Busselton Wastewater Treatment and Disposal

Water Corporation

Report and Recommendations
of the Environmental Protection Authority

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Summary and Recommendations

This report provides the Environmental Protection Authority's (EPA's) advice to the Minister for the Environment on the proposal by the Water Corporation to upgrade the Busselton Waste Water Treatment Plant (WWTP).

Although the Water Corporation proposes to increase throughput in 3 Stages, from the existing capacity of 1700 cubic metres per day (m3/day), to 4500 m3/day by about 2005 (Stage 1), 6750 m3/day by about 2020 (Stage 2) and 9000 m3/day by about 2035 (Stage 3), this assessment only covers Stages 1 and 2. Stage 3 would be referred at some date in the future. The upgrade involves using an Intermittently Decanted Extended Aeration (IDEA) Plant and an upgraded wetland. Treated wastewater of improved quality would be discharged to the Vasse Sub-A and Vasse Diversion Drains and thence to Geographe Bay.

After the upgrades the nutrient loads to the environment from the treated wastewater would be considerably less than the current loadings from the wastewater treatment plant and septic tanks combined and would represent a small proportion of the total nutrients entering Geographe Bay from all sources.

Section 44 of the *Environmental Protection Act 1986* requires the EPA to report to the Minister for the Environment on the environmental factors relevant to the proposal and on the Environmental Conditions and procedures to which the proposal should be subject, if implemented. In addition, the EPA may make recommendations as it sees fit.

Relevant environmental factors

In the EPA's opinion, the following are the environmental factors relevant to this proposal:

(a) Groundwater quality - protection of the Leederville Aquifer;

(b) Surface water quality - protection of Geographe Bay;

(c) Marine water quality - protection of Geographe Bay;

(d) Seagrasses - protection of seagrass in Geographe Bay;

(e) Public Health and Safety - public use of Geographe Bay.

Other Advice

The need for the upgrade of the Busselton WWTP is being driven by increase in population, and the infill sewerage programme for Busselton which will intercept and treat sewage effluent currently being discharged from septic tanks into the shallow groundwater along the edge of Geographe Bay. This will prevent more than 30 tonnes of nitrogen per year from entering groundwater flowing into the Bay.

The EPA notes that the Water Corporation's contribution of nitrogen into Geographe Bay from the Busselton WWTP is currently less than 5% of the total annual load. In addition to reducing this by upgrading the Busselton WWTP facility, the Water Corporation will establish an Environmental Improvement Initiative (EII) aimed at reducing nutrient inputs to Geographe Bay from diffuse sources in the catchment, principally agricultural. This will begin to address the 95% of total nutrient load entering from these sources.

Sources of nutrients which the EPA considers need to be better managed and controlled in the Busselton region include dairy farm effluent and runoff from paddocks, annual horticulture, urban runoff, and leachates from the Rendezvous Road landfill.

The EPA notes the need to establish broader environmental controls for the catchment area in order to reduce the amount of nutrients entering Geographe Bay from broadacre land uses. The Water Corporation's EII is focused on achieving reductions from the catchment. In addition,

there is an urgent need to develop and implement Dairy Regulations for this area and to develop strategies to reduce the loss to drainage of nutrients from horticulture and landfill sites. The Minister for the Environment, on the advice of the EPA, has already agreed to the preparation of Dairy Regulations. The EPA considers that similar environmental controls may be required to improve water and fertiliser use in annual horticulture to reduce off-farm nutrient export.

Conclusion

The EPA has considered the proposal by the Water Corporation to increase throughput of the Busselton Wastewater Treatment Plant (WWTP) to 4500m3/day by about 2005 (Stage 1) and 6750m3/day by about 2020 (Stage 2) and to discharge treated wastewater to the Vasse Agricultural Drainage Network, and thence to Geographe Bay, on a year round basis.

The essential elements of the proposal are that Water Corporation will treat increasing amounts of sewage effluent as the population of the Busselton area increases and as septic systems currently in use are replaced progressively by infill sewerage. The proponent needs to upgrade the facility to handle the additional volume of sewage and will be using that opportunity to install a substantially upgraded plant which will move the level of treatment from secondary to state-of-the-art tertiary treatment (incorporating additional removal of nutrients), and will disinfect the effluent using ultraviolet sterilisation. The proponent will also be redesigning the wetland to ensure greater removal of nutrients.

The EPA notes that implementation of the proposal would result in an overall decrease in phosphorus loads for both Stages 1 and 2 and that Stage 1 of the proposal would also result in a decrease in nitrogen load to the Vasse Agricultural Drainage Network. Stage 2 would discharge about the same nitrogen load to the environment as the current WWTP and half the phosphorus load, even though the volume of effluent being treated would be four times as great. In addition, the upgraded WWTP would reduce nutrients entering the groundwater from septic systems as houses with septic systems are linked into the sewerage network. More than 30 tonnes per year (t/yr) nitrogen and 6t/yr of phosphorus would be diverted and treated by the WWTP from septic systems alone.

The EPA notes that the Water Corporation's contribution of nutrients into Geographe Bay from the Busselton WWTP is currently less than 5% of the total annual load. In addition to reducing this by upgrading the Busselton WWTP facility, the Water Corporation will be establishing an Environmental Improvement Initiative (EII) aimed at reducing nutrient inputs to Geographe Bay from diffuse sources in the catchment, principally agricultural. This will begin to address the 95% of total nutrient load entering from these sources.

The EPA notes the need to establish broader environmental controls for the catchment area in order to reduce the amount of nutrients entering Geographe Bay from broadacre land uses. The Water Corporation's EII is focused on achieving reductions from the catchment. In addition, there is an urgent need to develop and implement the Dairy Regulations for this area and to develop strategies to reduce the loss to drainage of nutrients from horticulture and landfill sites. The EPA considers that similar environmental controls may also be required to improve water and fertiliser use in annual horticulture to reduce off-farm nutrient export.

The key environmental aspect of proposals in this area is the water quality within Geographe Bay and the potential for increased nutrients, in particular nitrogen, to affect seagrass growth and quality. The additional sewage to be treated in Stages 1 and 2 would result in the discharge of treated wastewater on a year round basis into Geographe Bay rather than only in winter as is currently the case. However, the summer nitrogen load would be small (about 2.6 tonnes in Stage 1 and 4 tonnes in Stage 2) compared with the annual load of 198 tonnes (mostly during the winter) from agricultural and other sources in the catchment. Moreover, the proposal would prevent the accession of about 12 tonnes of nitrogen per year, during the summer, from groundwater contaminated by septic systems until the nutrient seepage from septic systems into the groundwater has been attenuated.

With regard to the Busselton WWTP proposal, the EPA supports the commitments made by the proponent in regard to monitoring within Geographe Bay to quantify spatial and temporal

variation in marine water quality within the Special Management Area (500m each side of the discharge point of the Vasse Diversion Drain) and reporting on marine water quality in Geographe Bay within the Special Management Area. In addition the Water Corporation has made a commitment that should the desired management objectives not be met, the DEP and WRC would be notified immediately and investigations undertaken to determine whether the breach of objective is attributable to the WWTP or to other sources. If attributable to WWTP, the Water Corporation would consider a range of options to further decrease discharge of nutrients from the WWTP site, including:

- improving the performance of the IDEA plant; and/or
- constructing additional wetland on the site to further polish wastewater; and/or
- sealing the bottom of the wetland with more impervious material; and/or
- reducing local groundwater levels with trees; and/or
- diverting more treated wastewater to off-site users.

The EPA has concluded that the proposal can be implemented to meet the EPA's objectives provided the Environmental Conditions recommended in Section 4 and set out in Appendix 3 are imposed and enforced.

Recommendations

The EPA submits the following recommendations to the Minister for the Environment:

1. That the Minister considers the report on the relevant environmental factors as set out in Section 3.
2. That the Minister notes that the EPA has concluded that the proposal, consisting of the Stage 1 and Stage 2 upgrades, can be implemented to meet the EPA's objectives provided there is satisfactory implementation by the proponent of its commitments and the recommended Environmental Conditions.
3. That the Minister notes that the proponent will be implementing a Statewide Environmental Improvement Initiative (EII) totalling $1.75 million over five years, aimed at reducing nutrient losses from catchments, to complement upgrading of wastewater treatment facilities. The EII will commence in Busselton, where the proponent has undertaken to commit funding of up to $200 000 per year for five years, to assist dairies and other land users in the catchment to improve their nutrient and water management.
4. That the Minister imposes the Environmental Conditions and Procedures in Section 4 as set out in detail in Appendix 1 of this report.
5. That the Minister notes that the Minister, on the advice of the EPA, has agreed to the preparation of Dairy Regulations, that these should be progressed as a matter of urgency to support the Environmental Improvement Initiative, and that other similar environmental controls to improve the water quality of Geographe Bay in the long term may be required.
6. That the Minister forwards a copy of this report to the Minister for Water Resources.

Environmental Conditions

Having considered the proponent's commitments and the information provided in this report, the EPA has developed a set of Environmental Conditions which the EPA recommends should be imposed if the proposal by the Water Corporation to upgrade the Busselton WWTP (to increase throughput to a maximum of 6750 m3/day by about 2020 and continuing to discharge treated wastewater of improved quality to the Vasse Sub-A and Vasse Diversion Drains) is approved for implementation. These Environmental Conditions are presented in Appendix 3 and include the following requirements:

(a) that the proponent shall fulfil the commitments in the Consolidated Commitments statement set out as an attachment to the recommended Environmental Conditions;

(b) that future stages be subject to consideration by the EPA.

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1. Introduction

The Water Corporation proposes to upgrade the Busselton WWTP to increase throughput to a maximum of 6750 m3/day by about 2020 and to continue to discharge treated wastewater, of greatly improved quality, to Geographe Bay. The upgrade is from the current secondary treatment to state-of-the-art tertiary treatment using an Intermittently Decanted Extended Aeration (IDEA) plant and an upgraded wetland. Disposal of the treated wastewater of improved quality would continue to enter Geographe Bay via the Vasse Sub-A and Vasse Diversion Drains.

The Water Corporation has commenced an infill sewerage programme in Busselton. This, in addition to the diversion of flows from the future decommissioning of the temporary East Busselton WWTP and the continued population growth, will result in increased wastewater treatment demand at the Busselton WWTP.

The existing Busselton WWTP is a lagoon-based secondary system. A DEP Licence (No. 5952/3) currently enables the Water Corporation to discharge 1700 m3/day treated wastewater to an on-site wetland and thence to the Vasse Sub-A Drain and Vasse Diversion Drain (Figure 1).

Although the Water Corporation proposes to increase throughput in 3 Stages, from the existing capacity of 1700 cubic metres per day (m3/day), to 4500 m3/day by about 2005 (Stage 1), 6750 m3/day by about 2020 (Stage 2) and 9000 m3/day by about 2035 (Stage 3), this assessment only covers Stages 1 and 2. Stage 3 would be referred at some date in the future.

In arriving at the proposal, a number of alternative wastewater disposal options were considered by the Water Corporation, including the irrigation of woodlots, public areas, the Busselton Golf Course, agricultural crops, as well as disposal via an ocean outfall and discharge to the Vasse Agricultural Drainage Network. The proponent reported that many of these options had greater environmental impacts, poorer community acceptance and/or were not viable disposal options in terms of management and operational requirements, particularly because of the seasonal requirements for water for irrigation purposes.

The Water Corporation has committed to continue considering future disposal options and is currently liaising with the Busselton Golf Course to implement a wastewater re-use programme to irrigate the golf course and associated turf farm. However this cannot be considered within this assessment as this disposal option is undergoing further consideration and has not been finalised.

Upon referral to the EPA the level of assessment was set at Consultative Environmental Review (CER) on the grounds that the disposal of treated wastewater may affect ground, surface and marine water quality.

Further details of the proposal are presented in Section 2 of this Report. Section 3 discusses the environmental factors relevant to the proposal. The Environmental Conditions and Procedures to which the proposal should be subject, if the Minister determines that it may be implemented, are set out in Section 4. Section 5 provides Other Advice by the EPA. Section 6 presents the EPA's Conclusions and Section 7 details the EPA's Recommendations.

Appendix 1 contains the references; Appendix 2 lists the people and organisations from whom submissions were received; and Appendix 3 lists the recommended Environmental Conditions and the proponent's consolidated commitments.

The DEP's summary of submissions and the proponent's response to those submissions are presented in Appendix 4.

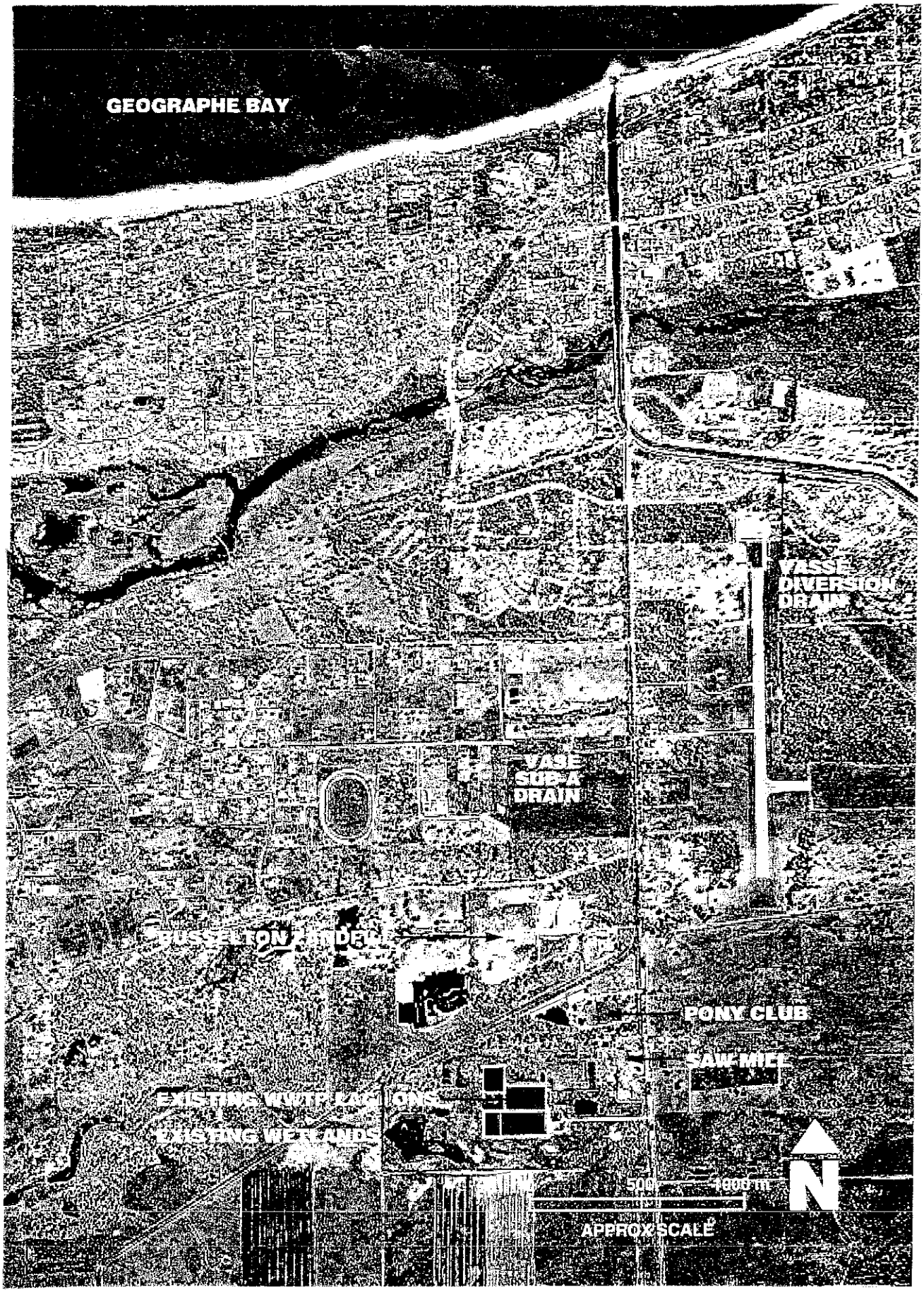


Figure 1. Aerial Photograph of Busselton Wastewater Treatment Plant Regional Location.

2. The Proposal

2.1 The Stage 1 and Stage 2 Upgrades

Wastewater from Busselton is currently managed through private residential septic tank treatment systems, the existing Busselton WWTP and the East Busselton temporary WWTP. Population increase, the sewerage infill programme and future decommissioning of the East Busselton Temporary WWTP will increase the wastewater treatment requirements at the Busselton WWTP.

A detailed description of the proposal was provided in Section 3 of the CER (Kinhill, 1998). A summary of the key characteristics of the proposal is presented in Table 1 with minor amendments from Section 2 of the Water Corporations' response to submissions (Appendix 4 of this Report). Figure 2 shows the changes in wastewater flows and nutrient loads that would result from the upgrade.

Following the commissioning of the new facilities the Water Corporation proposes to progressively increase throughput from the current 1700 m3/day to 6750 m3/day by about 2020 (Stages 1 and 2) and to discharge treated wastewater to the Vasse Diversion Drain on a year round basis rather than only in winter (Water Corporation, 1998). The treated wastewater is proposed to be discharged via a natural sumpland on-site which would be converted to a constructed wetland designed to remove additional nitrogen (N) and phosphorus (P) from the treated wastewater

In addition, the Water Corporation has proposed to implement an Environmental Improvement Initiative (EII) to provide a mechanism, and funding, to achieve significant reductions in nutrients emanating from diffuse sources (principally agricultural activities) which currently discharge into the drains entering the southern parts of Geographe Bay (Kinhill, 1998). The Water Corporation would provide funds to subsidise improvements in the catchment.

As waste disposal via septic tanks would be phased out progressively, the upgrade would lead to the reduction of nutrient inputs to Geographe Bay from this source. In addition, the tertiary treatment plant and wetland would result in overall reduction of nutrients entering Geographe Bay, even though the total amount of effluent being discharged would be increased four-fold from 1700 m3/day to 6750 m3/day.

The Water Corporation believes that reductions of diffuse N and P loads from the Environmental Improvement Initiative (EII) of at least 10-20%, and perhaps up to 40-50%, are achievable over a 3-5 year time-scale (Kinhill, 1998). These load reductions could be achieved by implementing improved monitoring and management of rural point sources and implementation of fertiliser management programmes based on soil nutrient testing. However, any nutrient reductions achieved by the EII would be beneficial to the water quality of Geographe Bay.

The proposal, including the implementation of the EII, offers the greatest potential for environmental gain in achieving the objectives of reducing nutrient inputs to Geographe Bay (Kinhill, 1998).

Upon commissioning of the new facilities the incoming wastewater would be treated in a mechanical activated sludge plant known as an Intermittently Decanted Extended Aeration (IDEA) plant. The IDEA plant would achieve substantial nitrogen (N) and phosphorus (P) reduction. Each subsequent upgrade is expected to further improve treated wastewater quality with the incorporation of technological advances, monitoring and process control (Kinhill, 1998).

Table 1: Summary of Key Proposal Characteristics for Stages 1 and 2.

Element	Description
Life of project	Staged capacity increase to be implemented as follows: **Indicative Timing** / **Flow** **Stage 1** 2005 4500 m3/day **Stage 2** 2020 6750 m3/day
Treatment process	Wastewater treated to tertiary standard using an IDEA plant discharging to storage ponds. Flow is then directed to a sand filtration and UV disinfection system prior to release into the on-site wetland system, Vasse Agricultural Drainage Network and consequently to Geographe Bay. Air emissions are not expected to adversely impact as the process is controlled to minimise odour production in addition to a 500 m buffer area from the perimeter of the site boundary.
Estimated median and 95th percentile water quality output to the on-site wetland.	**Parameter** / **Current** 1700 m3/day / **Stage 1** 4500 m3/day / **Stage 2** 6750 m3/day BOD (g/m3): not measured / 10 / 10 Suspended Solids (SS) (g/m3): 20 / 10 / 10 Total Nitrogen (TN) (g/m3): 20 / 10 (20) / 8 (16) Total Phosphorus (TP) (g/m3): 3.5 (8) / 1 (2) / 0.8 (1.6) Thermotolerant Coliforms (cfu/100mL): 450(summer) 2000(winter) / 10 / 10 Note: Values are medians (values in parenthesis are 95th percentiles)
Disposal to Wetland	**Current** / **Stage 1** / **Stage 2** Total flow (m3/day) SUMMER: 1700 / 4500 / 6750 Northern wetland: N/A / 200 / 200 Southern wetland: N/A / 4300 / 6550 WINTER Northern wetland: N/A / 500 / 500 Southern wetland: N/A / 4000 / 6250 Note: Proposed reuse by Busselton Golf Club would reduce disposal to southern wetland by 1100 m3/day during the summer irrigation period.

Disposal from Wetland	Treated wastewater from the Southern wetland will be released to the Vasse Agricultural Drain A_2 A, Vasse Sub A_2, Vasse Sub-A, and Vasse Diversion Drain adjacent to Queen Elizabeth Avenue and subsequently discharged to Geographe Bay.
Implementation of the Environmental Improvement Initiative (EII).	Catchment-based nutrient reduction initiative focusing mainly on rural nutrient discharges from the catchments of the Buayanup River, Vasse Diversion Drain, the Vasse-Wonnerup System, and the Abba and Ludlow Rivers for a maximum of five years. The EII will focus on and support the dairy, intensive and broadacre agricultural industries (eg, vegetable growers) to implement improved nutrient and water management practices and programmes to reduce their nutrient export.
Odour management	Low odour IDEA plant which is fully contained within the Water Corporation owned buffer.

The existing stabilisation lagoons would be converted to treated wastewater storage lagoons and biosolids holding lagoons. The storage lagoons would provide an equalisation facility to cater for the intermittent decant from the IDEA plant. An overflow storage lagoon is provided in case emergency storage is required.

From the storage lagoons the treated wastewater would be directed to a sand filtration and ultra-violet disinfection system prior to release into the sumpland, which would become a wetland. It is expected that levels of faecal microbes may increase marginally during residence in the wetland as a result of re-contamination from fauna.

The Water Corporation has proposed to upgrade and divide the existing sumpland into a northern and southern wetland to increase residence time and increase nutrient uptake. The southern wetland has a direct flow path and supports extensive vegetation. In order to maximise its nutrient stripping performance, the southern wetland would be modified by increasing the existing bunds to accommodate the majority of the treated wastewater. The northern wetland would remain unbunded and would only accommodate a small amount of treated wastewater to maintain existing winter water levels and enable it to dry out in summer. Each wetland would contain a number of zones between 0 to 0.9m in depth, to support different vegetation species to maximise nutrient uptake by plants and nutrient reduction by other processes such as sediment binding and denitrification.

Treated wastewater is proposed to be discharged to the Vasse Sub-A_2A drain from the on-site wetland on a year-round basis. The Vasse Sub-A_2A Drain flows to the Vasse Sub-A_2, Vasse Sub-A and the Vasse Diversion Drain and subsequently to Geographe Bay (Figure 3), a distance of about 5 km from the WWTP wetland discharge point.

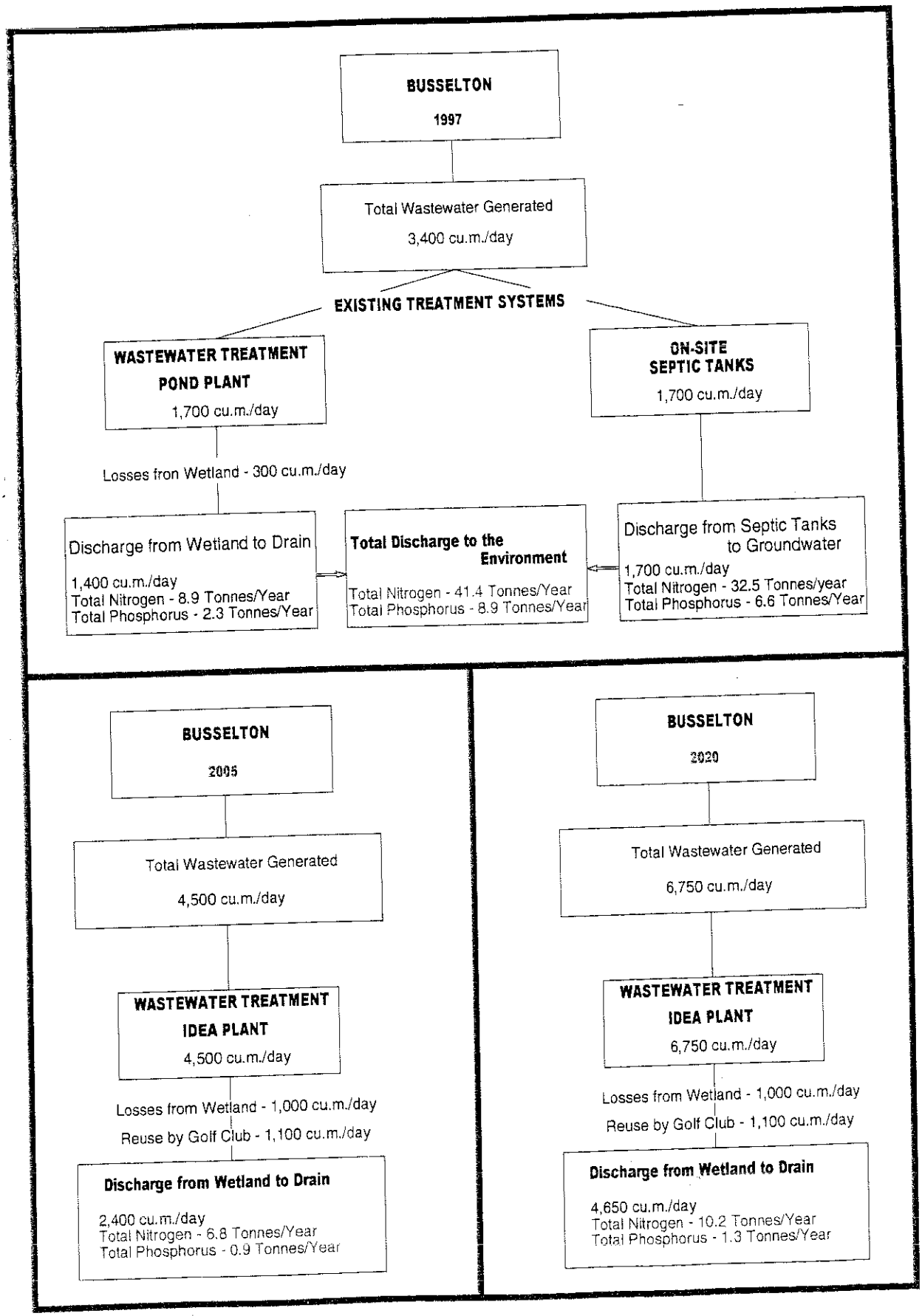


Figure 2. Flow Chart showing changes in Volumes of Effluent being treated and Nutrient Load Changes from the current situation to the Stage 1 and Stage 2 upgrades.

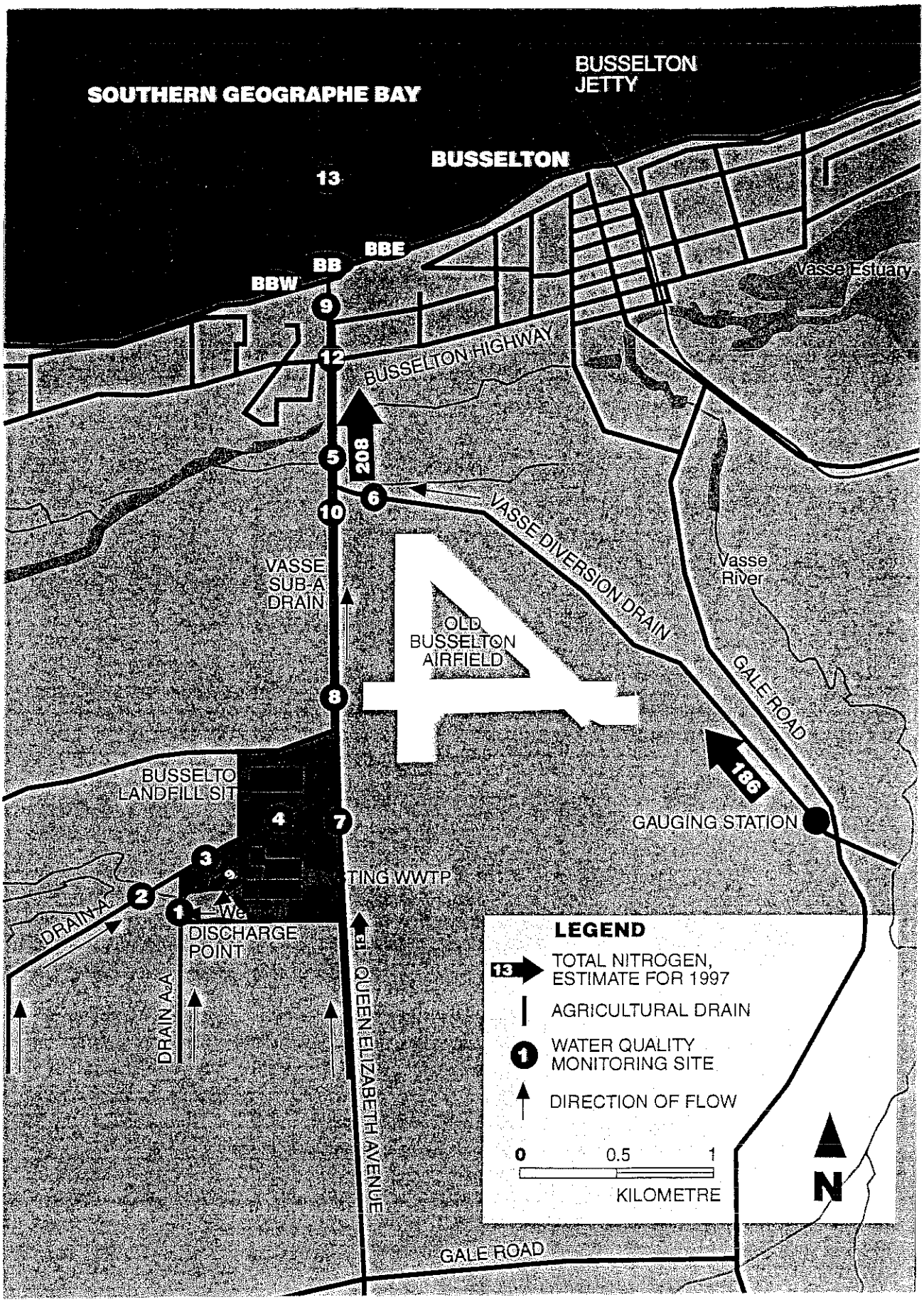


Figure 3. Vasse Agricultural Drainage Network and Monitoring Sites.

Since release of the CER, a number of modifications to the proposal have been made by the proponent. These include:

- A request that only Stages 1 and 2 be assessed, and an undertaking to refer Stage 3 to the EPA at a later time for separate assessment;
- Increased disinfection treatment prior to effluent discharge to the wetlands. The UV disinfection capacity was upgraded to reduce the median value in thermotolerant colony forming units per 100mL (cfu/100mL) from the 150 initially proposed, to 10;
- Redesign of the constructed wetland (Figure 2) to minimise vegetation disturbance and achieve maximum nutrient stripping performance by creating a northern and southern wetland. The southern wetland would be bunded to enable it to receive the majority of the treated waste water on a year round basis. The northern wetland would be unbunded and would receive 500 m3/day in winter and 200 m3/day during summer, which would enable the wetland to dry out in summer.
- Construction of an additional emergency storage lagoon between the two existing effluent lagoons increasing the emergency storage capacity from a minimum of 24 hours to 48 hours (Figure 4).
- The option of irrigating the 37 ha Busselton Golf Course and its 3 ha turf farm with treated effluent was presented in the CER. The Busselton Golf Course has expressed considerable interest in a proposal to use 1100 m3/day during the summer months commencing in 2005. However, an agreement is yet to be finalised.

The potential impacts of the proposal as predicted by the proponent, and the proposed management, were addressed in section 6 of the CER document (Kinhill, 1998), and are summarised in Appendix 1 of the CER.

2.2 The Environmental Improvement Initiative

The Water Corporation has proposed to implement an Environmental Improvement Initiative (EII) which will provide funds to implement specific catchment improvement works to complement and support the Corporation's objective of returning to the environment only highly treated wastewater from its wastewater treatment plants. The EII will operate State-wide with guaranteed funding of $1.75 million over five years.

The first application of the EII is proposed for the Busselton area as part of the Water Corporation's strategy for year-round disposal of highly treated wastewater to the Vasse Diversion Drain. It is anticipated that if the Busselton EII is successful it will be expanded to other parts of the State where WWTP's are being upgraded.

The key aim of the EII for Busselton is to reduce substantially nutrient loads being exported to Geographe Bay from the major polluting activities within the southern coastal plain catchments of the Bay. This recognises that the upgraded Busselton WWTP would contribute less than 5% of the nutrients entering Geographe Bay, compared to the much greater loadings associated with the predominantly rural sources associated with land uses in the Busselton hinterland.

Funding of $200 000 will be made available for the Busselton EII each year for up to five years. Funding under the EII will be targeted to projects where the greatest nutrient reductions can be achieved for the funding expended. Dairies are recognised as a major "hidden" source of nutrients in the coastal plain catchments of Geographe Bay.

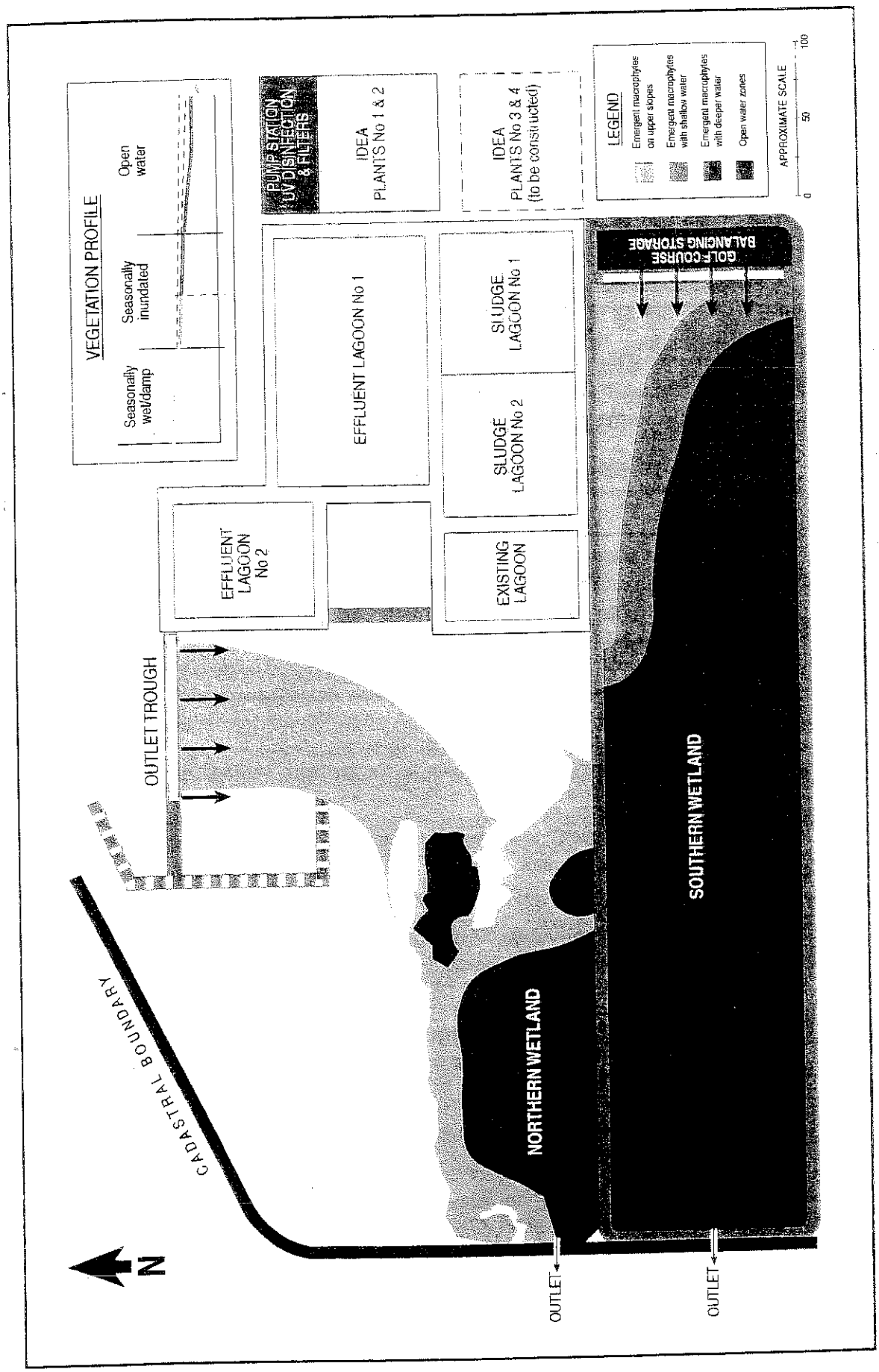


Figure 4. Plan of upgraded Busselton Wastewater Treatment Plant.

The many dairies in the region are major point sources of nutrients. There are some 16 dairies situated on the Busselton coastal plain which discharge runoff to the southern Geographe Bay drainage system. Advice from Agriculture Western Australia (AgWA) indicates that only about 25% of these have any means of containing and recycling nutrients from dairy sheds, and the vast majority discharge their concentrated liquid wastes off-farm directly and indirectly into the drainage system, and ultimately into Geographe Bay. Dairy shed effluent represents about 10% of the nutrients from dairy farms and the other 90% is left on paddocks and farm lanes. The Water Corporation is confident of significantly reducing the loss of nutrients from dairy farms through application of the EII.

Other likely areas where EII funding will be targeted include improving nutrient management of grazing and horticultural lands and addressing urban sources of pollution.

3. Relevant Environmental factors

Section 44 of the *Environmental Protection Act 1986* requires the EPA to report to the Minister for the Environment on the environmental factors relevant to the proposal and the Environmental Conditions, if any, to which the proposal should be subject. In addition, the EPA may make recommendations as it sees fit.

The identification process for the relevant factors is summarised in Table 2.

Having considered appropriate references, public and government submissions and the proponent's response to submissions, the EPA considers that the following environmental factors are relevant to the proposal:

(a) Groundwater quality - protection of the Leederville Aquifer;

(b) Surface water quality - protection of Geographe Bay;

(c) Marine water quality - protection of Geographe Bay;

(d) Seagrasses - protection of seagrass in Geographe Bay;

(e) Public Health and Safety - public use of Geographe Bay.

A description of the relevant environmental factors and their assessment is contained in Sections 3.1 - 3.5 . The description of each factor shows why it is relevant to the proposal and how it would be affected by the proposal.

The assessment of each factor is where the EPA decides whether or not a proposal meets the environmental objective set for that factor.

A summary of the assessment of the environmental factors is presented in Table 3.

3.1 Groundwater Quality

Description

The area surrounding the Busselton WWTP has a high water-table consisting of a shallow superficial groundwater aquifer and the deeper Leederville Aquifer, separated from each other by a relatively impermeable clay layer. The Leederville Aquifer occurs below the clay layer and is under positive pressure discharging upwards through the clay layer into the superficial groundwater (Kinhill, 1998). The recharge zone for the Leederville Formation is inland and is not affected by the proposal.

The superficial groundwater has high to very high salinity (91-630 mS/m) and is high in nitrogen (3.8-12.0 g/m3). The nearest known groundwater extractions are a bore at a sawmill located 300 m east, a bore at the Busselton Pony Club located 300 m north east, and a private well located 550 m north of the WWTP site. The extracted groundwater is for non-potable uses (eg log wetting and toilet flushing). The water in the confined Leederville Aquifer is less saline and is used extensively for domestic, horticultural and other agricultural purposes (Kinhill, 1998)

Table 2: Identification Process for Relevant Environmental Factors

Preliminary Environmental Factor	Relevant Area	Proposal Characteristic	Government Agency and Public Comments	Identification of Relevant Environmental Factors
BIOPHYSICAL				
Terrestrial Flora and Fauna	Busselton and Geographe Bay	Proposal modifies an existing wetland to increase wastewater detention times to improve nutrient removal.	The DEP advised that the wetland is currently degraded and the proposal is considered beneficial increasing the wetland's environmental values.	**Not considered to be a relevant factor.** Proposal contributes to and enhances the wetlands environmental values.
Marine water quality	Geographe Bay	Proposal increases discharges of tertiary treated wastewater from the current 1800m3/d to 9000m3/d in 2035 to Vasse Diversion Drain and further into Geographe Bay. Disposal may adversely impact by increasing nutrient and bacterial load on Geographe Bay. Total nutrient load entering Geographe Bay from the WWTP in the years approaching 2035 would marginally exceed 1997 levels	The DEP commented that: • if the project should proceed the EPA should recommend a staged approach (eg. expansion to 9000 m^3/d in 2035 should be dependent upon information gathered in the first phase of expansion); • the EPA should use this assessment to strengthen and encourage a more comprehensive approach to catchment management and restriction of nutrients (particularly nitrogen) in to Geographe Bay; • it does not agree that the long term objective of the nearshore marine area should be for Industrial Buffer purposes; • comparison between nutrient concentrations in Geographe Bay and Cockburn Sound is not useful, particularly as McMahon's results are based on very limited data and there is no consideration of the types of phytoplankton species. The area of influence could well exceed 500m radius of the discharge point; • monitoring water quality on a six monthly basis would not be ecologically or statistically meaningful. (DEP); and • further investigation is necessary with respect to the impacts of total nutrient loads, nutrient effects could reach 10 km longshore even allowing for dilution. The CER conclusion that nutrient input for sewage will be reduced has to be questioned when the data (Lord's nutrient load estimate) hasn't been verified.	**Considered to be a relevant environmental factor.**

			Water Corporation should aim for zero discharge to the marine environment. The CER provides scant poorly referenced and vague information on the hydrodynamic flushing characteristics of Geographe Bay. (CALM, HDWA) Data indicates elevated nutrient and phytoplankton levels within 500 m of drain discharge (which already indicate eutrophication). A drain discharge is not designed for efficient dilution at point of release. (CALM). The sampling to determine existing water quality in Table 4.2 is inadequate to base a 22 year project on. The data from Derrington & McMahon only represent a snapshot. The proposal suggests there should be a special management area up to 1000 m either side of the discharge point of the Vasse Diversion Drain. Insufficient work (monitoring) has been done to conclude that this would be the limit of environmental impacts around the drain mouth, and further work should be done(WRC).	
Marine Flora - seagrass	Geographe Bay	WWTP discharge to Geographe Bay may further increase the nutrient and bacterial loading in the bay which may adversely impact on marine flora (seagrass).	On 15 December 1997 the Minister for the Environment announced the Geographe Bay-Capes-Hardy Inlet areas as priority areas for consideration as a possible marine reserve. Geographe Bay has seagrass meadows which are the most extensive on the West Coast except perhaps those of Shark Bay. (CALM) Cockburn Sound and Albany Harbour are examples/mistakes from which we should learn. Water circulation is weakest during summer. Summer discharge is unacceptable, particularly if the precautionary principle is adopted. Existing nutrient loads from the Geographe Bay catchment are higher than from urban areas so there is a need to reduce nitrogen loads. There is a long lag time between effluent discharge and changes in seagrass distribution and abundance.	**Considered to be a relevant environmental factor**

Preliminary Environmental Factor		Proposal Characteristic	Government Agency and Public Comments	Identification of Relevant Environmental Factors
POLLUTION				
Odour	Shire of Busselton	Odours emanating from the WWTP may adversely affect the welfare and amenity of the Busselton Township and surrounding community.	Water Corporation should specify a time-frame with which any odours will be fixed. (DEP) Existing hydrogen sulphide odour can be smelt at the primary school in Queen Elizabeth Avenue on sporadic occasions.	**Not considered to be a relevant factor** The upgraded WWTP prevent odorous conditions developing. The Shire of Busselton's Draft Town Planning Scheme provides for a 500m buffer distance in addition to an internal buffer distance of approximately 250m Odorous algal blooms are unlikely given the water quality and flows discharged.
Noise and Particulate emissions	Shire of Busselton	Proposals increased throughput may result in increased operational noise levels. Construction of the proposal involves earthworks which may generate noise and dust.	The DEP advised that: • the new IDEA and doubling in size of the IDEA for 2035 will both increase noise levels from the plant. What noise levels typically come from a 900 m3/d plant? Is a 500 m buffer proposed to address this?; and • the operation needs to be in compliance with the Environmental Protection (Noise) Regulations 1997	**Not considered to be a relevant factor.** The Shire of Busselton's Draft Town Planning Scheme Provides for a 500m buffer distance in addition to an internal buffer distance of approximately 250m. These buffers are considered adequate given the surrounding rural land uses. Any operational issues can be managed by Noise Regulations.

Groundwater Contamination	Leederville Formation	Increases in WWTP discharges from the current 1800m3/d to 9000m3/d in 2035 to Vasse may cause nutrient and bacteriologically enriched water to infiltrate into the groundwater. Treated wastewater and biosolids will be stored on site in lagoons prior to release to the wetland and removal to landfill respectively. The natural earth lagoons may permit movement of water into the groundwater.	The proposed groundwater monitoring program is considered adequate, but a nest of monitoring bores could be established at one site to determine the vertical distribution of any contamination. (WRC) The objective for groundwater should be to maintain and improve beneficial uses and environmental standards, rather than to maintain water quality to "environmentally acceptable standards". (WRC) Given the reliance on the Leederville aquifer, what measures are in place to monitor and protect this aquifer?	**Considered to be a relevant environmental factor**
Surface water quality	Shire of Busselton	Proposal increases discharges of tertiary treated wastewater to Vasse Diversion Drain from the current 1800m3/d to 9000m3/d in 2035. The discharges may enable existing surface water in the drains to become nutrient and bacteriologically enriched.	Long-term residents report that there has been a change in colour, smell of the water, increased algae growth near the outlet and drain, a dramatic decrease in seagrass and continuing problems with water flow in the drain. The DEP noted that no data has been provided on contaminant loads in the drain of herbicides, pesticides, heavy metals, oils and grease etc. The CER states that a key aim is to achieve the maximum total reduction in nutrients per dollar of expenditure. The standards set should not only be cost effective but also environmentally effective. Virus, fungi and protozoa do not get a mention. Will these be at zero levels consistent with tertiary treatment standards? The data presented in Table 3.1 is misleading, the use of 95^{th} percentile figures show that the anticipated quality may in reality exceed those maximum levels approved by the EPA.	**Considered to be a relevant Environmental factor**

			Public perception is that no matter how highly treated it is, it has the potential to be dirty and unsafe. This is a key social concern which does not seem to have been taken into account. Monthly results should be published in the local paper. Claim that loads of nitrogen, phosphorus and faecal coliform will decrease (because of better management practices evolving) despite increasing volumes is not substantiated. Proposal that improvements in IDEA plant occur in 2020 & 2035 is too infrequent. There appears to be uncertainty whether the IDEA plant will achieve the proposed reductions detailed in Table 3.1. The success of other plants should be investigated. (WRC) Given that there is "little experience with constructed wetlands in Australia" it is not appropriate to experiment where waste water flows into a sensitive environment such as Geographe Bay. What contingency is in place should the wetlands be shown not to be effective after three years? The use of UV radiation to sterilise effluent has been found to be effective only where turbidity levels are low. Will the facility be capable of maintaining the required low levels? (WRC) A contingency plan is needed for controlling effluent in the case of equipment failure & power blackouts (blackouts & 'brown outs' are frequent in Busselton). (WRC) The drain will not be able to cope with additional water - in winter the water level sits only 90 cm from the traffic bridge, and will back up in storms. In summer a lagoon is formed/ mouth silts up in January & February leaving a smelly brown pool until the channel is re-opened by a storm. The CER claims a 5 m deep permanent pool in the tidal part of the drain. Even a 1 m depth would be generous during summer, and during winter.	

Preliminary Environmental Factor		Proposal Characteristic	Government Agency and Public Comments	Identification of Relevant Environmental Factors
SOCIAL SURROUNDINGS				
Public Health and Safety	Shire of Busselton	Proposed wastewater discharges to an on-site wetland, Vasse Diversion Drains and further into Geographe Bay which may further increase mosquito levels representing public health risk.	The strategies proposed to constrain breeding of *Coquillettidia* sp. nr. *linealis* and *Culex annulirostins* mosquitoes are considered effective, if applied correctly. However, prevention of breeding by reducing organic loadings is unlikely to constrain breeding. (HDWA) CER says increased water flow through wetland is likely to reduce mosquito problem, but this is questionable. A detailed evaluation and mosquito management plan is needed.	**Considered to be a relevant factor**
OTHER				
Amenity - Recreation	Vasse Diversion Drain and Geographe Bay	Discharge of treated wastewater into Drains and consequently into the Vasse Diversion Drain and Geographe Bay Proposal achieves disinfection within guideline value for primary contact recreation prior to release into the wetland.	CER data indicate the beach near the drain is unsuitable for swimming in winter, (winter samples fail to meet ANZECC Guidelines for Primary Contact Recreation) a high level of recreational use. Drain is used regularly for recreational activities including swimming, fishing (most mornings) and canoeing, by five schools. Yacht Club competitions take place regularly across the outlet area. In relation to the reported public use of the drains, it is likely that the erection of signs advising against swimming will be recommended by the HDWA Can the Water Corporation guarantee that bacteria will not regrow to levels exceeding health criteria?	**Considered to be a relevant factor** This factor will be assessed with Public Health and Safety

			Discharge water should support zero bacteria. Chlorination may be needed as water leaves the wetland. Copies of all microbiological results will be required to be forwarded to the Wastewater Management Section of the Health Department of Western Australia, and compliance with standards would be monitored.	
Alternatives	Geographe Catchment	Proposal found the following alternatives unacceptable: • Irrigation of woodlots with winter storage of effluent; • Summer irrigation of woodlots with winter discharge to drain; • Irrigation of public parks, gardens and Busselton Golf Course with winter discharge to drain; • Summer irrigation of agricultural crops with winter discharge to drain; and • Ocean discharge via pipeline.	Elimination by the Water Corporation of options which could not use all of the waste water is an inflexible negative methodology to choose the right option. Alternative uses suggested include • land irrigation, especially during summer, include the golf course, horticulture, viticulture, a plantation at the Busselton Airfield, a tree lot on the slopes or at the foot of the Whicher Range, joint options with farmers rather than the Water Corporation purchasing the land, use on CALM land and use in Shire parks and gardens; • the use of tertiary treated water to improve water quality in the Vasse River; • inclusion of dual pipe systems in new residential areas so water can be used for garden watering in new housing estates. We agree that the following options are unacceptable: irrigation of woodlots with winter storage effluent; summer irrigation of woodlots with winter discharge to drain; summer irrigation of agricultural crops with winter discharge to drain; and ocean discharge via pipeline. Some of the potential areas for irrigation of agricultural crops are recharge areas for the Leederville aquifer. From a public health perspective, an appropriately situated ocean outfall would be the preferred option. Thought it was government policy (expressed by Minister for Water Resources Peter Foss in 1995, reported in the Busselton Margaret River Times of 31 July) that there be no future outfalls. People should be given a choice of costed options. This was promised by the Water Corporation at the "Value management workshop January 1997".	**Not considered to be a relevant environmental issue**

Environmental Improvement Initiative	Geographe Catchment		Both the existing nutrient load in the drain and from the waste water treatment plant deserve more consideration, but the Environmental Improvement Initiative should be considered as a separate proposal. Support in-principle the Environmental Improvement Initiative, but should not be used as a trade off. It is inappropriate to compare potential nutrient reductions in the Peel Harvey catchment to the Geographe Bay catchment. The 40-50% reductions in diffuse nitrogen and phosphorus were the result of theoretical modelling. Whole farm nutrient management systems would reduce nutrient exports more significantly than a focus on dairy sheds alone. Initiative should recognise the potential community resistance to improved catchment management. The Environmental Improvement Initiative estimate of potential nutrient reduction by targeting the dairy industry may have been overestimated because: • nutrient cycling processes are ignored; • dairy sheds only hold about 10% of the nutrients/ faecal matter produced by the herd; and • little nutrient monitoring has been undertaken along drains.	**Not considered to be a relevant environmental factor.** Addressed under Other Advice.

Table 3: Assessment of Relevant Environmental Factors

Relevant Factor	Relevant Area	EPA Environmental Objectives	EPA Assessment	EPA Advice

Ground water quality	Leederville Formation and the Geographe Catchment	Maintain or improve the quality of groundwater to ensure that existing and potential uses, including ecosystem maintenance are protected, consistent with the draft WA Guidelines for Fresh and Marine Waters (EPA, 1993) and the NHMRC / ARMCANZ Australian Drinking Water Guidelines - National Water Quality Management Strategy.	• The area surrounding the WWTP has a high water-table consisting of superficial groundwater and the Leederville Formation. The recharge zone for the Leederville formation is inland and is not affected by the proposal.
			• The superficial groundwater has high to very high salinity (630-91 mS/m) and is high in Nitrogen (3.8-12.0g/m3). There are 3 superficial groundwater bores within 600m of the WWTP for non-potable uses, (eg log wetting and toilet flushing).
			• Waste water entering the wetland from the IDEA plant will have:
			  • 5-10g/m3 TN; and
			  • 0.5-1g/m3 TP;
			while wastewater exiting the wetland and entering the drain (Vasse Sub A drain) is of the following criteria;
			  • 3-5g/m3 TN; and
			  • 0.4-0.6g/m3 TP.
				Having particular regard to:
				a) the separation and upward discharge of the Leederville Aquifer to the superficial groundwater table;
				b) the water quality of the treated wastewater being of better quality than the current quality of the superficial groundwater;
				c) the proponent's commitments to conduct ongoing monitoring of groundwater levels, water quality and the vertical distribution of any contamination; and
				d) the proponent's commitment of reduce the infiltration of treated wastewater to the superficial groundwater table if problems occur,
				it is the EPA's opinion that Stages 1 and 2 of the proposal can be managed to meet the EPA's environmental objective.

Surface water quality	Geographe Bay Catchment	Maintain or improve the quality of surface water to ensure that existing and potential uses, including ecosystem maintenance are protected, consistent with the draft WA Guidelines for Fresh and Marine Waters (EPA, 1993).	• On advice from the WRC, Geocatch and DEP, the drainage channels in Busselton, including the drain discharging to Geographe Bay (Vasse Diversion Drain), are of limited environmental value and should be maintained consistent with amenity. The water quality currently released from the WWTP to the on-site wetland is: TN 30g/m3 and TP 8g/m3. Discharge to the Vasse Diversion Drain from the wetland	Having particular regard to: a) the limited environmental value of the Vasse Diversion Drain; b) the overall reduction in phosphorus concentration and load discharged from the WWTP to the Vasse Drainage System during Stages 1 and 2; c) the overall reduction in nitrogen concentration and load discharged

			is: TN 13-14g/m3; TP 2.35-5.2g/m3; and TTC 450-2000cfu/100ml. Background water quality in the Vasse Diversion Drain is: TN 0.74-3.2g/m3, TP 0.05-0.65g/m3; and TTC 10-920 cfu/100ml • The drain flow discharging into Geographe Bay is an estimated 80 000 - 800 000m3/day. • STAGE 1 and 2 (2005 & 2020) will discharge the following water quality at 4500m3/day and 6750m3/day respectively : TN 3.5-5.0g/m3; TP 0.6g/m3; and disinfect to TTC 300cfu/100ml. • Winter discharges are at the higher concentration ranges however are unlikely to cause an impact as dilution is high and the proportion of discharge as compared to the catchment is low. • Summer discharges are in the lower concentration ranges however the dilution rate is lower and the proportion of load is greater in an active water system. • The Vasse Diversion Drain has shown limited signs of eutrophication, the proposal is not considered to improve the likelihood of further eutrophication.	from the WWTP and the reduction during Stage 1, and the containment in Stage 2 of the nitrogen load to about the level from the current WWTP; d) the substantial reduction in thermotolerant coliforms released from the WWTP; e) the greater proportion of nutrients entering the Vasse Agricultural Drainage System from the greater catchment from agricultural and other land uses in comparison to the nutrients from the WWTP; and f) the proponent's monitoring and wastewater discharge criteria commitments; and g) the proponent's commitment to develop, subsidise, and implement the Environmental Improvement Initiative in the catchment of Geographe Bay, it is the EPA's opinion that Stages 1 and 2 of the proposal can be managed to meet the EPA's objective.
Marine water quality	Geographe Bay	• Maintain or improve the quality of marine water consistent with the draft WA Guidelines for Fresh and Marine Waters (EPA, 1993); • Meet the requirements of the Australian Water Quality Guidelines for Fresh and Marine Waters (ANZECC, 1992); and • Maintain water quality and	• Main nutrient sources on Geographe Bay are the Vasse-Wonnerup Estuary , the Vasse Diversion Drain (including the WWTP), unsewered areas of Busselton and the Buayanup River and Drain. The WWTP currently contributes approximately 2% of the total Nitrogen and 4% of the total Phosphorus entering the southern Geographe Bay. • Nine marine water quality sampling sites show 7 sites (within 500m radius of the discharge point) were within the Western Australian Water Quality Guidelines for Fresh and Marine Waters (Bulletin 711, 1993) detailing 0.01-	Having particular regard to: a) the total nutrient load to southern Geographe Bay and the very small proportion of the load which comes from the WWTP; b) the diversion of septic tank wastes from disposal to shallow groundwater to the WWTP for treatment; c) the overall reduction of total phosphorus load from the WWTP during Stages 1 and 2;

		sediment quality to EPA (1993) standards and to protect environmental values of recreation, aesthetics, aquatic life or human consumption and maintenance of ecosystems in agreed areas.	0.1mg/l Total-P and 0.1-0.75mg/l Total-N are concentrations from which problems have been known to occur in water bodies. • Two sites, at the discharge point and 200m east of the discharge point, exceeded the ANZECC criteria being 1.228mg/l and 0.829mg/l. • All samples except 1 at the discharge point were within the ANZECC guideline value of 1000cfu/100ml for secondary contact recreation. One sample was within the guideline value of 150cfu/100ml for primary contact recreation. • The Western Australian Water Quality Guidelines For Fresh and Marine Waters (Bulletin 711, 1993) Nitrogen and Phosphorus guideline values will be used as a basis for the future Geographe Bay Environmental Management Plan and State of the Environment Report nutrient target values. • The nutrient loads currently released from the WWTP are: TN 8.9tpa (3.4tpa summer, 5.6tpa winter); and TP 2.3tpa (1.3tpa summer, 1.0tpa winter) • STAGE 1 (by 2005) will discharge; TN 6.8tpa (2.6 tpa summer, 4.2tpa winter); and TP 0.9tpa (0.4 tpa summer, 0.5tpa winter) • STAGE 2 (by 2020) will discharge; TN 10.2tpa (4.0 tpa summer, 6.2tpa winter); and TP 1.3tpa (0.4 tpa summer, 0.5tpa winter)	d) the reduction in nitrogen load from the WWTP during Stages 1 and the containment to current WWTP nitrogen loads in Stage 2; and e) the proponent's commitments to monitor marine water quality within a Special Management Area and to take appropriate action should management objectives not be met, if the breach is directly attributable to the WWTP, it is the EPA's opinion that Stages 1 and 2 of the proposal can be managed to meet the EPA's environmental objective.
Marine flora - seagrass	Geographe Bay	Maintain the ecological function, abundance, species diversity and geographic distribution of seagrasses.	• Geographe Bay supports extensive seagrass meadows estimated to be 60-80% cover, but they are absent in coastal waters within approximately 300m of the Vasse Diversion Drain discharge point to Geographe Bay. • Total Nitrogen concentrations directly impact on seagrass meadows. Current Total Nitrogen concentrations decline from 1200mg/m3 at the discharge point to 250mg/m3 500m north of the drain. • Marine water quality sampling sites 300m from the discharge point are within the Western Australian Water	Having particular regard to: (a) the sensitivity of WA seagrass systems to nutrient enrichment, in particular nitrogen; (b) the current good health of the seagrass meadows under current nutrient loading regimes; (c) monitoring which indicates that the Vasse Diversion Drain discharge is having a low impact on near-shore

			Quality Guidelines For Fresh and Marine Waters (Bulletin 711, 1993) at which problems have been known to occur in water bodies. • The Western Australian Water Quality Guidelines For Fresh and Marine Waters (Bulletin 711, 1993) Nitrogen and Phosphorus guideline values will be used as a basis for the Future Geographe Bay Environmental Management Plan and State of the Environmental Report nutrient target values. • TN loads are of limited environmental consequence in winter due to total catchment flows and dilution. • Stage 1 summer TN load is a reduction and thus is not considered an environmental consequence. • Stage 2 increases TN load by 1.3 tpa. • In summer these loads are 74% and 77% of the total load in the Drain, but they are offset by the removal of 12t of TN per summer from groundwater contribution to Geographe Bay.	nutrient and chlorophyll-a concentrations; (d) the fact that seagrass meadows are currently absent in the near-shore zone to 300m offshore; (e) that monitoring shows that elevated N and P levels fall to background levels within 300m of the shore; (f) that the upgraded treatment regime would divert about 12 tonnes of N each summer and about 30 tonnes of N/year from groundwater entering the Bay; (g) the Water Corporation commitment to monitor the near-shore response to nutrients and to reduce nutrient losses further in the event that problems caused by the WWTP are detected; and (h) the environmental improvement initiative (EII) would reduce the total nutrient loadings entering Geographe Bay from the catchment, it is the EPA's opinion that Stages 1 and 2 of the proposal can be managed to meet the EPA's environmental objective.
Public health and safety	Shire of Busselton	Ensure that the sewage effluent is treated and/or disposed of in a manner that does not pose an unacceptable risk to public health and which poses minimal environmental risk in the long term.	• The Vasse Diversion Drain is an artificial waterway accepting stormwater and the waters from the Vasse River and is used for fishing, swimming and canoeing despite recommendation against these uses. • The Drain discharges to Geographe Bay at a popular swimming beach. • The WWTP currently discharges: 500-2000cfu/100ml TTC: • Background levels of the Vasse Diversion Drain are; 10-920cfu/100ml • Stages 1 & 2 will discharge 10cfu/100ml to the wetland,	Having particular regard to: (a) the existing WWTP discharges make little contribution to the microbial content of the water within the Vasse Diversion Drain; (b) the proponent's commitment to disinfect treated wastewater prior to disposal to the wetland to a level of 10 cfu/100mL, which is substantially below the ANZECC Guideline for primary contact recreation; and

			from which some reinfection is expected to occur • Stages 1 & 2 are well below the ANZECC guideline of 150cfu/ml for primary recreational contact. • A BOD loading to the wetland of less than 90kg/ha/day is recommended to avoid excessive mosquito populations (Kadlec & Knight, 1996) • Water Corporation has committed to minimise the risk of disease being spread from the WWTP by mosquitoes.	(c) the proponent's commitment to monitor and manage mosquito populations if the upgraded WWTP exacerbates the mosquito problem, it is the EPA's opinion that Stages 1 and 2 of the proposal can be managed to meet the EPA's environmental objective.

The existing WWTP wetland is not lined and some of the nutrients from the existing on-site wetland and storage lagoons gain access to the superficial groundwater.

Treated wastewater entering the wetlands from the outflow of the IDEA plant would contain between 5-10 g/m3 Total Nitrogen (TN) and 0.5-1.0 g/m3 Total Phosphorus (TP). At the point of discharge from the wetland to the Vasse drainage system the TN and TP contained within the wastewater is expected to be reduced to 3-5 g/m3 and 0.4-0.6 g/m3 respectively during Stage 1. Stage 2 would be expected to achieve at least these levels.

The Water Corporation currently conducts groundwater monitoring around the WWTP site. It is proposed that a number of additional monitoring bores would be installed to improve the monitoring regime. The proponent has advised that these additional bores have already been installed and are being monitored.

It is expected that infiltration and direct discharge from the wetlands would be intercepted by the agricultural drains where the nutrient levels would undergo further reduction from denitrification and phosphorus adsorption by sediment uptake processes, including binding with soil particles and mineralisation.

Submissions

Submissions made during the public review period questioned the adequacy of the current and proposed sampling regime in relation to the operation of the WWTP and the protection of the Leederville Aquifer. Some submitters believed that, while the proposed groundwater monitoring program is considered adequate, a nest of bores could be established at one site to determine the vertical distribution of any contamination.

Concerns were also expressed in regard to the groundwater objective. It was suggested that the objective should be to maintain and improve beneficial uses and environmental standards, rather than to maintain water quality to "environmentally acceptable standards".

Assessment

The area considered for assessment of this factor is the Leederville Aquifer and the superficial groundwater in the vicinity of the Busselton WWTP.

The EPA's environmental objective for this factor is to maintain or improve the quality of groundwater to ensure that existing and potential uses, including ecosystem maintenance, are protected consistent with the draft WA Guidelines for Fresh and Marine Water (EPA, 1993) and the NHMRC/ARMCANZ Australian Drinking Water Guidelines - National Water Quality Management Strategy.

The EPA notes that the Leederville Aquifer is unlikely to be affected by the WWTP as it is held under positive pressure and separated from the superficial groundwater table by a relatively impermeable clay layer.

The EPA notes that the superficial groundwater is already degraded as it is high in salinity and nitrogen and is not used as a potable water source. The EPA also notes that the treated wastewater leaving the IDEA Plant and the on-site wetland would be much lower in nitrogen than current levels within the superficial aquifer.

The Water Corporation has committed to ensure superficial groundwater level and quality in the vicinity of the WWTP is maintained to environmentally acceptable standards by:

- Installing six groundwater monitoring bores and conducting ongoing monitoring of groundwater levels and water quality around the WWTP site and at the nearest down-gradient bore potentially affected by the WWTP operation;
- Installing and monitoring a nest of monitoring bores at the northern edge of the WWTP; and

- If deterioration in existing groundwater quality is detected by routine monitoring, reducing infiltration to the superficial aquifer of nutrients in the treated wastewater from the wetland and holding lagoons by:
  - improving the performance of the IDEA plant; and/or
  - constructing additional wetland on the site to further polish wastewater; and/or
  - sealing the bottom of the wetland with more impervious material; and/or
  - reducing local groundwater levels with trees; and/or
  - diverting more treated wastewater to off-site users.

Summary

Having particular regard to:

(a) the separation and upward discharge of the Leederville Aquifer to the superficial groundwater table;

(b) the water quality of the treated wastewater being of better quality than the current quality of the superficial groundwater;

(c) the proponent's commitments to conduct ongoing monitoring of groundwater levels, water quality and the vertical distribution of any contamination; and

(d) the proponent's commitment of reduce the infiltration of treated wastewater to the superficial groundwater table if problems occur,

it is the EPA's opinion that Stages 1 and 2 of the proposal can be managed to meet the EPA's environmental objective for groundwater.

3.2 Surface Water Quality

Description

The Water Corporation proposes to discharge tertiary treated wastewater from the southern on-site wetland into the Agricultural Drainage Network. Specifically this would involve transport along 2.5 km of the Vasse Sub-A_2A and A_2 Drains, 2 km of the Vasse Sub-A Drain and a further 1.5 km along the Vasse Diversion Drain and thence into Geographe Bay (Figure 1).

The main channel of the drain, the Vasse Sub-A and Diversion Drain, is adjacent to Queen Elizabeth Avenue. The land uses adjacent to the drain include agricultural/rural and residential areas to the south and developed and developing residential areas to the north. Whilst the current WWTP makes some contribution to nutrient levels in the Vasse Agricultural Drainage Network, fertiliser and other agricultural nutrient applications within the catchment area, and the probable seepage of nutrients from the landfill site north of the WWTP are known to be larger contributors.

Advice from the Water and River Commission and Geocatch is that the agricultural drains and the Vasse Diversion Drain are of limited environmental value. Therefore the main consideration in assessing the proposal in relation to this factor is the use of the drain by the community.

The current median TN and TP concentrations in the Vasse Agricultural Drainage Network in the vicinity of the WWTP exceed the upper guideline value at which phytoplankton problems in streams and rivers have been known to occur (ANZECC, 1992) and the background water quality of the receiving drains upstream of the WWTP also exceed the guideline values (Table 4). These elevated nutrient levels are typical of agricultural drains in the Vasse-Wonnerup catchment area (Kinhill, 1998), and probably contribute to algal blooms, affecting the water quality in the Vasse Diversion Drain.

The concentrations of nitrogen, phosphorus and thermotolerant coliforms in the drainage system decline rapidly with increasing distance from the point of WWTP wetland discharge to the Vasse Sub A_2 drain. (Figures 5, 6, and 7). Total nitrogen (TN) and total phosphorus (TP)

concentrations discharged would be even lower after the Stage 1 upgrade than levels from the current WWTP (Table 4) and would be similar to background summer values in the Vasse Diversion Drain. TN load in Stage 2 would approach current WWTP annual TN loads but at lower concentration. In winter, TN and TP concentrations would be dominated by the quality of agricultural runoff.

Currently the WWTP discharges a maximum of 1700 m3/day to the Vasse Agricultural Drains via the on-site wetland. At this volume infiltration within the wetland and sub-drains prevents wastewater from reaching the Vasse Diversion Drain during summer. A flow of approximately 4500m3/day from the WWTP is expected to result in summer flows through to the Vasse Diversion Drain.

The upgraded WWTP is expected to discharge treated wastewater to the Vasse Sub A_2 of superior quality to the existing background water quality contained within the drain in summer (refer to Table 4).

Table 4: Expected Water Quality from the Upgraded WWTP Compared to the Current Water Quality of the Vasse Agricultural Drainage Network at Sites Not Influenced by the Current WWTP (median values).

Site	Season	Total Nitrogen (g/m3)		Total Phosphorus (g/m3)		Thermotolerant Coliforms (cfu/100mL)	
WWTP discharge to Vasse Sub A_2A		Stage 1	Stage 2	Stage 1	Stage 2	Stage 1	Stage 2
	Summer	3.5	3.5	0.6	0.6	300	300
	Winter	5.0	5.0	0.6	0.5	300	300
Vasse Sub A_2 Background (Site 2 - upstream of WWTP)	Summer	7.25		0.9		375	
	Winter	3.0		0.6		750	
Vasse Sub-A Background (Site 7 - upstream of WWTP)	Summer	1.56		0.25		70	
	Winter	2.04		0.425		1000	
Vasse Diversion Background (Upstream of confluence with Vasse Sub-A drain)	Summer	0.84		0.125		10	
	Winter	1.57		0.15		500	
ANZECC 1992 Guideline Values		0.75		0.1		150 (contact recreation)	

The Stage 1 upgrade would reduce the proportion of the summer TP load from the WWTP to the drainage system (Table 6). As the proposal reduces the phosphorus load in the Vasse Agricultural Drains from the Busselton WWTP, there would be no adverse impact on existing water quality. Stage 1 would also reduce the proportion of the summer TN load to the drainage system from the WWTP.

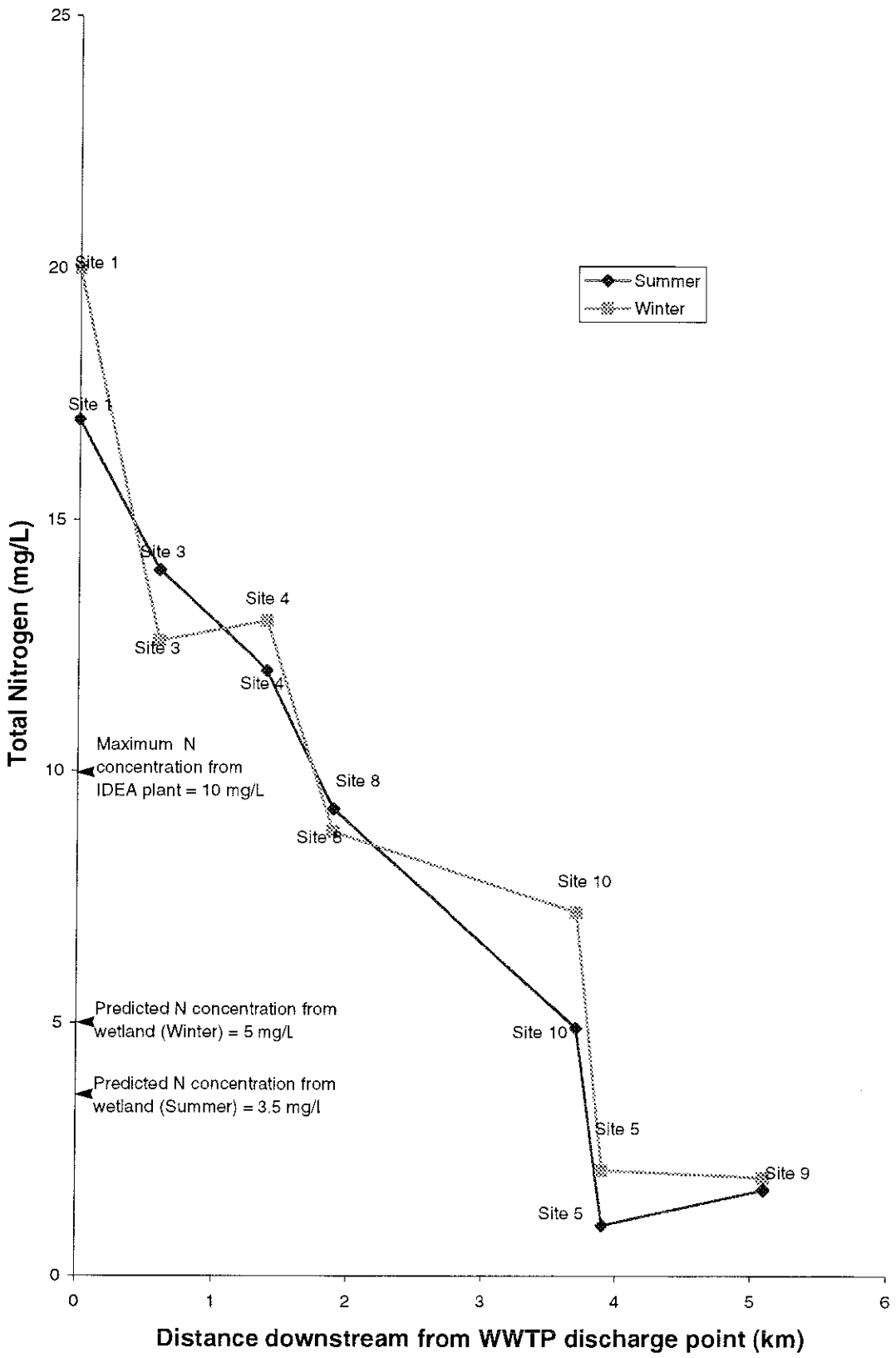


Figure 5. Variation of Median Total Nitrogen Concentrations in the drainage system with distance downstream of the Wastewater Treatment Plant.

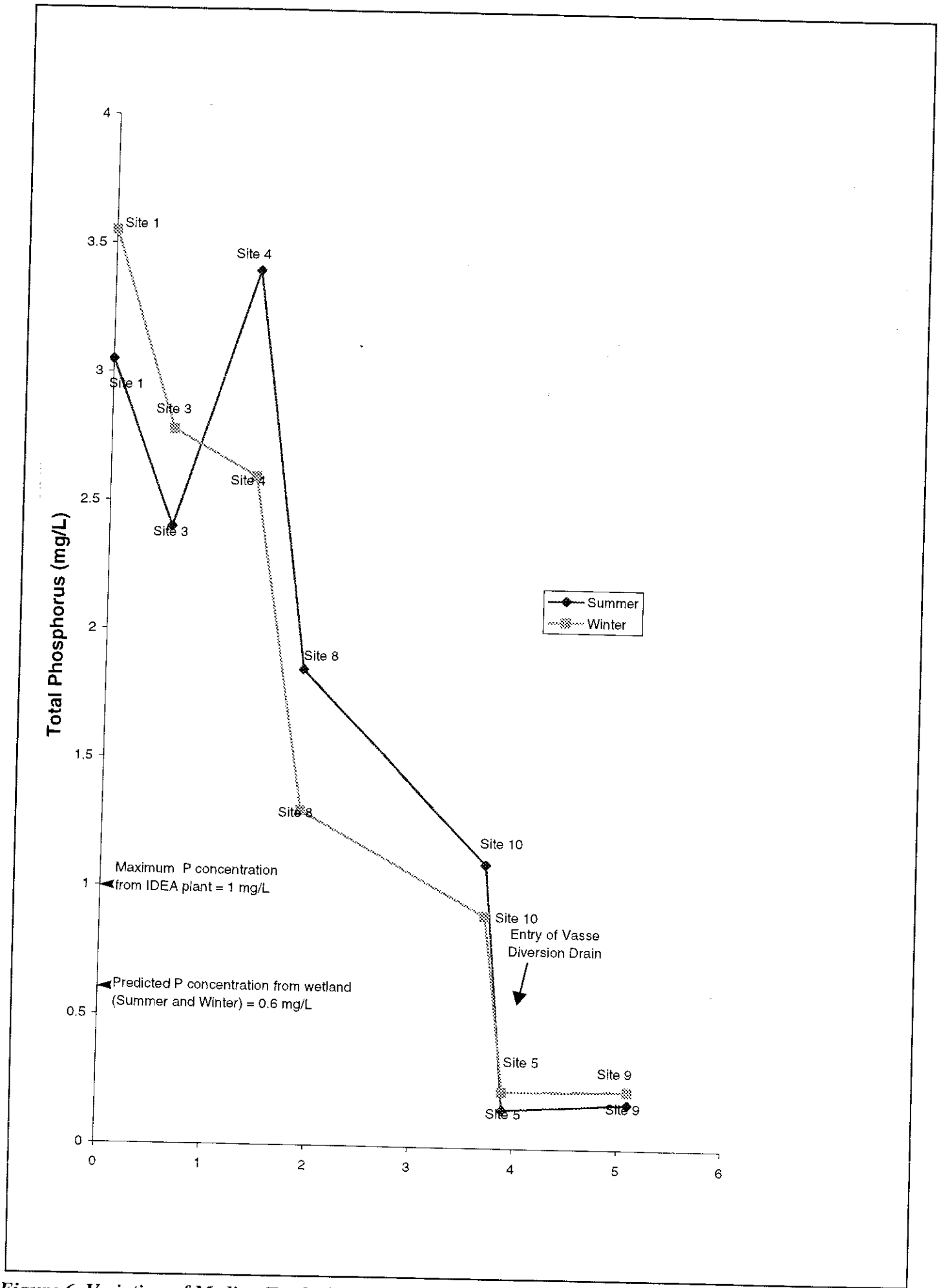


Figure 6. Variation of Median Total Phosphorus Concentrations in the drainage system with distance downstream of the Wastewater Treatment Plant.

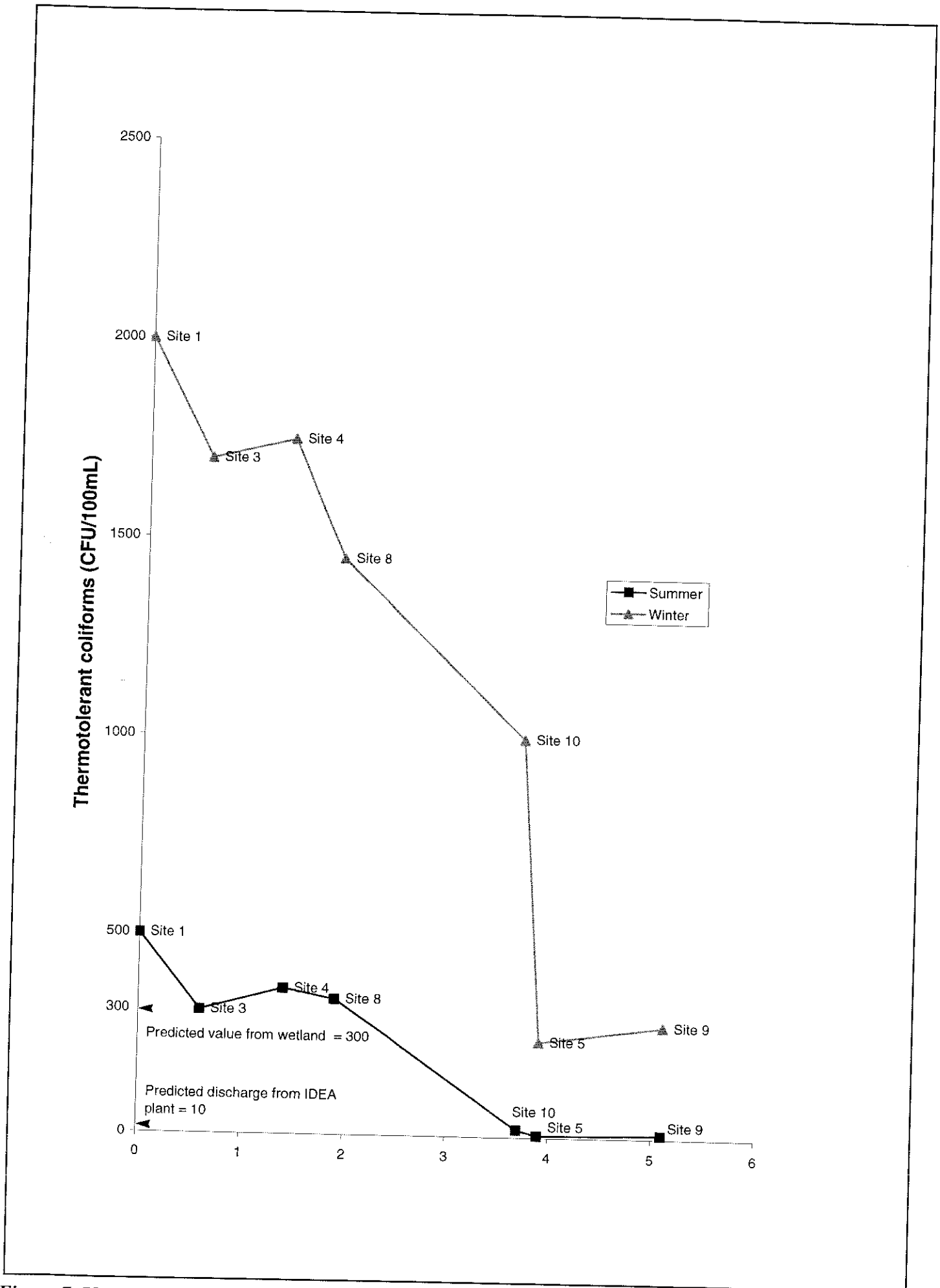


Figure 7. Variation of Median Thermotolerant Coliform Concentrations in the drainage system with distance downstream of the Wastewater Treatment Plant.

The proposal would improve the bacterial quality of the drain as the upgraded WWTP achieves disinfection well below ANZECC guidelines for primary contact recreation (150 cfu/100mL) during the wastewater treatment process, achieving a median of 10 cfu/100mL. However, a degree of re-infection is expected to occur from use of the on-site wetland by fauna and this may elevate faecal bacterial levels from 10 cfu/100mL (ex WWTP) to in the order of 300 cfu/100mL.

The Water Corporation has proposed to implement an Environmental Improvement Initiative (EII) to provide a mechanism (and funding) to achieve nutrient load reduction in the drains that enter the southern parts of Geographe Bay from agricultural and other sources. This would lead to significant reductions in the amount of nitrogen, phosphorus and faecal bacteria entering the drainage system and Geographe Bay.

Submissions

Submissions made during the public advertising period questioned the adequacy and validity of the regime for sampling of the existing water quality of the Vasse Agricultural Drains and mouth of the Diversion Drain.

Long-term residents reported that there has been a change in colour and smell of the water, increased algal growth near the outlet and drain, a dramatic decrease in seagrass and continuing problems with water flow in the drain.

Submitters raised concerns that no data were presented on herbicide, pesticide, heavy metal or oil and grease contaminant loads in the Vasse drainage system or the contribution of contaminant levels from CALM-managed land.

Claims that the wastewater is proposed to be tertiary treated was challenged in a number of submissions due to the water quality (nitrogen, phosphorus and bacterial parameters) of the treated wastewater leaving the on-site wetland. Further concern was raised pertaining to the microbiological (bacterial, viral, fungal and protozoan) content of the treated wastewater leaving the wetland and its downstream uses for recreational activities in the Vasse Diversion Drain. On a related matter concern was raised that UV radiation will only be effective where turbidity levels in the treated wastewater are low.

Other submissions suggested that the proposed improvements to the WWTP planned for 2020 and 2035 are too infrequent. Several suggested that improvement should be made at least every five years, or intervals consistent with technological advances in wastewater treatment.

Concern was expressed as to the public availability of the water quality monitoring results of the Vasse Drainage system and Geographe Bay. It was suggested that the results be published in the local paper and that the EPA recommend how the results be reported.

A number of submissions raised concerns pertaining to predicted treated wastewater quality criteria, suggesting that the predicted water qualities are misleading, vague, contain uncertainties are estimations and that the actual quality will be different, even to the point that it may exceed criteria approved by EPA. The success of other IDEA plants should be documented to test the modelling.

Other submissions suggested that given that there is little experience with constructed wetlands and IDEA plants in Australia it is not appropriate to experiment with the sensitive environs of Geographe Bay and that further research should be undertaken. Other concerns were raised regarding what contingency plans are in place should the wetlands fail to deliver the predicted water quality.

Submissions also questioned the impact of nutrient loads on the wetland and drains and the likelihood of eutrophication. If eutrophication were to occur what contingency plans could be implemented to rectify any impacts.

A number of submissions suggested that the Vasse Drainage System would not be able to cope with the increased flows from the WWTP and that proposal contains incorrect depth and width estimates of the Vasse Diversion Drain.

Assessment

The area considered for assessment of this factor is the Vasse Agricultural Drainage Network including the Vasse Diversion Drain.

The EPA's environmental objective for this factor is to maintain or improve the quality of surface water entering Geographe Bay to ensure that existing and potential uses, including ecosystem maintenance are protected, consistent with the draft WA Guidelines for Fresh and Marine Waters (EPA, 1993).

The EPA notes that the purpose of the Vasse Agricultural Drainage Network is to dispose of agricultural runoff from the Vasse-Wonnerup Catchment to reduce flooding of Busselton and that the Water and Rivers Commission regards the drains as having only limited environmental value.

In this context, the EPA notes that the Vasse Diversion Drain was built with a design flow capacity of 143 cubic metres per second, or 12,300,000 cubic metres per day. The maximum flow rate from Stage 2 of the WWTP would be 6750 m3/day, which is about 5 hundredths of one percent (0.05%) of the flow capacity of the drain. The ultimate flow rate from the WWTP (Stage 3, 9000 m3/day) would be only seven hundredths of one percent (0.07%) of the drain's flow capacity.

The EPA notes that the drainage system is used for recreation, including swimming, even though its water quality is not suitable because of bacterial levels from agricultural activities in the catchment which make contact recreation an undesirable activity from a human health perspective. Wastewater would be treated to achieve disinfection within ANZECC guidelines for primary contact recreation during the wastewater treatment process, and would improve the bacterial quality of the drain.

The EPA is aware that the Vasse Diversion Drain has displayed some signs of eutrophication in the summer months.

The EPA notes that implementation of the proposal would result in an overall decrease in phosphorus loads to the Vasse Drainage System and that Stage 1 of the proposal would result in a decrease in nitrogen load to the Vasse Agricultural Drainage Network. Stage 2 would discharge about the same nitrogen load as the current WWTP and half the phosphorus load, even though the volume of effluent being treated would be four times as great. In addition, the upgraded WWTP would reduce nutrients entering the groundwater from septic systems as houses with septic systems would be linked into the sewerage network. More than 30t/yr nitrogen and 6t/yr of phosphorus would be diverted through the WWTP from septic systems for treatment.

The Water Corporation has committed to ensuring that discharge from the WWTP will comply with licence requirements by undertaking ongoing monitoring of flow and water quality at the discharge point of the WWTP, at the wetland, and at various other sites in nearby drains. This would enable determination of the relative contribution of nutrients from the WWTP and other sources in the catchment.

The EPA notes that the regional land uses substantially contribute to the nutrient loads entering Geographe Bay from the drainage system and that it is desirable that there be a regional initiative to reduce the nutrient loads from the broader catchment. With regard to this, the Water Corporation plans to implement an Environmental Improvement Initiative (EII) to help reduce nutrient loads and microbial losses from agricultural and other sources entering the drains which flow into parts of Geographe Bay.

The Water Corporation believes that the EII could produce reductions in levels of nitrogen and phosphorus from diffuse sources of at least 10-20%, and perhaps up to 40-50%, over a 3-5 year time-scale (Kinhill, 1998). These load reductions could be achieved by implementing improved monitoring and management of rural point sources and implementation of fertiliser management programmes based on soil nutrient testing.

The proposal, including the implementation of the EII offers the greatest environmental gain in achieving the objective of reducing overall nutrient inputs to Geographe Bay.

Summary

Having particular regard to:

(a) the limited environmental value of the Vasse Diversion Drain;

(b) the overall reduction in phosphorus concentration and load discharged from the WWTP to the Vasse Drainage System during Stages 1 and 2;

(c) the overall reduction in nitrogen concentration and load discharged from the WWTP and the reduction during Stage 1, and the containment in Stage 2 of the nitrogen load to about the level from the current WWTP;

(d) the substantial reduction in thermotolerant coliforms released from the WWTP;

(e) the greater proportion of nutrients entering the Vasse Agricultural Drainage System from the greater catchment from agricultural and other land uses in comparison to the nutrients from the WWTP; and

(f) the proponent's monitoring and wastewater discharge criteria commitments; and

(g) the proponent's commitment to develop, subsidise, and implement the Environmental Improvement Initiative in the catchment of Geographe Bay,

it is the EPA's opinion that Stages 1 and 2 of the proposal can be managed to meet the EPA's objective for surface water quality.

3.3 Marine Water Quality

Description

The disposal of tertiary treated wastewater from the Busselton WWTP to the Vasse Agricultural Drainage Network would result in nutrients from the WWTP continuing to be discharged into Geographe Bay but with significantly reduced microbial, nitrogen and phosphorus loads from that source. In addition, successful implementation of the EII should result in further significant reductions.

The Vasse Diversion Drain discharges into Geographe Bay at a location where shallow water restricts dispersion. The dispersion of the Vasse Diversion Drain discharge is expected to be strongly influenced by prevailing wind conditions affecting near-shore currents (Kinhill 1998).

Currently the Busselton WWTP annually contributes approximately 2% of the TN load and 4% of TP load accessing the southern portion of Geographe Bay (Kinhill, 1998). This is very low compared with other sources (Table 5), which are principally agricultural.

The Water Corporation has recently advised that after completion of the Busselton infill sewerage programme and the diversion of the current septic tank effluent load to the upgraded WWTP, more than 30 tonnes of nitrogen per year would be prevented from entering Geographe Bay (see Figure 2).

The main nutrient sources to the southern part of Geographe Bay include the Vasse-Wonnerup estuary, the Vasse Diversion Drain (including the WWTP), unsewered areas within Busselton and the Buayanup River and Drain (Table 5).

Marine water quality monitoring at nine sites within a 500 m radius of the Vasse Diversion Drain discharge point has indicated that all sites with the exception of two are below the ANZECC 1992 Guideline values for nitrogen and phosphorus (0.1-0.75 mg/L and 0.01-0.1 mg/L respectively). However, even at these values environmental problems have been known to occur. The two sites exceeding the guideline values are 200 m east of the Vasse Diversion Drain discharge point, and at the discharge point. It should be noted that the guideline values are only indicative values based upon past experience.

Table 5: Estimated Nutrient Contributions To Southern Geographe Bay (after Kinhill, 1998).

Site	Total Nitrogen		Total Phosphorus	
	t/a	%	t/a	%
Vasse Diversion Drain (1996)[1]	199	38	16	25
Vasse-Wonnerup Estuary (1993)[2]	204	39	27	43
Carbanup/Buayanup Drain (1993)[2]	86	17	11	18
Busselton unsewered areas (1993)[2]	22	4	7	10
Busselton WWTP (1997)[1]	**8.9**	**2**	**2.3**	**4**
Total	**520**	**100**	**63**	**100**

Discharge during the summer periods of higher than current nutrient concentrations from the Vasse Diversion Drain (particularly nitrogen) combined with the typically weak circulation in the southern end of Geographe Bay have the potential to result in a deterioration in water quality in the Bay. However, this needs to be considered against the removal of nutrients from septic tanks that will result from application of the infill sewerage programme. This reduction will act in two ways:

a) an immediate reduction in the annual input of nutrients entering the groundwater, through diversion of nutrients from septic systems into the sewerage system; and

b) reduction over time from rundown of phosphorus and nitrogen already in the groundwater from contamination by septic systems, as well as prevention of additional nutrients entering groundwater because of replacement of septics by the sewerage scheme.

All samples except at the discharge point were less than the ANZECC guideline value of 1000 thermotolerant cfu/100mL for secondary contact recreation. One sample was within the guideline value of 150 cfu/100mL for primary contact recreation.

Table 6 outlines the predicted nutrient load output from the proposed WWTP for Stages 1 and 2, based upon the nutrient loads disposed to the drain from the wetland at the WWTP site.

The implementation of Stages 1 and 2 would reduce the TP and TN loads to the Bay. This is considered to be an environmental benefit as the nutrient levels entering Geographe Bay would be reduced. They would be further reduced by successful implementation of the EII in the short term, and in the longer term additionally reduced as contamination levels in groundwater seepage reduce.

Table 6: Comparison of Estimated Seasonal Nutrient Loads to be Discharged from the Proposed Busselton WWTP Compared with Nutrient Loads in the Vasse Diversion Drain (after Kinhill, 1998).

	Total Nitrogen						Total Phosphorus					
	Summer		**Winter**		**Total**		**Summer**		**Winter**		**Total**	
	t/a	% in drain	t/a	% in drain	t/a	% in drain	t/a	% in drain	t/a	% in drain	t/a	% in drain
Vasse Diversion Drain & other	1.4	29	198	97.4	199.3	95.3	1.1	43.9	15	94.1	16.1	87.7
WWTP 1997 (flow 1700m3/day	3.4	71	5.6	2.7	8.9	4.3	1.3	56	1.0	6.0	2.3	12.5
WWTP 2005 - Stage 1 (flow 4500m3/day)	2.6	65	4.2	2.1	6.8	3.3	0.4	29	0.5	3.2	0.9	5.5
WWTP 2020 - Stage 2 (flow 6750 m3/day)	4.0	74	6.2	3.0	10.2	4.9	0.7	39	0.6	4.0	1.3	7.5

The proposal incorporates high levels of disinfection during the wastewater treatment process achieving 10 cfu/100mL which is well below the ANZECC guidelines for primary contact. Although a degree of re-infection is expected to occur from the wetland to elevate faecal bacterial levels to 300 cfu/100mL, this is not considered significant in terms of the bacteriological water quality in Geographe Bay as these levels are still below the current background microbial levels in the agricultural drain at the discharge point.

Submissions

Submissions pointed out that data indicate elevated nutrient levels within 500 m of the drain discharge. A submission pointed out that the drain is not designed for efficient dilution at the point of release. It was suggested that other alternatives should be considered and researched.

A number of submissions believed that the extent of research sampling was inadequate on which to base a 22 year project. The data collected over two summers and one winter are not adequate, given the variability of conditions and flows into the marine environment, nor reliable enough on which to base long-term predictions regarding circulation and hydrodynamic flushing. Further, the CER conclusion that nutrient input from sewage will be reduced needs to be questioned when data have not been verified.

Another submission questioned the usefulness of comparing Cockburn Sound with Geographe Bay.

It was pointed out that the CER provides scant, poorly referenced and vague detail on the hydrodynamic flushing characteristics of Geographe Bay which is not adequate for decision making. The information provided should have taken into account water circulation, density stratification, the energetics of mixing, an understanding of the relative importance of regional and local forcing and pathways of material transport, and seasonal differences to build an ecological nutrient-effects model.

Submissions suggested that the proposal for a special management area up to 500 m either side of the discharge point of the Vasse Diversion Drain is based on insufficient work and that impacts could be experienced over a wider area.

Other submissions suggested that the effects from nutrient loads could possibly be present up to 10 km from the discharge point, given the preliminary modelling, and further, that the concentration-based approach to nutrient management is inappropriate for marine systems.

Submissions also suggested that the EPA should use this assessment to strengthen and encourage a more comprehensive approach to catchment management and restriction of nutrients to Geographe Bay. Others suggested that should the project go ahead the EPA should recommend a staged approach, whereby each stage is dependent upon further research from the prior stage.

The CER data indicate that the beach near the drain is unsuitable for swimming in winter as it fails to meet ANZECC Guidelines for Primary Contact. Therefore microbiological sampling should be undertaken along the beaches of the southern Geographe Bay and the Vasse Diversion Drain downstream from the Sub A drain, and appropriate preventative action taken .

Assessment

The area considered for assessment of this factor is Geographe Bay.

The EPA's environmental objective for this factor is:

- to maintain or improve the quality of marine water consistent with the draft WA Guidelines for Fresh and Marine Waters (EPA, 1993);
- to meet the requirements of the Australian Water Quality Guidelines for Fresh and Marine Waters (ANZECC, 1992); and
- to maintain water quality and sediment quality to EPA (1993) standards and to protect environmental values of recreation, aesthetics, aquatic life or human consumption and maintenance of ecosystems in agreed areas.

The EPA notes that the main nutrient sources to southern Geographe Bay are from agricultural land uses in the catchments of the Vasse-Wonnerup estuary, the Vasse Diversion Drain, the Buayanup River and Drain and unsewered areas within Busselton. The existing lagoon system of the Busselton WWTP contributes approximately 2% of the TN and 4% of the TP entering southern Geographe Bay if the discharge reaches the Vasse Diversion Drain.

The EPA notes that the current marine water quality in Geographe Bay is within ANZECC guidelines for primary recreational contact (ANZECC, 1994) and well within the ANZECC guideline values for nitrogen and phosphorus concentrations at or above which algal problems are known to occur (Table 7). At times marine waters near the Vasse Diversion Drain and other discharge points exceed these levels.

The EPA notes that in the summer months if there is inadequate dispersion, elevated nutrient discharges may exceed these levels and result in localised nutrient enrichment near the discharge points. In marine systems, elevated nitrogen levels would be of more concern than elevated phosphorus levels.

The EPA notes that the implementation of Stages 1 and 2 would reduce the total phosphorus and nitrogen loads by diversion of wastewater from septic systems to the WWTP and a much higher level of treatment, and would therefore be of environmental benefit in terms of reducing nutrients reaching Geographe Bay.

The Water Corporation has committed to ensuring discharges from the WWTP comply with DEP licence requirements by undertaking ongoing monitoring of flow and water quality at the discharge point of the WWTP, wetland and at various other sites in nearby drains. This would enable determination of the relative contribution of nutrients from the WWTP and from agricultural and other sources in the catchment, as is the case with the current license.

The Water Corporation has also committed to quantify spatial and temporal variation in marine water quality within the Special Management Area (500m each side of the discharge point of the Vasse Diversion Drain) by undertaking ongoing monitoring of, and reporting on, algal growth responses to marine water quality in Geographe Bay within the Special Management Area. In addition the Water Corporation has made a commitment that should the desired management objectives not be met, the DEP and WRC will be notified immediately and investigations undertaken to determine whether the breach of objective is attributable to the WWTP or to other sources. If attributable to WWTP, the Water Corporation would consider a range of options to further decrease discharge of nutrients from the WWTP site, including:

- improving the performance of the IDEA plant; and/or
- constructing additional wetland on the site to further polish wastewater; and/or
- sealing the bottom of the wetland with more impervious material; and/or
- reducing local groundwater levels with trees; and/or
- diverting more treated wastewater to off-site users.

Summary

Having particular regard to:

(a) the total nutrient load to southern Geographe Bay and the very small proportion of the load which comes from the WWTP;

(b) the diversion of septic tank wastes from disposal to shallow groundwater to the WWTP for treatment;

(c) the overall reduction of total phosphorus load from the WWTP during Stages 1 and 2;

(d) the reduction in nitrogen load from the WWTP during Stages 1 and the containment to current WWTP nitrogen loads in Stage 2; and

(e) the proponent's commitments to monitor marine water quality within a Special Management Area and to take appropriate action should management objectives not be met, if the breach is directly attributable to the WWTP,

it is the EPA's opinion that Stages 1 and 2 of the proposal can be managed to meet the EPA's environmental objective for marine water quality.

3.4 Marine Flora - Seagrasses

Description

Geographe Bay supports extensive seagrass meadows on a shallow sandy bottom, dominated by *Posidonia* species, and interspersed with species of other genera such as *Amphibolis* (Kirkman and Walker, 1989).

The seagrass cover in Geographe Bay has been estimated at 60-80% cover, occasionally interrupted by 'blowouts', which are oriented parallel to the south-west swells, with a rim of sand to the shoreline. It is also evident that seagrass is largely absent in Geographe Bay within approximately 300 m of the Vasse Diversion Drain discharge point (Kinhill 1998).

Nitrogen is discharged to the Vasse Agricultural Drainage Network and subsequently to Geographe Bay from all catchment sources, including the WWTP. If in excess it may stimulate growth of epiphytes and phytoplankton, which in turn may restrict light availability to seagrass meadows which may compromise seagrass survival.

Monitoring indicates that although concentrations of nutrients in drain water at the discharge point of the Vasse Diversion Drain exceed National Guidelines, there is a low impact on near-shore nutrient concentrations in the vicinity of the drain (Kinhill, 1998), and levels monitored

1 km from the discharge point are within National Guidelines (ANZECC 1992) and there is no adverse impact (Table 7).

The information presented in Table 8 indicates that the water quality in Geographe Bay is very good, with chlorophyll-a levels lower than those measured in the Marmion Marine Park.

Table 7: Geographe Bay Marine Water Quality 1km from Vasse Diversion Drain Outlet.

	Phosphorus g/m3	Nitrate/nitrite g/m3
Geographe Bay 1 km off shore	.00045	0.2
ANZECC National Guidelines 1992	0.01- 0.1	0.1 - 0.75

Table 8: Chlorophyll-a concentrations in Geographe Bay 1km from Vasse Diversion Drain Outlet (median values) Compared with those in Marmion Marine Park.

	Chlorophyll-a (mg/m3)
Geographe Bay 1 km off shore	0.18 - 0.23
Marmion Marine Park	0.6 (1.5) - 0.7 (2.0) summer 0.4 (0.7) - 0.5 (0.8) winter

Note: 95th percentile represented in brackets

The Water Corporation undertook a marine water quality programme sampling at a number of sites between the Vasse Diversion Drain discharge outlet extending off shore to 500 m (Table 9). The monitoring indicated that nutrient levels are generally elevated in the immediate vicinity of the discharge point.

The data also predominantly indicate that beyond 300 m offshore, nutrient and chlorophyll-a concentrations return to background levels. However occasionally a plume extends westward to inshore waters, possibly due to strong easterlies. During winter, a buoyant plume generally dissipates in an easterly direction whilst remaining nearshore. In summer, nutrient concentrations are generally lower than in winter and no patterns can be clearly defined because the monitoring data indicate that the rate and direction of dispersion of water leaving the outlet is dependent upon the prevailing hydrodynamic conditions.

Marine water quality sampling sites 300 m from the discharge point are within the Western Australian Water Quality Guidelines For Fresh and Marine Waters (EPA, 1993), and the ANZECC Guidelines (ANZECC, 1992). Marine water quality 150m from the discharge also meets the ANZECC Guidelines for N and P with the exception of one easterly sampling point where the measured level of nitrogen was 765 mgN/m3, just above the maximum Guideline value of 750 mgN/m3 (Guideline range 100-750 mgN/m3) (Table 9).

Table 9: Geographe Bay Marine Water Quality - Results of Transect out to 500 m from the Vasse Diversion Drain Outlet.

Site			Nitrogen (mgN/m3) (median values)	Phosphorus (mgP/m3) (median values)
150 m transects	East	Summer	305	7
		Winter	765	83
	Directly out from discharge point	Summer	318	7
		Winter	596	57
	West	Summer	339	2
		Winter	218	21
300 m transects	East	Summer	319	15
		Winter	480	43
	Directly out from discharge point	Summer	329	6
		Winter	271	15
	West	Summer	167	11
		Winter	243	15
500 m transects	East	Summer	215	8
		Winter	266	15
	Directly out from discharge point	Summer	211	9
		Winter	246	21
	West	Summer	154	6
		Winter	175	15
ANZECC National Guidelines 1992 (indicative concentrations)			100 - 750	10 - 100

Note: sampled 30cm from surface

Submissions

Submissions made during the public review period advised that the Minister for the Environment had made the announcement that the Geographe Bay-Capes-Hardy Inlet areas were priority areas for consideration as a possible marine reserve (announcement made on 15 December 1997). Seagrass meadows form the basis of marine ecology in the Bay and should be protected. Existing nutrient loads from rural areas of the Geographe Bay catchment are higher than from urban areas, so the need to reduce nitrogen loads is high.

Others suggested that, given the weak circulation in summer, this discharge is unacceptable particularly given the adoption of the precautionary principle and the long lag time between effluent discharge and changes in seagrass distribution and abundance.

Assessment

The area considered for assessment of this factor is southern Geographe Bay.

The EPA's environmental objective for this factor is to maintain the ecological function, abundance, species diversity and geographic distribution of seagrasses.

Protection of the seagrasses of Geographe Bay is a primary goal of the EPA. This is consistent with the Minister for the Environment's recent statement that the Geographe Bay-Capes-Hardy Inlet areas are priority areas for consideration as a possible marine reserve because of the extensive seagrass meadows.

Elevated nitrogen levels stimulate algal growth which may adversely affect seagrass health. The EPA notes monitoring which indicates that the Vasse Diversion Drain discharge is currently having a low impact on near-shore nutrient concentrations in the vicinity of the drain (Table 9).

The current and future TN discharge from the WWTP during the winter months is considered to be of low environmental consequence given that the percentage contributions from the WWTP are small and seagrass is less sensitive to nutrients at that time of year.

Although recent marine water quality monitoring show nutrient levels in Geographe Bay tend to be lower during summer, it is during the summer period that the WWTP is expected to contribute the highest percentage of N to the Vasse Diversion Drain. However groundwater N levels would be reduced by infill sewerage which would offset this.

During summer the current WWTP contributes 71% of the TN load in the Vasse Diversion Drain. The upgraded WWTP is expected to contribute 65% of the TN load in the Vasse Diversion Drain during Stage 1 and 74% during Stage 2 (Table 6). Although these percentages may seem large they equate to 2.6 and 4.0 tonnes of nitrogen/yr compared to the 198 tonnes of nitrogen/yr currently being discharged by the Vasse Diversion Drain in winter from agricultural and other sources in the catchment. Implementation of the proposal would also remove an estimated 32.5 tonnes of N per year from the existing septic systems which discharge to shallow groundwater along the edge of the Bay.

Nutrients already in the groundwater from septic systems would continue to discharge to Geographe Bay but would run down over time. It is estimated that about 22 tonnes per year of nitrogen would continue to enter the Bay for a period of time from septic contamination of groundwater (Kinhill, 1998).

The EPA notes that, although the nutrient levels in Geographe Bay tend to be lower in summer, the proposal may have a higher environmental consequence during this period as it would contribute 2.6 tonnes per annum of nitrogen in Stage 1 and 4.0 tonnes per annum of nitrogen in Stage 2 to the discharge by the Vasse Diversion Drain to Geographe Bay over current levels. However this may be offset by the removal of 12 tonnes of N per summer from groundwater currently entering the Bay (Kinhill, 1998). The EPA notes that the Water Corporation is proposing additional action to address other sources of nitrogen in the catchment of Geographe Bay. This is considered further in Section 5 on other advice.

Summary

Having particular regard to:

(a) the sensitivity of WA seagrass systems to nutrient enrichment, in particular nitrogen;

(b) the current good health of the seagrass meadows under current nutrient loading regimes;

(c) monitoring which indicates that the Vasse Diversion Drain discharge is having a low impact on near-shore nutrient and chlorophyll-a concentrations;

(d) the fact that seagrass meadows are currently absent in the near-shore zone to 300m offshore;

(e) that monitoring shows that elevated N and P levels fall to background levels within 300m of the shore;

(f) that the upgraded treatment regime would divert about 12 tonnes of N each summer and about 30 tonnes of N/year from groundwater entering the Bay;

(g) the Water Corporation commitment to monitor the near-shore response to nutrients and to reduce nutrient losses further in the event that problems caused by the WWTP are detected; and

(h) the environmental improvement initiative (EII) would reduce the total nutrient loadings entering Geographe Bay from the catchment,

it is the EPA's opinion that Stages 1 and 2 of the proposal can be managed to meet the EPA's environmental objective for seagrass.

3.5 Public Health and Safety

Description

The Water Corporation proposes to discharge tertiary treated wastewater to the Vasse Diversion Drain, which accepts agricultural drainage waters from the surrounding regions and diverts the Vasse River away from the Busselton Town Centre, discharging the combined flow to Geographe Bay.

The Vasse Diversion Drain is currently used for a number of recreational uses including fishing, swimming and canoeing. These recreational uses occur despite warnings to users from local and state government agencies of the associated health risks involved, given the somewhat degraded water quality within the Drain.

The WWTP currently discharges to the drain without disinfection. The proposal incorporates a high level of disinfection during the wastewater treatment process achieving 10 cfu/100mL, which is an order of magnitude below the ANZECC guidelines of 150 cfu/100mL for primary contact. A degree of re-infection is expected to occur from the wetland, elevating faecal bacterial levels to 300 cfu/100mL. This is low compared to the levels in agricultural runoff and would not adversely affect the bacteriological water quality of the Vasse Sub-A, Vasse Diversion Drains or Geographe Bay.

The combination of people and the low-lying topography and extent of wetland areas within the Busselton region has resulted in the potential for mosquitoes to become a problem. Some species of mosquitoes are carriers of diseases such as Ross River Virus.

Mosquito production resulting directly from the implementation of the proposal is likely to be negligible if well-treated wastewater is discharged to the wetland (Kinhill, 1998). A Biochemical Oxygen Demand (BOD) loading to the wetland of less than 90 kg/ha/day is recommended to avoid excessive mosquito populations (Kadlec & Knight, 1996) and the new IDEA plant would meet this guideline value.

Submissions

Submissions questioned the statement in the CER that increased water flow through the wetlands is likely to reduce mosquito problems, and suggested that a detailed evaluation and mosquito management plan is needed.

The Health Department of Western Australia considered that the strategies which are proposed to constrain the breeding of particular mosquito disease vectors would be effective if applied correctly. However, comment was also given that the reduction of organic loadings is unlikely to constrain breeding.

Assessment

The area considered for assessment of this factor is within 25km radius of the Busselton WWTP (the likely maximum migration distance by mosquitoes moving from the WWTP wetland).

The EPA's environmental objective for this factor is to ensure that sewage effluent is treated and/or disposed of in a manner that does not pose an unacceptable risk to public health and which poses minimal environmental risk.

The EPA notes that the Vasse Sub-A and Diversion Drains are used for recreational purposes despite the Water Corporation and government warnings against such uses.

The EPA notes that current water quality monitoring indicates that the WWTP currently has little or no impact on the bacteriological water quality of the Vasse Sub-A and Vasse Diversion Drains and that the proposed WWTP would discharge water containing substantially lower microbial levels than background levels currently existing in the drain water.

The Water Corporation has committed to provide additional disinfection to reduce bacteria in treated wastewater leaving the IDEA plant to achieve a median of 10 cfu/100mL. The Water Corporation has also committed to ensuring that discharges of specified faecal bacteria meet licence requirements by providing additional disinfection if the concentration of faecal bacteria in the Vasse Diversion Drain and within the Special Management Area are unacceptable as a consequence of construction and operation of the WWTP and wetlands.

The EPA notes that the Busselton region has experienced excessive mosquito populations in the past which have contributed to outbreaks of Ross River Virus. In recognition of this, the Water Corporation has committed to minimise the risk of disease being spread from the WWTP and wetland by mosquitoes by undertaking ongoing monitoring of mosquito populations within the southern and northern wetlands, and controlling mosquito populations at the WWTP site to acceptable levels.

Summary

Having particular regard to:

(a) the existing WWTP discharges make little contribution to the microbial content of the water within the Vasse Diversion Drain;

(b) the proponent's commitment to disinfect treated wastewater prior to disposal to the wetland to a level of 10 cfu/100mL, which is substantially below the ANZECC Guideline for primary contact recreation; and

(c) the proponent's commitment to monitor and manage mosquito populations if the upgraded WWTP exacerbates the mosquito problem,

it is the EPA's opinion that Stages 1 and 2 of the proposal can be managed to meet the EPA's environmental objective for public health and safety.

4. Environmental Conditions and Commitments

Section 44 of the *Environmental Protection Act 1986* requires the EPA to report to the Minister for the Environment on the environmental factors relevant to the proposal and on the Environmental Conditions and procedures to which the proposal should be subject, if implemented. In addition, the EPA may make recommendations as it sees fit.

In developing recommended Environmental Conditions for each project, the EPA's preferred course of action is to have the proponent provide an array of commitments to ameliorate the impacts of the proposal on the environment. The commitments are considered by the EPA as part of its assessment of the proposal, and following discussion with the proponent the EPA may seek additional commitments.

The EPA recognises that not all of the commitments are written in a form which makes them readily enforceable. They do, however, provide a clear statement of the action to be taken as part of the proponent's responsibility for, and commitment to, continuous improvement in environmental performance. The commitments, modified if necessary to ensure that they are enforceable, then form part of the Environmental Conditions to which the proposal should be subject if it is to be implemented.

The EPA may, of course, also recommend Environmental Conditions additional to that relating to the proponent's commitments.

4.1 Proponent's Commitments

The proponent's commitments as set in the CER and subsequently modified, as shown in Appendix 1 should be made enforceable.

4.2 Recommended Environmental Conditions

Having considered the proponent's commitments and the information provided in this report, the EPA has developed a set of Environmental Conditions which the EPA recommends should be imposed if the proposal by the Water Corporation to upgrade the Busselton WWTP to a tertiary plant and increasing throughput to a maximum of 6750m3/day by about 2020 and discharging treated wastewater to the Vasse Agricultural Drainage Network on a year round basis is approved for implementation. These Environmental Conditions are presented in Appendix 3 and include the following requirements:

(a) The proponent shall fulfil the commitments in the Consolidated Commitments statement set out as an attachment to the recommended Environmental Conditions;

(b) Future stages be subject to further consideration by the EPA.

5. Other Advice

The need for the upgrade of the Busselton WWTP is being driven by increase in population and the infill sewerage programme for Busselton which will intercept and treat sewage effluent currently being discharged from septic tanks into the shallow groundwater along the edge of Geographe Bay. This will prevent more than 30 tonnes of nitrogen per year from entering groundwater flowing into the Bay.

The EPA notes that the Water Corporation's contribution of nutrients into Geographe Bay from the Busselton WWTP is currently less than 5% of the total annual load. In addition to reducing this by upgrading the Busselton WWTP facility, the Water Corporation will be establishing an Environmental Improvement Initiative (EII) aimed at reducing nutrient inputs to Geographe Bay from diffuse sources in the catchment, principally agricultural. This will begin to address the 95% of total nutrient load entering from these sources.

Sources of nutrients which the EPA considers need to be better managed and controlled in the Busselton region include dairy farm effluent and runoff from paddocks, annual horticulture, urban runoff, and leachates from the Rendezvous Road landfill.

The EPA notes the need to establish broader environmental controls for the catchment area in order to reduce the amount of nutrients entering Geographe Bay from broadacre land uses. The Water Corporation's EII is focused on achieving reductions from the catchment. In addition, there is an urgent need to develop and implement Dairy Regulations for this area and to develop strategies to reduce the loss to drainage of nutrients from horticulture and landfill sites. The Minister for the Environment, on the advice of the EPA, has already agreed to the preparation of Dairy Regulations. The EPA considers that similar environmental controls may be required to improve water and fertiliser use in annual horticulture to reduce off-farm nutrient export.

6. Conclusions

The EPA has considered the proposal by the Water Corporation to increase throughput of the Busselton Wastewater Treatment Plant (WWTP) to 4500m3/day by about 2005 (Stage 1) and 6750m3/day by about 2020 (Stage 2) and to discharge treated wastewater to the Vasse Agricultural Drainage Network, and thence to Geographe Bay, on a year round basis.

The essential elements of the proposal are that Water Corporation will treat increasing amounts of sewage effluent as the population of the Busselton area increases and as septic systems currently in use are replaced progressively by infill sewerage. The proponent needs to upgrade the facility to handle the additional volume of sewage and will be using that opportunity to install a substantially upgraded plant which will move the level of treatment from secondary to state of the art tertiary treatment (incorporating additional removal of nutrients), and will disinfect the effluent using ultraviolet sterilisation. The proponent will also be redesigning the wetland to ensure greater removal of nutrients.

The EPA notes that implementation of the proposal would result in an overall decrease in phosphorus loads for both Stages 1 and 2 and that Stage 1 of the proposal would also result in a decrease in nitrogen load to the Vasse Agricultural Drainage Network. Stage 2 would discharge about the same nitrogen load to the environment as the current WWTP and half the phosphorus load, even though the volume of effluent being treated would be four times as great. In addition, the upgraded WWTP would reduce nutrients entering the groundwater from septic systems as houses with septic systems are linked into the sewerage network. More than 30t/yr nitrogen and 6t/yr of phosphorus would be diverted and treated by the WWTP from septic systems alone.

The EPA notes that the Water Corporation's contribution of nutrients into Geographe Bay from the Busselton WWTP is currently less than 5% of the total annual load. In addition to reducing this by upgrading the Busselton WWTP facility, the Water Corporation will be establishing an Environmental Improvement Initiative (EII) aimed at reducing nutrient inputs to Geographe Bay from diffuse sources in the catchment, principally agricultural. This will begin to address the 95% of total nutrient load entering from these sources.

The EPA notes the need to establish broader environmental controls for the catchment area in order to reduce the amount of nutrients entering Geographe Bay from broadacre land uses. The Water Corporation's EII is focused on achieving reductions from the catchment. In addition, there is an urgent need to develop and implement the Dairy Regulations for this area and to develop strategies to reduce the loss to drainage of nutrients from horticulture and landfill sites. The EPA considers that similar environmental controls may also be required to improve water and fertiliser use in annual horticulture to reduce off-farm nutrient export.

The key environmental aspect of proposals in this area is the water quality within Geographe Bay and the potential for increased nutrients, in particular nitrogen, to affect seagrass growth and quality. The additional sewage to be treated in Stages 1 and 2 would result in the discharge of treated wastewater on a year round basis into Geographe Bay rather than only in winter as is currently the case. However, the summer nitrogen load would be small (about 2.6 tonnes in Stage 1 and 4 tonnes in Stage 2) compared with the annual load of 198 tonnes (mostly during the winter) from agricultural and other sources in the catchment. Moreover, the proposal would prevent accession of about 12 tonnes of nitrogen per year, during the summer, from groundwater contaminated by septic systems until the nutrient seepage from septic systems into the groundwater has been attenuated.

With regard to the Busselton WWTP proposal, the EPA supports the commitments made by the proponent in regard to monitoring within Geographe Bay to quantify spatial and temporal variation in marine water quality within the Special Management Area (500m each side of the discharge point of the Vasse Diversion Drain) and reporting on marine water quality in Geographe Bay within the Special Management Area. In addition the Water Corporation has made a commitment that should the desired management objectives not be met, the DEP and WRC would be notified immediately and investigations undertaken to determine whether the breach of objective is attributable to the WWTP or to other sources. If attributable to WWTP, the Water Corporation would consider a range of options to further decrease discharge of nutrients from the WWTP site, including:

- improving the performance of the IDEA plant; and/or
- constructing additional wetland on the site to further polish wastewater; and/or
- sealing the bottom of the wetland with more impervious material; and/or
- reducing local groundwater levels with trees; and/or
- diverting more treated wastewater to off-site users.

The EPA has concluded that the proposal can be implemented to meet the EPA's objectives provided the Environmental Conditions recommended in Section 4 and set out in Appendix 3 are imposed and enforced.

7. Recommendations

The EPA submits the following recommendations to the Minister for the Environment:

1. That the Minister considers the report on the relevant environmental factors as set out in Section 3.
2. That the Minister notes that the EPA has concluded that the proposal, consisting of the Stage 1 and Stage 2 upgrades, can be implemented to meet the EPA's objectives provided there is satisfactory implementation by the proponent of its commitments and the recommended Environmental Conditions.
3. That the Minister notes that the proponent will be implementing a Statewide Environmental Improvement Initiative (EII) totalling $1.75 million over five years, aimed at reducing nutrient losses from catchments, to complement upgrading of wastewater treatment facilities. The EII will commence in Busselton, where the proponent has undertaken to commit funding of up to $200 000 per year for five years, to assist dairies and other land users in the catchment to improve their nutrient and water management.
4. That the Minister imposes the Environmental Conditions and Procedures in Section 4 as set out in detail in Appendix 1 of this report.
5. That the Minister notes that the Minister, on the advice of the EPA, has agreed to the preparation of Dairy Regulations, that these should be progressed as a matter of urgency to support the Environmental Improvement Initiative, and that other similar environmental controls to improve the water quality of Geographe Bay in the long term may be required.
6. That the Minister forwards a copy of this report to the Minister for Water Resources.

Appendix 1

References

EPA (1993) *Draft Western Australian Water Quality Guidelines for Fresh and Marine Waters.* Environmental Protection Authority Bulletin 711, October 1993.

DEP 1996 Southern Metropolitan Coastal Waters Study (1991-1994). Department of Environmental Protection . Perth Western Australia.

Kadlec, R. H. And R. L. Knight. 1996. *Treatment Wetlands* Ann Arbor, Michigan: Lewis Publishers.

Kirkman and Walker 1989. Chapter 5: regional Studies - Western Australian Seagrasses. Larkum , A. W. D. Mc Comb, A. J. And Shepherd, S, A. Eds *Seagrasses: a treatise on the biology of seagrasses with special reference to the Australian region. North Holland: Elsevier; pp. 157-181.*

Kinhill (1998) *Consultative Environmental Review - Busselton Wastewater Disposal* prepared for the Water Corporation, Perth.

Water Corporation (1999) *Consultative Environmental Review - Busselton Wastewater Disposal - Response to Summary of Submissions*

Appendix 2

Submitters

Organisations:

Agriculture Western Australia
Busselton - Dunsborough Environment Centre
Busselton Senior High School
Conservation Council of Western Australia
Department of Conservation & Land Management
Department of Environmental Protection
Geocatch Catchment Council
Health Department of Western Australia
Legislative Assembly - Member for Vasse
Shire of Busselton
Siesta Park Holiday Resort
Water and River Commission

Individual:

B Biggs
J Brennan
J and L Brown
V J Bussell
I Devoy
E Donnelly
R Donelley
T Donnelly
E Earp
C M Ellis
J Elphick
J Evans
L Kingsely
P & M Langridge
M Liedermay
N Littrangton
E & M McBindie
J and J Ramshacs
N Read
A P Steele
M Strong
G Tuck
P May
A E Warburton
W & J White

Appendix 3

Recommended Environmental Conditions

and Proponent's Consolidated Commitments

Statement No.

STATEMENT THAT A PROPOSAL MAY BE IMPLEMENTED (PURSUANT TO THE PROVISIONS OF THE ENVIRONMENTAL PROTECTION ACT 1986)

WASTEWATER DISPOSAL - BUSSELTON WASTEWATER TREATMENT PLANT
QUEEN ELIZABETH AVENUE, BUSSELTON

Proposal: The staged development of the Busselton Wastewater Treatment Plant, Queen Elizabeth Avenue, Busselton to an output of 6750 cubic metres per annum, comprising Stages 1 and 2, disposal of treated wastewater from the Plant via an on-site wetland to the Vasse Agricultural Drain (A_2A, A_2) and consequently to the Vasse Diversion Drain, as documented in Schedule 1 of this Statement

Proponent: Water Corporation

Proponent Address: 629 Newcastle Street, LEEDERVILLE WA 6007

Assessment Number: 1132

Report of the Environmental Protection Authority: Bulletin 945

The proposal to which the above report of the Environmental Protection Authority relates may be implemented subject to the following conditions and procedures:

1 Implementation

1-1 Subject to these conditions and procedures, the proponent shall implement the proposal as documented in schedule 1 of this statement.

1-2 Where the proponent seeks to change any aspect of the proposal as documented in schedule 1 of this statement in any way that the Minister for the Environment determines, on advice of the Environmental Protection Authority, is substantial, the proponent shall refer the matter to the Environmental Protection Authority.

1-3 Where the proponent seeks to change any aspect of the proposal as documented in schedule 1 of this statement in any way that the Minister for the Environment determines, on advice of the Environmental Protection Authority, is not substantial, those changes may be effected.

2 Proponent Commitments

2-1 The proponent shall implement the consolidated environmental management commitments documented in schedule 2 of this statement.

2-2 The proponent shall implement subsequent environmental management commitments which the proponent makes as part of the fulfilment of conditions and procedures in this statement.

3 Proponent

3-1 The proponent for the time being nominated by the Minister for the Environment under section 38(6) or (7) of the Environmental Protection Act 1986 is responsible for the implementation of the proposal until such time as the Minister for the Environment has exercised the Minister's power under section 38(7) of the Act to revoke the nomination of that proponent and nominate another person in respect of the proposal.

3-2 Any request for the exercise of that power of the Minister referred to in condition 3-1 shall be accompanied by a copy of this statement endorsed with an undertaking by the proposed replacement proponent to carry out the proposal in accordance with the conditions and procedures set out in the statement.

4-3 The proponent shall notify the Department of Environmental Protection of any change of proponent contact name and address within 30 days of such change.

4 Commencement

4-1 The proponent shall provide evidence to the Minister for the Environment within five years of the date of this statement that the proposal has been substantially commenced.

4-2 Where the proposal has not been substantially commenced within five years of the date of this statement, the approval to implement the proposal as granted in this statement shall lapse and be void. The Minister for the Environment will determine any question as to whether the proposal has been substantially commenced.

4-3 The proponent shall make application to the Minister for the Environment for any extension of approval for the substantial commencement of the proposal beyond five years from the date of this statement at least six months prior to the expiration of the five year period referred to in conditions 4-1 and 4-2.

4-4 Where the proponent demonstrates to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority that the environmental parameters of the proposal have not changed significantly, then the Minister may grant an extension not exceeding five years for the substantial commencement of the proposal.

5 Compliance Auditing

5-1 The proponent shall submit periodic Performance and Compliance Reports, in accordance with an audit program prepared in consultation between the proponent and the Department of Environmental Protection.

5-2 Unless otherwise specified, the Chief Executive Officer of the Department of Environmental Protection is responsible for assessing compliance with the conditions, procedures and commitments contained in this statement and for issuing formal, written advice that the requirements have been met.

5-3 Where compliance with any condition, procedure or commitment is in dispute, the matter will be determined by the Minister for the Environment.

Note

1 The proponent is required to apply for a Works Approval and Licence for this project under the provisions of Part V of the Environmental Protection Act.

Schedule 1

The Proposal

Increase throughput of the Busselton Wastewater Treatment Plant to 6750 cubic metres per day and dispose treated wastewater to an on-site wetland overflowing to the Vasse Agricultural drainage system, Vasse Diversion Drain and consequently to Geographe Bay. The plant is located on Queen Elizabeth Avenue, Busselton which will discharge treated water to the Vasse Agricultural Drain (A2A and A2) and Vasse Diversion drain adjacent to Queen Elizabeth Avenue, Busselton (see Figures 1 and 2).

The wastewater will be treated in a mechanical activated sludge plant known as an Intermittently Decanted Extended Aeration (IDEA) Plant, stored in stabilisation lagoons, sand filtered, disinfected using an ultraviolet disinfection treatment system and discharged to the on-site wetlands for disposal.

The Cproponent will implement an Environmental Improvement Initiative which is a catchment-based nutrient management initiative to reduce catchment-based nutrient input, focussing on rural nutrient discharges affecting Southern Geographe Bay.

Key Characteristics Table

<table>
<tr><th>Element</th><th colspan="4">Description</th></tr>
<tr><td>Life of project</td><td colspan="4">Staged capacity increase to be implemented as follows:
Indicative Timing — Flow
Stage 1 — 2005 — 4500 m3/day
Stage 2 — 2020 — 6750 m3/day</td></tr>
<tr><td>Treatment process</td><td colspan="4">Wastewater treated to tertiary standard using an IDEA plant discharging to storage ponds. Flow is then directed to a sand filtration and UV disinfection system prior to release into the on-site wetland system, Vasse Agricultural Drainage Network and consequently to Geographe Bay. Air emissions are not expected to adversely impact as the process is controlled to minimise odour production in addition to a 500 m buffer area from the perimeter of the site boundary.</td></tr>
<tr><td rowspan="7">Estimated median and 95th percentile water quality output to the on-site wetland.</td><td>Parameter</td><td>Current 1700 m3/day</td><td>Stage 1 4500 m3/day</td><td>Stage 2 6750 m3/day</td></tr>
<tr><td>BOD (g/m3)</td><td>not measured</td><td>10</td><td>10</td></tr>
<tr><td>Suspended Solids (SS) (g/m3)</td><td>20</td><td>10</td><td>10</td></tr>
<tr><td>Total Nitrogen (TN) (g/m3)</td><td>20</td><td>10 (20)</td><td>8 (16)</td></tr>
<tr><td>Total Phosphorus (TP) (g/m3)</td><td>3.5 (8)</td><td>1 (2)</td><td>0.8 (1.6)</td></tr>
<tr><td>Thermotolerant Coliforms (cfu/100mL)</td><td>450(summer)
2000(winter)</td><td>10</td><td>10</td></tr>
<tr><td colspan="4">Note: Values are medians (values in parenthesis are 95th percentiles)</td></tr>
</table>

Disposal to Wetland		Current	Stage 1	Stage 2
	Total flow (m3/day)	1700	4500	6750
	SUMMER			
	Northern wetland	N/A	200	200
	Southern wetland	N/A	4300	6550
	WINTER			
	Northern wetland	N/A	500	500
	Southern wetland	N/A	4000	6250
	Note: Proposed reuse by Busselton Golf Club would reduce disposal to southern wetland by 1100 m3/day during the summer irrigation period.			
Disposal from Wetland	Treated wastewater from the Southern wetland will be released to the Vasse Agricultural Drain A_2 A, Vasse Sub A_2, Vasse Sub-A, and Vasse Diversion Drain adjacent to Queen Elizabeth Avenue and subsequently discharged to Geographe Bay.			
Implementation of the Environmental Improvement Initiative (EII).	Catchment-based nutrient reduction initiative focusing mainly on rural nutrient discharges from the catchments of the Buayanup River, Vasse Diversion Drain, the Vasse-Wonnerup System, and the Abba and Ludlow Rivers for a maximum of five years. The EII will focus on and support the dairy, intensive and broadacre agricultural industries (eg, vegetable growers) to implement improved nutrient and water management practices and programmes to reduce their nutrient export.			
Odour management	Low odour IDEA plant which is fully contained within the Water Corporation owned buffer.			

Summary of environmental commitments

Item		Issue	Objective	Commitment	Timing	Advising Authority	Specification
1. Proposal Implementation	1.1	Environmental Management Plan (EMP)	Demonstrate compliance with relevant marine water quality standards for each stage through the development and implementation of an Environmental Management Plan, taking into account programmes in commitments 5 and 6.	Prepare and implement an EMP demonstrating compliance with relevant marine water quality standards for Stages 1 and 2.	Prior to commissioning of the upgraded wetland and discharge of treated wastewater from the wetland; and reviewed prior to commissioning of Stage 2 of the plant	EPA	EMP developed and implemented to requirements and satisfaction of the EPA
2. Wetland and WWTP	2.1	Wetland vegetation	Minimise disturbance to existing native flora and fauna	Retain as much of the existing vegetation as possible during construction of the upgraded wetland.	Construction phase	DEP	Disturbance to area no greater than agreed with DEP officer at on-site inspection prior to commencement of works
	2.2	Water resources	Ensure efficient use of local water resources	Explore treated wastewater reuse opportunities for other off-site users	As opportunities arise, for the life of the WWTP	DEP	Discussions held with potential users of treated wastewater as opportunities arise
	2.3	Discharged wastewater quality	Ensure discharges from WWTP comply with licence requirements	Undertake ongoing monitoring of flow and water quality at the discharge point of the WWTP, the wetland, and as per the schedule of drain monitoring in the CER (specifically drain monitoring points 1, 2, 4, 5, 6, 7, 8, 9, 10, BB, BBW, and BBE), to determine the relative contribution of nutrients from the WWTP with total load discharging to sea from the Vasse Diversion Drain outlet.	Monthly, while treated wastewater is discharged to the Vasse Agricultural Drainage Network	DEP	Treated wastewater complies with DEP licence. Gauging stations constructed and surface water monitoring results reported to Water and Rivers Commission annually.

3.	**Groundwater**	3.1	Groundwater quality	Ensure superficial groundwater level and quality in the vicinity of the WWTP is maintained to environmentally acceptable standards	Install six groundwater monitoring bores around the WWTP site and conduct ongoing monitoring of groundwater levels and water quality at those bores and the nearest down-aquifer bore potentially affected by the WWTP operation. Install and monitor a nest of monitoring bores at the northern edge of the site to determine the vertical distribution of any contamination.	Install before commissioning, and then monitor annually for the life of the WWTP	DEP	Monitoring bores installed and annual groundwater monitoring results reported to DEP
					Implement one or more of the following options to decrease discharge of nutrients from the WWTP site: • improve the performance of the IDEA plant; • sealing the bottom of the wetland with more impervious material; • reducing local groundwater with trees; • diversion of treated wastewater to off-site users; and/or • other suitable measures as agreed, if a deterioration in existing groundwater quality is detected by routine monitoring		DEP	Action taken to prevent infiltration of treated wastewater if problem identified
4.	**Catchment management**	4.1	Environmental Improvement Initiative	Work towards overall reduction of nutrient loads entering Southern Geographe Bay [1].	Establish an Environmental Improvement Initiative for the Southern Geographe Bay Coastal Catchment	Up to a period of 5 years.	Water Corporation	Provision of up to $200,000 annually to establish a trust from which suitable projects are funded
5.	**Marine water**	5.1	Marine water quality monitoring	Quantify spatial and temporal variation in marine water quality within the Special Management Area [2]	Undertake ongoing monitoring of, and report on, marine water quality in Geographe Bay within the Special Management Area [2]	Every six months, for the life of the WWTP	DEP	Marine water monitoring results reported to DEP annually.

				If desired management objectives are not met, the DEP and WRC will be notified immediately. In the first instance, it will be important to determine whether breach of the objective was attributable to operation of the WWTP or to other point or diffuse contributions to Geographe Bay [1]. If it was determined that unacceptable levels of nutrients were being discharged into Geographe Bay from treated wastewater, the Water Corporation would consider and, following discussion with the DEP, implement one or more of the following options to decrease discharge of nutrients from the WWTP site: • improve the performance of the IDEA plant; • construct additional wetlands on the site to further polish the wastewater; • sealing the bottom of the wetland with more impervious material; • reducing local groundwater with trees; • divert treated wastewater to off-site users; or • other suitable measures as agreed.			
6. Seagrass	6.1	Seagrass management	Ensure that there is no loss of seagrass as a result of release of treated wastewater to drain through excessive epiphytic fouling in the area influenced by the Vasse Diversion Drain outflow	Undertake ongoing monitoring of, and report on epiphytic (or periphytic) biomass in Geographe Bay within the Special Management Area [2].	Annually, during the summer disposal period to Geographe Bay	DEP	Marine environmental monitoring results reported to DEP annually.
				Undertake aerial monitoring of the spatial distribution of seagrass meadows within 1km of the Vasse Diversion Drain outlet.	Every four years for the life of the WWTP discharge to Geographe Bay.	DEP	No decline in seagrass meadows as a result of WWTP operations

ɔur complaints	As required, for the life of the WWTP	DEP	No unacceptable odours emanating from the WWTP operations outside the 500m buffer area
oring of mosquito uthern and northern	Fortnightly during summer breeding season, for the life of the wetlands	Health Department of Western Australia	Fortnightly mosquito monitoring data provided to Health Department of Western Australia
tions at the WWTP	During summer breeding season, for the life of the wetlands	Health Department of Western Australia	Mosquito levels at WWTP site below guidelines specified by the Health Department of Western Australia
ction if the nic bacteria in the d within the Special cceptable as a on and operation of	For the life of the WWTP	DEP	The concentrations of pathogenic bacteria comply with licence requirements
ction to reduce ater leaving the IDEA stated in the	For the life of the WWTP	DEP	The concentrations of pathogenic bacteria comply with the objective and the commitment
ic use of the wetlands -maintained wetlands	Construction phase and for the life of the WWTP	Water Corporation	Groups visiting the wetlands
sthetically attractive lanting trees around nce	Construction phase and for the life of the WWTP	Water Corporation	Landscaping plans implemented

10. Auditing and reporting	10.1	Auditing	Confirm WWTP and wetlands perform as expected, and commitments are implemented each stage of plant	Conduct regular audits of the performance of the WWTP and wetland	Annually or as required by regulator	DEP	Audit reports presented to the DEP as required
	10.2	Reporting	Report to the community	Report to the Busselton community on a range of issues, including providing water quality monitoring results (groundwater bores, drains, and the marine environment), mosquito counts at WWTP site, odour complaints, and the progress being made with the Environmental Improvement Initiative.	Quarterly	Water Corporation	Quarterly reports submitted to the Shire of Busselton and published in local newspaper

Note:

1 Landholders, Agriculture WA and Water and Rivers Commission also have responsibility for influencing the appropriate management of nutrients in catchments discharging to Southern Geographe Bay.

2 The Special Management Area is defined as the area up to 500m along the Busselton Beach either side from the discharge point of the Vasse Diversion Drain, and up to 300m offshore.

Appendix 4

Proponent's Response to Summary of Submissions

BUSSELTON WASTEWATER DISPOSAL

CONSULTATIVE ENVIRONMENTAL REVIEW

January 1999

Part A: REVISIONS TO THE PROPOSAL

Part B: RESPONSE TO PUBLIC SUBMISSIONS

Prepared by:

WATER CORPORATION

629 Newcastle Street
Leederville, WA 6007
Telephone (08) 9420 2420, Facimile (08) 9420 3200

CONTENTS

Part A: Revisions to the proposal

Response to submissions on the proposed Busselton Wastewater Treatment Plant (1132)

Submissions were received by the Environmental Protection Authority (EPA) from the following:

- Agriculture Western Australia;
- Busselton-Dunsborough Environment Centre;
- Busselton Senior High School;
- Conservation Council of Western Australia Inc;
- Department of Conservation & Land Management;
- Department of Environmental Protection;
- Health Department of Western Australia;
- Shire of Busselton;
- Water & Rivers Commission;
- Bernie Masters MLA, Member for Vasse; and
- 25 individuals

The proponent was asked to address all issues and questions raised by these submissions to demonstrate how the relevant EPA objectives shown in the following table will be achieved.

Environmental Factors and Preliminary EPA Objectives

Environmental Factor	Preliminary EPA Objective
Surface water quality - general	Maintain or improve the quality of surface water to ensure existing and potential uses are protected.
Surface water quality - sewage	Wastes should be contained and isolated from groundwater and surface surrounds. (liquid waste)
Marine water quality	Meet requirements of the EPA's Environmental Water Quality Objectives (EQO).
Groundwater - general	Maintain or improve ground water quality
Groundwater - contamination	Water on or beneath the site, or discharging from the site, should not have an adverse impact on people or the environment.
Odour	Odours emanating from the proposed development should not adversely affect the welfare and amenity of nearby land users.
Seagrass	Maintain the ecological function, abundance, species diversity and geographic distribution of seagrasses.
Marine Fauna	
Public Health and Safety	Risk should be as low as reasonably achievable and comply with acceptable standards.
Mosquitoes	(i) Mosquito numbers on the site should not adversely affect the health, welfare and amenity of future residents; and (ii) Ensure the breeding of mosquitoes is controlled to the satisfaction of the Health Department without adversely affecting other flora and fauna.
Nutrients	Ensure that nutrient discharged from the development meets water quality standards to protect the estuary and adjacent coastal waters.
Recreation	Not to compromise recreational uses of the area, as developed by planning agencies.

1 Introduction

Since the publication of the CER in March 1998, the Water Corporation has made a number of changes to the original proposal to upgrade the Wastewater Treatment Plant (WWTP) and wetland, and to release treated wastewater to existing drains adjoining the WWTP site. These changes have been made in response to:

- public submissions on the CER;
- requests from potential users of treated wastewater;
- comments received during the three month community consultation process managed by the Corporation from April – June 1998; and
- requests for additional information and issues raised by the CEO of the Department of Environmental Protection, at a meeting held to discuss the project. Specifically the CEO requested the Corporation to address the risks to water quality associated with summer release of treated wastewater to the drains, and plant/process failures.

The changes to the proposal include modifications to the design of the constructed wetland, increased levels of bacterial treatment, more information about the risks and impacts of release of treated wastewater to drains, and changes to the environmental commitments proposed by the Corporation.

2 Changes to the proposal

2.1 WASTEWATER TREATMENT PLANT

The Water Corporation will further improve the disinfection of the treated wastewater at the outlet of the IDEA plant beyond the commitments made in the CER. With the improvements, the treated wastewater entering the wetland would have a median of 10 thermotolerant coliform bacteria colony forming units (cfu)/100mL, not 150 cfu/100mL as proposed in the CER. This improvement means that the bacterial quality of the tertiary treated wastewater leaving the treatment plant will be better than National ANZECC standards for water quality at which it is safe to ingest shellfish harvested locally.

2.2 HOLDING LAGOONS

The existing stabilisation lagoons will be converted into treated wastewater storage and biosolids storage lagoons as described in Section 3.3 of the CER document.

In the event of a breakdown of any part of the system or due to power failures, some of the lagoons on site will be able to store wastewater. Two existing wastewater treatment lagoons on the western side of the WWTP site will be emptied and made available for emergency storage. An additional pond will be created between these ponds to provide additional emergency storage. These lagoons have capacities of approximately 4,850, 7,644, and 5,016m3 respectively and will collectively be able to store between 2 and 3.9 days of inflowing wastewater at flows of 4,500-9,000m3/d. Additional storage may be available depending on the status of the biosolids storage lagoon, the treated wastewater storage pond and the constructed wetland (refer Figure 3.1 and Tables I and II, in Section 3). It is estimated that the proposed wetland will have a detention time of between 7.6 and 9.6 days in 2005, and between 3.6 and 4.0 days in 2035.

The Water Corporation is confident that more than sufficient capacity will be provided on site to accommodate emergency storage requirements resulting from any power outage, process failure, or adverse climatic event. This issue is addressed in more detail in responses to questions 1.3.13, 1.3.14, 6.5.1, and 6.5.2 in Part B of this document.

2.3 REUSE OF TREATED WASTEWATER

The option of irrigating the 37-ha Busselton Golf Course and its 3-ha turf farm with treated wastewater was raised in the CER, but at that time the Busselton Golf Club had not made a commitment to the project. Since the publication of the CER, the Water Corporation and the Busselton Golf Club have continued negotiations aimed at detailing mutually satisfactory arrangements to supply and reuse the treated wastewater. The Busselton Golf Club has expressed considerable interest in the proposal, but no agreement has been reached to date.

In the event that the Busselton Golf Club decides to use treated wastewater to satisfy its summer irrigation requirements, the Water Corporation will pump treated wastewater along a pipeline to the golf course located some 4 km south-east of the WWTP. The Busselton Golf Course has an estimated peak water demand of 1,800 m^3/d and an average daily demand of 1,250–1,540 m^3/d over a six month summer period. In order to determine the impacts of this proposal, it has been assumed that wastewater would be used over a six month summer period (November to April) with an average daily flow of 1,100 m^3/d.

The Water Corporation will also construct a storage dam to the south of the existing Sludge Lagoon No. 1 as part of this WWTP upgrade to facilitate reuse of treated wastewater generally, whether or not the Busselton Golf Club agrees in the short term to take treated wastewater to irrigate the golf course. This 4,500 m3 balancing storage dam will store filtered and disinfected wastewater from the IDEA plant. Wastewater from the balancing storage dam will be pumped on an as-required basis to the Busselton Golf Course and to any other reuse scheme, and the excess wastewater will be released into the constructed wetland.

2.4 CONSTRUCTED WETLAND

The constructed wetland has been redesigned for the following reasons:

- to reduce the extent of site and vegetation disturbance, while maintaining the nutrient-stripping performance of the wetland;
- to improve the initial nutrient-stripping performance of the wetland; and
- to retain the maximum amount of native vegetation on site.

This is discussed in detail in Section 3.

3 Constructed wetland

This section details the design changes, the treatment performance of the revised wetland design, and subsequent nutrient loads to drain from the WWTP site, together with an assessment of the environmental impacts of the revised nutrient loadings.

3.1 DESCRIPTION

The Water Corporation proposes to upgrade the southern part of the existing wetland and to release the majority of the treated wastewater to this area (see Figure 3.1). The reasons for choosing to upgrade this area as a constructed wetland to provide the final polish for the treated wastewater are:

- the area already has a direct flow path which minimises the extent of earthworks necessary to achieve the most effective nutrient removal;
- this area contains the best existing native wetland vegetation and would provide better initial nutrient-stripping performance, compared with the original proposed constructed wetland;
- the native vegetation in this area is well adapted to high water levels and flooding, and would not be adversely affected by raising the water level.

It is also proposed to maintain and improve the degraded area to the west of the existing treatment lagoons and north of the proposed constructed wetland by diverting a small amount of treated wastewater to maintain the existing winter water levels. This northern wetland area would be unbunded and allowed to dry out in summer, in order to re-establish a more natural semi-permanent wetland area, similar to the sumpland which characterised the site prior to the Water Corporation occupancy.

The southern wetland would be created by increasing the height of the existing bunds along the southern and eastern boundaries, and constructing new bunds along the northern and western edges.

The proposed southern wetland has the features shown in Table I.

Table I Design features of southern constructed wetland

Parameter	Winter	Summer
Total area (ha)	7.55	7.55
Top water level (m AHD)	7.0	7.0
Total volume (m^3)	48,449	48,449
Vegetated area (ha)	7.45	7.45
Vegetated volume (m^3)	46,834	46,834
Detention time (2005) (d)	7.61	9.63
Detention time (2020) (d)	4.87	5.63
Detention time (2035) (d)	3.58	3.97

The features of the northern wetland are shown in Table II. This wetland would have an inundated area with an expected maximum depth of 1.7 metres and an average depth of 0.3 metres.

Table II Design features of northern wetland

Parameter	Winter
Total inundated area (ha)	2.71
Top water level (m AHD)	6.5
Total wetted area (ha)	4.86
Total catchment area (ha)	10.21
Detention time (d)	8.8 - 18.4

3.2 ESTABLISHMENT

The existing natural surface contours in the southern wetland area provide for the following range of water depths:

- shallow water zone (0 to 0.2 m water depth) which would support a wide range of rush/sedge species and currently contains the native sedge *Bolboschoenus caldwellii*;
- deeper water zone (0.2 to 0.4 m water depth) which would support a range of rush/sedge species and be planted with *Baumea articulata* and *Schoenoplectus validus*;
- deep water zone (0.4 to 0.9 m water depth) which would support a limited range of rush/sedge species and be planted with *Schoenoplectus validus*; and
- open water zone (> 0.9 m water depth) which is located just before the wetland outlet and would provide some open water to be utilised by aquatic bird species.

Baumea articulata and *Schoenoplectus validus* would be established by hand seeding. The recommended planting density is 4 plants per square metre to prevent weed incursion. Planting would occur in dense 10 m wide bands, spaced 20 m apart perpendicular to the flow path in order to redistribute flow across the full 125 m width of the wetland.

4 Return of treated wastewater to the environment

It is proposed to distribute the majority of the treated wastewater from the WWTP into the southern constructed wetland, with the remainder to the northern wetland. After passing through the northern and southern wetlands, treated wastewater will be released year-round to drain. The Corporation is hopeful that at least a part of the flow to the drain in summer will be diverted to the Busselton Golf Course and other reuse opportunities in the future.

Section 4.1 describes the water quality aspects and impacts on the drain system and the nearshore marine environment, resulting from year-round release of the highly treated wastewater, and the associated redesign of the wetland system. Section 4.2 describes the water quality impacts on the drain system and nearshore marine environment of diverting part of the summer flow to the Busselton Golf Course.

4.1 YEAR-ROUND RELEASE OF TREATED WASTEWATER TO DRAINS

This section describes the impacts of the changes to the Busselton WWTP upgrade proposal on the quality of the treated wastewater and nutrient loads released year-round into the drains, and the consequent environmental impacts associated with this strategy for returning the community treated wastewater to the environment.

4.1.1 Wastewater flows

The predicted flows to the upgraded wastewater treatment plant, and the volumes to be directed to the southern and northern wetlands, are shown in Table III.

Table III Predicted flows from the WWTP

Flows (m^3/d)	1997	2005	2020	2035
Total flow	1800	4500	6750	9000
Summer flow to northern wetland	-	200	200	200
Summer flow to southern wetland	1800	4300	6550	8800
Winter flow to northern wetland	-	500	500	500
Winter flow to southern wetland	1800	4000	6250	8500

4.1.2 Wastewater quality

Table IV estimates the likely quality of treated wastewater leaving the southern wetland, based on the influent having the target IDEA plant treated wastewater

quality as described in the CER (except for coliform bacteria where the Corporation is committed to producing a final treated wastewater with a much lower median value of 10cfu/100ml).

Table IV **Predicted median and 95th percentile wastewater quality leaving the southern wetland**

Parameter	Season	Year 2005	Year 2020	Year 2035
Biological Oxygen Demand (BOD) (g/m^3)	Winter	5.0	6.0	7.0
	Summer	5.0	6.0	7.0
Suspended solids (g/m^3)	Winter	4.0	4.0	4.0
	Summer	6.5	6.5	6.5
Total nitrogen (g/m^3)	Winter	5.0 (9.0)	5.0 (9.5)	4.0 (7.0)
	Summer	3.5 (5.0)	3.5 (5.0)	3.0 (5.5)
Total phosphorus (g/m^3)	Winter	0.6 (1.1)	0.5 (1.1)	0.4 (0.8)
	Summer	0.6 (1.0)	0.6 (1.0)	0.4 (0.8)
Faccal coliforms (cfu/100 mL)	All year	300	300	300

Based on median wastewater quality leaving the IDEA plant
Summer average daily (21°C) and winter average daily (13°C) temperatures used.
Anticipated 95th percentile values are in parenthesis (based on 95th percentile concentrations leaving the IDEA plant).

The water quality leaving the WWTP site from the southern wetland is virtually the same high quality as predicted with the constructed wetland originally proposed in the CER. It is evident from modelling studies that in the worst case, there will be a slight increase in the concentrations of nitrogen and phosphorus of the polished treated wastewater leaving the southern wetland, compared to that presented in the CER (Table 3.2). The quality of wastewater leaving the northern wetland is likely to be better than that leaving the southern wetland.

However the data reported in Table IV are conservative and it is possible that total nitrogen levels in the treated wastewater leaving the southern wetland could approach background levels of around 1.5 g/m^3. However, the performance of the wetland cannot be guaranteed, and an extensive period of operation (> 3 years) is required to confirm the modelled predictions, during which time nutrient levels leaving the wetland could exceed those listed in Table IV. Nevertheless, the performance of the southern wetland will be significantly better than that of the existing wetland, and should greatly improve the quality of the treated wastewater discharged to the drains.

4.1.3 Nutrient loadings

Table V shows current and anticipated future summer and winter nutrient load contributions from the WWTP to the Vasse Diversion Drain, based on the concentrations shown in Table IV and wastewater flows estimated using a water balance model. This table also presents percentage changes from 1997 nutrient loads.

The overall impact of the revised wetland design is to very slightly increase nutrient loadings to the Vasse Diversion Drain from the community's treated wastewater, compared with the loadings under the original WWTP upgrade proposal. However the Corporation is confident that, as the nutrient loadings from the original WWTP

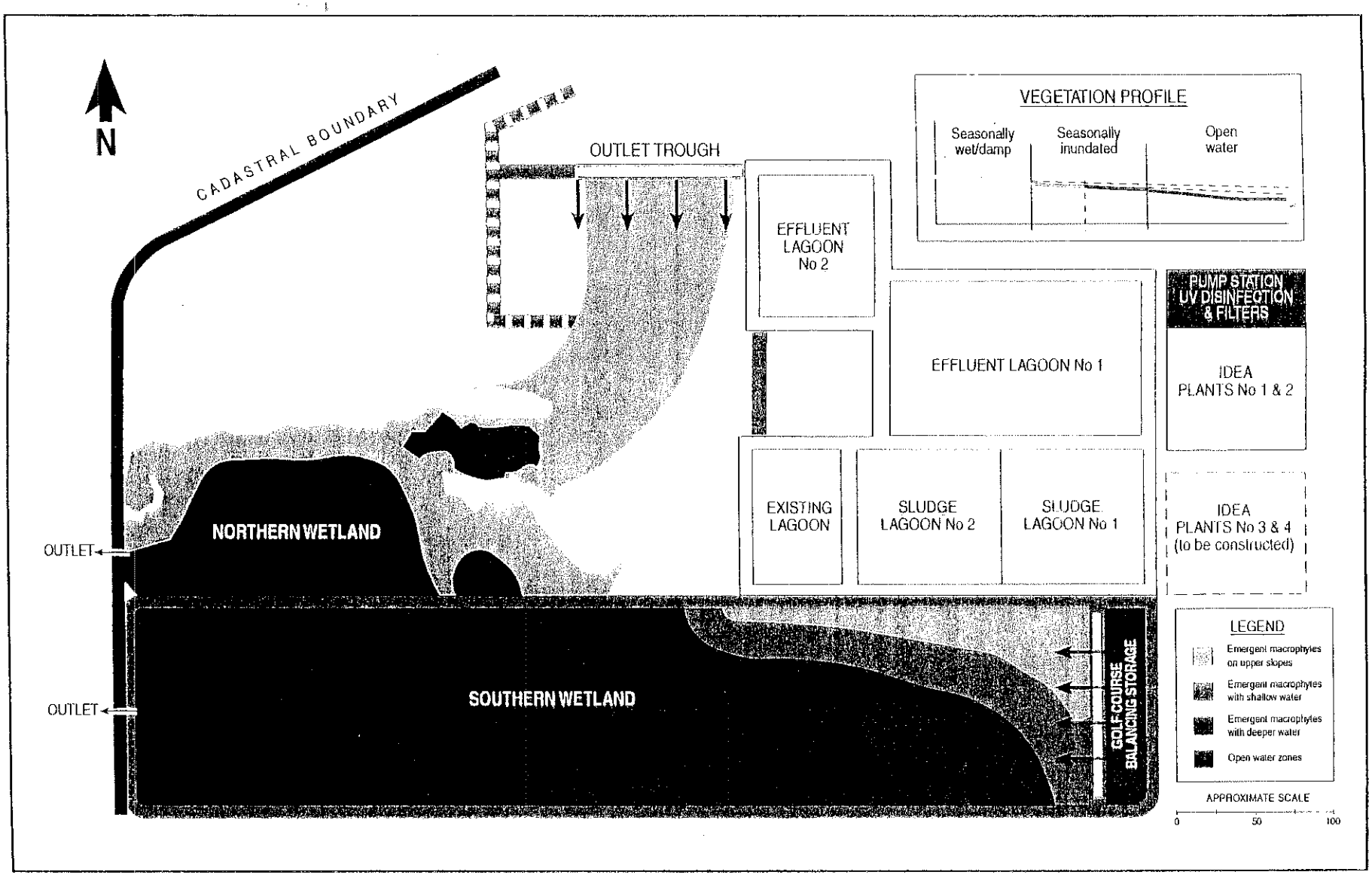


Figure 3.1 Proposed vegetation zones for constructed wetlands

proposal were predicted to be very low, the marginal increase will not adversely impact on drain and nearshore marine water quality.

As discussed in the CER, the initial upgrading of the WWTP and the southern and northern wetlands will significantly reduce annual nitrogen and phosphorus loads (compared with the present) to the year 2005. As the flow rate of treated wastewater from the WWTP increases post-2005, and the detention time in the wetlands decreases, nutrient loads will generally increase over time, generally as described in Table 6.1 in the CER.

Compared with the nutrient loads for the original proposal (discussed in Table 6.1 in the CER) the revised wetland design is expect to:

- increase annual total nitrogen loads in 2020, but only by 1.1t. This represents about 15% more than the existing 1997 nitrogen loads of 8.9t/annum.
- further increase annual total nitrogen loads in 2035 compared with 2020 levels, but only by 0.7t. This assumes that there would be no further process upgrades to improve the level of treatment, which is unrealistic.
- significantly reduce annual phosphorus loads from 2.3 t/annum in 1997 to 1.3t/annum in 2020. This is only 0.1 t/annum (or 100kg) more than would have been achieved by the original constructed wetland proposed in the CER.
- maintain the very low 2020 annual phosphorus loads through to 2035, which is an improvement over the original proposal. While the revised wetland is expected to maintain TP loads at 1.3t/annum, the original proposal would have seen a slight increase to 1.6t/annum by 2035.

In winter 2020, the WWTP may contribute 5% of the total nitrogen and less than 7% of the total phosphorus to the Vasse Diversion Drain. In summer, with low flows in the drains, the WWTP is estimated to contribute approximately 77% of the total nitrogen and 37% of the total phosphorus to the drain. However, the total nutrient loading to the Vasse Diversion Drain in summer is minimal when compared with winter.

This analysis demonstrates that the effect of revising the wetland design on annual total nitrogen and phosphorus loads is negligible, and represent a statistically undetectable contribution to the Vasse Diversion Drain, compared with the very large catchment contributions of nutrients.

In addition the analysis assumes that there will be no further process upgrades beyond 2005 to improve the level of treatment and hence improve water quality, particularly for nitrogen. However this is unlikely to be the case, and the Corporation fully expects to implement the latest technological advances for its WWTPs in the future where monitoring shows that water quality may deteriorate to unacceptable levels.

Table V Estimated nutrient loads to the Vasse Diversion Drain and percentage change from 1997

Source	Summer			Winter			Total		
	tonnes	%	% change from 1997	tonnes	%	% change from 1997	t/a	%	% change from 1997
				Total Nitrogen					
Vasse Diversion Drain	1.3	27	0.0	185	91	0.0	186.3	89	0.0
Other	0.1	1.9	0.0	12.9	6.4	0.0	13.0	6.3	0.0
WWTP - 1997 (Average flow = 1,700 m^3/d)	3.4	71	0.0	5.6	2.7	0.0	8.9	4.3	0.0
Total - 1997	**4.8**	**100**	**0.0**	**203.5**	**100**	**0.0**	**208.3**	**100**	**0.0**
WWTP - 2005 (Average flow = 4,500 m^3/d)	2.6	65	-23	4.2	2.1	-25	6.8	3.3	-24
Total - 2005	**4.0**	**100**	**-17**	**202.1**	**100**	**-1**	**206.1**	**100**	**-1**
WWTP - 2020 (Average flow = 6,750 m^3/d)	4.0	74	18	6.2	3.0	11	10.2	4.9	15
Total - 2020	**5.4**	**100**	**12**	**204.1**	**100**	**0.3**	**209.5**	**100**	**0.5**
WWTP - 2035 (Average flow = 9,000 m^3/d)	4.6	77	35	6.6	3.2	18	11.2	5.3	26
Total - 2035	**6.0**	**100**	**25**	**204.5**	**100**	**0.1**	**210.5**	**100**	**1**
				Total Phosphorus					
Vasse Diversion Drain	1.0	41	0.0	14.0	88	0.0	15.0	82	0.0
Other	0.1	2.9	0.0	1.0	6.1	0.0	1.1	5.7	0.0
WWTP - 1997 (Average flow = 1,700 m^3/d)	1.3	56	0.0	1.0	6.0	0.0	2.3	12.5	0.0
Total - 1997	**2.4**	**100**	**0.0**	**15.9**	**100**	**0.0**	**18.4**	**100**	**0.0**
WWTP - 2005 (Average flow = 4,500 m^3/d)	0.4	29	-69	0.5	3.2	-50	0.9	5.5	-61
Total - 2005	**1.5**	**100**	**-37**	**15.5**	**100**	**-2.5**	**17.0**	**100**	**-8**
WWTP - 2020 (Average flow = 6,750 m^3/d)	0.7	39	-46	0.6	4.0	-40	1.3	7.5	-43
Total - 2020	**1.8**	**100**	**-25**	**15.6**	**100**	**-2.0**	**17.4**	**100**	**-5.5**
WWTP - 2035 (Average flow = 9,000 m^3/d)	0.6	37	-54	0.7	4.2	-30	1.3	7.3	-43
Total - 2035	**1.7**	**100**	**-29**	**15.7**	**100**	**-1.1**	**17.4**	**100**	**-5.5**

Notes: *Based on a water balance model and median concentrations leaving the WWTP and wetlands*

Summer = November–April. Winter = May–October.

Assumes no change in nutrient loads from sources other than the WWTP and assumes no unsewered contributions from 2005 onwards.

Some percentages may be marginally affected by rounding.

4.1.4 Environmental impacts and risks of year-round release of treated wastewater to drains

The issues which need to be addressed are environmental impacts and risks associated with microbes and nutrients transported from the outlet to the wetland, into the drain system, and downstream into the nearshore environment of Southern Geographe Bay.

It is important to understand that the current (1998) discharges of treated, but undisinfected wastewater have no measurable adverse impact on the water quality of the Vasse Diversion Drain and Geographe Bay. This is because summer flows from the WWTP do not reach the Diversion Drain, and winter flows comprise only a very minor proportion of the water and nutrients entering the Diversion Drain and the nearshore marine environment of Geographe Bay.

4.1.4.1. Microbes

As the amended proposal states that thermo-tolerant faecal coliforms will be reduced to a median level of 10 cfu/100 mL at the point of release from the IDEA plant, no risk of infection from the plant releases will occur under normal operating conditions. This assertion is reinforced by current drain monitoring (see Figure 1 in Section1.1 in Part B: Response to Specific Questions) which show that the relatively high thermo-tolerant coliform concentrations discharged from the existing plant, decline consistently and markedly with distance downstream in the drain, and that the recreational contact criterion of 150 cfu/100mL is already easily met within the estuarine section of the Vasse Diversion Drain in summer.

Another issue raised by the community was the potential for regrowth of faecal bacteria in the drainage system. Advice from the Health Department states:

"Water is not an ideal medium for pathogenic bacteria of faecal origin. Many faecal bacteria will persist in water, but whether they multiply or not will depend on the state of the water. Nutrients, organic matter and suspended solids will encourage longer survival or growth."

It must be stressed that the IDEA plant will produce a very high quality treated wastewater with greatly reduced levels of suspended solids, organic matter and nutrients compared with the treated wastewater flowing from the existing plant (see table IV). Because of this, the Water Corporation is confident that regrowth of pathogenic bacteria of faecal origin in the drain or the ocean in summer will not occur as a result of the Water Corporation's releases to the drains.

In addition, the response to question 1.2.4 incorporates advice from the Health Department of WA, which states that infection of the wetland by waterbirds and other fauna poses minimal health risk to humans.

The Water Corporation's commitment to significantly reduce the level of faecal coliforms from a median value of 150cfu/100mL to only 10cfu/100mL, has resulted in advice from the Health Department of WA stating that it does not object to the release of the treated wastewater year round to the drainage system.

4.1.4.2 Nutrients and the Risk of Algal Blooms

At present treated wastewater does not reach the Vasse Diversion Drain in summer as it infiltrates and evaporates within the current informal wetland and in the minor drain tributaries (the Vasse A2A and the Vasse Sub-A Drains) upstream of the Vasse Diversion Drain. Under current levels of treatment, the treated wastewater causes algal blooms in the ponds of the existing WWTP, and some of this suspended algal chlorophyll is discharged from the informal wetland to Drain A2A, a tributary of the Vasse Sub-A Drain. Observations show that this suspended chlorophyll does not move far beyond the end of the A2A Drain (sampling site 4), and that it is largely replaced by attached macroalgae in the Vasse Sub-A Drain. This also results in a clear treated wastewater stream flowing down the drain system from the point where the change in form of algal material occurs.

The commissioning of the new IDEA plant will have an immediate very beneficial impact on water quality, with significantly less nitrogen and phosphorus flowing from the wetland into the drainage system. Flows of wastewater to the drains will increase with time, and at some stage treated wastewater from the IDEA plant will 'break through' into the estuarine part of the Vasse Diversion Drain in summer. Because of relatively poor knowledge of the local groundwater system, it has not been possible to quantitatively determine the daily flow rate at which break through flow into the Diversion Drain will occur. Operational monitoring of the existing plant reveals that the peak daily summer flow discharged to the drains (1700 m3/day) does not reach the Vasse Diversion Drain. It is conservatively assumed that a daily flow of 2500 m3/d will be absorbed or evaporated before breakthrough flows would occur. This figure will be confirmed by monitoring, and reported to the EPA/DEP as part of the normal reporting cycle.

As future household sewer connections to the wastewater system will take time, it is estimated that the daily flow of 4500 m3/d will not be reached before 2005. At this flow rate, water quality in the drain in 2005 will be greatly improved compared with the existing situation: the nitrogen load to the drain is estimated to be 17% lower than at present, and the summer phosphorus load will be about 69% lower than at present (see table V). Nutrient loads are unlikely to increase beyond these figures, even as wastewater flows to the drains increase with time, because of progressive implementation of process improvements and plant upgrades beyond 2005 (Table V).

The Water Corporation is very confident that the water quality in the tributary drains during summer will be much better than at present as a result of the improved wastewater quality. The only residual concerns are whether summer flows (and nutrients) entering the estuarine part of the Vasse Diversion Drain will cause nuisance algal blooms, and whether such flows will adversely affect water quality in the ocean off the mouth of the drain in summer.

With a daily release of 4500 m3/d from the IDEA plant, only about 2000m3/d is likely to flow into the estuarine part of the Vasse Diversion Drain based on the current observed losses through the wetland and drainage system. Calculations have been made to assess the effects of continuous inflow of highly treated wastewater to the Vasse Diversion Drain in summer.

Calculations show that, for the worst case where the inflowing concentration of treated wastewater entering the estuarine part of the Vasse Diversion Drain is assumed to be 3.5mg/L N and 0.6mg/L P in summer (ie the median concentrations of nutrients in the treated wastewater at the point of release from the southern wetland), the concentrations will increase from the present level of about 1.7mg/L N and 0.2mg/L P to close to 3.5mg/L N and 0.6mg/L P. The calculations also show that these new concentrations in the estuarine part of the drain will be reached about a month after the flow reachs the estuarine part of the drain.

However the Corporation is confident that actual nutrient concentrations experienced in the estuarine part of the Vasse Diversion Drain as a result of break through flows from the new IDEA plant and revised wetland will be virtually the same as the existing background level of about 1.7mg/L N and 0.1mg/L P, and in the worst case will only be slightly higher than this background value. This is because the concentrations of nutrients in the treated wastewater stream at the point of entering the estuarine part of the Vasse Diversion Drain will be much lower than at the point of release from the wetland, nearly 3km upstream.

Current monitoring data demonstrates that nutrients are rapidly attenuated down stream in the drain system (Figures 4.1 and 4.2) by such likely processes as nutrient take-up by in-drain vegetation and denitrification. In summer the median nutrient concentrations in the treated wastewater discharged from the existing informal wetland are 17mg/L N and 3mg/L P, and reduce consistently down drain to about 5mg/L N and 1mg/L P nearly 3km downstream in the drain, before the flow ceases.

The Corporation has every confidence that nutrient uptake down stream in the drain system will continue to reduce nutrient levels in the future. With the commissioning of the new IDEA plant and revised wetland in place, the Corporation expects that nutrient concentrations in summer will attenuate down the drain from about 3.5mg/L N and 0.6mg/L P exiting the wetland, to about 1.7mg/L N and 0.2mg/L P ie the existing summer background levels in the estuarine part of the Vasse Diversion Drain.

However it is possible that total nitrogen levels in the treated wastewater leaving the southern wetland could approach background levels of around 1.5mg/L, as the Corporation has used conservative estimates of the nutrient removal efficiency of the southern wetland. If this is the case, then nutrient attenuation down stream in the drain will result in nutrient concentrations of the treated wastewater flowing into the estuarine part of the Vasse Diversion Drain which are lower than the background level of about 1.7mg/L N.

However if the extent of nutrient attenuation down the drain system is not as efficient as expected, some minor increase in nutrient levels may occur in the estuarine part of the Vasse Diversion Drain. This would be unlikely to cause algal blooms because the water in that part of the drain is coloured, and therefore not conducive to growth of algae. Current monitoring shows that summer nutrient concentrations off the mouth of the Vasse Diversion Drain are not of concern.

The Corporation is confident that nutrient levels will not build up in the estuarine part of the Vasse Diversion Drain and will therefore not have an adverse environmental impact on water quality in both the drain and in the nearshore marine

environment, as a result of break through flows of highly treated wastewater from the new IDEA plant and revised wetland.

The Corporation is committed to implementing a rigorous monitoring and reporting program for the Busselton WWTP upgrade as detailed in the CER. As part of this the Corporation will monitor the effects of the releases to the Vasse drainage system, and in the unlikely eventuality that nutrient levels do increase, any tendency to algal problems will be detected early. If these are shown to be from the WWTP, the Corporation will take action to rectify the problem. The Department of Environmental Protection can also amend the licence conditions at any time to ensure appropriate action by the Corporation.

Figure 4.2: Variation of Median Total Phosphorus concentrations in the drain system with distance downstream from the WWTP

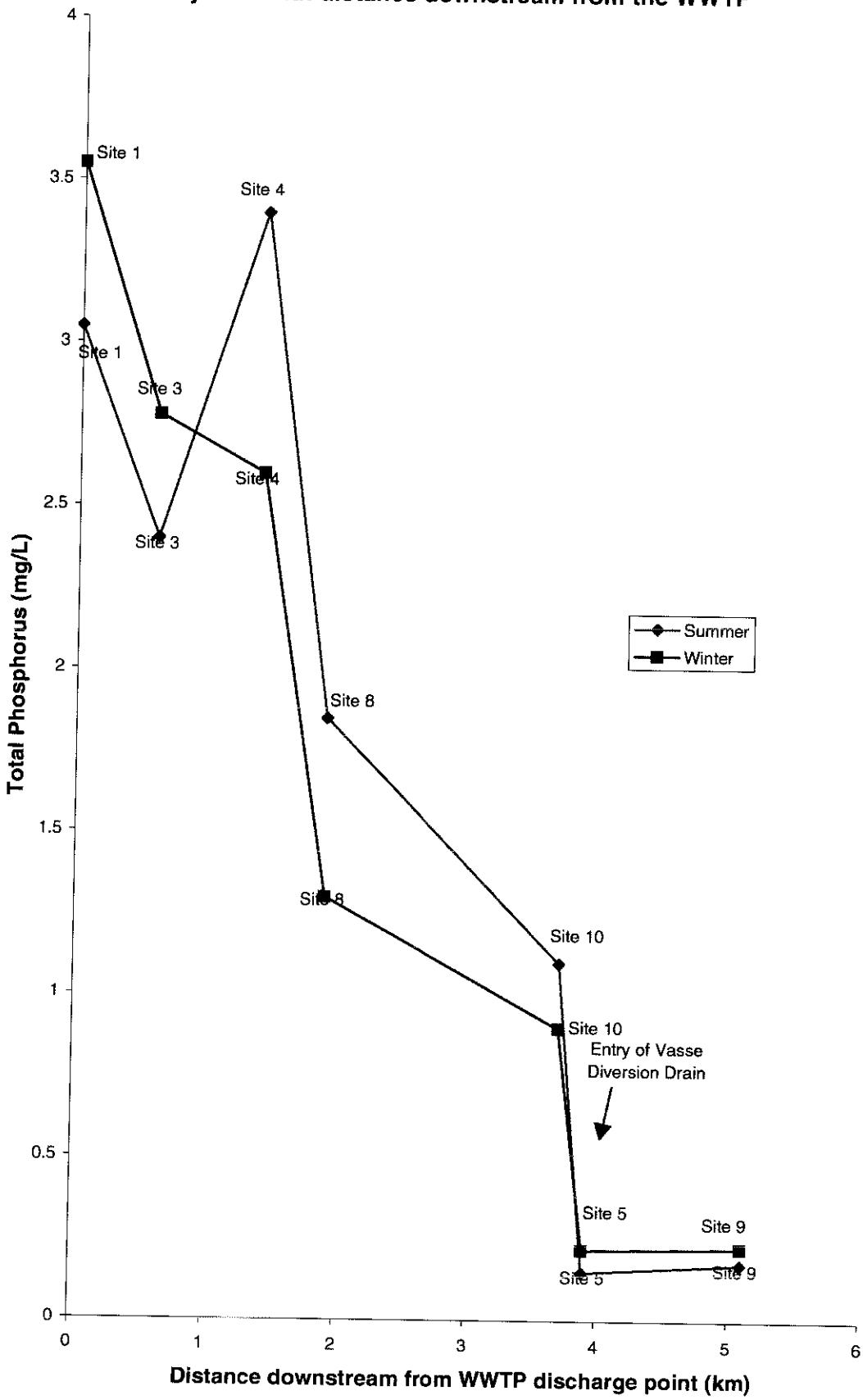
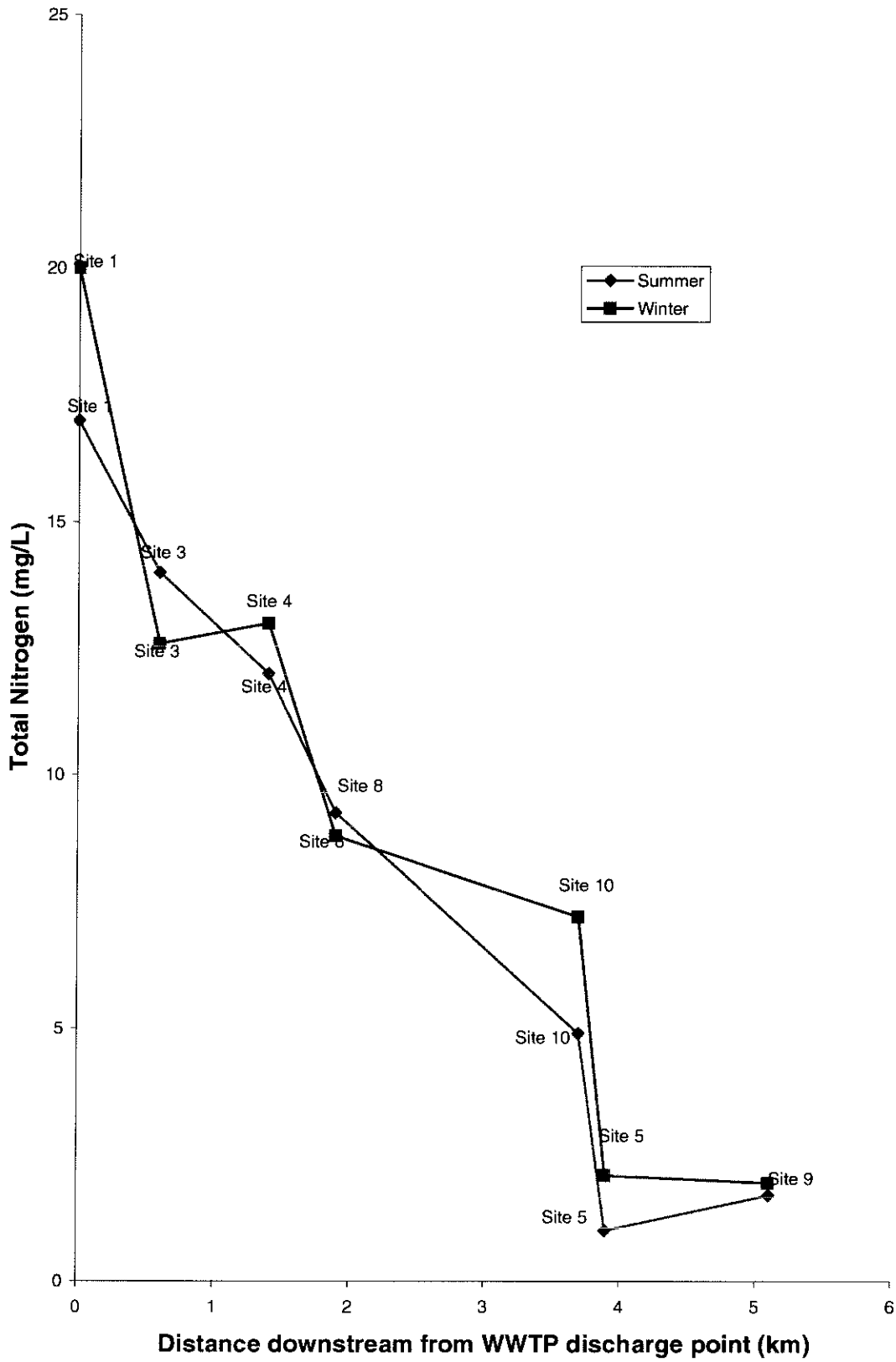


Figure 4.1: Variation of Median Total Nitrogen concentrations in the drain system with distance downstream from the WWTP



4.2 YEAR-ROUND RELEASE OF TREATED WASTEWATER TO DRAINS WITH SOME SUPPLY TO THE BUSSELTON GOLF COURSE

This section discusses the proposal to irrigate the Busselton Golf Course in summer with treated wastewater, and the associated environmental impacts on water quality in the drains and the nearshore marine environment, resulting from reduced summer releases of highly treated wastewater.

4.2.1 Wastewater flows

The Busselton Golf Course has an estimated peak irrigation water demand of 1,800 m^3/d and an average daily demand of 1,250–1,540 m^3/d over a four month summer period. Modelling of the performance of the constructed wetlands is based on six month summer (November to April) and winter (May to October) periods, and the average daily volume delivered to the Busselton Golf Course in summer only is estimated to be 1,100 m^3/d. About 500 m^3/d (in winter) and 200 m^3/d (in summer) of wastewater would be pumped to the northern wetland, with the dual objectives of minimising the releases to drain and preventing the wetland from completely drying out in summer.

The predicted flows to the upgraded wastewater treatment plant, and the volumes to be directed to the southern and northern wetland areas and the golf course, are shown in Table VI.

Table VI Predicted flows from the WWTP with supply to Busselton Golf Course

Flows (m^3/d)	1997	2005	2020	2035
Total flow	1800	4500	6750	9000
Summer flow to golf course	-	1100	1100	1100
Summer flow to northern wetland	-	200	200	200
Summer flow to southern wetland	1800	3200	5450	7700
Winter flow to northern wetland	-	500	500	500
Winter flow to southern wetland	1800	4000	6250	8500

4.2.2 Wastewater quality

Table VII estimates the quality of treated wastewater leaving the southern wetland, based on the influent having the target IDEA plant treated wastewater quality as described in the CER.

Table VII Predicted median and 95th percentile wastewater quality leaving the southern wetland, with some summer flow diverted to the Busselton Golf Course

Parameter	Season	Year 2005	Year 2020	Year 2035
Biological Oxygen Demand (BOD) (g/m^3)	Winter	5.0	6.0	7.0
	Summer	5.0	6.0	6.5
Suspended solids (g/m^3)	Winter	4.0	4.0	4.0
	Summer	7.5	6.5	6.5
Total nitrogen (g/m^3)	Winter	5.0 (9.0)	5.0 (9.5)	4.0 (7.0)
	Summer	3.0 (3.5)	3.0 (4.5)	3.0 (5.0)
Total phosphorus (g/m^3)	Winter	0.6 (1.1)	0.5 (1.1)	0.4 (0.8)
	Summer	0.5 (1.0)	0.5 (1.0)	0.4 (0.8)
Faecal coliforms (cfu/100 mL)	All year	300	300	300

Based on median wastewater quality leaving the IDEA plant
Summer average daily (21°C) and winter average daily (13°C) temperatures used.
Anticipated 95th percentile values are in parenthesis (based on 95th percentile concentrations leaving the IDEA plant).

The data in Table VII indicate that diverting part of the summer treated wastewater flow to the golf course results in only minor changes to the concentration of nitrogen and phosphorus in treated wastewater entering the drains:

- the summer concentrations of both nitrogen and phosphorus are the same as that for the original proposal as presented in the CER (Table 3.2) and hence are also very slightly lower than that expected with year-round discharge to drain (without partial reuse). This is a consequence of diverting some treated wastewater to the Busselton Golf Course, which reduces the flow to the southern wetland and hence increases the residence time in this wetland.
- the winter concentrations of both nitrogen and phosphorus in treated wastewater leaving the southern wetland are the same as with year-round release to the drains (without partial reuse), and are also very slightly higher than would be expected in the original proposal presented in the CER (Table 3.2).
- the quality of wastewater leaving the northern wetland is equal to or better than that leaving the southern wetland.

As discussed earlier the data reported in Table VII are conservative and it is possible that total nitrogen levels in the treated wastewater leaving the wetland could approach background levels of around 1.5 g/m^3. However, the performance of the wetland cannot be guaranteed. An extensive period of operation (> 3 years) is required to confirm the modelled predictions, during which time nutrient levels leaving the wetland could exceed those listed in Table VII. Nevertheless, the performance of the revised wetland would be significantly better than that of the existing wetland, and should greatly improve the quality of the treated wastewater released to the drains.

4.2.3 Nutrient loadings

Table VIII shows current and anticipated future summer and winter nutrient contributions of the WWTP to the Vasse Diversion Drain, based on the concentrations given in Table VII and wastewater flows estimated using a water

balance model. This table also presents percentage changes from 1997 nutrient loads.

The impacts of reduced releases to the drain system resulting from partial diversion of treated wastewater to the golf course are to:

- reduce the total nitrogen loads to the Vasse Diversion Drain by only about 100kg per year to 2035 compared with the loads expected for the original proposal in the CER; and by 1.2t/annum to 2020 compared with the loads expected with the revised wetland and year-round release to drain;
- reduce the total phosphorus loads to the Vasse Diversion Drain by only 0.2t/annum to 2020 compared to the loads expected for year-round release to drain via the revised wetland (1.3t/annum), and only by 100kg per year to 2020 compared to the loads expected with the original proposal in the CER; and

In summary, diverting part of the summer flow to the Busselton Golf Course has only a very slight beneficial influence on nutrient loads entering the estuarine part of the Vasse Diversion Drain, compared with releasing the full volume down the drain system. In winter in 2035, the WWTP would contribute less than 3% of the total nitrogen and less than 5% of the total phosphorus to the Vasse Diversion Drain. In summer, the WWTP would contribute approximately 74% of the total nitrogen and 33% of the total phosphorus to the drain. However, the total nutrient loading to the Vasse Diversion Drain in summer is minimal when compared with winter.

4.2.4 Environmental impacts and risks of year-round release to drain with some supply to the Busselton Golf Course

Clearly the environmental impacts on water quality in the drains and the nearshore marine environment as discussed in Section 4.1.4 are slightly reduced if some of the treated wastewater is diverted to the Busselton Golf Course in summer. However the Corporation considers that any reduction in impacts and risks are so slight as to not be statistically measurable.

Table VIII Estimated nutrient loads to the Vasse Diversion Drain and percentage change from 1997 with supply to Busselton Golf Course

Source	Summer			Winter			Total		
	tonnes	%	% change from 1997	tonnes	%	% change from 1997	t/a	%	% change from 1997
					Total Nitrogen				
Vasse Diversion Drain	1.3	27	0.0	185	91	0.0	186.3	89	0.0
Other	0.1	1.9	0.0	12.9	6.4	0.0	13.0	6.3	0.0
WWTP - 1997 (Average flow = 1,700 m^3/d)	3.4	71	0.0	5.6	2.7	0.0	8.9	4.3	0.0
Total - 1997	**4.8**	**100**	**0.0**	**203.5**	**100**	**0.0**	**208.3**	**100**	**0.0**
WWTP - 2005 (Average flow = 4,500 m^3/d)	1.6	53	-53	4.2	2.1	-25	5.8	2.8	-35
Total - 2005	**3.0**	**100**	**-47**	**202.1**	**100**	**-1**	**205.1**	**100**	**-1.5**
WWTP - 2020 (Average flow = 6,750 m^3/d)	2.8	67	-17	6.2	3.0	11	9.0	4.3	1
Total - 2020	**4.2**	**100**	**-12**	**204.1**	**100**	**0**	**208.3**	**100**	**0**
WWTP - 2035 (Average flow = 9,000 m^3/d)	4.0	74	18	6.6	3.2	18	10.6	5.1	19
Total - 2035	**5.4**	**100**	**11**	**204.5**	**100**	**0.1**	**209.9**	**100**	**0.8**
					Total Phosphorus				
Vasse Diversion Drain	1.0	41	0.0	14.0	88	0.0	15.0	82	0.0
Other	0.1	2.9	0.0	1.0	6.1	0.0	1.1	5.7	0.0
WWTP - 1997 (Average flow = 1,700 m^3/d)	1.3	56	0.0	1.0	6.0	0.0	2.3	12.5	0.0
Total - 1997	**2.4**	**100**	**0.0**	**15.9**	**100**	**0.0**	**18.4**	**100**	**0.0**
WWTP - 2005 (Average flow = 4,500 m^3/d)	0.3	20	-77	0.5	3.2	-50	0.8	4.5	-65
Total - 2005	**1.4**	**100**	**-41**	**15.5**	**100**	**-2.5**	**16.9**	**100**	**-8**
WWTP - 2020 (Average flow = 6,750 m^3/d)	0.5	30	-61	0.6	4.0	-40	1.1	4.2	-52
Total - 2020	**1.6**	**100**	**-33**	**15.6**	**100**	**-2.0**	**17.2**	**100**	**-6.5**
WWTP - 2035 (Average flow = 9,000 m^3/d)	0.5	33	-61	0.7	4.2	-30	1.2	6.9	-48
Total - 2035	**1.6**	**100**	**-33**	**15.7**	**100**	**-1.1**	**17.3**	**100**	**-6**

Notes: *Based on a water balance model and median concentrations leaving the WWTP and wetlands*

Summer = November–April. Winter = May–October.

Assumes no change in nutrient loads from sources other than the WWTP and assumes no unsewered contributions from 2005 onwards.

Some percentages may be marginally affected by rounding.

Part B: Response to public submissions

CONTENTS

1 Surface water quality

1.1 EXISTING ENVIRONMENT

1.1.1 Question - The 16 samples to determine existing drain water quality have not been taken all year round and none were taken at mouth of the drain so they have limited validity. How statistically significant are these figures, particularly the medians?

Table 4.2 on page 4-12 of the CER indicates that over 85 samples were collected in the drains affected by and immediately surrounding the Busselton Wastewater Treatment Plant (WWTP). Another 45-50 samples were collected in the Vasse Diversion drain between 1994 and 1997. In addition, five samples were taken within 10 m of the mouth of the drain. These samples are valid for the sites from which they are taken.

Since the CER was released, the regular sampling program has continued and additional data (primarily for winter, but with some additional summer data) are now available. A revised Table 4.2 and Figure 4.4 are presented in Table 1 and Figure 1. Over 120 samples (in total) have now been collected in the drains affected by and immediately surrounding the WWTP. Another 65-70 samples (in total) have been collected in the Vasse Diversion drain. In addition, thirteen samples have now been taken within 10 m of the mouth of the drain.

The additional data supports the discussion of nutrient and bacterial concentrations in the Vasse Sub-A drain on pages 4-11 and 4-13 of the CER.

Sites immediately downstream of the WWTP have high median nutrient concentrations in summer and winter (9-14 g/m^3 total nitrogen and 1.3-3.4 g/m^3 of total phosphorus). However, sites upstream of the WWTP discharge (sites 2 and 7) also have elevated nutrient concentrations typical of agricultural drains in the area.

The additional sampling data indicate that median bacterial levels in the drains and the beach are generally less than those indicated in the CER. The data indicate that, in winter, median bacterial levels in the Vasse Sub-A drain decrease regularly with distance along the drain from the WWTP, probably because of bacterial die-off. In sections of the Vasse Sub-A drain upstream of and not affected by discharge from the WWTP (sites 2 and 7), median winter concentrations of coliforms (750, 1000 cfu) are only marginally lower than sites affected by the WWTP (sites 3, 4 and 8; 1700, 1750 and 1450 cfu). As stated in the CER, this suggests that the Vasse Sub-A Drain is also affected by bacteria from other sources. Potential sources of bacteria entering the

drain include agriculture (e.g. dairy farming), stormwater runoff, and natural use of the drain by animals, including birds.

Table 1 Surface water quality data (1994–1998)

		Total nitrogen (g/m^3)				Total phosphorus (g/m^3)				Thermotolerant coliforms (cfu/100 mL)			
Site	Season	Min.	Median	Max.	n	Min.	Median	Max.	n	Min.	Median	Max.	n
Discharge from WWTP site (from existing wetland)													
1	S	12	17	43	7	1.7	3.05	8	8	10	500	3600	9
	W	11	20	43	6	1.4	3.55	4.8	6	60	2000	36000	24
Receiving drains													
2	S	2.95	7.25	9.65	3	0.85	0.9	2.7	3	160	375	460	4
	W	1.8	3	5.5	16	0.35	0.6	2.28	15	80	750	10000	16
3	S	0.86	14	31.2	9	0.25	2.4	7.2	9	10	310	1100	6
	W	2.6	12.6	35	19	0.7	2.78	4.93	19	80	1700	14400	21
4	S	2.25	12	28.4	9	0.4	3.4	8.7	9	0	365	1400	6
	W	3.48	13.0	37	19	0.85	2.6	5.56	19	110	1750	30000	20
7	S	0.34	1.56	9.8	6	0.1	0.25	1.5	6	40	70	240	3
	W	0.32	2.04	30	18	0.05	0.425	5.1	18	200	1000	5000	17
8	S	6.66	9.25	13.0	4	1	1.85	2.3	4	90	340	16000	3
	W	0.52	8.8	25	8	0.05	1.3	3	8	100	1450	10000	16
10	S	0.66	4.9	6	4	0.05	1.1	2.3	4	0	20	300	3
	W	0.85	7.2	16	10	0.2	0.9	2.7	10	46	1000	8178	18
Vasse Diversion Drain													
6	S	0.47	0.84	3	7	0.05	0.125	0.3	8	10	10	10	2
	W	0.6	1.57	18	18	0.05	0.15	4.3	18	100	500	8000	19
5	S	0.62	1.01	2.2	7	0.05	0.15	0.35	7	0	5	10	2
	W	0.81	2.1	4.1	13	0.1	0.22	1.1	13	10	240	5300	17
12*	S	1	1.2	1.5	4	0.1	0.13	0.23	4	–	–	–	–
	W	0.51	1.15	1.3	3	0.09	0.13	0.18	3	–	–	–	–
9	S	0.74	1.7	2.6	7	0.05	0.175	1.1	8	0	10	40	5
	W	1.5	1.95	6.3	8	0.1	0.225	0.4	8	2	280	6800	20
Geographe Bay within 1000 m of the Vasse Diversion Drain discharge point													
13**	S	0.13	–	0.26	2	0.004	–	0.005	2	–	–	–	–
	W	–	0.24	–	1	–	0.01	–	1	–	–	–	–
BB	S	0.21	0.23	0.25	2	0.01	0.01	0.01	2	0	10	170	8
	W	1.23	1.43	2.10	3	0.09	0.14	0.24	3	0	120	2600	13
BBW	S	0.23	1.99	3.75	2	0.01	0.02	0.02	2	0	10	240	9
	W	0.27	0.55	0.87	3	0.02	0.05	0.06	3	0	10	1000	19
BBE	S	0.21	0.25	0.29	2	0.01	0.01	0.02	2	0	10	100	9
	W	0.38	0.83	0.93	3	0.02	0.05	0.12	3	0	60	2000	17

Note: For sample locations refer to Figure 4.3 in the CER

Site 1 = 'Discharge from Property'.

S = summer (November–April); W = winter (May–October).

Min. = minimum; Max. = maximum

n = number of samples.

CFU = colony forming units.

Sample points BBW and BBE are 200m along Busselton Beach, west and east of the discharge point of Vasse Diversion Drain (BB), respectively.

**Data from Derrington (unpublished), August 1996–April 1997, Vasse Diversion Drain, corner Queen Elizabeth and Bussell Highway.*

***Data from McMahon (1994), January–September 1994, 1 km offshore from Vasse Diversion Drain.*

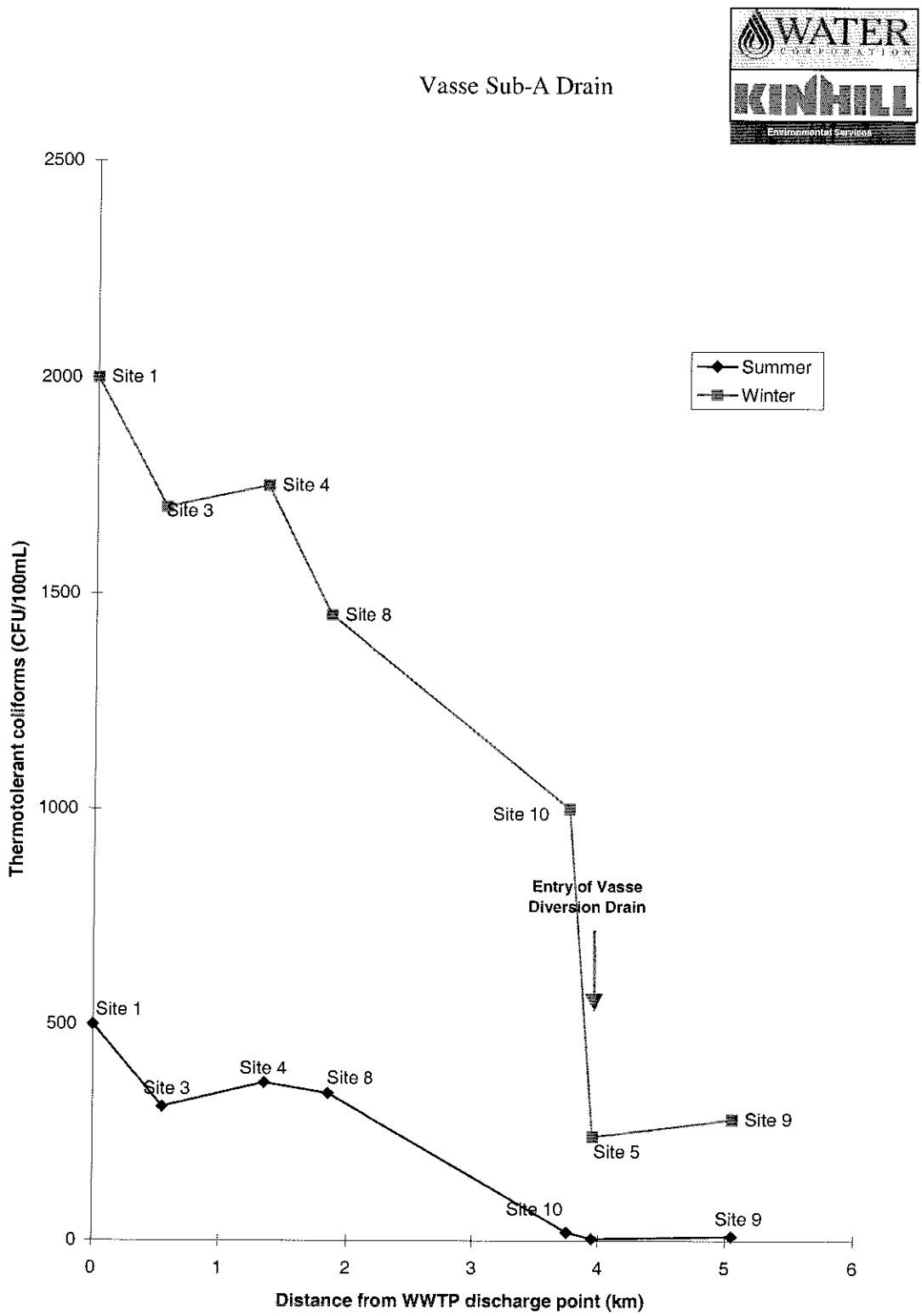


Figure 1
Variation of median thermotolerant coliform concentrations with distance downstream in the drain system

The data suggest that in summer, median bacterial concentrations decrease with distance along the drain. Further, in summer, the current data suggest that the median bacterial level at site 10, which is above the intersection of the Vasse Sub-A Drain with the Vasse Diversion Drain, is lower than the guideline of 150 cfu/100 mL for primary contact recreation. The additional data also give added confidence that the median bacterial level along the beach at Busselton in summer is 10 cfu/100 mL, well below the guideline of 150 cfu/100 mL for primary contact recreation.

1.1.2 Question - Long-term residents report that there has been a change in colour, smell of the water, increased algae growth near the outlet and drain, a dramatic decrease in seagrass and continuing problems with water flow in the drain.

The reports of long-term residents are valued. Nevertheless, it is difficult to know the reliability of the anecdotal evidence referenced. Additionally it is difficult to be certain of the time or source of the problem or perceived problem. The symptoms reported could be related to increased rural contributions to the drain.

In any event, the upgraded WWTP should reduce the extent of any real or perceived contribution from the WWTP to nutrient levels, colour or odour. Additionally, the revised proposal, as described in the introduction, indicates that the nutrient loads released from the revised wetland will be lower that those described in the CER and represent an overall lowering of nutrient discharge loads through until about the year 2020 when flow to the WWTP is envisaged to be approximately 6,750 m^3/d. Further, at present, there is no flow from the WWTP in the Vasse Sub-A drain upstream of the Vasse Diversion Drain during summer.

Dates of the reported dramatic decline in seagrass together with estimated distances of retreat would be useful because then potential changes could be assessed against aerial photography or other records. Photographs of the seagrass surrounding the drain in October 1996 do not show any obvious decline in seagrass at the drain outlet compared with nearby areas.

In addition, seagrass banks in Geographe Bay move from year to year as a result of movement of bottom sand caused by wind and wave action. Their absence in a particular location in any one year is not necessarily a sign of decline. Analysis of historical and recent aerial photography (1963-1993) indicated that the area of seagrass in Geographe Bay has been stable over at least the last 20 years (D.A. Lord 1995). An earlier study by Riedel and Byrne in 1988 indicated that seagrass decline in Geographe Bay was observed between 1947 and 1967. This coincided with rapid post-war expansion of agriculture in the catchments and construction of drainage systems to the sea. Where studies have demonstrated losses in seagrass close to shore, such as at Quindalup, it is likely that this has been due to physical action, such as smothering by sand or scouring. It is unlikely that this has been due to algal growth because seagrasses close to shore have high levels of available light.

1.1.3 Question - Testing by the Land Conservation District Committee from 1992 to 1996 found rising amounts of nutrients each year. The system cannot sustain more.

A drain/waterway monitoring program undertaken by the Sussex Land Conservation District from 1992 to 1995 utilising weekly sampling of the drains/waterways from the Vasse Diversion drain west to the Station Gully Drain ("Water Testing Program: 1992-1996, Sussex Land Conservation District Committee, November 1996") came up with a number of conclusions including the following:

- "-The nutrient levels of drainage lines is consistently well above the standards of total phosphorus (0.001g/m^3) and total nitrogen (0.75 g/m^3) set by the DEP
- While these levels are very disturbing and call for early positive response they are similar to those other streams in along (sic) the Swan coastal plain
- Results over the four years of our study 1992/3/4/5 indicate no discernible upward or downward trend from year to year
- Concentrations from those points on the down stream of sewage works near Queen Elizabeth Drive and of Dunsborough ponds are consistently much higher than streams draining lands with horticultural and pastoral use only
- Calculations of reliable and accurate total load figures is not possible with the basic procedures used in this project
- Recent advice from marine scientists from University of WA, and from DEP is that Geographe Bay is currently in a healthy state although it is vulnerable to summer storms and certainly to further increased nutrient load."

The findings of the LCDC's monitoring conflicts with the submission to the CER about upward trends in nutrient loads, even acknowledging the lack of reliability of the monitoring to generalise to the conclusions drawn.

The upgrade to the WWTP and constructed wetland is anticipated to reduce nitrogen discharge loads from the 1997 levels immediately. However, as described in the CER, and assuming accurate flow projections, discharged nitrogen loads will increase over time to be very slightly higher by the year 2020 (about 0.1 tonnes/a). It is important to note, however, that this marginal increase will be significantly offset by reduced seepage of nutrients from unsewered areas (estimated to be 22 tonnes/a) as a result of the Busselton sewer infill program. Total phosphorus levels are anticipated to be lower than the 1997 discharge levels through to the year 2035 as well as reducing seepage from unsewered areas.

1.1.4 Question - The Water Corporation told us that water from the treatment plant did not and could not enter the Sub A drain, yet the CER states it does in the Summary (see paragraph 2) This erodes Water Corporation credibility. What measures are in place to prevent lower grade waste water from entering the Sub A Drain?

Treated wastewater from the existing WWTP has been discharged for many years into a low-lying area adjacent to a minor drain (Drain A2) which flows into the Sub A drain. The wastewater produced in the new IDEA plant will be of much higher quality

than currently being released into the low-lying area (vis < 10 g/m^3 N, < 1 g/m^3 P from the IDEA plant compared with 30 g/m^3 N and 8 g/m^3 P from the wastewater treatment lagoons before the recent introduction of alum dosing to reduce phosphorus levels) and so the quality of water flowing into the Sub A drain will be significantly improved. The CER indicates that the Water Corporation introduced alum dosing to the WWTP in May 1996 (section 4.2.1 page 4-4) which reduced the current total P levels in the wetland discharge to < 3 g/m^3.

The Water Corporation will also disinfect the wastewater released to the wetland to a median of 10 cfu/100mL. This is substantially better than the levels proposed in the CER and lower than the current median levels of approximately 2000 and 450 cfu/100mL in treated wastewater leaving the wetland in winter and summer respectively.

1.1.5 Question - No data has been provided on contaminant loads in the drain of herbicides, pesticides, heavy metals, oils and grease etc.

The Perth Long Term Ocean Outlet Monitoring Program 1995-1998 analysed the levels of metals and pesticides in treated wastewater from the Beenyup, Subiaco and Woodman Point Wastewater Treatment Plants, which together treat 90% of Perth's domestic wastewater. It was found that the concentration of metals and pesticides (other than zinc and copper) in all recent samples were lower than the National Guidelines (ANZECC 1992) for the protection of aquatic, marine ecosystems, or lower than the limit of detection, without any dilution in the receiving environment (Kinhill 1998c); levels of zinc and copper were less than fifteen times greater than the National Guidelines. It is therefore likely that the largely domestic sewage directed to the Busselton WWTP would have similarly low levels of herbicides, pesticides and heavy metals. Further, Industrial Waste Regulations restrict the discharge of waste from commercial sewer connections in Busselton to further reduce the likelihood of high levels of these contaminants reaching the wastewater treatment plant. Commercial and industrial discharges are required to pre-treat wastes prior to discharge to the sewer.

As with nutrients, the major sources of herbicides and pesticides in the drain is from agriculture. Concentrations of herbicides, pesticides and heavy metals in the Vasse Diversion Drain will vary significantly with flow. The highest loads will typically be discharged when the Vasse Diversion Drain is in flood and typically in the first pulse of floodwaters. Base flow sampling would be of limited value. Detection of chemicals such as herbicides and pesticides requires good knowledge of the type and quantity of chemicals used in the catchment together with their likely environmental breakdown times and by-products, if any.

The low levels of oil and grease present in untreated wastewater, will be almost totally if not entirely removed by the proposed IDEA plant.

Because herbicides, pesticides, heavy metals and oil and grease are likely to be present at such low levels, these elements are not sampled as a component of the Water and Rivers Commission Reference program which only looks at parameters such as river flow and nutrients.

1.1.6 Question - The contribution of CALM managed land to contaminant levels in the drain has not been discussed.

The contribution of CALM managed lands to contamination levels in the drain has not been considered in the CER. Figure 4.5 in the CER indicates that CALM Estate comprises a very minor portion of the Vasse River/Diversion Drain catchment. Forested catchments typically contribute run-off of high quality water containing low, natural background levels of nutrients. Where logging is taking place close to waterways, water quality may be degraded for short periods. Sites of active erosion such as destabilised gullies can also supply long-term sources of sediment and nutrient.

In any event, the specific contribution of CALM managed lands does not alter the fact that the Busselton WWTP is only a minor contributor to the nutrient loads entering Geographe Bay. It is also well known that farming activities contribute significant quantities of nutrients to waterways if they are not well managed.

1.2 SEWAGE EFFLUENT STANDARDS

1.2.1 Question - Claims by Water Corporation that the waste water will be tertiary treated is not consistent with the characteristics of the water leaving the upgraded wetland, because it still contains 3-4.5g/m^3 of N, 0.5g/m^3 of P and 300 cfu/100mL thermotolerant coliform bacteria. Tertiary treated waste water by definition "involves removal of nutrients ... and any remaining organisms in the secondary effluent".

The treated wastewater which will be produced by the new Busselton IDEA plant will be treated to tertiary standards. Tertiary treatment is defined as treatment which involves processes which actually remove nutrients, but this does not mean total removal of all nutrients. Most of the nitrogen in the incoming wastewater stream will be biologically removed in the IDEA plant, whereas phosphorus will be removed by chemical means (ie alum dosing).

As indicated in Part A of this document, the Water Corporation is also now proposing to disinfect the wastewater discharged to the wetland so that only a median of 10 coliform forming units/100mL will be produced. This is much less than the Water Corporation committed itself to in the CER and much lower the current median levels of approximately 2,000 and 450 cfu/100mL in winter and summer respectively.

1.2.2 Question - The CER states (Paragraph 3.8.1) that a key aim is to achieve the maximum total reduction in nutrients per dollar of expenditure. The aim should include consideration of the costs of rectifying damage as a result of excessive nutrient inflows. The standards set should not only be cost effective but also environmentally effective.

This key aim stated in the CER refers to the Water Corporation's aim in establishing the Environmental Improvement Initiative (EII). It is a responsible approach recognising that greater substantial overall environmental improvement could be obtained by targeting the major sources of nutrient input to Geographe Bay. The Water Corporation is currently producing approximately 2% of the total nitrogen and

4% of the total phosphorus discharged to Southern Geographe Bay. Improved land use management practices would achieve a greater overall reduction in nutrient loadings to Southern Geographe Bay than could be achieved by total removal of nutrients in treated wastewater from the WWTP. The EII will target the major contributors of nutrients through encouraging improved land use management.

Targeting particular nutrient 'hotspots' in the catchment for EII funding is an effective means of both achieving significant cost and environmentally effective reductions in nutrient loads to Geographe Bay. The EII together with the other aspects of the wastewater treatment and disposal upgrade proposed by the Corporation are considered to be an overall environmental upgrade.

Monitoring to date indicates that current nutrient discharges to Geographe Bay are not causing environmental degradation of the Bay. Nitrogen discharges from the WWTP expected in 2035 will be slightly higher (0.9 t) than the existing 8.9 tonnes/a (2%) of nitrogen released from the WWTP in 1997. However this will be offset by the reduction of approximately 22 t/a nitrogen which is estimated to seep from unsewered areas within Busselton. Additionally the annual discharge of total phosphorus from the wetland is anticipated to halve from the estimated 2.3 tonnes/a released in 1997 as well as reducing seepage from septic systems. It is noted again that the WWTP was estimated to contribute only (4%) of phosphorus entering Southern Geographe Bay in 1997. Wastewater currently treated in septic tanks will be collected by sewers for transfer to the WWTP. This will provide an overall environmental benefit, and demonstrates the Water Corporation's commitment to maintaining the quality of Geographe Bay.

1.2.3 Question - There is no concrete data on coliform counts. For example, the expected range (10-50 cfu/100mL) is significantly lower than what system is expected to achieve (< 150 cfu/100mL).

The Corporation is committed to producing treated wastewater from the IDEA Plant that is well below national guidelines for primary contact recreation (ie a median level of 150 cfu/100mL). It is normal for operating levels of process routinely to target and achieve levels much lower than required. Consequently, it is expected that the normal operation of the UV disinfection system would result in thermotolerant coliform levels of 10-50 cfu/100mL (as quoted in the CER).

However as indicated in Part A of this document, recognising the community's concerns, the Water Corporation is now proposing to disinfect the wastewater so that only a median of 10 cfu/100mL will be present in wastewater entering the wetland.

1.2.4 Question - The 300cfu/100mL expected to leave wetlands is not an appropriate level for primary recreational activities that may occur further down the drain.

As indicated in Part A of this document, the Water Corporation is now proposing to reduce the bacteria levels leaving the WWTP to a median of 10 cfu/100mL. However, subsequent bacterial infection is anticipated to occur within the wetland area as a result of waterfowl utilisation. The intention of producing a wastewater that is well below the national guideline for primary contact recreation when it leaves the disinfection unit, is so that, even with subsequent infection, the numbers of coliform

bacteria in wastewater released from the wetland will be relatively low. As stated in the CER, it is estimated that the concentration of coliform bacteria leaving the wetland will be less than 300 cfu/100mL which is the median level of coliforms found in the discharge of wastewater treatment wetlands (Kadlec and Knight 1995). However, like any wetland with living organisms, including birds, the amount of coliform bacteria exiting the wetland cannot be accurately predicted or guaranteed. Bacterial levels could vary with variation in the usage of the wetland by waterbirds and other influencing factors.

Further, bacteria from human waste is of much greater concern than that from other animals because of its potential to contain pathogenic bacteria capable of causing specific and very significant diseases in humans, such as typhoid fever. Waterbirds do not carry pathogenic typhoid bacteria. Waterbirds may carry a variety of pathogenic Salmonella bacteria, and while infection is possible, it is usually by ingestion of food or water. Infection will depend upon the number of bacteria ingested, the age and health of the affected person, and the time since the water was infected.

It should also be pointed out that the Water Corporation is not the only contributor of bacteria (and other microorganisms) to the drain. Of particular concern is Cryptosporidium, a microorganism associated with pasture and other animals which could enter the drain via runoff from pastures, but not from the constructed wetland. These other discharges are unregulated and the Water Corporation cannot prevent microorganisms, manure, nutrients, heavy metals, hydrocarbons, pesticides and other environmentally and socially undesirable materials washing or being dumped into the drains. As a result, neither the Water Corporation, the Water and Rivers Commission, nor the Health Department can guarantee that the water in the drain is at all times fit for public recreational activities. The Water Corporation discourages primary contact recreation in drains for these reasons, and recommends that signs be erected at strategic locations to discourage and warn possible users of the potential risks.

1.2.5 Question - There is no information on expected contaminant loads in the waste water treatment plant effluent with respect to herbicides, pesticides, heavy metals, oils and grease etc.

As indicated in the response to Question 5 in Section 1.1, from measurements of treated wastewater produced by the Subiaco Wastewater Treatment Plant and others, it is anticipated that the largely domestic sewage directed to the Busselton WWTP would have very low levels of herbicides, pesticides or heavy metals as the sewage received is likely to be primarily domestic waste. The major sources of herbicides and pesticides in the drains around the WWTP would be from farming practices.

Oil and grease will be present in the wastewater from domestic operations and fast food outlets. However, fast food outlets should have grease traps installed, in accordance with the Industrial Waste Regulations (refer also to the response to Question 1.1.5), so that the levels of oil and grease reaching the treatment plant should be at the normal level of 50-150 g/m^3 (Wastewater Engineering. Treatment, disposal, reuse. Metcalf and Eddy, 2nd edition, 1979) which is readily removed by the IDEA plant.

The Industrial Waste Regulations managed by the Water Corporation also reduce the likelihood of discharge of elevated levels of other chemicals to the WWTP.

1.2.6 Question - Virus, fungi and protozoa do not get a mention. Will these be at zero levels consistent with tertiary treatment standards?

The definition of tertiary treatment does not include reduction of levels of all pathogens to zero. Results from Eastern Australia and the United States indicate that the levels of these organisms in reclaimed, tertiary treated wastewater after filtration and disinfection would typically be less than 1 virus per 100 L and less than 1 to 10 protozoans per 100 L (I.B. Law, "Domestic non-potable reuse. Why even consider it?", Water, 24 (3):9-13 (1997)). The degree of removal of organisms by ultra-violet light is dependent on many factors including the dosage of the ultra-violet light per unit volume of water, as well as the clarity of the water.

1.2.7 Question - The data presented in Table 3.1 is misleading, the use of 95th percentile figures show that the anticipated quality may in reality exceed those median levels approved by the EPA.

Table 3.1 indicates that the 'average' or median values to be produced at the WWTP would always meet the DEP requirements.

The conditions of Works Approval 1755 issued by the DEP on the 9th April 1997 set an 'average' level for Nitrogen and Phosphorus in wastewater discharged from the WWTP. Additionally, the Works Approval sets 'average' levels for BOD, suspended solids and thermotolerant coliform bacteria. The CER presented these figures in Table 3.1 as 'median Works Approval limit (maximum)'. This was intended to indicate that the average, or median, must never go above the limits set in the Works Approval. Occasional values (i.e. at the 95th percentile level) for nitrogen may be higher than the allowed 'average' but the average value would remain within the limits established by the DEP.

It is not clear in the Works Approval what sampling regime should be established to determine the 'average' and over what period of time (e.g. 2 weeks, 2 months, 1 year) the 'average' is to apply to. In the absence of clear guidelines from the DEP, the Water Corporation has adopted a monthly sampling regime, as is standard practice at all other WWTPs.

The Operating Licence specifies on-going, operational conditions that need to be met by the Water Corporation. These are reviewed annually by the DEP, in the light of the Water Corporation's experiences in operating the plant during the year. There is always the possibility that water quality criteria are made more stringent for the following year's operations, where the DEP considers this is necessary to further protect the environment.

1.2.8 Question - Proposal that improvements in IDEA plant occur in 2020 & 2035 is too infrequent. Improvements should be made at least every five years, or intervals consistent with technological advances in wastewater treatment.

The CER indicates that proposed expansions to the WWTP are scheduled for 1998, 2005 and 2020 (Page 3-4). These expansions are staged to coincide with anticipated increases in flow of wastewater to the WWTP as a consequence of population growth and the directing of wastewater to the plant from the infill sewerage program.

The Water Corporation has approval from the EPA for the wastewater treatment technology provided at Busselton. This technology (including methods of automated plant control) is progressively developing, and it is not possible to predict when improvements will occur. However, it is anticipated that by the year 2020, sufficient advances will have been made to be confident that better wastewater quality will be achieved routinely, but this may occur earlier.

The operating licence for the WWTP will be renewed annually by the Department of Environmental Protection. The conditions of the licence will be reviewed if problems or improvements in the previous year's operations become evident. This will allow improvements which occur before the year 2020 to be implemented.

The Water Corporation is also developing an Environmental Management System to the ISO14000 standard, which commits it to a process of continual improvement in environmental management. In addition, the Water Corporation conducts quarterly reviews of monitoring results and operational management to ensure the desired performance standards are being met. These procedures would ensure that improvements in technology are implemented when they become cost-effective.

1.2.9 Question - Public perception is that no matter how highly treated it is, it has the potential to be dirty and unsafe. This is a key social concern which does not seem to have been taken into account.

It is difficult for the Water Corporation to dispel the community perception that highly treated wastewater is not sewage i.e. raw wastewater. The Water Corporation recognises that it needs to do more to gain community confidence about its performance in the wastewater management area. The community consultation program implemented by the Water Corporation within the Busselton Community partly addresses this issue.

The drain monitoring program being established by the Busselton Senior High School, with support from the Water Corporation and GeoCatch/Ribbons of Blue, will help to inform the community about the Water Corporation's performance and issues in managing the community's wastewater. The Water Corporation is also improving its community consultation processes associated with upgrades of other wastewater treatment plants, to ensure the community is consulted more effectively and earlier in the process.

1.2.10 Question - Monthly results should be published in the local paper. I request the EPA to recommend how the results of water quality monitoring (drain and Geographe Bay) will be reported to the community.

The Water Corporation has made a commitment to audit the performance of the treatment plant and wetland and to report to the DEP (Commitment 9.1). However, because of community concerns regarding the proposal, and in the light of the establishment of the Busselton Senior High School drain water quality monitoring program , the Water Corporation will also commit to report openly on a quarterly basis to the Busselton community via a publicly available report lodged in the local library and via the local newspapers. Reporting will cover a range of issues, including providing water quality monitoring results (groundwater bores, drains, and the marine

environment); mosquito counts, odour complaints, and the progress being made with the Environmental Improvement Initiative.

Commitment - The Water Corporation will report to the Busselton community on a quarterly basis on a range of issues, including providing water quality monitoring results (groundwater bores, drains, and the marine environment), mosquito counts, odour complaints, and the progress being made with the Environmental Improvement Initiative.

1.2.11 Question - When the drain is enclosed by a sand bar, water will become putrid & unhealthy.

It is recognised that the quality of the water in the drain near the ocean may deteriorate if the flow ceases and the water becomes stagnant and putrid from decomposing vegetative material and anaerobic sediments in the drain. However, this deterioration can and does occur now, independent of the WWTP discharge because under normal climatic conditions no flow from the WWTP currently reaches this part of the drain in summer.

In the future, with increased flows from the WWTP, some of the wastewater discharged to the drain may reach the ocean. However, this wastewater would have fewer nutrients and bacteria than that currently discharged from the WWTP. Consequently, this may flush the drain other sources of contamination such as agricultural or urban runoff, resuspension of sediments or bacterial contamination from waterbirds. In addition, agricultural drainage and urban runoff may contribute to and possibly elevate levels of nutrients and bacteria in the water within the drain much more than that from the WWTP.

The Water Corporation is currently monitoring and proposes to continue monitoring the water in the drain to assess the water quality and determine if and when other actions are required.

1.3 UNCERTAINTIES ABOUT MEETING EFFLUENT STANDARDS AND NEED FOR CONTINGENCY PLANNING

1.3.1 Question - CER figures are vague, and full of uncertainties because they are primarily based on modelling. CER statements such as "actual loads are likely to be substantially higher than calculated loads" (see page 4-16 paragraph 2) and "the performance of the wetland cannot be guaranteed" add uncertainty.

The statement relating to 'actual loads are likely to be substantially higher....' relates to nutrient loads currently being exported from rural catchments to Geographe Bay. It is true that there are great uncertainties in terms of quantifying and understanding nutrient fluxes and water flows in the Busselton region (and this is also generally true for the rest of the State). This is because of a lack of monitoring programs providing adequate, detailed data over significant periods of time. It is also because of the inherent difficulties in measuring nutrient loads in waterways subject to pulses in flows and nutrient concentration. Finally, it is impossible to accurately predict drain flow. Nevertheless, the contribution of the WWTP to nutrient loads in the drain is likely to be an overestimate (i.e. the percentage contribution of the WWTP is likely to

be lower than stated in the CER) as the actual nutrient loads in the drain from other sources are likely to be much higher.

However, if monitoring programs were in place, the data would still show great variation between samples because of the variability of rainfall events and their ability to flush nutrients from the land into drains and waterways. In addition, there is great spatial and temporal variation in land use and land management practices in the catchments which makes any estimate not necessarily representative of future situations.

With regard to the performance of the wetland, the Water Corporation can accurately specify and guarantee the quality of the final treated wastewater leaving the treatment plant. This is because the treatment processes can be tightly controlled by the plant operators. On the other hand, the effectiveness of the wetland is reliant on the natural processes operating in the wetland. The removal of nutrients depends on a number of factors, including the water temperature, the wastewater flow path, the growth and density of the plants and the use of the wetland by waterbirds. While these processes will be actively managed by the Corporation, it is difficult to be prescriptive because of the natural processes involved.

The purpose of the CER is to provide a best estimate of performance and likely impacts based on current knowledge. However, the DEP and EPA's role does not end there, as on-going environmental management, monitoring and reporting on the plant and discharge will be required to ensure that the actual impact is acceptable.

1.3.2 Question - Claim that loads of nitrogen, phosphorus and faecal coliform will decrease (because of better management practices evolving) despite increasing volumes is not substantiated - will more likely increase, with attendant impacts on the Bay.

It is unclear whether this concern relates to increasing nutrient loads entering Geographe Bay from catchment sources, or whether it relates to concerns that the new WWTP will not perform as stated by the Water Corporation. If the concern is regarding the predicted performance of the WWTP, the Water Corporation can confidently state that the proven, high technology plant will produce a final treated wastewater which is very high in quality by world standards. This wastewater quality will result in a decrease in the loads of nitrogen and phosphorus to the Bay from the WWTP. Additionally, the associated infill sewerage program will eventually eliminate seepage of nutrients from unsewered areas by 2020. This will occur in spite of an anticipated four-fold increase in wastewater flow treated over that time. This is because of the effectiveness of the treatment processes. For example, the current quality of the treated wastewater produced at the existing plant is about 30 g/m^3 N and 3 g/m^3 P (after chemical dosing). This will reduce to 10 g/m^3N and 1 g/m^3P in the new treatment processes.

The Water Corporation will also disinfect the treated wastewater which will substantially reduce the level of bacteria released from the WWTP. The Water Corporation is now proposing to disinfect the wastewater so that only a median of less than 10 cfu/100mL will be produced in treated wastewater entering the wetland. This is much less than the Water Corporation originally committed to in the CER.

Commitment: The Water Corporation will disinfect treated wastewater from the IDEA plant to reduce thermotolerant coliforms in the treated wastewater released to the wetlands, or diverted to prospective users to a median level of less than 10 cfu/100 mL.

1.3.3 Question - Load estimates are only a guess - who is going to take responsibility when children get sick from playing in drain and surrounding beach.

The Water Corporation has responsibilities for keeping its drains in good operating order and for managing the flows in the drains. However, a number of agencies and authorities including the Water and Rivers Commission, Department of Environmental Protection/Environmental Protection Authority, Health Department of Western Australia and the local government are responsible for managing the quality of the water in the drains.

Non point-source discharges or catchment-wide contributions to the drain system are not controlled or regulated by any agency, and the Water Corporation cannot prevent microorganisms, manure, nutrients, heavy metals, hydrocarbons, pesticides and other undesirable materials and contaminants washing or being dumped into the drains. As a result, neither the Water Corporation, the Water and Rivers Commission nor the Health Department of Western Australia can guarantee that the water in the drain is at all times fit for public recreational activities.

It is important to note that the Water Corporation does not encourage contact recreation in drains for the reasons stated above. In order to inform the community about the potential public health concerns associated with primary contact recreation in the drains, the Water Corporation recommends that a few appropriately located warning signs be erected along some of them. Additionally, the Water Corporation will shortly release an information brochure on the health and safety aspects of its drains.

The Environmental Improvement Initiative, as well as being targeted to reduce the loads of nitrogen and phosphorus to Geographe Bay, would focus on improved water and waste management. The EII should also lead to an improvement in the bacterial quality of water running into the drain from rural sources.

1.3.4 Question - There appears to be uncertainty whether the IDEA plant will achieve the proposed reductions detailed in Table 3.1. The success of other plants should be investigated.

The Water Corporation investigated a range of treatment systems, prior to committing to adopt the IDEA technology, which is recognised as world's best practice technology. IDEA plants have been installed and are operating well at Denmark, Bullsbrook, Australind, Mundaring and Rottnest Island. The response to Question 1.3.2 also addresses the issue of the plant's ability to achieve the stated water quality objectives.

1.3.5 Question - Given that there is "little experience with constructed wetlands in Australia" it is not appropriate to experiment where waste water flows into a sensitive environment such as Geographe Bay.

The Water Corporation's proposal to discharge an advanced tertiary quality treated wastewater into a constructed wetland is to provide a final 'polish' for the wastewater prior to entering the drain. It is important to note that the quality of the treated wastewater from the IDEA plant will be substantially better than that currently discharged, so that the consequences of the wetland failing are minor.

Constructed wetlands have been used to treat wastewater around the world and in several areas of Australia. Wetlands can reduce the level of nutrients in wastewaters flowing through them. What is uncertain in an Australian or Western Australian context is the exact extent or degree of nutrient removal from already highly-treated wastewater. For this reason, the CER was conservative in its prediction of the improvement to be gained by passing treated wastewater from the IDEA plant through the wetland.

The Water Corporation is now proposing to improving the disinfection of the treated wastewater so that only a median of 10 cfu/100ml will be present in wastewater entering the wetland, not 150 cfu/100ml as stated in the CER. Nevertheless, the wetland could be infected by bacteria from waterbirds and other animals using the wetland. Even if bacteria levels leaving the WWTP are reduced to zero, these levels are likely to increase within the wetland and drain at a rate depending on factors including potential utilisation by waterbirds, agricultural drainage and urban runoff. As stated in the CER, it is estimated that the concentration of bacteria leaving the wetland will be less than 300 cfu/100mL which is the median level of coliforms found in the discharge of wastewater treatment wetlands (Kadlec and Knight 1995). Actual bacterial levels, similar to that of any wetland and water supply, could vary with variation in the usage of the wetland by waterbirds and other influencing factors. Monitoring as proposed in the CER and subsequent measures will obviously be an important component of wetland management.

1.3.6 Question - How long will it take for the wetland to perform adequately? It could take years - plants do not grow instantly.

The Water Corporation anticipates that it will take five to six years for the wetland originally proposed in the CER to perform to the levels envisaged for 2005 and as reported in Part A. This is because it will take time for the wetland plants to grow or regenerate after disturbance and spread to bare areas to the extent needed for effective removal of nutrients, particularly nitrogen. Consequently the area and density of vegetation within the constructed wetland will increase from time of planting through until 2005. Additionally the anticipated flows to the WWTP will increase through this period as well.

The Corporation now proposes to revise the design of the constructed wetland, as detailed in Part A of this document. Anticipated flow volumes, concentrations and loadings leaving this wetland are described in more detail in Part A of this document.

1.3.7 Question - The increased nutrient loads into the wetland may result in algal blooms which will require additional management.

The upgrading of the WWTP will progressively reduce the concentration of nutrients in the wastewater discharged to the wetland as the flow volume into the wetland increases. The load of nutrients into the two wetlands described in Part A is also anticipated to decrease from the 1997 levels. This is shown in Table 2.

Table 2 Nutrient loads anticipated from the WWTP to the wetlands

Parameter	1997	Flow = 4500 m^3/d (1998–2005)	Flow = 6750 m^3/d (2005–2020)	Flow = 9000 m^3/d (2020–2035)
Concentration of discharge				
Total nitrogen (g/m^3)	30*	10	8	5
Total phosphorus (g/m^3)	3-5*	1	0.8	0.5
Total estimated flow to wetland/s (1000 m^3/a)	657	1442	2263	3084
Estimated nutrient load				
Total nitrogen (t/a)	20	14.4	18.1	15.4
Total phosphorus (t/a)	2.0-3.3	1.4	1.8	1.5

** Estimate*

The overall anticipated effect is that the load of nutrients into the wetland will decrease marginally from estimated 1997 levels but generally remain constant. It is almost certain that management techniques will change over the 35 year period of operation of the wetland, but the relatively consistent load of nutrients passing through the wetland with increasing flows is anticipated to produce a relatively consistent level of algal growth.

The proposed wetland is a combination of open and dense vegetated zones with an area of open water at the inlet (balancing storage) and outlet as described in the revised proposal (see Part A of this document). The incidence of algal blooms would be relatively low through the continual flow of wastewater through the wetland, and interception of algae by plant stems and sedimentation as the wastewater leaves the wetland.

1.3.8 Question - How will the Water Corporation control the amount of pollution exiting the old and new rubbish tips into their wetlands?

Groundwater from the old and new rubbish tips will not flow towards and be intercepted by the wetland, as local groundwater flow is to the north, away from the treatment plant and wetland. The Water Corporation has installed groundwater monitoring bores between the wetland and the rubbish tip to confirm this. Management of leachate from local rubbish tips is the responsibility of the Busselton Shire Council.

1.3.9 Question - What contingency is in place should the wetlands be shown not to be effective after three years?

The constructed wetland will be monitored and the performance reviewed quarterly. Annual reports will be presented to the Department of Environmental Protection. If the wetland was shown to be not effective, the Water Corporation will investigate other options for disposal or reuse of the water, improve nutrient reduction, construct additional wetlands on the site, or change the design of the wetland to incorporate more vegetation.

1.3.10 Question - What happens to waste water quality when dredging of sediments from wetlands is occurring?

Periodically, perhaps every 10 years, the phosphorus-rich sediments deposited in the wetland may need to be removed. If necessary, sediment removal may be effected through temporary draining of all or parts of the wetland or by small-scale dredging. Depending on the extent and location within the wetland of any sediment removal operations, diversion of treated wastewater away from the area of sediment removal may be required to maintain the quality of the treated wastewater.

Additionally, it is anticipated that maintenance activity would be largely undertaken in summer when at least a portion of the wastewater flows may be diverted to off-site users. Alternatively, treated wastewater may be discharged to the three emergency storage lagoons on site for several days during dredging and then be re-directed to the wetland once maintenance operations are completed.

1.3.11 Question - Retention time will reduce from 11 to 6 days by 2030. How will this affect effluent standards, particularly as capacity increases?

The efficiency of nutrient removal is likely to diminish as the retention/detention time in the wetland is reduced. However, the Water Corporation plans to introduce improvements in the performance of the IDEA plant by 2020 and 2035 to offset the reduced effectiveness of the wetland if necessary. As indicated in the response to Question 7 in section 1.3, the overall load of nutrients to the wetland will be relatively constant from 1998-2005 through to 2035.

It is noted that the revised wetland as detailed in Part A of this document has detention times of between 7.6 and 9.6 days in 2005. These are envisaged to drop to between 3.6 and 4.0 days in 2035 based on speculative predictions of anticipated flow to the WWTP.

1.3.12 Question - The use of UV radiation to sterilise effluent has been found to be effective only where turbidity levels are low. Will the facility be capable of maintaining the required low levels?

Section 3.4, page 3-4 of the CER indicated that sand filtration of the wastewater is proposed within the IDEA plant. This will produce a very high quality, and clear, treated wastewater, which will ensure that UV disinfection is very effective.

1.3.13 Question - Too often accidents occur and pollute water downstream. The risks/impacts of such accidents are unacceptable.

The key risk which may lead to 'accidents' at the WWTP is considered to be loss of power to the treatment plant. This is discussed below in answer to Question 1.3.14. Other risks may include failure of the WWTP or of the wetland. These potential scenarios are discussed in the CER in sections 6.5.1 and 6.5.2 (pages 6-12 to 6-14).

In the event of an 'accident' at or poor performance of the IDEA plant, wastewater will first have to flow through the modified wetland, which will provide some treatment and a buffer in the flow of wastewater to the drain. The Water Corporation will also be required to advise the Department of Environmental Protection of such 'accidents' or 'incidents'. In such a worst case scenario, the Water Corporation would undertake remedial action as a matter of urgency to prevent any permanent impact on the environment.

It is worthy of note that there are also risks of accidents happening in the vicinity of the drain system, which would also cause pollution of the drain. For example spillages from roads, or of agricultural chemicals, could impact considerably on the drain. However, these are outside the control of the Water Corporation.

1.3.14 Question - A contingency plan is needed for controlling effluent in the case of equipment failure & power blackouts (blackouts & 'brown outs' are frequent in Busselton).

In the event of a breakdown of any part of the system or due to power failures, some of the lagoons on site would be able to store wastewater. Two existing wastewater treatment lagoons on the western side of the WWTP site would be emptied and be made available for emergency storage. An additional pond would be created between these ponds to provide additional emergency storage. These lagoons have capacities of approximately 4,850, 7,644, and 5,016 m^3 respectively and would collectively be able to store between 2 and 3.9 days of inflowing wastewater at flows of 4,500 - 9,000 m^3/d. Additional storage may be available depending upon the status of the biosolids storage lagoon, the treated wastewater storage pond and the constructed wetland. Wastewater would then be recycled through the IDEA plant for treatment before release to the constructed wetland.

Power failures which affect the treatment plant only would lead to a temporary shut-down in the treatment of wastewater in the IDEA plant and in the filtration and disinfection units. Partially treated wastewater would flow from the treatment plant into the holding lagoons. Once power was restored, this wastewater could, if necessary, be pumped back through the treatment plant, including the filtration and disinfection units, to ensure the treated wastewater quality was maintained. Power failures which affected the whole of Busselton would prevent the wastewater from reaching the WWTP, and would therefore have minimal impact on treated wastewater quality.

Provision has been made to provide power to the site with an emergency generator in the case of lengthy power outages. Additionally, the Water Corporation is developing an Environmental Management System through its asset management plan and suitable emergency response / incident management plans will be developed.

2 Surface water quantity

2.1.1 Question - The drain can not cope with existing flows and has broken its banks into residential areas over the last three years, including last year with only a 70 mm downpour. This will worsen with urban expansion, climate change and increased clearing in the upper catchments. How will it cope with additional flows from the waste water treatment plant?

The Vasse River Diversion broke its banks in August 1997. This was the first time since 1964 that this had occurred and this was estimated to be a one in 20-25 year event. Urban expansion is expected to have little impact on flow in this drain as all new subdivisions are required to limit peak stormwater discharge primarily through some form of on-site retention or infiltration. With the trends in land use changes in the rural catchment towards protecting remnant vegetation, and establishing tree crops and perennial horticulture, it is anticipated that the rural runoff will decrease in the next few years. Further information in relation to this question is provided in the response to Questions 2.1.2 and 2.1.4.

2.1.2 Question - The drain will not be able to cope with additional water - in winter the water level sits only 90 cm from the traffic bridge, and will back up in storms. In summer a lagoon is formed/ mouth silts up in January & February leaving a smelly brown pool until the channel is re-opened by a storm.

The additional flow from the WWTP will be insignificant in relation to the winter flows. The design flow rate for which the Vasse Diversion Drain was built is 143 cubic metres per second or 12,300,000 cubic metres per day (Water and Rivers Commission, pers. comm, 1998). The anticipated ultimate flow rate from the WWTP is 9,000 cubic metres per day, which is only 7 hundredths of one per cent (0.07%) of the capacity of the drain. Consequently, the extra flow of treated wastewater from the WWTP will not impact on the ability of the Vasse Diversion Drain to handle winter flows.

The mouth of the Vasse Diversion Drain has not closed except for brief periods since the rock retaining wall was built some 10 to 15 years ago. As a general rule flows from the WWTP currently do not reach the mouth of the drain in summer. Hence, the water in any stagnant or semi stagnant lagoons formed at the mouth of the drain are tidal waters flowing back into the drain, or water from the upper Vasse Diversion Drain, not from the discharge from the WWTP.

2.1.3 Question - In winter high seas drives water into the drain.

In winter, storms do have the effect of holding up the water in the drain to higher levels. That is why the drain is confined within levees to allow the drain levels to

exceed the sea levels and still discharge water. Extreme events will cause flooding, but this is unrelated to WWTP discharges, which are minor. Peak flows in the drain typically occur during the winter months. It is noted that storm-induced tidal surges into the drain may add to the flushing effect.

2.1.4 Question - Could it be that the existing drain capacity is being gorged by the massive addition of waste water on a daily basis?

This is not happening, and will not happen as a consequence of this project.

Monitoring data from the Water and Rivers Commission and preliminary modelling undertaken by Kinhill indicate that actual flows at the mouth of the Vasse Diversion Drain have ranged from 0 to 6,200,000 m^3/day (compared to a capacity of 12,300,000 m^3/day). In the year 2035 it is anticipated that about 9,000 m^3/day of wastewater would be released from the treatment plant. This would contribute only 0.2% during high flow of the Vasse Diversion Drain. An alternative way to appreciate the insignificance of the maximum flow compared to the flow in the drain, is to realise that a pipe of only 30 cm diameter flowing full at 1 m/s would be needed to transport the wastewater from the WWTP. This is clearly a very insignificant pipe compared with the size of the Vasse Diversion Drain.

2.1.5 Question - No guarantee that drain will not need to be improved at a cost of $50m to Busselton Ratepayers.

A drain upgrade would not be required as a consequence of the disposal of treated wastewater due to the relatively insignificant volume of wastewater compared with drainage from other sources.

2.1.6 Question - The CER claims a 5m deep permanent pool in the tidal part of the drain. Even a 1m depth would be generous during summer, and during winter. These sorts of mistakes reduce the credibility of the document.

It is acknowledged that this was an error in the CER. The CER states that the drain incision is approximately 5m deep, but it is acknowledged that the depth of the water within the tidal lagoon formed at the mouth of the drain during summer is about 1m deep. The depth of permanent water in the drain was not critical in terms of calculations regarding nutrient loadings in the drain or discharge characteristics. Consequently, it does not affect any of the statements made in, or credibility of, the CER document.

3 Marine water quality

3.1.1 Question - Data indicates elevated nutrient and phytoplankton levels within 500 m of drain discharge (which already indicate eutrophication). A drain discharge is not designed for efficient dilution at point of release. Perhaps other alternatives should be considered and researched (eg. alter the drain outlet or put tertiary treated water into the Vasse River to improve its water quality), and/or further research be carried out at the drain.

Drain Discharge

The statement that drain discharges are not designed for efficient dilution is correct. The only means by which greater dilution of drain discharges may be achieved is by increasing the velocity of discharge of water from the drain, by altering the gradient of the drain or discharging the water through a pipe. Neither of these options is practical for a large system such as the Vasse Diversion Drain.

It should be pointed out that there is significant additional flow in the drain in winter. This will carry the water in the drain some distance into Geographe Bay and facilitate greater dilution.

At present, there is no flow of treated wastewater from the WWTP to the mouth of the Vasse Diversion Drain in summer, because it seeps into the groundwater through the base of the drain before it reaches the ocean. As the volumes of wastewater treated at the WWTP increase in the future, there will an increase in discharge to the drain, particularly if there is no additional reuse. However, it is anticipated that still only a very small portion (if any) of this wastewater will reach the ocean so that there would be little if any direct discharge of nutrient-laden water to the ocean offshore from the mouth of the drain. In addition, whatever little wastewater did reach the Vasse Diversion Drain would mix with the water in the lower tidal section of the drain, and be diluted before being discharged into Geographe Bay.

Discharge to Vasse River

It is noted that the Vasse River is already eutrophic and periodically suffers from algal blooms downstream of the barrage which diverts the Vasse River into the Diversion Drain. Discharging treated wastewater to the Vasse River is not appropriate because the wastewater discharge would not disperse and be flushed from the system.

3.1.2 Question - A decrease in nitrogen, phosphorus and coliforms is necessary for the health of the Bay - not maintenance of current levels.

It should be stated that there is no evidence that Geographe Bay is showing signs of eutrophication. The Water Corporation believes that this situation should be

maintained by good management and agrees with the concept that Geographe Bay should not receive more nutrients or bacteria.

The Water Corporation's proposal will achieve a real reduction in nitrogen, phosphorus, and faecal coliforms in the treated wastewater discharged to drain from the WWTP to about 2020. In the longer term, there would only be a very slight increase in nitrogen discharge from the WWTP but a substantial reduction in phosphorus. However, these minor increases in nitrogen discharge predicted in the longer term will be offset by the significant reductions in seepage of nitrogen, and to a lesser extent phosphorus, from unsewered areas in Busselton.

Additionally, the Water Corporation proposes to establish an Environmental Improvement Initiative to provide funds to reduce nutrients from agricultural and urban sources, which account for approximately 98% of the total nitrogen and 96% of the total phosphorus load entering Southern Geographe Bay.

3.1.3 Question - It will take many years for the Bay to recover from septic tank pollution - no more wastes/ nutrients must be added.

In general, there is no evidence of damage to the Geographe Bay ecosystem from existing nutrient discharges at the present time, either from septic tanks or other sources. However, the Water Corporation agrees that it is prudent to remove septic tanks as a source of nutrients and bacteria.

The Water Corporation estimates that the unsewered areas of Busselton presently contribute 4% of the total nitrogen and 10% of the total phosphorus (CER Table 4.6, page 4-20) load to Southern Geographe Bay. The contribution from unsewered areas will gradually reduce as the Infill Sewerage Program is progressively implemented in Busselton. However, from early 1999 the new treatment plant will be operational and there will be an immediate and significant reduction in nutrient loads to the Bay from the plant. This represents an overall reduction in nutrients from the wastewater from the Busselton community.

3.1.4 Question - There is no evidence that the Bay can continue to support the current nutrient load, or determine what load we can put into the Bay without disastrous effects.

Water quality monitoring undertaken by the Water Corporation and by independent marine water quality experts demonstrates that Geographe Bay is currently very healthy. Current concentrations of dissolved nutrients in Geographe Bay are consistently low and environmental indicators such as nutrient levels, phytoplankton and epiphyte loads are well within national guidelines for the protection of estuaries and embayments. In addition, the current nutrient loads to Geographe Bay are not having an adverse impact on the existing seagrass communities or on marine water quality. Surveys undertaken by a number of seagrass specialists, including Dr Diana Walker of the University of Western Australia (1994, 1994b, 1995 a,b,c), confirms that the seagrass communities in the vicinity of Busselton in southern Geographe Bay are healthy. This is the case even in the vicinity of drain discharge points where there are slightly elevated nutrient levels, possibly as a result of urban and rural contributions to the drain.

The Water Corporation's proposal will lead to a significant reduction in nutrient loads to Geographe Bay generally, and to the drain from the WWTP at least until 2020. This will further reduce the potential for eutrophication of the nearshore marine environment, and hence provide additional protection of Geographe Bay.

3.1.5 Question - The sampling to determine existing water quality in Table 4.2 is inadequate to base a 22 year project on. The data from Derrington & McMahon are only represent a snapshot.

The Water Corporation recognises that it would be preferable to have water quality monitoring data over many years to better assess the environmental impacts of the Water Corporation's proposal. Consequently, the Water Corporation has been collecting extra data regularly since the CER was published (see Part A of this document). Nevertheless, data over a longer time frame are not available, and the Water Corporation needs to upgrade the WWTP and seek approval for treated wastewater discharge now. What is certain is that the WWTP upgrade and associated actions will significantly reduce current nutrient loads to Geographe Bay.

Monitoring also indicates that current discharges are not having an adverse impact on marine water quality and marine flora and fauna communities, and that there are much larger discharges of nitrogen and phosphorus to Geographe Bay from sources other than the WWTP.

The Water Corporation's proposal will significantly reduce total nutrient inputs to Geographe Bay from all community wastewater sources. Consequently, the Water Corporation considers that its proposal will be beneficial to the health of the nearshore marine environment.

3.1.6 Question - Data collected over two summers and one winter is not adequate given the variability of conditions and flows into the marine environment, nor reliable enough on which to base long-term predictions regarding circulation.

See response to Question 3.1.5. The Water Corporation acknowledges that the flows into Geographe Bay are highly variable, both between individual rainfall events and from year to year. Although it would be preferable to have data over a longer time period, this is not available. In the CER, the Water Corporation committed to undertake on-going monitoring of the flow and water quality in the drains influenced by discharge of treated wastewater and in Geographe Bay in collaboration with other agencies. The results of this monitoring, analysis and reporting will be used to confirm the predictions made in the CER and provide the basis for any changes if necessary.

3.1.7 Question - The prevailing winds in winter will drive the nutrient enriched waste back into the shore.

This is accepted. If winds blow from the north-west in winter, then the outflow from the drain will stay relatively close to shore, but will be mixed and diluted by wind and wave action. The CER has acknowledged that under these conditions there will be minimal dispersion from a drain discharge. However, it should be pointed out that treated wastewater to be discharged from the WWTP will be of better quality than at

present, which can only be beneficial to the environment. It is also important to realise that the vast bulk of nutrients and other contaminants entering Geographe Bay in winter originate from agricultural and urban sources, not the WWTP. Reduction of nutrient loads from these sources is essential if the long-term health of Geographe Bay is to be assured.

3.1.8 Question - When tests were carried out to determine the direction of currents for the Port Geographe development it was demonstrated that there is a circular movement around Geographe Bay, so pollutants do not get flushed out to sea.

The Geographe Bay Study (D.A.Lord and Associates 1995) indicated that flushing times (based on 3D numerical modelling) for southern Geographe Bay at a constant wind speed of 5.5 m/sec (which is the average wind speed for the area) will range between 3–15 days depending on the wind direction. Consequently, while this flushing is less than in more exposed coastal situations, any parcel of water entering Geographe Bay will eventually be flushed out to "sea". No "circular flow" predictions were made.

In any event, while nutrients and bacteria are discharged by the drain into the sea, the nutrients are used by plants and the bacteria die off. Consequently, by the time any particular parcel of water is "flushed" out to sea, it contains extremely low levels of "pollutants".

3.1.9 Question - The CER provides scant poorly referenced and vague detail on the hydrodynamic flushing characteristics of Geographe Bay which is not adequate for decision making. The information provided should have taken into account water circulation, density stratification, the energetics of mixing, an understanding of the relative importance of regional and local forcings and pathways of material transport, and seasonal difference to build a ecological nutrient-effects model.

The CER is based on numerous scientific studies and provides references to reports which have dealt extensively with the hydrodynamics and flushing characteristics of Geographe Bay (Walker et al., 1994, 1995). These studies demonstrate that there is no evidence of any nutrient-derived impacts in Geographe Bay. The Water Corporation is proposing an overall reduction in the amount of nutrients and bacteria discharged from the WWTP compared to 1997 levels, at least in the short to medium term (i.e. up to the year 2020), thereby improving the situation if anything.

There are no ecological effects models that are accurate for oligotrophic (low nutrient status) waters such as Geographe Bay. In addition, the forces driving circulation in Geographe Bay are understood, and the circulation patterns are broadly known. Consequently, there is little purpose in building such a model.

3.1.10 Question - Comparison between nutrient concentrations in Geographe Bay and Cockburn Sound is not useful, particularly as McMahon's results are based on very limited data and there is no consideration of the types of phytoplankton species. The area of influence could well exceed 500m.

Since the establishment of National ANZECC guidelines (1992) for nutrient levels in the marine environment, a number of studies have indicated that these concentration-based criteria must be treated with considerable caution.

The DEP (1996) stated that: "The results of the SMCWS (Southern Metropolitan Coastal Waters Study and the PCWS (Perth Coastal Waters Study) demonstrate the inherent spatial and temporal variability in the physical and chemical characteristics within Perth's coastal waters, and highlight the difficulty in establishing criteria that can be generally applied throughout Perth's coastal waters." "A concentration-based approach to nutrient management in isolation is inappropriate for local marine ecosystems because of the confounding influence of biological uptake". "Despite this limitation, nutrient concentrations that are above typical background concentrations can be indicative of an existing problem, or an emerging problem, and their spatial distribution can also help determine the source/s and the maximum 'zone of influence' of nutrient inputs."

A wide range of nutrient data is available from Geographe Bay (McMahon, 1994; Walker et al., 1994a,b; 1995a,b,c,d; Derrington, unpublished; Lord *et al.*, 1995). Of this wide array of data, a limited set - that of McMahon, 1994 - was tabulated in Table 4.8 of the CER, since sampling locations were in the vicinity of the Vasse Diversion Drain; further references are provided in the text.

Geographe Bay could be compared with a range of embayments in the SW including Cockburn Sound. Cockburn Sound was chosen for comparison because a comprehensive data set is available (DEP, 1996).

However, such comparisons - and concentration based nutrient data - must be treated with considerable caution, because factors such as the capability of an ecosystem to absorb nutrients, and the high natural variability in nutrient data can affect results.

3.1.11 Question - The proposal suggests there should be a special management area up to 1000m either side of the discharge point of the Vasse Diversion Drain. Insufficient work (monitoring) has been done to conclude that this would be the limit of environmental impacts around the drain mouth, and further work should be done.

The Water Corporation agrees that there are insufficient data in the nearshore area around the outlet of the Vasse Diversion Drain, and more measurements are required.

The size and dimensions of the Special Management Area were chosen based on marine and nearshore water quality monitoring which indicated that nutrient enrichment did not occur further along Busselton Beach than 500m either side of the discharge point of the Vasse Diversion Drain, and less than 300m offshore. Clearly, if monitoring in the future shows that nutrient effects are evident across and beyond the boundary, the boundaries of the Special Management Area would need to be modified through negotiation with the Department of Environmental Protection. This

negotiation would obviously need to involve all potential major contributors influencing the quality of water within the Special Management Area.

3.1.12 Question - Further investigation than that presented in the CER is necessary with respect to the impacts of total nutrient loads, as the scale of the nutrient effects could possibility be of the order 10 km longshore even allowing for dilution effects based on preliminary modelling. A concentration-based approach to nutrient management is inappropriate for marine systems.

It is correct that a concentration-based management approach for the marine environment is an over-simplification, for reasons presented to answer Question 3.10. The PCWS (eg Lord & Hillman, 1995), SMCWS (DEP, 1996) and PLOOM (eg DA Lord & Associates. 1998; Kinhill 1998b) and interstate (eg PPBES, 1996) as well as overseas studies (eg. CSDOC, 1997) have therefore implemented a combination of monitoring strategies, where nutrient levels were monitored in combination with studies of phytoplankton, benthic invertebrate communities, macroalgal communities, periphyton communities, seagrass health and epiphyte loadings, modelling exercises, microbial observations and a study of heavy metals and pesticide levels in biota and sediments.

A comprehensive data set exists on seagrass health, epiphyte loadings and phytoplankton levels for Geographe Bay, although there is room for ongoing monitoring. The CER has therefore argued for a regional approach to ongoing monitoring, one in which other bodies would be involved as well as the Water Corporation.

The CER has explored changes in nutrient loadings (not nutrient concentrations) as a result of proposed changes in discharge from the WWTP in Section 6.3 (eg. Table 6.1) and revised in Part A of this document. Such data demonstrate that total annual nutrient loads from the WWTP to the Vasse Diversion Drain are estimated to decrease substantially until 2005, and increase by only 0.1 t nitrogen to the year 2020. Highly speculative predictions beyond 2020 indicate that loadings of nitrogen would increase above 1997 levels by approximately 0.9 tonnes of nitrogen and decrease by 1.1 tonnes of phosphorus. However, the upgrades to the WWTP will mean that the estimated input of 22 tonnes/annum nitrogen and approximately 6 tonnes/annum phosphorus from previously unsewered areas will no longer be a source of pollution for Geographe Bay.

Thus, providing other nutrient sources remain unchanged, the current situation of Geographe Bay may serve to predict future changes within Geographe Bay. Current studies confirm that Geographe Bay can be categorised as a healthy ecosystem; deleterious impacts are highly localised and restricted to the immediate vicinity of the drains. In addition, the quality of drain discharges is largely determined by factors outside the control of the Water Corporation.

The environmental health of Geographe Bay could be verified by means of a comprehensive monitoring study on a 'user-pays' basis. The CER argues that the Busselton WWTP is expected to contribute only 2.0% of total nitrogen loadings to Southern Geographe Bay, and 2.1% of total Phosphorus loadings by 2035 (Table 6.2 of CER (Kinhill 1998) and revised in Part A of this document). It is appropriate for a local agency to be appointed to coordinate any such investigations. All parties who

are potentially impacting on, or have responsibilities for, Geographe Bay, such as the Water Corporation, Agriculture Western Australia, the Department of Environmental Protection, Water and Rivers Commission, the Busselton Shire Council and the local farming community, should be encouraged to contribute to such studies.

3.1.13 Question - Water Corporation should aim for zero discharge to the marine environment.

The Water Corporation aims to produce a high quality treated wastewater which will not have adverse impacts when returned to the environment. It is technically feasible to almost completely remove the remaining 3% of Total Nitrogen and Phosphorus contributed to Southern Geographe Bay by the community's wastes via the treatment plant. However, it would not make economic or environmental sense to do so because it would not have a measurable beneficial impact on either drain water quality or marine water quality. The Environmental Improvement Initiative is much more cost effective because it offers a significant reduction in the 98% of total nitrogen and 96% of total phosphorus contributed from the Southern Geographe Bay catchment primarily by rural land users.

3.1.14 Question - Extrapolating the Water Corporation's figures shows nitrogen loads will increase from the current 9 tonnes/annum, to 34 tonnes/annum in seven years time and by 2035 be 67.5 tonnes/annum. This is not an acceptable solution. The current discharge is already excessive, as the bay is poorly flushed. What overall effect will this have on the bay?

It is incorrect to extrapolate current nutrient loads produced by the existing treatment system to indicate the loads which will be produced with the new, high technology IDEA treatment system. The new treatment system will produce a final, treated wastewater which is of much higher quality and contains far fewer nutrients than that produced by the existing plant (ie about 30 g/m^3 Total N and 8 g/m^3 Total P under the existing plant, compared to 10 g/m^3 Total N and 1g/m^3 Total P with the IDEA plant). (Refer also to the response to Question 1.3.7 regarding the current quality of wastewater discharged from the WWTP).

Even though wastewater flows will increase significantly in time, the total nutrient loads produced in 2035 will not be very different to loads in 1997. For example, 2.0-3.3 tonnes per annum of Total P was estimated to be produced by the plant in 1997 processing approximately 1,700 m^3 of wastewater per day, but in 2035 this will reduce to only 1.5 tonnes per annum of Total P produced by the IDEA plant processing 9,000 m^3 of wastewater per day. The comparative figures for Total N are 20.9 tonnes per day in 1997 compared to 15 tonnes per day in 2035 (refer to answer to Question 1.3.7).

3.1.15 Question - The Department of Environmental Protection Marine Branch does not agree that the long term objective of the nearshore marine area should be for Industrial Buffer purposes.

The Water Corporation does not propose to use the nearshore area for Industrial Buffer Purposes. The CER has stated that Geographe Bay is well within draft EQO 2

Class II criteria (Multiple Use Zone) with regards to chlorophyll-*a* levels and other ecological parameters (Section 4.5.4); no specific criteria exist - or indeed can be defined (see Section 3.1.10) - for nutrient concentrations. However, draft environmental criteria for EQO 2 Class II may be exceeded locally around a number of drains.

Only limited specific ecological criteria (as distinct from pollutants such as heavy metals and pesticides) currently exist within national guidelines (ANZECC 1992; also see EPA 1993). Draft EQO criteria as defined by DEP (1996) remain to be ratified, and currently serve only as voluntary guidelines. These draft EQO criteria do not provide guidelines for nutrient loadings, but are instead defined in terms of a range of ecological parameters such as light attenuation, phytoplankton levels, epiphyte loadings, macrophyte composition and invertebrate health.

There are no specific ecological criteria for marine waters that exceed EQO 2 Class II, other than draft EQO 2 Class III criteria (named by the DEP as Industrial Buffer Zone). However, this name would be inappropriate in this zone, as it is the Water Corporation's intention that environmental parameters should remain at or below 1997 levels (Table 7.2), and it is not proposed that additional discharges be allowed or encouraged in this area.

3.1.16 Question - It seems incongruous that treated waste water would be discharged into Geographe Bay as it is a priority area for consideration as a possible marine park.

The Water Corporation's view is that declaring Geographe Bay as a Marine Park should not preclude return of highly treated wastewater generated by the community to the marine environment. The Water Corporation will ensure that the advanced tertiary treated wastewater maintains the environmental values of the receiving environment and prevents adverse impacts.

The Corporation is committed to meeting high standards, as it already does for return of the Perth Metropolitan community's treated wastewater into the ocean including the Marmion Marine Park and the Sepia Depression. Monitoring indicates that concentrations of dissolved nutrients in Geographe Bay are consistently low, and that current nutrient levels are within national guidelines for the protection of estuaries and embayments, and are well within proposed chlorophyll-a criteria for the Marmion Marine Park.

As the Water Corporation will be producing a tertiary treated wastewater from the Busselton WWTP which has less nutrients than currently produced from the existing WWTP, the Water Corporation is confident that nutrients from wastewater in the future will not be cause for concern for the environmental health of Geographe Bay. However, monitoring clearly shows that significant nutrient loads enter the Bay from predominantly rural catchment sources. These point and diffuse sources of nutrients may well compromise the ecological values of Geographe Bay unless firm and timely action is taken (by those responsible) to reduce these nutrient inputs. The proposed Environmental Improvement Initiative will address this issue.

3.1.17 Question - If the project should proceed the EPA should recommend a staged approach (eg. expansion to 9000m^3/d in 2035 should be dependent upon information gathered in the first phase of expansion).

The Water Corporation has already been given Works Approval by the DEP for the construction of the WWTP to treat up to 4,500 m^3/d of wastewater to stringent quality criteria. The Water Corporation is seeking approval for its proposal strategy to return the highly treated wastewater to the environment. As Licences are reviewed annually by the DEP, and an additional Works Approval would be required to construct additional treatment modules to treat flows to the year 2035, it is clear that further expansions will be assessed by the DEP based on the Water Corporation meeting its conditions of approval.

3.1.18 Question - The CER conclusion that nutrient input for sewage will be reduced has to be questioned when the data (Lord's nutrient load estimate) hasn't been verified.

The estimates of nutrient inputs into Geographe Bay presented in the Geographe Bay Summary Report (D.A. Lord 1995) are acknowledged as estimates. The uncertainty in these estimates is related to uncertainty with respect to flows and concentrations from drains and groundwater. There are fewer uncertainties in the estimates of flows and concentrations from the WWTP.

The CER indicated that the nutrient load from the proposed WWTP would be less than that from the existing plant, even though it will be accepting wastewater currently being treated in septic tanks. The performance of the new, high technology wastewater treatment plants are readily verifiable, and it is clear that the new plant will produce a treated wastewater of significantly higher quality with far fewer nutrients and bacteria than the existing plant.

3.1.19 Question - Monitoring water quality on a six monthly basis would not be ecologically or statistically meaningful.

In order to comprehensively monitor water quality within the entire Geographe Bay, an intensive monitoring strategy would need to be adopted. The Water Corporation's PLOOM studies for Perth coastal waters have adopted a 4-6 week sampling strategy for nutrient and phytoplankton levels (eg Thompson 1997), while other studies (eg. Kinhill 1998a) have demonstrated that nutrient concentrations may fluctuate, even on a daily basis. Clearly, a concerted effort between relevant authorities is needed in order to maximise the use of available resources.

Any monitoring program must be defined in terms of its aims and objectives. Although the design of an appropriate monitoring programme is not within the scope of the CER, the CER argues that in the context of the proposed development, the aims should be defined as the spatial extent of environmental impacts around the drain. Under this definition, monitoring would include a comparison of locations with increasing distance from the Vasse Diversion Drain.

Although an intensive local and Geographe Bay-wide sampling effort is preferable, such approach is not the sole responsibility of the Water Corporation. Instead, the CER proposed (Section 7.4.2) that "a broader program to monitor water quality in

Geographe Bay is the responsibility of Government and the Water Corporation is willing to contribute to such program", while "a monitoring strategy would be determined in discussion with DEP and the Water and Rivers Commission." The CER provides suggestions for water quality monitoring, but does not define a final monitoring strategy. Table 7.2 provides suggested guidelines for ecological parameters during Summer and Winter, and suggests a sampling intensity (refer page 7-7 of the CER). However, the Water Corporation is open to negotiations with other parties on an appropriate monitoring program and more coordinated monitoring efforts.

3.1.20 Question - The EPA should use this assessment to strengthen and encourage a more comprehensive approach to catchment management and restriction of nutrients (particularly nitrogen) in to Geographe Bay.

The Water Corporation agrees wholeheartedly with the view that landholders, through catchment management programs, must achieve significant reduction in nutrients entering Geographe Bay. The Water Corporation's proposed Environmental Improvement Initiative is aimed at providing real financial support for landholders to adopt improved technology and land management practices to reduce nutrient losses from their lands, and to monitor the effects of these improved practices on catchment water quality.

4 Groundwater contamination

4.1.1 Question - Number of samples for Table 4.1 and the interval they were taken over is inadequate.

The number of samples, while few, is adequate to assess the current quality of the groundwater. This is because groundwater quality parameters do not change rapidly over time. Additional groundwater monitoring would be an integral part of on-going environmental management of the site, and additional sampling is already underway.

4.1.2 Question - Is the current monitoring network effective and does it show anything?

Groundwater monitoring is needed to determine the impacts of treated wastewater discharge on the local water resources. To date the DEP has not considered groundwater monitoring to be necessary. However, the Water Corporation has recently installed an additional set of monitoring bores to address these issues.

The sampling undertaken by the Water Corporation indicates that the local groundwater resources in the vicinity of the treatment plant are of poor quality because it has relatively high salt levels. In addition, the local groundwater has very high levels of nitrogen.

The salinity is probably mostly due to natural causes, as the whole Busselton coastal plain area comprises low shore-parallel, coastal dunes reflecting Holocene (i.e. up to about 4,000 year old) shorelines built on beach sediments. Hence until very recent geological times, the local groundwater was marine in origin, or heavily influenced by interactions with seawater. Domestic wastewater is slightly saline as salts are concentrated in human wastes relative to salt levels in the fresh water consumed. Infiltration of treated wastewater from the existing wastewater treatment plant lagoons and wetland could thus also have contributed to the observed saline groundwater in the immediate vicinity of the WWTP. However, high salt levels in the groundwater could also be partially attributable to other historic or nearby land use practices including agriculture.

High nitrogen levels in the groundwater are likely to be attributable to infiltration of treated wastewater from the existing wastewater treatment plant lagoons and degraded wetland. However, it is also possible that current and historic nearby land use practices including agriculture have contributed to the observed high nitrogen levels.

4.1.3 Question - The proposed groundwater monitoring program is considered adequate, but a nest of monitoring bores could be established at one site to determine the vertical distribution of any contamination.

The Water Corporation is pleased that the above comment from the Water and Rivers Commission endorses its groundwater monitoring program, and agrees with the Commission's additional suggestion, which will be included in a revised environmental commitment for groundwater management.

Commitment - The Water Corporation will monitor the nest of monitoring bores that have recently been installed at the northern edge of the site to determine the vertical distribution of any contamination.

4.1.4 Question - The objective for groundwater should be to maintain and improve beneficial uses and environmental standards, rather than to maintain water quality to "environmentally acceptable standards".

The proposed upgrading of the WWTP will possibly improve and certainly reduce any continuing deterioration of the underlying groundwater through treatment of the wastewater to a higher degree and the cessation of infiltration of treated wastewater through the existing wastewater treatment lagoons.

Further improvement and remediation of the groundwater is considered unreasonable for the following reasons:

- the quality of the local groundwater is already poor and unfit for potable water supplies and irrigation of crops, due to naturally high salinity levels and contamination from a variety of sources over the years;
- there is little beneficial use being made of the groundwater in the immediate vicinity of the WWTP, and the current quality is appropriate to its present use of wetting logs at the local sawmill and stock watering.

4.1.5 Question - Given the reliance on the Leederville aquifer, what measures are in place to monitor and protect this aquifer?

As indicated in answer to question 4.1.4, the proposed upgrading of the WWTP would possibly improve and certainly reduce any continuing deterioration of the underlying groundwater through treatment of the wastewater to a higher degree and the cessation of infiltration of treated wastewater through the existing wastewater treatment lagoons.

Further, the WWTP is in an area where the superficial aquifer is recharged by upward leakage from the underlying Leederville aquifer, rather than the reverse. In other words, any contaminated water in the superficial groundwater will not be able to enter and contaminate the Leederville aquifer because there is pressure forcing the water in the opposite direction.

The Water Corporation will install a nest of monitoring bores at the northern edge of the site to monitor whether there is any contamination of the Leederville aquifer.

5 Seagrass

5.1.1 Question - On 15 December 1997 the Minister for the Environment announced the Geographe Bay-Capes-Hardy Inlet areas as priority areas for consideration as a possible marine reserve. Geographe Bay has seagrass meadows which are the most extensive on the West Coast except perhaps those of Shark Bay. The health of the seagrass meadows, which is essential for the well-being of Geographe Bay and protects the bay from erosion during storms must be protected.

Marine water quality monitoring demonstrates that the waters of Geographe Bay are nitrogen-poor, and current discharges of nutrients are not having an adverse impact on the environmental health of seagrasses, either in terms of stimulating growth of seagrasses or stimulating growth of algae and epiphytes. On the other hand, nutrient and Chlorophyll-a levels were shown to be elevated in the vicinity of *all* drain outlets (ie not only the outlet to the Vasse Diversion Drain which currently discharges treated wastewater in winter), but returned to background levels within 300m offshore. As there is no evidence of biostimulation, it appears that existing localised elevated levels of nutrients are also not having an adverse impact on the environmental health of seagrasses.

In addition, in Section 1.1.2, it was indicated that the area of seagrass in Geographe Bay has been stable over at least the last 20 years (D.A. Lord 1995). An earlier study by Riedel and Byrne in 1988 indicated that seagrass decline in Geographe Bay was observed between 1947 and 1967,which coincided with rapid post-war expansion of agriculture in the catchments and construction of drainage systems to the sea.

5.1.2 Question - Seagrass form the basis of marine ecology and should be protected. Existing nutrient loads from the Geographe Bay catchment are higher than from urban areas so the need to reduce nitrogen loads is even greater than in areas such a Jervoise Bay where seagrasses have already been devastated. Existing nutrient levels are a concern for seagrasses.

There is no evidence that existing nutrient levels are having an adverse impact on the environmental health of seagrasses. Green epiphytic algae such as *Cladophora* spp., commonly considered indicative of eutrophication are uncommon in Geographe Bay, and when present, appear associated with nutrient sources such as localised groundwater intrusions. In Section 1.1.2, it was indicated that the area of seagrass in Geographe Bay has been stable over at least the last 20 years (D.A. Lord 1995). An earlier study by Riedel and Byrne in 1988 indicated that seagrass decline in Geographe Bay was observed between 1947 and 1967,which coincided with rapid post-war expansion of agriculture in the catchments and construction of drainage systems to the sea.

In the future, the new IDEA plant will produce a final treated wastewater with fewer nutrients than the small amount produced from the existing plant (relative to catchment sources). This will reduce the contribution of wastewater from the Busselton Community as a source of concern for the future health of seagrass.

5.1.3 Question - Cockburn Sound and Albany Harbour are examples/mistakes from which we should learn.

Causes for seagrass losses in Cockburn Sound, and Princess Royal and Oyster Harbours have been well documented. These embayments are less well flushed than Geographe Bay, and suffered from discharge of high nutrient loads. It is now widely accepted that increased nutrient loadings will result in increased epiphytic and phytoplankton growth, and decreases in light attenuation. This, in turn may lead to seagrass losses. All regulatory agencies and proponents are aware of these issues and incorporate appropriate measures to address them.

Environmental conditions in Geographe Bay at present are no cause for concern with respect to seagrass health. In addition, the CER proposes to significantly reduce nutrient loadings to the Vasse Diversion Drain from the WWTP up till at least the year 2020. Total loadings to Geographe Bay, however, are outside the control of the Water Corporation. Consequently, the CER has argued for the establishment of an Environmental Improvement Initiative and an authority to manage all loadings to Geographe Bay.

5.1.4 Question - Currently little drain discharge in summer, but sewage will make it flow continuously during summer changing algal growth & impacting on seagrass. Circulation is weakest during summer. Summer discharge is unacceptable, particularly if the precautionary principle is adopted in the light of D R Lords Geographe Bay study (see conclusion 6.7 p 31). More research is needed.

Currently, the summer flows from the WWTP never reach Geographe Bay. In the future, with increased wastewater flows from the WWTP, it is likely that an appreciable volume of the increased volume of wastewater, as well as nutrients, may continue to seep through the bottom of the drains receiving the treated wastewater in summer when regional water tables are lower. While the average volume of treated wastewater from the WWTP is expected to increase from 1,700 m^3 /d in 1997 to 6,750 m^3/d in 2020, it is unclear whether this would affect the water flow from the Vasse Diversion Drain to Geographe Bay significantly.

Recent studies of Perth coastal waters (eg Thompson, 1997) have confirmed that these systems are nitrogen rather than phosphorus limited. Thus, nitrogen loading is the critical parameter in determining deleterious impacts to Geographe Bay, and not total nutrient loadings or flow rates.

The WWTP is currently estimated to contribute less than 5% of the total nitrogen and less than 13% of the total phosphorus to the drain. The WWTP is expected to further decrease total summer nitrogen loadings between 1997 and 2020 by 0.6 tonnes (a 17% reduction on the estimated 1997 levels of 3.4 tonnes), while phosphorus loadings are estimated to decrease from the 1.3 tonnes in 1997 to 0.5 tonnes in 2020 and 2035 This

is a reduction of 38% reduction during summer (Table 6.1 CER and as revised in Part A of this document). Some increases in total loadings are expected beyond 2020, although such predictions are subject to considerable uncertainty. Summer loadings of nitrogen and phosphorus from the WWTP to the drain will reduce for all years from the levels anticipated to be released in 1997. This will lead to an improvement of conditions rather than a deterioration.

5.1.5 Question - There is a long lag time between effluent discharge and changes in seagrass distribution and abundance (CRC Reef News, Dec 97). Concerned the effect of a continuous nutrient flow may not be picked up until too late.

Monitoring demonstrates that there are neither signs of eutrophication in offshore marine waters in the vicinity of the seagrass meadows, nor any evidence of deterioration of the seagrass meadows which in any way suggest that the existing levels of nutrients could be having a detrimental impact on the seagrasses. Changes to epiphyte loads and phytoplankton typically precede changes to seagrasses as these indicators are more sensitive to altered nutrient status. The proposed measurement of these characteristics should serve as an early-warning for potential changes to the health of seagrass communities.

6 Mosquitoes

6.1.1 Question - CER says increased water flow through wetland is likely to reduce mosquito problem, but this is questionable. A detailed evaluation and mosquito management plan is needed.

The concern above relates to only one of a number of strategies proposed to constrain the breeding of mosquitoes proposed by the Water Corporation. The Water Corporation is confident that the proposed package of measures will be effective, as supported by the Health Department (see Question 2 below). However, on-going monitoring of mosquito numbers will be the crucial test of the effectiveness of the measures proposed. Control strategies will be taken prior to mosquito numbers building up to levels of concern.

6.1.2 Question - The Health Department of Western Australia considers strategies proposed to constrain breeding of *Coquillettidia* sp. nr. *linealis* and *Culex annulirostins* mosquitoes are considered effective, if applied correctly. However, prevention of breeding by reducing organic loadings is unlikely to constrain breeding.

The Water Corporation notes the Health Department of Western Australia's comments. However, the cited reference in the CER (page 6-15) considers that organic loading, if high, could result in excessive mosquito breeding. In this instance, with the wetland used more as a polishing rather than treatment pond, organic loading will be low so that mosquito breeding should be low also.

7 Odour

7.1.1 Question - Existing hydrogen sulphide odour can be smelt at the primary school on sporadic occasions in Queen Elizabeth Avenue. This is unacceptable, so comment/ commitment that site is unlikely to generate more odour is unacceptable, and consideration should be given to moving the treatment plant out of town (eg at the Whicher Range).

The new IDEA WWTP, which will be constructed by the end of 1998, has received full environmental approval and approval from the Shire of Busselton in its present location.

Odour from the new plant is not expected to be a problem for the following reasons:

- unlike the existing pond treatment system, the new treatment system is based on mechanically aerating the wastewater to maximise biological digestion processes, which minimises the risk of wastewater becoming anoxic and hence odorous;
- the capacity of the new plant is much greater than the existing plant. This greater treatment capacity will eliminate odours which sometimes arise in peak holiday periods, when the existing plant becomes overloaded.

For the new WWTP, there is adequate buffer separation between the treatment plant site and residential areas. This will be assured by the Shire of Busselton's new District Planning Scheme, which provides support for a 250m-wide Wastewater Exclusion Area and a 500m-wide Wastewater Buffer Area surrounding the treatment plant site. The Exclusion Area is primarily located on the treatment plant site owned by the Water Corporation. The Buffer Area includes the existing Rendezvous Road rubbish tip and the pony club land north of the treatment plant site as well as a small area of agricultural land south of the treatment plant.

7.1.2 Question - The increased nutrient loads into the drain and wetland may result in algal blooms which will require additional management. What measures will be put in place to address this problem?

The drain already has some attached algae, but no phytoplankton (unattached) algal blooms have been reported to date even during periods of no flow. The current high levels of nutrients and water flow in the Vasse A subdrain may have resulted in establishment of the attached water weeds, which may give the impression of algae. These weeds may help to take up additional nutrients.

It is unlikely that algal blooms will be stimulated in the future by a larger volume of wastewater with much lower nutrient concentrations. In summer, there may not even be any flow in the drains as the wastewater may continue to seep through the bottom of the drains receiving the treated wastewater. Nevertheless, the Water Corporation

will monitor the condition of the drains with regard to water quality and algal status and take appropriate remedial actions to further reduce nutrient concentrations if possible and necessary.

7.1.3 Question - Water Corporation should specify a time-frame to have problems which create odours fixed within.

It is not practical or useful to specify a time frame within which odour problems would be addressed, as the causes of odour problems vary from those which are readily identifiable and quickly fixed, to those which occur for reasons which cannot be controlled or prevented by the Water Corporation, such as extended power cuts and unusual climatic conditions.

However, the Water Corporation's Customer Services Charter specifies that customer complaints will be responded to within 24 hours. All complaints are formally logged by the Water Corporation, and records show that all odour complaints have been responded to within this time.

8 Nutrients

8.1.1 Question - Water Corporation should be more concerned with their own practices rather than shifting focus to farmers. The plant should be considered on its own merits.

The Corporation's objective in providing wastewater management services is to ensure that it collects, treats, and disposes/reuses the community's wastewater in environmentally acceptable ways and which minimise adverse environmental impacts. The total 'package' for Busselton will substantially reduce nutrients entering Geographe Bay from the following three sources:

- septic tanks. Providing deep sewerage for the whole of the town will eliminate nutrients from existing septic tanks leaching to adjacent beaches and entering Geographe Bay, currently estimated at 22 tonnes of nitrogen (4% of current loads to the Bay from all sources) and 7 tonnes of phosphorus (10% of current loads to the Bay).

- the wastewater treatment plant. The new, high technology treatment system will reduce the loading of nutrients from the community's wastewater over current levels from the existing plant. For example, in spite of a four-fold increase in expected flows of wastewater in 2020, the amount of nitrogen will increase by only 100 kg (from 8.9 tonnes in 1997 to 9.0 tonnes in 2020), while the amount of phosphorus will reduce from 2.3 tonnes in 1997 to 1.1 tonnes in 2020 (ie a 47% reduction over 1997 loads). The treatment system represents world's best technology, and produces a final, treated wastewater quality which more than meets the requirements of the DEP.

- wider catchment sources. The Environmental Improvement Initiative recognises that by far the greatest amount of nutrients entering Geographe Bay via drains and rivers are shed from land in the catchments of these waterways. The EII will operate State-wide within the catchments in which the Water Corporation is upgrading or establishing new wastewater treatment plants, to provide funding to landholders to reduce loss of nutrients from their land. The first application of the EII funds is to be as part of the provision of the new Busselton WWTP. Hence the main beneficiaries of the EII program will be farmers, recognising that agricultural land use is the main contributor of nutrients to waterways and Geographe Bay, but funding will not be limited solely to farmers.

The emphasis for the Busselton EII on farmers is a matter of geography and land use – if the program had been initiated as part of a wastewater treatment plant upgrade elsewhere, the main beneficiaries of funding may well have been industry or urban land use, if these land uses were the main sources of nutrients to sensitive receiving environments.

The Water Corporation's aim in establishing the EII is to help address community concerns over nutrient inputs to Geographe Bay. The funding provided by the program will lead to a substantial reduction in nutrients entering Geographe Bay. The basis of the EII is that for a fixed amount of funding, a far greater amount of nutrients can be removed from relatively concentrated, unmanaged or untreated sources (such as dairy shed wastes and animal waste runoff from paddocks) and will achieve far greater environmental benefits, than attempting to remove the last, few remaining nutrients in the highly treated wastewater.

The Water Corporation also believes that a rational, equitable and balanced approach must be adopted to reducing nutrient losses to Geographe Bay. If such an approach is not adopted, the long-term health of Geographe Bay would be more at risk than if the Water Corporation were to concentrate all its resources to treat wastewater to an exceptionally high standard.

8.1.2 Question - Both the existing nutrient load in the drain and from the waste water treatment plant deserve more consideration, but the Environmental Improvement Initiative should be considered separately/ be removed from the waste water treatment plant proposal.

The Water Corporation has proposed the EII at the time of upgrading the WWTP to demonstrate to the Busselton community its commitment to good environmental outcomes. The Water Corporation is not content to only manage the community's wastewater using best technology treatment systems. The Water Corporation intends to 'go beyond compliance' to provide resources to address the community's concern to achieve an even greater reduction in nutrient loads to Geographe Bay from the other sources which are not the Water Corporation's responsibility. The Water Corporation believes this would provide a greater environmental benefit than expenditure on additional wastewater treatment.

8.1.3 Question - The logical move now that a problem has been identified with the drain is to address the issue, not add to the problem as the Water Corporation plans to do.

It is unclear what problem is being referred to here. If the concern is about contaminant loads being transported via drains to Geographe Bay, the real issue is the need to address the far more substantial quantities of nutrients shed from catchment sources, rather than the contribution from the community's treated wastewater which represents only about 3% of the total nutrient loads into the Bay. A second point is that the Water Corporation is addressing the problem as the new high technology WWTP will reduce the overall nutrient loads from the community's wastewater, compared to estimated 1997 loads.

If the concern is about the capacity and operational management of the drain, this has been addressed in the responses in Section 2.1.

8.1.4 Question - There are existing sources of funds to help streamlining and dairy waste management. By 2040 Water Corporation could be the main contributor of nutrients to the bay.

It is extremely unlikely that the Water Corporation would be the major contributor of nutrients to Geographe Bay, even in the year 2040. This would require all other land users to have reduced their contributions by more than 99%.

There are a number of sources of funding for streamlining activities, including funding available from an LCDC (Land Care District Committee) project, the Natural Heritage Trust, Greening Western Australia funding programs, etc. However, Agriculture WA and Geocatch confirm that there are no sources of funding for dairy farmers to manage their dairy wastes, particularly dairy shed wastes, other than the tax write-off provisions under the Income Tax Act. This is one reason why the EII at Busselton will target financial support to better manage dairy wastes from sheds, accessways and paddocks. The other reason is that dairy wastes are a concentrated source of nutrients and bacteria which contribute substantially to the contaminant loads to Geographe Bay.

Waterways monitoring programs generally demonstrate that water quality in most of the State's waterways within rural catchments continue to deteriorate, even with active landcare programs in place. This is confirmed by the 1997 State of the Environment report, which places eutrophication of inland waterways as a high priority environmental issue for the State, which requires immediate action to reduce nutrient and soil export from farmland, industry and urban sources. The 1997 State of the Environment report also recommends that to achieve a sufficient reduction in nutrient levels in affected waterways, best land management practices will need to be implemented by 50% of landholders by 2010 and 100% by 2020. The EII will assist in implementing this recommendation.

The Water Corporation is more than playing its part in reducing nutrient exports to Geographe Bay from the community's wastewater, by producing a very high quality tertiary treated wastewater with significantly reduced levels of nutrients (48% less phosphorus to 2020), eliminating septic effluent leaching into Geographe Bay with the Infill Sewerage Program, and establishing the EII to support the farming community's efforts in reducing their nutrient contributions to the Bay.

8.1.5 Question - Consider the message that the Environmental Improvement Initiative will not be available if Water Corporation can't use drain to be blackmail. Water Corporation has a responsibility for drainage.

The Water Corporation's responsibilities for drainage are to provide and maintain the main drain infrastructure to a standard required to transport excess land runoff in a safe and efficient manner. The Water Corporation's responsibilities do not extend to the quality of the water carried in its drains. The quality of drainage waters is currently the responsibility of a number of agencies including the Water and Rivers Commission, Department of Health Western Australia, the Department of Environmental Protection / Environmental Protection Authority and Busselton Shire Council.

The basis of the EII is that for a fixed amount of funding, a far greater amount of nutrients can be removed from relatively concentrated, unmanaged or untreated sources (such as dairy shed wastes and animal waste runoff from paddocks). This will achieve far greater environmental benefits than attempting to remove the last, few remaining nutrients in the highly treated wastewater.

Reuse of reclaimed water in no way threatens the EII, which will continue regardless of the amount of reclaimed water used for other purposes. However, disposal to drain is needed for operational reasons, particularly to have the flexibility to dispose of water if there are no users of reclaimed water, or if not all the water available is able to be used by others.

8.1.6 Question - Support in-principle the Environmental Improvement Initiative, but the fact that other nutrient sources are entering the bay should not be used as an excuse to not reduce nutrient levels from the plant.

The Water Corporation is definitely reducing the contribution of nutrients from the community's wastewater through the construction of the new, high technology IDEA treatment plant. The treatment system is designed in such a way that, in spite of a four-fold increase in expected flows of wastewater in 2020, the amount of Nitrogen will increase by only 100 kg (from 8.9 tonnes in 1997 to 9.0 tonnes in 2020), while the amount of Phosphorus will reduce from 2.3 tonnes in 1997 to only 1.1 tonnes in 2020 (ie a 47% reduction over 1997 loads). The treatment system represents world's best technology, and produces a final, treated wastewater quality which more than meets the requirements of the DEP.

8.1.7 Question - It is not realistic to suggest that helping farmers will reduce loads because quoted figures are unreliable, the funds are too small and nutrient loads from the plant will continue to increase.

The figures quoted in the CER were obtained from relevant officers of Agriculture WA, who acknowledged that they are *estimates* of nutrient losses from dairies and other rural sources. However, it is widely recognised that the major sources of nutrient runoff to Geographe Bay are from dairies, broadacre grazing, horticulture, and to a lesser extent urban and point sources from the wastewater treatment plant, the landfill site and other sources. As indicated in the response to other questions, the Water Corporation's contribution from the Busselton WWTP will decrease (to the year 2020), or at the worst, increase only slightly (by 2035).

The Busselton EII will provide up to $200,000 for up to 5 years. This is substantially more than other sources of funding for catchment management works available in the area, for example GeoCatch's Water, Land and Life grants program which provides $60,000 per annum.

8.1.8 Question - The Environmental Improvement Initiative estimate of potential nutrient reduction by targeting the dairy industry may have been overestimated because;

- the calculation does not take into account nutrient cycling processes before nutrients reach the drain;

- dairy sheds only hold about 10% of the nutrients/faecal matter produced by the herd;
- nutrient transport and cycling processes in the paddock are difficult to determine; and
- little nutrient monitoring has been undertaken along drains.

It is acknowledged that the figure of 19-94 tonnes of nitrogen quoted in the CER as being contributed by dairies in the catchment of the Vasse Diversion Drain is an estimate, which does not take account of the amount of nitrogen taken up by pastures. However, the absence of nutrient/waste management measures on most dairy farms in the Busselton coastal plain area to contain runoff means that significant amounts of contaminated runoff will occur from hardstand areas (such as dairy sheds and accessways), particularly in winter when the pastures are waterlogged, and nutrients in this runoff will not be effectively taken up in pastures.

In addition, the nutrient of main concern in marine environments, nitrogen, occurs mostly in the soluble form, and is therefore not readily bound to soil particles. Hence, nitrogen in faecal matter produced by dairy herds in paddocks which is not taken up by pastures inevitably contributes to runoff or seeps into the groundwater to be discharged via the drains.

Agriculture WA's concern that little nutrient monitoring has been undertaken along drains is acknowledged. The Water Corporation currently undertakes weekly sampling in 12 locations along the Vasse A Subdrain and the Vasse Diversion Drain.

The Water Corporation suggests that monitoring of other rural drains to augment the Water Corporation's drain monitoring should be undertaken to better understand nutrient runoff processes and loads within rural catchments, and from individual rural enterprises. However, this is clearly outside the scope of work for the Water Corporation.

Future monitoring responsibilities and frequency will be negotiated with the Department of Environmental Protection in determining licence conditions.

8.1.9 Question - It is inappropriate to compare potential nutrient reductions in the Peel Harvey catchment to the Geographe Bay catchment. The 40-50% reductions in diffuse nitrogen and phosphorus over a 3-5 year time scale in the Peel Harvey (page 2-6 of the CER) were the result of theoretical modelling, and have not been the actual on-ground experience in Peel Harvey.

The Water Corporation considers that, in the absence of detailed nutrient runoff information from the Busselton Coastal Plain System, it is acceptable to compare the potential nutrient reductions from improved land management in the Busselton area with that for the Peel Harvey as both areas have similar soil types, landforms, and land use. In addition, the approaches applied to reduce nutrient loads from agriculture in the Peel Harvey catchment are equally applicable to the Geographe Bay catchment.

The actual wording of the section in the CER dealing with reducing nutrients through the EII is "Experience gained from studies of the Peel-Harvey system suggests that reductions of diffuse nitrogen and phosphorus loads of at least 10-20%, and *perhaps up to 40-50%* (Water Corporation emphasis) are achievable over a 3-5 year

timescale." The Water Corporation is confident that at least 10-20 % reductions are achievable, but would be keen to achieve greater reductions, although it is recognised that this may not be practically achievable under existing land use patterns. Even a reduction of 10–20% in the estimated 489 tonne/annum of nitrogen and 54 tonne/annum of phosphorus discharged into Geographe Bay from the drains (i.e. the non-domestic sourced nitrogen load) is a target well worth aiming for, and much greater than the contribution from the Busselton WWTP.

8.1.10 Question - Funding not enough (ie. $200,000 pa for five years), not specific to Busselton and will rapidly be used for monitoring station and committee expenses. It will not be enough to achieve desired outcomes.

The funding for the Busselton EII is significant compared to other sources available to the area (see response 8.1.7 above). While the Water Corporation's EII program is to operate Statewide, the first allocation of funding from this program, the Busselton EII, is specifically for the Busselton area. The CER clearly states that "nutrients exported to Geographe Bay from the Buayanyup River, the Vasse Diversion Drain, the Vasse-Wonnerup System, and the Abba and Ludlow River would be targeted" (CER 3.8.1). The Water Corporation has internally allocated an additional amount of funding to administer the Busselton EII over and above the (maximum) $200,000 per annum for five years for actual works. This was deliberately done recognising the community concern/perception about the amount of landcare funding for works which is taken up in grant program administration.

The Water Corporation recognises that the EII funding alone will not be enough to achieve the desired outcomes in terms of greatly reducing the nutrient loads to Southern Geographe Bay. However, this is not the aim of the EII program. Rather the Corporation aims to provide real financial *assistance* to *encourage* rural landholders and others to co-invest and implement best management practices which will reduce their contribution to nutrient runoff to sensitive receiving environments. The Water Corporation's financial assistance will need to be augmented by the landholders concerned, recognising that they are responsible for their nutrient contributions, not the Corporation.

8.1.11 Question - Should use Environmental Improvement Initiative money to find new options for the waste water.

The CER concerns only disposal options for the treated wastewater, as the IDEA treatment plant has already received Works Approval from the DEP. Negotiations to implement environmentally and economically viable reuse options for the wastewater are continuing, as stated in the CER. The basis and aims of the Water Corporation's EII have been explained at 8.1.1. The EII is being proposed as an alternative to reuse of treated wastewater because, in spite of the considerable effort to date, no environmentally and economically effective reuse options have been developed and agreed with second parties.

8.1.12 Question - Does not appear equitable that Water Corporation provides $1m for Environmental Improvement Initiative for a saving of $8.5m, and while revenue continuously increases as more premises are connected to sewerage.

It is not clear to what the saving of $8.5 million relates. Table 2.4 of the CER indicated that the anticipated cost of the IDEA plant, constructed wetland and discharge to drain was approximately $17.5M excluding operating and maintenance costs. Construction of an ocean outfall would be approximately $3.5M more than this option. Irrigation of woodlots was estimated to be $5.5M to $12.5M more expensive than the wetland option (ie. total cost $21M to more than $30M).

Since the 1st of January 1996, the Water Corporation has been required to fully recover the capital cost of new infrastructure. This is achieved through the annual service charge to the Water Corporation's customers (rates) or through a community service obligation agreement with the State Government.

The cost of operating infrastructure must also be recovered and this is usually done through rates. It is worth noting that future rate increases in most country towns are ear-marked to recover the costs of the existing schemes. Therefore an increasing number of connections to the sewerage system does not necessarily increase the amount of available funds. The Water Corporation has responsibility to Government, through the Office of Water Regulation, to provide cost effective wastewater services - an expenditure of $8.5 million on the Busselton scheme is not considered to be cost-effective.

It is also worth noting that large capital expenditures such as $8.5 million on any one scheme limits the Corporation's ability to fund other worthwhile capital projects.

8.1.13 Question - Potential community resistance to improved catchment management should be taken into account/ determined in respect to the Environmental Improvement Initiative (eg. farmers may not be willing to enter into binding agreements). Community has secured NHT funding for fencing and rehabilitation of waterways, which it is having some difficulty in acquitting, not to mention the added responsibility of administering these funds. If little community acceptance, what happens to the money?

It is acknowledged that landholders may resist taking part in the Busselton EII, particularly in the first year when the new program will need considerable promotion and explanation to landholders. Various academic studies of reasons for adoption and non adoption of landcare practices generally conclude that landholders will resist adoption if they consider it is too difficult to access funding (excessive form-filling, etc) and if accountability requirements for acceptance of funding are too onerous.

It is important to recognise that the guidelines for the Busselton EII have not been determined. These guidelines would be developed in association with a local EII advisory group, comprising members of the Local Authority, GeoCatch, other relevant local groups, and regional officers of the Corporation, Water and Rivers Commission, and Agriculture WA. It will be up to this local advisory group to recommend reasonable guidelines which meet the needs of both the community and the Water Corporation.

Discussions with officers of Agriculture WA suggest that the Busselton EII will be attractive to landholders, particularly dairy farmers as a major target group, for the following reasons:

- there are no financial incentives available to dairy farmers, other than the tax write off provisions under the Income Tax Act;
- capital costs are high for constructing ponds to collect and store dairy shed wastewater during winter, and to purchase appropriate irrigators to spread the wastewater during summer;
- dairy waste management is recognised as one of the most significant challenges facing dairy farmers in operating more sustainably. This is reinforced by the allocation of considerable funding to this area by Agriculture WA's Dairy Program;
- the Dairy Code of Practice developed jointly with the Water and Rivers Commission and Agriculture WA indicates increasing interest by regulators in achieving improved land management practices by dairy enterprises;
- newly establishing dairies in the Shire of Busselton are required to install effective dairy waste management systems. It is therefore only a matter of time before existing operators will be required to do similar. New Dairy regulations are under development by the Department of Environmental Protection.

In the unlikely situation that there is little community acceptance of the Busselton EII, then the funding will be reallocated to other rural catchments where there is interest. The Corporation is upgrading a number of wastewater treatment plants in Margaret River, Boyup Brook, Pinjarra, Collie, Bridgetown, etc, and it is likely that additional funding for local catchment management activities will be welcomed by these communities.

8.1.14 Question - The Environmental Improvement Initiative would be more successful if both the Water Corporation and Agriculture Western Australia work collaboratively.

The Water Corporation has held a number of meetings with officers of Agriculture WA to help define the EII program, to scope likely guidelines and administrative procedures for the Busselton EII, and to discuss the sorts of works which would be effective in minimising nutrient runoff particularly from dairy farms. The Water Corporation envisages that Agriculture WA would provide technical assistance to assess project proposals (as required), and would help promote the program within their farming networks.

8.1.15 Question - Significant reductions in nutrient exports from horticulture could be achieved if projects focus on irrigation, fertiliser and drainage management, and soil particle loss. There is an opportunity for Agriculture Western Australia and the Water Corporation to work collaboratively on projects using biosolids from the waste water treatment plant in the Horticultural Industry Soil Amendment Project.

The Corporation strongly supports this suggestion.

8.1.16 Question - Whole farm nutrient management systems would reduce nutrient exports more significantly than a focus on dairy sheds alone.

The Water Corporation endorses this view. The Busselton EII will not be limited to funding dairy shed waste management systems, but will include projects to improve pasture nutrient management, to reduce nutrient laden stormwater flowing off farms and urban areas, and to improve on-farm nutrient and water management. However, if demand for EII assistance exceeds available funding, the Water Corporation would be keen to ensure that funding is allocated to projects which achieve the greatest reduction in nutrient loss. It is envisaged that EII funding would be for actual works, rather than planning activities, which are better (and already) supported through NHT and State sources of funding.

8.1.17 Question - The Environmental Improvement Initiative should invest in innovative projects which could easily be adapted to a range of industries and therefore achieve high rates of nutrient export abatement per dollar spent.

It is unclear to what this comment is specifically referring. The Water Corporation considers that the EII is a highly innovative program, which is generating considerable interest from the water industry in other States. The aim of the EII is certainly to achieve a high rate of nutrient export abatement per dollar spent. The Water Corporation would welcome specific suggestions of innovative on-farm management or treatment of nutrient-laden wastewater.

8.1.18 Question - Agriculture Western Australia will not be responsible for policing contracts between the Water Corporation and private parties.

The Water Corporation has not suggested that Agriculture WA take on such a role. It would be beneficial for the effective and successful operation of the EII for Agriculture WA to assess particular project proposals (eg pond systems or irrigators for containing and irrigating dairy wastewater, respectively), and to check that pond systems, for example, are constructed correctly.

8.1.19 Question - Some of the Environmental Improvement Initiative funds should be directed to strengthen the flow and water quality monitoring so loads to Geographe Bay can be accurately determined, and determine if the long term objective of reducing loads is being achieved.

The Water Corporation will make limited Environmental Improvement Initiative funding available for water quality monitoring.

9 Noise

9.1.1 Question - The new IDEA and doubling in size of the IDEA for 2035 will both increase noise levels from the plant. What noise levels typically come from a 900 cum/d plant? Is a 500 m buffer proposed to address this?

Noise generation from equipment within the WWTP would be set to ensure that noise levels at 1m from each item of equipment were no greater than 85 dBA. It is expected that this would ensure that allowable neighbourhood noise levels would be met at the edge of the proposed buffer zone.

The CER (Page 1-3 and 6-14) indicates that:

"A proposal to create a 500-m-wide buffer zone surrounding the WWTP site is a component of the WWTP upgrade."

This is both to protect the WWTP from encroachment of future development and to ensure that land use contiguous with the WWTP is of a compatible nature. Such a buffer dimension is typically set to address any potential for odours emanating from the wastewater treatment plant, but should also be adequate for noise attenuation. The buffer zone will be assisted by the Shire of Busselton's new District Planning Scheme, which provides support for a 250m-wide Wastewater Exclusion Area and a 500m-wide Wastewater Buffer Area surrounding the treatment plant site.

In addition, the Water Corporation would landscape the site between the WWTP and the road. This would assist in attenuating any noise (and odour) emission.

10 Recreation

10.1.1 Question - CER data indicate the beach near the drain is unsuitable for swimming in winter, (winter samples fail to meet ANZECC Guidelines for Primary Contact Recreation) where there is a health club 50m from the outfall and a high level of recreational use. Will signage be erected or the drain diverted to another location? Can you put a price tag on human health and safety.

The monitoring undertaken by the Water Corporation has for the first time provided information for the community on the water quality of a main drain system and the beach in Busselton. The evidence is that the microbial quality of the water is variable but poor in winter.

Recent monitoring of bacterial and faecal sterol levels at the beach has been undertaken. The results indicate that bacteria at the beach originate in contaminated surface runoff which is transported to the beach via the drainage system draining the whole catchment. These bacteria principally originate from farm animals (CSIRO 1998).

The existing WWTP (and wetland) produces a treated wastewater with a median of 2000 cfu/100mL, which fails to meet ANZECC guidelines for both primary and secondary recreation. The water quality in the minor receiving drain into which the WWTP discharges has similar median bacteria counts (1800 cfu per 100mL) and also fails the guidelines. The source of this contamination upstream of the WWTP is agricultural runoff, which is the only land use in this part of the catchment. This is the case also for the Vasse Sub A Drain upstream of any influence of the discharge of treated wastewater.

In winter then, bacteria at the beach currently originate mostly from runoff of manure from farms, the treatment plant and possibly also the Rendezvous Road rubbish site (where septage disposal has occurred until very recently). However, with the new IDEA treatment plant, the contribution of bacteria from the community's wastewater will be much less than that from the existing plant. The Water Corporation has modified the disinfection system so that the bacterial counts at the outlet of the WWTP are expected to be a median of less than 10 cfu per 100mL (ie less than the primary contact recreation standard of 150 cfu per 100mL).

Although there may be some additional bacterial contamination in the wetland, bacteria emanating from the new IDEA treatment plant will be so low as to not impact on current beach water quality. However, the existing catchment sources will still contribute high, but variable, levels of bacteria in winter. Only when these catchment sources are significantly reduced will bacteria not be of concern on the beach in winter.

Appropriate signs may be erected in strategic locations along the drain by the Water Corporation and on the beach in the vicinity of the drain outlet warning of possibly high bacterial levels.

10.1.2 Question - Drain is used regularly for recreational activities including swimming, fishing (most mornings) and canoeing, especially by the five schools adjacent to the drain & Yacht Club competitions take place regularly across the outlet area. If we find signs banning recreational use of the drain how should we tell our children that they should respect the authorities and not vandalise public property.

The relevant public authorities responsible for informing the community about the quality of the water in the drain are the Water Corporation (as owners of the drain), the Water and Rivers Commission (responsible for water quality of all the State's waterways), the Health Department (responsible for ensuring public health), and the Shire of Busselton (responsible for ensuring the health of the local community).

These public agencies have a duty of care to inform the community about the potential hazards associated with direct and indirect (contact) recreation in the drain. The solution to the problem lies in preventing unacceptable levels of bacteria entering the drain system, and for the community to recognise that drains should not be used for recreational activities until a considerable effort has been made by all landholders in the catchments of the drains to eliminate land management practices which continue to contaminate the drains with bacteria.

The Water Corporation is working with other relevant agencies to prepare school curriculum materials and public information leaflets to point out the problems with, and to discourage, the use of drains for recreation.

10.1.3 Question - In relation to the reported public use of the drains, it is likely that the erection of signs advising against swimming will be recommended by the Health Department of Western Australia.

The Water Corporation agrees with this advice, and may erect appropriate signs at strategic locations along the drain.

10.1.4 Question - If the treated waste water is unfit for irrigation, it is most certainly unfit to swim in or eat fish from.

In the CER, the Water Corporation proposed to disinfect the treated wastewater to the standard suitable for primary contact recreation (ie a median value less than 150 cfu/100mL). The standard for irrigation of crops eaten raw or only partly cooked is a median of less than 10 cfu/100mL, and for shellfish the figure is 14 cfu/100mL. If and where any reuse of treated wastewater for irrigation of these types of crops occurs, the wastewater would be disinfected prior to being irrigated, in compliance with Health Department requirements.

Treated wastewater has a relatively high salt content, which can make it unsuitable for application to certain types of vegetation and crops. Its salt content would not,

however, render it unacceptable for recreation or the consumption of fish swimming in the treated wastewater.

10.1.5 Question - Can the Water Corporation guarantee that bacteria will not regrow to levels exceeding health criteria.

Bacteria in waterbodies tend to die out naturally when exposed to natural UV light and as a result of predation by other organisms in the waterbodies. Monitoring indicates that bacteria die off very rapidly in the Vasse Sub A drain in summer, such that water quality meets primary contact recreation standards before the flow dries out entirely just south of the point where the drain meets the Vasse Diversion Drain. In winter, this trend is not evident because of low residence time in the drain, the high, and highly variable, bacteria counts from catchment sources, less attenuation because of lower UV light conditions, and lower water temperature.

As the Water Corporation is now confident of further significantly reducing the level of bacteria leaving the WWTP from a median of 150 to 10 cfu/100mL, the Water Corporation is confident that bacteria will not regrow in the drain system to levels exceeding primary contact recreation in summer or winter (from the community wastewater component of the flow, not from catchment sources).

10.1.6 Question - Discharge water should support zero bacteria. Chlorination may be needed as water leaves the wetland.

UV disinfection is most effective where the water is clear and light penetration is very high. UV disinfection is not as effective where the water is cloudy, such as that exiting the wetland due to mixing and suspension of bottom sediments. High clarity water can be guaranteed in the treated wastewater exiting the IDEA treatment process, so the treated wastewater will be disinfected at the outlet of the plant, not at the exit of the wetland.

The Water Corporation's aim is to achieve a treated wastewater with very low levels of bacteria exiting the wetland. To this end, the Water Corporation is proposing to achieve a median of less than 10 cfu/100mL in treated wastewater entering the wetland, significantly better than its original commitment in the CER of achieving a median of less than 150 cfu/100mL. There will be some contamination by defecating waterbirds in the wetland and drain system, but the extent of this cannot be predicted. As catchment sources of bacteria are currently mostly unmanaged and will continue, it serves no useful purpose to completely eliminate bacteria from only one (minor) part of the flow in the drain. However, if the levels of bacteria in wastewater leaving the wetland are unacceptably high, the Water Corporation would consider what alternative measures to employ.

Chlorination would not be used because the chlorine would not persist very long in the treated wastewater or in the drain, as it would rapidly react with other contaminants in the drain and be ineffective.

10.1.7 Question - Routine microbiological sampling should be undertaken along the beaches of the southern Geographe Bay and the Vasse Diversion Drain downstream from the Sub A drain, and appropriate preventive action taken.

Microbiological sampling is already being done routinely, both along the Vasse Diversion Drain and at the beach (see Table 1) and this will continue, as specified in the CER. If the levels of bacteria in the drain and at the beach are unacceptably high, the Water Corporation would consult with other agencies and consider what course of action to take, along with (other) potential contributors to the problem.

10.1.8 Question - Copies of all microbiological results will be required to be forwarded to the Wastewater Management Section of the Health Department of Western Australia, and compliance with standards would be monitored.

This is standard practice with which the Corporation complies for its 90 wastewater treatment plants throughout the State.

11 Other

11.1 ALTERNATIVES

11.1.1 Question - Elimination by the Water Corporation of options which could not use all of the waste water is an inflexible negative methodology to choose the right option.

The Water Corporation will not eliminate reuse options which will take only part of the total flow of treated wastewater. Negotiations are now proceeding to irrigate Busselton Golf Course during summer months and additional potential areas for reuse are being sought. However, while reuse of the total flow of treated wastewater is not assured or not assured for any length of time, the Water Corporation must seek approval to be able to discharge or otherwise dispose of the remaining part of the flow which is not reused.

11.1.2 Question - Water Corporation commitment to 'explore' alternatives is no real commitment.

The Water Corporation has expended considerable effort to date to investigate and promote reuse opportunities with landholders, to little or no avail. The Water Corporation has investigated purchase and lease of farmland for reuse, and has made efforts to seek local markets for the treated wastewater. The Water Corporation can do little more until landholders are willing to accept reusing the community's treated wastewater, rather than seeking the use of fresh water.

The Water Corporation is currently attempting to finalise an agreement with the Busselton Golf Club which will enable a significant component of the summer flow of treated wastewater to be reused. The agreement needs to suit both parties, and an important issue to resolve is that of management responsibility for ensuring application of the treated wastewater on the golf course so that it does not cause adverse environmental impacts. Further opportunities for reuse are being investigated.

There are a number of potential difficulties for landholders in reusing the treated wastewater, which may be why landholders appear reluctant to take up reuse opportunities. These include the moderate salt content of the wastewater which prevents irrigation of sensitive crops; the need to manage application of the treated wastewater to land very carefully to ensure no unacceptable environmental impacts occur, and to take responsibility for such assurances; and making a commitment to take a specified quantity of the treated wastewater for a minimum period of time.

Nevertheless, the Water Corporation is prepared to continue to negotiate with any landholders potentially interested in using reclaimed water, and is hopeful that once a single landholder agrees to take treated wastewater, other landholders will follow suit.

11.1.3 Question - On page 2.14 the figures for the recommended option and the woodlot option appear to be reversed, causing confusion and distrust.

The figures are correct as stated in Table 2.4, and are different because the recommended option includes a constructed wetland. The quality of the treated wastewater to be used in either of the woodlot options is that produced from the IDEA treatment process directly, and does not rely on the wastewater flowing through a constructed wetland. The Water Corporation's preferred option includes a constructed wetland, which will further reduce the nutrient levels, but slightly increase the bacteria counts as the water passes through the wetland due to the presence of waterbirds and other animals.

11.1.4 Question - An alternative must be found even if the costs are greater. Every effort be made to find uses for this water.

This view is endorsed. The Corporation is actively pursuing reuse opportunities. However, landholders need to be willing to take the treated wastewater, and to use and apply it in ways which are environmentally acceptable. This will require a higher level of management by landholders to ensure groundwater rise does not become a problem, to ensure land does not become salinised, and to ensure excess nutrients do not leach into the shallow groundwater or runoff to surface drains.

11.1.5 Question - Alternative uses suggested include:

- land irrigation especially during summer when potential impacts on Geographe Bay are highest
- irrigation uses suggested include the golf course, horticulture, viticulture, a plantation at the Busselton Airfield, a tree lot on the slopes or at the foot of the Whicher Range, joint options with farmers rather than the Water Corporation purchasing the land, use on Department of Conservation and Land Management land and use in Shire parks and gardens
- the use of tertiary treated water to improve water quality in the Vasse River,
- inclusion of dual pipe systems in new residential areas so water can be used for garden watering in new housing estates.

The Water Corporation has taken considerable effort to investigate and promote a variety of reuse options, including irrigation of woodlots, horticulture, irrigation of Shire recreation areas and irrigation of the Busselton Golf Course. A firm reuse proposal is now being negotiated with the Golf Club.

Environmentally acceptable irrigation and complementary land management practices are more readily managed where only one or two landholders take the treated wastewater. It would be much more difficult to ensure environmental requirements for irrigation and associated land management are acceptable where treated

wastewater is shared with many landholders. Many landholders would be required to use reclaimed water for irrigated horticulture and silviculture, as large areas of land are required to dispose of the quantities of wastewater generated by the Town of Busselton by the year 2035. It has proved difficult to find sufficient numbers of neighbouring landholders willing to use reclaimed water, since supplying reclaimed water to widely scattered users is very expensive.

A plan is being developed with GeoCatch and the Shire of Busselton to improve the condition of the Lower Vasse, which is highly eutrophic. A major requirement is to periodically dredge and remove the organic sediments accumulating in the base of the Lower Vasse estuary. The likely management objective for the Lower Vasse will be to maintain the waterbody as an estuary by maintaining the floodgates in a closed position during summer, rather than opening the floodgates to enable some tidal exchange and flushing of the waterbody. If this is the case then allowing treated wastewater to flow into the Lower Vasse will exacerbate its nutrient enrichment problems because the nutrients in the treated wastewater will accumulate in the Lower Vasse estuary.

Installing a dual pipe system in new residential subdivisions is possible, but would need to be specifically requested and supported by the Shire of Busselton. Such systems are very costly.

Irrigation of Shire parks and gardens has been examined, and while the Shire expressed some interest and it is technically feasible, the possible areas are widely separated, it would be the most costly option, and it would not be able to use all the treated wastewater generated.

11.1.6 Question - Alternative uses would be consistent with Wastewater 2040 and the principle of water being an asset, and could be implemented progressively as the plant expands.

The Corporation concurs with findings of the Wastewater 2040 report, and its strong support for reuse over disposal of treated wastewater. However, Wastewater 2040 also indicated that disposal of highly treated wastewater to surface waterbodies via constructed wetlands could also be acceptable. The Water Corporation is seeking approval for disposal to the drain via a constructed wetland all year round, while also negotiating to irrigate the Busselton Golf Course (as detailed Part A) and to seek other reuse options to actively achieve reuse of the treated wastewater.

For planning reasons and to provide certainty to Busselton ratepayers wanting assurances about the amount of drainage and sewerage rates they will be required to pay, the Water Corporation requires approval for a disposal strategy to 2005, even if only as a fall-back position if no other options arise. The Water Corporation is committed, however, to promoting effective reuse of as much of the community's treated wastewater as practically possible, and would be actively assessing reuse opportunities over the next 20 years, not just when expansions of the treatment plant are anticipated.

11.1.7 Question - Disposal into the drain should be a last resort option.

The Corporation is hopeful that in addition to reuse on the Busselton Golf Course, practical reuse opportunities will be available such that disposal to drain in summer occurs only as a last resort. Discharge to drain in winter is considered particularly environmentally acceptable because of the insignificance of the contribution of the treated wastewater compared to the total flow from the rural catchments down the drain, both in terms of volume of water and nutrient loadings.

11.1.8 Question - We agree that the following options are unacceptable: irrigation of woodlots with winter storage effluent; summer irrigation of woodlots with winter discharge to drain; summer irrigation of agricultural crops with winter discharge to drain; and ocean discharge via pipeline.

The Water Corporation believes that the irrigation options listed above, particularly the woodlot options, are likely to be environmentally acceptable but technically difficult in the Busselton area. Irrigation of agricultural crops, particularly vineyards, may in the near future become feasible because of the rapid expansion in the number of vineyards in the southern coastal plain area. Ocean disposal via a pipeline is likely to be environmentally acceptable, but the Water Corporation's view is that this would not be socially acceptable to the community.

11.1.9 Question - Irrigated woodlots are not an option on the floodplain.

The Water Corporation believes that the irrigation of woodlots is likely to be environmentally acceptable but technically difficult in the Busselton area.

11.1.10 Question - Some of the potential areas for irrigation of agricultural crops are recharge areas for the Leederville aquifer, so this may not be an option unless water is free of bacteria and nutrients.

Agreed. The Whicher Scarp area is a known recharge area for the Leederville Formation, which precludes serious consideration of irrigation of crops in this area.

11.1.11 Question - If land disposal is not an option effluent should be piped out beyond the enclosed Geographe Bay (eg 25 km the other side of the Cape) to eliminate controversy and decrease the chances of the water becoming eutrophic.

The Water Corporation considers that a 4 km pipeline into 10m depth of water in Geographe Bay would provide sufficient dilution and dispersal of the treated wastewater such that there would be no adverse environmental impacts. The Continental Shelf to the west of the Cape to Cape area is very narrow, and plunges into very deep water very close to shore. An ocean outlet pipe would not have to be very long before it was in an adequate depth of water to ensure good mixing, but it would be technically difficult to build. However, a 25 km pipeline to the Yallingup area would be enormously expensive to construct and this would present a considerable financial burden on the ratepayers of Busselton.

11.1.12 Question - From a public health perspective, an appropriately situated ocean outfall would be the preferred option.

The Water Corporation recognises that this is the Health Department's stated preferred option. However, the Water Corporation has received recent advice from the Health Department (14/8/98) stating that because of the much higher microbiological quality of the treated wastewater to which the Water Corporation is committing itself to achieve (ie a median of 10 cfu per 100ml, rather than a median of 150 cfu per 100mL, as proposed in the CER), the Health Department has no objections to the disposal of the treated wastewater to drain.

11.1.13 Question - Thought it was government policy (expressed by Minister for Water Resources Peter Foss in 1995, reported in the Busselton Margaret River Times of 31 July) that no future outfalls.

An ocean outfall is not being proposed for Busselton. The intention of the Minister's Statement was that reuse or land disposal is preferable and would be used where practicable. Additionally, there is no specific Government Policy in Western Australia against ocean outlets.

11.1.14 Question - Community is against ocean outfall option - should be no ocean outfall.

An ocean outfall is not being proposed for Busselton.

11.1.15 Question - People should be given a choice of costed options at a referendum or similar to find out if people would contribute to extra cost of alternatives such as irrigation. This was promised by the Water Corporation at the "Value management workshop January 1997" (see page 18, item 7).

The CER provided the cost of the various alternatives and is a document prepared for public comment. Additionally, the Water Corporation has conducted an intensive community consultation program. This included the following:

- two rounds of market survey, involving 300 residents in Busselton, to determine community attitudes and issues about treated wastewater reuse and the disposal options. The most recent survey was completed on 24th July 1998.
- an open facilitated workshop attended by 32 members of the Busselton community to prioritise the treated wastewater disposal options.
- distribution of a pamphlet to 6300 households in the Busselton area responding to community attitudes and allowing the community the opportunity to rank the disposal and reuse options.

In addition to these formal surveys, the Water Corporation has actively disseminated information in relation to the project via a weekly information program in the local newspaper; meetings with various stakeholders and service clubs, an internet site; media liaison, and an interactive display.

Consequently the community, or considerable portions of the community, have been given many occasions to communicate their thoughts on the proposed project to the Water Corporation, as promised at the Value Management Workshop.

11.1.16 Question - The sewerage infill program presents an opportunity to redirect nutrient laden waste away from the groundwater. Would be absurd to redirect those nutrients to other sensitive environments.

The Infill Sewerage Program is designed to reduce or eliminate leaching of nutrients and bacteria from septic tank systems, some of which may find its way to the drain or the beach The Infill Sewerage Program will direct this wastewater to the advanced IDEA wastewater treatment plant. The IDEA treatment plant will produce a very high quality treated wastewater which, together with the likely reuse of the treated wastewater in summer, will reduce the level of nutrients and bacteria ultimately draining to Geographe Bay to insignificant levels.

11.2 SOLID WASTE

11.2.1 Question - Wetland sediment management is not detailed.

This issue is discussed in the CER on Page 3-7 as follows:-

"Most phosphorus is removed by precipitation and adsorption in the sediments (Bolton and Greenway 1995). Depending upon the phosphorus adsorption characteristics of the sediments within the wetland, sediment may have to be removed at periodic (eg. ten-year) intervals. The time frame for development of the organic peat/sediment layer on the base of the wetland cannot be accurately predicted. Monitoring of the condition of the wetland and the quality of discharges from the wetland would be necessary to determine the requirement for sediment removal.

"If necessary, sediment removal may be effected through temporary draining of parts of the wetland or by small-scale dredging. Depending on the extent and location within the wetland of any sediment removal operations, diversion of treated wastewater away from the area of sediment removal may be required to maintain effluent quality. In general, any sediment removal operations would be staged to ensure minimal impact on final quality of the treated wastewater."

The wetland water level is controlled by the internal and outlet weirs and the flow regime from the treatment plant is relatively constant. These measures should ensure that sediment disturbance or changes in sediment chemistry are minimised.

The ultimate option for disposal of the sediment which would be removed has not been decided. Options include incorporation into biosolids or other soil amendments, or land spreading on sandy soils.

11.2.2 Question - Method of disposal of biosolids should be detailed.

The biosolids will be digested aerobically in part of the IDEA plant before being pumped to the biosolids storage lagoon along with the alum sludge from phosphorus precipitation. The biosolids will be pumped from the biosolids storage lagoon as a

slurry, dewatered, probably using a mobile dewatering centrifuge, and trucked away for local commercial sale as a soil conditioning agent or fertiliser, at 2-5 year intervals.

The Water Corporation is also examining other uses for the biosolids, including direct land application as a soil conditioner on farms and in tree plantations.

11.2.3 Question - What will happen to nutrients extracted from waste water? If it is to be re-used in the catchment, how will the catchment nutrient budget be affected (eg. will imports of fertiliser reduce?).

As indicated in Section 3.5.3 of the CER, most of the nitrogen in the wastewater would be removed by denitrification (both in the IDEA plant and in the wetland) and returned as nitrogen gas to the atmosphere. Most of the phosphorus would be precipitated into a sludge (at the outlet of the IDEA plant) and directed to the biosolids storage lagoon or precipitated into the wetland sediments. Use of the biosolids as a fertiliser on agricultural land would reduce the requirement for other sources of fertiliser, though the phosphorus is not as concentrated or as readily available as in superphosphate.

11.3 GENERAL

11.3.1 Question - The licence should be reviewed every two years in the context of other options being considered.

The Water Corporation's licence to operate the WWTP and discharge treated wastewater to drain will be reviewed annually by the DEP. If the WWTP and treated wetland cannot be managed to meet the strict criteria proposed in the CER then it is possible that the option of discharge to drain could be removed. Nevertheless, the Water Corporation is committed to continued assessment of alternative reuse options for the wastewater in summer as detailed in section 11.1.2.

11.3.2 Question - The health and economy of our region is at stake, particularly the tourism industry on which Busselton depends. People will not come for holidays to swim in water if they perceive it to be contaminated or are frightened it might be contaminated with treated waste water, even if it is well treated.

The Infill Sewerage Program for Busselton together with the provision of the IDEA treatment plant will facilitate tourism development in the town by providing a new wastewater treatment facility which has the capacity to handle the tourism-generated peak flows in summer, well into the next centuary.

The Water Corporation is confident that the very high quality treated wastewater will not impact adversely on Busselton beaches. The Water Corporation's commitment to significantly reduce the bacterial levels from a median of 150 to 10 cfu/100mL, has resulted in a favourable response from the Health Department to the Water Corporation's preferred option (see response 11.1.12 above). The Health Department states that this very low level of bacteria is not a public health concern for recreation on Busselton beaches. The low levels of nutrients are also not of concern in terms of degrading the nearshore marine environment or reducing water quality.

The Corporation will undertake a comprehensive water quality monitoring program for the drain and the beach Special Management Area, and will report on the findings to the Shire of Busselton and the community, in addition to its legal requirements to report to regulators (DEP, Health Department, Water and Rivers Commission).

In addition, the IDEA plant and constructed wetland would showcase world-class technology which could be promoted to demonstrate Busselton's commitment to high class environmental management. The wetland itself could be promoted as an excellent site for bird-watching.

11.3.3 Question - The Busselton Shire Council is disappointed at the timing of the CER given the Easter and school holiday period and the public consultation process organised by the Water Corporation happening four days before the close of submissions.

This is acknowledged. However key officers and elected members of the Shire of Busselton were kept closely informed of the Water Corporation's preferred option as it was being developed, and were provided a final draft of the CER to provide feedback to the Corporation prior to its release. No comments were received.

The Water Corporation, recognising community concern over the short period for public comment, suspended the CER process in order to undertake a more intensive 12 week public information and consultation process. Community reactions to the Water Corporation's preferred option and other options were surveyed at the start and following the completion of the 12 week public consultation program. The community's 'willingness to pay' for various disposal/reuse options was also canvassed.

11.3.4 Question - A poorly advertised public meeting with 200-250 people attending found only one person in support of the proposal.

The public meeting was organised by the Water Corporation to inform the community, to address concerns, and to gauge reactions to the proposal. Two people spoke out publicly supporting the Water Corporation's preferred option, and only a third of the 125-150 people attending the meeting asked questions or spoke out against the proposal. It is well recognised that public meetings are a poor method of determining community opinions about specific issues or proposals.

The meeting was well advertised by the local public and commercial radio stations, and the local newspapers. The Water Corporation produced a brochure explaining the project and encouraging people to attend the public meeting. 5000 brochures were produced and delivered to every household in the town.

11.3.5 Question - I support/ strongly support the proposal

Thank you.

11.3.6 Question - Proposal should be re-considered in the context of the Kyoto Protocol of the United Nations - the submitter notes the use of woodlots as greenhouse sinks as the relevant aspect here.

The Water Corporation has actively investigated reuse options for wastewater disposal including woodlots and is aware that carbon credits may accrue from this. The Water Corporation considers that the woodlot option is environmentally acceptable but technically difficult on the Busselton floodplain. Woodlots are being considered for other treatment plant upgrades within the south-west. Carbon uptake by other agricultural crops is relatively small.

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13 Revised summary of commitments

A revised summary of commitments is shown in Table 3.

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