ANNUAL NUTRIENT SURVEY
for Local Government Authorities
Results 2020

An initiative of the South East Regional Centre for Urban Landcare's Phosphorus Awareness Project

ALGAE BUSTER PHOSPHORUS AWARENESS PROJECT

SERCUL South East Regional Centre for Urban Landcare

GOVERNMENT OF WESTERN AUSTRALIA

Department of **Biodiversity, Conservation and Attractions**

PARKS AND WILDLIFE SERVICE

ALGAE BUSTER

PHOSPHORUS
AWARENESS
PROJECT

SERCUL

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ANNUAL NUTRIENT SURVEY 2020 OVERVIEW

The Swan River and its major tributary, the Canning River, flow through the heart of Perth and greatly contribute to the city's recreational, economic and ecological attributes. In recent times, however, the positive attributes of these river systems, and many wetlands, have been damaged by the occurrence of regular algal blooms. These blooms occur due to excessive inputs of nutrients, particularly phosphorus and nitrogen, combined with low water flows. Algal blooms are undesirable as they lower dissolved oxygen levels resulting in fish kills, reduce sunlight to aquatic plants and can be unsightly, foul smelling and toxic to humans and animals. The Phosphorus Awareness Project (PAP), supported by the Rivers and Estuaries Branch of the Department of Biodiversity, Conservation and Attractions (DBCA) and managed by the South East Regional Centre for Urban Landcare (SERCUL), aims to raise awareness of the sources of nutrients, the need to minimise their use, and how this can be achieved.

LGA	Participation Rate (%)
Vincent	100
Armadale, Bayswater, Belmont, Canning, Cockburn, Nedlands	95
Melville, South Perth	90
Cottesloe, Subiaco	89
Claremont, Cambridge	84
Kwinana	81
Kalamunda	76
Gosnells	71
Rockingham, Stirling, Swan	68
Peppermint Grove, Perth	63
Victoria Park	58
Serpentine-Jarrahdale	57
Fremantle, Joondalup	53
Mundaring	47
Mosman Park	37
Wanneroo	32
East Fremantle	26
Bassendean	11

Table 1: Level of Participation in the Annual Nutrient Survey

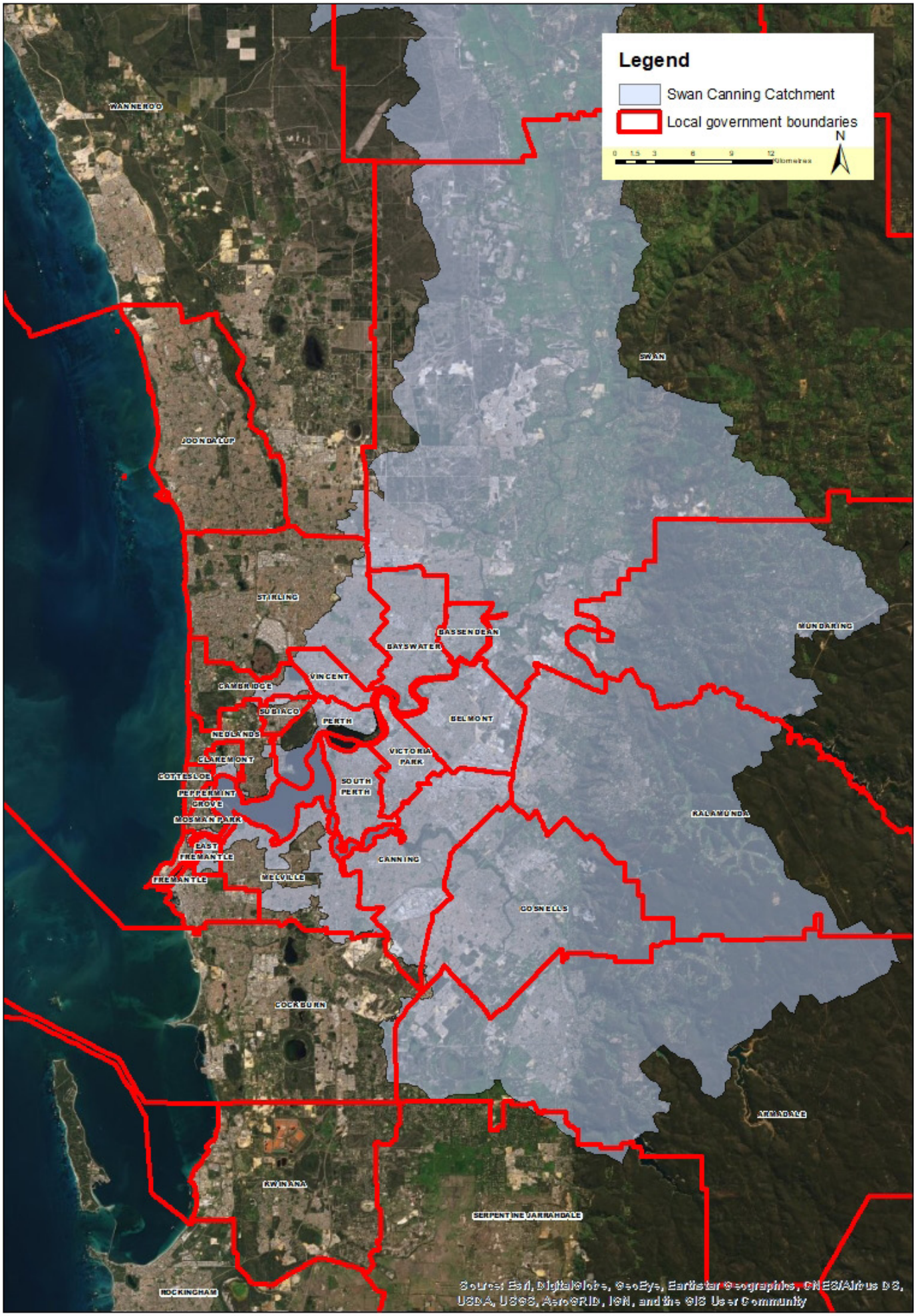
Local authorities are responsible for nutrient use on turfed areas, reserves and in local planning decisions and thus can lead the community by setting examples in best practice. The Annual Nutrient Survey for Local Government Authorities was designed to determine Local Government Authority (LGA) practice with respect to nutrients and to inform the local community.

Each year the thirty LGA's of the Perth Region are given the opportunity to take part in the Annual Nutrient Survey. Of the thirty LGA's invited to take part in this survey, twenty-seven touch upon the boundaries of the Swan Canning Catchment (refer to Map 1 over page). This was the nineteenth survey including all of the LGA's of the Perth Region and the twenty-first survey of the LGA's of the Canning Catchment. Twenty-one LGA's responded to the survey this year, which is an improvement on 2019 when nineteen responses were received. The LGA's that responded in 2020 were: Bayswater, Belmont, Cambridge, Canning, Claremont, Cockburn, Cottesloe, Gosnells, Kalamunda, Kwinana, Melville, Mundaring, Nedlands, Rockingham, South Perth, Stirling, Subiaco, Swan, Victoria Park, Vincent and Wanneroo. Seventeen of the LGA's that responded this year also participated in the 2019 survey. The Armadale and Serpentine-Jarrahdale LGA's participated in 2019, but not this year, and Bayswater, Cambridge, Mundaring and Wanneroo participated this year but not in 2019. The Towns of Bassendean, East Fremantle and Mosman Park, Shire of Peppermint Grove and Cities of Perth, Fremantle and Joondalup have not responded in two or more years. Each LGA's level of participation in the survey since its inception in their area (2000 for those in the Canning Catchment and 2002 for those in the wider Perth region) is shown in Table 1. It is important that *all* LGA's take the opportunity to participate in this survey *every* year as a way of monitoring their management practices over time and the impact they may be having on their catchment and so that we are able to gain an understanding of the amount of nutrients potentially entering our Swan Canning Catchment waterways .

The results of the survey indicate that the LGA's who responded are conducting varying degrees of Best Management Practices (BMP's) with regards to nutrients. This year the LGA's are excelling in the implementation of BMP's in the areas of nutrient monitoring and nutrient education, have achieved an above average level in nutrient management and development control and an average level in the areas of water quality monitoring and fertiliser applications to foreshore areas. The Cities of Bayswater and Swan should be commended for having adopted all of the BMP's! In 2019/20, 132 tonnes of nitrogen and 13 tonnes of phosphorus was applied by the LGA's that have some part of their boundaries within the Swan Canning Catchment.

Signage about an algal bloom and not feeding birds located near the Swan River in 2020

It is strongly recommended that every LGA reads the recommendations section at the end of this report. This section outlines the strategies that need to be implemented to achieve a high level of nutrient best management practice for all questions asked in this survey. All LGA's are encouraged to compare their individual responses for each question to the recommendations provided and implement those that they do not currently undertake. Score Cards will be provided to the LGA's that responded to this year's survey that clearly show where and how improvements can be made for each area (refer to www.sercul.org.au/fertilisewise). These scorecards will provide an overall score based on results provided since 2000, those for the last five years and those for this year. This will allow LGA's to see how they are doing over the long-term, short-term and at the current time.

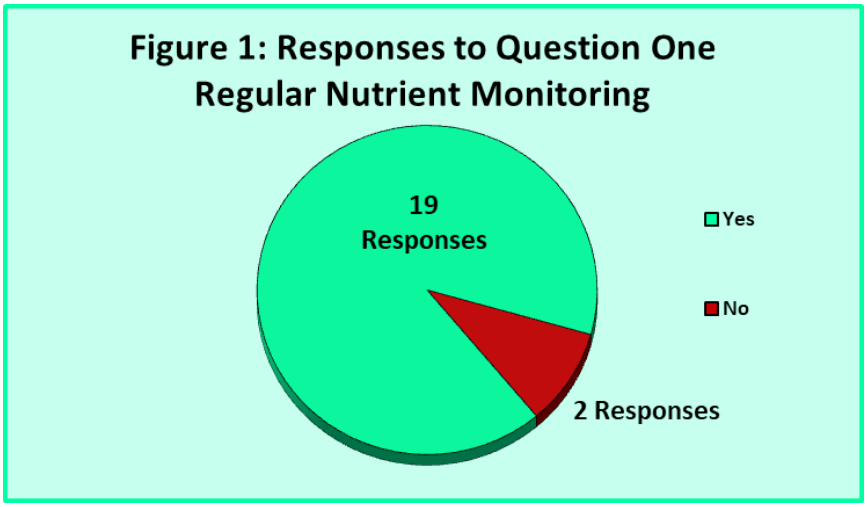


Map 1: Swan Canning Catchment (grey) overlayed with LGA boundaries (red)

NUTRIENT MONITORING

QUESTIONS ONE AND TWO

Questions One and Two related to soil tests, leaf tissue analysis and moisture testing in grassed and turfed areas. Nineteen of the twenty-one LGA's that responded to the survey conducted at least one type of soil, leaf tissue and/or moisture testing in grassed and turfed areas (refer to Figure 1).



All LGA's are encouraged to conduct nutrient testing. This testing is extremely important as it provides information to determine whether nutrients are required and if required, the application rate and types of nutrients and fertiliser needed. It is strongly recommended that all LGA's regularly conduct these tests before applying fertiliser, so that unnecessary nutrient applications can be avoided. The leaf tissue nitrogen content should be maintained between 1.5% - 2% for passive turf and 2% - 3% for sports fields while the leaf tissue phosphorus content should be maintained between 0.2% - 0.4% (Ruscoe, Johnston & McKenzie, 2004). It is also strongly recommended that Parks and Gardens Officers attend the Fertilise Wise Fertiliser Training courses that are hosted by the Phosphorus Awareness Project in 2021 to fully understand the results of testing that is undertaken in the LGA's area.

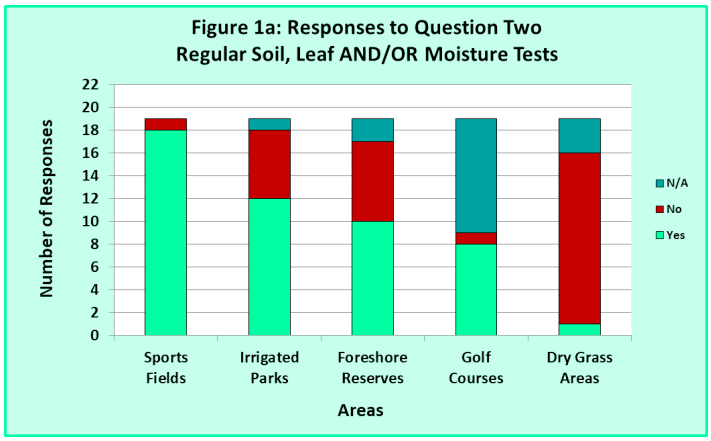


Figure 1a shows the number of LGA's who performed at least one type of testing – soil, leaf and/or moisture – in each of the different areas.

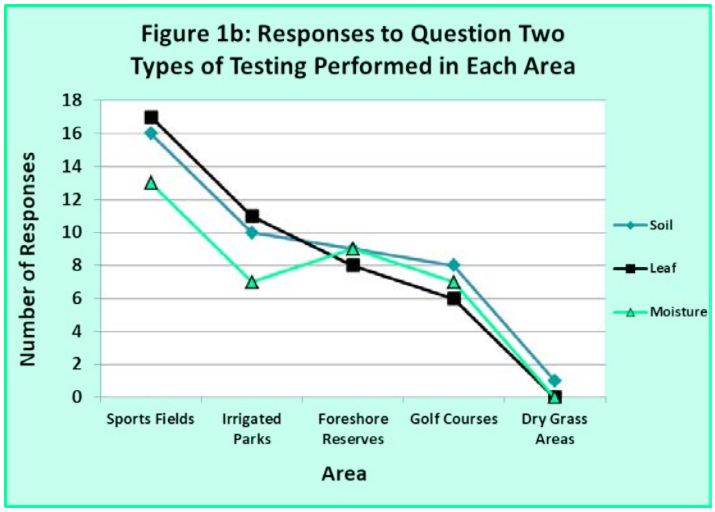


Figure 1b shows the number of LGA's that performed each of the different types of testing – soil, leaf tissue or moisture - in the five areas – sports fields, irrigated parks, foreshore reserves, golf courses and dry grass areas.

Two of the LGA's did not conduct any testing. One of these LGA's only has a minimal area encroaching on the Swan Canning Catchment and the other is a locality in the Darling Ranges. Of the nineteen LGA's who conducted testing, the raw data shows that all of them conducted soil tests, all but one conducted leaf analysis and fourteen conducted moisture testing in at least one of the five areas -sports fields, irrigated parks, foreshore reserves, golf courses or dry grass areas.

It is encouraging that the majority of LGA's performed at least one type of testing on their sports fields, however it would be preferable to see soil testing and leaf tissue analysis backed up with increased moisture testing. It is recommended that all LGA's conduct soil, leaf tissue and moisture content tests on sports fields as they are high use areas requiring good quality turf where over-fertilising and overwatering could occur if not monitored appropriately. The number of LGA's testing irrigated parks needs improvement. Overwatering and/or over-fertilising of turfed areas can result in nutrients being leached beyond the root zone to groundwater and consequently to waterways. It is strongly recommended that irrigated parks are regularly tested, especially for moisture, so that irrigation schedules can be adjusted accordingly to avoid leaching of nutrients from these areas and the wasting of water. Of the twenty-one LGA's who were surveyed, two did not have foreshore reserves (see Figure 4 Question 7a). Both of the LGA's who didn't do any testing have foreshore reserves, but only one of them applies fertiliser. Another LGA fertilises foreshore areas but doesn't do any testing in this area. Currently, three LGA's who don't add fertiliser to foreshore areas conduct testing. Therefore, a further two LGA's should be testing, bringing the number who *should* test foreshore areas to nine. It is recommended that before fertiliser is applied to foreshore reserves that they are tested for nutrients, to avoid the overuse of fertiliser, due to the close proximity of waterways.

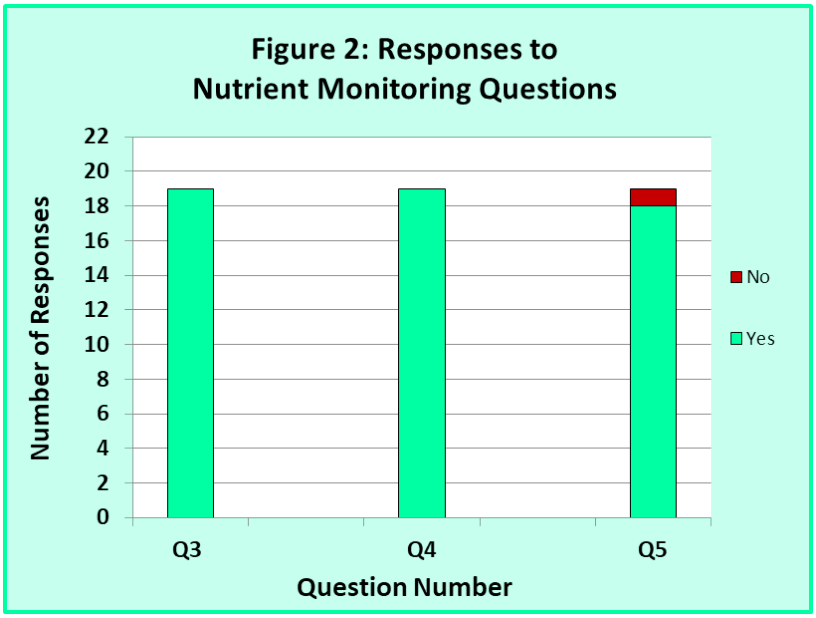
Golf courses are another area where inappropriate fertilising and watering could result in the leaching of nutrients, particularly given the large number of golf courses located near and around natural and man-made waterbodies. The numbers who stated that this question was not applicable to their LGA, suggests that the maintenance of golf courses in some areas is either tendered out or that the golf courses are privately owned. It is recommended that all LGA's promote testing of golf courses in their areas because they can be a significant source of nutrients to waterways. The absence of testing in dry grass areas could be an indication that fertiliser is not applied to these areas. If fertiliser is applied, it is recommended that regular testing occur as nutrients can leach to groundwater from these areas in the wetter months.

It is encouraging that all of the LGA's that responded are conducting soil tests and leaf tissue analysis in at least one of the areas that they are responsible for managing. This indicates that in those areas they have scientific information to know exactly how much and what type of nutrient needs to be applied and as such over-fertilising is less likely to occur. However, it is disappointing that moisture testing is not conducted by all LGA's in irrigated areas. If areas are overwatered then it is highly likely that nutrients in the soil will be washed past the root zones of turf and plants and enter the groundwater system. Thus, it is recommended that all areas that are irrigated have regular moisture testing to ensure that leaching does not occur.

QUESTION THREE

Figure 2 shows the responses from Questions Three, Four and Five. Question Three asked whether the LGA had its analyses conducted by a laboratory affiliated with the *Australian Soil and Plant Analysis Council* (ASPAC). All of the LGA's that carry out tests have their analyses conducted by these affiliated laboratories.

This result is encouraging as ASPAC laboratories are independent, offer quality assurance, follow standard procedures and employ experienced staff. It is recommended that LGA's use these laboratories for their analyses to ensure accurate information is received.



QUESTIONS FOUR AND FIVE

Questions Four and Five were directly related to the monitoring of phosphorus. Question Four asked whether available phosphorus was measured by the standard Colwell method. Question Five was about measuring of the Phosphorus Retention Index (PRI). All of the LGA's that carry out tests measured the available phosphorus in the soil by the standard Colwell method. Eighteen LGA's tested the Phosphorus Retention Index of the soil.

Phosphorus Recommendations		
PRI (Allen & Jeffery method)	Soil Test P (Colwell test)	Recommendations
O or negative		Do not apply P
0.1 - 0.5	< 5 ppm > 5 ppm	Apply up to 5 kg P/ha Do not apply P
0.5 - 2	< 7 ppm > 7 ppm	Apply up to 5 kg P/ha Do not apply P
3 - 5	< 10 ppm > 10 ppm	Apply up to 10 kg P/ha Do not apply P
> 5	< 10 ppm	Apply up to 20 kg P/ha

Source: Ruscoe, Johnston & McKenzie 2004, *Turf Sustain – A Guide to turf management in Western Australia*. Sports Turf Technology, WA.

Table 2: Phosphorus recommendations using PRI and P soil test results

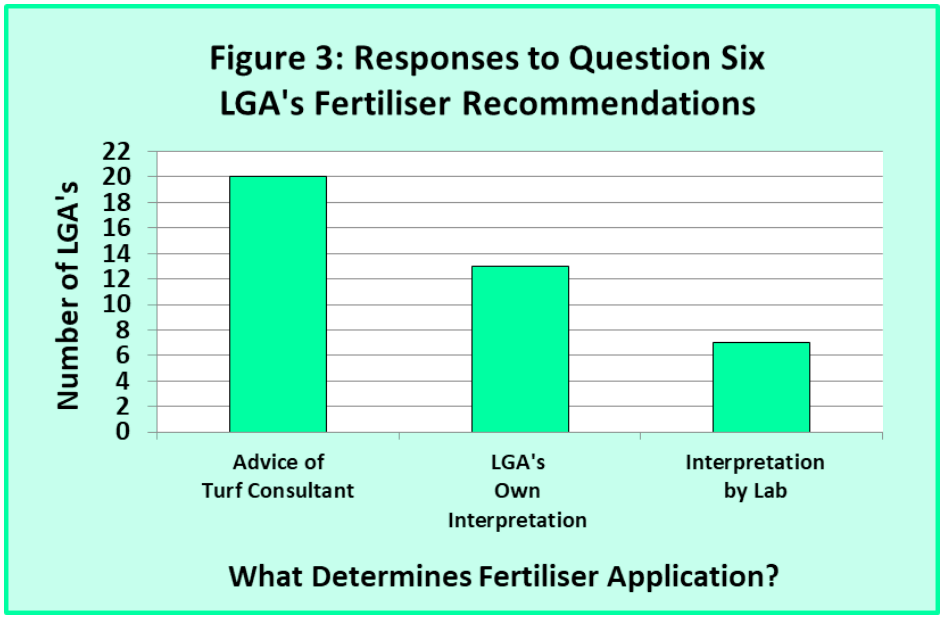
It is encouraging that in most LGA's, both the Colwell method (the standard method for Western Australian conditions) and the PRI of the soil are being measured together to determine phosphorus levels in soils. Without both tests being conducted, an accurate interpretation of phosphorus levels cannot be achieved, and thus inappropriate fertiliser regimes may be used. It is recommended that all LGA's use both tests, in conjunction, to determine phosphorus levels in soils and then apply results to Table 2 to determine if phosphorus applications are necessary. As a minimum, these tests should be conducted every second year.

FERTILISER APPLICATIONS

QUESTION SIX

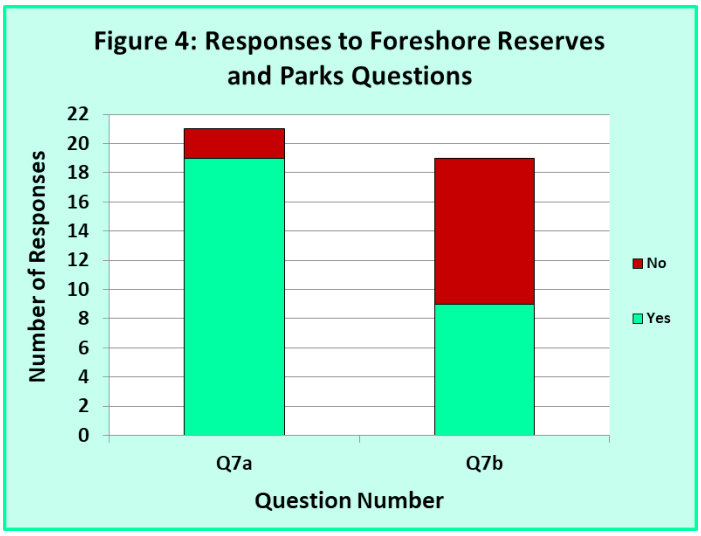
Question Six asked where the LGA's obtained their fertiliser recommendations. Fourteen LGA's had more than one response to this question. Figure 3 shows twenty of the twenty-one LGA's received advice from independent turf consultants, thirteen interpreted the results themselves and seven followed the interpretation of the laboratory.

The multiple responses from some of the LGA's to this question indicated that experienced turf managers used their own judgement, blended with a consultant's or the laboratories advice, to decide on a fertiliser program for different turfed areas. It is encouraging that a range of opinions were utilised to determine application rates of fertiliser, rather than single sources, and it is recommended that this continue. The high level of advice from turf consultants who are specifically trained in turf management and usually have many years of on ground experience is highly desirable, and it is recommended that LGA's use their expertise to determine appropriate fertiliser regimes. It is strongly recommended that Parks and Gardens Officers attend the Fertilise Wise Fertiliser Training course hosted by the Phosphorus Awareness Project in 2021 to obtain a greater understanding of appropriate fertiliser and nutrient applications.



QUESTION SEVEN

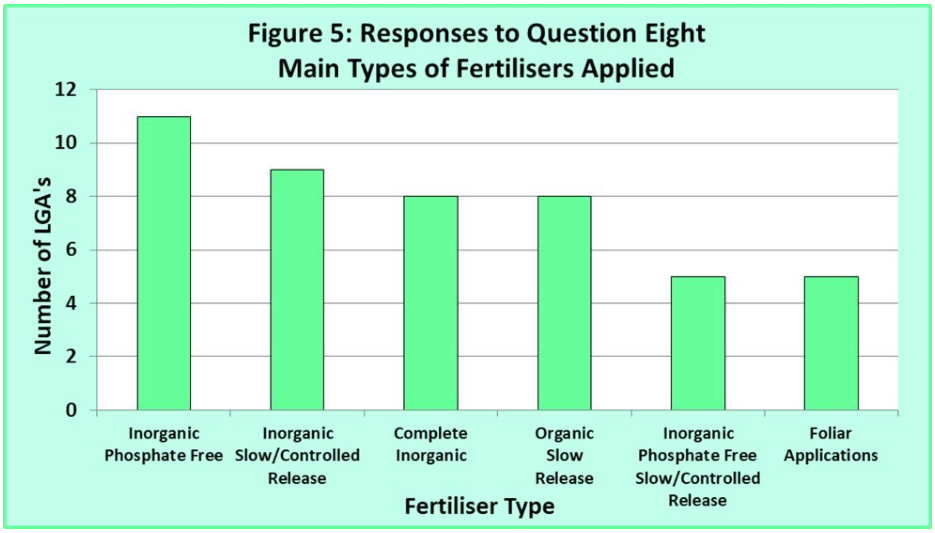
Question Seven asked if LGA's have foreshore reserves and parks and if they did whether fertiliser was added to them. As can be seen from Figure 4 Question 7a, nineteen LGA's reported having foreshore reserves and parks. Question 7b shows that of the nineteen, nine LGA's added fertiliser to their foreshore reserves and parks, with ten LGA's not adding fertiliser. As stated previously under Questions 1 and 2, of the nine that stated that they added fertiliser only seven of them conducted any soil, leaf or moisture testing. Conversely, three LGA's that don't add fertiliser to their foreshore reserves are still conducting some sort of testing in this area which is to be commended. Foreshore reserves and parks are potentially high-risk areas where nutrients can enter waterways. It is recommended that all LGA's test foreshore reserves before they apply fertiliser to these sensitive areas to avoid unnecessary nutrient applications. If nutrients are required, then controlled release or low water soluble fertilisers should be applied. Fertiliser should not be applied in the winter months when heavy rainfall can wash nutrients into the waterway and irrigation needs to be carefully monitored so that overwatering does not occur. Only one LGA reported applying fertiliser to foreshore areas in winter. If possible, a 50 metre buffer zone should be established between fertilised areas and waterways (DoW, 2004-2007). LGA's can refer to *'Fertiliser application on pasture or turf near sensitive water resources (2010)'* available from the Department of Water and Environmental Regulation for further information.



QUESTION EIGHT

Question Eight determined exactly what types of fertilisers the LGA's applied to various areas as well as the percentages of Nitrogen (N) and Phosphorus (P) of the fertiliser, average application rates of the fertiliser, area (hectares) that was fertilised and the season(s) in which they applied fertiliser. LGA's were asked to provide answers to these questions for fertiliser applications to active turf (eg. sports ovals), passive turf (eg. parks), foreshore areas, non-native gardens, native gardens and other areas.

Figure 5 shows the main types of fertiliser applied by each LGA. To obtain a more complete picture of the types of fertiliser used by each LGA, the answers for this question that were provided by the respondents were combined with research on the brand used and percentages of nitrogen and phosphorus to further break down the types of fertilisers depending on whether they were organic or inorganic and had phosphate present or absent. The foliar fertilisers as represented in the graph were a mixture of organic, inorganic, phosphorus free and slow release. Where the brand name and percentages of nutrients weren't supplied the responses provided by the LGA were used without research to further define it. Fertilisers used that contained no nitrogen or phosphorus were excluded from these results.



The raw results were broken down further to determine what types of fertiliser were applied to the different areas of active turf, passive turf, foreshore, non-native gardens, native gardens and other applications (such as tree tablets). In active turf areas, phosphate free inorganic fertiliser was the most commonly used (by 43% of the LGA's), followed by complete inorganic (33%), inorganic slow/controlled release fertilisers both with and without phosphate (24%), organic slow release (19%) and foliar (14%) fertilisers. In the passive turf areas the phosphate free inorganic fertilisers (24%) were favoured followed closely by the organic slow/controlled release fertilisers (19%) and then the complete inorganic fertilisers (10%). In the foreshore areas, phosphate free inorganic fertiliser (19%) was most commonly used. 14% of LGA's used inorganic slow release fertiliser in their non-native gardens and 10% used organic fertilisers in the non-native gardens, inorganic phosphate free slow/controlled release fertiliser in the native gardens and inorganic slow/controlled release fertiliser in other areas. Those fertiliser types not mentioned for each area were used by 5% or less of LGA's (which equates to one or no LGA's).

It is recommended that LGA's apply fertilisers according to the conditions of the area as determined by soil type, soil and leaf nutrient testing, irrigation levels and how the area is used. ie active vs passive use. Complete inorganic fertilisers can contain high levels of phosphorus and nitrogen and should only be applied if soil and leaf tissue testing reveal these nutrients are required. It is pleasing to see that phosphate free inorganic fertiliser was the most commonly used fertiliser in turfed areas, as many turfed areas do not require phosphorus. High nitrogen levels in fertiliser can also cause problems in waterway systems and should only be applied when testing indicates that it is required. Complete inorganic fertiliser is used by more LGA's in active turf areas that in passive turf areas. This most likely reflects the desire in the heavily trafficked active areas for the accelerated growth provided by the rapid release of nutrients, as they are subject to more wear and tear than the passive turf areas. Its use should, however, always be coupled with nutrient and moisture testing.

Slow release fertilisers generally release many of their nutrients slowly over a period of time according to a number of variables (soil moisture, temperature, pH, etc) and plants and turf have an extended opportunity to take up all the nutrients released. Nutrients in controlled release fertilisers are released according to soil temperature, meaning they are released faster in the warmer months during peak growth times. Composted organic fertilisers release nutrients slowly and could also have the added benefit of improving the soil, whilst foliar applications of fertiliser that involve spraying nutrients on to the foliage of turf and other plants means that nutrients will mostly be taken up into the leaves, with only minimal amounts entering soil where it can be leached to groundwater and waterways. It would be beneficial for more LGA's to consider applying their fertiliser using this method. Whilst it is good that the fertiliser being applied to foreshore areas is largely phosphate free, it should also be slow release to reduce the risk of soluble nutrients entering the waterways. As stated previously, soil, leaf tissue and moisture testing should be conducted before any nutrients are applied to reduce the risk of nutrients leaching to groundwater and waterways.

The responses from the nineteen LGA's to the percentage of Nitrogen (N) and Phosphorus (P) of the fertiliser, average application rates of the fertiliser, area (hectares) that was fertilised and the percentage of LGA's applying fertiliser each season were collated and analysed to provide the results in Table 3 for each of the application areas including active turf, passive turf, foreshore reserves, non-native gardens, native gardens and other areas. As with all of the responses in this survey, these results are only as accurate as the data provided.

The average nutrient application rate of nitrogen and phosphorus for each fertiliser was calculated by multiplying the amount of fertiliser applied per hectare (application rate in kg/ha or l/ha) by the percentage of nutrient (either N% or P%) in the fertiliser and dividing it by 100. The results from all LGA's who provided complete data were collated in this way and then averaged. This year instead of calculating the total applications per season from all of the LGA's and then expressing the results as percentages for each application area, we have calculated what percentage of the total number of LGA's have applied any fertiliser containing Nitrogen and Phosphorus in a particular season. The average annual nutrient rate of nitrogen and phosphorus added was calculated for each fertiliser by multiplying the average nutrient application rate for each nutrient by the number of times it was applied over the year. The results from all LGA's who provided complete data were collated in this way and then averaged. The total nutrient applied on an area was calculated by multiplying the average annual nutrient rate for each nutrient (unit of measurement/ha/yr) by the number of hectares it was applied to each year. The results from all LGA's who provided complete data were then added together. The values that were given in litres are only included for informative purposes as the density of each liquid would need to be known to convert them to kilograms and use them for comparative purposes. Where a range of values were provided by LGA's, this is represented accordingly.

Units of Measure	Average Nutrient Application Rate (units of measure/ha)		% of LGA's who Applied Fertiliser per Season				Average Annual Nutrient Rate (units of measure/ha/yr)		Total Nutrient Applied on Total Area (units of measure/yr)	
	Nitrogen	Phosphorus	Winter	Spring	Summer	Autumn	Nitrogen	Phosphorus	Nitrogen	Phosphorus
Applications to active turf (e.g. Sporting ovals) Total area excluding area to which liquid was applied: 1307 ha										
Kilograms (kg)	39.54 - 39.97	2.84	29	90	62	76	96.82-97.69	6.77	111988-112256	12891
Litres (l)	5.93	0					10.43	0	645	0
Applications to passive turf (e.g. Parks) Total area: 1001 ha										
Kilograms (kg)	25.47	1.48	5	62	10	24	37.68	2.37	36792	438
Applications to foreshore areas Total area: 87 ha										
Kilograms (kg)	24.32	0.71	5	33	10	19	46.61	1.43	4471	110
Applications to non-native gardens Total area: 7 ha										
Kilograms (kg)	3.5	1.35	5	19	5	14	6.86	2.69	61	24
Applications to native gardens Total area: 8 ha										
Kilograms (kg)	10.94	0.05	10	19	5	19	22.66	0.15	349	1
Applications to other areas										
No usable data			5	10	0	10	No usable data			
Total Area: 2410 ha									**153662 –153929**	**13465**

Table 3: Summary of the analysed responses from the 21 LGA's to fertiliser questions for each application area

As can be seen from Table 3 there was variation in the average application rates for nitrogen between the different application areas, which is to be expected as different areas have different requirements. The maximum recommended application rate of nitrogen to turfed areas is 40 kg/ha (Ruscoe, Johnston & McKenzie, 2004), though 30 kg/ha is usually sufficient. Higher rates can be used if the fertiliser has a higher proportion of controlled release nitrogen (Ruscoe, Johnston & McKenzie, 2004). Average nitrogen application rates (in kg/ha) for all turfed areas were under the recommended rate of 40 kg/ha, however the value for the active turf areas was very close to this rate. An analysis of the raw data showed that some LGA's were applying rates of nitrogen at levels far in excess of the recommended rate. The highest average rates of nitrogen applied by individual LGA's to each area include 129 kg/ha on active turf, 55 kg/ha on passive turf, 35 kg/ha on foreshore reserves, 10 kg/ha on non-native gardens and 42 kg/ha on native gardens, although most of these values were for fertilisers with some proportion of slow release nutrients. No usable results were obtained from any of the LGA's regarding the application rates of fertilisers to other areas due to data being provided in the wrong units of measurement for calculations to be made.

It may seem discouraging that that the average application rate of nitrogen to active turf is nearing the recommended rate (40 kg/ha) and well above the sufficient rate (30 kg/ha) as this is a large turfed area within most LGA boundaries. However, given that all but one of the LGA's with application rates in excess of the recommended rate are testing levels of nutrient in soil and leaf tissue in sports fields, and where applicable golf courses, it could be assumed that they are applying fertiliser according to these results. In addition, the LGA that has excessive application rates of nitrogen but isn't testing for nutrients in either soil or leaf tissue only just touches upon the boundaries of the Swan Canning Catchment so the majority of these nutrients would not make their way into the catchment. According to the data received, passive turf and foreshore areas are receiving an average application rate of nitrogen below both the recommended and sufficient rates, which is encouraging, and the average application rate to garden areas is quite low. However, more accurate data on the application of nitrogen to garden and other areas would be obtained if more LGA's kept records of the average application rates, area to which fertiliser is applied and percentage of nitrogen in the fertiliser and provided the data in the correct units of measurement. It is highly recommended that every LGA determines the rate of nitrogen they are applying when they apply a particular fertiliser and do so before the fertiliser is applied so that the amount of nitrogen that is applied at one time does not exceed the recommended amount.

There was some variation between the average application rates for phosphorus between the different application areas. The maximum recommended application rate of phosphorus to turf in one application is 5 kg/ha (J. Forrest, pers. comm). Where turf is tested the amounts recommended are as determined by Table 2, with amounts over 5kg/ha completed in more than one application. As can be seen from Table 3 the average application rates to the turfed areas were below recommended rates. An analysis of the raw data, however, showed that some LGA's were applying rates of phosphorus to active turf areas at levels higher than the 5kg/ha rate, however once again all of these councils, with the exception of the one who only touches upon the Swan Canning Catchment, were conducting soil and leaf tissue nutrient analysis and presumably applying according to those

results. The highest average rates of phosphorus applied by individual LGA's to each area include 22.5 kg/ha on active turf, 5 kg/ha on passive turf, 5 kg/ha on foreshore areas, 4 kg/ha on non-native gardens and 0.13 kg/ha on native gardens.

It is encouraging that average phosphorus application rates to active turf, passive turf and foreshore reserves are below the recommended 5 kg/ha maximum application rate in one application as they are large areas within LGA control. It is pleasing that the application of phosphorus to garden areas is also low, particularly in native gardens where many native species do not respond well to high levels of this nutrient. However, once again, more accurate data on the application of phosphorus to garden and other areas would be obtained if more LGA's kept records of the average application rates, area to which fertiliser is applied and percentage of phosphorus in the fertiliser and provided the data in the correct units of measurement. It is highly recommended that every LGA determines the rate of phosphorus they are applying when they apply a particular fertiliser and do so before the fertiliser is applied so that the amount of phosphorus that is applied at one time does not exceed the recommended amounts.

As can be seen in Table 3, spring and autumn months are when the majority of LGA's apply fertiliser. There are however, a large number of LGA's applying fertiliser to active turf areas in the summer months, with some also applying it in winter. An analysis of the raw data revealed that the majority of LGA's are applying fertiliser by multiple applications over the year rather than one large application per year.

The responses to this part of question 8 are promising with a large number of LGA's applying fertiliser in the spring and autumn months when turf and plants are actively growing. Some LGA's applied fertiliser in the winter months which is disappointing as it is likely that the nutrients applied will be leached from the soil in heavy rain. The majority of LGA's also have warm season grasses like kikuyu and couch (refer to Question 14), of which couch is dormant during the winter months and any fertiliser applied will not be taken up by this grass during this period of dormancy. The data that was provided regarding the fertilisation of other areas suggested that fertiliser was sometimes applied to trees in winter. Planting trees in the winter months is highly recommended so they can establish themselves before the dry summer months, so this is the only instance when applying fertiliser during winter is acceptable. Some LGA's stated that they fertilised in the summer months. Many turf types will not take up nutrients from fertiliser if there is an extended period of high temperatures during the summer months. It is encouraging that the majority of the LGA's are applying fertiliser by multiple applications over the year, rather than one large application per year, and it is recommended that this practice continues.

The average annual nutrient rate responses, as shown in Table 3, reveal that the maximum average annual rates of 98 kg/ha/yr of nitrogen and 7 kg/ha/yr of phosphorus added to active turf are either below or within the recommended levels of 100-200 kg/ha/yr for nitrogen and 0-50 kg/ha/yr of phosphorus for high maintenance active turf (Department of Environmental Protection & Water and Rivers Commission, 2001). For passive turf the average annual rate of 38 kg/ha/yr of nitrogen was within the recommended rate of 0-50 kg/ha/yr for nitrogen and the 2 kg/ha/yr of phosphorus applied fell within the recommended rate of 0-5 kg/ha/yr for phosphorus (Department of Environmental Protection & Water and Rivers Commission, 2001). The foreshore areas average annual rate of 47 kg/ha/yr for nitrogen is within the recommended rate which is 0-50 kg/ha/yr while the 1.43 kg/ha/yr average annual rate of phosphorus is within the recommended rate for this area which is 0-5 kg/ha/yr for phosphorus (Department of Environmental Protection & Water and Rivers Commission, 2001). The average annual nutrient rates for non-native gardens and native gardens can be viewed in Table 3 but it is difficult to determine if levels have been exceeded due to the vast variety of different plant species that fit into these categories.

It is encouraging that the average annual nitrogen and phosphorus rates applied to active and passive turf and foreshore areas are below or within the recommended levels for these areas and it is recommended that this continue. All LGA's are encouraged to keep a log book of their nitrogen and phosphorus applications over the year for all application areas to ensure that recommended rates for these areas are not exceeded.

Table 3 reveals that around 112000 kg/yr of nitrogen and 12891 kg/yr of phosphorus have been applied on 1307 ha of active turf by the LGA's who participated in the survey. Passive turf had 36792 kg/yr of nitrogen and 438 kg/yr of phosphorus applied to 1001 ha, foreshore areas had 4471 kg/yr of nitrogen and 110 kg/yr of phosphorus to 87 ha, non-native gardens had 61 kg/yr of nitrogen and 24 kg/yr of phosphorus applied to 7 ha and native gardens had 349 kg/yr of nitrogen and 1 kg/yr of phosphorus to 8 ha. Overall 153662 – 153929 kg/yr of nitrogen and 13465 kg/yr of phosphorus has been applied by the LGA's to a total of 2410 ha. This does not take into consideration the areas that LGA's stated that they were fertilising, however did not provide enough information to enable a calculation to be made of the amount of nitrogen and phosphorus being applied.

The Swan Canning Water Quality Improvement Plan states that the maximum acceptable load of total nitrogen to the Swan and Canning Rivers is 130 tonnes per year and total phosphorus is 14 tonnes per year (Swan River Trust, 2009). Of the 30 LGA's asked to participate in this survey every year, only Joondalup, Kwinana and Rockingham don't have any part of their LGA within the Swan Canning Catchment (refer to Map 1). Excluding the data supplied by Kwinana and Rockingham, this means that up to 132133 - 132401 kg/year (132 tonnes) of nitrogen and 13465 kg/year (13 tonnes) of phosphorus has been applied by the LGA's within the Swan Canning Catchment. If all of these nutrients were to reach these waterways, it would have exceeded the maximum accepted total load of total nitrogen and been just under the maximum accepted total load of total phosphorus. It should be kept in mind however that the total area covered by each LGA does not always feed into the Swan Canning Catchment

(see Map 1) so it is likely that not all of these nutrients have the potential to reach the waterways of this catchment either through leaching to groundwater or runoff onto hard surfaces and into stormwater drains or directly into waterways. However, given that eight LGA's belonging to the Swan Canning Catchment didn't respond to this survey and the nutrient load from other sources hasn't been taken into account for these values, these levels of nutrients are concerning. It is recommended that LGA's implement the best management practices for fertiliser/nutrient applications recommended in this report to ensure that the majority of these applied nutrients do not enter the rivers.

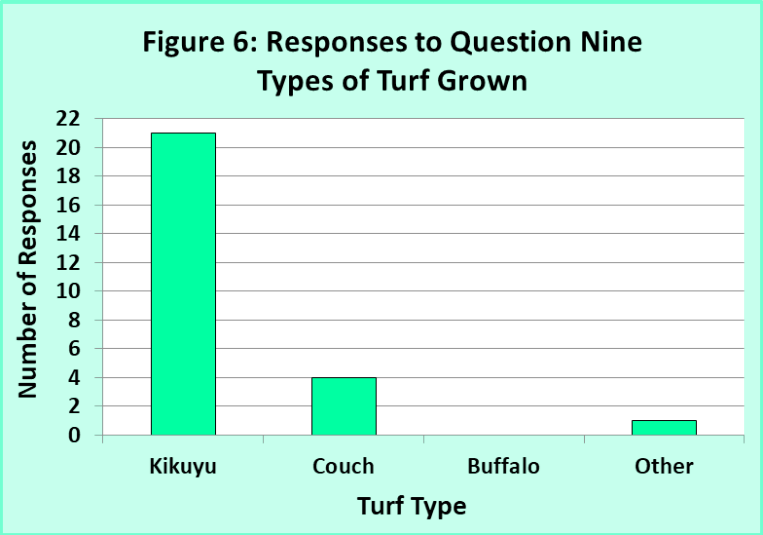
Due to the difficulty in assessing overall level of best management practices because of differences in LGA areas including (but not limited to): soil type, turf type, passive vs active turf, age of turf, location of turf, percentage of nutrients in fertiliser and whether nutrient monitoring of turf occurred, it is recommended that LGA's implement the following strategies to ensure management practices approach a high level:

- Determine the rate of each nutrient of the fertiliser they intend to apply before application to ensure that over application of phosphorus and nitrogen does not occur. The formula to determine the rate of nutrient is to multiply the amount of fertiliser to be applied per hectare by the percentage of that nutrient (either N% or P%) in the fertiliser, divided by 100.
- The maximum nitrogen rate for a single application is 40 kg nitrogen/hectare (Ruscoe, Johnston & McKenzie, 2004) though 30 kg nitrogen/hectare is usually sufficient.
- The maximum phosphorus rate for a single application to turfed areas is 5 kg phosphorus/hectare (J. Forrest, pers. comm). Where testing of turfed areas occurs it should be applied according to Table 2, with amounts over 5kg/ha applied using multiple applications rather than a single application.
- High maintenance active turf should not exceed applications of 100-200 kg/ha/yr for nitrogen and 0-50 kg/ha/yr for phosphorus.
- Passive turf and foreshore area applications should not exceed 0-50 kg/ha/yr for nitrogen and 0-5 kg/ha/yr for phosphorus.
- Keep a log book to record details of fertiliser and nutrient applications over the year for each application area including details such as weather conditions and monitoring information.
- If fertiliser is required, apply in spring and/or early autumn (September, October, November, March and April) when grass grows rapidly. Apply the fertiliser in small amounts and often over these months instead of a single application. This will ensure all nutrients can be utilised by the turf.
- Do not fertilise in summer or winter (with the exception of native trees that are planted in winter). Summer fertilising encourages over use of water and turf may grow excessively while fertiliser applied during winter will be washed into stormwater drains or leached into groundwater.
- Do not apply fertiliser too close to hard surfaces such as roads. Fertiliser on hard surfaces will be washed into stormwater drains and end up in waterways. Also, do not apply fertiliser around the edges of wetlands and rivers where it can directly be washed into these waterways.
- Avoid applying fertiliser before heavy rainfall and do not over water turf as both actions could result in leaching of nutrients to groundwater and waterways.
- LGA Parks and Gardens Officers should attend the Fertilise Wise Fertiliser Training, which is hosted by the Phosphorus Awareness Project, in 2021 to learn fertiliser best management practices specific for the Perth Metropolitan Area.
- LGA's should refer to the following publications (see Reference section for full publication details) to obtain more information on fertiliser and irrigation best management practices:
  - *Turf Sustain – A guide to turf management in Western Australia*
  - *Western Australian environmental guidelines for the establishment and maintenance of turf grass areas (2014)*
  - *Stormwater Management Manual for Western Australia.*

TURF TYPE

QUESTION NINE

Question Nine asked for the main type of turf grown in the LGA's area. Four of the LGA's had more than one response to this question. As can be seen from Figure 6, all of the LGA's had kikuyu listed as a turf type. Seventeen of the LGA's used kikuyu exclusively, with three combining its use with couch and another with couch and bent grass, which was used at golf courses. None used couch exclusively and no LGA's reported using Buffalo.



The response to this question is very encouraging as all LGA's are using kikuyu. It is recommended that LGA's continue to use kikuyu as their first choice for turfed areas due to its low fertiliser requirements, medium water usage, drought and wear tolerance and long growing season. The use of kikuyu results in less nutrients and water having to be applied to turfed areas, with less chance of nutrients leaching, when compared to other turf types. The LGA's that stated that they also use couch should note that fertiliser should not be applied to these areas in the winter months as the couch could be dormant and thus would not take up nutrients. Three of the LGA's that reported using couch indicated that they apply fertiliser in winter, mostly to active turf areas and in the case of one LGA to passive turf areas as well, although it is not clear if those areas to which it is applied contain kikuyu or couch turf.

NUTRIENT MANAGEMENT

QUESTION TEN

Question Ten part a) asked if measures are in place to prevent grass clippings from entering stormwater drains and if so part b) asked respondents to list these measures. As can be seen from Figure 7, all but one of the LGA's stated that they have measures in place to prevent grass clippings from entering stormwater drains. Seventeen LGA's had more than one response to this question. The measures the LGA's have taken can be seen in Table 4.

Measure Taken	No. of LGA's Using Measure
Direct debris away from road/path/waterways	13
Street sweeping	9
Clippings collected and/or removed from site	7
All clippings left on lawn	6
Regular mowing to reduce excess clippings	4
Turf machinery cleaned down after use	3
Catchers used on mowers	3
Informing staff of correct procedures ie. at toolbox meetings	3
Water Sensitive Urban Design (WSUD) ie. rain gardens, vegetated drains, interceptor traps	3
E-ducting	2
Gross Pollutant Traps (GPT's) cleaned regularly	2
Landscaping of GPT's	2
Gross Pollutant Traps	1
Vegetated buffer zones around lakes	1
Use of sumps and soakwells	1
Sweeping of ovals when windrows occur	1
Application of growth retardant	1
Lab testing on its debris collected by street sweepers for petroleums & hydrocarbons	1
Grates/screens over drains	1

It is encouraging that nearly all of the LGA's who responded to this year's survey have measures in place to prevent grass clippings from entering stormwater drains, as grass clippings are high in nutrients and can end up in waterway systems if they are left on hard surfaces and enter stormwater drains. Most measures that the LGA's indicated they undertook to prevent clippings from entering drains are best management practices. It should be noted, however, that Gross Pollutant Traps (GPTs), drainage sumps and soakwells will not prevent the nutrients from grass clippings entering waterways. Reassuringly, all of the LGA's that indicated that they have GPTs, drainage sumps and/or soakwells also indicated that they use other measures to prevent grass clippings entering drains and many indicated that they have landscaping rather than turf around their GPTs or that they clean them regularly.

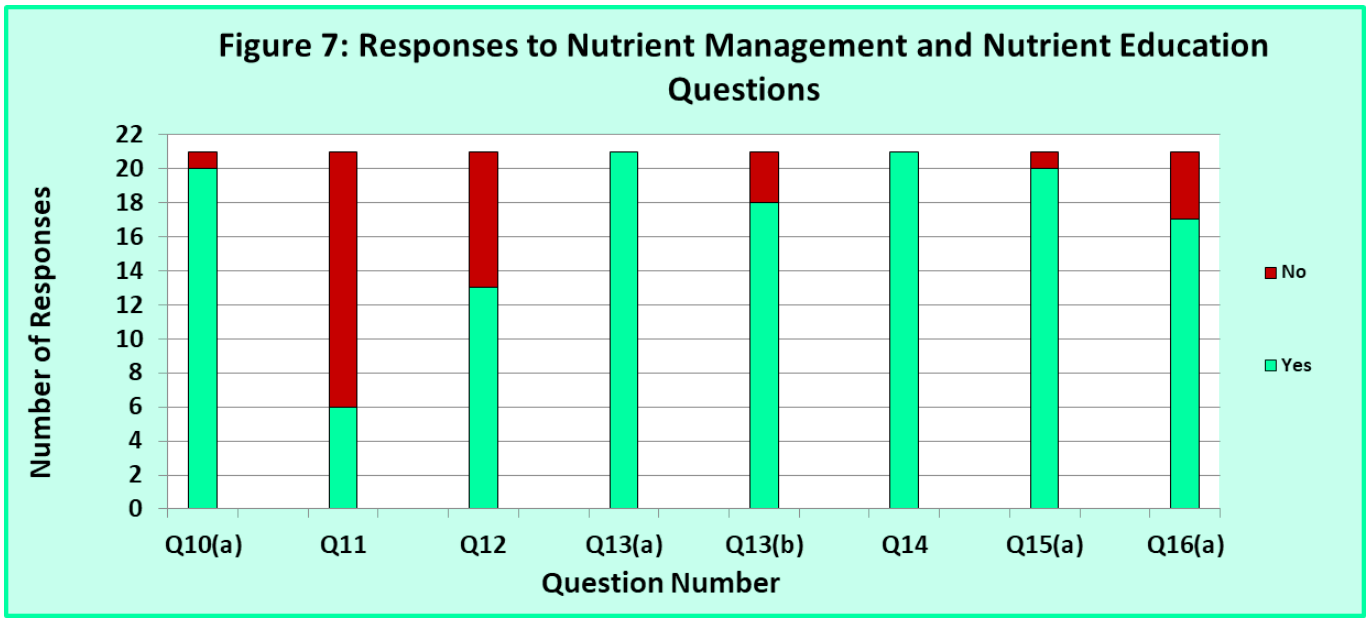
Table 4: Measures taken by the 20 LGA's to prevent grass clippings entering stormwater drains.

It is recommended that LGA's take the following measures to prevent grass clippings entering stormwater drains and waterways:

- Where testing determines that nutrients are lacking, LGA's should leave grass clippings on the mowed turf which returns the nutrients contained in the clippings back to the soil thus reducing fertiliser requirements. Clippings left in piles should be removed to disperse clippings. If testing reveals that nutrients are required in turfed foreshore areas, this practice should be adopted in favour of adding fertiliser or to reduce fertiliser requirements and only controlled/slow release or low water soluble fertiliser should be used. If nutrients are not required, clippings should be removed from these areas.
- When mowing, clippings should be thrown away from hard surfaces and waterways.
- When mowing median strips and small areas near hard surfaces or waterways a catcher should be used.
- If clippings need to be removed they should be composted and then utilised as a soil amendment.
- Grass clippings that end up on hard surfaces such as roads and driveways should be swept up and removed (either manually or with a street sweeper) or blown off the hard surface back onto the turfed area.
- Grass clippings should never be blown, hosed or swept onto hard surfaces such as roads or driveways as they can be washed or blown into stormwater drains ending up in waterway systems.
- Mowing equipment should be cleaned down before going to the next location.
- When hosing down mowing equipment ensure that this water does not enter stormwater drains.

Further information can be obtained from the Department of Water's '*Stormwater Management Manual for Western Australia*' and the Swan River Trust's (Fertiliser Partnership Urban Users Working Group) '*Western Australian Environmental Guidelines for the Establishment and Maintenance of Turf Grass Areas*'.

Figure 7 shows the responses to Questions Ten through to Sixteen.



QUESTION ELEVEN

Question Eleven asked if Nutrient and Irrigation Management Plans (NIMP) are implemented for streetscapes. Six of the twenty-one LGA's that responded had a NIMP for their streetscapes.

It is disappointing that less than a third of all of the LGA's surveyed have a NIMP for their streetscapes. It is recommended that a NIMP be implemented by all LGA's for streetscapes. Streetscapes include median strips, roundabouts, entry statements, car park landscaping and road verges, which when combined are large areas within a LGA where nutrients and water usage should be controlled more appropriately. The use of local native species in streetscapes would reduce the need to water and fertilise in these areas. Refer to Question Twelve for information on using local native species in streetscapes.

Information about NIMP's is available from the Department of Water and Environmental Regulation's website where the following documents can be located:

* *Water Quality Protection Note 33 (June 2010) Nutrient and Irrigation Management Plans*
* *Water Quality Information Sheet 04 (August 2010) Nutrient and Irrigation Management Plan Checklist.*

QUESTION TWELVE

Question Twelve asked if LGA's have a policy to use local native plants as the first choice in public and private (developers) landscaping. Thirteen LGA's had a local native plant policy as the first choice in landscaping.

It is recommended that every LGA adopts a policy of using local native plants as the first choice when landscaping as they require low levels of water and fertiliser and once established may require no further applications. This will result in reduced applications of water and nutrients in landscaped areas with less chance of leaching of nutrients from these areas. Information on local native plant policies and using local native species is available from the Eastern Metropolitan Regional Council's Landscaping with Local Plants Policy and Guidelines section of their '*Local Government Natural Resources Management Policy Manual*'. SERCUL's Phosphorus Awareness Project produces '*Grow Local Plants*' leaflets for the five main soil types in Perth. These leaflets contain species lists of local plants that are found on each soil type from groundcovers and climbers through to trees.

QUESTION THIRTEEN

Question Thirteen part a) asked if LGA's have deciduous trees in parks or streetscapes whilst part b) asked if they have measures in place to prevent deciduous leaves from entering stormwater drains and if so what are these measures. The scoring on the Nutrient Scorecards provided to LGA's which are based on their survey responses was changed for this question in 2019 to reflect the concern of a number of LGA's that they were being penalised for having historical plantings of deciduous trees. They are now scored based on whether they have measures in place to prevent leaves entering stormwater drains, rather than if they have deciduous trees.

All of the LGA's had deciduous trees in parks or streetscapes and eighteen had measures in place to prevent leaves from entering stormwater drains. Fourteen LGA's had more than one measure in place. The responses to what measures were given to prevent leaves from entering drains can be seen in Table 5.

Measure Taken	No. of LGA's Using Measure
Regular or during leaf drop Road/Park/Path sweeper	18
Drains educted or cleaned	7
GPT's present and/or regularly cleaned	6
Sumps and soakwells present and/or regularly cleaned	5
WSUD incl rain gardens, vegetated drains, interceptor traps	3
Leaf drop mowed and caught in catcher	2
Informing staff of correct procedures ie at toolbox meetings	1
Machinery cleaned	1
Grates/Screens over drains	1
Turf Tidy Sweeping machines used in parks	1
All City drains are independent sumps/soak wells and therefore do not flow back into the river.	1

Table 5: Measures taken by the 18 LGA's to prevent deciduous leaves from entering stormwater drains.

It is encouraging that the majority of LGA's implement measures to prevent leaves from entering drains, however disappointing that there are still some with deciduous trees in place and no action is taken to prevent nutrients from the loss of leaves entering waterways. The falling leaves from deciduous trees decompose quickly releasing excessive nutrients to waterways via the stormwater drains, groundwater or directly into waterways in the late autumn/early winter months. As such, it is recommended that LGA's opt to plant native, evergreen trees where new trees are required. At the very least they should minimise their use of deciduous trees and definitely not plant them along waterways or roads where their falling leaves can enter waterways. Refer to Question Twelve for information on using local native species in parks and streetscapes.

Most of the measures adopted to prevent leaves or their nutrients entering the water are best management practices. Many LGA's undertake regular street sweeping which is increased in frequency during the late autumn/early winter months when leaf drop occurs. As stated previously with regard to grass clippings, Gross Pollutant Traps (GPT's), soakwells and sumps would not prevent nutrients from leaves entering waterways unless they are cleaned out on a regular basis, particularly during the autumn and early winter months, as deciduous leaves decompose readily. Even those that are independent from the river will contribute nutrients to the groundwater and ultimately to waterways if leaves are left to decompose within them. Reassuringly most of the LGA's that listed that they had GPT, sumps and/or soak wells indicated that they were regularly cleaned or had other measures in place to prevent leaves from entering drains, such as street sweeping.

QUESTION FOURTEEN

Question Fourteen asked whether the council provided dog poo bins and bags in parks and foreshore reserves. All of the LGA's stated that they provided these bags and bins in their parks.

The results from this question are encouraging, and should be continued, as dog poo is one of the largest sources of phosphorus to waterways in urban areas. It is recommended that every park or reserve have dog poo bins and bags provided and preferably that these bags are biodegradable.

NUTRIENT EDUCATION

QUESTION FIFTEEN

Question Fifteen part a) asked if measures are taken in foreshore reserves and parks to educate the public about not feeding bread to waterbirds and if yes part b) asked what measures are taken. Bread contains high levels of phosphorus and when distributed to waterbodies, either directly or through the waste products of animals like birds, can contribute to algal blooms. Twenty of the LGA's had measures in place and eleven LGA's had more than one response to what measures are taken. The LGA who did not have measures in place is a beachside LGA that does not have river foreshores and only just touches upon the Swan Canning Catchment. However, birds will frequent their ocean foreshore and the mobility of these birds means that they should not be fed bread in that location as they can still travel to other areas where wetlands and lakes are located and excrete their waste products. The measures that the LGA's used to educate the public on not feeding bread to waterbirds can be seen in Table 6.

Measure Taken	No. of LGA's Using Measure
Information signage	19
Information on website	6
Pamphlets	6
Media ie. newsletters, social media, print media	4
Information distributed by staff ie. Rangers, Security, Office Staff	3
Workshops	3
Community events	3
Ranger enforcement	2
Signage stating that feeding ducks attracts a $100 fine (Urban Environment and Nuisance local law)	1
Information distributed to friends groups	1

Table 6: Measures taken by 20 LGA's to educate the public about not feeding bread to waterbirds.

The response to this question is promising with nearly all of the LGA's educating the public about not feeding bread to waterbirds. The use of interpretative signage is effective as it means information about the effects of feeding is being provided at the site where it is occurring. The use of enforcement by one LGA is an important strategy to deter persistent bird feeders and it is recommended that other LGA's also adopt this practice. At a minimum, it is strongly recommended that all LGA's erect signage in river and ocean foreshore reserves and parks educating the public about the effects of bread on waterways (eg. increased phosphorus levels and algal blooms) and waterbirds (eg. malnutrition, botulism and aggressive behaviour). SERCUL's Phosphorus Awareness Project has a brochure which outlines this issue that could be the basis for signage. It is also recommended that LGA's use other strategies to educate ratepayers about the effects of bread on waterways and waterbirds such as local media, environmental workshops, LGA newsletters, websites and brochures and Rangers advising people of the disadvantages of this activity.

QUESTION SIXTEEN

Question Sixteen part a) asked if advice was provided to ratepayers about best practice in fertiliser management according to soil type and if so part b) outlined the strategies used to provide this advice. Seventeen of the LGA's stated that they provide advice to their ratepayers and twelve had more than one response to this question. The responses as to how they provided this advice can be seen in Table 7.

Measure Taken	No. of LGA's Using Measure
Native plants to residents programs/subsidies	8
Pamphlets	6
Workshops	6
Information on LGA website	5
SERCUL Fertilise Wise information on LGA website	5
SERCUL Fertilise Wise brochures	4
Verbal/email advice	3
Verge policy/rebates	3
Information at community events	2
Catchment Friendly Garden Competition category in LGA garden competition	1
Rural property stocking rates	1
Social media	1

Table 7: Measures taken by 17 LGA's to advise ratepayers about best practice in fertiliser management.

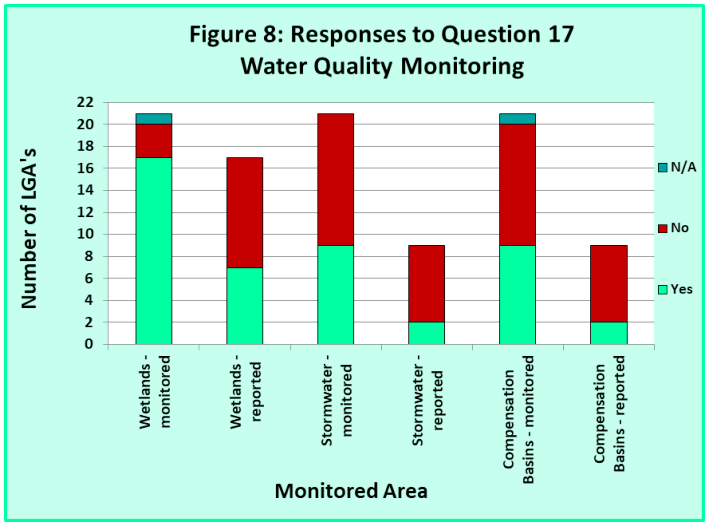
It is encouraging that most of the LGA's surveyed are providing some sort of advice to their ratepayers. The focus of the information provided should be based around the fertilisation of lawns as ratepayer's lawns, when combined, would form the largest turfed area in a LGA. Householders generally have limited knowledge of best practice fertiliser management. It is recommended that LGA's provide advice to ratepayers on fertiliser practices. This will help to reduce the high levels of nutrients from fertilisers that leach through the sandy soils of the Swan Coastal Plain and into groundwater and waterways.

The Phosphorus Awareness Project produces '*Fertilise Wise*' leaflets for the five main soil types in Perth. These leaflets contain information on fertiliser best management practices targeted at homeowners and are available for LGA's to distribute to their ratepayers for free. The PAP and SERCUL have also developed a website, www.sercul.org.au/fertilisewise, that contains Fertilise Wise and other gardening information specific to the Perth region. LGA's are encouraged to link this website to their own. LGA's could also host a 'Great Gardens' or 'Beyond Gardens' workshop to educate ratepayers on fertiliser and water management and other garden issues. Workshops can be organised by contacting The Forever Project or the Beyond Gardens team.

WATER QUALITY MONITORING

QUESTION SEVENTEEN

Question Seventeen part a) asked whether regular monitoring of wetlands, stormwater drains and compensation basins was performed for nutrient levels and if so, part b) asked whether these results were reported to the local community. As can be seen from Figure 8, seventeen LGA's monitored wetlands and nine monitored stormwater drains and compensation basins. One LGA stated that the monitoring of wetlands was not applicable to them as they do not have any in their jurisdiction, whilst another indicated that the monitoring of compensation basins was not applicable to their LGA. Of those that monitored the various areas, seven reported on the results of at least one area to the community, with seven reporting their wetland monitoring results, two reporting their stormwater monitoring results and two reporting their compensation basin monitoring results.



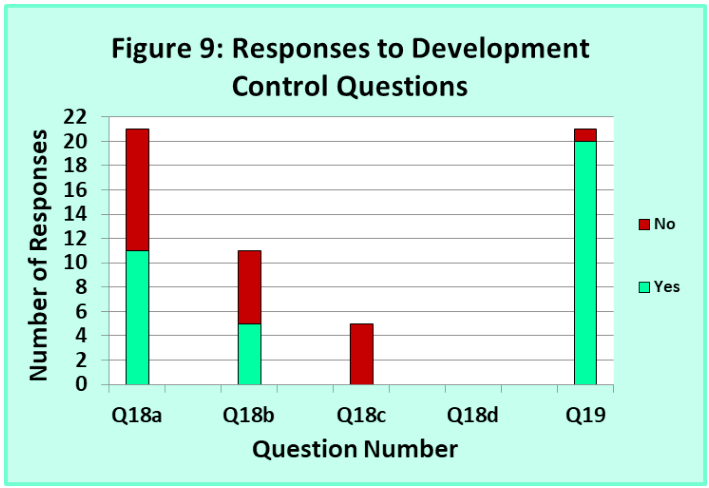
The number of LGA's monitoring stormwater and compensation basins is quite low. It is recommended that monitoring of all these areas occur as they may all be influenced by fertiliser applications on surrounding areas and monitoring could also help pinpoint the sources from which pollution is entering waterways. Stormwater drains, compensation basins and wetlands are connected to the river systems through ground or surface water. There is a high potential that nutrients, algal blooms or other pollutants from these areas could enter the rivers.

Greater reporting of the results of this monitoring to the public is to be encouraged. Reporting these results to the community would reflect the LGA's commitment to the environment and provide important information to community catchment and environment groups. These groups could use this information to determine where rehabilitation of waterways and education of general community members needs to occur.

DEVELOPMENT CONTROL

QUESTIONS EIGHTEEN AND NINETEEN

Questions Eighteen and Nineteen related to new developments. Question Eighteen part a) asked if conditions are imposed on developments which include a Nutrient and Irrigation Management Plan (NIMP). Monitoring for compliance (Qu 18b), results of monitoring (Qu 18c) and prosecution for lack of compliance (Qu 18d) were also addressed by this question. As can be seen from Figure 9, eleven LGA's imposed conditions on developments, but only five of the eleven monitored these for compliance. Of the five that monitor for compliance none reported that developments had been found to be non-compliant in the last 12 months or had made a prosecution for lack of compliance in the last 12 months.



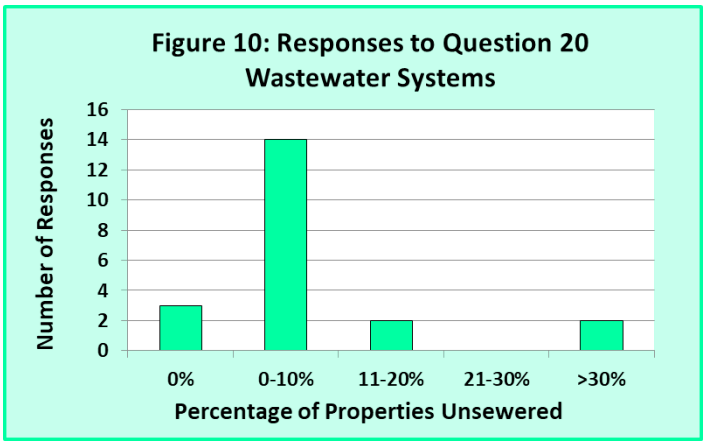
It is imperative that all LGA's impose conditions, monitor compliance to these conditions and prosecute for non-compliance. Potentially these conditions are being imposed but they are included in Urban Water Management Plans and are not clearly defined as a NIMP. Many new developments, especially subdivisions, are major sources of nutrients to waterways and this could be reduced by monitoring for compliance and prosecuting developers for their lack of compliance, not only to recoup costs for environmental damage but to deter the developers from not complying on future projects.

Question Nineteen asked if the LGA had provisions in the Town Planning Scheme or Planning Policies to enforce environmental conditions on development. Twenty LGA's had provisions to enforce environmental conditions.

The number of LGA's that have provisions to enforce environmental conditions is very encouraging and it is recommended that all LGA's introduce these provisions. This may prevent environmental harm from occurring and will allow the LGA to prosecute if developers are not adhering to best management practices. As stated above, it is however imperative that if they have the provisions to enforce environmental conditions that they monitor for compliance and prosecute for non-compliance.

WASTEWATER SYSTEMS

QUESTION TWENTY



Question Twenty asked what percentage of properties in the LGA's urban zone were not connected to the sewer. As can be seen from Figure 10, three LGA's had 0% not connected to sewer, fourteen had 0-10%, two had 11-20%, none had 21-30%, and two had greater than 30%. The two LGA's with greater than 30% are located in the hills on clay soils.

It is recommended that LGA's encourage those house-holders that remain unconnected to connect to the main sewerage line as leaking septic tanks can contribute nutrients to the river systems. It is acknowledged that this will be more difficult for houses in areas located in the Darling Ranges.

ADDITIONAL INFORMATION

QUESTION TWENTY-ONE

Question Twenty-One asked whether the LGA implemented any other strategies in relation to nutrient management that they felt were not adequately captured in the survey. Seven of the LGA's provided additional information relating to various approaches to nutrient management that they have in place including the completion of a case study for the Sediment Task Force, implementation of Water Sensitive Urban Design practices including living streams, wetlands and raingardens, the participation of Parks and Gardens officers in Fertilise Wise training, Clean Drains River Gains activities with school children and lysimeter monitoring of leachate before and after fertiliser applications. The information specific to those LGA's will be summarised on their scorecard.

Annual Nutrient Survey for Local Government Authorities 2020
RECOMMENDATIONS

The following recommendations for each question, if implemented, will help LGA's to achieve a high level of nutrient best management practice.

NUTRIENT MONITORING

QUESTION ONE – Does your LGA conduct regular soil tests, leaf tissue analysis and/or moisture tests for nutrients in grassed and turfed areas?

Recommendations

1. LGA's should regularly conduct soil tests, leaf tissue analysis and moisture testing before applying fertiliser to determine if nutrients are required, and if required, the application rate and type of nutrients needed. This testing will result in unnecessary fertiliser applications being avoided and excess nutrients being leached to groundwater.
2. The leaf tissue nitrogen content should be maintained between 1.5% - 2% for passive turf and 2% - 3% for sports fields (Ruscoe, Johnston & McKenzie, 2004).
3. The leaf tissue phosphorus content should be maintained between 0.2% - 0.4% (Ruscoe, Johnston & McKenzie, 2004).
4. LGA Parks and Gardens Officers should attend the Fertilise Wise Fertiliser Training course that is hosted by the Phosphorus Awareness Project in 2021.

QUESTION TWO – If yes for question no.1, for which areas? Areas - sports fields, golf courses, irrigated parks, dry grass areas and foreshore reserves. Tests – soil tests, leaf tissue analysis and moisture testing.

Recommendations

1. LGA's conduct soil testing and leaf tissue analysis of sports fields, irrigated parks, golf courses under their control, dry grass areas and foreshore reserves before applying fertiliser. This will result in unnecessary fertiliser applications being avoided.
2. LGA's regularly conduct moisture testing of these areas to avoid overwatering and the potential leaching of nutrients from these areas.
3. LGA's promote testing of golf courses in their areas because they can be a significant source of nutrients to waterways.

QUESTION THREE – Are analyses carried out by a laboratory affiliated with the *Australian Soil and Plant Analysis Council* (ASPAC)?

Recommendations

1. LGA's use ASPAC laboratories for their analyses so that accurate information is received.

QUESTION FOUR - Is available phosphorus in the soil measured by the standard Colwell method?

Recommendations

1. LGA's measure the available phosphorus in the soil using the Colwell method (standard method for Western Australian conditions) to determine accurate levels of phosphorus, thus preventing unnecessary nutrient applications.

Phosphorus Recommendations		
PRI (Allen & Jeffery method)	Soil Test P (Colwell test)	Recommendations
O or negative		Do not apply P
0.1 - 0.5	< 5 ppm > 5 ppm	Apply up to 5 kg P/ha Do not apply P
0.5 - 2	< 7 ppm > 7 ppm	Apply up to 5 kg P/ha Do not apply P
3 - 5	< 10 ppm > 10 ppm	Apply up to 10 kg P/ha Do not apply P
> 5	< 10 ppm	Apply up to 20 kg P/ha

Source: Ruscoe, Johnston & McKenzie 2004, *Turf Sustain – A Guide to turf management in Western Australia*. Sports Turf Technology, Como, Western Australia.

QUESTION FIVE - Is the Phosphorus Retention Index (PRI) of soil measured?

Recommendations

1. LGA's measure the PRI of soil to determine the capacity of the soil to hold on to phosphorus, thus preventing unnecessary nutrient applications.
2. LGA's apply the analyses obtained from the Colwell method and PRI to the following table to determine if phosphorus applications are necessary. As a minimum, these tests should be conducted every second year.

FERTILISER APPLICATIONS

QUESTION SIX - Are fertiliser recommendations based on either: advice from an independent turf consultant, LGA's own interpretation of results and experience, interpretation by the laboratory or other?

Recommendations

1. LGA's use a range of opinions to determine application rates and types of fertiliser, rather than single sources to ensure appropriate fertiliser regimes are being conducted.
2. LGA's use a turf consultant's expertise to determine fertiliser regimes as they are specifically trained in turf management, usually with many years on ground experience.
3. LGA Parks and Gardens Officers attend the Fertilise Wise Fertiliser Training course that is hosted by the Phosphorus Awareness Project in 2021.

QUESTION SEVEN – (a) Do you have foreshore reserves and parks? (b) Do you add fertiliser to foreshore reserves and parks?

Recommendations

1. If LGA's have foreshore reserves and parks they test these areas before applying fertiliser to avoid unnecessary nutrient applications which could leach into groundwater and nearby waterways.
2. If nutrients are required then controlled release or low water soluble fertilisers should be applied to reduce leaching.
3. Fertiliser should not be applied in the winter months when heavy rainfall can wash nutrients into the waterway and irrigation needs to be carefully monitored so that overwatering also does not wash nutrients into the waterway.
4. If possible, establish a 50 metre buffer zone between fertilised areas and waterways (DoW, 2004-2007).
5. LGA's refer to '*Fertiliser application on pasture or turf near sensitive water resources (2010)'* available from the Department of Water and Environmental Regulation.

QUESTION EIGHT - In general, what are the main types of fertilisers applied to established turf and other areas either: complete inorganic, phosphate-free inorganic, organic/slow release, foliar applications or other? If applied: Fertiliser brand name, N%, P%, Average application rate in kg/hectare, Area, Number of applications per season - winter, spring, summer, autumn? Applications were categorised in the following areas: active turf, passive turf, foreshore areas, non-native gardens, native gardens and other areas.

Active turf has different requirements to passive turf

Recommendations

1. LGA's use specific fertilisers according to the soil and leaf tissue analyses for each site rather than using the same fertiliser for all sites to ensure that all the nutrients are utilised by the turf and not leached into groundwater.
2. LGA's only apply phosphorus and nitrogen when testing indicates it is required to avoid leaching of nutrients that are not required by the turf.
3. LGA's determine the rate of each nutrient of the fertiliser they intend to apply before application to ensure that over application of phosphorus and nitrogen does not occur. The formula to determine the rate of nutrient is to multiply the amount of fertiliser to be applied per hectare by the percentage of that nutrient (either N% or P%) in the fertiliser, divided by 100.
4. The maximum nitrogen rate for a single application is 40 kg nitrogen/hectare (Ruscoe, Johnston & McKenzie, 2004) though 30 kg nitrogen/hectare is usually sufficient.
5. The maximum phosphorus rate for a single application is 5 kg phosphorus/hectare (J. Forrest, pers. comm).
6. High maintenance active turf should not exceed applications of 100-200 kg/ha/yr for nitrogen and 0-50 kg/ha/yr of phosphorus.
7. Passive turf and foreshore area applications should not exceed 0-50 kg/ha/yr for nitrogen and 0-5 kg/ha/yr for phosphorus.
8. Keep a log book to record details of fertiliser and nutrient applications over the year for each application area including details such as weather conditions and monitoring information.
9. If fertiliser is required, apply in spring or early autumn (September, October, November, March and April) when grass grows rapidly. Apply the fertiliser in small amounts and often over these months instead of a single application. This will ensure all nutrients can be utilised by the turf.
10. Do not fertilise in summer or winter. Summer fertilising encourages over use of water and turf may grow excessively while fertiliser applied during winter may be washed into stormwater drains or leached into groundwater.
11. Do not apply fertiliser too close to hard surfaces such as roads. Fertiliser on hard surfaces will be washed into stormwater drains and end up in waterways.
12. Avoid applying fertiliser before heavy rainfall and do not over water turf as both actions could result in leaching of nutrients to groundwater and waterways.

13. LGA Parks and Gardens Officers attend the Fertilise Wise Fertiliser Training course that is hosted by the Phosphorus Awareness Project in 2021.
14. LGA's refer to the following publications (see Reference section for full publication details) to obtain more information on fertiliser and irrigation best management practices:
    - *Turf Sustain – A guide to turf management in Western Australia*
    - *Western Australian environmental guidelines for the establishment and maintenance of turf grass areas (2014)*
    - *Stormwater Management Manual for Western Australia*.

TURF TYPE

QUESTION NINE - What is the main type of turf grown in your area: kikuyu, couch, buffalo or other?

Recommendations

1. LGA's use kikuyu as the first choice for turfed areas as it has low fertiliser requirements, requires a medium water usage and is drought and wear tolerant.
2. LGA's with couch and buffalo in their area should not fertilise this turf in the winter months as it could be in its dormant phase.

NUTRIENT MANAGEMENT

QUESTION TEN - Do you have measures in place to prevent grass clippings from entering stormwater drains? If yes, please state what measures are taken.

Recommendations

Lawn clippings on hard surfaces should be blown back onto the turfed area

1. LGA's have measures in place to prevent grass clippings from entering stormwater drains as they are high in nutrients and will end up in waterway systems.
2. Where testing determines that nutrients are lacking, LGA's should leave grass clippings on the mowed turf which returns the nutrients contained in the clippings back to the soil thus reducing fertiliser requirements. Clippings left in piles should be remowed to disperse clippings. If testing reveals that nutrients are required in turfed foreshore areas, this practice should be adopted in favour of adding fertiliser or to reduce fertiliser requirements and only controlled/slow release or low water soluble fertiliser should be used. If nutrients are not required, clippings should be removed from these areas.
3. When mowing, clippings should be thrown away from hard surfaces.
4. When mowing median strips and small areas near hard surfaces or waterways a catcher should be used.
5. If clippings need to be removed they should be composted and then utilised as a soil amendment.
6. Grass clippings that end up on hard surfaces such as roads and driveways should be swept up and removed (either manually or with a street sweeper) or blown off the hard surface back onto the turfed area and then left or removed based on nutrient testing.
7. Grass clippings should never be blown, hosed or swept onto hard surfaces such as roads or driveways as they can be washed or blown into stormwater drains ending up in waterway systems.
8. Mowing equipment should be cleaned before going to the next location.
9. When hosing down mowing equipment ensure that this water does not enter stormwater drains.

QUESTION ELEVEN - Do you have a Nutrient and Irrigation Management Plan (NIMP) implemented for your streetscapes? (i.e. for median strips, roundabouts, entry statements, car park landscaping, road verges, etc.)

Recommendations

1. LGA's implement NIMP for streetscapes, as combined they are large areas within a LGA where nutrients and water usage should be controlled more appropriately.
2. Information about NIMP is available from the Department of Water and Environmental Regulation's website where the following documents can be located:

   * '*Water Quality Protection Note 33 (June 2010) Nutrient and Irrigation Management Plans*'
   * '*Water Quality Information Sheet 04 (August 2010) Nutrient and Irrigation Management Plan Checklist*'

QUESTION TWELVE - Do you have a policy to use local native plants as the first choice in public and private (developers) landscaping?

Use local natives as the first choice in landscaping

Recommendations

1. LGA's have a local native plant policy and plant local native species in their management areas as they require low levels of water and fertiliser and once established may require no further applications.
2. Information on local native plant policies and using local native species is available from the Eastern Metropolitan Regional Council's Landscaping with Local Plants Policy and Guidelines section of their '*Local Government Natural Resources Management Policy Manual*' and the Phosphorus Awareness Projects '*Grow Local Plants*' leaflets.

QUESTION THIRTEEN - Do you have deciduous trees in your parks or streetscapes? If yes, please state what measures, if any, are taken to prevent deciduous leaves from entering stormwater drains.

Recommendations

1. LGA's minimise the use of deciduous trees as their leaves decompose quickly releasing excessive nutrients in waterways.
2. LGA's do not plant deciduous trees along roads where their falling leaves can enter stormwater drains and then waterways.
3. LGA's use a street sweeper, on a regular basis, especially during the autumn months when deciduous leaves lose their leaves to prevent leaves entering stormwater drains and then waterways.

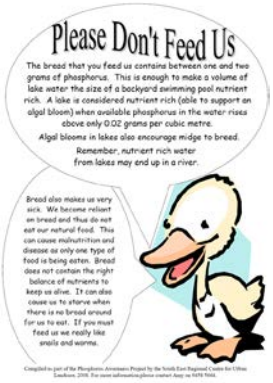
QUESTION FOURTEEN - Do you provide dog poo bins and bags in your parks and foreshore reserves?

Recommendations

1. LGA's provide compostable dog poo bags and bins in parks and foreshore reserves as dog poo is a major contributor of nutrients to groundwater and waterways.

NUTRIENT EDUCATION

QUESTION FIFTEEN - Are measures taken in foreshore reserves and parks to educate the public about not feeding bread to waterbirds? If yes, please state what measures are taken.



Recommendations

1. LGA's erect signage in foreshore reserves and parks educating the public about the effects of bread on waterways (eg. increased phosphorus levels and algal blooms) and waterbirds (eg. malnutrition and aggressive behaviour). The Phosphorus Awareness Project has a brochure which outlines this issue that could be the basis for signage (refer to picture at right).
2. LGA's distribute information to their ratepayers about the effects of bread on waterways and waterbirds through local media, environmental workshops, LGA newsletters, website, brochures and Rangers talking to people about the disadvantages of feeding when it occurs.
3. LGA's introduce Local Laws (and enforce those laws) that prohibit the feeding of birds.

QUESTION SIXTEEN - Do you provide advice to ratepayers on best practice in fertiliser management according to soil type? If yes, please state how advice is provided to ratepayers.

Recommendations

1. LGA's provide advice to ratepayers on fertiliser practices as ratepayers generally have limited knowledge of fertiliser management and would, when combined, have the largest turfed area in the LGA.
2. '*Fertilise Wise*' leaflets are available for free from the Phosphorus Awareness Project to distribute to ratepayers.
3. LGA's link the Fertilise Wise website - www.sercul.org.au/our-projects/fertilise-wise/ to their own website.
4. LGA's host a 'Great Gardens' or 'Beyond Gardens' workshop to educate their ratepayers on fertiliser and water management and other garden issues. Workshops can be organised by contacting The Forever Project or the Beyond Gardens team.

WATER QUALITY MONITORING

QUESTION SEVENTEEN - Do you regularly monitor the following areas under your control for nutrient levels and do you report these results to your local community? Areas: wetlands, stormwater drains, compensation basins.

Recommendations

1. LGA's regularly monitor wetlands, stormwater drains and compensation basins for nutrient levels to determine if pollution is occurring and potentially pinpoint sources.
2. LGA's report these results to the local community reflecting their commitment to the environment and providing important information to community catchment and environment groups to determine where rehabilitation of waterways and education of general community members needs to occur.

DEVELOPMENT CONTROL

QUESTION EIGHTEEN – (a) Do you impose conditions on developments which include Nutrient and Irrigation Management Plans (NIMP)?
(b) Do you monitor these for compliance?
(c) Have you made any prosecutions for lack of compliance in the last 12 months?

Recommendations

1. LGA's impose NIMP conditions on developments, monitor these for compliance and prosecute for lack of compliance as new developments are potentially major sources of nutrients to groundwater and waterways.

QUESTION NINETEEN - Do you have provisions in the Town Planning Scheme or Planning Policies to enforce environmental conditions on development?

Recommendations

1. LGA's introduce Town Planning Scheme provisions or Planning Policies to enforce environmental conditions on developments to prevent environmental harm and allow the LGA to prosecute if developers are not adhering to best management practices.

WASTEWATER SYSTEMS

QUESTION TWENTY - What percentage of properties in your urban zoned land is either unsewered or if sewered is not connected to sewer? (Subdivisions less than 1 ha) Percentages - 0%, 0-10%, 11-20%, 21-30% or >30%.

Recommendations

1. LGA's encourage householders to connect to the main sewerage line as leaking septic tanks can contribute nutrients to groundwater and waterways.

REFERENCES AND CONTACTS FOR FURTHER INFORMATION

- Beyond Gardens Workshops. Available from the Beyond Gardens team - www.beyondgardens.com.au or by emailing garry@beyondgardens.com.au.
- Department of Water (2004-2007) *Stormwater Management Manual for Western Australia.* Department of Water, Perth, WA. Available from the Department of Water and Environmental Regulation - www.water.wa.gov.au
- *Fertiliser application on pasture or turf near sensitive water resources (2010)*. Available from the Department of Water and Environmental Regulation - www.water.wa.gov.au
- Fertilise Wise Fertiliser Training, Fertilise Wise guides, Fertilise Wise website, Grow Local Plants leaflets and Feeding Water Bird brochures. Available from the Phosphorus Awareness Project, South East Regional Centre for Urban Landcare (SERCUL) – www.sercul.org.au/fertilisewise and www.sercul.org.au/our-projects/pap or by phoning 9458 5664.
- Great Gardens Workshops. Available from The Forever Project – www.theforeverproject.com.au or by phoning 0409625299.
- *Landscaping with Local Plants Policy and Guidelines - Local Government Natural Resources Management Policy Manual.* Available from the Eastern Metropolitan Regional Council by phoning 9424 2222.
- Ruscoe, Johnston & McKenzie (First Published 2004, Reprinted 2014) *Turf Sustain – A Guide to turf management in Western Australia***.** Sports Turf Technology, Como, WA. Available from Sports Turf Technology – www.sportsturf.net.au or by phoning 9367 1600.
- Swan River Trust (2009) *Swan Canning Water Quality Improvement Plan*. Swan River Trust, East Perth, WA. Available from the Department of Biodiversity, Conservation and Attractions - www.dpaw.wa.gov.au or by phoning 9219 9000.
- Swan River Trust (2014) *Western Australian environmental guidelines for the establishment and maintenance of turf grass areas*. Swan River Trust with support from organisations represented on the Fertiliser Partnership Urban Users Working Group, Kensington, WA. Available from the Department of Biodiversity, Conservation and Attractions - www.dpaw.wa.gov.au or by phoning 9219 9000.
- *Water Quality Protection Note 33 (June 2010) Nutrient and Irrigation Management Plans. Water Quality Information Sheet 04 (August 2010) Nutrient and Irrigation Management Plan Checklist.* Available from the Department of Water and Environmental Regulation – www.water.wa.gov.au

This report has been prepared for the Phosphorus Awareness Project,
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www.sercul.org.au/fertilisewise

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