the environment as a result of automobile exhaust emissions. However, since the replacement of leaded gasoline with unleaded gasoline in the mid-1980's, lead from that source has virtually disappeared. The primary sources of lead in urban stormwater now include petrol additives, tyres, industrial and mining emissions, manufacturing and smelting industries, lead water pipes and soldered joints, burning of fossil fuels, plastic pipes and guttering, and paints (IEA 2003).

The ANZECC recreational trigger value of 0.1 mg/L and the trigger value of 0.0034 mg/L for freshwater lowland rivers should not be exceeded. The trigger values for lead are affected by water hardness. Therefore the trigger values are variable, dependent on the water hardness concentration recorded at each site (Appendix B for details). It is important to note that water hardness concentrations were very low and within the 'soft' range during August. These really low concentrations resulted in very low hardness modified trigger values that are much more sensitive to exceedances. In the figure this can be noticed as the trigger values adjusted for water hardness during August are commonly below the limit or reporting.

The concentrations of total lead in the surface waters of the Bassendean catchment exceeded the site specific trigger values at sites 14, 18, 15, 16, 19, 21 and 22 during August. Site 14 also exceeded the trigger value during July.

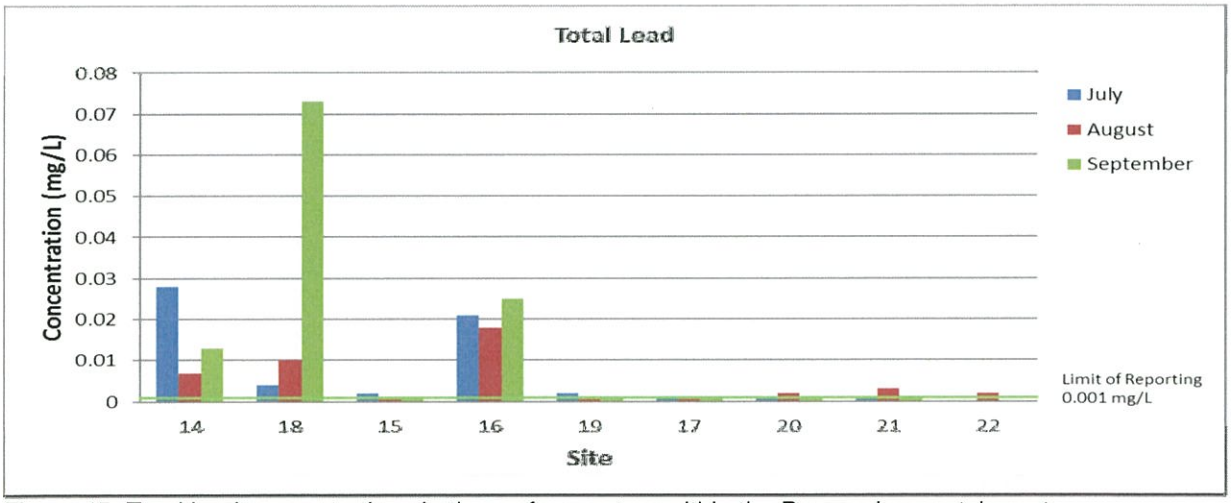


Figure 45: Total lead concentrations in the surface waters within the Bassendean catchment.

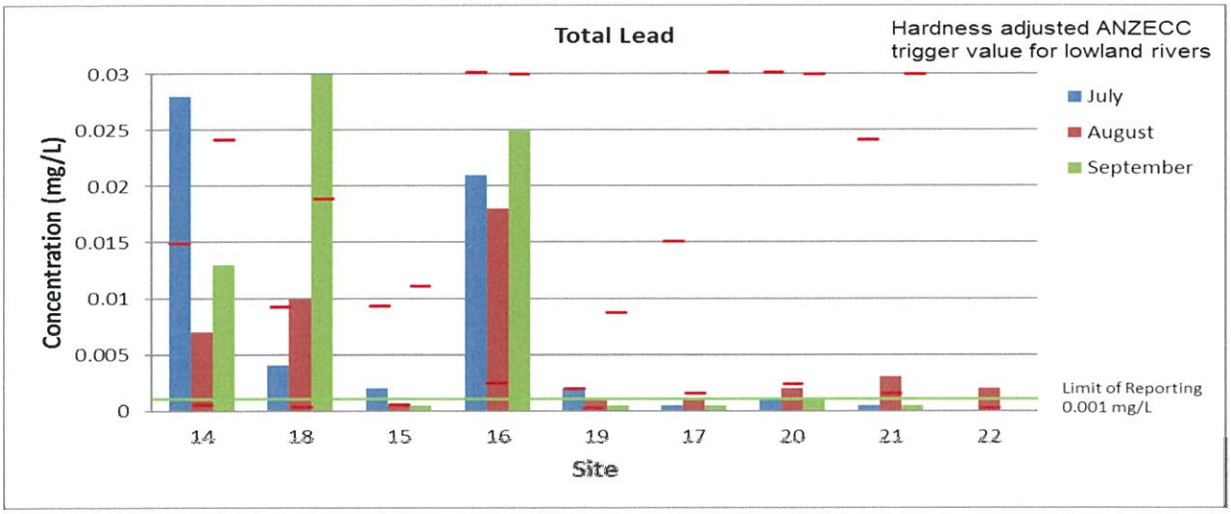


Figure 46: Total lead concentrations zoomed in.

Table 29: Total lead concentrations recorded in the Bassendean catchment from 2010 - 2016

LOR= 0.001 mg/L Exceeds adjusted trigger value for water hardness

Total Lead	2010					2011			2012			2013			2014			2015			2016		
Site Number	Jul	Aug	Sep	Oct	Nov	Jul	Aug	Sep	Jul	Aug	Sep	Jul	Aug	Sep	Aug	Sep	Oct	Jul	Aug	Sep	Jul	Aug	Sep
7	0.005	0.017	0.012	0.008	0.005																		
14												0.056	0.043	0.022	0.064	0.029	0.015	0.003	0.02	0.017	0.028	0.007	0.013
18																		0.005	0.005	0.005	0.004	0.01	0.073
15												0.002	0.0031	0.003	0.001	0.0005	0.0005	0.001	0.002	0.001	0.002	0.0005	0.0005
16												0.006	0.019	0.029	0.044	0.034	0.008	0.012	0.025	0.033	0.021	0.018	0.025
19																		DRY	DRY	0.002	0.002	0.001	0.0005
17												0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.001	0.0005	0.001	0.0005
20																		0.002	0.0005	0.001	0.001	0.002	0.001
21																		0.01	0.004	0.001	0.0005	0.003	0.0005
22																		DRY	DRY	DRY	DRY	0.002	DRY
6	0.003	0.002	0.002	0.001	0.001																		
8	0.0005	0.0005	0.0005	0.0005	0.0005																		
13						0.001	0.002	0.0024															

3.5.10. Manganese

Manganese is commonly associated with dissolved ferrous iron and is a naturally occurring component of groundwater (Department of Environment 2004). Other sources of manganese to waterways include wear of tyres and brake pads, steel manufacturing, manufacture of dyes and paints, agricultural and gardening applications, alkaline and dry cell batteries, some fertilisers and some disinfectants (Recycled Organics Unit 2007). Manganese is a vital micro-nutrient for both plants and animals. When not present in sufficient quantities, plants exhibit a yellowing of leaves (chlorosis) or failure of the leaves to develop properly. Inadequate quantities of manganese in domestic animal food result in reduced reproduction and deformed or poorly maturing young. Permanganates have been reported to kill fish in 8 to 18 hours at concentrations of 2.2 to 4.1 mg/L, but they are not persistent.

The ANZECC recreational trigger value of 5 mg/L and the trigger value of 1.9 mg/L for freshwater lowland rivers should not be exceeded.

The concentrations of total manganese in the surface waters of the Bassendean catchment did not exceed the ANZECC recreational or lowland trigger values on any sampling occasions. All sites recorded concentrations above the limit of reporting.

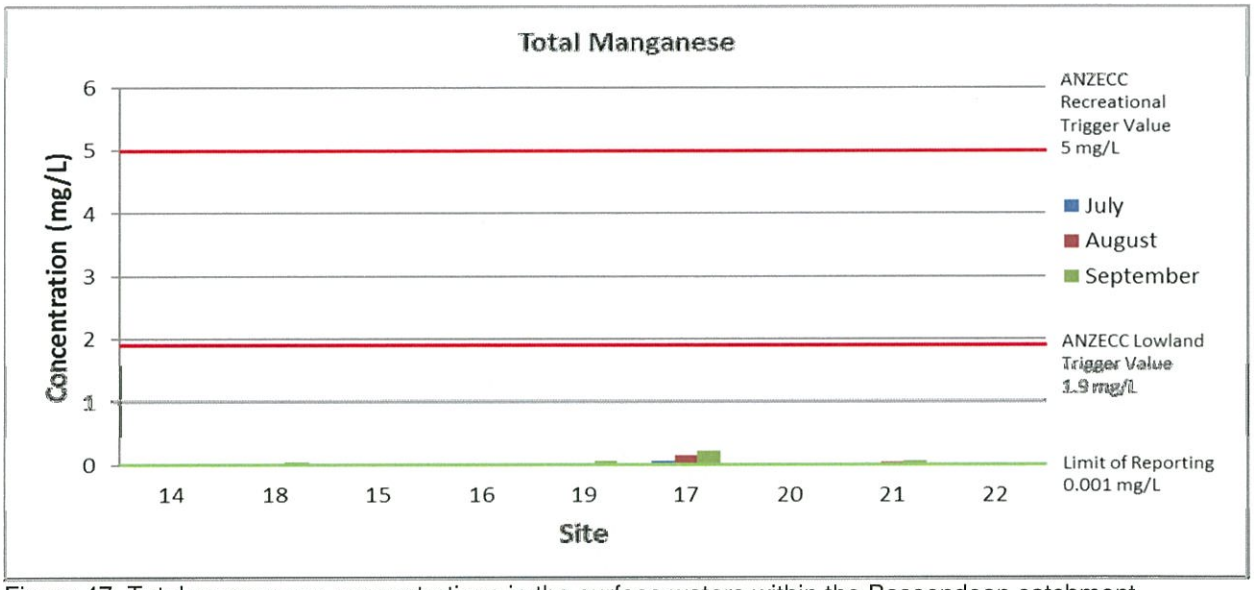


Figure 47: Total manganese concentrations in the surface waters within the Bassendean catchment.

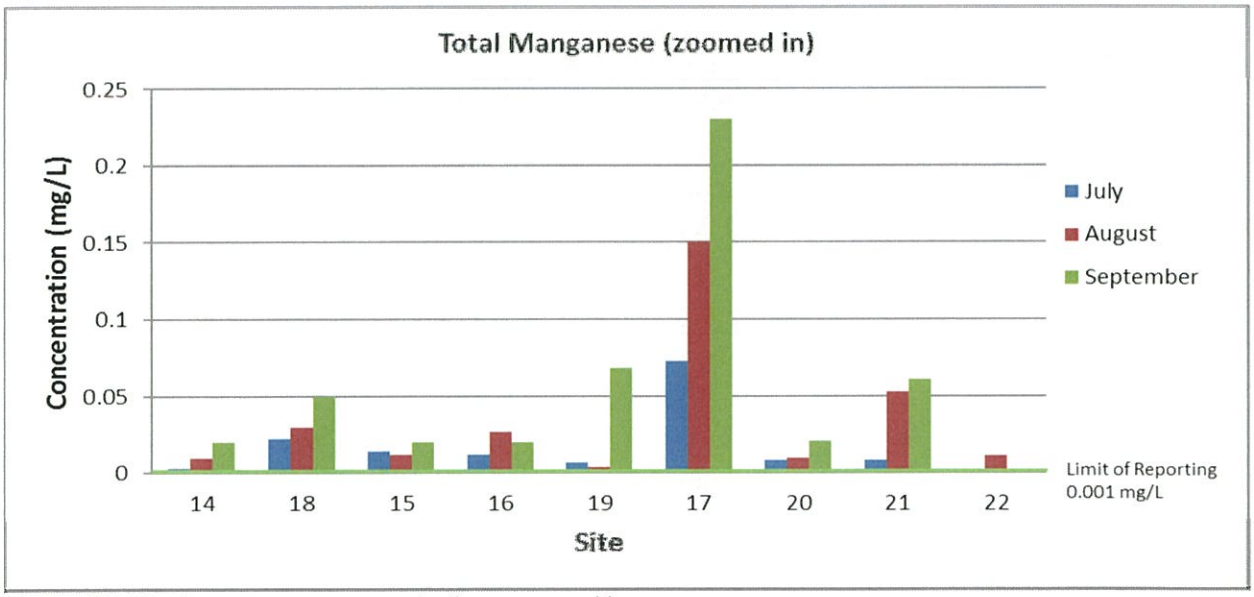


Figure 48: Total manganese concentrations zoomed in.

Table 30: Total manganese concentrations recorded in the Bassendean catchment from 2010 - 2016

	LOR: 0.001 mg/L			ANZECC Lowland Rivers: 1.9 mg/L						ANZECC Recreational: 5 mg/L														
Total Manganese	2010					2011			2012			2013			2014			2015			2016			
Site Number	Jul	Aug	Sep	Oct	Nov	Jul	Aug	Sep	Jul	Aug	Sep	Jul	Aug	Sep	Aug	Sep	Oct	Jul	Aug	Sep	Jul	Aug	Sep	
7																								
14												0.004	0.006	0.006	0.01	0.009	0.012	0.041	0.004	0.004	0.003	0.01	0.02	
18																		0.05	0.042	0.024	0.022	0.03	0.05	
15												0.016	0.017	0.018	0.018	0.02	0.018	0.017	0.027	0.018	0.014	0.012	0.02	
16												0.008	0.009	0.038	0.006	0.007	0.017	0.025	0.0005	0.011	0.012	0.027	0.02	
19																		DRY	DRY	0.008	0.007	0.004	0.068	
17												0.041	0.29	0.18	0.29	0.24	0.15	0.12	0.11	0.17	0.073	0.15	0.23	
20																		0.0026	0.0059	0.055	0.008	0.01	0.021	
21																		0.014	0.024	0.03	0.008	0.053	0.061	
22																		DRY	DRY	DRY	DRY	0.011	DRY	
6																								
8																								
13						0.065	0.069	0.079																

3.5.11. Zinc

Zinc bioaccumulates easily in plants and animals and is mostly associated with dissolved solids, although it will adsorb to suspended particles. Zinc is found naturally in many rock-forming minerals and is an essential element in the diet. It is not considered very toxic to humans or other organisms. Sources of zinc in storm water include wear from tyres and brake pads, combustion of lubricating oils, and corrosion of galvanised roofs, pipes and other metal objects (IEA 2003). Because of its use in the vulcanisation of rubber, it is generally found at higher levels near highways. It also may be present in industrial discharges. It is found in batteries, plastics, wood preservatives, antiseptics and in rat and mouse poison (zinc phosphide).

The ANZECC recreational trigger value of 30 mg/L and the trigger value of 0.008 mg/L for freshwater lowland rivers should not be exceeded. The trigger values for zinc are affected by water hardness. Therefore the trigger values shown on the graph are variable, dependent on the water hardness concentration recorded at each site. For the details and calculations see appendix B. It is important to note that water hardness concentrations were very low and within the 'soft' range during August. These really low concentrations resulted in very low hardness modified trigger values that are much more sensitive to exceedances.

The concentrations of total zinc were high and exceeded the site specific trigger values at sites 18, 19, 17, 21 and 22 on all sampling occasions. Sites 14 and 15 also exceeded the adjusted trigger value during July and August. The soluble zinc concentrations exceeded the site specific trigger values at all sites during all sampling events.

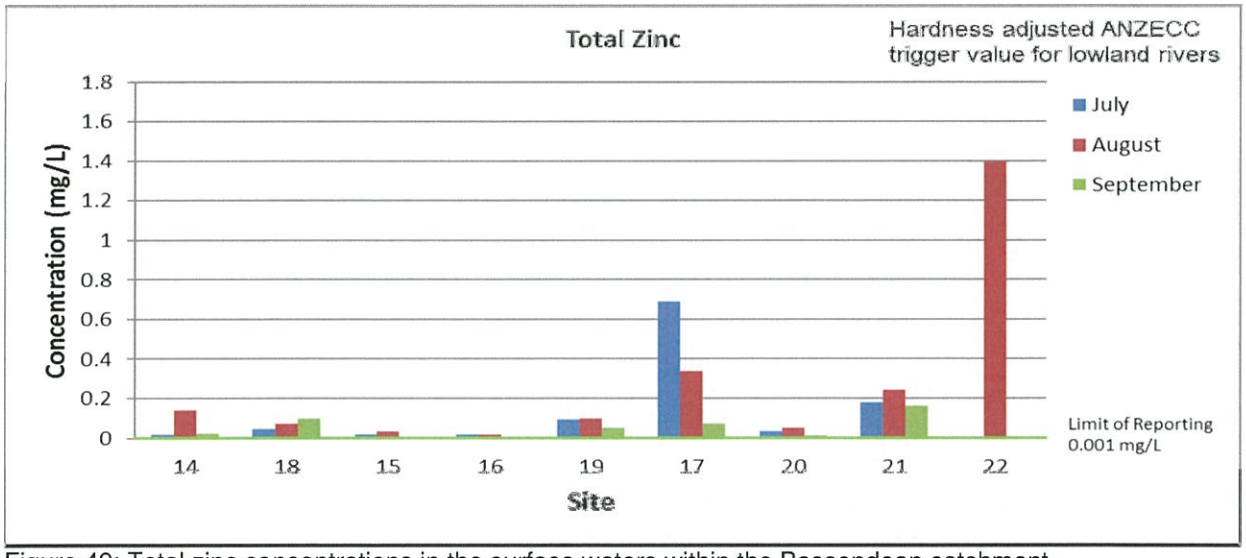


Figure 49: Total zinc concentrations in the surface waters within the Bassendean catchment.

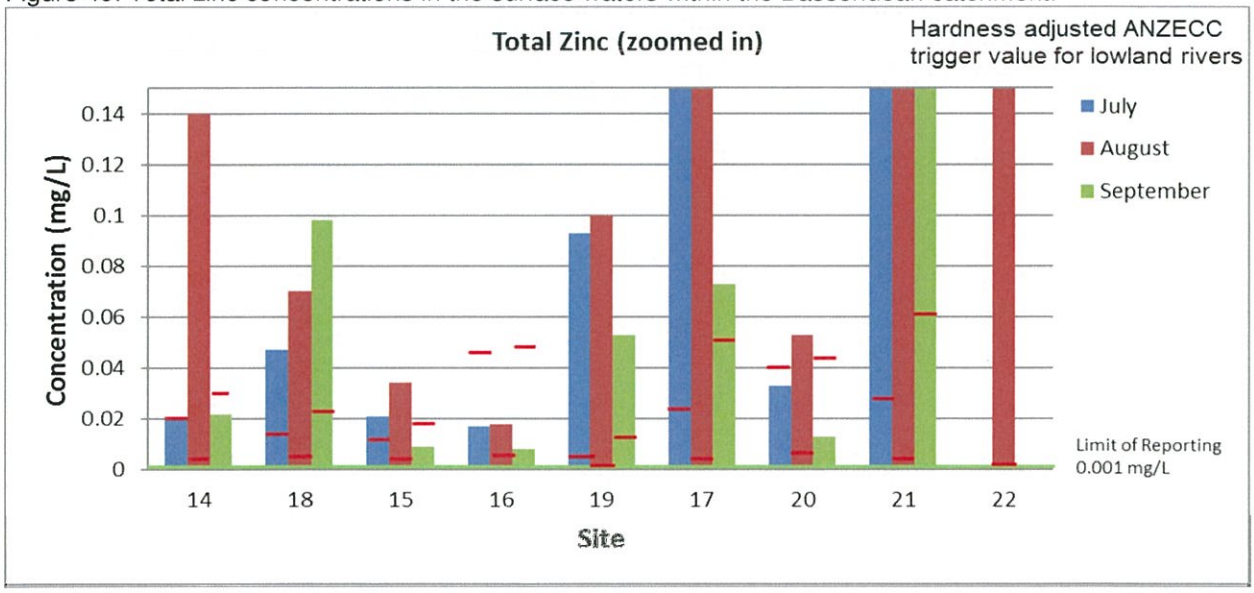


Figure 50: Total zinc concentrations zoomed in.

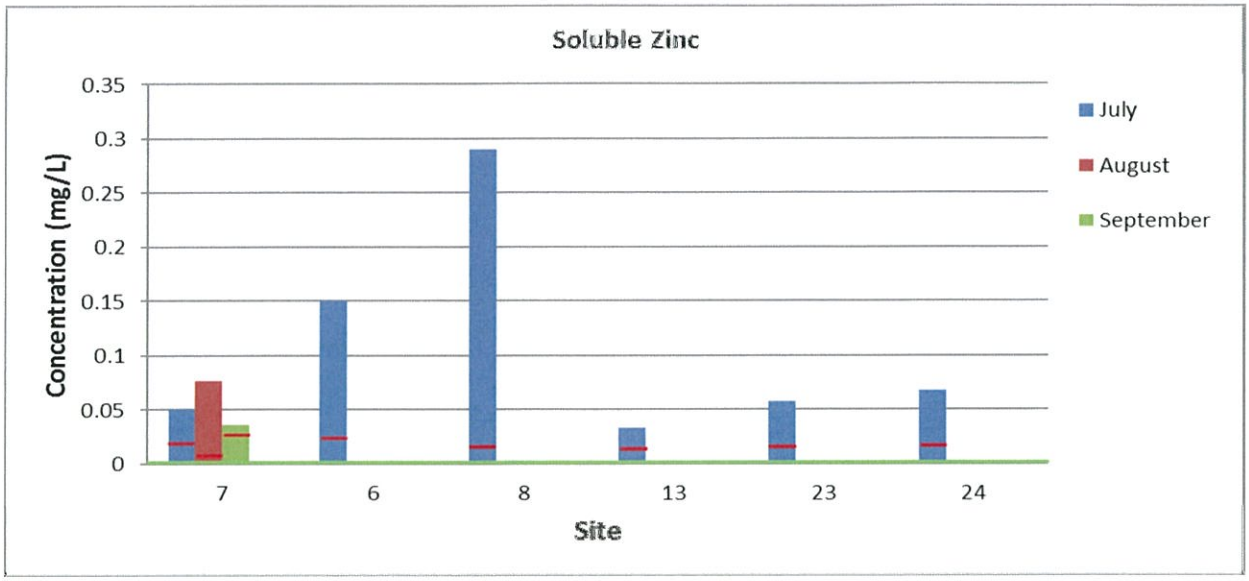


Figure 51: Soluble zinc concentrations in the surface waters within the Bassendean catchment.

Table 31: Total zinc concentrations recorded in the Bassendean catchment from 2010 - 2016

	LOR= 0.001 mg/L			Exceeds adjusted trigger value for water hardness							Max											
Total Zinc	2010					2011			2012			2013			2014			2015			2016		
Site Number	Jul	Aug	Sep	Oct	Nov	Jul	Aug	Sep	Jul	Aug	Sep	Jul	Aug	Sep	Aug	Sep	Oct	Jul	Aug	Sep	Jul	Aug	Sep
7	0.22	0.04	0.03	0.07	0.84																		
14												0.052	0.047	0.03	0.037	0.024	0.029	0.22	0.02	0.02	0.021	0.14	0.022
18																		0.007	0.019	0.02	0.04	0.07	0.098
15												0.071	0.041	0.11	0.015	0.013	0.012	0.02	0.036	0.02	0.021	0.034	0.009
16												0.021	0.01	0.02	0.009	0.01	0.008	0.018	0.0005	0.05	0.017	0.018	0.008
19																		DRY	DRY	0.07	0.093	0.1	0.053
17												0.53	0.25	0.25	3.7	2.3	0.13	1.6	1.1	1	0.69	0.34	0.073
20																		0.024	0.023	0.04	0.033	0.053	0.013
21																		0.14	0.085	0.09	0.18	0.24	0.16
22																		DRY	DRY	DRY	DRY	1.4	DRY
6	0.23	0.09	0.07	0.09	0.23																		
8	0.39	0.42	0.49	0.45	0.38																		
13						0.033	0.037	0.012															

Table 32: Soluble zinc concentrations recorded in the Bassendean catchment from 2010 - 2016

	LOR= 0.001 mg/L			Exceeds adjusted trigger value for water hardness							Max											
Soluble Zinc	2010					2011			2012			2013			2014			2015			2016		
Site Number	Jul	Aug	Sep	Oct	Nov	Jul	Aug	Sep	Jul	Aug	Sep	Jul	Aug	Sep	Aug	Sep	Oct	Jul	Aug	Sep	Jul	Aug	Sep
7	0.16	0.03	0.05	0.06	0.47	0.074	0.048	0.033	0.24	0.052	0.036	0.19	0.045	0.12	0.046	0.041	0.024	0.19	0.14	0.22	0.05	0.077	0.036
6	0.22	0.07	0.06	0.09	0.21	0.24	0.19	0.11	0.21	0.13	0.1	0.13			0.075			0.087			0.15		
8	0.37	0.41	0.47	0.42	0.36	0.4	0.51	0.5	0.33	0.33	0.36	0.35			0.45			0.3			0.29		
13						0.032	0.033	0.011	0.03	0.029	0.023	0.036			0.016			0.024			0.033		
23																		0.035			0.058		
24																		0.05			0.068		

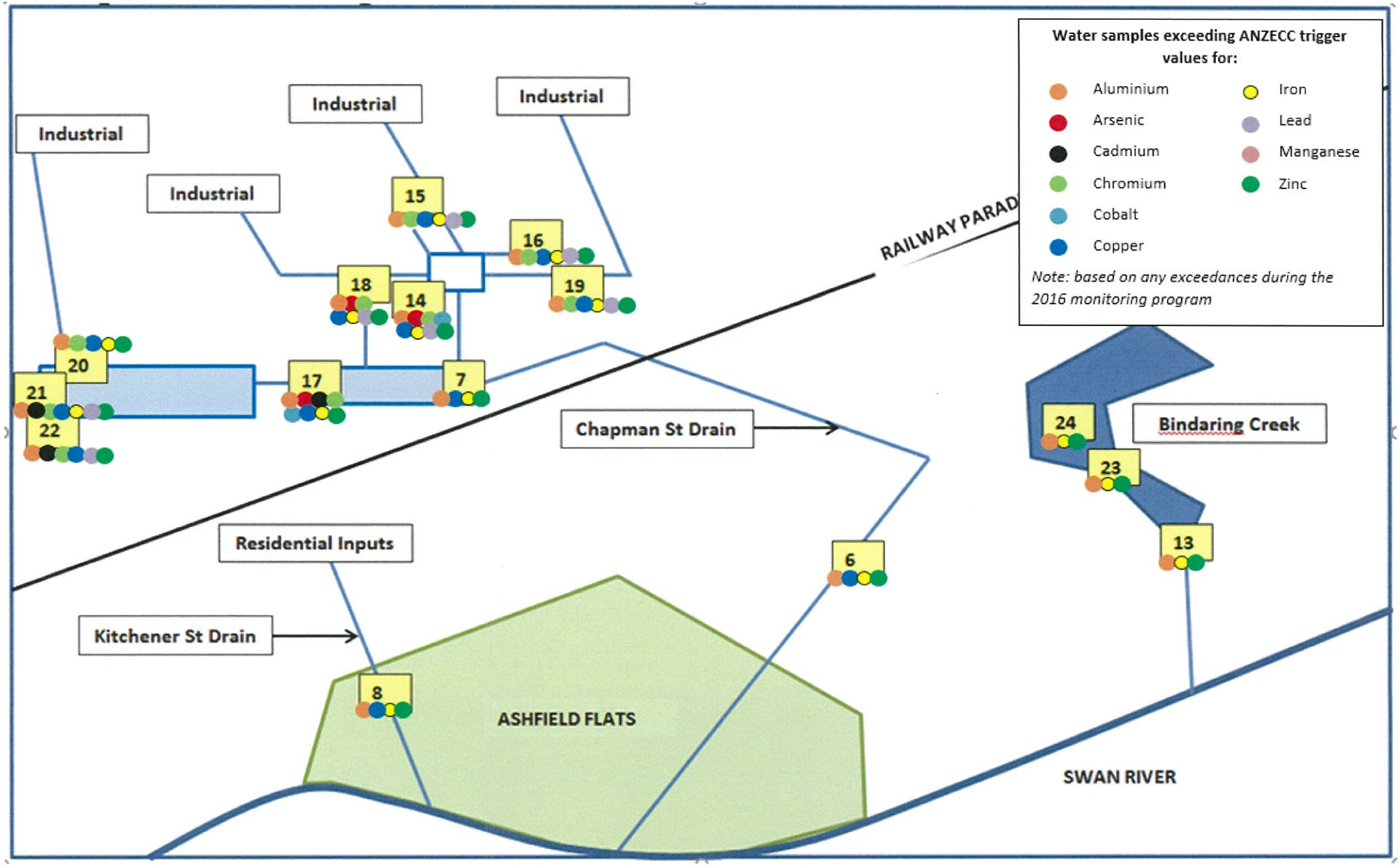


Figure 52: Water samples where metal concentrations exceeded the appropriate ANZECC trigger values or water hardness adjusted trigger values in 2016

3.5.12. Summary of Results

Using the number of instances where the ANZECC guidelines were exceeded, the industrial sites 7, 14, 18 and 17 were of most concern. Site 17 is of particular concern given the detection of cadmium and the highest concentrations of arsenic.

Total:

- The ANZECC freshwater trigger value for total **aluminium** was exceeded at all sites on one or more sampling occasions. Sites 14, 18, 15, 16, 19 and 20 also exceeded the recreational trigger value on one or more sampling occasions.
- The ANZECC freshwater trigger value for total **arsenic** was exceeded at sites 18 and 17 during all sampling events and site 14 during July and September. The higher ANZECC recreational trigger value was also exceeded at site 18 during September and site 17 during August and September (September recording the highest concentration at site 17).
- The adjusted trigger values for total **cadmium** were exceeded at site 17 during July and August, and sites 21 and 22 during August.
- The adjusted trigger values for total **chromium** were exceeded at sites 14, 18, 15, 16, 19, 17, 20, 21 and 22 during August. Site 19 also equaled the hardness adjusted trigger value during July.
- The ANZECC freshwater trigger value for total **cobalt** was exceeded at site 17 during all sampling events.
- The adjusted trigger values for total **copper** were exceeded at all sites on all sampling occasions, with the exception of site 19 during September.
- The ANZECC freshwater trigger value for total iron was exceeded at sites 14, 15, 16 and 17 on all sampling occasions, and at sites 18, 19, 20 and 21 on one or more sampling occasions. The higher ANZECC recreational trigger value was also exceeded at sites 14, 18, 16 and 17 exceeding the recreational trigger value on one or more sampling occasions, with site 17 of most concern.
- The adjusted trigger values for total **lead** were exceeded at sites 14, 18, 15, 16, 19, 21 and 22 during August. Site 14 also exceeded the trigger value during July.
- The adjusted trigger values for total **zinc** were exceeded at sites 18, 19, 17 and 21 on all sampling occasions. Sites 14 and 15 also exceeded the adjusted trigger values during July and August, and sites 16, 20 and 22 exceeded the adjusted trigger values during August.

Soluble:

- The ANZECC freshwater trigger value for soluble **aluminium** was exceeded at all sites. Site 7 also exceeded the higher recreational trigger value during July and September, and sites 6, 8 and 23 also exceeded the recreational trigger value during July.
- The adjusted trigger values for soluble **copper** were exceeded at site 7 on all sampling occasions, and at sites 6 and 8 during the snapshot monitoring in July.
- The ANZECC lowland trigger value for soluble **iron** was exceeded at all sites during all sampling events.
- The adjusted trigger values for soluble **zinc** were exceeded at all sites during all sampling events.

3.5.13. Discussion

It is difficult to compare the sites completely in terms of the number of exceedances as the new sites were only sampled for total metals, whilst the existing sites (6, 7, 8 and 13) were sampled for soluble metals. Sites 23 and 24 were only added to the program in 2015 and were also sampled for soluble metals to keep consistency in the data for the Town of Bassendean officers investigating restoration options for Bindaring Creek.

For this reason, the industrial sites 14, 18, 15, 16, 19, 17, 20, 21 and 22 were compared against each other; sites 7, 6, 8 and 13 were compared against each other; and sites 23 and 24 were looked at separately with site 13. However, site 7 was also looked at closely in comparison to the industrial sites and whilst in previous years it was seen as the site of worst quality, the new sites that feed into site 7 have proven to actually be of most concern.

In comparison to the other sites, site 17 recorded the highest concentrations of arsenic, cadmium, cobalt, copper, iron and zinc, and it also recorded concentrations of aluminium and chromium.

Sites 14 and 18 both recorded concentrations exceeding the guidelines of aluminium, arsenic, chromium, copper, iron, lead and zinc. This is to be expected as they are within close proximity to each other, and the

surrounding industrial premises should be investigated for potential sources of some of these metals, particularly arsenic, chromium and lead.

It is interesting to note that cadmium was of most concern at site 17, but also exceeded the hardness modified trigger values at sites 21 and 22. These sites feed into site 17 (the inlet to the compensating basin off railway parade). The outlet of this compensating basin (site 7) however, did not exceed the hardness modified trigger values and was in fact below detection limits.

Iron was consistently elevated at all sites, but especially at site 17. Whilst these levels were above the ANZECC trigger value, iron is a naturally occurring and widespread metal in WA and is not a main concern like arsenic and cadmium.

The original sites generally displayed the same elevated concentrations as previous years. Site 7 recorded the highest soluble iron and copper concentrations and also elevated concentrations of aluminium and zinc. Site 6 recorded elevated concentrations of aluminium, copper, iron and zinc. Site 8 recorded the highest concentration of aluminium and zinc and also elevated concentrations of copper and iron. Sites 13, 23 and 24 recorded elevated concentrations of aluminium, iron and zinc.

Following the results from this year's monitoring program, the metals that are of concern at the new sites will be retained in next year's program and may be sampled as 'solubles'. The metals explained in detail below were those that were of concern in 2016:

Aluminium:
Concentrations of soluble aluminium at sites 7, 6, 8 and 13 exceeded the freshwater trigger value. Site 7 also exceeded the higher recreational trigger value during July and September, and sites 6, 8 and 23 exceeded the it during July. The ANZECC freshwater trigger value for total **aluminium** was exceeded at all sites on one or more sampling occasions. Sites 14, 18, 15, 16, 19 and 20 also exceeded the higher recreational trigger value on one or more sampling occasions. These sites are located within the industrial section of the Bassendean catchment and it is likely the high aluminium concentrations are contributed to the system from the surrounding industries. In Bassendean these industries may include car wreckers, building product suppliers, automotive repair shops, sheet metal and fabrication facilities and aluminium and chrome product suppliers. Anthropogenic releases are in the form of air emissions, waste water effluents, and solid waste primarily associated with industrial processes, such as aluminium production. However, aluminium is the most abundant metal and the third most abundant element in the earth's crust, therefore natural weathering processes exceed the contribution of releases to air, water, and land associated with human activities (Lantzy and MacKenzie 1979). Whilst it is a natural element, aluminium is toxic to fish in acidic, un-buffered waters starting at a concentration of 0.1 mg/L. Aluminium is generally more toxic over the pH range 4.4 – 5.4, with a maximum toxicity occurring around pH 5.0 – 5.2 (ANZECC 2000). The lowest pH was recorded at site 18 during August and September (5.5 and 4.75 respectively). Aluminium ions accumulate on the gills and clog these with a slimy layer, which limits breathing (Lenntech 2012b).

Arsenic:
Arsenic often occurs naturally in stormwater because of leaching from soils and is largely immobile, however it can be mobilised under acidic conditions. Sites 14, 18 and 17 were of concern (the same as last year's results) and these sites also recorded the lowest pH levels. Site 17 was of most concern. The presence of arsenic at these sites could be contributed from the surrounding businesses as sources of arsenic include the combustion of fossil fuels, primary production of iron, steel, copper, nickel and zinc, wood treatment products and burning of treated wood.

Cadmium:
Cadmium is highly toxic and has been linked with some human cancers, therefore any detection is highly concerning. It was of great concern at site 17 during July and August, similar to previous years. In 2010 cadmium was detected at site 7 and with further sampling conducted the past few years upstream at sites 14, 15, 16 and 17, it was thought that the source of cadmium to the system was originating upstream of site 17. Sites 20, 21 and 22 were added to the program in 2015 which feed into site 17, and whilst cadmium was not detected at these sites during 2015 it was above the adjusted trigger values during August at sites 21 and 22 during this year's monitoring. There is a storage yard for old trains directly behind site 17, and whilst this site hasn't been audited it could potentially be contributing high levels of metals, including cadmium to the system. The IEA (2003) describes sources of cadmium entering the stormwater system via "steel plating, battery manufacture, pigments, plastics, wear of tyres and brake pads, possible combustion of lubricating oils, industrial emissions, fertilisers and pesticides, corrosion of galvanised metals and landfill leachate".

Chromium:
Chromium was recorded in the catchment at sites 14, 18, 15, 16, 19, 17, 20, 21 and 22 during August. Site 19 also equaled the hardness adjusted trigger value during July. Chromium in storm water is mostly associated with suspended solids (IEA 2003) which could be linked with the elevated levels of TSS recorded at sites 14, 18, 19 and 17. The toxicity of both chromium forms to freshwater organisms decreases with increasing water hardness and/or alkalinity (ANZECC 2000). However the speciation of chromium could not be determined without further analysis. Sources of chromium include the chemical manufacturing industry (e.g. dyes for paints, rubber and plastic products), the metal finishing industry, manufacturers of pharmaceuticals, wood, stone, clay, glass, electrical and aircraft products, steam and air conditioning supply services, cement producing plants, incineration of refuse and sewage sludge and combustions of oil and coal (Australian Government 2010). Considering the industry surrounding these sites it is likely they are contributing chromium to the stormwater system.

Cobalt:
Site 17 was of concern for total cobalt, with concentrations exceeding the freshwater trigger value on all sampling occasions. All other sites were acceptable, the same as recorded in previous years. Sources of cobalt include the chemical manufacturing industry (e.g. additives of paint, ceramics, glass, ink, enamels and fertiliser), automotive repair shops (e.g. batteries) and metal industry (in the production of steel and other alloys) (Australian Government 2010). As the concentration of total cobalt in freshwaters is generally low, higher concentrations are generally associated with industrial areas.

Copper:
Concentrations of total copper were an issue at all sites on all sampling occasions, except for site 19 during September. Site 17 was of particular concern, the same as previous years. Concentrations of soluble copper exceeded the trigger values adjusted for water hardness at site 7 on all sampling occasions, and at sites 6 and 8 during the snapshot monitoring in July. The concentration of copper greatly increases with decreasing water hardness and dissolved oxygen concentrations (Australian Government 2010). This is consistent with the findings for site 17, with the exception of a very hard total water hardness recording during September. Copper is used in metal plating processes and brass products, which is likely to be originating from the surrounding industrial premises.

Iron:
All sites recorded elevated concentrations on one or more sampling occasions for total and soluble iron (with the exception of site 22). Of most concern was site 17, but also 14 and 18 (the same as previous years). Iron is soluble in water where there is little or no oxygen, and where low pH values exist (DPI 2005). This is particularly evident at sites 14, 18 and 17.

Lead:
Sites 14, 18, 15, 16, 19, 21 and 22 recorded elevated concentrations of total lead during August. Site 14 also exceeded the adjusted trigger values during July. Lead has been used as constituents of petrol, oil, grease and paints. In 2015 lead was only detected above the trigger value at site 14, suggesting that a localised source was being contributed to the stormwater system along this section of the drainage line. However, during this year's monitoring the other industrial sites also recorded concentrations of lead. This could be linked to the fact that the hardness modified trigger values are so low during August making the trigger values much more sensitive (due to the very low water hardness concentrations recorded).

Manganese:
No site exceeded the lowland or recreational trigger values for manganese. In previous years it has been reported that sites 14, 18, 15, 16, 17, 20 and 21 were of concern as they exceeded the recreational guideline, however it is important to note that there has been a change in the guidelines as per section 3.1.

Zinc:
Concentrations of total and soluble zinc exceeded the guideline on at least one sampling occasions at every site. Site 22 and 17 were of most concern. Zinc is common in all brass and galvanised products. Roofs, pipes, fittings, scrap metal, vehicles and machinery are all potential sources and are all prominent within the Bassendean industrial area.

Local scale pollution in the industrial area surrounding the new sites is likely to be contributing to the very poor and contaminated water quality either through deliberate illegal discharge or accidental of disposal of industrial by-products. Industrial audits of the local businesses should be undertaken.

It was observed that the locations of all sites sampled are bordered by roads and intersections frequently used by residential traffic. These sites have recorded concentrations of metals that are commonly found in road runoff (US EPA 1997; Department of Water 2005) such as;

- Aluminium: auto body corrosion
- Chromium: air conditioning coolants, engine parts, brake lining wear
- Copper: brake lining wear, bearing and brushing wear, engine parts
- Iron: auto body rust, engine parts, steel highway structures
- Lead: tyre wear, vehicle exhaust
- Zinc: tyre wear, vehicle exhausts, motor oil, grease, brake emissions, corrosion of galvanised parts

3.5.14. Recommendations

In addition to routine monitoring, the following recommendations should be considered and implemented if possible. Due to the financial climate we live in it is understood that not every action can be implemented at once. Therefore, this report reiterates the proposals from the previous Bassendean Monitoring Reports (2010 – 2015).

The following recommendations for the Town of Bassendean will contribute to better water quality outcomes for the catchment and the Swan River:

- Continue to undertake industry audits and monitor their environmental management practices to attempt to identify the source of the metals of concern (listed below), particularly cadmium.
- Education of managers of small to medium-sized industry in relation to proper environmental management systems and in particular stormwater, wastewater and waste management.
- Desk top study to identify old landfill sites that may now be leaching contaminated groundwater.
- As all sites are in close proximity to roads, further investigation into treatment options to remove pollutants from road drainage prior to discharge into wetlands and consequently the river is required to maximise infiltration and improve water quality.
- Again, for this reason it is vitally important that local and state government work closely with small to medium enterprises (SMEs) to educate and where necessary regulate these businesses in implementing best management storage and disposal techniques.

Future Monitoring:

- Aluminium, arsenic, cadmium, chromium, cobalt, copper, iron, lead and zinc.

4.0. Conclusions and Recommendations

All sites that were monitored have been identified as having different priorities for requiring remediation. In previous years site 7 was always of most concern, however after further investigation upstream of this site from 2013 onwards it has been discovered that the sites within the industrial area that discharge into this compensation basin are of most concern and are a potential source for the contaminants downstream.

Site 17 recorded the highest concentrations of arsenic, cadmium, cobalt, copper, iron and zinc, and it also recorded concentrations of aluminium and chromium. Site 17 is the western the inlet to the compensation basin located adjacent to intersection of May Holman Drive and Railway Parade.

Sites 14 and 18 both recorded concentrations exceeding the guidelines of aluminium, arsenic, chromium, copper, iron, lead and zinc. This is to be expected as they are within close proximity to each other, and the surrounding industrial premises should be investigated for potential sources of some of these metals, particularly arsenic, chromium and lead.

Sites 20, 21 and 22 were added to the program in 2015 and produced some surprising results. According to the existing drainage maps, site 20 captures the drainage line up to Collier Road and sites 21 and 22 are small inlets from the back of UGL Rail Bassendean. It is interesting to note that cadmium was of most concern at site 17, but also exceeded the hardness modified trigger values at sites 21 and 22. These sites feed into site 17 (the inlet to the compensating basin off railway parade). The outlet of this compensating basin (site 7) however, did not exceed the hardness modified trigger values and was in fact below detection limits.

The Town of Bassendean is currently working with the Department of Environment Regulation to undertake industrial audits within the vicinity of these sites. It is likely that local scale pollution in the industrial area surrounding the new sites is contributing to the very poor and contaminated water quality either through deliberate illegal discharge or accidental of disposal of industrial by-products. Given some of the very concerning metals found like cadmium especially, but also arsenic; it is highly recommended that the industrial audits focus on potential sources of these metals. Remediation of the poorly degraded compensation basin (site 7 and 17) is still recommended, however any actions undertaken should be done in conjunction with addressing the source of the pollutants from the industrial sites upstream.

Nutrients were of concern at all sites within the Bassendean catchment, a reflection of previous year's results.
Site 7 is of concern as the trigger values (where appropriate) for the nutrients monitored were exceeded on every single sampling event (15 exceedances out of a possible 15). However, site 18 and 21 also recorded a high number of exceedances (14 and 11 exceedances out of a possible 15, respectively). It is important to note that site 18 recorded the highest concentration of soluble reactive phosphorus and total phosphorus during September (site 17 also equalled the highest TP during September). Site 21 recorded the highest concentration of ammonia during August, and the highest concentrations total oxidised nitrogen and total nitrogen both during August and September.

In general, total nitrogen concentrations exceeded the trigger value at all sites on one or more sampling occasions (sites 15 and 22 the only exceptions), however the only sites that really stood out during the 2016 monitoring of concern were sites 21 and 8.

In general, total phosphorus concentrations were high and exceeded the trigger value at all sites on most sampling occasions. The industrial sites were of most concern, particularly sites 18, 17 and 21. The existing sites 6, 8 and 13, and the new sites 23 and 24 also exceeded the trigger values, however they recorded distinctly lower concentrations than the industrial sites upstream of railway parade.

Sites 6 and 8 (Chapman St open drain and Kitchener St open drain) were very similar in terms of the concern of the water quality of the site as per previous years, exceeding the appropriate guidelines for aluminium, copper, iron, zinc, total nitrogen, total oxidised nitrogen, total phosphorus and soluble reactive phosphorus. As site 6 is downstream of the industrial catchment, the water quality at site 6 is likely to be an expression of what is present upstream, and could possibly be improved via management actions targeting the industrial sites. The first priority is improving the industrial area, but out of these two sites the greater priority is likely to be site 8 as the source is unknown. Also, site 8 recorded the higher concentrations of nutrients. In 2010 the catchment upstream of site 8 was investigated for potential monitoring sites, which

was unsuccessful due to inaccessibility. Whilst aluminium, iron and zinc are all common in WA stormwater, converting the stretch of open drain between the inlet and the river into a living stream would assist in the utilisation of some of the excess nutrients and potentially reduce the mobility of the metals.

Site 13 (Bindaring Park) recorded elevated concentrations for aluminium, iron, zinc, total nitrogen, ammonia, total oxidised nitrogen, total phosphorus and soluble reactive phosphorus. This site would also benefit from further restoration work. The Town of Bassendean is currently addressing this option with a consultant. Whilst Bindaring Creek is not of most concern in terms of the health of the water body in comparison to the industrial sites, it is a large open water body that has the potential to attract a lot of wildlife and provide an ecological linkage to the river and other nearby wetlands such as the Eric Singleton Bird Sanctuary in Bayswater in what is otherwise a fairly urbanised catchment.

Further investigation:

Sampling of the Bassendean catchment first started in 2010. During 2013, four new sites were added to the sampling program to try and provide further information to determine potential pollution sources upstream from the sites of most concern, site 7. During 2015 a further 5 sites were added upstream of site 7 and a further 2 sites were added to provide a snapshot of Bindaring Creek.

Every year there have been sufficient funds to implement the monitoring program to continue to gather data on these sites, however the recommended management actions need to start to be implemented if there is to be any change to the health of the catchment in the near future. It is recommended that the Town of Bassendean thoroughly read through this report and the proposed actions and determine the best way forward for implementation.

Monitoring of all sites is ideal to maintain continuous data records, especially if management actions are to be implemented so as to compare data on any changes to the catchment. However, should there be any future funding limitations from the Town of Bassendean, it is suggested to concentrate monitoring efforts around the industrial sites to try and identify any sources of pollution.

Exceedence of a trigger value, for any parameter, indicates that there is the potential for an impact to occur and management responses should be oriented to minimise or alleviate those impacts before water flows to the Swan River. The parameters outlined in this report that are to be monitored closer include:

- Nutrients in water- entire suite.
- Metals in water- aluminium, arsenic, cadmium, chromium, cobalt, copper, iron, lead and zinc.

Contaminants occurring in groundwater may pose a potential ecological risk to the Swan and Canning estuaries which has not been looked at, including:

- Nutrients; and
- Metals as discovered in the surface water samples above appropriate guideline values.

Management recommendations:

The 3 principles of stormwater management are as follows (CSIRO, 1999). Ultimately preservation and prevention is key, however given that the Town of Bassendean is an older town and has a legacy of problems associated with its development other controls may need to be drawn upon.

1. Preservation: preserve existing valuable elements of the stormwater system, such as natural channels, wetlands and streamside vegetation.
2. Source control: limit changes to the quantity and quality of stormwater at or near the source. These measures can include land-use planning, education, regulation, design and operational practices to limit changes to the quality or quantity of urban runoff before it enters the stormwater system.
3. Structural control: use structured measures, such as treatment techniques or detention basins, to improve water quality and control stream-flow discharges. This involves building structures to reduce or delay stormwater flow, or to intercept or remove pollutants after they have entered the stormwater system.

The following management options are a mixture of source and structural controls and should be discussed with Council Officers and other stakeholders where appropriate:

- Convert the stretch of open drain at site 8 between the inlet and the river into a living stream;
- Convert the stretch of open drain at site 6 between the inlet and the river into a living stream;
- Convert the compensation basin (site 7 and 17) into a restored wetland;
- Undertake industry audits and monitor businesses environmental management practices in the vicinity of the new sites with DER officer;

- Education of managers of small to medium-sized industry in relation to proper environmental management systems and in particular stormwater, wastewater and waste management;
- Conduct a desk top study to identify old landfill sites that may now be leaching contaminated groundwater;
- Regularly sweep roads, car parks and paths that are identified as 'hot spots' for sediments and gross pollutants;
- Regularly remove accumulated pollutants (e.g. sediments and gross pollutants) from nodes in the stormwater network, such as pits and infiltration sumps;
- Incorporate water sensitive urban design techniques into management practices when upgrading the catchment e.g. permeable paving, bioretention swales, pipeless streets and rain gardens;
- Where roadside vegetation exists, ensure that it operates as an effective filter strip to improve the quality of road runoff and to promote infiltration;
- Generally restrict the use of herbicides and insecticides on roadside vegetation, and ensure maintenance staff use appropriate handling and application procedures for these materials. Although no monitoring data has been collected in this round of sampling to suggest that this is an issue it is just good standard practice; and
- Use indigenous vegetation along roadsides, paths and in swales.

Refer to individual sections for specific recommendations;

- Physical Parameters, pg 25
- Nutrients, pg 40
- Metals, pg 69

5.0. References

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6.0. Appendix

6.1. Appendix A – Bassendean catchment water quality results

Table 33: Physical properties in water samples.

	Date Collected	7	14	18	15	16	19	17	20	21	22	6	8	13	23	24
pH	22/07/2016	7.22	6.78	7.22	6.45	6.08	7.81	6.18	7.62	7.39	dry	7.16	6.95	7.2	7.2	7.23
	18/08/2016	6.88	6.99	5.5	6.37	6.97	7.17	6.24	7.38	7.07	7.29					
	15/09/2016	6.91	6.89	4.75	6.52	7.25	6.48	6.5	7.43	6.98	dry					
DO %	22/07/2016	62.8	30.5	45.9	39.1	7.6	85.2	47.4	78.7	62.3	dry	101.1	85.5	72	46.8	45.2
	18/08/2016	52.4	67.9	16.8	44	51.8	82.7	13.4	64.5	61.1	80.6					
	15/09/2016	54.4	16.5	5	21.5	11.7	1.5	11.2	65.8	25	dry					
DO mg/L	22/07/2016	6.24	3.01	4.58	3.7	0.75	8.8	4.99	7.51	6.13	dry	9.88	8.1	7.59	4.97	4.75
	18/08/2016	5.15	6.94	1.67	4.19	5.15	8.63	1.42	6.24	5.97	8.34					
	15/09/2016	5.29	1.64	0.49	1.99	1.16	0.15	1.15	6.28	2.37	dry					
Electrical Conductivity	22/07/2016	0.643	0.827	0.796	0.45	0.467	0.086	0.399	0.743	0.506	dry	0.717	0.806	0.731	0.551	0.703
	18/08/2016	0.55	0.262	0.463	0.407	0.712	0.2	0.441	0.632	0.535	0.25					
	15/09/2016	0.593	0.836	0.55	0.525	0.689	0.186	0.89	0.652	1.134	dry					
Temperature	22/07/2016	15.6	15.7	15.4	18	16	13.9	13	17.5	16.1	dry	16.4	17.8	12.9	12.6	13.1
	18/08/2016	16.1	14.3	15.6	17.7	15.6	13.4	12.6	16.9	16.4	13.8					
	15/09/2016	16.6	15.5	16.3	19.1	15.8	15.4	14	17.5	17.9	dry					
Salin - PSS	22/07/2016	0.31	0.41	0.39	0.22	0.23	0.04	0.19	0.36	0.25	dry	0.35	0.4	0.36	0.27	0.35
	18/08/2016	0.27	0.13	0.22	0.2	0.35	0.1	0.21	0.31	0.26	0.12					
	15/09/2016	0.29	0.41	0.27	0.25	0.34	0.09	0.44	0.32	0.57	dry					

Guideline	ANZECC Water Quality Guideline - Recreational (2000)		ANZECC Water Quality Trigger Values - Lowland Rivers (2000)		
pH	6.5-8.5		6.5-8.0		
DO %	>80		80-120		
DO mg/L	Very low: < 4.0	Low: 4.0 to 6.0	Moderately Oxygenated: 6.0 to 8.0	Well Oxygenated: 8.0 to 10	Hyperoxic: > 10
SpC	Fresh: <0.965	Marginal: 0.965 to 1.952	Brackish: 1.953 to 8.835	Saline: >8.835	

Table 34: Nutrient concentrations in water samples.

	Date Collected	7	14	18	15	16	19	17	20	21	22	6	8	13	23	24
Ammonia as NH3-N	22/07/2016	0.18	0.19	0.52	0.44	0.052	0.021	0.057	0.019	0.053	dry	0.042	0.045	0.11	0.04	0.02
<0.010	18/08/2016	0.17	0.013	0.45	0.39	0.013	0.005	0.041	0.055	1.5	0.005					
mg/L	15/09/2016	0.23	0.18	0.63	0.42	0.005	0.021	0.62	0.046	0.03	dry					
FRP as P	22/07/2016	0.16	0.24	0.43	0.24	0.1	0.021	0.14	0.03	0.032	dry	0.083	0.19	0.052	0.044	0.053
<0.005	18/08/2016	0.16	0.022	0.21	0.2	0.13	0.007	0.16	0.023	0.39	0.064					
mg/L	15/09/2016	0.19	0.18	0.66	0.18	0.09	0.013	0.074	0.068	0.53	dry					
Dissolved Organic Nitrogen	22/07/2016	0.63	0.56	0.38	0.49	1.1	0.21	0.23	0.45	0.58	dry	0.91	1.3	0.8	0.72	0.82
<0.025	18/08/2016	0.55	1.1	0.27	0.42	1	0.057	0.36	0.22	1.2	0.11					
mg/L	15/09/2016	0.45	0.77	0.3	0.52	0.94	0.27	0.79	0.39	0.53	dry					
Total Organic Nitrogen	22/07/2016	0.67	0.58	0.39	0.49	1.1	0.27	0.24	0.48	0.8	dry	0.96	1.4	0.83	0.76	0.85
<0.025	18/08/2016	0.57	1.2	0.36	0.43	1.1	0.09	0.45	0.25	1.3	0.15					
mg/L	15/09/2016	0.56	0.99	0.42	0.63	1.3	1.1	1.1	0.48	0.99	dry					
Total Nitrogen	22/07/2016	1.8	0.9	1.4	1	1.2	0.32	0.35	2.7	8.8	dry	2.5	5.1	1.2	1.3	2
<0.025	18/08/2016	1.6	1.2	1.1	0.9	1.1	0.14	0.52	1.7	10	0.29					
mg/L	15/09/2016	1.8	1.2	1.3	1.1	1.3	1.2	1.7	2	10	dry					
Total Oxidised Nitrogen	22/07/2016	0.93	0.13	0.5	0.079	0.016	0.028	0.054	2.2	8	dry	1.5	3.6	0.28	0.45	1.1
<0.010	18/08/2016	0.86	0.005	0.29	0.084	0.021	0.044	0.023	1.4	7.5	0.15					
mg/L	15/09/2016	0.98	0.037	0.25	0.071	0.005	0.032	0.005	1.5	9.1	dry					
Total Phosphorus	22/07/2016	0.21	0.26	0.5	0.26	0.13	0.031	0.24	0.032	0.052	dry	0.12	0.25	0.089	0.07	0.088
<0.005	18/08/2016	0.19	0.072	0.45	0.2	0.18	0.017	0.36	0.077	0.45	0.07					
mg/L	15/09/2016	0.3	0.36	1.2	0.28	0.23	0.13	1.2	0.069	0.84	dry					
Total Suspended Solids	22/07/2016	0.5	1	2	0.5	4	5	2	1	0.5	dry	0.5	0.5	3	2	1
<1	18/08/2016	1	21	10	0.5	5	4	5	3	4	3					
mg/L	15/09/2016	2	8	8	3	5	9	102	1	2	dry					

Guideline			
	ANZECC Water quality trigger value – lowland river (2000)	* WRC Interim guideline	Above LOR
Ammonia as NH3-N	0.08		
FRP as P	0.04		
Dissolved Organic Nitrogen	no guideline		
Organic Nitrogen - Total	no guideline		
Total Nitrogen	1.2		
Total Oxidised Nitrogen (TON)	0.15		
Total Phosphorus	0.065		
Total Suspended Solids	no guideline	6	

Table 35: Metal concentrations in water samples.

	Date Collected	7	14	18	15	16	19	17	20	21	22	6	8	13	23	24
Aluminium Filtered	22/07/2016	0.22										0.21	0.77	0.19	0.23	0.18
<0.005	18/08/2016	0.18														
mg/L	15/09/2016	0.23														
Aluminium Total	22/07/2016		0.2	0.45	0.54	0.31	0.36	0.16	0.59	0.096						
<0.005	18/08/2016		0.36	1.1	0.42	0.39	0.15	0.15	0.52	0.15	0.07					
mg/L	15/09/2016		0.18	2.6	0.49	0.19	0.03	0.1	0.64	0.11						
Arsenic Total	22/07/2016		0.026	0.051	0.002	0.005	0.0005	0.053	0.005	0.0005						
<0.001	18/08/2016		0.006	0.047	0.002	0.006	0.0005	0.076	0.006	0.0005	0.0005					
mg/L	15/09/2016		0.036	0.074	0.002	0.004	0.0005	0.26	0.008	0.001						
Cobalt Total	22/07/2016		0.0005	0.0005	0.0005	0.0005	0.0005	0.005	0.0005	0.0005						
<0.001	18/08/2016		0.0005	0.0005	0.0005	0.0005	0.0005	0.006	0.0005	0.0005	0.0005					
mg/L	15/09/2016		0.0005	0.001	0.0005	0.0005	0.0005	0.009	0.0005	0.0005						
Iron Filtered	22/07/2016	1.5										0.55	0.45	1.1	0.68	0.44
<0.005	18/08/2016	2.2														
mg/L	15/09/2016	2.3														
Iron Total	22/07/2016		2.4	1.2	0.75	1.6	0.29	1.6	0.18	0.17						
<0.005	18/08/2016		1.2	0.2	0.89	3	0.19	31	0.28	1	0.17					
mg/L	15/09/2016		4.6	3.8	1.4	2.3	1.2	40	0.34	0.2						
Manganese Total	22/07/2016		0.003	0.022	0.014	0.012	0.007	0.073	0.008	0.008						
<0.001	18/08/2016		0.01	0.03	0.012	0.027	0.004	0.15	0.01	0.053	0.011					
mg/L	15/09/2016		0.02	0.05	0.02	0.02	0.068	0.23	0.021	0.061						
Hardness	22/07/2016	110	95	67	65	230	19	96	200	140		130	86	100	89	120
<5	18/08/2016	12	6	10	7	26	2.5	14	21	12	2.5					
mg/L	15/09/2016	140	140	110	83	240	61	280	210	330						

Guideline				
Metal	ANZECC Water quality trigger value – Recreational (2000)	ANZECC Water quality trigger value – Freshwater 95% (2000)	Above LOR	
Aluminium (if above 6.5 pH)	0.2	0.055		
Arsenic	0.05	0.024		
Cobalt	no guideline	0.0028		
Iron	0.3	no guideline		
Manganese	0.01	1.9		
Hardness as CaCO3 (Calc)	Soft: 0 - 59	Moderate: 60 - 119	Hard: 120 - 179	Very hard: 180 - 240

Table 36: Metal concentrations in water samples adjusted for water hardness.

	Date Collected	7	14	18	15	16	19	17	20	21	22	6	8	13	23	24
Cadmium Filtered	22/07/2016	0.00005										0.0002	0.00005	0.00005	0.00005	0.00005
<0.0001	18/08/2016	0.00005														
mg/L	15/09/2016	0.00005														
Cadmium Total	22/07/2016		0.00005	0.00005	0.00005	0.00005	0.00005	0.002	0.00005	0.00005						
<0.0001	18/08/2016		0.00005	0.00005	0.00005	0.00005	0.00005	0.0008	0.00005	0.0002	0.0005					
mg/L	15/09/2016		0.00005	0.0002	0.00005	0.00005	0.00005	0.0003	0.00005	0.0002						
Chromium Total	22/07/2016		0.002	0.001	0.001	0.005	0.001	0.001	0.001	0.0005	DRY					
<0.001	18/08/2016		0.002	0.003	0.0005	0.005	0.0005	0.001	0.002	0.0005	0.0005					
mg/L	15/09/2016		0.003	0.002	0.001	0.004	0.0005	0.003	0.001	0.001	DRY					
Copper Filtered	22/07/2016	0.019										0.012	0.005	0.003	0.003	0.004
<0.001	18/08/2016	0.012														
mg/L	15/09/2016	0.012														
Copper Total	22/07/2016		0.024	0.016	0.014	0.023	0.003	0.085	0.031	0.006						
<0.001	18/08/2016		0.025	0.016	0.004	0.022	0.002	0.11	0.04	0.037	0.013					
mg/L	15/09/2016		0.02	0.023	0.004	0.015	0.002	0.072	0.053	0.015						
Lead Total	22/07/2016		0.028	0.004	0.002	0.021	0.002	0.0005	0.001	0.0005						
<0.001	18/08/2016		0.007	0.01	0.0005	0.018	0.001	0.001	0.002	0.003	0.002					
mg/L	15/09/2016		0.013	0.073	0.0005	0.025	0.0005	0.0005	0.001	0.0005						
Zinc Filtered	22/07/2016	0.05										0.15	0.29	0.033	0.058	0.068
<0.001	18/08/2016	0.077														
mg/L	15/09/2016	0.036														
Zinc Total	22/07/2016		0.021	0.047	0.021	0.017	0.093	0.69	0.033	0.18						
<0.001	18/08/2016		0.14	0.07	0.034	0.018	0.1	0.34	0.053	0.24	1.4					
mg/L	15/09/2016		0.022	0.098	0.009	0.008	0.053	0.073	0.013	0.16						

Guideline		
Metals above	Above LOR	Exceeds trigger Value adjusted for water hardness

6.2. Appendix B – Metal trigger values adjusted for water hardness

Table 37: Calculations for metal trigger values adjusted for water hardness.

Metal	Water hardness as CaCO3 (mg/L)	Original trigger value	New trigger value
Copper	**July**	**July**	**July**
BASS07	110	0.0014	0.004
BASS14	95	0.0014	0.004
BASS18	67	0.0014	0.003
BASS15	65	0.0014	0.003
BASS16	230	0.0014	0.008
BASS19	19	0.0014	0.001
BASS17	96	0.0014	0.004
BASS20	200	0.0014	0.007
BASS21	140	0.0014	0.005
BASS22			
BASS06	130	0.0014	0.005
BASS08	86	0.0014	0.003
BASS13	100	0.0014	0.004
BASS23	89	0.0014	0.004
BASS24	120	0.0014	0.005
Zinc	**July**	**July**	**July**
BASS07	110	0.008	0.024
BASS14	95	0.008	0.021
BASS18	67	0.008	0.016
BASS15	65	0.008	0.015
BASS16	230	0.008	0.045
BASS19	19	0.008	0.005
BASS17	96	0.008	0.022
BASS20	200	0.008	0.040
BASS21	140	0.008	0.030
BASS22			

BASS06	130	0.008	0.028
BASS08	86	0.008	0.020
BASS13	100	0.008	0.022
BASS23	89	0.008	0.020
BASS24	120	0.008	0.026
Lead	**July**	**July**	**July**
BASS07	110	0.0034	0.018
BASS14	95	0.0034	0.015
BASS18	67	0.0034	0.009
BASS15	65	0.0034	0.009
BASS16	230	0.0034	0.045
BASS19	19	0.0034	0.002
BASS17	96	0.0034	0.015
BASS20	200	0.0034	0.038
BASS21	140	0.0034	0.024
BASS22			
BASS06	130	0.0034	0.022
BASS08	86	0.0034	0.013
BASS13	100	0.0034	0.016
BASS23	89	0.0034	0.014
BASS24	120	0.0034	0.020
Chromium	**July**	**July**	**July**
BASS07	110	0.001	0.003
BASS14	95	0.001	0.003
BASS18	67	0.001	0.002
BASS15	65	0.001	0.002
BASS16	230	0.001	0.005
BASS19	19	0.001	0.001
BASS17	96	0.001	0.003
BASS20	200	0.001	0.005
BASS21	140	0.001	0.004
BASS22			

BASS06	130	0.001	0.003
BASS08	86	0.001	0.002
BASS13	100	0.001	0.003
BASS23	89	0.001	0.002
BASS24	120	0.001	0.003
Cadmium	**July**	**July**	**July**
BASS07	110	0.0002	0.0006
BASS14	95	0.0002	0.0006
BASS18	67	0.0002	0.0004
BASS15	65	0.0002	0.0004
BASS16	230	0.0002	0.0012
BASS19	19	0.0002	0.0001
BASS17	96	0.0002	0.0006
BASS20	200	0.0002	0.0011
BASS21	140	0.0002	0.0008
BASS22			
BASS06	130	0.0002	0.0007
BASS08	86	0.0002	0.0005
BASS13	100	0.0002	0.0006
BASS23	89	0.0002	0.0005
BASS24	120	0.0002	0.0007

Metal	Water hardness as CaCO3 (mg/L)	Original trigger value	New trigger value
Copper	**August**	**August**	**August**
BASS07	12	0.0014	0.0006
BASS14	6	0.0014	0.0004
BASS18	10	0.0014	0.0006
BASS15	7	0.0014	0.0004
BASS16	26	0.0014	0.0012
BASS19	2.5	0.0014	0.0002
BASS17	14	0.0014	0.0007
BASS20	21	0.0014	0.0010

BASS21	12	0.0014	0.0006
BASS22	2.5	0.0014	0.0002
Zinc	**August**	**August**	**August**
BASS07	12	0.008	0.004
BASS14	6	0.008	0.002
BASS18	10	0.008	0.003
BASS15	7	0.008	0.002
BASS16	26	0.008	0.007
BASS19	2.5	0.008	0.001
BASS17	14	0.008	0.004
BASS20	21	0.008	0.006
BASS21	12	0.008	0.004
BASS22	2.5	0.008	0.001
Lead	**August**	**August**	**August**
BASS07	12	0.0034	0.0011
BASS14	6	0.0034	0.0004
BASS18	10	0.0034	0.0008
BASS15	7	0.0034	0.0005
BASS16	26	0.0034	0.0028
BASS19	2.5	0.0034	0.0001
BASS17	14	0.0034	0.0013
BASS20	21	0.0034	0.0022
BASS21	12	0.0034	0.0011
BASS22	2.5	0.0034	0.0001
Chromium	**August**	**August**	**August**
BASS07	12	0.001	0.0005
BASS14	6	0.001	0.0003
BASS18	10	0.001	0.0004
BASS15	7	0.001	0.0003
BASS16	26	0.001	0.0009
BASS19	2.5	0.001	0.0001
BASS17	14	0.001	0.0005

BASS20	21	0.001	0.0007
BASS21	12	0.001	0.0005
BASS22	2.5	0.001	0.0001
Cadmium	**August**	**August**	**August**
BASS07	12	0.0002	0.00009
BASS14	6	0.0002	0.00005
BASS18	10	0.0002	0.00008
BASS15	7	0.0002	0.00005
BASS16	26	0.0002	0.00018
BASS19	2.5	0.0002	0.00002
BASS17	14	0.0002	0.00010
BASS20	21	0.0002	0.00015
BASS21	12	0.0002	0.00009
BASS22	2.5	0.0002	0.00002

Metal	Water hardness as CaCO3 (mg/L)	Original trigger value	New trigger value
Copper	**September**	**September**	**September**
BASS07	140	0.0014	0.005
BASS14	140	0.0014	0.005
BASS18	110	0.0014	0.004
BASS15	83	0.0014	0.003
BASS16	240	0.0014	0.008
BASS19	61	0.0014	0.003
BASS17	280	0.0014	0.009
BASS20	210	0.0014	0.007
BASS21	330	0.0014	0.011
BASS22			
Zinc	**September**	**September**	**September**
BASS07	140	0.008	0.030
BASS14	140	0.008	0.030
BASS18	110	0.008	0.024

BASS15	83	0.008	0.019
BASS16	240	0.008	0.047
BASS19	61	0.008	0.015
BASS17	280	0.008	0.053
BASS20	210	0.008	0.042
BASS21	330	0.008	0.061
BASS22			
Lead	**September**	**September**	**September**
BASS07	140	0.0034	0.024
BASS14	140	0.0034	0.024
BASS18	110	0.0034	0.018
BASS15	83	0.0034	0.012
BASS16	240	0.0034	0.048
BASS19	61	0.0034	0.008
BASS17	280	0.0034	0.058
BASS20	210	0.0034	0.040
BASS21	330	0.0034	0.071
BASS22			
Chromium	**September**	**September**	**September**
BASS07	140	0.001	0.004
BASS14	140	0.001	0.004
BASS18	110	0.001	0.003
BASS15	83	0.001	0.002
BASS16	240	0.001	0.006
BASS19	61	0.001	0.002
BASS17	280	0.001	0.006
BASS20	210	0.001	0.005
BASS21	330	0.001	0.007
BASS22			
Cadmium	**September**	**September**	**September**
BASS07	140	0.0002	0.0008
BASS14	140	0.0002	0.0008

BASS18	110	0.0002	0.0006
BASS15	83	0.0002	0.0005
BASS16	240	0.0002	0.0013
BASS19	61	0.0002	0.0004
BASS17	280	0.0002	0.0015
BASS20	210	0.0002	0.0011
BASS21	330	0.0002	0.0017
BASS22			

Table 38: Metals and new trigger values (adjusted for water hardness).

Highlighted blue if the values exceed the new trigger values (adjusted for hardness)

Copper									
Site	July (Total)	July (Filtered)	July new TV	August (Total)	Aug (Filtered)	Aug new TV	Sept (Total)	Sept (Filtered)	Sept new TV
BASS07		0.019	0.004		0.012	0.0006		0.012	0.005
BASS14	0.024		0.004	0.025		0.0004	0.02		0.005
BASS18	0.016		0.003	0.016		0.0006	0.023		0.004
BASS15	0.014		0.003	0.004		0.0004	0.004		0.003
BASS16	0.023		0.008	0.022		0.0012	0.015		0.008
BASS19	0.003		0.001	0.002		0.0002	0.002		0.003
BASS17	0.085		0.004	0.11		0.0007	0.072		0.009
BASS20	0.031		0.007	0.04		0.001	0.053		0.007
BASS21	0.006		0.005	0.037		0.0006	0.015		0.011
BASS22				0.013		0.0002			
BASS06		0.012	0.005						
BASS08		0.005	0.003						
BASS13		0.003	0.004						
BASS23		0.003	0.004						
BASS24		0.004	0.005						

Zinc									
Site	July (Total)	July (Filtered)	July new TV	August (Total)	Aug (Filtered)	Aug new TV	Sept (Total)	Sept (Filtered)	Sept new TV
BASS07		0.05	0.024		0.077	0.004		0.036	0.03
BASS14	0.021		0.021	0.14		0.002	0.022		0.03
BASS18	0.047		0.016	0.07		0.003	0.098		0.024
BASS15	0.021		0.015	0.034		0.002	0.009		0.019
BASS16	0.017		0.045	0.018		0.007	0.008		0.047
BASS19	0.093		0.005	0.1		0.001	0.053		0.015
BASS17	0.69		0.022	0.34		0.004	0.073		0.053
BASS20	0.033		0.04	0.053		0.006	0.013		0.042

BASS21	0.018		0.03	0.24		0.004	0.16		0.061
BASS22				1.4		0.001			
BASS06		0.15	0.028						
BASS08		0.29	0.02						
BASS13		0.033	0.022						
BASS23		0.058	0.02						
BASS24		0.068	0.026						

Chromium									
Site	July (Total)	July (Filtered)	July new TV	August (Total)	Aug (Filtered)	Aug new TV	Sept (Total)	Sept (Filtered)	Sept new TV
BASS14	0.002		0.003	0.002		0.0003	0.003		0.004
BASS18	0.001		0.002	0.003		0.0004	0.002		0.003
BASS15	0.001		0.002	0.0005		0.0003	0.001		0.002
BASS16	0.005		0.005	0.005		0.0009	0.004		0.006
BASS19	0.001		0.001	0.0005		0.0001	0.0005		0.002
BASS17	0.001		0.003	0.001		0.0005	0.003		0.006
BASS20	0.001		0.005	0.002		0.0007	0.001		0.005
BASS21	0.0005		0.004	0.0005		0.0005	0.001		0.007
BASS22				0.0005		0.0001			

Lead									
Site	July (Total)	July (Filtered)	July new TV	August (Total)	Aug (Filtered)	Aug new TV	Sept (Total)	Sept (Filtered)	Sept new TV
BASS14	0.0028		0.015	0.007		0.0004	0.013		0.024
BASS18	0.004		0.009	0.01		0.0008	0.073		0.018
BASS15	0.002		0.009	0.0005		0.0005	0.0005		0.012
BASS16	0.021		0.045	0.018		0.0028	0.025		0.048
BASS19	0.002		0.002	0.001		0.0001	0.0005		0.008
BASS17	0.0005		0.015	0.001		0.0013	0.0005		0.058
BASS20	0.001		0.038	0.002		0.0022	0.001		0.04
BASS21	0.0005		0.024	0.003		0.0011	0.0005		0.071

BASS22				0.002		0.0001			

Cadmium									
Site	July (Total)	July (Filtered)	July new TV	August (Total)	Aug (Filtered)	Aug new TV	Sept (Total)	Sept (Filtered)	Sept new TV
BASS07		0.00005	0.0006		0.00005	0.00009		0.00005	0.0008
BASS14	0.00005		0.0006	0.00005		0.00005	0.00005		0.0008
BASS18	0.00005		0.0004	0.00005		0.00008	0.0002		0.0006
BASS15	0.00005		0.0004	0.00005		0.00005	0.00005		0.0005
BASS16	0.00005		0.0012	0.00005		0.00018	0.00005		0.0013
BASS19	0.00005		0.0001	0.00005		0.00002	0.00005		0.0004
BASS17	0.002		0.0006	0.0008		0.0001	0.0003		0.0015
BASS20	0.00005		0.0011	0.00005		0.00015	0.00005		0.0011
BASS21	0.0001		0.0008	0.0002		0.00009	0.0002		0.0017
BASS22				0.0005		0.00002			
BASS06		0.0002	0.0007						
BASS08		0.00005	0.0005						
BASS13		0.00005	0.0006						
BASS23		0.00005	0.0005						
BASS24		0.00005	0.0007						

6.3. Appendix C – Trigger values, guidelines and limit of reporting

Table 39: ANZECC trigger values for nutrient concentrations and physical properties for South-West Australian waters.

Guideline	D0 (%)	pH	TN (mg/L)	TON (mg/L)	DON (mg/L)	NOx (mg/L)	Ammonia (mg/L)	TP (mg/L)	SRP (mg/L)	TSS* (mg/L)
ANZECC Water Quality Guideline – Recreational (2000)	>80	6.5 - 8.5	-	-	-	10	-	-	-	-
ANZECC Water Quality Trigger Values - Lowland Rivers (2000)	80-120	6.5 - 8.0	1.2	-	-	0.15	0.08	0.065	0.04	6.0
NMI Limit of Reporting			0.025	0.025	0.025	0.01	0.01	0.005	0.005	1

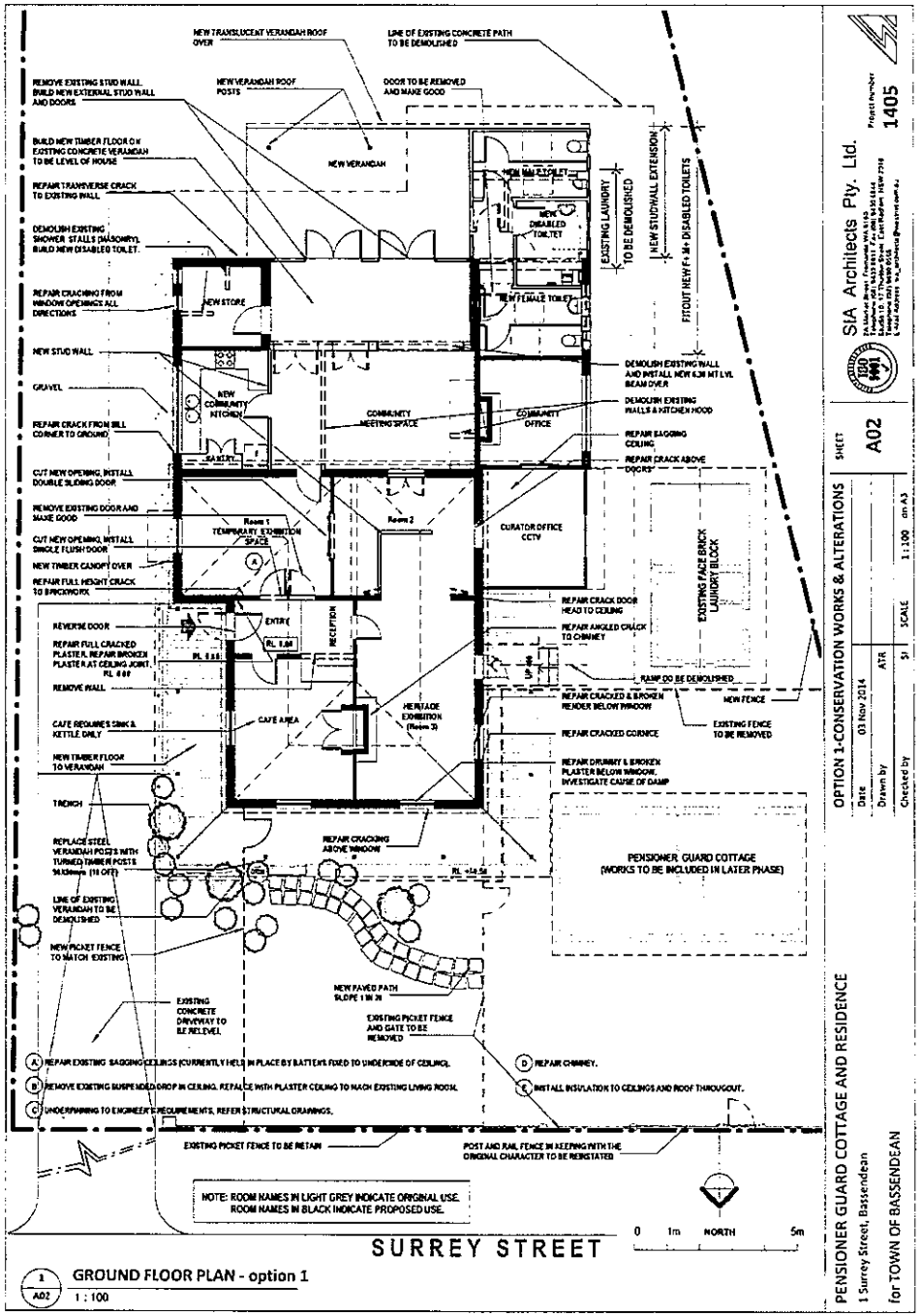
*WRC interim guideline

Table 40: ANZECC trigger values for metals in freshwater.

Guideline	Al (mg/L)	As (mg/L)	Cd* (mg/L)	Cr* (mg/L)	Co (mg/L)	Cu* (mg/L)	Fe (mg/L)	Pb* (mg/L)	Mn (mg/L)	Zn* (mg/L)
ANZECC Water quality trigger value – Freshwater 95% protection level	0.055	0.024	0.0002	0.001	0.0028	0.0014	0.3	0.0034	1.9	0.008
ANZECC Water quality guideline – Recreational	0.2	0.07	0.02	0.5	-	20	3	0.1	5	30
NMI Limit of Reporting	0.005	0.001	0.0001	0.001	0.001	0.001	0.005	0.001	0.001	0.001

*Trigger values adjusted for water hardness.

ATTACHMENT NO. 7


NEW TRANSLUCENT VERANDAH ROOF OVER
LINE OF EXISTING CONCRETE PATH TO BE DEMOLISHED
REMOVE EXISTING STUD WALL, BUILD NEW EXTERNAL STUD WALL AND DOORS
NEW VERANDAH ROOF POSTS
DOOR TO BE REMOVED AND MAKE GOOD
BUILD NEW TIMBER FLOOR ON EXISTING CONCRETE VERANDAH TO BE LEVEL OF HOUSE
NEW VERANDAH
REPAIR TRANSVERSE CRACK TO EXISTING WALL
DEMOLISH EXISTING SHOWER STALLS (MASONRY), BUILD NEW DISABLED TOILET.
NEW DISABLED TOILET
EXISTING LAUNDRY TO BE DEMOLISHED
NEW STUDWALL EXTENSION
FITOUT NEW F+M DISABLED TOILETS
REPAIR CRACKING FROM WINDOW OPENINGS ALL DIRECTIONS
NEW STORE
NEW FEMALE TOILET
NEW STUD WALL
GRAVEL
NEW COMMUNITY KITCHEN
COMMUNITY MEETING SPACE
COMMUNITY OFFICE
DEMOLISH EXISTING WALL AND INSTALL NEW 6.3M MT LVL BEAM OVER
DEMOLISH EXISTING WALLS & KITCHEN HOOD
REPAIR CRACK FROM SILL CORNER TO GROUND
SAWDUST
REPAIR SAGGING CEILING
REPAIR CRACK ABOVE DOORS
CUT NEW OPENING, INSTALL DOUBLE SLIDING DOOR
REMOVE EXISTING DOOR AND MAKE GOOD
Room 1 TEMPORARY EXHIBITION SPACE
Room 2
CURATOR OFFICE CCTV
CUT NEW OPENING, INSTALL SINGLE FLUSH DOOR
NEW TIMBER CANOPY OVER
REPAIR FULL HEIGHT CRACK TO BRICKWORK
EXISTING FACE BRICK LAUNDRY BLOCK
REVERSE DOOR
ENTRY
RECEPTION
REPAIR CRACK DOOR HEAD TO CEILING
REPAIR ANGLED CRACK TO CHIMNEY
REPAIR FULL CRACKED PLASTER, REPAIR BROKEN PLASTER AT CEILING JOINT.
RAMP DO BE DEMOLISHED
REMOVE WALL
REPAIR CRACKED & BROKEN RENDER BELOW WINDOW
NEW FENCE
CAFE REQUIRES SINK & KETTLE ONLY
CAFE AREA
HERITAGE EXHIBITION (Room 3)
EXISTING FENCE TO BE REMOVED
REPAIR CRACKED CORNICE
NEW TIMBER FLOOR TO VERANDAH
REPAIR DRUMMY & BROKEN PLASTER BELOW WINDOW, INVESTIGATE CAUSE OF DAMP
TRENCH
PENSIONER GUARD COTTAGE (WORKS TO BE INCLUDED IN LATER PHASE)
REPLACE STEEL VERANDAH POSTS WITH TURNED TIMBER POSTS 90.63mm (10 OFF)
REPAIR CRACKING ABOVE WINDOW
LINE OF EXISTING VERANDAH TO BE DEMOLISHED
NEW PICKET FENCE TO MATCH EXISTING
NEW PAVED PATH SLOPE 1 IN 20
EXISTING CONCRETE DRIVEWAY TO BE RELEVEL
EXISTING PICKET FENCE AND GATE TO BE REMOVED
A REPAIR EXISTING SAGGING CEILINGS (CURRENTLY HELD IN PLACE BY BATTENS FIXED TO UNDERSIDE OF CEILING).
B REMOVE EXISTING SUSPENDED GROP IN CEILING. REPALCE WITH PLASTER CEILING TO MACH EXISTING LIVING ROOM.
C UNDERPINNING TO ENGINEER'S REQUIREMENTS, REFER STRUCTURAL DRAWINGS.
D REPAIR CHIMNEY.
E INSTALL INSULATION TO CEILINGS AND ROOF THROUGOUT.
EXISTING PICKET FENCE TO BE RETAIN
POST AND RAIL FENCE IN KEEPING WITH THE ORIGINAL CHARACTER TO BE REINSTATED
NOTE: ROOM NAMES IN LIGHT GREY INDICATE ORIGINAL USE. ROOM NAMES IN BLACK INDICATE PROPOSED USE.
0 1m NORTH 5m
SURREY STREET
1 / A02 GROUND FLOOR PLAN - option 1
1 : 100
OPTION 1-CONSERVATION WORKS & ALTERATIONS
Date 03 Nov 2014
Drawn by ATR
Checked by
SCALE 1:100 on A3
SHEET A02
SIA Architects Pty. Ltd.
Project Number 1405
PENSIONER GUARD COTTAGE AND RESIDENCE
1 Surrey Street, Bassendean
for TOWN OF BASSENDEAN

From: Scott Williams [mailto:Scott.Williams@lotterywest.wa.gov.au]
Sent: Friday, April 7, 2017 12:13 PM
To: 'bjarvis@bassendean.wa.gov.au'
Subject: FW: 1 Surry Street -Lotterywest Application No. 421010236

Hi Bob

Kate passed your email on to me for a response.

Thanks for outlining the potential changes in scope regarding the 1 Surry Street conservation project. As I understand it the project relates to the conservation of the site which will result in a community space that will be used for heritage purposes, and accommodation (or continued to accommodation) for community groups. Lotterywest's primary concern is with this intent, and ultimately the benefit to the community.

However, the technical aspects of the project form a significant part of the approvals, endorsement and council resolutions (including why the Option 2 design was the preferred option), all of which were provided as supporting evidence as to the feasibility of the project, and were considered as part of the assessment by Lotterywest staff. The details provided demonstrated that the Town has the necessary support and approvals for the project to commence. Should the scope of the project change, resulting in the current approvals becoming invalid, Lotterywest would need evidence that the new proposal (option 1 or otherwise) had successfully received the same approvals and endorsements to progress (eg State Heritage Office, National Trust WA, The Royal WA Historical Society, Bassendean Historical Society). The new motion (item 7) refers to community input, which may have implications on the scope, resulting in further changes to the project.

The technical aspects of the project guided the quantity surveyor's pre-tender estimate, on which the project budget (and the recommended grant amount) has been based. If this budget changes, Lotterywest may need to consider if it's contribution towards the project is still appropriate.

At this stage the funding is secure, as no formal request to change the scope of the project has been received. Depending on the full extent of any changes proposed, the impact on future usage of the space for the community (the new motion item 6 refers to usage of the space), the impact on the timing of the project and/or the impact on the budget for the project, a formal variation may be required. Depending on the scale of the variation, it may be able to be managed at an administrative level or may require consideration by the Lotterywest Board. The new motion (item 2) indicates that the Town will submit a new grant application following additional work (presumably cancelling the current grant) so a variation on the existing grant may not be appropriate. Unfortunately given the variables, I cannot provide clear advise about the security of the grant in hypothetical scenarios.

Lotterywest is happy to continue to work with you as we understand that projects don't always go as planned. Lotterywest would hope that any changes proposed by the Town would be about further enhancing the benefit to the community. Following your workshop on 10 April, it would be great if we could have a discussion about the decisions made so Lotterywest can further advise on any action required. If it would be beneficial, I'd be happy to come to the Town to meet with you.

Please feel free to call or email of you would like to discuss further.

regards
Scott Williams
Senior Grants Management Officer
Lotterywest

In the short term at least, Lotterywest would be happy wait and see what impact the proposed changes will have on the timing, budget, approvals and endorsements, and overall community benefit. Once known, we can determine if Option 1 (or whatever the final option ends up being) can be managed as a variation. This will keep the current grant funds secure for the time being and give the greatest range of options as things progress. However, given that Council has resolved to resubmit an application in the future, I'm not sure what your options are. Acknowledging that there could be different interpretations of Council's intent, I'd be happy to take your guidance on the Town's preferred option.

Please feel free to email or call at your convenience if you would like to discuss anything.

regards
Scott Williams
Senior Grants Management Officer
Lotterywest
Ph: 08 9488 6123
Mob: 0428 956 499
Em: scott.williams@lotterywest.wa.gov.au<mailto:scott.williams@lotterywest.wa.gov.au>

From: Bob Jarvis [mailto:bjarvis@bassendean.wa.gov.au]
Sent: Wednesday, 3 May 2017 3:08 PM
To: Scott Williams
Cc: Simon Stewert-Dawkins (SDawkins@bassendean.wa.gov.au)
Subject: OEM-6653317 - 1 Surry Street -Lotterywest Application No. 421010236

Dear Scott

As you are aware on the 2 March 2017, Lotterywest provided the attached letter advising that the Town of Bassendean had been successful in obtaining the 1 Surrey Street grant funding. After receiving the Lotterywest letter, the Town had intended to invite tenders and appoint a Heritage Builder to undertake the restoration, reconstruction and refurbishment of the Residence, Pensioner Guard Cottage and the construction of a new community space.

However, on Tuesday 26th April 2017, a Notice of Motion presented by Cr Bridges was tabled for Council consideration and the following was resolved:

OCM – 3/04/17 MOVED Cr Bridges, Seconded Cr Brown, that with relation to the 1 Surrey Street project Council:

1. Rescinds motion OCM-6/11/15, which reads:

"MOVED Cr Pule, Seconded Cr Brown, that Council:

1. Receives the SIA Architects Pty Ltd progress report regarding the design options for the restoration, reconstruction and refurbishment of 1 Surrey Street project;

2. Notes the feedback received from Bassendean Historical Society Inc Bassendean Arts Council Inc. the 1 Surrey Steering Group members, the State Heritage Office and Museums Australia concerning the various schematic design options

3. Endorses SIA Architects Pty Ltd Option 2C draft design proposal, as included as an attachment to the Ordinary Council Agenda of 24 November 2015, to demolish the c.1952 rear extension under concrete roof and the standalone ablution/laundry building and the proposal to construct a separate building (Community Meeting Place) on the southern side of the Residence, as well as a separate toilet block on the western boundary;

4. Requests SIA Architects Pty Ltd re-align the proposed studio in Option 2C designs to achieve a North /South access in order to preserve the existing mature tree and increase the backyard usable space;

5. Requests SIA Architects Pty Ltd give due consideration in Phase 3 of the Detailed Design, Development & Documentation process to provide acoustic separation (shutters, walls & doors) in the 2C design to ensure the dual use of the kitchen area can be achieved for the Museum and / or Community/arts activities;

6. Requests SIA Architects Pty Ltd reinstate the gable eave overhang as per the original fabric of the Pensioner Guard Cottage, and;

7. Notes that the Community Development Directorate intends to provide a Governance Model report in the future for the 1 Surrey Street to guide the ongoing management of the facility.
CARRIED 4/2;

2. Informs LotteryWest that the current grant application will be resubmitted pending completion of items 3-7 below;

3. Has plans prepared consistent with Option 1 prepared by the SIA architects and the building uses recommended in the Interpretation Plan and subject to modifications sought by the key user groups as previously documented being included;

4. Requires interpretation within the museum space to include original and reproduction artefacts and within the cottage to include interpretation of a standard commensurate with that of the Howick Historical Village in Auckland New Zealand to create an authentic experience for museum visitors;

5. Requires a management plan for the ongoing use of the site to be presented to the Audit and Risk Committee and adopted by Council;

6. Requires site use areas be defined for the museum component, dedicated work and storage space for the Bassendean Arts Council and common shared meeting and activity spaces for multiple user groups including capacity for school education programs; and

7. Requires site and building plans, costings, the management plan and the details of the proposed interpretation be made available to the public via the Town's website and presented at a public meeting for community input prior to the commencement of construction.
CARRIED 4/2

Crs Bridges, Brown, Lewis & McLennan voted in favour of the motion. Crs Gangell & Pule voted against the motion.

In accordance with the Council (OCM – 3/04/17) resolution, I am informing Lotterywest that the current grant application will be resubmitted pending completion of items 3-7 below:

3. Has plans prepared consistent with Option 1 prepared by the SIA architects and the building uses recommended in the Interpretation Plan and subject to modifications sought by the key user groups as previously documented being included;

4. Requires interpretation within the museum space to include original and reproduction artefacts and within the cottage to include interpretation of a standard commensurate with that of the Howick Historical Village in Auckland New Zealand to create an authentic experience for museum visitors;

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7. Requires site and building plans, costings, the management plan and the details of the proposed interpretation be made available to the public via the Town's website and presented at a public meeting for community input prior to the commencement of construction

The attached Lotterywest letter, page 6 states in part the following:

2. PROPOSED VARIATIONS TO GRANTS
2.1. Any proposed variation to the grant, including any changes to the list of works to be undertaken or supervision by a different conservation practitioner, will need to be made in writing to Lotterywest.

It is imperative that the variation does not proceed without written approval from Lotterywest.

2.2. Please note that variations to increase the amount of the grant are unlikely to be considered favourably and no guarantee of approval is implied.

It is imperative that the variation does not proceed without written approval from Lotterywest.

Considering the Council direction, the Town instructed SIA Architects to arrange meetings and briefings with the sub-consultants involved with preparation of the detailed Design and Specifications, to suitably inform them of what portion of current completed documentation would or may not be affected and could be retained, and what section would entail new work relating to the existing rear addition to the Residency.

SIA Architects have been requested to provide by the Thursday 11 May 2017, the order of magnitude of costs and estimated time lines to implement the OCM – 3/04/17.

Taking into consideration the overall grant conditions, it would be helpful for Council to have an indication from Lotterywest by Thursday 11 May 2017, what specific action is required and within what period.

The intention is that the SIA Architects letter, outlining the order of magnitude of costs and estimated time lines, and hopefully, a Lotterywest letter advising what specific action is required and within what time-frame, will be presented to the May 2017 Ordinary Council Meeting.

Should Lotterywest staff wish to inspect the 1 Surrey Street building, discuss the option 1 design plans and/or meet with SIA Architects, please let me know, and I will ask the Director Operational Services – Simon Stewert-Dawkins to arrange those meetings.

Regards
Bob Jarvis
Chief Executive Officer
Town of Bassendean
Phone: (08) 9377 8000
Direct Line: (08) 9377 8004
Facsimile: (08) 9379 3209
Email: bjarvis@bassendean.wa.gov.au<blocked::mailto:s@bassendean.wa.gov.au>
Web: www.bassendean.wa.gov.au<blocked::blocked::http://www.bassendean.wa.gov.au/>

-----Original Message-----
From: Scott Williams
Sent: Tuesday, 9 May 2017 4:18 PM
To: 'Bob Jarvis' <bjarvis@bassendean.wa.gov.au>
Subject: IEM-12057817 - RE: OEM-6653317 - 1 Surry Street -Lotterywest Application No. 421010236

Hi Bob

Thanks for your email outlining the recent decision by Council in relation to 1 Surry Street. From Lotterywest's point of view, there are two options going forwards:

A. The Town can Resubmit an application for funding towards the project at 1 Surry Street once items 3-7 have been completed. Specifically ,this would require:

a. Cancellation of the current grant (421010236). If the Town prefers this option, I can provide further information about how the grant can be cancelled

b. A new application to be developed and submitted by the Town at a point in the future

c. A full assessment of the new application with a recommendation presented to the Lotterywest Board and Minister for consideration

d. Once the current grant is cancelled, there are no time limits for the new submission

B. Your reference below to the Proposed Variations to Grants section of Lotterywest Approval Schedule refers to Variations; where elements of a project are varied beyond what was initially assessed, however the broad scope and intent of the project is maintained, and the benefit to the community is not diminished. This does not require a resubmission as the original approval is still valid. For Lotterywest to consider managing 1 Surry Street as a variation, specifically we would need to know:

a. The impact on project timing

b. The impact on project budget

c. That all relevant approvals and endorsements can be obtained (as per the original application)

d. That the intended benefit to the community will not been diminished (or is enhanced)

e. Regarding timeframes, the sooner as the Town is able to provide the relevant information above the better. The first drawdown due date for the current grant is 28 February 2018. Extensions to due dates can be granted, however Lotterywest needs to be comfortable that projects are progressing towards completion.

f. Ultimately, if any information provided at any stage indicates that the project will go out of the scope of the original grant, there is still the possibility that the original grant will need to be cancelled and a new grant application be submitted

In the short term at least, Lotterywest would be happy wait and see what impact the proposed changes will have on the timing, budget, approvals and endorsements, and overall community benefit. Once known, we can determine if Option 1 (or whatever the final option ends up being) can be managed as a variation. This will keep the current grant funds secure for the time being and give the greatest range of options as things progress. However, given that Council has resolved to resubmit an application in the future, I'm not sure what your options are. Acknowledging that there could be different interpretations of Council's intent, I'd be happy to take your guidance on the Town's preferred option.

Please feel free to email or call at your convenience if you would like to discuss anything.

regards
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Senior Grants Management Officer
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Ph: 08 9488 6123
Mob: 0428 956 499
Em: scott.williams@lotterywest.wa.gov.au<mailto:scott.williams@lotterywest.wa.gov.au>

From: Bob Jarvis [mailto:bjarvis@bassendean.wa.gov.au]
Sent: Wednesday, 3 May 2017 3:08 PM
To: Scott Williams
Cc: Simon Stewert-Dawkins (SDawkins@bassendean.wa.gov.au)
Subject: OEM-6653317 - 1 Surry Street -Lotterywest Application No. 421010236

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1. Receives the SIA Architects Pty Ltd progress report regarding the design options for the restoration, reconstruction and refurbishment of 1 Surrey Street project;

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3. Endorses SIA Architects Pty Ltd Option 2C draft design proposal, as included as an attachment to the Ordinary Council Agenda of 24 November 2015, to demolish the c.1952 rear extension under concrete roof and the standalone ablution/laundry building and the proposal to construct a separate building (Community Meeting Place) on the southern side of the Residence, as well as a separate toilet block on the western boundary;

4. Requests SIA Architects Pty Ltd re-align the proposed studio in Option 2C designs to achieve a North /South access in order to preserve the existing mature tree and increase the backyard usable space;

5. Requests SIA Architects Pty Ltd give due consideration in Phase 3 of the Detailed Design, Development & Documentation process to provide acoustic separation (shutters, walls & doors) in the 2C design to ensure the dual use of the kitchen area can be achieved for the Museum and / or Community/arts activities;

6. Requests SIA Architects Pty Ltd reinstate the gable eave overhang as per the original fabric of the Pensioner Guard Cottage, and;

7. Notes that the Community Development Directorate intends to provide a Governance Model report in the future for the 1 Surrey Street to guide the ongoing management of the facility.
CARRIED 4/2;

2. Informs LotteryWest that the current grant application will be resubmitted pending completion of items 3-7 below;

3. Has plans prepared consistent with Option 1 prepared by the SIA architects and the building uses recommended in the Interpretation Plan and subject to modifications sought by the key user groups as previously documented being included;

4. Requires interpretation within the museum space to include original and reproduction artefacts and within the cottage to include interpretation of a standard commensurate with that of the Howick Historical Village in Auckland New Zealand to create an authentic experience for museum visitors;

5. Requires a management plan for the ongoing use of the site to be presented to the Audit and Risk Committee and adopted by Council;

6. Requires site use areas be defined for the museum component, dedicated work and storage space for the Bassendean Arts Council and common shared meeting and activity spaces for multiple user groups including capacity for school education programs; and

7. Requires site and building plans, costings, the management plan and the details of the proposed interpretation be made available to the public via the Town's website and presented at a public meeting for community input prior to the commencement of construction.
CARRIED 4/2

Crs Bridges, Brown, Lewis & McLennan voted in favour of the motion. Crs Gangell & Pule voted against the motion.

In accordance with the Council (OCM – 3/04/17) resolution, I am informing Lotterywest that the current grant application will be resubmitted pending completion of items 3-7 below:

3. Has plans prepared consistent with Option 1 prepared by the SIA architects and the building uses recommended in the Interpretation Plan and subject to modifications sought by the key user groups as previously documented being included;

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The attached Lotterywest letter, page 6 states in part the following:

2. PROPOSED VARIATIONS TO GRANTS

2.1. Any proposed variation to the grant, including any changes to the list of works to be undertaken or supervision by a different conservation practitioner, will need to be made in writing to Lotterywest.

It is imperative that the variation does not proceed without written approval from Lotterywest.

2.2. Please note that variations to increase the amount of the grant are unlikely to be considered favourably and no guarantee of approval is implied.

It is imperative that the variation does not proceed without written approval from Lotterywest.

Considering the Council direction, the Town instructed SIA Architects to arrange meetings and briefings with the sub-consultants involved with preparation of the detailed Design and Specifications, to suitably inform them of what portion of current completed documentation would or may not be affected and could be retained, and what section would entail new work relating to the existing rear addition to the Residency.

SIA Architects have been requested to provide by the Thursday 11 May 2017, the order of magnitude of costs and estimated time lines to implement the OCM – 3/04/17.

Taking into consideration the overall grant conditions, it would be helpful for Council to have an indication from Lotterywest by Thursday 11 May 2017, what specific action is required and within what period.

The intention is that the SIA Architects letter, outlining the order of magnitude of costs and estimated time lines, and hopefully, a Lotterywest letter advising what specific action is required and within what time-frame, will be presented to the May 2017 Ordinary Council Meeting.

Should Lotterywest staff wish to inspect the 1 Surrey Street building, discuss the option 1 design plans and/or meet with SIA Architects, please let me know, and I will ask the Director Operational Services – Simon Stewert-Dawkins to arrange those meetings.

Regards

Bob Jarvis
Chief Executive Officer
Town of Bassendean
Phone: (08) 9377 8000
Direct Line: (08) 9377 8004
Facsimile: (08) 9379 3209
Email: bjarvis@bassendean.wa.gov.au<blocked::mailto:s@bassendean.wa.gov.au>
Web: www.bassendean.wa.gov.au<blocked::blocked::http://www.bassendean.wa.gov.au/>

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SIA ARCHITECTS pty ltd

ACN 090 958 357

16th May 2017

Simon Stewert-Dawkins
Director Operational Services
Town of Bassendean
48 Old Perth Road, WA 6054

Dear Simon

RE: **Pensioner Cottage, 1 Surrey Street Bassendean**
Council Resolution 26th April 2017 – Order Magnitude of Costs

Please find below response to your email of 1st of May following Council resolution of 26th of April I regard to magnitude of costs, consistent with Option 1 and list of possible consultants.

Your list includes:

- Museum Curator consultant – to consider the Interpretation Plan within the Museum Space as per April 2017 Council direction. Site use areas to be defined for the museum component, dedicated work and storage space for the Bassendean Arts Council and common shared meeting and activity spaces for multiple user groups including capacity for school education programs
- Exhibition consultant – Please note that Creative Spaces contract has concluded and therefore the exhibition plan for the 2C design will most likely need to be amended. A new Exhibition consultant is required
  interpretation within the museum space to include original and reproduction arte-facts and within the cottage to include interpretation of a standard commensurate with that of the Howick Historical Village in Auckland New Zealand to create an authentic experience for museum visitors

- Heritage consultant – (As Dr. Fiona Bush contract has concluded, a new heritage consultant is required)

- Building Management consultant - Prepare "risk management" and "building management" plans as per April 2017 Council direction. A management plan for the ongoing use of the site to be presented to the Audit and Risk Committee and to be adopted by Council

- Building Surveyors – quantity estimator during the detailed design phases
- Energy Efficiency consultation during the detailed design phases

- Structural Engineering Assessment and advice during the detailed design phases
- Mechanical Consultant
- Electrical Consultant
- Hydraulic Engineering Consultant
- Landscape Consultant

- Architectural Consultant
  For plans prepared consistent with Option 1 prepared by the SIA architects and the building uses recommended in the Interpretation Plan and subject to modifications sought by the key user groups as previously documented being included.

  The above services would include site and building plans, costings, the management plan and the details of the proposed interpretation be made available to the public via the Town's website and presented at a public meeting for community input prior to the commencement of construction.

Studio 10, 17 Thurlow Street East Redfern NSW 2016
T (02) 9360 9833
sia_architects@westnet.com.au

2A Market Street Fremantle 6160
T (08) 9430 6811 Fax (08) 9430 6844
web siaarchitects.com

SIA ARCHITECTS pty ltd

ACN 090 958 357

We have received the following quotations from a list of consultants. For these quotations we have contacted consultants that have worked on the project to date in engineering and landscaping. In relation to museum curator, exhibition and heritage, we have obtained a single quotation from one consultant who is highly regarded in WA and well experienced in these disciplines. The result is as follows:

1	Museum Consultant, Exhibition Consultant, Heritage (Schools' Curriculum/programs)		$ 35,000.00 ($ 10,000.00*)
2	Building Management Consultant		$ 4,950.00
3	QS/Quantity Surveyor		$ 16,335.00
4	Energy Efficiency Consultant		$ 8,540.00
5	Structural Engineer		$ 9,300.00
6	Mechanical Engineer		$ 6,300.00
7	Electrical Engineer		$ 7,390.00
8	Hydraulic Engineer		$ 5,950.00
9	Landscape Consultant		$ 1,980.00
10	Architectural Consultant (Phases 1- 4)		$ 18,500.00
	TOTAL (not including gst) **TOTAL** INCLUDING GST		**$ 114,245.00** **$ 125,669.50**

- We have advice from the museum consultant that a specialist consultant would need to be considered for preparing a 'schools' curriculum programs' in relation to the museum. We have obtained a quotation from such a consultant for $ 8,500.00 to $10,000.00 to prepare such a program for the Bassendean Pensioner Guard Museum project. The $10,000.00 amount displayed in brackets in the above schedule has not been included in the overall cost of $125,669.50.

Further to your request for an 'order of magnitude of costs', we have been requested to submit an 'estimate of time frames' for the delivery of the project that will undergo again the following phases:

- Phase 1: Pre- Design
- Phase 2: Schematic Design –including Risk Management Plans/ Museum & Exhibition Plans/ Key Stakeholder and community consultation
- Phase 3: Design Development & Documentation
- Phase 4: Submitting Development Applications Design process

Our estimate of the time phases is:

- Phase 1: Pre- Design (invitation to tender/consultants & review) 4 weeks
- Phase 2: Schematic Design 10 weeks *
- Phase 3: Design Development & Documentation 8 weeks *
- Phase 4: Submitting Development Applications Design process 8-10 weeks
  (this may take longer as subject to review by State Heritage and WA Museum)

TOTAL ESTIMATE OF TIME* 30-32 weeks/ (7.5-8 months)

- Phase 2 & 3 Period includes provision of time for consultation & review with stakeholders though the time community consultation may take cannot be determined at this stage.
- "Total Estimate of Time" does not include time required for provision of café facilities to north east corner of museum/Residency building. Further 12 months should be allocated to the program for a rezoning process that would need to be applied to allow for café use, public access and use of café facilities to the Residency or the site generally.

Studio 10, 17 Thurlow Street East Redfern NSW 2016
T (02) 9360 9833
sia_architects@westnet.com.au

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web siaarchitects.com

SIA ARCHITECTS pty ltd

ACN 090 958 357

Your letter of email of 1st of May also includes with other details reference to Option 1 & Option 2 Estimates of costs from an Agenda – OCM 24/11/2015:
*"**Option 1 ($758,605) is also cheaper than option 2 ($808,898) see pp43/44 of 90 Agenda OCM 24/11/2015**"*
I have referred this item to the Quantity Surveyor TAMRAM, Terry Merefield, the appointed QS from the start of the project who had prepared these estimates and the latest most recent pre-tender estimates of cost. His advice is that the these estimates of November 2015 were prepared before further detailed structural reports were received in regard to the condition of the rear addition concrete roof and further advice received by us (SIA) in regard to structural modifications and ongoing maintenance costs that would need to be applied to the rear addition to adapt it to the proposed layout for Option 1.

Mr. Merefield has advised that in factoring works relating to repair or removal of the concrete roof, (new roofing and ceiling structure, roofing, ceilings and associated repairs), for additional shoring of structure to accommodate latest Option 1 proposed layout and for ongoing maintenance costs to rear roof (if the concrete roof was retained), Option 1 cost would exceed the cost of Option 2 - relating to this portion of the over Pensioner Guard project.

Regards

Sasha Ivanovich
FRAIA
Managing Director/Heritage Architect (WA/NSW)
SIA Architects Pty Ltd

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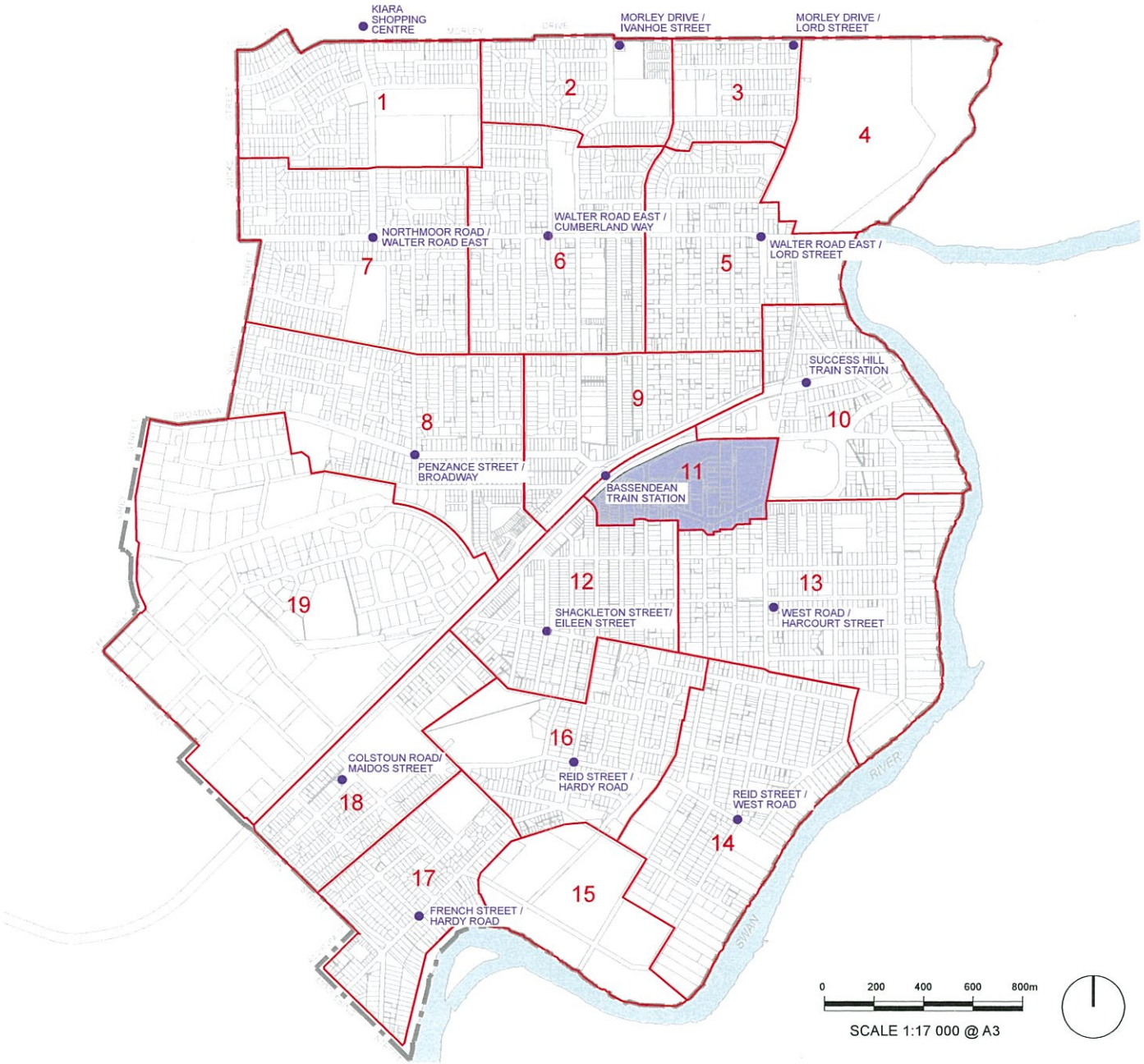
ATTACHMENT NO. 8



LOCAL PLANNING STRATEGY 2017 - 2030

NOTIONAL PLANNING PRECINCTS

Planning Precinct Boundary + Extent

Notional Town Centre

Notional 'Local Centre'

Planning Precincts

Eden Hill West	1
Eden Hill Central	2
Eden Hill East	3
Pyrton	4
Bassendean North East	5
Bassendean North	6
Bassendean North West	7
Bassendean West	8
Bassendean Central	9
Success Hill	10
Town Centre	11
Bassendean South West	12
Bassendean East	13
Bassendean South East	14
Ashfield Flats	15
Bassendean South	16
Ashfield South	17
Ashfield North	18
Tonkin Business Park	19

Notes:

The shape and size of the notional Planning Precincts depicted on the map are predicated upon a 400 metre radius 'ped-shed' measured from the centre of the 'ped-shed' to its edge.

The size and positioning of these precincts are notional only and may change.

Their purpose is to provide the initial basis for defining and shaping the Town of Bassendean's proposed Planning Precincts.

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Home by the Swan

Drawing Ref: LUAP/PLANNG/18_NPP002
May 2017

Some Design Principles

- Some universal design principles that apply to the designing of a neighbourhood include:
  - Accommodating an average size population of around 500 people—more than 1,500 people is too many
  - The edge or boundary should align with some lineal or topographical feature, eg. a creek, river, trail, canal, arterial road, boulevard etc
  - Priority access is given to pedestrians and cyclists over motor vehicles
  - The neighbourhood centre is located at—and fronts—the intersection of connecting (higher-order) local streets and minor arterial roads

SOME DESIGN PRINCIPLES *(continued)*

- The provision of medium-density housing surrounding the neighbourhood centre

- Additionally, the WAPC recommends:

  - A maximum floor area of any retail use within a Local Centre being limited to a maximum of 1,500 m^2 of nett lettable area (NLA)

    NB: This is quite generous considering lesser floor space limitations prescribed in local planning schemes are placed on the size of corner stores and home stores

    Traditionally, corner stores and the like have been allowed to comprise up to a maximum floor area of between 200m^2 ~ 250 m^2

Some Design Principles *(continued)*

- Medium density housing around a neighbourhood (or local) centre be provided at a density between R40 ~ R60 extending outwards within a 200 m - 250 m radius of the centre, with low density housing (eg. < R40) extending beyond to the edge

- The centre be located adjacent to a public transit route stop

(A stylised graphic illustrating and interpreting the neighbourhood design principles follows on the next slide)

SOME DESIGN PRINCIPLES *(continued)*

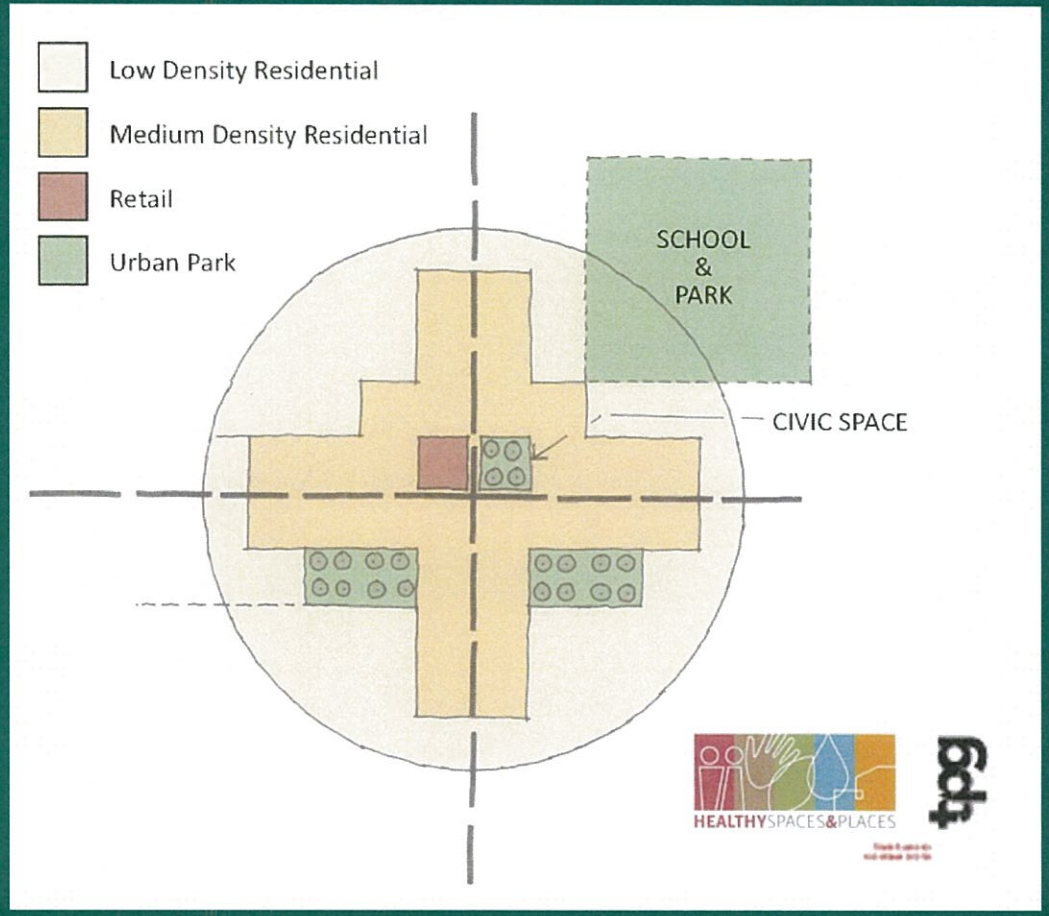


TABLE 3: ACTIVITY CENTRE FUNCTIONS, TYPICAL CHARACTERISTICS AND PERFORMANCE TARGETS					
Typical characteristics	**Perth Capital City**	**Strategic metropolitan centres**	**Secondary centres**	**District centres**	**Neighbourhood centres**
Main role/function	Perth Capital City is the largest of the activity centres, providing the most intensely concentrated development in the region. It has the greatest range of high order services and jobs, and the largest commercial component of any activity centre.	Strategic metropolitan centres are the main regional activity centres. They are multipurpose centres that provide a diversity of uses. These centres provide the full range of economic and community services necessary for the communities in their catchments.	Secondary centres share similar characteristics with strategic metropolitan centres but serve smaller catchments and offer a more limited range of services, facilities and employment opportunities. They perform an important role in the city's economy, and provide essential services to their catchments.	District centres have a greater focus on servicing the daily and weekly needs of residents. Their relatively smaller scale catchment enables them to have a greater local community focus and provide services, facilities and job opportunities that reflect the particular needs of their catchments.	Neighbourhood centres provide for daily and weekly household shopping needs, community facilities and a small range of other convenience services.
Transport connectivity and accessibility	Focus of regional road and rail infrastructure as well as radial bus network.	Important focus for passenger rail and high frequency bus networks.	Important focus for passenger rail and/or high frequency bus network.	Focal point for bus network.	Stopping / transfer point for bus network.
Typical retail types	▪ As per strategic metropolitan centres	▪ Department store/s ▪ Discount department stores ▪ Supermarkets ▪ Full range of speciality shops	▪ Department store/s ▪ Discount department store/s ▪ Supermarkets ▪ Speciality shops	▪ Discount department stores ▪ Supermarkets ▪ Convenience goods ▪ Small scale comparison shopping ▪ Personal services ▪ Some specialty shops	▪ Supermarket/s ▪ Personal services ▪ Convenience shops
Typical Office development	▪ Major offices ▪ Commonwealth and state government agencies	▪ Major offices ▪ State government agencies	▪ Major offices ▪ Professional and service businesses	▪ District level office development ▪ Local professional services	▪ Local professional services

TABLE 3: ACTIVITY CENTRE FUNCTIONS, TYPICAL CHARACTERISTICS AND PERFORMANCE TARGETS									
Typical characteristics	**Perth Capital City**	**Strategic metropolitan centres**		**Secondary centres**		**District centres**		**Neighbourhood centres**	
Future indicative service population (trade) area[4]	Greater metropolitan region	150,000–300,000 persons		Up to 150,000 persons		20,000–50,000 persons		2000–15,000 persons (about 1 km radius)	
Walkable Catchment for residential density target	N/A	800m		400m		400m		200m	
Residential density target per *gross hectare*[5]	N/A	Minimum	Desirable	Minimum	Desirable	Minimum	Desirable	Minimum	Desirable
		30	45	25	35	20	30	15	25

Table 3: Diversity performance target - *mix of land uses* [6]		
	Centre size - *Shop-retail* floor space component	*Mix of land uses* floorspace as a proportion of the centre's total floor space[7]
Perth Capital City	N/A	
Strategic metropolitan centres, secondary and district centres	above 100 000m2	50 %
	above 50 000m2	40 %
	above 20 000m2	30 %
	above 10 000m2	20 %
	less than 10 000m2	N/A
Neighbourhood centres	N/A	

[4] Service population or retail trade areas for (residential-associated) centres are indicative only and often overlap.
[5] Typically, the average R Code (or net density) equivalent is two to three times the number of dwellings per *gross hectare*.
[6] "*Mix of land uses*" includes office, civic, business, health, community, entertainment cultural uses and showrooms: see definition in **Appendix 1.**
[7] Total shop-retail and *mix of land uses* floor space.

Fine-tuning the calculation

There are practical influences on walkable catchments such as short-cuts through parks or along pedestrian paths. These should only be included where there is a high level of surveillance, during evenings and at weekends, from adjoining development that fronts the parks and where there is good lighting. Similarly, the walkable catchment may need to be reduced where there is poor surveillance and routes are perceived to be unsafe.

Figure 41: Conventional subdivision around a neighbourhood centre.

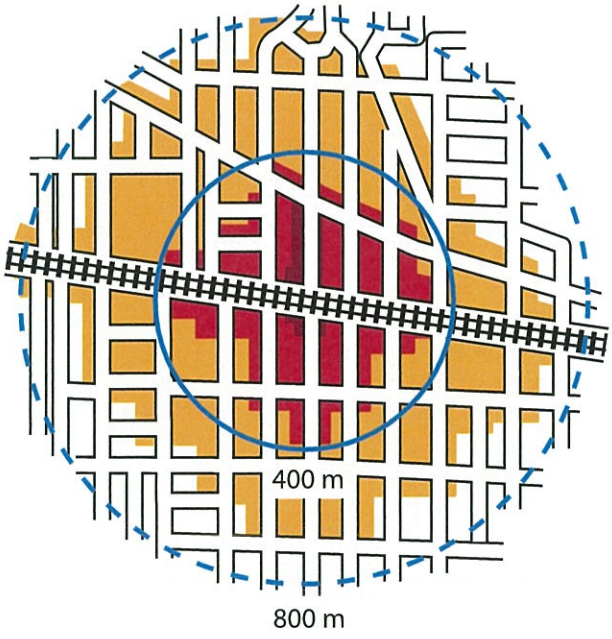


Figure 42: A walkable neighbourhood around a neighbourhood centre and transit station

Urban structure

Objective 2: To develop a coherent urban structure of compact walkable neighbourhoods which cluster around activity centres capable of facilitating a broad range of land uses, employment and social opportunities

Planning of an urban structure is focused on clusters of compact and well-defined walkable neighbourhoods and activity centres.

Neighbourhoods are initially identified as circles of 400 metre radius (approximately 50 hectares in area) showing the theoretical distance a pedestrian walks in five minutes from the centre to its perimeter (Figure 2). Most people will consider walking up to 400 metres to access services and facilities, or 800 metres to a train station or higher-order centre. The target is for 60 per cent of the area within a 400 metre radius of the destination to be within a 400 metre walk, using the pedestrian network.

Once indicative catchments have been identified each neighbourhood cell is connected through a network of highly interconnected streets, which allows the optimal integration of land uses to maximise local access to services and facilities contributing to urban vitality and activity.

Integrator arterials and neighbourhood connectors are drawn through the neighbourhoods so that points of intersection are potential new activity centres (Figure 3).

Neighbourhood or local centres are located centrally within the neighbourhood catchment. The design of the activity centre will vary in size depending on community needs, transport connections, residential densities, demographics and proximity to other centres.

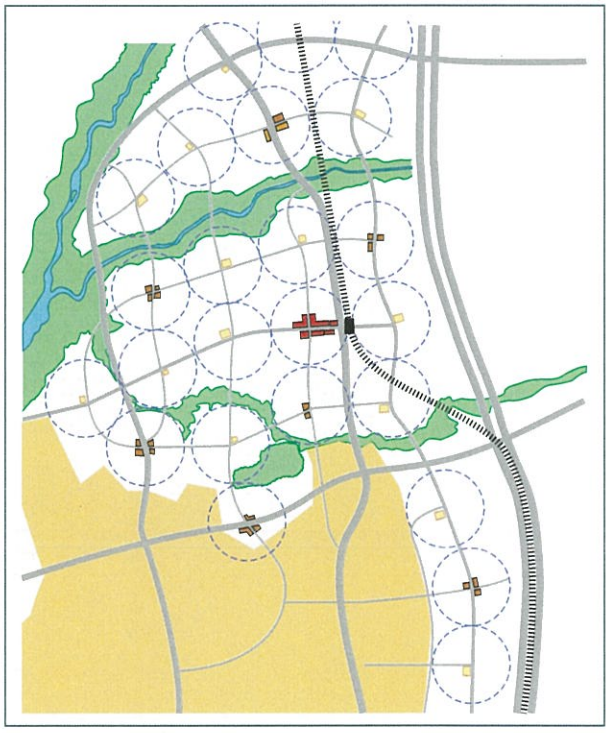


Figure 2: Clustering of neighbourhoods

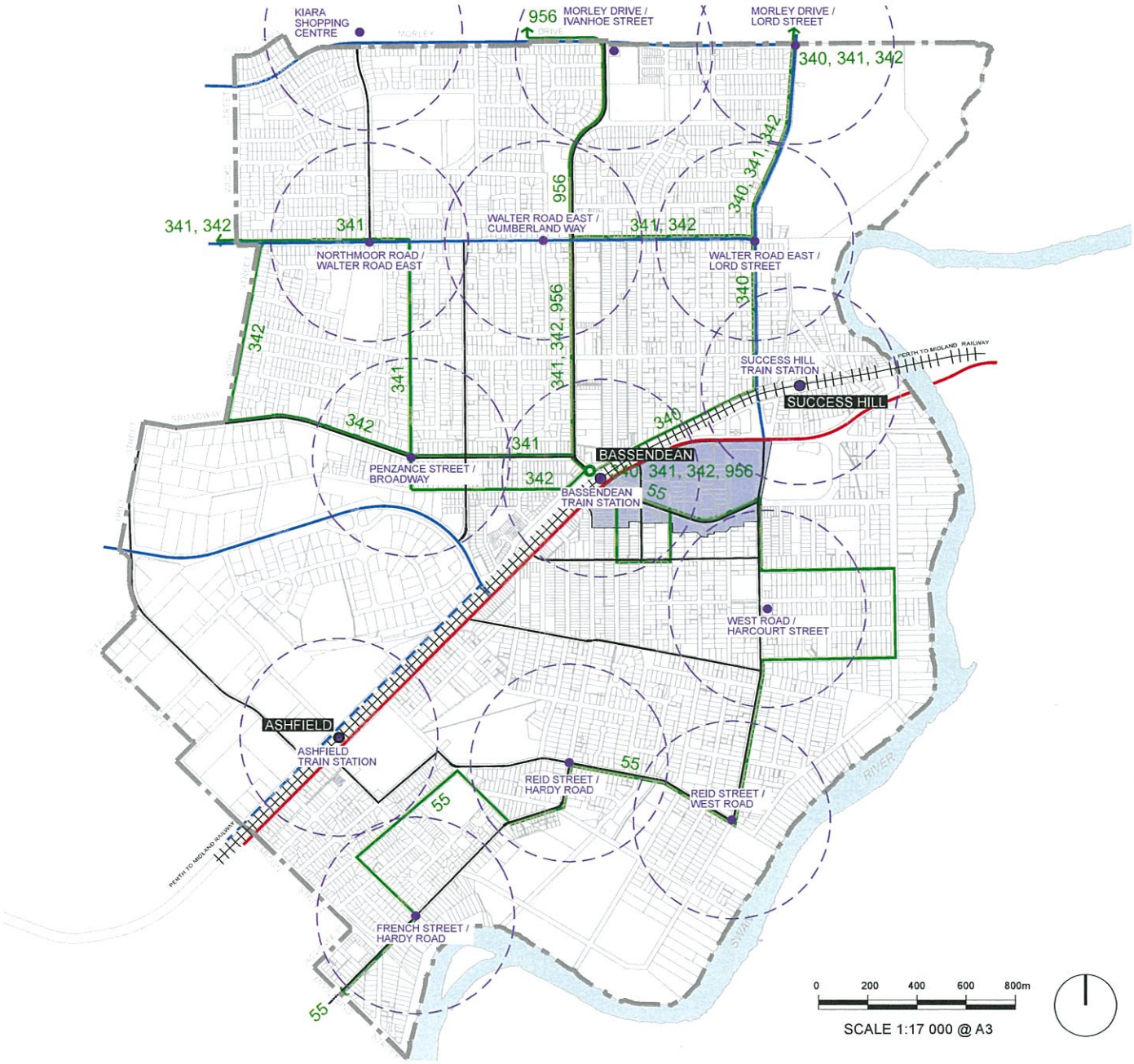
URBAN STRUCTURE REQUIREMENTS

2.1	Cluster six to nine neighbourhoods to provide an adequate population to sustain a centrally located large district and/or secondary centre.
2.2	Connect new urban areas to existing, or proposed urban areas ensuring permeability and synergies of land uses.
2.3	At least 60 per cent of dwellings to be in a 400 metre walk from an activity centre or an existing or future public transit stop or station.

LOCAL PLANNING STRATEGY 2017 - 2030

NOTIONAL PEDSHEDS

SCENARIO 2



- Primary Distributor
- Integrator Arterial A
- Intergrator Arterial B
- Neighbourhood Connector
- Town Centre
- 'Local Centre'
- Railway, Railway Station (Transperth)
- Bus Route, Route No. (Transperth) — 55
- 400 metre radius 'Pedshed'

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Home by the Swan

Drawing Ref: LUAP/PLANNG/18_NPP001
April 2017

ATTACHMENT NO. 9

Community Events Sponsorship

TOWN OF
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COMMUNITY EVENTS SPONSORSHIPS

GUIDELINES AND APPLICATION FORMS

Community Events Sponsorship

Please return to:
Town of Bassendean
PO Box 87
Bassendean, WA, 6934
Enquiries – 9377 8000

GUIDELINES

1 INTRODUCTION

The Town of Bassendean is committed towards the provision of community events as they enhance the quality of life in the Town. The Town is also committed towards facilitating community capacity-building and self-reliance by supporting quality community generated events. To achieve this outcome, the Town provides sponsorship opportunities for eligible organisations.

2 PROGRAMME OBJECTIVES

Objectives

- To be cooperative leaders in the provision of events for the community, by establishing mutually beneficial partnerships between the Town and the community.
- To further assist community organisations to maximise their development, in partnership with the Town of Bassendean.
- To provide an equitable means by which community organisations can access Council funds for their sustainability.
- To provide an approach for facilitating community development within the Town of Bassendean.

3 SPONSORSHIP ELIGIBILITY

To be **eligible** for sponsorship the applicant must meet one of the following classifications: -

The **APPLICANT** shall be:

- An *incorporated sporting/leisure/cultural* organisation, which is based in the Town of Bassendean or undertakes projects for the benefit of Town of Bassendean residents. The primary aim of these organisations should be to advance the social, cultural, leisure or sporting needs of the local community.

- An *incorporated charitable (non profit)* organisation, which is based in the Town of Bassendean or undertakes projects for the benefit of Town of Bassendean residents. The primary aim should be to improve the quality of life of underprivileged sections of the local community.

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3. Opening and closing dates for sponsorship applications will be as follows:
   - Applications for sponsorship will open in July (immediately following the adoption of the Council Budget).
   - Eligible groups can apply any time, with sponsorships being considered at the next available Cultural Development Committee meeting, which are scheduled for February, May, July & October.
   - Sponsorship shall be awarded for eligible projects on a "first in – first served" basis.

4. All applicants shall be advised of the decision in writing. Successful applicants will be required to enter into a formal sponsorship agreement (contract) with the Town of Bassendean. The applicant's acceptance of an offer of sponsorship by the Town will result in the applicant being contractually bound to carry out the project, which has been put forward to the Town, as a matter of contractual obligation in consideration of the sponsorship payment.

5. Successful applicants will be required to provide return benefits to the Town.

6. The Town will make sponsorship available to the applicant soon after receipt of the signed contract. All sponsorship is to be expended within twelve months of it being awarded. Applicants shall provide an acquittal report [on the form provided] within four weeks of the completion of the community event. Non-reporting may jeopardise future sponsorship applications.

7. Any variation to the total cost after sponsorship approval will be solely at the applicant's cost.

8. Should an applicant fail to secure funding from alternative sources, resulting in the applicant being unable to meet the cost of the community event then the Town's sponsorship will be withheld.

9. Major variations to the project plan need to be approved by Council.

7 RETURN BENEFITS TO THE TOWN OF BASSENDEAN

Successful applicants will be expected to provide return benefits to the Town, including but not limited to:

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- Agreeing to place the Town's logo on any promotional literature associated with the community event.
- Agreeing to place signage (provided by the Town) at the sponsored community event.
- Agreeing to undertake joint media promotion with the Town.

The return benefits will be specified on the sponsorship contract.

8 CRITERIA FOR ASSESSMENT

The sponsorship application may require additional criteria appropriate to the program, however the following general criteria will be used in the assessment of the application:

- The request demonstrates a 'need'.
- The project is based within the Town, or offers return benefits for Town of Bassendean residents.
- The community event must comply with the Town's Local Laws and Policies.
- Demonstrate local residents' participation.
- Local support either financial or in-kind.
- The activity should attract people to the Town or benefit the general community.
- The activity must provide value to the Town.
- The application must fit in with the Town's Corporate Plan, including:
    - To secure a better and safe environment
    - To create a proud, positive and harmonious community
    - To facilitate effective community participation and consultation

9 HOW TO APPLY

Preparation of the Application Form

It is important that applicants read the guidelines carefully to ensure they meet the selection criteria. Before making an application, discuss your project idea with the Town's Cultural Development Officer.

Lodgment of the Application Form

Applications must be prepared on the forms provided by the Town of Bassendean. **Faxed or emailed applications will not be accepted.**

Applications can be lodged in person at the Town of Bassendean

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- An *incorporated community group*, which is based in the Town of Bassendean or undertakes projects for the benefit of Town of Bassendean residents. The provider may be an adjunct organisation of a government instrumentality, whose primary aim is to provide a community service to all or specific sections of the local community.

- An *educational institution*, which is based in the Town of Bassendean or undertakes projects for the benefit of Town of Bassendean residents. The institution may be a State or private organisation, which is recognised by the State Dept as a provider of education services for the local community.

4 TYPES OF EVENTS THAT MAY BE CONSIDERED FOR SUPPORT

- Eligible applicants can request sponsorship up to a maximum of $1,000, for a range of community events (including but not limited to the following events):
  - Community picnics,
  - All ages gigs,
  - Youth Advisory Council (YAC) concerts
  - Open days for local sporting & community groups and
  - Celebratory days (Christmas, New Years Eve, Harmony Day, NAIDOC Week etc).
- The sponsorship can be utilised to assist with the following costs to conduct the event: facility hire, equipment hire, entertainment and promotional costs.
- The sponsorship may not be utilised for catering (including alcohol), admin, merchandise, trophies or uniforms.
- Successful applicants are only eligible to receive one sponsorship in this category per financial year.
- Priority for sponsorship may also be given to eligible applicants who have not received sponsorship under this category in the previous three years.
- If the community event is a profit-making venture (e.g. a fund raising event) the applicant shall provide an indication of what the profits will be spent on.

5 IMPORTANT INFORMATION ON THE GOODS AND SERVICES TAX (GST)

Under the current Federal legislation relating to the Goods and

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Services Tax (GST), sponsorship income received by an organisation may be subject to GST. The following guidelines are provided to help applicants understand the implications of the GST.

Organisations who have an Australian Business Number (ABN) and who are registered for the GST: such applicants will be liable to pay GST on any sponsorship received from the Town of Bassendean, to the Australian Taxation Office (ATO). In this case the Town will provide a "cashed-up" amount, i.e. it will include an additional 10% for the GST. For example, if an organisation applies for sponsorship of $1,000 and the Town approves it, they will receive $1,100. **Organisations will be asked to provide a tax invoice to the Town of Bassendean**, and the Town will then claim the GST component back from the ATO as an input tax credit.

Organisations who have an Australian Business Number (ABN) and who are not registered for the GST: such applicants will not be liable to pay GST on any sponsorship received from the Town of Bassendean, to the Australian Taxation Office (ATO). In this case the Town will not "cash up" the sponsorship amount.

Organisations who do not have an Australian Business Number (ABN) and who are not registered for the GST: such applicants will not be liable to pay GST on any sponsorship received from the Town of Bassendean, if they can provide proof that their organisation is not required to have an ABN (please complete the "statement by a supplier" form which is available from the Australian Taxation Office). If this is not provided, the organisation may have 48.5% of their sponsorship payment withheld by the Town of Bassendean, which is then payable to Australian Taxation Office.

6 GENERAL CONDITIONS OF SPONSORSHIP

Applicants must be aware of and agree to the following general sponsorship conditions:

1. Applicants must liaise with the Town's Community Development Officer (Culture) before, during and upon completion of the sponsored project.

2. Failure to complete the application form and attach necessary documentation to the satisfaction of the Town, may deem the application invalid. Requests for sponsorship for items over $500 must be supported by two written quotes from contractors/suppliers and must be included with the application forms.

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APPLICATION FORM

To assist in the assessment of your application, please ensure you print clearly, complete all details and provide any attachments requested – Thank you.

NAME OF APPLICANT GROUP:	**Bassendean 55 Plus Association Inc.**
NAME OF EVENT:	**Launch of New Name and Logo**

TYPE OF APPLICANT GROUP:	o Incorporated sporting/leisure/cultural organisation o Incorporated charitable (non profit) organisation o Incorporated community group o Educational institution

CONTACT PERSON: (Must be over 18yrs)	Mr o Mrs o Ms o	Given Name	**E. John**
		Surname	**Sutherland**
		Position Held	**President**
		Proof of Identity (Driver's License No.)	**0332623**

POSTAL ADDRESS (For Invoices):		**PHYSICAL ADDRESS:**	
50 Old Perth Rd		**50 Old PerthRd**	
Suburb	Bassendean	Suburb	**Bassendean**
Postcode	6054	Postcode	**6054**

CONTACT NUMBERS	Work Phone	**92791944**	Fax	**N/A**
	Home Phone	**92791774**	Mobile	**N/A**
	E-mail	**seniors05@bigpond.com**		

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IS THE APPLICANT GROUP REGISTERED FOR THE GST? **YES** ☙ **NO** o	**DOES THE APPLICANT GROUP HAVE AN AUSTRALIAN BUSINESS NUMBER (ABN)?** **YES** o **ABN is:72853934716** **NO** o
IS THE APPLICANT GROUP INCORPORATED? **YES** o **Incorporation number on top of incorporation certificate is: _attached** **NO** o	**DOES THE APPLICANT GROUP HAVE CURRENT PUBLIC LIABLITY INSURANCE?** **YES** o [Please attach a copy of your certificate of currency for public liability cover] **NO** o

PROJECT DESCRIPTION (Brief description of overall project – 150 words max):

AFTER 54 YEARS OF SERVING THE COMMUNITY OF BASSENDEAN, On the 29th March 2017 the BASSENDEAN Seniors Citizen's Welfare association officially changed its name to Bassendean 55 Plus Association. The purpose of this project is to officially launch our new name and logo. It is intended to do this with a lunch at the Senior's and Community Hall, for our own members and representatives from other organisations involved with the older section of the community. We would also like to include our sponsors, local businesses and council representatives . This will provide an opportunity for networking among the groups and future interaction and cooperation.

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BRIEF BACKGROUND OF ORGANISATION (Purpose, how long in operation, etc. 150 words max.):

_Founded in 1964 The Bassendean Senior Citizens Welfare Association has a long successful history of serving the older members of the Bassendean community .
However times have changed and to keep abreast of the new social environment it is also time for us to make some changes . To this end we have changed our constitution and name but will still continue to provide programmes that stimulate the mind, encourage physical activity, and provide a friendly meeting place for our members, and thus provide the three elements that will enable our older citizens have a healthy and happy lives.

PROJECT OUTCOMES:

Greater profile of our organisation to similar groups and the wider Bassendean community. To increase our membership and ability to provide more activities to the senior members of the Bassendean community. Programmes that provide

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WHAT RELATIONSHIP DOES YOUR ORGANISATION HAVE WITH OTHER SERVICES WITHIN THE COMMUNITY?

_We have a close working relationship with many other organisations in the town including, Wider Vision, The Bassendean Seniors and Disabilities Services,The Melody Club. .

WHAT BENEFITS DO YOU SEE FOR YOUR GROUP FROM THIS PROJECT?

It is planned that this activity should enable the group to reinvigorate by encouraging new members, especially those in the younger demographic and members of our community who are at present not active and isolated in their homes..

TARGET GROUP:
Who is the project being developed for and state approximately how many people will benefit from the project?

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The project is being developed to increase our membership within the senior section of the community, so that we will be able to provide more activities in a safe friendly environment and thus help to alleviate by sense of loneliness and isolation felt a many older members of our community particularly those on non-European decent.
We anticipate raising awareness in 200-300 members of the Bassendean community.

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BUDGET

INCOME	
Income - Cash	
Sponsorship requested from the Town of Bassendean (GST exclusive)	**$1000**
Cash Contribution from Applicant	**$1150**
Ticket Sales if applicable	
Merchandise Sales if applicable	
Other cash income	
Income - In Kind	
Venue Donation	
Coordinators Time	**$300**
Materials	**$50**
Photocopies	**$100**
Mail outs	
Other In-kind support volunteers time	**$300**
TOTAL INCOME	**2600**

EXPENDITURE	
Expenditure - Cash	
Artist Fees or Quote for Service	**$880**
Equipment Hire	
Venue Costs	
Marketing Promotion mail out and advertisement	**$200**
Administration	**$200**
Materials	**$50**
Catering	**$1000**
Merchandise	
Other	
Expenditure - In Kind	
Venue Donation	**$20**
Coordinators Time	**$300**
Materials	
Photocopies	
Mail outs	
Other In-kind expenditure Afternoon tea	**$200**
TOTAL EXPENDITURE	

Note:

- The sponsorship request that is made to the Town of Bassendean should not include the GST, because the Council will automatically "cash-up" the amount for successful applicants if they are registered for the GST, (i.e. The Council will include an additional 10% for the GST). For example, if an organisation applies for sponsorship of $1,000 and it is approved by Council, they will receive $1,100, if they are registered for GST.
- Requests for sponsorship for items over $500 shall be supported by two written quotes from contractors/suppliers (and included with the application form). In the event of insufficient contractors/ suppliers, one quotation will be accepted.

Community Events Sponsorship

TOWN OF BASSENDEAN
Home by the Swan

Please return to:
Town of Bassendean
PO Box 87
Bassendean, WA, 6934
Enquiries – 9377 8000

CHECKLIST

Please check your application against the table below and ensure all relevant criteria has been completed. If any criteria has not been completed, please supply a **brief** comment stating reasons.

Criteria	Yes	No	Comments *If applicable*
Have you enclosed six copies of the completed application?	✓		
Have you enclosed copies of the quotes from supplier/service providers, if required?		✓	
Have you enclosed a copy of your Certificate of Incorporation?	✓		
Have you completed the budget and attached details as outlined in the application?	✓		
Have you consulted with community groups and individuals affected by the project?	✓		
Have you discussed this project with Council staff?	✓		

Community Events Sponsorship

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Bassendean, WA, 6934
Enquiries – 9377 8000

Conditions of Application to Town of Bassendean

If the application is successful these conditions will form part of your sponsorship contract with the Town of Bassendean.

1. We agree to display the Town of Bassendean logo (supplied by Council) on our letters.
2. We agree to acknowledge the Town's sponsorship through public address announcements.
3. We agree to acknowledge the Town's sponsorship by displaying signage (supplied by Council) at our event.
4. We are prepared to undertake joint media promotion with the Town.
5. We recognise that special conditions may need to apply to the sponsorship addressing relevant elements of the Town's Corporate Plan to compliment the organisation's objectives.
6. We agree to invite two representatives from the Town of Bassendean to the sponsored activity or event.
7. We agree to provide an acquittal report on the form provided within four (4) weeks of the project's completion.
8. We undertake in consideration of the sponsorship payment to carry out our proposed project in full.

Acceptance of Conditions

I have read and understand the above conditions and am authorised to accept them on behalf of the hirer / club / group / school named previously.

APPLICANT GROUP: Bassendean JS Plus

SIGNATURE OF APPLICANT: _____ DATE: 6 4 2017

SGIO

SGIO SERVICE TBC
463 OUEN ST
WEST PERTH WA 6005

GPO Box M929
PERTH WA 6001
Telephone 13 2818
Facsimile 1300 367310

COMMERCIAL INSURANCE
ACCOUNT SUMMARY

Page 1 Client Original

050

BASSENDEAN SENIOR CITIZENS WELFARE
50 OLD PERTH RD
BASSENDEAN WA 6054

Doc No: 42-7925 14/1
Client No: 6-0772
Issue Date: 31/07/2016
Policy No: BP 42-7925
Team: DIR MC6
Requested By: AUTOREN

Insured: BASSENDEAN SENIOR CITIZENS WELFARE ASSOCIATION (INC)

ABN 72 853 934 716

Please retain this Document for your records.

Date Payable	Amount	
6/09/16	$1,111.80	(including $91.88 GST)

Total Amount **$1,111.80** **(including $91.88 GST)**

This document will become a Tax Invoice upon payment

If you are registered for GST purposes, your Input Tax Credit entitlement is based on the amount shown above. Please note that in accordance with the GST law relating to insurance premiums the GST amount may be less than 1/11th of the total amount payable

Cheque No 000219 - Bendigo Bank 9/9/2016

RECEIVED 12-9-2016

A.16/72

Form 5

Certificate of Incorporation

Associations Incorporation Act, 1895-1969
Section 3 (3)

These are to Certify that ..

BASSENDEAN SENIOR CITIZENS' WELFARE ASSOCIATION INC.

has this day been incorporated as an Association under the provisions of the Associations Incorporation Act, 1895-1969

Dated this twentyeighth day of March, 19 72.

DEPUTY REGISTRAR OF COMPANIES.

ATTACHMENT NO. 10

Little Italy Street Festival Extravaganza

Spring Sagra

Saturday 9 & Sunday 10 September 2017

Town of Bassendean Council Gardens
Town of Bassendean Community Main Hall
Bassendean Seniors & Community Centre Car Park

2017 Stakeholder Prospectus

Presented by Nella Fitzgerald Events

Reasons the event is needed

Little Italy Street Festival Extravaganza is a free entry family friendly community event proposed to be presented in the Town of Bassendean in 2017. It will be a celebration of our community, a sharing of stories, connecting with our fellow people in our community and an acknowledgement and celebration of the enormous contribution our forebears from Italy brought to the town many decades ago.

Festival core values that are relevant in our community reflect the ongoing commitment of Nella Fitzgerald to ensure the Italian heritage and culture are valued and continued in the wider Western Australian community:

Reconnecting with our traditions and values

Connecting with the younger generation of Italo-Australians

Sharing of our culture and heritage with the wider community

A sharing and collecting of stories

A curated multicultural festival and promotions for *Spring Sagra* will provide a high quality alternative to mainstream festival events in Western Australia, ensuring the Town of Bassendean becomes renown tourist destination for cultural events. The festival will be an innovative opportunity to invite the community to participate in a high quality, family friendly free event.

The Italian culture is one of the modern world's richest cultures, going back to the times of ancient Rome and beyond. With over a million citizens of Italian origin living in Australia today, the Italian language and culture are of ever increasing importance.

The strong presence of the Italian community in Australia has captured the interest of Australians from all backgrounds, and the community is eager to familiarize themselves with a culture which has become increasingly admired, valued and respected. Australia prides itself on being a multi-cultural community and this project will introduce the Italian culture to a wide range of people from all walks of life.

Western Australia is one of Australia's most culturally diverse states and our advancing universal society has gained increasing relevance for arts and cultural organizations. Cultural diversity is an integral part of Western Australia's social fabric and The Festival offers an opportunity to highlight the modern evolving face of Multicultural Arts in Western Australia.

The Arts sector is potentially one of the most powerful mediums through which to facilitate a more cohesive and harmonious society. The event will offer the Western Australian community benefits by showcasing the creative and diverse input of multicultural artists.

The Festival will be a cultural event that will reflect a global view of the world in keeping with Western Australia's cosmopolitan nature and the globalisation of the 21st century.

The promotion of friendship, tolerance and understanding of each individual - the building blocks towards our mutual community goal of respect, tolerance and celebration of our being part of an extended global family.

The artistic and cultural value of the project will contribute enormously to strengthening the links between Australia and Italy through the universal language of music, while keeping the Italian music and culture alive for future generations.

Opportunities made available to the wider community to experience the contemporary face of Italy through the presentation of an innovative event.

Different communication styles reflect philosophies and worldviews that are the foundations of cultures.

While our backgrounds, experiences and interests are different, our shared values connect us as Western Australians. The festival will *emphasize common interests rather than differences.*

The Key Objectives

- Unify Australians of all backgrounds, encouraging the spirit of friendship throughout our community. People will embrace the camaraderie that can exist amongst us all, providing an opportunity for them to contribute and participate in a premier event promoting community harmony in Australia's multicultural society.
- Foster a vibrant, healthy and livable community and expanded public availability through a culturally innovative event. A ground-breaking combination of high quality professional entertainment and free entry thereby increasing accessibility across a broad spectrum of our multicultural community.
- Produce quality outcomes to underline the importance of multicultural arts, both to participants and the community.
- Provide outstanding network opportunities through structured events and promotions, allowing key stakeholders and sponsors to profile and promote their businesses and key staff within the business community.
- Present an extraordinary opportunity to sponsors and key stakeholders to experience the innovation, passion and energy that is unique to the project.
- Offer a unique and world class hospitality environment for enhancing professional relationships through memorable experiences in a shared and stimulating setting.
- Maintain broad ranging business development opportunities for the business and corporate sectors.
- Celebrate and explore the cultures and the diversity of our community and create an experience that is accessible to the widest possible range of people.

- Ensure the ongoing promotion of talented and highly skilled Western Australian artists, that will positively influence our country for future generations to come.
- Promote respect, fairness, inclusion and a sense of belonging, for everyone.
- Develop the existing linkages of family and association between Italy and Australia.
- .Participants to proudly identify themselves as Australians, each with a unique cultural background and a strong sense of identity.

The Key Outcomes

- Advancing creativity, innovation and development in Western Australia, and underpinning the State's ability to sustain long term economic growth.
- Assist the arts sector to directly stimulate economic development and the health and wellbeing of the community.
- Contribution to the development of a vibrant community that will attract business leaders to live, work and visit.
- Establishing the festival as an anticipated annual cultural event in Western Australia, becoming an important participant in mainstream arts.
- Recognition of the festival as a cultural and event destination in Western Australia.
- Encourage the maximum participation of many ethnic organizations, community groups, corporate, private and government organisations in Western Australia.
- Recognition throughout the community of the contribution the Italian culture has made in shaping modern Australia.
- The community will continue to support future professionally presented multicultural festivals in Western Australia, with a strong increase in audience numbers achieved by a significant

investment of time and effort to build audiences and arts products.

- Italian Australians of all ages will gain pride in their Italian heritage and in an Italian-Australian identity.
- Presentation of a high quality innovative cultural event that will have engaged attendees and given them the opportunity to participate in the experience.
- Accessibility to free high profile world class events for the entire community.
- Continuing support of Western Australia's professional artists by the ongoing development of festivals and events.

The festival will enable community partnerships /by:

- Providing opportunities to engage with all sections of the community to communicate key messages.
- The promotion of values articulated by event sponsors by displaying active citizenship and shared responsibility.
- Acknowledging and promoting the achievements and contributions made by Italian-Australians.
- Stimulating involvement in community - in person, through festivals and promotions.
- The creation of strong links that promote collaboration and provide sustainable benefits to the community.
- Involvement in productive partnerships that foster strong, vibrant and inclusive communities.
- Developing rewarding and enduring partnerships between all sectors.
- Providing outstanding network opportunities through structured events and promotions, allowing sponsors to profile and promote their businesses and key staff.

Promote community Inclusivity and Connectedness through:

- Advocating respect, fairness, inclusion and a sense of belonging, for everyone.
- All people coming together as a united, integrated community.
- Celebrating and exploring the cultures and the diversity of our community and creating an experience that is accessible to the widest possible range of people.
- Portraying the contemporary face of Australia through the sharing of our culture.
- Applauding individual and collective achievements and contributions.
- Fostering pride in the achievements of outstanding community members.

The festival will embrace diversity through/by:

- The involvement of participants from all origins and acknowledgement of their talents and contributions to the cultural fabric of our society.
- Aiming for as many people as possible to come together as a united, integrated community.
- Promoting an awareness of our history, heritage and attributes.
- A positive focus on the excitement and celebration of individual stories and the importance of embracing and respecting every person, regardless of their background or individual circumstances.

The festival will promote innovation and creativity through/by:

- Fostering a vibrant, healthy and livable community and expanded public availability through a culturally innovative event, which will be a ground-breaking combination of high quality professional entertainment, free entry and a festival the whole community can enjoy.

Marketing and Promotions

Background and Overview

The Italian civilization is one of the modern world's richest cultures, going back to the times of ancient Rome and beyond. With over a million citizens of Italian origin living in Australia today, the Italian language and heritage is of ever increasing importance. The strong presence of the Italian community in Australia has captured the interest of Australians from all backgrounds, and the community is eager to familiarise themselves with a culture which has become admired, valued and respected.

Australia prides itself on being a multi-cultural community and *Spring Sagra* will introduce the Italian lifestyle, heritage and culture to a wide range of people from all walks of life.

A curated multicultural festival and promotions for *Spring Sagra* will provide a high quality alternative to mainstream festival events in Western Australia, in a world renown tourist destination. The festival will be an innovative opportunity to invite the community to participate in a high quality, family friendly free event.

Target Market and Audience

- Federal, State, and Local government departments and agencies that support multicultural events
- Tourism sector, state and national
- Mainstream community, particularly individuals who have an appreciation of the Italian lifestyle and culture
- Mainstream corporate and business owners with an interest in supporting multiculturalism and the community as a whole
- Corporate and business owners of Italian-Australian background
- Multicultural communities, clubs, and associations
- First, second, and third generation Italian-Australians

- Senior Italian-Australians, including post-World War II migrants who helped shape the community and promote the beginnings of multiculturalism in Perth in the last century
- Members of the greater community in Perth with genealogical links to Italy

Advertising

- Little Italy Street Festival Extravaganza Facebook page
- Posters and flyers via a large database and followers, including schools and education providers throughout WA and the greater Perth metropolitan area
- Printed media advertisements
- Printed and online media
- Printed and online editorials and newspaper features
- Tourism providers
- State and Local government departments
- High profile event-finder sites
- Prominent social networking sites
- Online directory comprising corporate and small business' in WA
- Multicultural associations throughout WA
- Word of mouth

Public Relations

- Media releases: mainstream and multicultural media, State and Local government publications, multicultural associations
- Media interviews with key festival participants in mainstream and multicultural media and Local government publications
- Newspaper editorials in mainstream and multicultural
- Official Little Italy Street Festival Extravaganza promotional events
- Primary, secondary and tertiary schools and institutions within the greater Perth and Fremantle metro areas and greater WA

Little Italy Street Festival Extravaganza

Presents

Spring Sagra

Event Evaluation

Presented to the Town of Bassendean

Opening Statement

The Little Italy Street Festival Extravaganza *Spring Sagra* addresses the key strategic guiding principles in the Town of Bassendean's Vision 2030 Community Plan.

The plan describes the Town of Bassendean thriving as "a vibrant and cohesive community".

"The capacities, gifts and strengths of local people are greatly valued and seen as the Town's greatest asset".

As a resident of the Town of Bassendean I believe I have much to offer our community by way of my experience and commitment in presenting large scale events.

Since 1993 I have run my own business in event production and management, encompassing corporate, government, private and community events. The events have ranged from being "one-off" productions to annual events, and achieved great success which can be demonstrated as per my letters of reference.

During this period of time I was most fortunate to produce and participate in events that have supported sectors of the community such as Telethon, produced annually by Seven Network (Perth), Australian Red Cross, Princess Margaret Hospital for Children, World Vision Australia and children and youth who have aspirations in the entertainment industry.

My company was also the promoter and producer for Placido Domingo's Australian concert - *"The Event"* at the Burswood Dome in 1997. I also created and produced the Western Australian Community Song Contest for the State Government which was part of the Millennium West Concert at Cottesloe Beach for New Year's Eve 1999.

My management style is participative with a focus on developing and empowering others to achieve required objectives.

I created, developed, produced and presented the *International Youth Song Festival, Italian Children's Festival of Song, Piccolo Coro, Squadra Italia* and *Le Voci Unite Festival* in Western Australia, all which grew to become very successful, respected and well known annual community events.

The children's choir and festivals were under the Patronage of the Office of Youth Affairs, Office of Citizenship and Multicultural Interests and the Consulate of Italy in Western Australia.

In 1998 I was a recipient of the Italo-Australian Welfare and Cultural Centre Inc. Community Award for services within the Australian and Italian communities in Western Australia.

My most recent event Little Italy by the Sea, which was held in the City of Fremantle, was acclaimed a great success with over 15,000 people in attendance.

I believe that each of us has the fundamental responsibility to contribute to our community through the unique gifts we possess, and to actively encourage the endeavors of our children and youth while promoting our rich cultural heritage.

Through my work in the community, I am equipped with the skills to work with businesses, associations and the general community, for optimum results in all facets. I am also able to provide a folio of testimonials of recognition and support from government, community and business leaders relating to the previous events I have produced.

I am fully committed to the advancement of multicultural arts in Australia and the promotion of our talented Western Australian artists.

2030 Vision Community Plan

History and Diverse Culture

The Town of Bassendean's Vision 2030 Community Plan states that "The history and diverse culture of the Town of Bassendean is valued and sought after".

The *Spring Sagra* addresses the need to acknowledge and promote the strong Italian-Australian history and settlement in the Town of Bassendean.

Western Australia is one of Australia's most culturally diverse states and our advancing universal society has gained increasing relevance for arts and cultural organizations. Cultural diversity is an integral part of Western Australia's social fabric and The Festival offers an opportunity to highlight the modern evolving face of our multicultural community.

Participants of the festival will come together as a united, integrated nation, proudly embracing the core set of values that Australia is built on, promoting community harmony in Australia's multicultural society.

The Festival will be a world class cultural event that will reflect a global view of the world in keeping with Western Australia's cosmopolitan nature and the globalisation of the 21st century.

The involvement of community groups, the ability to attract audiences from marginalised ethnic, cultural and socio-economic groups and the ability to make these groups feel legitimised by what they see, hear and experience in the event has immeasurable value in developing a cohesive community in Western Australia.

The project will promote friendship, tolerance and understanding of each individual - the building blocks towards our mutual community goal of respect, tolerance and celebration of our being part of an extended global family.

The artistic and cultural value of the project will contribute enormously to strengthening the links between Australia and Italy.

Opportunities made available to the wider community to experience the contemporary face of Italy through the presentation of an innovative event in the Town of Bassendean.

The repertoire characteristic with Italian music, well known all over the world, will play a significant role in encouraging our young people to rediscover the traditions and the values of their parents and grandparents, who came to Australia.

The festival will provide Australians with a platform to proudly identify themselves as Australians, with a genuine commitment to Australia and the acknowledgement of their Italian heritage and culture, during a significant event.

The event will promote a united community, a strong sense of identity and of belonging to Australia, whilst respecting and acknowledging our Italian heritage.

The need to foster pride in our Italian heritage and in an Italian-Australian identity will be met.

While our backgrounds, experiences and interests are different, our shared values connect us as Western Australians. The project will *emphasize common interests rather than differences.* Artists have the capacity to break down racial and cultural barriers and create cross-cultural understanding.

Different communication styles reflect philosophies and worldviews that are the foundations of cultures. These values will be shared via the festival artists, participants and the community.

The event will promote the advancement of community harmony in Australia's multicultural society - a community of communities.

2030 Vision Community Plan

Celebration of

Community Diversity

"The Town of Bassendean has a strong sense of place and belonging through the protection of its rich history and heritage and the celebration of community diversity through various festivals and community events".

"Community members are vibrant participants individually and collectively expressing their unique values, experiences and human spirit in a wide variety of artistic and cultural ways".

"The Town will invest in a program of free public events and cultural festivals'.

I am committed to the growth and sustainability of the *Spring Sagra* in the Town of Bassendean.

In February 2016, I funded and presented the Little Italy Street Festival Extravaganza which was a free entry event for the entire community.

The festival was embraced by the Town and attracted a large attendance from both the town residents and throughout the greater Perth metropolitan area.

The Little Italy Street Festival Extravaganza was supported by over 5,000 people over the Friday and Saturday nights.

With funding support and sponsorship in kind from the Town of Bassendean the event is anticipated to grow into one of the State's largest annual multicultural festivals which will be supported throughout the greater Perth metropolitan area.

To create more accessibility for family groups, the festival is planned to be presented on Saturday 9 from 11 am through to 8pm and Sunday 10 from 11am through to 8pm.

Extensive community consultation suggests that this will be a popular and well attended time frame, offering families with young children and seniors an opportunity to attend at a time that fits in with their lifestyle.

Town of Bassendean

Vision 2030 Community Plan

A Safe and Healthy Community

"The whole community recognises, values and embraces people from many diverse cultures, languages and customs".

"Community cultural and artistic events are generally popular and well attended".

"Where people feel they belong, are welcome and enjoy their interaction with each other. A well connected town with extensive social networks and a great degree of social cohesion".

Rich history and heritage; "Bassendean celebrate's it's community diversity where people encourage and respect individual cultural and social differences. This diversity is recognised and celebrated as a great strength. Ongoing community and cross-cultural connections strengthen the sense of understanding and harmony between all residents of the Town".

"Bassendean Town centre becomes a niche village centre attracting people from all over Perth to the cafes and restaurants".

The event will offer the Town of Bassendean community access to renown food specialists who are based throughout the greater Perth metropolitan area.

Festival patrons will experience authentic, creative Italian cuisine—rustic and traditional paired with on trend contemporary food in a safe environment.

A pop up café, licenced bar and a specially created pop up restaurant will reflect the bustling food scene that is becoming a driving force in the Town.

The *Spring Sagra* will welcome community members with warm and genuine hospitality, with an invitation to experience the Italian way of life. A sharing of cultures and a celebration of our community will reflect the Little Italy Street Festival Extravaganza core values.

Town of Bassendean

Vision 2030 Community Plan

A Vibrant Local Economy

"Bassendean Town centre will become a niche village and station precint attracting people throughout the greater Perth metropolitan area. People looking for a unique experience. Residents have a strong 'place based' sense of connection to the Town, and consider it a special place to live, work and recreate".

"Social and cultural businesses make a major contribution to the local economy and character of the Town centre by providing an exciting main street retail and dining experience".

Guiding principles:

"Small business growth is encouraged and promoted."

"Everyone benefits from a strong business economy".

The first Little Italy Street Festival Extravaganza presented in the Town of Bassendean in February 2016 proved to be very successful for the town's key businesses in the area as the flow on effect from the event brought about high turnover for the cafes and licensed venues.

Business proprietors expressed their appreciation to the festival director for the support the festival provided in ensuring their unprecedented turnovers.

The event will ensure that this economic objective for the Town of Bassendean businesses will continue in 2017 by:

- The creation of strong links that promote collaboration and provide sustainable benefits to the community.
- Involvement in productive partnerships that foster strong, vibrant and inclusive communities.

The Spring Sagra fulfils these guiding principles with the following key objectives;

Foster a vibrant, healthy and livable community and expanded public availability through a culturally innovative event.

Provide outstanding network opportunities through a structured event and promotions, allowing key stakeholders and sponsors to profile and promote their businesses and key staff within the business community.

Present an extraordinary opportunity to key stakeholders to experience the innovation, passion and energy that is unique to the event and to the Town of Bassendean.

Offer a unique and world class hospitality environment for enhancing professional relationships through memorable experiences in a shared and stimulating setting.

Advancing creativity, innovation and development in the Town of Bassendean, and underpinning the Town's ability to sustain economic growth in the long term.

Contribution to the development of a vibrant community that will attract business leaders to live, work and visit.

Establishing the festival as an anticipated annual premier cultural event in the Town of Bassendean, becoming an important participant in mainstream arts.

Recognition of the festival as a cultural and event destination in Western Australia.

Little Italy Street Festival Extravaganza

Presents

Spring Sagra

Event Evaluation

Presented to the Town of Bassendean

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During this period of time I was most fortunate to produce and participate in events that have supported sectors of the community such as Telethon, produced annually by Seven Network (Perth), Australian Red Cross, Princess Margaret Hospital for Children, World Vision Australia and children and youth who have aspirations in the entertainment industry.

My company was also the promoter and producer for Placido Domingo's Australian concert - *"The Event"* at the Burswood Dome in 1997. I also created and produced the Western Australian Community Song Contest for the State Government which was part of the Millennium West Concert at Cottesloe Beach for New Year's Eve 1999.

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My most recent event Little Italy by the Sea, which was held in the City of Fremantle, was acclaimed a great success with over 15,000 people in attendance.

I believe that each of us has the fundamental responsibility to contribute to our community through the unique gifts we possess, and to actively encourage the endeavors of our children and youth while promoting our rich cultural heritage.

Through my work in the community, I am equipped with the skills to work with businesses, associations and the general community, for optimum results in all facets. I am also able to provide a folio of testimonials of recognition and support from government, community and business leaders relating to the previous events I have produced.

I am fully committed to the advancement of multicultural arts in Australia and the promotion of our talented Western Australian artists.

2030 Vision Community Plan

History and Diverse Culture

The Town of Bassendean's Vision 2030 Community Plan states that "The history and diverse culture of the Town of Bassendean is valued and sought after".

The *Spring Sagra* addresses the need to acknowledge and promote the strong Italian-Australian history and settlement in the Town of Bassendean.

Western Australia is one of Australia's most culturally diverse states and our advancing universal society has gained increasing relevance for arts and cultural organizations. Cultural diversity is an integral part of Western Australia's social fabric and The Festival offers an opportunity to highlight the modern evolving face of our multicultural community.

Participants of the festival will come together as a united, integrated nation, proudly embracing the core set of values that Australia is built on, promoting community harmony in Australia's multicultural society.

The Festival will be a world class cultural event that will reflect a global view of the world in keeping with Western Australia's cosmopolitan nature and the globalisation of the 21st century.

The involvement of community groups, the ability to attract audiences from marginalised ethnic, cultural and socio-economic groups and the ability to make these groups feel legitimised by what they see, hear and experience in the event has immeasurable value in developing a cohesive community in Western Australia.

The project will promote friendship, tolerance and understanding of each individual - the building blocks towards our mutual community goal of respect, tolerance and celebration of our being part of an extended global family.

The artistic and cultural value of the project will contribute enormously to strengthening the links between Australia and Italy.

Opportunities made available to the wider community to experience the contemporary face of Italy through the presentation of an innovative event in the Town of Bassendean.

The repertoire characteristic with Italian music, well known all over the world, will play a significant role in encouraging our young people to rediscover the traditions and the values of their parents and grandparents, who came to Australia.

The festival will provide Australians with a platform to proudly identify themselves as Australians, with a genuine commitment to Australia and the acknowledgement of their Italian heritage and culture, during a significant event.

The event will promote a united community, a strong sense of identity and of belonging to Australia, whilst respecting and acknowledging our Italian heritage.

The need to foster pride in our Italian heritage and in an Italian-Australian identity will be met.

While our backgrounds, experiences and interests are different, our shared values connect us as Western Australians. The project will *emphasize common interests rather than differences.* Artists have the capacity to break down racial and cultural barriers and create cross-cultural understanding.

Different communication styles reflect philosophies and worldviews that are the foundations of cultures. These values will be shared via the festival artists, participants and the community.

The event will promote the advancement of community harmony in Australia's multicultural society - a community of communities.

2030 Vision Community Plan

Celebration of

Community Diversity

"The Town of Bassendean has a strong sense of place and belonging through the protection of its rich history and heritage and the celebration of community diversity through various festivals and community events".

"Community members are vibrant participants individually and collectively expressing their unique values, experiences and human spirit in a wide variety of artistic and cultural ways".

"The Town will invest in a program of free public events and cultural festivals'.

I am committed to the growth and sustainability of the *Spring Sagra* in the Town of Bassendean.

In February 2016, I funded and presented the Little Italy Street Festival Extravaganza which was a free entry event for the entire community.

The festival was embraced by the Town and attracted a large attendance from both the town residents and throughout the greater Perth metropolitan area.

The Little Italy Street Festival Extravaganza was supported by over 5,000 people over the Friday and Saturday nights.

With funding support and sponsorship in kind from the Town of Bassendean the event is anticipated to grow into one of the State's largest annual multicultural festivals which will be supported throughout the greater Perth metropolitan area.

To create more accessibility for family groups, the festival is planned to be presented on Saturday 9 from 11 am through to 8pm and Sunday 10 from 11am through to 8pm.

Extensive community consultation suggests that this will be a popular and well attended time frame, offering families with young children and seniors an opportunity to attend at a time that fits in with their lifestyle.

Town of Bassendean

Vision 2030 Community Plan

A Safe and Healthy Community

"The whole community recognises, values and embraces people from many diverse cultures, languages and customs".

"Community cultural and artistic events are generally popular and well attended".

"Where people feel they belong, are welcome and enjoy their interaction with each other. A well connected town with extensive social networks and a great degree of social cohesion".

Rich history and heritage; "Bassendean celebrate's it's community diversity where people encourage and respect individual cultural and social differences. This diversity is recognised and celebrated as a great strength. Ongoing community and cross-cultural connections strengthen the sense of understanding and harmony between all residents of the Town".

"Bassendean Town centre becomes a niche village centre attracting people from all over Perth to the cafes and restaurants".

The event will offer the Town of Bassendean community access to renown food specialists who are based throughout the greater Perth metropolitan area.

Festival patrons will experience authentic, creative Italian cuisine—rustic and traditional paired with on trend contemporary food in a safe environment.

A pop up café, licenced bar and a specially created pop up restaurant will reflect the bustling food scene that is becoming a driving force in the Town.

The *Spring Sagra* will welcome community members with warm and genuine hospitality, with an invitation to experience the Italian way of life. A sharing of cultures and a celebration of our community will reflect the Little Italy Street Festival Extravaganza core values.

Town of Bassendean

Vision 2030 Community Plan

A Vibrant Local Economy

"Bassendean Town centre will become a niche village and station precint attracting people throughout the greater Perth metropolitan area. People looking for a unique experience. Residents have a strong 'place based' sense of connection to the Town, and consider it a special place to live, work and recreate".

"Social and cultural businesses make a major contribution to the local economy and character of the Town centre by providing an exciting main street retail and dining experience".

Guiding principles:

"Small business growth is encouraged and promoted."

"Everyone benefits from a strong business economy".

The first Little Italy Street Festival Extravaganza presented in the Town of Bassendean in February 2016 proved to be very successful for the town's key businesses in the area as the flow on effect from the event brought about high turnover for the cafes and licensed venues.

Business proprietors expressed their appreciation to the festival director for the support the festival provided in ensuring their unprecedented turnovers.

The event will ensure that this economic objective for the Town of Bassendean businesses will continue in 2017 by:

- The creation of strong links that promote collaboration and provide sustainable benefits to the community.
- Involvement in productive partnerships that foster strong, vibrant and inclusive communities.

The Spring Sagra fulfils these guiding principles with the following key objectives;

Foster a vibrant, healthy and livable community and expanded public availability through a culturally innovative event.

Provide outstanding network opportunities through a structured event and promotions, allowing key stakeholders and sponsors to profile and promote their businesses and key staff within the business community.

Present an extraordinary opportunity to key stakeholders to experience the innovation, passion and energy that is unique to the event and to the Town of Bassendean.

Offer a unique and world class hospitality environment for enhancing professional relationships through memorable experiences in a shared and stimulating setting.

Advancing creativity, innovation and development in the Town of Bassendean, and underpinning the Town's ability to sustain economic growth in the long term.

Contribution to the development of a vibrant community that will attract business leaders to live, work and visit.

Establishing the festival as an anticipated annual premier cultural event in the Town of Bassendean, becoming an important participant in mainstream arts.

Recognition of the festival as a cultural and event destination in Western Australia.

ATTACHMENT NO. 11

TOWN OF
BASSENDEAN
Home by the Swan

Strategic Community Plan
2017 - 2027

"A connected community, developing a vibrant and sustainable future, built upon the foundations of our past"

CONTENTS

1 MESSAGE FROM THE MAYOR

The Town of Bassendean has developed a new Strategic Community Plan 2017-2027, which was adopted by Council at a Special Council meeting on 23 May 2017.

The Strategic Community Plan is the "visions and aspirations" of the community and embraces the comments and direction provided by the community for the future of the Town over the next 10 years.

Council has adopted a new "Vision" for the future of the Town that encapsulates maintaining a sustainable future without forgetting our past.

"A connected community, developing a vibrant and sustainable future, that is built upon the foundations of our past"

In developing the Strategic Community Plan, the Town undertook extensive community consultation from July to September 2016, which resulted in 1,200 responses. A further 80 community members attended workshops in November 2016.

The Strategic Community Plan is premised on the sustainability principles and include the following themes:

- Social
- Natural Environment
- Built Environment
- Economic; and
- Good Governance

Thank you to our wonderful community in the Town of Bassendean for their assistance in developing a workable and achievable Plan which will guide the Town of Bassendean into the future.

Cr John Gangell
Mayor

2 INTRODUCTION TO THE STRATEGIC COMMUNITY PLAN

The Town of Bassendean's Strategic Community Plan is the highest level Plan the Council will prepare. Following significant input from community members, it has been developed to reflect what matters most to our community. The Strategic Community Plan spans a 10-year time period and documents Council's commitment to working to fulfill the community's vision, key priorities, expectations and aspirations.

In accordance with the Department for Local Government and Communities' legislated Integrated Planning and Reporting Framework, the Town will use this Strategic Community Plan to guide and structure its daily business activities. This includes area/place/regional plans, resourcing, and other informing strategies, such as annual budgets, workforce plans, asset management plans and service plans. Together the plans should enable and allow for meaningful progress, monitoring and reporting, whilst ensuring the constraints of finances, asset management and staffing levels are understood.

Strong partnerships with community members, groups, local businesses and State and Federal Government will be essential to successfully achieving the Town's Vision.

3 AN OVERVIEW OF OUR COMMUNITY

The Town of Bassendean is located approximately10 kilometres north-east of Perth and 5 minutes from the Swan Valley vineyards. With a total area of 11 square kilometres, the Town is bounded by the Swan River, the City of Swan to the north and the City of Bayswater to the west. It has a river frontage of 7 kilometres.

Well served by metropolitan train and bus services, the International Airport terminal is 20 minutes and the Domestic Terminal only 10 minutes from the Town Centre by car.

KEY STATISTICS- (Australian Bureau of Statistics 2015)

Included areas: Suburbs of Ashfield, Bassendean and Eden Hill

Population: - 16,101

Demographics: 21.2% of the population aged between 0 and 17, and 20.7% aged 60+ years

Born overseas: 28%

Non-English speaking background: 13%

Median age: 38

Population density: 13.33 persons per hectare

Geographic area: 11 km2

Distance from Perth: 10km

Number of Dwellings: 6,394 (2011 Census), average household size of 2.38

Housing tenure: In 2011, 67% of households were purchasing or fully owned their home, 20.4% were renting privately, and 6.2% were in social housing.

Dominant household types: 26.1% couple families with child/children; lone person households 27.5%; couples without children 24.6%

Length of Roads: 95km (all sealed)

Flora and Fauna

The Swan River is a scenic treasure, a playground, a natural drain and functional ecosystem. The trees and shrubs, rushes and sedges prevent soil erosion along the river. The nearby wetlands provide a natural habitat for frogs, water birds and tortoises. Our natural parks are home to birds such as silver-eyes, honeyeaters, willie wagtails, grey fantails, white-tailed black cockatoos, Australian kestrels, white cockatoos and the pink-and-grey galah, to name a few. The Bassendean Preservation Group works with the Council to preserve our natural bushland and wetlands.

History

Beginning as a small settlement called West Guildford in 1839 and which was renamed Bassendean in 1922. Bounded on two sides by the Swan River, Bassendean became a separate local authority in 1901. The Town now has a mix of housing, parks and recreational areas, as well as light industry and commercial areas. It also has riverside public open space, some of which was land used by Aboriginal people for thousands of years as ceremonial places.

Bassendean residents participated in both World Wars, and, as a working-class suburb, it was severely affected by the 1930's Depression. It saw rapid population growth with the migration of new residents from Britain, Europe and Asia during the post-World War II period. Through it all, Bassendean has retained its strong sense of identity and community, to become the thriving township it is today.

Key characteristics the Town has considered in planning for the future

The Town of Bassendean must plan and operate to the best of its ability within its unique circumstance and key characteristics which include:

- Increased demand for transparency, accountability and community consultation and engagement
- Population of older persons (20.7%) and 0 to 17 year olds (21.2%) placing demands and expectations on services and infrastructure
- Slowdown in economy – demand for jobs, demand for technology
- Increasing employment demands and opportunities
- Changing State and Federal policy driving service reviews and role of local governments
- Increased demand for housing diversity near transport hubs and employment nodes

Critical Shifts and Key Considerations

This section identifies the critical shifts in the operating environment since 2013 when the current Strategic Community Plan was endorsed. The key critical shifts identified with implications across all of the priority areas, include:

- a slow down in the Western Australian economy;
- shifts in economic growth industries;
- population growth and residential development may be less than anticipated;
- increasing pressure to demonstrate responsiveness to environmental issues;
- changing role for local government in community service provision in a complex operating environment. (Increased and changing customer expectations, Federal and State funding arrangements and legislative changes); and
- increasing accountability and performance expectations from State Government and the community.

A copy of the critical shifts and key consideration report is available on the Town's website at www.bassendean.wa.gov.au.

4 THE INTEGRATED PLANNING AND REPORTING FRAMEWORK

The State Government has legislated an Integrated Planning and Reporting Framework (IPR) for all Local Governments. The IPR aims to ensure the integration of community priorities into strategic planning for Councils, as well as delivering the objectives that have been set from these priorities. It also provides a process for community members and stakeholders to participate in shaping the future of their community and in identifying issues and solutions.

The framework helps the community to understand that:

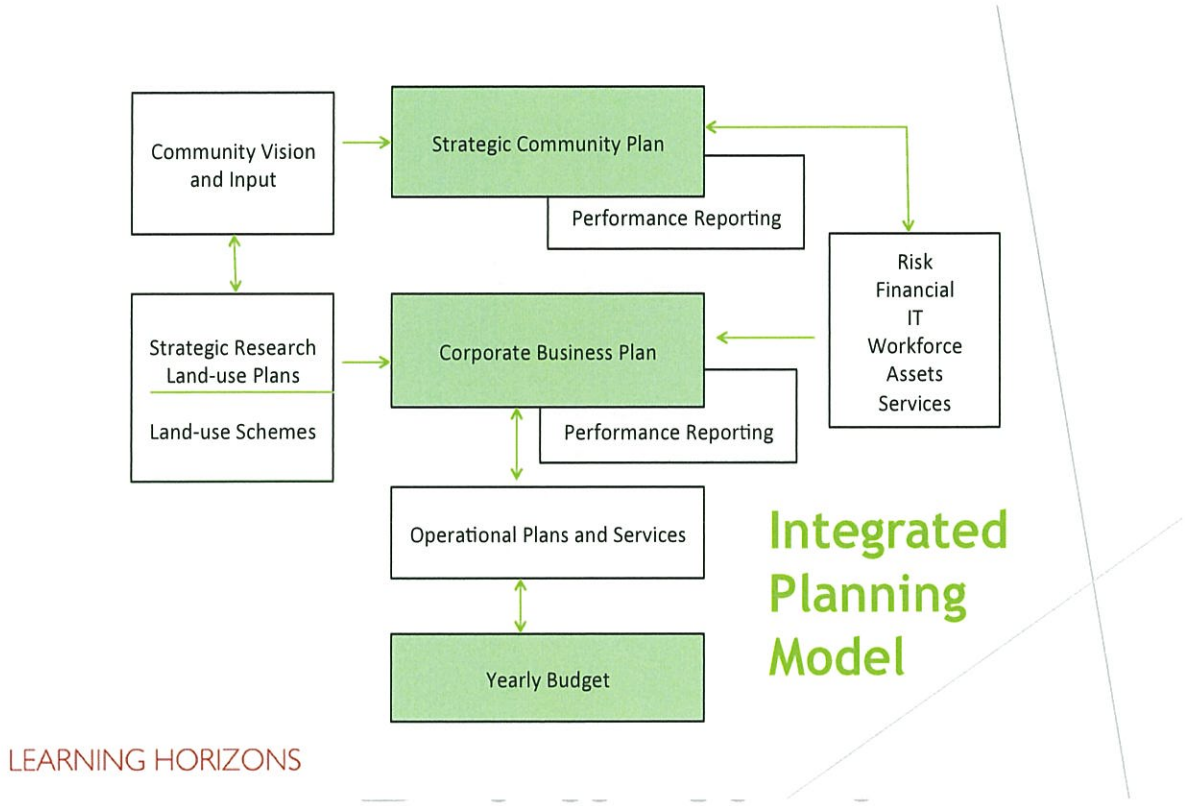
- Their input at the community engagement events has shaped our overall community aspirations;
- These aspirations are distilled into a clear vision and objectives that the Town will implement to achieve these priorities;
- The online publication of the Strategic Community Plan and other documents in the IPR ensure that the Town is accountable through clear reporting; and
- There is a role for the Town and other key stakeholders, i.e, Federal and State Government, in achieving the community aspirations, objectives and strategies.

The Strategic Community Plan documents the community's vision, outcomes and priorities. It is a 10-year plan that is reviewed every two years with a major review every four years.

The Strategic Financial Plan will incorporate the future requirements of the Strategic Community Plan and within the Corporate Business Plan the resourcing requirements are detailed.

The Corporate Business Plan is a four-year plan that details the services, operations and projects the Town of Bassendean will deliver. It articulates the Town's commitments and the measurements that will be used to determine if the Town is progressing towards the aspirations of the Strategic Community Plan. Annual Business Plans and Annual Budgets are developed from the Corporate Business Plan.

The diagram below depicts the key components of the Town of Bassendean's Integrated Planning and Reporting Framework:



5 HOW OUR STRATEGIC COMMUNITY PLAN WAS DEVELOPED

The Town of Bassendean prepared this Strategic Community Plan in the following stages:

- Research was conducted to determine trends, issues and impacts;
- Community consultation was undertaken via community workshops, online and paper surveys;
- The plan was refined with Council to develop the outcomes, objectives and strategies needed to achieve the overall vision.; and
- Council adopted the plan before advertising it to the public.

Stakeholder Engagement

In July 2016, Council advertised a community survey through a "postcard" being distributed to all residences as well as providing a website for on-line responses. The survey closed on 9 September 2016.

Staff and Councillors spent time at shopping centre displays and received approximately 1,200 responses to the survey. Following the closure of the survey, independently facilitated workshops were conducted in November 2016 and attended by some 80 community members. Feedback received from the community during the engagement activities has been recorded and has informed the development of the Strategic Community Plan.

(include photos and snippets from the Community Survey)

6 HOW OUR STRATEGIC COMMUNITY PLAN IS USED

The Strategic Community Plan outlines the vision for the Town of Bassendean and identifies community priority areas for the next 10 years.

VISION

A descriptive statement of the future desired position for the Town of Bassendean.

STRATEGIC PRIORITY AREAS

Strategic Priority 1: Social
Strategic Priority 2: Natural Environment
Strategic Priority 3: Built Environment
Strategic Priority 4: Economic
Strategic Priority 5 : Good Governance

Within each of the key result areas are the following elements:

Objectives
What we need to achieve.

Strategies
How we're going to do it.

Measures of Success
How we will be judged.

The strategic direction of the Town is translated into services and projects that are delivered to our community through the Corporate Business Plan, which is a 4-year plan subject to annual review. This ensures strategic priorities are translated into real actions.

7 OUR VISION FOR THE FUTURE

"A connected community, developing a vibrant and sustainable future, that is built upon the foundations of our past"

Community Input:

Feedback from the community via the survey and community engagement workshops consistently communicated what the Bassendean community value most:

1. A beautiful and healthy natural environment, with ample open space, beside the Swan River
2. Bassendean's history and heritage
3. Fostering an engaged, thriving, activated community with impressive volunteer capacity.
4. Flow and connection, i.e, bike paths, footpaths, train stations, communication
5. Friendly and welcoming
6. Relevant services and opportunity for all
7. Maintaining the unique character of Bassendean - balancing growth and development with social needs, heritage and the natural environment
8. Changes to waste services - reflection on other local government services, frequency of collection and changes to annual verge collections
9. Improving streetscapes - tree canopy retention, footpaths, verges, street lighting and pedestrian movement and safety
10. Play and recreation facilities for all ages - reviewing current facilities and innovative approaches to recreation areas
11. Fresh approaches to events and celebrations
12. Community activation of spaces across all neighbourhoods within Town of Bassendean, eg, community gardens, open space improvements
13. Community wide duty to climate change resilience planning
14. Reinvigoration of Old Perth Road with public art and diverse businesses
15. Strong business networks and support of home-based businesses
16. Partnerships with schools and educational institutions to promote innovation
17. Focus on water capture, sustainable use and quality of runoff into the Swan River, eg, modification of drains into Livable Streams
18. An open, collaborative and communicative Council who engages and partners with the community

One survey respondent summed up much of the feedback received with this sentence:

"The Town needs to retain its unique ambience of a close knit community which still feels spacious and attractive."

8 OUR VALUES

People Councillor, staff and volunteer contributions are vital in striving to meet our diverse community's aspirations and well-being. We will actively engage our community and seek their participation in planning their future.

Excellence We strive to achieve the highest standards in local government and to consistently provide consultative, ethical and responsive services.

Heritage Preserving and communicating our shared history and heritage increases our capacity to balance today's needs with the long-term interests of future generations.

Partnerships Collaborative partnerships and regional cooperation increase value to our community and the East Metropolitan Region.

Sense of Place We recognise that maintaining our natural environment is crucial to sustaining our future. We acknowledge that our community requires Council to preserve and enhance our streetscapes, built and natural environment, and to protect the Swan River as our greatest natural asset.

9 STRATEGIC COMMUNITY PLAN

Strategic Priority 1: Social

Objectives *What we need to achieve*	Strategies *How we're going to do it*	Measures of Success *How we will be judged*
1.1 Build a sense of place and belonging	1.1.1 Facilitate engagement and empowerment of local communities	Community / Stakeholder Satisfaction Survey (Engagement and Participation)
	1.1.2 Activate neighbourhood spaces to facilitate community gathering	
	1.1.3 Ensure our unique culture and history are shared and celebrated	
	1.1.4 Continue to support and facilitate participation in the arts, community festivals and events	
1.2 Ensure all community members have the opportunity to be active, socialise and be connected	1.2.1 Provide accessible facilities that support leisure, learning and recreation for people of all ages.	Community / Stakeholder Satisfaction Survey (Activity and connectivity) Volunteer Rate
	1.2.2 Provide life-long learning opportunities	
	1.2.3 Enhance partnerships with the local Noongar people	
	1.2.4 Ensure people with disabilities and those from diverse backgrounds are valued and supported to participate in community life	
	1.2.5 Support our volunteers and community groups to remain empowered, dynamic and inclusive	
1.3 Plan for a healthy and safe community	1.3.1 Facilitate safer neighbourhood environments	Community / Stakeholder Satisfaction Survey (Safety, Health and Well-being)
	1.3.2 Promote and advocate community health and well-being	
1.4 Improve lifestyle choices for the aged, families and youth	1.4.1 Facilitate healthy and active aging in place	Community / Stakeholder Satisfaction Survey (Aged, Families and Youth)
	1.4.2 Partner with service providers to improve / expand access to services and facilities	
	1.4.3 Enhance the wellbeing, and participation of our youth and children	

Services *Council's ongoing supporting services*	Partnerships
• Strategic Planning services • Support for volunteers and friends groups • Library services • Club connect services • Arts and Culture services • Sport and Recreation services • Youth services • Disability services • Educational services • Customer services • Asset services • Ranger services • Environmental Health services • Swimming pool inspections	• Child Protection & Family Support • Department of Health • State Library Board • Department of Sport & Recreation • Office of Emergency Management • WA Police • Disability Services Commission • Road Safety

Strategic Priority 2: Natural Environment

Objectives *What we need to achieve*	**Strategies** *How we're going to do it*	**Measures of Success** *How we will be judged*
2.1 To display leadership in environmental sustainability	2.1.1 Strengthen environmental sustainability practices and climate change mitigation	Waste reduction ratio to population Carbon emissions ("Planet Footprint")
	2.1.2 Reduce waste through sustainable waste management practices	
	2.1.3 Initiate and drive innovative Renewable Energy practices	
2.2 Protect our River, Bushland Reserves, and Biodiversity	2.2.1 Protect and restore our biodiversity and ecosystems	Community / Stakeholder satisfaction Survey (River, Bushland and Reserves) Biodiversity and Bush Condition ("Keighery" Scale of bush condition) measurement
	2.2.2 Sustainably manage significant natural areas	
	2.2.3 Partner with stakeholders to actively protect, rehabilitate and enhance access to the river	
2.3 Ensure the Town's open space is attractive and inviting.	2.3.1 Enhance and develop open spaces and natural areas to facilitate community use and connection.	Community / Stakeholder Satisfaction Survey (Open Space and use of Open Space) Tree Canopy Area monitoring (Private and Public realms) Water Quality (entering the Swan River analysed in accordance with the Australian Government National Health and Medical Research Council Guidelines)
	2.3.2 Sustainably manage ground water, facilitate the conversion of drains to living streams	

Services *Council's ongoing supporting services*	**Partnerships**
• Strategic Planning services • Building maintenance • Fleet management • Waste management • Parks and gardens • Environmental services • Volunteer support • Storm Water Management Plan • Asset Management Plan • Engineering • Recreation and Culture	• Western Australian Planning Commission • Department of Parks and Wildlife • Water Corporation • East Metropolitan Regional Council • Department of Fire & Emergency Services

Strategic Priority 3: Built Environment

Objectives *What we need to achieve*	Strategies *How we're going to do it*	Measures of Success *How we will be judged*
3.1 Plan for an increased population and changing demographics	3.1.1 Facilitate diverse housing and facility choices	The number of new dwelling approvals granted by the Town against the *Perth Peel @ 3.5 Million* planning framework target for Bassendean (4,200 new dwellings by 2050) The level of community engagement and participation into Local Area Planning (Input into plans and policy development.)
	3.1.2 Implement sustainable design and development principles	
	3.1.3 Plan for local neighbourhoods and their centres	
	3.1.4 Ensure infrastructure is appropriate for service delivery	
3.2 Enhance connectivity between places and people	3.2.1 Connect the Town through a safe and inviting walking and cycling network.	Community / Stakeholder Satisfaction Survey (roads, footpaths and cycle paths) Community/ Stakeholder Satisfaction Survey (access to public transport both access to Town and within.)
	3.2.2 Advocate for improved and innovative transport access and solutions.	
	3.2.3 Enhance the livability of local neighbourhoods.	
	3.2.4 Enhance road safety through design	
3.3 Enhance the Town's appearance	3.3.1 Improve amenity and the public realm	Community / Stakeholder Satisfaction Survey (heritage, amenity and appearance)
	3.3.2 Strengthen and promote Bassendean's unique character and heritage	
	3.3.3 Implement design policies and provisions of buildings and places	

Services *Council's ongoing supporting services*	Partnerships
• Strategic Planning services • Development services • Building services • Environment • Engineering services • Asset management • Parks and gardens • Community Development	• TravelSmart • Western Australian Planning Commission • Main Roads • Department of Transport • Road Safety Commission

Strategic Priority 4: Economic

Objectives *What we need to achieve*	**Strategies** *How we're going to do it*	**Measures of Success** *How we will be judged*
4.1 Build economic capacity	4.1.1 Encourage and attract new investment and increase capacity for local employment	Economic and Commercial Activity New businesses (including home based) granted development approval by the Town.
	4.1.2 Plan for and build capacity for Commercial and Industrial	
	4.1.3 Support and promote home based businesses	
4.2 Facilitate local business retention and growth	4.2.1 Strengthen local business networks and partnerships	Number of local business and Stakeholder Survey (Engagement and Facilitation of local Business Networks)
	4.2.2 Continue the activation of Bassendean's Town Centre	
	4.2.3 Enhance economic activity in neighbourhood centres	

Services *Council's ongoing supporting services*	**Partnerships**
• Strategic Planning services • Development services • Economic Development services • Customer services • Information Technology	• Western Australian Planning Commission • Central Eastern Business Association • East Metropolitan Regional Council

Strategic Priority 5: Good Governance

Objectives *What we need to achieve*	Strategies *How we're going to do it*	Measures of Success *How we will be judged*
5.1 Enhance organisational accountability	5.1.1 Enhance the capability of our people	Community / Stakeholder Satisfaction Survey (Governance) Compliance Audit Risk Management Profile Financial Ratio Benchmarked. Asset Ratio Benchmarked
	5.1.2 Ensure financial sustainability	
	5.1.3 Strengthen governance, risk management and compliance	
	5.1.4 Improve efficiency and effectiveness of planning and services	
	5.1.5 Ensure optimal management of assets	
5.2 Proactively partner with the community and our stakeholders	5.2.1 Improve customer interfaces and service	Community / Stakeholder Satisfaction Survey (Community engagement and participation)
	5.2.2 Engage and communicate with the community	
	5.2.3 Advocate and develop strong partnerships to benefit community	
5.3 Strive for Improvement and Innovation	5.3.1 Adopt and measure against best practices ensuring a focus on continuous improvement	Local Government Service Review Benchmarks Percentage uptake of the community of Ecommerce applications

Services *Council's ongoing supporting services*	Partnerships
• Executive Team • Human Resources • Financial Management • Customer Services • Information Technology • Rating Services • Records Management • Asset Management • Community Development / Engagement	• Department of Local Government and Communities • Western Australia Local Government Association • Local Government Insurance Services • Australian Accounting Standards Board • Council's appointed Auditors