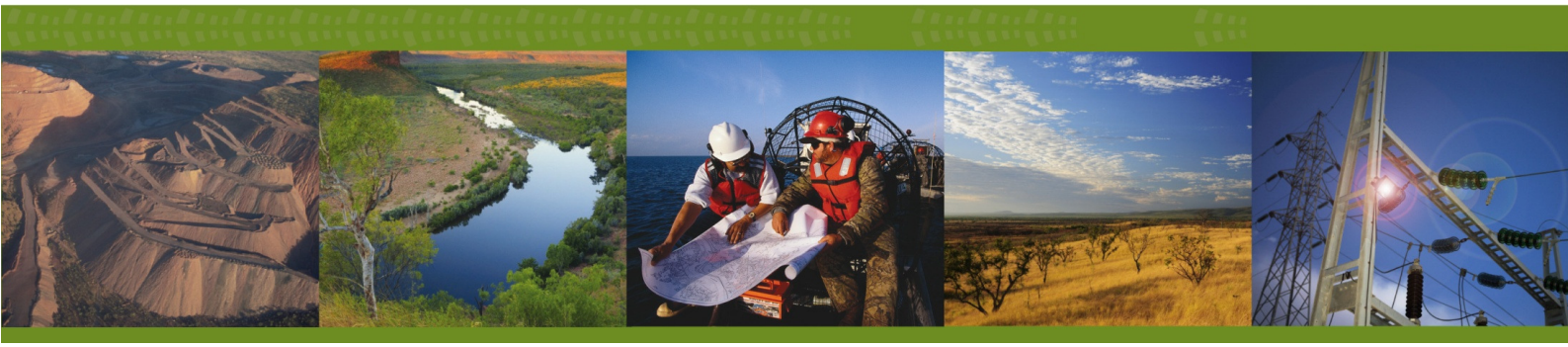

Detailed Response to Matters Raised in Submissions on the Mangles Bay PER

Prepared for
Cedar Woods
by Strategen

STRATEGEN
environmental consultants

Detailed Response to Matters Raised in Submissions on the Mangles Bay PER

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Client: Cedar Woods

Report Version	Revision No.	Purpose	Strategen author/reviewer	Submitted to Client	
				Form	Date
Preliminary Draft Report	A	Client Review	KT, NZ, JM, ILP, PB / DW	Electronic	
Final Report	0	OEPA Submission	KT, DW, ILP, MD	Electronic and hardcopy	
Final report	1	OEPA Submission	GH/DW	Electronic	

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1. The proposal

1.1 Definition

	Respondent (sub #)	Submission and/or issue	Response to comment
1	Public; Cape Peron Community Vision Working Group; Maritime Union of Australia; Wildflower Society of WA; Hon Lyn MacLaren MLC	The proposal is in contravention to three of the EPA's guiding principles, the precautionary principle, the principle of intergenerational equity, and the principle of the conservation of biological diversity and ecological integrity. The risks to the environment posed by this proposal are evidence that serious consideration of these principles has occurred.	The proposal has been specifically designed to minimise risks to the adjacent ecosystems, most of which have survived much greater man-induced disturbance in the recent past than the demonstrably low level of disturbance which will arise from the proposal. All of the EPA's key significant issues as identified in their Strategic Advice to the Minister in 2006 (EPA 2006) have been thoroughly assessed and the Proponent has demonstrated that the risks posed to the environmental values of adjacent significant ecosystems is minimal. Furthermore, the Proponent has proposed a range of offsets that will adequately mitigate residual impacts of the proposal. Hence the Proponent considers that the proposal is NOT in contravention of the EPA's guiding principles and provides the following advice in support of this position: Biological diversity and ecological integrity: Studies and assessment in the PER demonstrate that no significant long term impacts to critical assets will occur as a result of the Proposal. Intergenerational equity: The Proposal will not result in the extinction or complete removal of any asset, and therefore will not results in irreparable damage to ecosystems for future generations. Nor will it result in legacy costs to future generations. Precautionary principle: The Proposal has been reviewed and refined based on the assessment of environmental risk. Decision making has taken the precautionary principle into account and thus the current Proposal represents the iteration with the lowest level of environmental impact.
2	Public	The polluter pays principle – those who generate pollution and waste should bear the cost of containment, avoidance and abatement has not been considered. The community will have the long-term cost involved from this project.	The Proposal will not generate pollution (i.e. contamination, emissions, discharges). Nutrient inputs to the waterbody are from background groundwater outflows and are not caused by the Proposal. The potential for the marina to become a source of additional nutrient input to Mangles Bay is low and is readily manageable in the unlikely event that it occurs over time.
3	Public	The proposal will pose security risks for the naval base on Garden Island.	Consultation with relevant agencies (including the Department of Defence) has been undertaken, and security risks to the Navy are not considered to be adversely affected by the Proposal.

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4	Water Corporation	The PER as a whole does not appear to make any allowances for the relocation of the existing SDOOL or the proposed SDOOL duplication. The PER does not provide the Water Corporation with the necessary certainty that the Corporation's assets will be maintained and managed in accordance with the Corporation's requirements. Specifically, the PER states that 'determining the acceptability of the impacts of the SDOOL duplication, and how these may be managed or mitigated are not within the scope of this PER'. The Water Corporation disagree with this statement and do not believe the proponent has considered in sufficient detail the range of approval that are required to ensure successful continued operation and duplication of the SDOOL. It is the responsibility of Cedar Woods to apply for and obtain all approvals for the relocation of the SDOOL to the Mangles Bay Utility Corridor.	The PER provides a service corridor which has been conceptually designed to accommodate the realignment of infrastructure. Furthermore the key environmental impacts from clearing and dewatering have been included within the PER. The SDOOL duplication is considered to be undertaken at the same time as the realignment of the existing works and will not contribute further to the environmental impacts. A Construction Environmental Management Plan (CEMP) will be prepared prior to the commencement of the realignment and duplication of the SDOOL. Cedar Woods has been consulting with the Water Corporation on this matter for 18 months, and Water Corporation are members of the technical working group, and Cedar Woods was surprised with the Water Corporation response. Cedar Woods has since met with the Water Corporation to address their comments on the PER.
5	Water Corporation	The PER states that the final service corridor has a total width of 45m, of which approximately 25m is required to accommodation existing and future Water Corporation infrastructure. There has been no allowance made in the service corridor for slope disturbance and batter construction and the associated impacts of this work. Therefore it is highly likely that the final corridor width will be greater than 45m to accommodate the engineering measures required to stabilise slopes/dunes located to the south west of the proposed corridor. In addition Water Corporation has yet to finalise the design of the infrastructure and cannot confirm the width required.	The proposed concept service corridor has included the batters for an assessment of the environmental impacts. The 45m proposed width for the service corridor has been formulated with input from Water Corporation engineers and requirements to accommodate a dual road lane to the Garden Island Causeway. The width will be subject to final design and survey.
6	Public; Cape Peron Community Vision Working Group; Preserve Point Peron for the People.	The area set aside for low cost accommodation is very minimal and there will be an overall loss due to the removal of the camps. Location identified on the map is not suitable since its next to the main road.	The inclusion of a low cost family affordable accommodation is to provide the public with an opportunity to stay along Mangles Bay. The existing camps have leases which will expire prior to development of the site. Location for the family affordable accommodation facility provides a transitionary use to commercial/ mixed use land use types towards the active centre of the marina. The final location of the family affordable accommodation will be determined during the planning process.
7	Public; Cape Peron Community Vision Working Group; Preserve Point Peron for the People.	The community vision for the project area, which was prepared in genuine consultation with the community and is better representative of the mainstream vision for the area, should be considered for the proposal.	The proposal vision and objectives were formulated from extensive public and stakeholder consultations which occurred over several years. Whilst the overall concept has evolved over this time, the vision and objectives have generally remained the same.

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8	Public; Cape Peron Community Vision Working Group; Cockburn Sound Management Council Officer Submission	The proponents have not provided evidence to substantiate the economic benefits (refer to pp. 2 & 6). There are a number of advocacy statements alluding to the economic benefits of the development should it proceed with indications that economic and social benefits will be dealt with in the planning approval process. There is no need for additional shops and eating establishments, these have already been set up along Palm Beach and elsewhere. Existing restaurants already have trouble maintaining staff levels.	A full detailed economic study will be undertaken following the structure planning of the proposal. An economic assessment by Martinovic (2011) and commercial assessment by Taktiks4 to support the indicative land use plan has been completed. The report shows the development can support commercial, mixed use and residential opportunities to attract investment. The proposed marina is considered to compliment rather than compete with the Palm beach businesses.
9	Public	The 13 recommendations of the Standing Committee on Environment and Public Affairs from 2006 need to be addressed.	The majority of these recommendations are actions to be undertaken by government during the environmental approvals process, or independently of the process. Only recommendation 5 relates to the proposal area. Recommendation 5 refers to ASS risk at Lake Richmond. In February 2010 GHD completed a Geotech and ASS investigation for the proposed development. Based on the findings of the investigation, it is considered that no further ASS investigations or management is likely to be required prior to commencement of onshore earthworks. A further ASS investigation will be undertaken during the planning to confirm the absence of ASS soils.
10	Public; Cape Peron Community Vision Working Group; Hon Lyn MacLaren MLC	The land was given to the State Government in 1964 by the Commonwealth on the proviso that it be reserved for conservation and recreation. This proposal is in contravention to this. The proponent has still to evidence that the Commonwealth has relaxed the provisions provided in the granting of land to allow use that is not “a reserve for recreation and/or park lands”. This should be completed prior to the EPA completing its assessment of the proposal.	The Commonwealth has no legal interest in the land. The State owns the land and can legally develop the land for the Mangles Bay Proposal. The State has legal advice which states the Commonwealth has no right to compensation or preventing development.
11	Cockburn Sound Management Council Officer Submission	Statements about land tenure may be misleading because change of land use and vestment or ownership of land titles has not been confirmed. This is particularly relevant for Commonwealth lands and special purpose zonings for lands vested to state agencies.	The Commonwealth has no legal interest in the land. The State owns the land and can legally develop the land for the Mangles Bay Proposal. State has legal advice which states the Commonwealth has no right to compensation or preventing development.
12	Cockburn Sound Management Council Officer Submission	In section 3.3 there is a reference to "opportunities for a combined marina and land development". Our understanding is that there has been recognition of the need for marina and mooring facilities, but not necessarily land development.	It is not uncommon to see different forms of development (other than marine related) being provided in association with a Marina Development. Mandurah Ocean Marina is a very good example of this. This is because a marina development creates a unique opportunity for a large variety of complimentary land-uses to be co-located, leading to increased activity and vibrancy and ultimately desirability as a destination.

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13	Cockburn Sound Management Council Officer Submission	In section 3.4.1 on marina and canal construction, an outline is provided of the proposed staged development. We have concerns that the degree of clearing and levelling that will precede the beginning of stages 1 and 2 and possibly 3, will leave a large amount of cleared vacant and degraded land until in-fill development occurs, This would need to be very carefully managed and sequenced in the short term to avoid leaving non-functional, dusty and weed infested uncleared land that would lead to community complaints and, in the long term, so that this sensitive area is not left with an environmental scar.	Comment is noted. Every effort will be made to ensure that the concerns which have been described do not eventuate. For example, where practical, remnant vegetation will remain in place until development of any given area is intended to proceed. Furthermore, the management practises normally associated with land development will also be implemented to mitigate any potential risk of the types of issues as raised arising.
14	Cockburn Sound Management Council Officer Submission	In section 5.3 (Table 6) statements are made to address the applicability of the proposal to the principles of environmental protection. However, we note that recreational and environmental attributes could be enhanced by better public access and a modest rehabilitation plan that would provide trails, and other amenities and improved management, at much lower cost than in the development proposal outlined in the PER. In other words; the development is not the only means of improving this area	A major objective of the proposal is to improve public access as well as the general amenity of Mangles Bay. One of the ways the proposal addresses this is via an interconnected system of paths and trails linking key attributes both within and outside the proposal area. Another is by undertaking a program of rehabilitation works within Cape Peron. It is noted that there may be various ways of achieving these objectives and the PER does not purport to suggest anything to the contrary.
15	Maritime Union of Australia Public	While the Environmental Review contains many positive statements of intent by the developer which gives the impression that there is little to worry about, the MUA is concerned that too much is in the category of what is acceptable, what is manageable, impacts that will not significantly affect and other statements which are similarly qualified. This style of language enables statements to be made that are seemingly commitments but the qualification they are couched within provides for a let out. If there is the risk that negative changes are expected in such a proposal we don't expect "weasel words" but rather an honest appraisal of the impact.	Comment is noted – assessments of impacts and management actions have been conducted in an impartial and honest manner, and have been based on technical reports, available to the public. In addition, some of these reports and assessed impacts have been independently peer reviewed by third parties.
16	Preserve Point Peron for the People.	Dog walking currently occurs along the Mangles Bay foreshore. Will this still be possible once the development has been completed.	The City of Rockingham as the local government authority will be responsible for determining suitability of dog access into the development.
17	Recfishwest	It is important to ensure that there is a disabled access fishing platform built into the marina, that the jetty accommodates for recreational fishing, and that there are accessible toilets within close proximity to the marina. It is important that all popular pastimes and people of all abilities are accounted for in the planning of this tourist precinct.	The development will provide a platform for the disabled to access. The location of public toilets will be determined following further planning.
18	Department of Planning	Controlled public access to the beach should have with it interpretive signage.	Interpretative signage will be installed with consultation with the City of Rockingham.

	Respondent (sub #)	Submission and/or issue	Response to comment
19	Department of Health	In relation to the proposed marina development (pg 3), it is recommended that sullage pump-out facilities be included in the proposal to minimise potential effects from boat wastes, which may otherwise be emptied into the marina, boating channel, or Mangles Bay and have the potential to reduce water quality and create detrimental health effects	The consolidated club will provide a sullage pump out service to minimise potential effects from boat wastes, which may otherwise be emptied into the marina, boating channel, or Mangles Bay.
20	Department of Health	Although it is not evident within the document if beaches are proposed within the marina itself, it is recommended that beaches that promote whole of body contact (swimming) are not provided for public use within the marina boundaries. This will minimise potential public health concerns related to water quality issues that can be characteristic of confined marina/harbour developments. However, where a beach is provided: • Stormwater infrastructure should be designed to prevent stormwater runoff from discharging within close proximity (>50m) from designated swimming areas. Rainfall is known to increase faecal contamination and litter of waterways. • A routine recreational water quality monitoring program should be developed in accordance with the National Hearth and Medical Research Guidelines for Managing Risks in Recreational Waters and implemented for the life of the beach area to ensure water quality is safe for swimming. • When incongruent results occur a management action plan to be initiated. This may include the installation of intermittent warning signs advising the public not to have contact with the water until follow up sampling and sanitary survey occur	Beaches: There are no beaches planned for within the marina Stormwater: Drainage plan will be designed in accordance with DWMS and LWMS approved by DOW and Council. No direct discharge without appropriate treatment will be included and this includes 100% detention of 1 in 1 year events. Runoff from events greater than this will be directed into the Marina water body. Water Monitoring: The nearest routine Department of Health (DoH) routine beach monitoring site for beach grades (recreational water safety) is North Hymus Street. During detailed planning, the requirement for an additional monitoring site in Mangles Bay will be considered. Warning Signs: Comment is noted, warning signs will be considered during project planning.
21	Department of Health	Please confirm connection to sewer for wastewater disposal and provide details (including locations) for any additional wastewater treatment plants, sewage pump station facilities, outfalls etc that may be required to handle emergency wastewater overflow events e.g. as a result of loss of power, storm surge, flooding or other events.	It is envisaged that a vacuum/gravity pump station will be designed and constructed to be located in the south east corner of the proposal. Adequate emergency overflow storage will be provided in accordance with normal Water Corporation practice and requirements of design manuals.
22	Department of Environment and Conservation (260)	That it be made clear who will be responsible for the regular patrolling of the marina to remove line or other entanglement sources and support clean-up measures around fishing 'hot spots' in and around Mangles Bay.	Patrolling and removal of entanglement sources will be undertaken by the nominated marina manager who is required to enter into a Development Agreement with Cedar Woods and the City of Rockingham. A business plan for the marina management will be prepared for the nomination of a marina manager. The marina manager is to be determined before advertising of the Town Planning Scheme.

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23	Department of Environment and Conservation (260)	Further information be provided regarding the statement that there will be the provision of "...a base for surveillance, monitoring and research in the marine environment".	Full quote from the PER document reads: The Proposal will also offer opportunities for decreased stress on the marine ecosystem by supporting better management of impacts due to recreational fishing pressure through: • promoting/displaying information about ecological values and appropriate behaviour in the marine environment, including sustainable fishing practices • promoting/displaying information about recreational fishing regulations (e.g. catch limits, legal fish size etc) • providing a base for surveillance, monitoring and research in the marine environment, including the impacts of recreational use and management activities. The intention is to provide a facility to accommodate government managers of the adjacent environments. The scale and composition of this facility is yet to be decided and will be designed with input from relevant agencies during the detailed design stage of the proposal.
24	Department of Environment and Conservation (260)	That observation of marine species protected under the *Wildlife Conservation Act 1950*, collated by recreational and commercial vessel operators, is forwarded to DEC, as well as relevant individual research. A large number of mooring holders will be affected if the project goes ahead.	The nominated marina manager will be responsible for forwarding such information to DEC.
25	Department of Transport	As part of a design phase, Department of Transport would need to advise on the appropriate navigational aids for the channel and complete a full aquatic review process of the surrounding area considering any future use and user conflict.	Agreed, liaison with DoT on navigation and safety requirements would be undertaken during detailed design development.
26	Department of Transport; Public	An alternative mooring area has to be provided for those affected and environmental requirements for the new mooring area have to be complied. This submission is related to marine safety, and is referring to the large number of mooring holders that will be affected by the proposal.	It is acknowledged that some swing moorings will be removed due to the construction of the navigation channel. The proposal will serve to reduce the number of Mangles Bay swing moorings in consultation with the Department of Transport should the proposal be approved.
27	Cockburn Sound Management Council; Public; Friends of Point Peron	There are a number of references in the PER that state that the major purpose for the development is to provide marina and boating facilities to address the lack of and demand for these facilities in the Rockingham area. (E.g. page 6). however, 50% or more of the area to be developed will be for private residential and commercial facilities. If it were only for marina and boat facilities the Port Rockingham marina proposal, which is almost solely focussed on those needs, is in a more suitable nearby location. In addition, In the absence of recent and specific strategic assessments of boating facilities in Cockburn Sound it is difficult to confirm the need for these additional boating facilities (the 2008 Perth Recreational Boating Facility Study (2009) did not recognise Port Rockingham marina nor consult with CSMC and other stakeholder groups in its boating needs assessment). This argument is a poor one when considering sustainability principles and	The marina aims to improve the existing management of boating clubs which currently occupy Mangles Bay. The Port Rockingham proposal does not provide a site or seabed lease for the existing aquatic clubs along Mangles Bay. The DPI Boating Demand Study concludes a marina is required on the basis of the existing boat numbers within Rockingham. Furthermore the study has substantially undercounted the: • 650 swing mooring being within Mangles Bay • Number of residents mooring boats in other marina's due to the poor boating facilities around Rockingham. DoT (pers. comm.) authors of the Perth Recreational Boat Study have also advised the marina demand for Mangles bay will remain strong irrespective of whether or not Port Rockingham proceeds. The Mangles Bay marina is proposed to be staged to maintain a demand for the pens. A half reduction in the 650 swing moorings will also assist in the demand for pens.

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		smarter solutions are required to manage increasing population and demands. The 2009 DPI report using figures from 1991-2007 and projects these figures for population growth without any considering any other factor. There is every likelihood that increasing demand for boats will decrease once the mining boom levels out and increasing fuel prices limit reasonable access. The PER provides information that suggests demand for the number of proposed pens to moor large recreational boats in the marina will not be met until later this decade or beyond. This is because of the planned construction of the Port Rockingham marina with an estimated 500 pens and future boat stacking capacity at Woodman Point. There is concern that with this third marina-boating facility, the boat pen requirements may be exceeded for many years to come while potentially compromising an extremely productive habitat area critical for seagrass, fish and animal production in Cockburn Sound. It appears from the DoT report that there is more of a demand for launching facilities, not for marina pens for large-not trailerable boats specifically for the Rockingham area.	The increase to the number of boats on trailers have been addressed with a boat launching facility within the proposed club site in addition to Cedar Woods improving the existing Point Peron Boat ramp which experiences regular delays at peak periods..
28	Public; Cape Peron Community Vision Working Group Maritime Union of Australia; Preserve Point Peron for the People; Hon Lyn MacLaren MLC	Why is Western Australia still promoting canal estates given that similar canal estates are banned in Victoria and NSW due to environmental risks and problems.	Western Australia has decided to control such estates by the development of strict guidelines, the most recent of which is the Western Australian Planning Commission (WAPC) Development Control Policy 1.8 for Canal Estates and Artificial Waterways (May 2012). This guideline refers proponents of such developments to the EPA amongst many other State agencies. The EPA in Western Australia assesses proposals with the potential to impact the environment. This provides an independent assessment of the risk to the environment, and whether this is acceptable. The proposal has been subject to a Public Environmental Review to ensure that all risks are evaluated, and that the environment is not put at unacceptable risk.
29	Public	This is a poor location for a marina given the winds that funnel down Cockburn Sound.	The high number of boat moorings located in Mangles Bay testifies to its suitability for boat mooring purposes. it is a very protected location under most conditions. Wind and flushing have been evaluated as a part of the PER, and are addressed in sections 10, 11 and 12 of the PER. Location has also been evaluated in the form of several iterations of the proposal, and design changes to reduce environmental risks and impacts. Numerous marina proposals over time have recognised the location in Mangles Bay providing significant protection for siting a marina for mooring vessels. This location only requires protection from the north-northeast against locally generated seas in Cockburn Sound.

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30	Friends of Point Peron	Under Management Strategies the proponent states " Management strategies include … environmental awareness training to ensure all employees are aware of the requirement to minimise ground disturbance." (p xiv) This has already been shown to be a fantasy. In December 2009 contractors commissioned by Landcorp conducted a number of soil tests. In two cases they drove heavy equipment carelessly over vegetation, failing to even bother to return by their entry tracks. In one case they drove over at least 20 recently planted seedlings which were all marked by bamboo stakes and green plastic tree guards. In both cases they destroyed areas of bush of 100 metres by 3 metres to gain access and 10 by 5 metres at the excavation sites. In the third case of which FPP is aware the contractor broke the Water Corporation's service track alongside the drain when a front end loader fell into the drain. The results of these incidents were photographed and publicized in the local newspaper.	Procedures will be put into place prior to construction that will ensure the environment is protected during marina construction. Independent audit protocols will be adopted to ensure that procedures are being adhered to.

1.2 Alternative proposals

	Respondent (sub #)	Submission and/or issue	Response to comment
31	Public; Preserve Point Peron for the People.	Wanliss Street marina is a much better proposal and will include apartments and shops. It has a greatly reduced environmental impact and risk. Funding should be provided to the Wanliss St marina rather than this proposal.	The Mangles Bay site has been the subject of several years of planning, and several project iterations. The process of selecting the site was done in consultation with reference groups. The proposal in Mangles Bay is different to Wanliss Street, as Mangles Bay will provide tourist activities, restaurants, shops, recreation areas and housing, with opportunities for the existing aquatic clubs and public to moor their boats.
32	Public; Cape Peron Community Vision Working Group; Maritime Union of Australia; Preserve Point Peron for the People; Hon Lyn MacLaren MLC	A better alternative use of the land would be to set it aside for protection with additional facilities such as bike and walking paths and properly designed parkland. This is loss of public land for the benefit of a few, including loss of beaches. There are sufficient areas available for cafes and tourist facilities in other areas of Rockingham – the Rockingham strip opposite Churchill Park is under developed and under-utilised and further development will affect viability of existing businesses. Extensive research and data collected by Preserve Point Peron over the last seven years indicates that while the majority of the Rockingham public support the idea of a marina in principle, they overwhelmingly do not want the proposal because it would result in the loss of public land and community facilities and would severely and permanently damage the unique character and environment of Cape Peron.	Comment is noted. The proposal is a government initiative, through LandCorp. Community consultation has been undertaken at various stages during development of the proposal. Any conservation area that is impacted by the proposal will be offset in consultation with, and under the guidance of, the EPA, DEC, and the Department of Sustainability, Environment, Water, Population and Communities (SEWPaC). The proposal site will be for the use of all people, and will include areas of rehabilitated vegetation. As a part of the offsets package for the proposal, management and rehabilitation of surrounding vegetated areas will mean that there are better quality bushland available. The proposal will also include bike paths and walking paths.
33	Public	The consideration of alternative locations undertaken in 2005 was seriously flawed. The location analysis report was not made available for public input.	Analysis of location and structure of the proposal has been undertaken over a series of years, and the site at Mangles Bay was chosen as being the most suitable location. A Strategic Environmental Review was undertaken in 2005 and the EPA advised that the approvals process could be entered into at this location. In regards to public input, the public has had the chance to comment on the proposal at the Environmental Scoping Document and Public Environmental Review stages, and comments will be considered by the EPA prior to a decision being made.
34	Public	The proponent should look to develop vacant crown land and not conservation estate.	The proposal is a government initiative, through LandCorp. Community consultation has been undertaken at various stages during development of the proposal. Any conservation area that is impacted by the proposal will be offset in consultation with, and under the guidance of, the Environmental Protection Authority (EPA), the Department of Environment and Conservation (DEC), and the Department of Sustainability, Environment, Water, Population and Communities (SEWPaC).

2. Coastal processes and landforms

	Respondent (sub #)	Submission and/or issue	Response to comment
35	Public	Will seagrass loss contribute to sand movement in this area?	No. This is because the bulk of the seagrass loss predicted will be direct loss from beneath the footprint of the proposal. That is, it will be replaced by a 4m deep navigation channel, breakwaters, or beaches. Minor sand movement may occur along the slopes of the channel during storm events. Note that coastal dynamic studies indicate that there is very little alongshore sediment movement in Mangles Bay.
36	Public; Urban Bushland Council	a) What impact will the disruption of the natural long shore drift along the bay have on sand accretion and erosion? b) What is the predicted build-up of sand against the groynes and over the seagrass beds?	a) The review of the previous studies and the wave energy at proposal site show that the long shore drift is minimal in this low energy beach. In addition to assessments made for this PER, several published references have assessed longshore transport at the site as small (less than 1000m3/y). The build up of sand around the structures is shown as part of the concept layout and has been accounted for. b) The PER describes impacts around the groynes, including sand build up. A 'halo' effect around the breakwater has been allowed for in the calculation of indirect seagrass losses.
37	Public	Will the construction of the breakwaters and dredged passage further reduce localised flushing in Mangles Bay. Will it slow the movement of water across the seagrass meadows, leading to a further reduction in the flushing of the area?	The short entrance groynes and the dredging will lead to very minor changes in the local circulation processes however no significant impact to the flushing of the area will occur.
38	Public	Storm surges are prevalent during the winter months, causing significant erosion where man-made features, such as the Hymus Street storm wall, occur. Mangles Bay is an example of a low-energy beach, with the foreshore very susceptible to beach erosion. Significant beach recession has occurred west of the Hymus Street storm wall. This is despite the efforts of the City of Rockingham to place additional sand in this area, annually. The proposed canal estate head works will have a similar, though significantly, damaging effect on the coastline. Cedar Woods claim that the systems around the head works will reach 'equilibrium' is baseless. In fact, it flies in face of the known facts about the similar head works at Mandurah. There a dredge is permanently stationed at the channel. The sand trap is also very expensive. Solutions to coastal erosion are very complicated and come with no guarantees. If the Causeway caused sand to accrete at the Point Peron boat ramp how can the interruption of the longshore drift not cause the sand to now accrete either at the head works or in the channel. How much uncertainty is in the modelling and how much dredging will be required to keep both the marina and boat ramp accessible?	As noted in the PER, the major source of sand supply is from the west and after construction of the causeway, the beach receded due to a lack of sediment supply (this is now trapped and removed at the Point Peron Boat ramp). The beach has now stabilised at the receded shoreline and longshore drift at the site is very small (750m3/year estimated by MRA 2008). The proposal recognises some of this small amount of drift will collect either side of the structures forming the new beach shape indicated in the concept layout. Hymus Street was exposed when the shoreline retreated in response to the cut off of sediment by the Causeway and required a seawall to be constructed for protection. Renourishment there is carried out for beach amenity reasons, not in response to chronic erosion and as sand is available to do so at Point Peron. However, the groyned beaches at Palm Beach, for example, have stabilised in their compartments and indicate the stable beach alignments in this coastal sector. One of the major benefits of the proposal and its groyne field is that it will in fact stabilise the beach and maintain its amenity. Advice from the coastal engineers is that maintenance dredging of the channel is unlikely to be regularly required, if at all.

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39	Wetlands Conservation Society; Dr van Keulen; Urban Bushland Council; Naragebup Marine Working Group (261); Conservation Council of WA; Cape Peron Community Vision Working Group; Friends of Point Peron	The proponent has made no real attempt to address the interactions between the proposed development, climate change drivers and key environmental assets in the project area. Climate change is likely to lead to increased sedimentation and seagrass accumulation in the bay, at the mouth of the marina and possible erosion of the beach. Thermal expansion of marine waters at a regional level will enhance the average global change in sea-level adopted by the State Coastal Planning Policy. On top of that we are seeing extreme oceanographic events such as the super unprecedented Leeuwin Current strength caused by the super *La Nina* event of 2010 /11 producing super-normal sea-levels and major biological perturbations all along the west coast of Western Australia (Pearce *et al.* 2011). An increase in extreme events, including an increase in storm intensity from the increased southward penetration of tropical cyclones, can be expected. The proponents state they have considered the State Planning Policies 0.9m sea-level rise in their design but the impact was not modeled. LIDAR analysis could have been employed to look at the static sea-level at 0.9m over the region. Such analysis of levels at Mandurah area show vast areas that will no longer be habitable, particularly around the estuary. In relation to climate and sea-level change the proponent also needed to consider; • the erosion of the landform (i.e. the Point Peron tombolo) resulting from reduced swell protection from the offshore limestone reefs, • groundwater changes including the penetration of the salt wedge with a sea-level rise of 0.9m, • the impact of extreme *La Nina* events on top of global average sea-level rise, • the impact of sea-temperature rise (and thermal expansion) in a region experiencing rapidly rising sea temperatures (relative to other parts of the world), • the impact of extreme storm events, • The impact of tsunami waves entering this constrained corner of Cockburn Sound and the marina.	This comment appears to have two main issues: • increased storm activity due to climate change • inundation due to projected sea level rise (SLR). Assessments at the site have recognised that while prediction of future storm intensity is not possible at this time, conservative approaches to acute storm erosion in accordance with the SPP 2.6 guidance allows for some of this uncertainty. Wave attack at the site fronting Cockburn Sound is limited to northerly local wind fetch generated energy and adaptive approaches have been proposed to enhance the link with the planned built environment in the proposed concept with the Cockburn Sound Beaches. Protection on the ocean side of the development is provided by the significant rock and reef system that secure the development over the planned horizon and are not addressed given the significant setbacks available on other land tenures there. It is also important to note that assessments identified that: • As the proposal site is sheltered by Garden Island, climate change driven SLR would not change the wave energy significantly. Sensitivity analysis on the effect of SLR showed that the wave height would increase less than 10% at proposal site after 100yr (this is within the accuracy of many estimating methods). • Change of water level is much more important and assessments and adaptation measures proposed have allowed for an increased attack at higher water levels. Adaptation measure can be incorporated in the design by controlling water overtopping beaches and seawalls fronting the development and with the proposed increase in general levels across the site.
40	Public	The coastal processes modelling should use the latest version of State Coastal Planning Policy 2.6 currently out for comment pre-adoption by the Minister. The old version is now outdated and provides a much less precautionary approach. The new Policy provides improved allowances for potential impacts from coastal processes and emphasis on keeping development out of harm's way rather than relying on expensive to install and/or maintain precautionary measures, particularly for developments that restrict the public's access to the natural amenity of a foreshore environment. The proponents should also be consistent with current Western Australian Planning Commission's policies SPP 2.8 and Direction 2031	The draft of coastal planning policy had not been published at the time of the study, and is therefore not applicable to the impact assessment. However, the concept developed during the planning phases for this proposal, with public consultation, proposed a close link to the Mangles Bay beaches requiring a closer approach to the shore recognised as suitable for nodal development under the existing SPP 2.6. The beaches formed in the concept layout proposed provide protection to this nodal development while providing the amenity raised as desirable in earlier public consultation.

	Respondent (sub #)	Submission and/or issue	Response to comment
41	Department of Planning	The significant difference between the SPP2.6 setback and that proposed by the proponent warrants assessment by the Department of Transport to ascertain the probable accuracy of the coastal process modelling by the developers own consultants. This must be done prior to any finalisation of metropolitan and local scheme amendments. The Department of Transport should also be consulted regarding any maintenance issues associated with the marina, canal's and proposed coastal infrastructure.	The planning process for the proposal developed a layout which closely approached the Mangles Bay shore in a concept plan developed by inter-agency and public consultation. Development as a result encroaches on setbacks determined in accordance with SPP 2.6. However, this is allowed for under the SPP as nodal development. Therefore, protection and adaptation to SLR will be required. The current coastal assessments and opinion were provided on the concept from this process which identified that it is feasible to protect the development into the future including the use of adaptation measures aligned with other management actions on this section of coast. The study proposed protection and or adaptation strategies with reference to the following: • Wave energy that can impact the site is highly directional from the north. This has an impact in that energetic events do not generate significant longshore transport and therefore beach alignment change. The beaches will remain stable in alignment in the developed layout as they are currently. The current stabilised coastal segment at Palm Beach adjacent to the site give strong indications of the stability and alignment of beaches developed as proposed in response to the dominant northerly wave climate. • Acute storm erosion has been quantified and a buffer has been incorporated provided of 20m to maintain beach amenity. With application of the available basic empirical techniques to assess ongoing recession for the projected SLR the beach may retreat and the remaining 10m buffer over and above the acute erosion allowance may be lost over the next 40 years as the profile moves up and landward in response to SLR. The proposal recognises that adaptation may be required. If the management strategy is to maintain the planned beach width some renourishment could be required in the future to maintain amenity. The above allowance could be included for adaptation/beach management planning. Alternately, the buried protective seawall could be upgraded at the back of the beach and run-up controls and formation of steps etc providing protection from the periodic extreme event and an accessible beach area for ambient conditions for some time to come and nourishment provided over longer periods as part of the adaptation strategy. Maintenance strategies & plans can be developed during detailed design to meet the Department's requirements.

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42	Department of Transport	The total coastal setback of 20m recommended by the PER is not considered sufficient to accommodate the combined impact of sea level rise, acute erosion, and historic trend. The report did not demonstrate that appropriate input conditions, including appropriate water levels and extreme wave heights, have been selected for the acute setback (S1) assessment, neither the feasibility of measures to defend the area from coastal flooding and erosion in the next 100 years with the sea level rise stated by IPCC.	Firstly, it is important for the Department to recognise that once it is accepted that development will occur within the calculated (conservative) setbacks determined in accordance with SPP 2.6, the problem is then one of design of coastal protection elements, not compliance with a calculated SPP 2.6 setback. Design of protective structures (including beaches) require only that the run-up due to waves at the projected elevated sea levels is controlled to prevent the risk of coastal flooding and that it is feasible to adapt to any further sea level rise over and above the selected design life of the particular structure. Further, adaptation can occur at the end of the structures life to accommodate future projected SLR and changing design criteria. As detailed in the previous comment, the protective structure proposed is a combination of a protective beach, stable in alignment in response to the site's northerly dominated wave climate. Some allowance may be required for future maintenance of the beach and its 20m setback as sea level rises as the HSD retreats. However, all indications are that this is manageable and a number of adaptation measures can also be employed to accommodate the impact of sea level rise and the risk of inundation. Input conditions were modelled by extrapolation of offshore waves (far sea) from annualised wave data at Rottnest Island. Due to attenuation, the impact of these conditions on the site is very small but the persistent swell can affect beach orientation in this low energy beach environment. The literature was referenced in the report with respect to this. Acute storm erosion is therefore dominated by local seas generated within the sound. Check runs to confirm the order of the previously reported S1 value of 7m at the same site in the South Metropolitan Coast Coastal Setback Study (DoT, 2005) based on 3 consecutive 100yr storms considering 100yr water level. The Department's own report should give them confidence that the acute erosion value of 10m adopted for the initial setback calculation is appropriate at the site. Further, the concept design of the protective beaches accommodates an acute erosion of this order within a 20m buffer.
43	Department of Transport	The shoreline movement analysis by Oceanica (2010) for the same area has shown an erosion trend since 2005. The current State Planning Policy 2.6 states that *'On a relatively stable shore the minimum value ofS2 should be a 'safety' allowance of* ***20 metres,*** *except where there is evidence that chronic accretion in excess of that distance has been identified for the 100-year forward planning term when the value forS2 will be 0 metres'*. The zero metre longterm trend setback adopted by this PER and its supporting documents contradicts the SPP 2.6 guidelines.	Some erosion has occurred between 2005 and 2008, but overall the beach has been relatively stable from 1976 to 2008 (slight accretion). Analysis of the 2010 shorelines showed a recovery of the above noted erosion leading to the assessment that it was most likely in response to high water level storm events (acute storm erosion) in this period. Assessments confirm that the shoreline is accreting post causeway development apart from indicated responses to storm events. In addition, the proposal does not rely on calculations of SPP 2.6 setbacks including the S2 factor but proposes protection and adaptation measures. Also refer to reply on comment number 42. Note that the Coastal Processes Assessment and beach design for the marina has been peer reviewed by Matt Eliot of Damara WA Pty Ltd (Refer Appendix 2 to Strategen Response Document for peer review). In his initial review, Mr Eliot was critical of the confusion in the consultant's report (JFA) caused by intermingling the terminology of *SPP 2.6 Schedule one* (setback policy) with the proposed approach of active and adaptive coastal management which is allowable if the Marina is granted Coastal Node Status under *SPP 2.6*. JFA subsequently met with and responded to Mr Eliot's technical criticisms. Mr Eliot subsequently confirmed that his initial concerns had been satisfactorily addressed and that he supported the findings of the study and the use of a progressive and adaptive management approach to stabilising the coast.

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44	Dr van Keulen	Construction of the proposed marina and access channel through the seagrass meadow could result in destabilisation of the seagrass meadow in Mangles Bay and the release of fine sediments which have accumulated in the bay. In the longer term, wash from boat traffic through the access channel could result in additional destabilisation of sediment and the bisected seagrass meadow, making the system vulnerable to erosion during winter storms. Initial erosion of the seagrass could extend to tens of metres from the channel; however in the longer term more widespread losses could occur and lead to the loss of the seagrass meadow as a contiguous structure. If the seagrass meadow is lost from Mangles Bay the sediment adjacent to the shoreline may become destabilised and coastal erosion would be a distinct possibility.	Whilst this viewpoint is a valid concern, it is not a likely outcome for the following reasons: • The seagrass meadows are very dense, and underlain by a thick fibre mat. • There would have been evidence of any such boat wash effect by now around the numerous mooring scars in Mangles Bay, given the considerable amount of boat traffic that already occurs in the area. • The results of the sediment analysis that was undertaken for the PER indicate the sediments are sandy, with little fines content, and so they are not easily suspended and are quick to settle out if they are suspended. • The bay is very protected from wave attack from all directions except to the north • The navigation channel is oriented normal to the direction of the prevailing storm wave and will reduce wave energy in and immediately adjacent the channel. Monitoring of existing dredged channels in Cockburn Sound (Gordon et al 1996) shows that little seagrass regression occurs adjacent dredged channels once batter slopes stabilise after 2-3 years. Note that maximum batter slopes have been assumed in the total seagrass loss estimate provided in the PER.
45	Recfishwest	The accumulation of seagrass wrack against breakwater structures has not been accurately accounted for. Under the *Impact of Wrack Production* (page 240) the proponent uses comparisons between the amount of seagrass in Geographe Bay and Mangles Bay. This comparison is misleading as Geographe Bay covers an area 1200km2, while the proposed impact area within Mangles Bay covers just 0.12km2. Recfishwest believes that the entire area of Cockburn Sound needs to be taken into consideration when assessing the dynamics of seagrass wrack accumulation, not just the small portion of Mangles Bay.	It is not the area of Cockburn Sound that needs to be considered, but the area of seagrass bed that is available to deliver wrack to the coast. The only beds that occur to the north of Mangles Bay are those that are located on Southern flats and in Mangles Bay itself. This is a relatively small area, Given its location, Mangles Bay is considered to be a sink for seagrass wrack. However past experience indicates that it does not accumulate large banks of wrack, even after northerly storms. Hence if no substantial wrack accumulations occur at present, it is highly unlikely that a wrack accumulation problem will develop in the future. Furthermore there is no significant longshore drift able to carry seagrass up against structures over long sections of coast such as at Pt Geographe although local and small volume accumulations may occur and the coastal processes report addresses/comments on this.
46	Public	The stability of subsoil structure on the Tamala Limestone is NOT KNOWN. There is no proof that it will be geologically sound. Should an error be make here for lack of research the consequences would be immense. From surface observations groundwater dissolution is evident and collapse of limestone pillars are there for all to see. The risk of these things happening underground is there, but there is no evidence in the report that this has been fully investigated or even assessed. The substructure cannot be sound as on every headland in the island chain there are signs warning of unstable ground. The risks associated with Tamala limestone are NOT KNOWN – they need more investigation to fulfil the precautionary principle. Miscalculate in this area and great and irreparable damage will be done.	Site preparation requirements to support the development and intended land use has been investigated to date with geotechnical investigations including test pitting, probing, etc. on site. As the proposal proceeds, further detailed geotechnical investigations and reporting will be undertaken to suit the proposal. The draft SPP 2.6 Schedule 1 recognises that on rocky coasts the rate of coastal erosion is relatively slow. Indeed the Tamala limestone outcroppings are recognised as locally protecting coastlines from retreating. The interpretation of the durability of these rock formations needs to be considered in terms of the development design life, not the geological timescale as adaptation measures beyond the required 100 year timeframe may prompt different responses to different criteria.

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47	Friends of Point Peron/Hands off Point Peron (131); Urban Bushland Council; Public; City of Rockingham; Wildflower Society of WA	Brocx & Semeniuk (2007, 2009, 2011) set out criteria on how to recognise and evaluate sites of geoheritage significance (as distinct from those of biological significance). These criteria are becoming internationally accepted. Within the Point Peron area, the thrombolites, limestone rocky shore and seagrass sediments in a cuspate foreland are all of global significance; Lake Richmond is of national significance, the tombolo that forms part of the northern cusp of the twin cuspate system is of State-wide significance and the seagrass and algae is of regional significance. The proposal will involve modifying some 40-50% of the tombolo system and either locally destroying or impacting the global, national, state and regionally significant values. It is recommended that a specific study be undertaken to assess the Geoheritage impacts of the Proposal and this information be provided to the EPA.	The Proponent accepts that the Point Peron tombolo including Lake Richmond, may have geoheritage significance as well as conservation value. As noted in the submission, the project will only affect about 45% of the Tombolo and will not affect Lake Richmond adversely. Hence the geoheritage values will not be lost as a result of the project proceeding. However to mitigate disturbance of half the tombolo, prior to commencement of excavation works, and as part of geotechnical investigations, the Proponent will obtain quality stratigraphic and geomorphic information from across the site to capture data that may be used to further inform the community on the geological evolution of the area, and particularly the formation of Lake Richmond. This work will be supervised and interpreted by an appropriately experienced sedimentologist. It is therefore considered that a study of the geoheritage impacts is not required.
48	Friends of Point Peron/Hands off Point Peron (131);	The tips of cuspate forelands and of tombolos in southwestern Australia are oceanographically and sedimentologically one of the most complex coastal systems along the seaward Swan Coastal Plain. This has sediment transport implications for the immediate north-side of Point Peron and for the maintenance of seagrass beds on the north-side of Point Peron. This factor will impact on sedimentary filling of the marina, yet it is a factor little addressed in the PER. A robust sediment transport study must and should have been carried out for marina management purposes and for assessing the maintenance of seagrass beds.	This submission is addressed in the response to item 49
49	Friends of Point Peron/Hands off Point Peron (131);	Sedimentation in the marina is a difficult matter to quantify and there is marked and complex sand transport that will find its way into a marina. In spite of the apparent sheltered mature of this coastal region, there is much sediment transport as traction load sand, shoreline in suspension, and as mud in suspension. Rates of transport presented below are based on stratigraphic evidence, transport rates from Semeniuk (1983, 1985), and historical information (Semeniuk & Semeniuk 2011). Semeniuk & Semeniuk (2011) describe how the northern shore of Warnbro Sound, the location of the former Peel Harbour (surveyed by John Septimus Roe in 1839, and re-surveyed by Commander Archdeacon in 1878) that rapidly infilled with coastal sediments during the period 1839 to 1878 was an area of beach slacks, underlain by calcareous quartzose sand. This is the equivalent to the formation of Lake Richmond. I estimate that in years of low wave dominance sedimentation transport can be 5000 cubic metres per year. The average can be 100,000 cubic metres per year, and the extreme can be 200,000 cubic metres per year. This sand component can be transported around the tip of Point Peron. Similar transport occurs around the tip of Point Becher (Semeniuk 1995). Mud transport rates are calculated from stratigraphic evidence of rates of accumulation of 1000s of years. These point to transport rates at a MAXIMUM of 50 mm/year, and at a MINIMUM of 2.5 mm/year.	It is acknowledged that sediment transport around the tip of Point Peron can at times be substantial. Progradation of the shoreline to the west of the Point Peron boat launching ramp and the regular need to remove accumulated sand is testament to that. It is likely that some sediment enters the Sound through the trestle bridge opening in the causeway – as evidenced by the sediment scours aligned with the bridge. But fine sediment is likely to settle in the deeper waters of Cockburn Sound to the immediate east of the bridge. However, very little alongshore sediment movement occurs inside Mangles Bay now because the Causeway stops sediment movement, and seagrass meadows also act to stabilise sediment movement. As noted in the PER, after construction of the causeway, the beach receded due to a lack of sediment supply (this is now trapped and removed at the Pt Peron Boat ramp). The beach has now stabilised at the receded shoreline and longshore drift at the site is very small (750m3/year estimated by MPR 2008). The proposal recognises some of this small amount of drift will collect either side of the structures forming the new beach shape indicated in the concept layout

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50	City of Rockingham	The PER does not provide evidence of detailed modelling having been undertaken, nor are results presented of sediment fluxes, or ambient wave climate impact on the development. It is therefore recommended that the following information and/or studies be undertaken: 1. A long term current measurement or recent measured data, especially during the winter season, is required for flow model (hydrodynamic model) validation. This data, will be beneficial to predict the seasonal variation of the tidal water circulation within Cockburn Sound and Mangles Bay. 2. A 'detailed' long-shore sediment transport modelling study is required to be carried out to address the development impact on ambient wave climate and beach evaluation. A long term beach evaluation (at least one year) in quantity is required to be assessed through the study. 3. An efficient sediment bypass system should be investigated in association with the detailed long-shore sediment transport assessment results and existing sand renourishment management plan. 4. A technical review of the coastal processes study, and its outcomes is recommended.	1. It is not typical that a long term measurement program is required for projects of this nature. It is also not typical that measurement in all seasons is required as validation of the modelling, as generally the modelling is used to predict beyond a shorter measurement period. In the context of this proposal, the exchange between Mangles Bay and the marina entrance is the primary driver of the flushing and resulting level of increase in nutrients and other dissolved substances. Further measurement of conditions, for example during winter, is not expected to result in a change in the predicted flushing performance. It may provide further clarity to the processes in wider Mangles Bay, however that was not the intention of the studies required for this development. 2. As the wave energy, currents and longshore sediment transport are minimal a detailed sediment transport model for investigating long term behaviour of the beach will not provide reliable results as the expected transport rate would be in the order or less than the model accuracy considering the uncertainties in nature of numerical modelling. 3. In addition it is not typical to run a detailed sediment transport model for long term response of a beach (MEGA Scale) which may happen during decades. The upper limit of time scale of detailed sediment transport models is about a year (Macro Scale). 4. A sediment by-pass system is not required for this proposal An independent technical review of the coastal processes study has been undertaken by Dr Matt Elliot of Damara WA Ltd (Refer to Appendix 1 of Strategen document "Response to Key Marine and Groundwater Issues Raised in Submissions on the Mangles Bay PER"). In his initial review, Dr Elliot was critical of the confusion in the consultant's report (JFA) caused by intermingling the terminology of SPP 2.6 Schedule one (setback policy) with the proposed approach of active and adaptive coastal management which is allowable if the Marina is granted Coastal Node Status under SPP 2.6. JFA subsequently met with and responded to Dr Elliot's technical criticisms. Dr Elliot subsequently confirmed that his initial concerns had been satisfactorily addressed and that he supported the findings of the study and the beach design and adaptive management approach to stabilising the coast. Also refer to reply on comment number 38.

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51	Department of Transport	The credibility of the wave model and sediment transport model cannot be verified as the key information on the model input, calibration, and sensitivities of the models to their input conditions are absent in the supporting report (JFA, TABEC 2011). The predicted magnitude of sediment transport rate in the area has not been presented explicitly in the report. We notice that a three-and-a half year wave hindcast has been completed by APASA (2011) in the Marine Modelling Study (Appendix 5). We recommend that the two model results be compared as a cross validation exercise to reduce the uncertainty levels of both models.	Note, that the wave contributions to sediment mobilisation and the hindrance of settling related to dredging was very minor. We also note that the magnitude of the wave energy in the area is typically very low and beyond the capability of many instruments to accurately resolve both related wave periods and wave directions. Locally measured wave data, particularly during the design northerly storms was not available for the study for detailed calibration of the wave model. Additionally as noted above, ambient wave conditions are typically so low as to affect the accuracy of the measurements. Therefore, the model was calibrated against measured data at Cottesloe and Owen Anchorage. Given the lack of measured data and very minor contribution of waves to sediment mobilisation at most times, detailed sediment transport modelling for investigating long term behaviour of the beach will not provide reliable results as the expected transport rate would be in the order or less than the model accuracy of numerical modelling. The main application of the wave model results for this study was to determine the 100 year northerly seas at the proposal site. The result of the 3 year hindcast will represent the ambient conditions but can't be used for validating the extreme wave conditions. Therefore, it is very difficult to give an accurate explicit sediment transport rate in this low energy environment without transport calibration data at the site. The rate is very small (published reports give <750m3/y MRA 2008), has been incorporated in beach designs collecting against the proposed structures and practical experience would indicate that formed beaches at the site will form as detailed and be stable.
52	Department of Transport; Cockburn Sound Management Council Officer Submission; Public	The proposed coastal protection structures and measures to manage coastline retreat due to sea level rise in the next 100 years have severe detrimental effects, including loss of beach amenity and loss of seagrass if large scale beach nourishment becomes inevitable. It is almost certain that the protection cost for continuous seawall maintenance/upgrade over the entire coastline, will escalate rapidly as result of the predicted sea level rise in the next 100 years. Will the cost be borne by the proponent or the ratepayers of Rockingham?	The management and marina costs are to be included within a business case to nominate a marina manager. It is proposed that the rates paid by residents outside the development remain unaffected by the marina. Although it is noted that the creation of a marina tourism development will provide social and economic benefits largely to the Rockingham community. Large scale beach nourishment is not likely to be required as the beaches are relatively stable. Regarding risk to seagrass, to estimate the maximum foot print of the proposal, it has been considered that the beaches are fully filled with sand during construction. This figure presents the ultimate potential of the seagrass loss while enough sand is provided for the beach to reorient to the dominant wave direction. However, it is recommended that during construction the beach is partially filled with sand. Once a major storm occurs it will tend to reorient the beaches, then more sand can be filled to prevent exposure of seawall. In addition, the results of beach response modelling showed that the eroded sand would remain on the lower part of the beach and is not lost from the system. After the storm that sand will be gradually pushed back to the upper part of the beach by the background waves. This means that large scale beach nourishment is not likely to be required.

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53	Department of Transport	The buried seawall will become exposed seasonally and permanently with future sea level rise. The presence of a seawall will exacerbate the beach erosion in front of it as result of wave reflection. In an extreme circumstance the beach in front of the seawall may completely disappear. The PER and its supporting documents have not demonstrated that all other options for avoiding and adapting to coastal hazards have been fully explored before engineering defence measures are considered.	As noted in previous comments, a 20m buffer is provided in front of the buried seawall. With application of the available basic empirical techniques to assess ongoing recession for the projected SLR the beach may retreat and the remaining 10m buffer over and above the acute erosion allowance (10m) may be lost over the next 40 years as the profile moves up and landward in response to SLR. The proposal recognises that adaptation may be required in the future. This will occur at “pinch points” at ends of the beach compartments being affected by episodic acute storm erosion events and would be easily managed through minor renourishment past the estimated retreat timeframe. Therefore, the seawall is located sufficiently to the rear of the profile so as not to influence beach behaviour and will not exacerbate beach erosion. As noted in previous comments, the structure planning process for the proposal developed a layout which closely approached the Mangles Bay shore in a concept plan developed by inter-agency and public consultation. It is therefore assumed that this meets the nodal development tests of the current policy and the proposed public interest tests of the draft policy. The provided concept includes “soft” protection methods reinforced with hard structures in keeping with the development objectives which reduce risk and are shown to accommodate any impact from SLR to the development over the planning horizon. Management adaptation requirements in the future are shown to be small and manageable and can be planned in the design phase of the proposal as part of a comprehensive management strategy in keeping with the proposed management structure. In addition, the proposal recognises that ongoing management of nearby coastal sectors will be required.

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54	Hon Lyn MacLaren MLC (258)	The Assessment has not been undertaken within a comprehensive coastal hazard risk management framework. This is now considered to be best practice by ensuring that any proposed development takes account of the long-term adaptive capacity for managing current and future coastal hazards.20 The Assessment has been restricted to a bare minimum technical appraisal of coastal hazards within the immediate area without consideration of the adjacent coastal areas. The Coastal Processes Assessment does not analyse the broader implications of coastal defence structures since the sediment transport analysis is confined to the Mangles Bay area. The impact assessment of the coastal processes study was narrowly confined to the coastline between the Causeway and Hymus Street.21 The draft State Planning Policy 2.6, which has already been extensively reviewed by stakeholders, states that "there is a general presumption against new coastal protection works, except where such works are considered only after all other options for avoiding and adapting to coastal hazards have been fully explored as part of a comprehensive coastal hazard risk management process.22 The Assessment fails to provide either a coastal vulnerability/risk assessment of Mangles Bay and adjacent coastline or a comprehensive analysis of all available options including the option of avoidance. It is stated in the Coastal Processes Assessment that small groynes need to be constructed on either side of the main breakwater. This is an admission that the breakwater will directly affect the integrity of the seagrass meadows. The justification for the use of buried seawalls is to allow for a reduced setback allowance. The Assessment shows that under current State policy, the coastal setback for the Mangles Bay development should be 162 metres. The proposed setback within the PER is 20m because the proponent will be building sea walls "to mitigate the erosive effects of a severe storm on infrastructure and developed land...The buried seawall will also serve as a foundation element to allow the height of the coastal system to be raised while affording protection against shoreline retreat."25 Once again this is against current coastal planning best practice which is to use coastal defences as a last resort. Where no development has taken place, then the best strategy is to avoid development or only allow temporary structures. This approach is recognised in the Government's updated SPP 2.6.	The coastal hazard assessment has been carried out and references to published hazard assessments are also made in the PER. The risks to the proposed development from the impacts of SLR are shown to be of a scale which is relatively easy to adapt to and soft protection measures are proposed in accordance with stated planning objectives. Buried seawalls are proposed as management tools to provide security against delays in management actions and not to reduce setbacks. The development is essentially protected by the beaches from inundation from extreme storm events. The proposed system provides a number of options for adaptation to future impacts of SLR should they occur. Methods such as beach renourishment, crest protection etc are all feasible adaptation measures that can be taken towards the end of the planning period if required and retain the same risk profile while maintaining the stated amenity aims. For additional information, please refer to comment 36, 41 and 53. Note that the aim of the JFA study was to determine the required protection for the proposed development accepting it was desirable to approach the coast and that this was developed as part of a public and agency engagement process. The decision to avoid the need for the mandated coastal set-back was made during preliminary planning stages which developed the concept.

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55		The proponent may argue that the Mangles Bay develop is exempt from SPP 2.6 requirements. Under the SPP 2.6 Policy, a development may be considered exempt if it is an industrial or commercial development. This exemption should not apply to the Mangles Bay marina since most of the land use footprint is for residential and recreational purposes. Further, the proponent acknowledges that the construction of the breakwaters, groynes and buried sea walls will "interrupt longshore transport and cause realignment of the beach fronts". To counter this effect, the proponent proposes the solution of beach nourishment program.26 There are no cost estimates provided for the maintenance of the defensive structures and the beach nourishment program, which are known to be costly, both economically and environmentally. The Coastal Processes Assessment does not include the specific engineering design requirements for the defensive groynes and seawalls as well as estimates of the volume and frequency of beach nourishment thus precluding any independent assessment of their efficacy and ongoing maintenance requirements and costs. There is a risk that in the long term, costs may become an unacceptable burden on local ratepayers. This is a particular concern as the long term cost/benefit of coastal protection works (e.g monitoring and maintenance costs and shoreline alterations down drift) cannot be assessed against other non-defensive measures. It is necessary to consider therefore the financial responsibilities for ongoing maintenance and management of these defensive structures and to ensure that if the proposal is to proceed that an appropriate environmental bond is sought from the developers for the lifetime of the structures. It is noted that the ESD gave a specific commitment to provide engineering design requirements associated with coastal processes these have not been provided in sufficient detail for independent assessment of their efficacy. Once again, an independent peer-review of the Coastal Processes Assessment, commissioned by the EPA, would help to provide some assurances about the appropriateness of these coastal defensive measures. No consideration is given to the precautionary principle. It is well accepted that coastal systems are difficult to model and impacts of proposed development activities are difficult to predict.27 Hence, the precautionary principle is considered fundamental to all coastal planning activities.	

	Respondent (sub #)	Submission and/or issue	Response to comment
56	Naragebup Marine Working Group; Ho Lyn MacLaren MLC	The anticipated sea-level rise will significantly reduce the swell protection that maintains this landform. The most likely initial scenario may be that that the promontory erodes on its southern side re-establishing the limestone Cape as an island. There is no evidence the project has been designed with these sorts of changes being considered.	The Proposal will not impact on sea level rise although should such a scenario eventuate, it is likely that local and State authorities will undertake coastal stabilisation works to prevent loss of existing houses and infrastructure to the south of the proposal area. In addition, adequate warning of need for shore protection works is likely to be received and the required works can easily be retro-fitted at that time. Given that the most damaging storms attack from the north and north west, the Proposal site is sheltered by Garden Island, and climate change SLR would not change the wave energy drastically. Sensitivity analysis on the effect of SLR showed that the wave height would increase less than 10% at proposal site after 100yr. However as it was mentioned in the low energy beach the change of water level is much more important than the slight increase of wave height. This has been included in assessment of the acute storm erosion.
57	Department of Transport	It is considered essential that all collected data, and ideally data analysis, be made publicly available so that our management and understanding continues to improve with subsequent projects.	Data will be made available to the Department of Transport on request.
58	Friends of Point Peron	The text claims that the waves “continue to refract until they are almost perpendicular to the shoreline at Mangles Bay. But Figure 81 shows the West north west swell waves bending towards the south east in Mangles Bay. Either way it seems that both wave directions will be expected to force water into the mouth of the Marina’s entry channel. Observations of storm surge through the small bridge of the causeway suggest that there is immense power in waves entering Cockburn Sound which must have impact on flows within the Sound but there are no studies into this. The proponent should be required to conduct on site wave studies to confirm computer modellings of directions of waves under storm conditions at Mangles Bay and the likely impacts of these on water levels within the Marina and on effect of the shaping of the groynes.	Note, that the wave contributions to sediment mobilisation and the hindrance of settling related to dredging was very minor. We also note that the magnitude of the wave energy in the area is typically very low and beyond the capability of many instruments to accurately resolve both related wave periods and wave directions. Wave assessments indicated that the ambient wave climate is benign, further, wave measurements indicate the ambient swell to be extremely small. However, these background far sea conditions from outside the sound dominate the shape of the beaches. Our reviews included the swell penetrating the causeway in determining energy directions. Locally generated waves within the sound dominate the extreme wave climate and were used for acute erosion assessments. These wave directions, due to the geometry of the northerly fetches also approach the site perpendicular to the shore. Therefore, the indicated beach alignments will be very stable.

3. Marine water and sediment quality

	Respondent (sub #)	Submission and/or issue	Response to comment
59	Public	The proposal did sampling over a very limited time period – 12 months of sampling should be used for the modelling.	Available data indicate that phytoplankton growth is much less in winter and early spring than in summer and autumn. Water quality sampling was risk-based. It focussed on the time period of concern for water quality effects (summer and autumn), and also the period for which environmental quality criteria are established for water quality.
60	Public; Cape Peron Community Vision Working Group; Preserve Point Peron for the People.	The PER predicts some changes to water quality in Mangles Bay, why should the water quality in Mangles Bay be impacted at all. What contingencies have been planned if the marina doesn't adequately flush?	Conservative predictions based on available information indicate little or no effect on water quality in Mangles Bay (refer to Appendix 2 – Section 4 of Strategen document "Response to Key Marine and Groundwater Issues Raised in Submissions on the Mangles Bay PER"). The main risk to marina water quality is build up of organic matter in marina sediments, which would result in the sediment nutrient flux being higher than the rates used in predictive modelling. The proposed management contingency for this situation is the removal of such sediments.
61	Public (92); Cape Peron Community Vision Working Group; Wetlands Conservation Society	Research by Maxted et al (1997) found that canal estates are often dredged to a depth greater than the adjacent estuary, creating a sill that inhibits tidal exchange. Canals promote stagnation, poor water and sediment quality as well as depauperate biological community. The risk of creating stagnant pools of water in a marina with only one entrance is a high risk, particularly given WA summer conditions. Jervois Bay to the north has serious eutrophication problems due to inadequate flushing and is better sited. Mangles Bay already has poor water quality and cannot afford to receive more pollution.	The marina design involves no sills and no stagnant pools. The effect of the single entrance on flushing has been assessed through modelling. The flushing results have been presented factually and then an assessment has been conducted on the expected environmental implications. Jervoise Bay's serious eutrophication problems are largely due to high nutrient inputs, in combination with low flushing rates. This combination of factors results in a nutrient 'loading' per unit volume of water that is almost an order of magnitude higher than that predicted for the Mangles Bay marina (refer to Section 2.1.5 of refer to Appendix 2 – Section 4 of Strategen document "Response to Key Marine and Groundwater Issues Raised in Submissions on the Mangles Bay PER").
62	Public	The PER claims that there will be no indirect loss of seagrass due to the outflow of lesser water quality from the marina. However this is at best inaccurate as there will be a continuous outflow of high nutrient water which the models show will accumulate along the length of Mangles Bay and hence interfere with the values that make Mangles Bay a valuable fisheries nursery. Canal waters would be exchanging with already eutrophied, enclosed waters of this section of Cockburn Sound, reducing the effectiveness of the flushing.	Modelling of water quality in the marina indicates a gradient in water quality, from lowest at the end of the canals to highest at the marina entrance. Beyond the marina entrance, modelling further indicates that any elevations in nutrient concentrations and chlorophyll-a concentrations rapidly become both minimal and infrequent. Measurements at several marinas in Perth coastal waters with a variety of flushing times and water quality (including Jervoise Bay) also confirm little effect on water quality outside the marinas. Indirect loss of seagrass is unlikely as predicted effects on light attenuation are also minimal, and it is further noted that the seagrass meadows in Mangles Bay survived an extended period of much worse water quality during the 1970s and early 1980s (refer to Sections 3, 4 and 5 of Appendix 2 – Section 4 of Strategen document "Response to Key Marine and Groundwater Issues Raised in Submissions on the Mangles Bay PER"). The value of the seagrass meadows of Mangles Bay as a fisheries nursery is in large part because of its sheltered and slightly nutrient-enriched conditions.

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63	Public	Given that Hillary's Marina has developed poor water quality over time despite emptying onto a better flushed area, how well will this proposal flush given the Causeway restricts flushing of Cockburn Sound?	Refer to response to comment 62 above. We are not aware that Hillary's Marina has developed bad water quality over time, nor is this supported by any survey data collected by the DoT. The 'poor water quality' perception has arisen because of elevated bacterial counts that sometimes occur at the marina beach favoured by families with small children. During spells of fine, hot weather the high density of bathers (especially small children) in these sheltered waters can sometimes result in temporary elevations in bacterial counts due to 'faecal shedding'. It is noted that no beaches are planned for within the Mangles Bay marina. The modelling for the Mangles Bay marina indicates adequate flushing, and is also more comprehensive than modelling undertaken prior to the construction of Hillarys Marina.
64	Hon Lyn MacLaren MLC	In the report prepared for the PER, McLean observes that "The outflow from the marina into Mangles Bay has the potential to affect water quality in the bay and in adjacent waters of Cockburn Sound, such as the Shoalwater Islands Marine Park which borders Mangles Bay at the Garden Island Causeway.' This would cause a breach of one of the management objectives set out in *The Shoalwater Islands Marine Park Management Plan 2007 - 2017,* namely "[t]o ensure the water and sediment quality of the marine park is not significantly impacted by future human activities".	The operative word is 'potential' – as McLean's report was based on a risk assessment that involved identification of the potential risks and potential effects, and management measures to address them. Predictive modelling – backed up by data for other marinas in Perth coastal waters – indicates effects on water quality in Mangles Bay will be minimal, and effects on the Shoalwater Islands Marine Park even less (refer to Appendix 2 – Section 4 of Strategen document "Response to Key Marine and Groundwater Issues Raised in Submissions on the Mangles Bay PER").

	Respondent (sub #)	Submission and/or issue	Response to comment
65	Public; Department of Health; Friends of Point Peron	Additional impacts to water quality are expected from engine emissions, anti-fouling paint leaching, sewage and other waste discharges and increased littering. The Strategen report acknowledges the locally significant impacts on increased boat activity on marine water quality from fuel spillage, copper and tin in antifoulants and solvents such as tetrachloroethane, trichloroethene and trichloroethylene just to name a few. All may have the effect of increasing the potential to algal blooms, increased bacterial levels etc and affecting the nursery area and the ability for human contact. There is a high risk of impacts from boats and associated fuelling provisions to marine water quality. This impact should be quantified and assessed, including determining boat movements to assist in identifying the impacts.	The contaminants thus named are potential toxicants that would actually reduce risk of phytoplankton blooms. It is agreed that such contaminants could be present at very low concentrations. It is not possible to accurately quantify such effects, but data for other marinas in WA (including those in the sheltered conditions of the Swan River) do not indicate values harmful to human contact, nor is there typically a buildup of contaminant concentrations in sediments or biota (which are better long term indicators of water quality effects) that exceed ecological guidelines. Exceedance of hydrocarbon guidelines is rare, and exceedance of metal guidelines – when it does occur - is typically associated with boat maintenance facilities, occurring in the immediate facility of their stormwater outlets or interceptor outlets (Oceanica 2007). The one exception to this is the antifoulant ingredient tributyltin (TBT), which is very persistent and is often detected in WA marinas even though it has been banned from use on recreational boats since 1990. The marina will not 'inherit' any historical TBT contamination so this should not be an issue. Nonetheless, an appropriate Operational Environmental Management Plan will be in place monitor, detect and manage any contaminant inputs. The proposal aims to better control, monitor and manage effects due to boating activity. The proposed fuelling facilities should reduce the risks of fuel spills presently associated informal refuelling activities in Mangles Bay. The fuel dispensers can include safety features to reduce risks (e.g. automatic shut-off nozzles), and the semi-enclosed nature of the marina will greatly assist in the effective management of fuel spills within the harbour (e.g. using containment booms) – as required under the Oil Spill Management Plan for the proposal. Similarly, the availability of sullage pump-out facilities should reduce the occurrence of illegal discharges that presently occur in Mangles Bay.
66	Hon Lyn MacLaren MLC (258)	Mangles Bay is already the least mixed area within Cockburn Sound because of the interaction of the Sound with the Garden Island causeway. "With low water renewal within the marina, there is a real potential for anoxia which is known to have deleterious effects on benthic communities."	The Cockburn Sound Management Council's weekly December to March monitoring data for the Jervoise Bay Northern Harbour do not indicate anoxia, and this harbour is less well flushed, much deeper, and more nutrient enriched than the proposed marina. The shallowness of the water and predicted flushing rates make anoxia very unlikely in the Mangles Bay marina The buildup of extreme sediment nutrient enrichment could possibly cause reduced oxygen conditions under an extended period of calm, but extreme sediment nutrient enrichment is not predicted – and if for some unforeseen reason it does, contingency measures (sediment removal) are proposed.
67	Public	The PER suggests that groundwater nutrients that presently fuel epiphyte growth on the extensive seagrass meadows of Mangles Bay will instead be taken up by phytoplankton growth in marina waters. Please provide scientific documentation to support this hypothesis.	When there is already a major 'standing crop' of algae present in an area (seagrass epiphytes in this case), they are able to take up the larger proportion of any DIN inputs. Although phytoplankton can take up nutrients at a faster rate than most epiphytes, there is just not much of them present With the marina, phytoplankton will have a greater opportunity to take up groundwater nutrients due to the residence times of marina waters, before it moves over the seagrass meadows.

	Respondent (sub #)	Submission and/or issue	Response to comment
68	Dr van Keulen (97)	The proponents expect nutrients that come into the marina via groundwater to be partially taken up by phytoplankton, with the result that chlorophyll *a* levels in the proposed marina are expected to be approximately twice that of the adjacent waters in Mangles Bay. While modelled flushing rates are quoted by the proponents as adequate to prevent build up of nutrients or contaminants (Strategen, 2012), the modelled times appear to be sufficient to allow significant development of phytoplankton blooms: 4-13 days depending on location within the marina and time of year (APASA, 2011). This is of particular concern during the warm and calm autumn months, when conditions are ideal for phytoplankton growth. Rapid build up of phytoplankton populations can result in excessive dissolved oxygen demand, particularly a concern in the warm waters experienced in Perth during summer. The outcome of this process is likely to be the release of very low quality water onto the already vulnerable adjacent seagrass meadows.	60% of the flushing times presented in the PER represent the worst areas for flushing, at the very end of the canals. Overall marina waters will typically have flushing times of 6–8 days, with occasions of 10 days more frequent in autumn. Modelling of chlorophyll-a concentrations in the marina is based on overall marina waters, so concentrations would be lower at the marina entrance and higher at the end of the canals. Modelling further indicates that beyond the marina entrance, any elevations in chlorophyll-a concentrations (and attendant effects on light attenuation) rapidly become both minimal and infrequent, and that impacts on seagrass meadows (whether through nutrients or light attenuation) are very unlikely.
69	Cockburn Sound Management Council Officer Submission	We note with interest that the WAPC Policy DC 1:8 states *'that if source water does not meet general water quality guideline requirements, a canal estate for that location is considered inappropriate'*. Statements in the PER, and in particular in this section, conclude that water quality in the marina will be considerably worse than in adjacent marine waters in Mangles Bay. It is stated that the marina waters will experience twice the level of chlorophyll 'a' up to 4 times the DIN concentrations expected outside of the canal. It would thus appear that there will be water quality issues within Mangles Bay which is already of poor quality. Any additional stress created by poor water quality on the remaining seagrass meadows could be sufficient to create conditions leading to substantial long-term seagrass loss in this vitally important ecological corner of Cockburn Sound.	We believe this statement is from Section 5 of the 1999 version of WAPC Policy DC 1:8. The general requirements are subsequently set out, and Section 5.1.2 requires that water quality in marina is suitable for: • occasional human immersion and wading • boating • adjacent development • passive recreation Clause 5.1.3 states that development should not be permitted where "the source water has a beneficial use or water quality that is a lower standard than the beneficial uses in paragraph 5.1.2." The waters of Mangles Bay (source waters) meet these requirements, and so should marina waters. A revised version WAPC Policy DC 1:8 has just been released (May 2012; see also comment 70 below) and now requires the identification of an environmental quality management framework (to be developed in consultation with the CSMC), including environmental values, environmental quality objectives, levels of protection and environmental quality criteria to be met to maintain acceptable water and sediment quality in the marina. The environmental values for the marina have yet to be set, but are likely to include ecosystem health (level of protection to be determined), fishing (safe for consumption) and recreation and aesthetics (probably secondary contact recreation). These will need to be included in the Operational Environmental Monitoring Plan (OEMP) for the marina. Effects on the environmental values of the waters of Mangles Bay - and the extent to which environmental quality criteria are presently met – are predicted to be minimal. Refer also to responses to comments 62, 66 and 68 of Section 3.

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70	Department of Planning	Development Control Policy 1.8 - Canal Estates and Artificial Waterways Development expands and clarifies water quality management. It clarifies responsibilities between the developer, local government and State government agencies. It will be adopted shortly by the WAPC and the proposal should be in compliance with this new policy.	The Policy has been reviewed and a Draft EQMF developed in accordance with the Policy guidelines. Refer Section 2.6 of Appendix 2 – Section 5 of Strategen document "Response to Key Marine and Groundwater Issues Raised in Submissions on the Mangles Bay PER" for further detail. Once the EQMF is approved by regulators, the Proposal will be in compliance with the policy guidance. Other policy guidelines include; • identification of the waterways manager • monitoring and management of water quality to specified requirements • a sustainable maintenance program including obligations for water quality and sediment monitoring programmes, monitoring water depths (i.e. hydro surveys), dredging, monitoring erosion or accretion of shorelines associated with the waterways. The OEMP for the marina will address the environmental quality management framework required by the revised policy.
71	Dr van Keulen	The shallow nature of the surrounding meadow may result in enhanced drainage flow into the channel; the possible impacts of this are unknown. The channel forms a deep point in the middle of the seagrass meadow and it is anticipated that seagrass wrack will accumulate in it, potentially causing a nuisance for boaters.	If the seagrass wrack is buoyant it will be moved according to surface currents. Wrack generation within seagrass meadows in the area is small (refer to response to comment 45 in Section 2), and an even smaller proportion would drop into and accumulate in the channel. If wrack is not buoyant, it will stay trapped in the dense seagrass meadow itself. Wrack is unlikely to be a nuisance to boaters.
72	Public	Chlorophyll a concentrations are predicted to increase, however flushing in winter and autumn is greatly reduced around the boat ramp (with NW winds). With such polluted waters entering Mangles Bay it must have an impact on seagrass.	Refer to responses to comments 62, 66 and 68 in Section 3.
73	Public	This proposal will exacerbate the current breaching of existing Environmental Quality Guidelines for Mangles Bay where there are already signs of nutrient enrichments stress. Chlorophyll a levels are expected to be up to at least 2.4 times the current loading and this will breach the guidelines for even moderate protection though the area achieves the EPA Environmental Quality Standards for high protection.	The proposal is not expected to significantly affect the extent to which environmental quality criteria are presently met in the waters of Mangles Bay. The environmental values, environmental quality objectives, levels of protection and environmental quality criteria to be met to maintain acceptable water and sediment quality within the marina have yet to be set in consultation with the CSMC. (refer to response to comment 69 in Section 3).
74	Department of Health	The Department of Health and the City of Rockingham Environmental Health Services are to be advised immediately if any aesthetics or recreational trigger levels are exceeded as soon as the results become available.	Noted and accepted. This will be the responsibility of the marina manager.

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75	Friends of Point Peron	I note that no use has been made of the real time computer modelling program for water quality assessment in the Swan River to Cockburn Sound developed by the Centre for Water Research directed by Professor Jorg Imberger. The EPA should require the proponent to include the data from this program for a whole year cycle in its submissions regarding water quality and require the proponent to verify problematic aspects through thorough water monitoring of Mangles Bay at sites that include every 100 metres along Mangles Bay Beach.	The program relates to monitoring 'after the fact' for Perth coastal waters and the Swan River, rather than having relevance to predicting impacts of proposals.
76	Cockburn Sound Management Council Officer Submission	The modelling underpinning the water quality predictions of the Mangles Bay study, namely the hydrodynamic model, was not calibrated against a separate dataset as indicated by the technical report. In order to gain confidence in model outputs it is necessary to obtain two independent data sets. One data set is used to calibrate a model whilst the second data set is used to validate the calibrated model, to ensure that the calibration is valid. The metocean data acquired for this study was used to validate the predictions of the uncalibrated model for some but not all time periods simulated. Whilst the authors of the technical report (APASA 2011) are of the view that a calibration was largely unnecessary, they do not explain why. We consider that this approach reduces confidence in the model results.	We acknowledge that this section could have been presented with more clarity. In fact, the first measurement period was used as the calibration period, where the best winds, boundary conditions, friction factors and other parameters were determined to provide the strongest match to the data. The second measurement period was then used as a validation set, which was for both a different time period and a different location. Further validation was conducted using the drogue comparisons. The model was calibrated and the comments suggesting otherwise are incorrect. The flow features and conditions in other parts of Cockburn Sound do not have a significant bearing on the local exchanges between the marina and Mangles Bay. The focus was on the marina and Mangles Bay, however the larger scale region of Cockburn Sound was included primarily to ensure that the fetches for the winds were well represented and the effect of gross circulation on Mangles Bay, including the causeway entrances, was included. In terms of validating for all times simulated, this would require measurements for all times of the yea. Such a scope of works is typically not required for studies of this nature and additional validation will not substantially alter the results.
77	Cockburn Sound Management Council Officer Submission	There is a strong sentiment that CMAP data may deviate from reality to an extent where accurate resolution of hydrodynamic features is compromised. While additional project-specific data was reported to be used, the quality and quantity of this data is not described.	The best available bathymetric data have been applied for the project. In some areas the CMAP data (which is the same as is presented on the marine charts) may deviate from actual, however often that data is all that is available without collecting more information. Given that the performance of the marina in this case was largely governed by the exchange through the entrance, it is not necessary to require a new high-resolution bathymetric survey for the work.

	Respondent (sub #)	Submission and/or issue	Response to comment
78	Cockburn Sound Management Council Officer Submission	A number of issues were identified with data collection for the hydrodynamic model: • The observed data used for validation of the hydrodynamic model only covered three days of the three month summer simulation, five weeks of the three month autumn simulation and none of the winter/spring period. The lack of data coverage means that there is little support from measurements for the interpretation of sediment plume and water quality predictions. This raises some concern, particularly regarding the winter results as this is when the largest accumulation of DIN is observed and is also the only season when dredging is simulated (due to planned execution of dredging in winter). • There is an underlying assumption that only wind drives inter-annual variation in water circulation, since only wind data were analysed for multiple years to derive representative wind information for the three hydrodynamic regimes to be simulated. Other forcing conditions were derived based on data from a single year. There is, however, no data representation to show that 2011 forcing data was representative of general conditions, which would help qualify this assumption. • All fourteen drogues were deployed in the upper meter and can only be used to validate surface currents. The drogue paths show variable correspondence with the modelled trajectories suggesting that the model does not always resolve-small scale hydrodynamic movement adequately.	• The measurement period was designed to accommodate the proposal schedule and importantly capture the autumn period when flushing was expected to be generally weakest (as was later confirmed). Note that it is not typical that measurement from all seasons be required. Measurements outside the marina will have little bearing on the magnitude of the predicted increase in winter, as this was largely due to the greater groundwater flow and associated DIN concentrations. The low magnitude of dredging effects predicted would suggest that there is little risk and little need to obtain further measurements during a winter period. • Wind was used as a means of establishing periods that could be modelled as representative of the range of conditions within each of the seasonal regimes. It was never assumed that wind was the only factor in inter-annual variation, however it is a reasonable guide and a readily understandable measure. Note that for many of the other factors that may be important there is a paucity of data for analysis and application. Note also that all forcing conditions were applied using available measurements from the actual modelled periods and that the 2011 data was only used in the validation process. • Yes, we agree. Typically hydrodynamic models will have varying degrees of success in resolving fine scale features of flow, particularly where eddies may occur.

	Respondent (sub #)	Submission and/or issue	Response to comment
79	Cockburn Sound Management Council Officer Submission	With regard to performance of the hydrodynamic model, a quantitative measure was applied to ascertain the agreement between field and modelled measures of current speed, current direction and water level. This 'Index of Agreement' (IOA) ranges between 0-1 where 0 indicates no agreement and 1 indicates agreement between all measured and field observations. With limited guideline as to what IOA value delineates a 'good' model, 0.5 has been used. The following is noted: • Current speed has the lowest IOA (down to 0.58). Since the flow field constitutes the basis for all the results and conclusions presented this is a clear indication of model uncertainty in this study. • Model performance was best if the boundary conditions were set using water levels from Fremantle, which is located well inside the modelling domain, rather than a tidal model. This could be due to the enclosed nature of Cockburn Sound making it difficult to reproduce the flow into and out of the Sound using a tidal model. • The hydrodynamic model was successful at representing many hydrodynamic features of Mangles Bay and Cockburn Sound. However, as acknowledged by APASA, some short-term hydrodynamic features, as well as tidal features driven by the complex topography and resulting flow conditions near the causeway adjacent to Mangles Bay, are not resolved adequately. The conclusion that the flow conditions adjacent to the proposed marina in Mangles Bay are 'suitably represented1 may therefore be an overstatement.	• There is some uncertainty in the current predictions as noted, however we contend that at times this was due to differences in phasing and issues generated by the lack of suitable boundary conditions. However, the dynamics in terms of current reversals and flow magnitudes were demonstrated to be consistent, and the model provides sufficient certainty to be used for the purposes required by this study. • No, this is generally because of the fact that a large amount of surface elevation variation that is not due to the tide is prevalent in these waters – e.g. seiches, coastally trapped waves etc. Since the tidal signal is relatively weak, these variations can easily override a tidal effect. • We stand by the assertion that they are suitably represented in terms of variability and magnitude and are suitable for the purposes required by this study.

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80	Cockburn Sound Management Council Officer Submission	From the results presented in the technical report for the flushing study (APASA 2011) the following can be concluded: 1. The tides as well as the winds govern the flushing efficiency. As such, the flushing results are associated with some uncertainty given the proximity to the causeway and the associated problems with reproducing some tidal features in this area, as indicated in the above section. 2. The flushing time range of 7-10 days seems low given the intricate and narrow water ways of the marina plan. Officers acknowledge that a statement has been included in the PER which highlights that the marina has been designed specifically to enhance flushing capability. This assertion has not been qualified further. 3. Although the flushing time measure used in this study indicates that most of the marina will have been flushed (to 37%) within 7-10 days, this does not mean that levels of nutrients or contaminants released continuously within the marina will be low. This depends on the strength of the discharges. 4. Incomplete flushing of a non-continuous discharge will occur over any one tidal cycle implying that elevated nutrients levels may persist for extended periods of time, in turn providing opportunity for build-up of organic material or even algal blooms. *5.* The technical report (APASA 2011) further states that: *'Flushing is expected to be sufficiently effective to prevent the gradual build-up of concentrations over time. This suggests that the risk of adverse escalations is relatively low, based on the assumptions made and the input data provided for this study.'*	1. As indicated in the previous response the tidal signal in Mangles Bay is relatively weak and the direct exchange between the marina and Mangles bay is more dominated by other water level fluctuations locally, – e.g. seiches, coastally trapped waves etc. These local water level variations were well resolved by the model. 2. The actual reported (maximum) flushing range for the back end of the canals was 4 –13 days, not 7-10 days – see APASA (2011). Note that the flushing rate for the main marina water body is much less because of its proximity to the entrance. The median flushing time for ALL locations throughout the water body, for all seasons, was approximately 7 days. Key design initiatives to enhance flushing have included: • location of the main water body close to the marina entrance • reduction in the total area of canals from that originally identified as desirable • the inclusion of vertical impermeable polyvinyl sheeting walls in the canals • orientation of the canals in the prevailing wind directions and • reduction of depth in the canals to 2.5m. 3. Agreed. The effect on nutrients or contaminants was assessed in a later section of the APASA (2011) report which concluded that DIN concentrations within the waterbody will be up to 4 times the background level during winter when the loading is highest (but potential for algal blooms is the weakest), and generally less than twice the background level during summer and autumn, (when the potential for development of algal blooms is strongest). 4. Additional modelling and analyses have been undertaken by APASA and Oceanica to confirm the adequacy of the water quality predictions inside the marina water body. (refer to Appendix 2 of Strategen document "Response to Key Marine and Groundwater Issues Raised in Submissions on the Mangles Bay PER"). This work clearly demonstrates that the model results are very conservative and that the conclusions presented in the PER remain valid for all seasons. 5. This statement refers to the fact that there is no constant climbing concentration, but a dynamic fluctuation which was not predicted to escalate in the modelling. The statement was not related to the marina achieving background water quality – this is not possible as

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		• This conclusion is difficult to understand. Any degree of flushing will eventually cause the concentrations to reach quasi-stable levels. Only if there is no water exchange at all can build-up possibly continue forever. It is at what level the concentration stabilizes that is important to water quality. A long flushing time will however prolong the time it takes to reach a stable level. • It appears this statement is not supported by Fig. 8.1 in the technical report (APASA 2011). This figure clearly shows that during the 30-day analysis period for each seasonal case, nutrient concentrations are generally stable but clearly elevated compared with background levels. From this it can be concluded that flushing is not sufficient to reduce nutrient concentrations to background levels except at the marina entrance. The statement in the report, which is echoed in the PER, therefore appears incorrect and as an overly positive conclusion.	is well understood by the Respondent. It merely points to the establishment of a quasi-stable level that can then be assessed in terms of importance and environmental context. We believe that within the intended context, it is a correct statement and neither overly positive or negative.
81	Cockburn Sound Management Council Officer Submission	With regards to the setup of the sediment model, it is, unclear why APASA refers to Fitzpatrick et al. (2008) as a 'validation' of their sediment modelling approach, specifically the spill rate of 0.3% of gross production. Fitzpatrick et al. (2008), although mentioning that they did perform validation, show no data to that effect that can be evaluated. Also, Officers have been advised by experienced modellers that 0.3% is a fairly low estimate compared with other projects undertaken in other areas of WA.	This was referenced as it was a major study where the in-water TSS generated by the use of a cutter suction dredge (as proposed for this work) was modelled, calibrated and validated for FPA at a nearby location. The factor 0.3% is a very defendable value and backed by a reasonable amount of literature, as quoted in the reporting. It is low when compared to other types of dredging operations, however a small CSD operating in a predominantly sandy environment, and operating correctly, is expected to generate sediment at this rate. We would ask that the Respondent provide details of the suggested comparable projects. We also note that in many instances, review of other “experienced modellers” work has shown the adoption of percentages with little or no justification, and then no subsequent field verification. In this case, the number is backed by literature and resulted in a success validation against field data at a nearby location for a project where the same type of dredge plant was used.
82	Cockburn Sound Management Council Officer Submission	There is a discrepancy in the reported volume of dredge material between the APASA report and the PER which could potentially be an issue if this is indicative of a change in dredge operations between the production of the technical report and the PER.	The APASA report modelled the details available at the time. These slightly changed after the work was completed as identified in the PER.
83	Cockburn Sound Management Council Officer Submission	The sediment model should be able to predict deposition but this is not reported in the technical APASA report or in the PER. This is likely to be because the impact criteria are designed for TSSC. However, given the large proportion of sediments that will deposit quickly as well as the significant presence of seagrass in Mangles Bay (over 100 ha?) it may have been prudent to also assess the degree of deposition in the local area. Predicting the impact to seagrass from sedimentation was committed to in the ESD.	Sedimentation was modelled and results showed very localised effects (within a very short distance of the dredge area). No significant degree of sediment deposition outside the channel footprint due to the dredging was predicted by the model. Model output has since been provided and is presented in Appendix 2 – Section 2 of Strategen document “Response to Key Marine and Groundwater Issues Raised in Submissions on the Mangles Bay PER”.

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84	Cockburn Sound Management Council Officer Submission	With regards to the setup of the water quality model, the following can be concluded: • the assumptions implicit in the model are clearly not realistic. Importantly, however, the assumptions are seemingly not clearly qualified in the technical report (APASA 2011) or the PER. • It is surprising that a more vigorous approach which included biological and biogeochemical processes was not applied, especially given the routine water quality data sampled in Cockburn Sound and Mangles Bay which is appropriate for calibration and validation of baseline information - none of the ambient water quality information present in abundance for Cockburn Sound was used to calibrate a water quality model, a method that would have been more appropriate given the sensitivity and recreational value of the area. A more developed model could also include the effects of light attenuation from suspended dredge sediments. • It seems that the build-up of chlorophyll and potential mineralisation of organic matter is not adequately addressed given the sensitivity of the area as well as the site's history of exceeding water quality thresholds. • Groundwater intrusions resulting from excavation inside the proposed marina are the only sources of nutrients evaluated. Storm water from Lake Richmond and future hard-stand and gardens is not assessed even though they are potentially another significant source of nutrient loading during rainfall events. We acknowledge that the plan is to divert the drain from Lake Richmond east of the proposed marine with a drain outlet directly into Cockburn Sound, but notes that these other sources are not discussed. • The box model does not include physical or temporal resolution of the environment (although e-folding time to some extent can be considered to represent this). The box model does not include biological process descriptions beyond the conversion factor from DIN to chlorophyll. This does not allow in-depth understanding of the build-up and mineralisation of organic material and possible downstream effects on oxygen levels in the marina. The box model approach therefore represents a very simplified description of the ecological implications of altered DIN conditions, one that may misrepresent future conditions.	It was clearly noted in APASA (2011): *"Nitrogen and phosphorous were modelled as conservative tracers, a simple but effective approach that is typically used for short to medium term water quality modelling. Although release by sediments and decaying organic matter is ignored in this approach, the uptake by biological processes is also excluded and the results are generally suitable for initial water quality assessments and providing context to the likely effect of hydrodynamic flushing on water quality."* The objective was as a screening assessment and a readily achievable analysis. The extension to a full water quality model is rare for application to a development such as this, due to the complexity of the input data requirements, and the resulting uncertainty in a great number of water quality parameters. The approach undertaken for this proposal has been used successfully for a number of other similar developments, and is used in conjunction with the educated assessment and interpretation by experienced marine water quality experts. The modelling approach to predict water quality was simple, but conservative and robust. There was little to be gained – and considerable risk of unrealistic predictions – by using a complex ecological model that builds on the results of a hydrodynamic model that in turn incorporates the results of a groundwater model. Such an exercise would potentially be open to even more criticism. Stormwater inputs to the marina were deliberately excluded because the stormwater management measures were to ensure no inputs under most rainfall events, with the occasional overflow during large rainfall events expected to rapidly exit the marina as a buoyant surface flow (due to its freshwater nature). Modelling subsequent to the PER public comment period has confirmed the rapid exit of large stormwater flows, with recovery to pre-existing conditions within 2 days. Stormwater inputs are also no longer an issue because it is planned to discharge via an outfall at the end of the marina breakwaters The buildup of organic material in marina sediments is addressed by the inclusion of a realistic sediment nutrient flux (noting the management contingency to remove nutrient-rich sediments should excessive sediment nutrient release lead to higher than expected chlorophyll-a concentrations). Validation of the equilibrium (box) modelling using data for Jervoise Bay Northern Harbour indicates chlorophyll-a concentrations are over-predicted rather than under-predicted. Refer to Appendix 2 – Section 4 of Strategen document "Response to Key Marine and Groundwater Issues Raised in Submissions on the Mangles Bay PER". Dredge modelling did not include light attenuation because the spatial and temporal scale of impacts does not pose a risk to seagrass health.

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85	Cockburn Sound Management Council Officer Submission	With regards to data collection for the water quality model, inter-seasonal variation in groundwater and nutrient load is not resolved. The information used may be adequate for describing differences among the three hydrodynamic regimes covered in the study. However, it would not suffice if short term extreme events, such as downpours which may influence ground water intrusion levels, were to occur during or after construction. In such cases, nutrient load may be elevated compared with the scenario specifications outlined in this study.	There are innumerable types of extreme events that could be modelled. The modelling that was done covered a very good range of representative conditions. Additional work has shown that the recovery after extreme events is within 2 days (refer to response to comment 84 of Section 3 above).
86	Cockburn Sound Management Council Officer Submission	With regards to the results from the water quality model, the results of the box model approach show that double the ambient chlorophyll levels may easily be reached during all seasons (PER, Table 39). We not able to assess whether this is a conservative estimate, but simply note that the results are very uncertain in terms of chlorophyll export from the marina. It is clear that the very simple approach used does not allow accurate insight into the ecological effects of the proposed development. It should also be noted that the water quality cannot be fully described by modelling a single nutrient.	It is agreed that water quality cannot be fully described by modelling a single nutrient, but DIN was chosen as it is the limiting nutrient. The modelling was conservative in that it does not include the inhibition of phytoplankton growth by light or other nutrients and trace elements, nor does it include losses due to death, settling or grazing: it simply assumes that any DIN present is converted to phytoplankton growth, and that there are no losses of phytoplankton due to any processes. The modelling assumed full conversion of DIN to phytoplankton growth in summer and autumn, and 50% conversion in winter (consistent with empirical data for winter). Chlorophyll export from marina was addressed - albeit qualitatively described in the PER - and has since been (conservatively) quantitatively addressed (refer to Appendix 2 – Section 4 of Strategen document “Response to Key Marine and Groundwater Issues Raised in Submissions on the Mangles Bay PER”). Elevation of chlorophyll-a concentrations in the waters outside the marina (i.e. in Mangles Bay) is predicted to be minimal, and this is consistent with data for other marinas in Perth coastal waters.

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87	Cockburn Sound Management Council Officer Submission	There is an extensive water quality data set for the Mangles Bay locality based on annual monitoring undertaken by the CSMC. It is not clear how much or if any of this information was used and it appears that guideline and standard figures have been misinterpreted as EQC document table values are used rather than the long-term running medians as per the EQC methodology. The SEP and its accompanying technical documents instruct users to calculate guidelines and standards based on long-term running medians when enough data is available for their calculations. This has not been done and as a result future water quality is likely to be worse in terms of exceedances based on current running medians by several units. This is because ambient water quality based on chlorophyll 'a' and Light Attenuation (LAC) is generally improving at the Warnbro Sound reference site but not within southern Cockburn Sound. For example, CSMC updated EQC methodologies and data results show high and medium protection values for chlorophyll 'a' for 2011 are 0.6 and 1.2 compared to the original SEP EQC table values used in the PER which are 0.8 and 1.3 respectively. These potential miscalculations suggest water quality in the marina could be worse based comparisons to the Warnbro reference site. Refer to p224-225 that states 'the proposal will not result in any lessening of water quality in Mangles Bay, and that EQC for those environmental indicators that are presently met will continue to be met'. This may be true for physical-chemical measurements of salinity, pH and temperature but not for chlorophyll and light attenuation.	At the time the PER was released for public comment, the 2011/2012 data were not available. The updated high and medium protection values used were understood to be those that were relevant to the period data were collected: 2009/2010 results compared to EQC updated with 2009/2010 data, 2010/2011 results compared to EQC updated with 2010/2011 data. The potential change in the level of compliance of Cockburn Sound waters with EQC due to improving water quality word in Warnbro Sound is noted. The word 'presently' was used in the PER based on the information available at the time, and in retrospect should have been qualified to recognise the potential for changes in EQC compliance in Mangles Bay irrespective of whether the marina goes ahead. It should be more correctly stated that the marina will have little influence on water quality in Mangles Bay, and should not affect the degree to which EQC are met.
88	Cockburn Sound Management Council Officer Submission	There is also a lack of contemporary quantitative information to help clarify the contribution that increased phytoplankton production (resulting in poor water quality and higher turbidity levels) will have on background water quality in Mangles Bay. For example, the PER does not provide defensible estimates of volumes or mass calculations to give assessors a sense how much will contribute toward higher light attenuation, increased phytoplankton production and halo affects. Although the PER states that it does not consider that poor water quality will be exported from the marina, it acknowledges the potentially problematic reduced flushing rates and probable long-term accumulation of nutrients and phytoplankton detritus in the marina.	It is acknowledged that the required assessment was not presented in the PER. It has since been undertaken and results are presented in section 3.0 Appendix 2 – Section 4 of Strategen document "Response to Key Marine and Groundwater Issues Raised in Submissions on the Mangles Bay PER". Conservative, quantitative and estimates of the potential effects of water exported from the marina on chlorophyll-a concentrations and light attenuation in Mangles Bay have been made. Effects rapidly attenuate with increasing distance from the marina entrance, and are minimal in terms of both their magnitude and frequency. This pattern is consistent with data for other marinas in Perth coastal waters, including Jervoise Bay Northern Harbour (refer to Appendix 2 – Section 4 of Strategen document "Response to Key Marine and Groundwater Issues Raised in Submissions on the Mangles Bay PER").

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89	Recfishwest	The DEMP stipulates that dredging will take between 12-15 weeks and will be carried out during the winter months; *"The timing of these works has been selected so as to minimise the impact on the marine environment, and particularly the potential impact of turbidity on seagrass habitat in the area."* Recfishwest believes this statement is misleading, as the proponent has provided no documentation to support their suggestion that turbidity is at its peak during winter. In fact, Recfishwest understands the opposite is true. Storm surges are likely to be at their worst throughout winter, and will generate increased turbidity. The proponent should not insinuate that winter dredging will reduce the effects of turbidity on seagrass without supporting evidence.	It is agreed that storm surges in winter will generate high turbidity. The proposed timing for dredging is based on the physiology of seagrasses and to minimise effects on marina biota (e.g. fish spawning), not the background turbidity of waters in winter. Experiments investigating the time of year when shading occurs on the seagrass *Amphibolis griffithii* by McMahon & Lavery (2008) showed that time of year clearly affected the seagrasses susceptibility to shading and to its subsequent recovery. Plants shaded at the end of winter were generally *less affected* and had faster recovery than those shaded at the end of summer. Similar responses are expected for *Posidonia* seagrass, with less impact of shading during winter when light conditions are generally much lower and the seagrasses are not actively growing. Refer to Appendix 2 – Section 2 of Strategen document "Response to Key Marine and Groundwater Issues Raised in Submissions on the Mangles Bay PER".
90	Public; Preserve Point Peron for the People.	Where will the spoil be disposed of and what guarantee is there that it will remain in place. This relates to both capital and maintenance dredging.	Spoil from the dredging will be disposed of on land, not offshore. Spoil, where possible, will be used as part of the development fill. Maintenance dredging is expected to be extremely small and it is expected that beach nourishment within the development would be a suitable beneficial use subject to the normal approvals at the time. Areas are available to handle small maintenance volumes within / adjacent to the proposal area should the need arise.
91	Recfishwest	Recfishwest strongly opposes offshore dredge disposal as this will lead to the smothering of seagrasses which are an important juvenile nursery area and foraging habitat for many aquatic species and are already under significant pressure within Cockburn Sound.	Noted. Spoil from the dredging will be disposed of on land, not offshore.
92	Public; Hon Lyn MacLaren MLC	Dredging will continually impact the adjacent marine habitat and fauna in Mangles Bay. It will release heavy metals that accumulate in the marina sediment and disturbs the mud barrier which will allow the salt water to progress further inland much easier.	It is assumed that that the comment refers to maintenance dredging. Maintenance dredging will only be undertaken infrequently to maintain navigational depths (i.e. for safety), or to address contaminant build-up or excessive nutrient enrichment within the marina in the event that it arises. Maintenance dredging requirements for navigation are expected to be undertaken once every 25 years to restore design depths (i.e. no further ingress of the salt water wedge inland). The potential for contaminant build-up or excessive nutrient enrichment is also expected to be minimal, but removal is preferable to leaving it *in situ*.

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93	Hon Lyn MacLaren MLC (258)	McLean states that "Dredged material may ... enter Mangles Bay during transportation to disposal sites, leakage from pipelines or overflow from the barge." The Dredging Environmental Plan in the PER states that "the anticipated accretion rate of material within the dredged channel is difficult to accurately predict",11 and yet the consultants conclude that the expected volume and frequency of maintenance dredging will be "relatively low owing to the limited sediment mobility typically encountered within seagrass beds". The seagrass, however, will be removed as a result of the channel construction so it is illogical to make this claim.	Dredging is via enclosed pipeline – breakage will rarely occur if at all and no barging or overflow such as in trailing hopper dredging is proposed. The anticipated accretion rate of material within the dredged channel is difficult to accurately predict primarily because the amount of sediment movement is so minor.
94	Dr van Keulen	While measures are proposed to be installed to minimise impacts due to suspended sediments from construction, some leakage of sediment plumes during spoil transport and drainage is inevitable. It is likely that seepage of fine sediments from constructed breakwaters and reclaimed land will occur over an extended period after construction is complete, as was observed after construction of the causeway for the boating facility at Coral Bay (unpublished data); this would be expected to contribute to local sediment load for some time post construction.	Dredging will only generate sediments at the cutter head and will be pumped through enclosed lines to a settlement pond on land within the site. Seepage of fines from breakwaters is a minor source of turbidity. A conservative seagrass loss assessment adjacent the breakwater of 15m wide halo has been adopted. This halo is possibly too wide given the protected nature of Mangles Bay. It should be noted that seagrass grows immediately adjacent the eastern side of the Garden Island causeway.
95	Cockburn Sound Management Council Officer Submission Department of Health; Friends of Point Peron	It is important to emphasise that any discharge to the ocean must meet ANZECC guidelines and not exceed SEP EQC guidelines and values. This is an issue that must be addressed in the Construction Environmental Management Plan (CEMP) and will require more than one to two samples, rather more frequent sampling during dewatering or discharge in order to show that all guidelines have been met or have met contingency criteria. With regard to the placement of dredged material in settlement and infiltration basins, where seawater will infiltrate into the shallow ground water system and discharge to Mangles Bay, it is recommended that monitoring within Mangles Bay and designated monitoring bores in alignment between these basins be undertaken for pH, contaminants and nutrients.	The advice is noted and will be incorporated into the CEMP as requested. The frequency and scale of monitoring will be increased as required, employing a staged approach based on risk assessment: details will be confirmed in discussion with the CSMC and DoH
96	Public	Modelling of marina and water quality neglected to include nitrogen inputs from stormwater flow or inputs from the new housing development, despite the fact that storm water input is a primary culprit in lowering water quality in Mangles Bay.	Refer to response to comment 84 in Section 3.

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97	Department of Health; Public; Cockburn Sound Management Council Officer Submission	In discussion of key infrastructure, there is little information about the impact of the relocation of the Lake Richmond-Mangles Bay main drain to Hymus Street and what impact this could have on swimming and recreation there. The present drain discharges some distance from Palm Beach, which is one of the most popular beaches for swimming. With the re-routing of the overflow drain, this will introduce pollutants at an area much closer to popular recreational activities. More detail needs to be provided regarding intake and outfall locations, and clarify at what stage of proposal relocation and commissioning of the outfall pipe in context of other dredging, dewatering, infiltration and construction activities. The timing of commissioning may impact the requirement to undertake more specific monitoring of drain as for monitoring required for the settlement ponds.	To avoid the concerns expressed in this submission, the drain outlet is proposed to be realigned to discharge into Mangles Bay in deeper water from the eastern breakwater proposed for the marina entrance.
98	Department of Water	In regards to modification and realignment of the Lake Richmond outlet drain, discharge water needs to be adequately characterised before location and method of outfall is decided upon. It is unclear whether discharge into the marina would be appropriate, given the lack of flushing associated with the marina (e.g. pg 224 of the PER states: *marinas are.....calm sheltered environments, and therefore are less well flushed than adjacent waters.....”*). This should also be considered if stormwater from the development is to be discharged to the marina.	Please refer to previous response (97 in Section 3).

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99	Department of Water (255)	The statement "*The potential for contamination of sediments with polycyclic aromatic hydrocarbons is also considered low as EQGs are rarely exceeded in local coastal and estuarine waters, even in sheltered estuarine waters adjacent to major urban drains (DoW 2009).*" is misleading and incorrect due to the different location and type of aquatic environment the study was located in, the study only assessed sediments not water and the general inference that polycyclic aromatic hydrocarbons are not linked to drains is also incorrect. A second DoW study (part of the same project as that referred to the above also published in 2009 and also in the Swan Canning Estuary (Nice et al 2009) actually targeted urban drains which is a more relevant study to cite above, although it too does not substantiate the claim that polycyclic aromatic hydrocarbon contamination is low in relation to urban drains. In this study 44% of sediment samples contained polycyclic aromatic hydrocarbons with several guidelines exceeded. Therefore, DoW does not think there is appropriate evidence presented in this PER from which the statements above can be made.	The DoW (2009; Report WST 6) study the PER referred to was intended to apply to the latter part of the sentence… *even in sheltered estuarine waters adjacent to major urban drains* . The study involved 20 sites described as "generally located downstream from stormwater drains and/or in the vicinity of disused waste disposal sites", and no sediment EQGs for polycyclic aromatic hydrocarbons were exceeded at any site. The earlier part of statement was based on sediment quality data for nine yacht clubs/marinas in the Swan River (Oceanica 2007b). DoW (2007) also indicates no exceedance of EQGs in stormwater discharge and associated sediments, at Perth's marine beaches. In DoW (2009; Report WST 5) study, it is understood that although a wide variety of polycyclic aromatic hydrocarbons were detected in the drains of all sub-catchments, no freshwater ecosystem trigger values (ANZECC & ARMCANZ 2000) were exceeded. In the Nice et al study identified by the Respondent, (DoW 2009; Report WST 3) it is understood the waters and sediments in 77 drains in 27 subcatchments were sampled. PAHs were typically only found in the sediments, and guidelines for some individual PAHs were consistently exceeded in 3 subcatchments and occasionally exceeded in 6 subcatchments. It is agreed that it should have clarified that PAHs can be present in trace amounts in urban stormwater, and that sediments within some drains can exceed EQGs, but the statement holds that exceedance of EQGs is rare in marine and estuarine waters or sediments adjacent to drains.
100	Department of Health	It is noted that sediment analysis undertaken by Oceanica only included analysis of sediment in the ocean area of the proposed entrance channel and results presented do not demonstrate any likely risk to public/environmental health. However, It is not clear whether any other consultant (possibly groundwater consultant) has undertaken sediment core analysis within the proposed marina and canal areas to confirm any potential dredging/excavation/de-watering impacts (i.e. release of contaminants) into canal/marina waterways. If this has not been undertaken already, then core sample analysis in these areas would also be recommended to characterise/identify potential contaminants in these proposed additional excavation/dredging areas (as appropriate).	In February 2010 GHD completed a Geotech and ASS investigation for the proposed development. Based on the findings of the investigation, it is considered that no further ASS investigations or management is likely to be required prior to commencement of onshore earthworks. A further ASS investigation will be undertaken during the planning to confirm the absence of ASS soils.
101	Public	The PER suggests that the increase in contaminants will tend to accumulate in marina sediments rather than Mangles Bay. However the document has stated that marine water quality in Mangles Bay will not be affected. This appears to be a contradiction.	Most contaminants (metals and organic contaminants alike) bind strongly to sediment particles, and so contaminants tend to accumulate in the sediments beneath the source of the contaminant (i.e. vessels within marinas).

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102	Dr van Keulen (97); Hon Lyn MacLaren MLC; Naragebup Marine Working Group	Dredging can result in the release of pollutants bound in the sediment, potentially including nutrients and toxic compounds, some of which can be retained in sediments for extended periods after initial contamination. Even low levels of contamination can be a problem as a number of common pollutants are bio-accumulators and will multiply to high levels as they move up the food chain. Cockburn Sound has a long history of pollution as a result of a range of industrial activities and pollution from groundwater sources. The poor flushing of Cockburn Sound has led to the accumulation of fine organic sediments in Mangles Bay. The heavy use of Mangles Bay as a mooring location over several decades may have contributed to an increase in organotin compounds, some of which may have settled deep into the sediment. PAHs, PCBs and pesticides are all known to have been released into Cockburn Sound in the past; many of these have long residence times in marine sediments and may be released during the dredging process. The access channel is proposed to be dredged to a depth of 4 m through the existing seagrass meadow. Samples were taken from mooring scars within the seagrass meadow rather than among the seagrass to avoid additional seagrass loss during the sampling process. The mooring scars are better flushed than the seagrass meadow and it is likely that any contaminants will have been flushed out of the sediment that was collected. This is also reflected in the low percentage of fines reported in the sediment samples (Oceanica, 2012). For these reasons it is felt that the sampling process for sediments does not adequately represent the likely level of sedimentary contamination at the site.	The highest levels of contaminants in Cockburn Sound are more typical of the sediments of the deep central basin (water depth 15-20 m). There is also a gradient from north (lower values) to south (higher values) within the basin, but sediment EQGs are still met (Oceanica 2007). The gradient is consistent with the percentage of fine particles (silt and clay) and organic carbon present: metals have a strong affinity for fine particles, while organic contaminants tend to bind to organic carbon. There are low levels of contaminants present in the sandy sediments of the proposed channel, and there is unlikely to be a big difference in contaminant levels between the seagrass and the mooring scars. Any contaminants that bind to fine particles (e.g. fine organic matter) generated within the seagrass meadows would be readily dislodged by wave/storm action on a regular basis, and re-settle in the deeper basin of Cockburn Sound. The majority of the sediment to be dredged is also subsurface, and less contaminated (in relative terms) than the surface sediments: this would hold true in mooring scars and seagrass areas alike.

	Respondent (sub #)	Submission and/or issue	Response to comment
103	Friends of Point Peron/Hands off Point Peron (131);	Seagrass beds trap sediments that are mobilised as traction or suspended loads (sand and mud) traversing through their environment, but also generate sediment such as skeletal sand and mud. Once in the seagrass bed environment, the seagrass fronds baffle and bind mud into the substrate. That mud which might escape the trapping, baffling, and binding by sea grasses, within the wave-dominated coastal environment eventually finds its way to deep water below wave base (generally > 10 water depth) and accumulates as a mud sheet. *The effects of mud in the environment is underestimated in the PER.* Also, as there are two locations of mud accumulation, there are deposits that range from sand to muddy sand to mud accumulating in this region – the clean sands accumulated in beaches and dunes, the sand, muddy sand and mud within the seagrass environment, and the mud accumulated in deep water basins. These have resulted in three types of stratigraphic units m this region (Searle *et al* 1988) that occur in a set shoaling sequence from deep to shallow water: 1. clean sands accumulated in beaches and dunes = Safety Bay Sand (originally defined by Passmore, amended by Semeniuk & Searle 1985c) 2. sand, muddy sand and mud within the seagrass environment = Becher Sand (defined by Semeniuk & Searle 1985b) 3. mud accumulated in deep water basins = Bridport Calcilutite (defined by Semeniuk & Searle 1987) Clearly, the PER did not know of these stratigraphic subdivisions, or ignored them. At any rate, they are real stratigraphic subdivisions and have hydrogeological and environmental implications. It is a measure of the inadequacy of the stratigraphy of the PER that they have been omitted, and the extant environmental consequences and the consequences of exhuming fossil equivalents of these units of these stratigraphic units have not been addressed.	The paper that discusses different stratigraphic divisions is known, however it was not included as part of PER as it was not considered relevant to the assessment for this proposal. The proposal does not involve disturbance to the trapping or binding functions of the large majority of seagrasses in Mangles Bay, or any impacts on habitat >10 m water depth (or indeed >4 m water depth). Stratigraphy and lithology are not considered to be of consequence in defining the hydrologic parameters used for the conceptual and numerical hydrogeological models. The parameters used are similar to those widely used to determine the average parameters within defined model layers. If thin muddy sand layers and lenses do occur in the Becher Sand (but have not been identified on downhole geophysical logs) this would be a conservative factor in determining the water level drawdown associated with the marina.

	Respondent (sub #)	Submission and/or issue	Response to comment
104	Friends of Point Peron/Hands off Point Peron (131);	The construction phase would involve excavation of the sand underlying the tombolo and dredging of the limestone at the mouth/entrance of the marina. The excavation of the sand will mobilise any fine grained material from the seagrass sediment (Semeniuk & Searle 1985b), and will bring into the zone of oxidation the formerly buried iron sulphide enriched sediments and formerly in the anoxic zone of the groundwater, with consequences firstly for turbidity in the area, and secondly in generating acid sulphate soils. The dredging of the limestone will mobilise fine grained sediment into the environment with consequences for turbidity in the area.	Dredging will not involve limestone, and sampling of the access channel has characterised the sediment as predominantly sandy with little fines content. As a result, any turbidity generated will be minimal, and localised around the dredge channel. Sediments were also tested for ASS potential, and met relevant guidelines.
105	Friends of Point Peron	Using the figures from APASA 2011 in certain predictable weather events it is possible that such impacts will be continued, heavy and widespread. More honest interpretation of the data from APASA 2011 gives the following : At worst flushing will take 12.7 days on one occasion; 17% of flushing times were predicted to be 10 days or more and 45% were predicted to be 7 days or more. Given that autumn is nominally 92 days this means that on potentially 52 days would be consumed in flushing the five worst occurrences during which time water would be becoming anoxic and perhaps putrid within the canals. (Fig 73 on p 214). Independent research into water quality in similar marinas should be conducted into water quality over autumn, Similar independent research into the water quality along the Mangles Bay Beach westwards up to the causeway and in the lagoon of the Council launching ramp during autumn should be conducted.	The data on flushing times appears to have been misinterpreted. Please also note that 60% of the flushing times presented in the PER represent the worst areas for flushing, at the very end of the canals. Overall marina waters will typically have flushing times of 6–8 days, with occasions of 10 days more frequent in autumn. Also refer to responses to comments 68 and 79 in Section 3.

4. Benthic habitat and primary producers

	Respondent (sub #)	Submission and/or issue	Response to comment
106	Public; Cape Peron Community Vision Working Group; Friends of Point Peron; Friends of Point Peron	Seagrass communities in Cockburn Sound have less than 20% remaining and the loss of seagrass and poor water quality have incredible potential to reduce this even further. What would be the impacts of reduced water quality on the seagrass and the marine life it supports?	It is agreed that widespread historical seagrass loss occurred in Cockburn Sound when industry was first operating and little management was in place. Water quality was at its worst in the 1970s and early 1980s, but has improved considerably since then. Conservative modelling predictions indicate little effect on water quality outside the marinas. Indirect loss of seagrass is unlikely as predicted effects on light attenuation are also minimal, and it is further noted that the seagrass meadows in Mangles Bay survived the extended period of much worse water quality during the 1970s and early 1980s. Refer also to the response to comment 62 in Section 3.
107	Public; Hon Lyn MacLaren MLC	Removing so much seagrass from this proposal is not supported, particularly given that seagrass rehabilitation is still difficult to re-establish, particularly on this scale.	Noted. Seagrass rehabilitation can be very successful and can be achieved on this scale, although it will be costly and take time - both to transplant the seagrass and for it to grow to form a meadow.
108	Public	While offsets are proposed these will be established in other areas. Therefore what is the impact of losing habitat in Mangles Bay, particularly for the whole ecosystem?	Loss of habitat will be offset through provision of habitat (seagrass) in other areas of Cockburn Sound that are as close to the proposal site as is feasible. This will reduce the impact on Mangles Bay in the medium to long term. In the short term, there will be a minor reduction in the productivity of the Mangles Bay ecosystem. Until the transplant sites develop to their full area of coverage (7-10 years)

	Respondent (sub #)	Submission and/or issue	Response to comment
109	Public (92); Friends of Point Peron	*Posidonia sinuosa* is only found in Western Australia and South Australia. It is one of ten seagrasses identified in a worldwide study as in danger of being lost forever. According to the study it is declining at an alarming rate > about 1.2% annually. This seagrass study involved more than 20 leading researchers who used the Red List criteria of the International Union for the Conservation of Nature (UCN) to determine the conservation status of 72 seagrass species. Cedar Woods proposes to remove over 5.6 ha of one of the highest valued (but apparently not in Western Australia) ecosystems on earth. There is no documented evidence of the successful replanting of *P. sinuosa*. An early report, submitted by Cedar Woods in 2005, suggested that an immediate trial (suggested summer of 2005/06) would demonstrate within four years that it could be done. Unfortunately (though fortunately for Cedar Woods) that trial never occurred, so the matter remains unresolved. However the four-year trial period has now been extended to a quarter of a century! While Cedar Woods are proposing an offset, the proposal is for *P. australis*; not the endangered *P. sinuosa*.	There has been a lot of documented evidence on the success of *P. sinuosa* replanting in Albany Harbours (Oyster and Princess Royal Harbour) and Cockburn Sound (Southern Flats), primarily through Cockburn Cement's Seagrass Research and Rehabilitation Plan (SRRP): a copy of the synthesis report is publicly available on their website. In addition, a number of researchers from the SRRP have published in peer-reviewed journals demonstrating the success of seagrass rehabilitation techniques, primarily for *Posidonia australis* but also for *P. sinuosa*. Cedar Woods did fund the rehabilitation (using *P. australis*) of three mooring scars in Mangles Bay three summers ago, which is surviving and infilling. The same trial – carried out by Murdoch University – also documented natural infilling of *P. sinuosa* in mooring scars once the mooring had been replaced by a seagrass-friendly design. Both the rehabilitation trial and infilling are reported in Section 12.3.3 of the PER. *P. sinuosa* has been referred to as the climax species for colonization and succession, since it forms extensive meadows after colonization of other seagrass species (Kirkman 1985, Kendrick et al. unpublished). Primarily *P. australis* has been used as the target species for transplantation, as it is more robust for handling and anchorage and it is faster growing than *P. sinuosa*. *P. australis* is transplanted as an initial colonizer species in the rehabilitated area, due to its demonstrated ability to persist at the rehabilitation site, with *P. sinuosa* and other seagrass species expected to colonize the area in the future. Seagrass rehabilitation trials have shown that *P. sinuosa* will colonise after the transplanted *P. australis* has established.
110	Public	The impacts to seagrass and marine fauna from the Wanliss Street proposal should be closely monitored before proceeding with a more intrusive and large scale development in Mangles Bay.	There is no guarantee that the Wanliss Street marina proposal will proceed. However in the event that it does proceed to development, any lessons learned would be incorporated into construction and operation EMPs for the Mangles Bay marina if relevant.
111	Dr van Keulen	The proponent uses the Cockburn Sound Management Council (CSMC) report cards as a basis for its observations on site health; however the Auditor General's report on environmental management of Cockburn Sound identified errors and inconsistencies in the seagrass monitoring program commissioned by CSMC. It is clear that the CSMC report cards for the last several years cannot be relied on as a baseline reference for seagrass health in Mangles Bay.	While the auditor general's report did identify that Implementation and management oversight need to be strengthened to ensure the environmental management framework is fully effective, the report did not state that seagrass health monitoring results as reported in the CSMC report cards could not be relied upon. The report stated that use of a monitoring methodology that benchmarks seagrass health against a reference site in Warnbro Sound found a decline in seagrass shoot density in Warnbro Sound, which has caused a lowering of the standards used for determining healthy seagrass in Cockburn Sound. The monitoring itself was valid but the report recommended the need to improve transparency and reporting when benchmark standards for environmental quality criteria are adjusted.

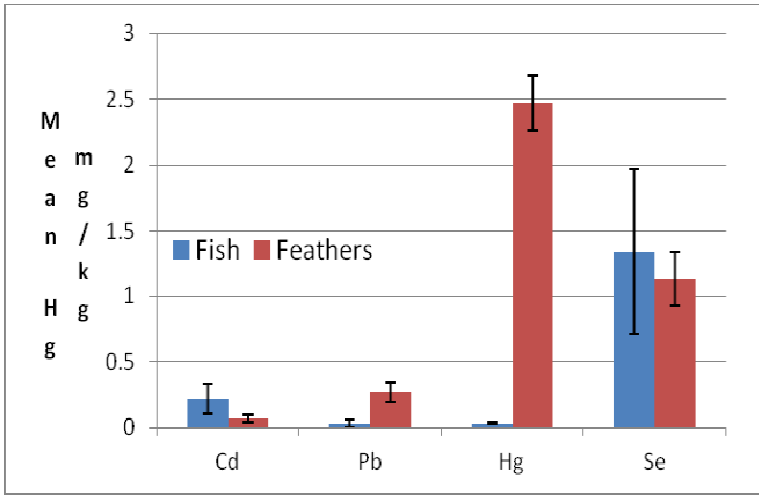
	Respondent (sub #)	Submission and/or issue	Response to comment
112	Dr van Keulen (97); Hon Lyn MacLaren MLC; Naragebup Marine Working Group	Seagrass health in Mangles Bay has been consistently poorer than elsewhere in the region (Waddington and Meeuwig, 2010). Regular monitoring commissioned by the CSMC (CSMC, 2009) shows that shoot densities in Mangles Bay are consistently lower than elsewhere in Cockburn Sound and epiphyte loads are higher than elsewhere. Shoot densities in the area have remained relatively stable over the last several years although there has been an overall decline since the monitoring programme was established in 2005; seagrass meadow health at Mangles Bay must be considered compromised and vulnerable to disturbance. Seagrass shoot densities have on occasion fallen below 50% of the EQS target (Western Australian Auditor General, 2010); studies on seagrass density declines have suggested that if the shoot density drops to 25% or less of natural (reference) meadow density, the structural integrity of the meadow becomes compromised and catastrophic loss may result from erosion due to hydrodynamic disturbance (van Keulen, 1998). Negative impacts on water quality or disturbance to sediment can be expected to undermine the stability of the meadows and potentially lead to catastrophic loss. At this point it is anticipated that events such as elevated chlorophyll *a* levels, elevated nutrient levels causing increased epiphyte loads, increased light attenuation due to turbidity plumes, and changes in hydrology, as might be expected to result from dredging the access channel to the marina, could all trigger a collapse in the remaining seagrass population in Mangles Bay. With sustained environmental impacts on the seagrass ecosystem it is likely that the majority of the seagrass meadow in Mangles Bay will become fragmented and lost, leaving only scattered small clumps of remnant vegetation.	It is agreed that the seagrass health monitoring site in Mangles Bay often does not meet the EQS. The degree to which EQSs are met appears to be both spatially and temporally variable in Mangles Bay, as reported in Section 12 of the PER. Conservative modelling predictions indicate that outflow of marina water will have a minimal impact on water quality in Mangles Bay. Measurements at several marinas in Perth coastal waters with a variety of flushing times and water quality (including Jervoise Bay) also confirm little effect on water quality outside the marinas. Indirect loss of seagrass is unlikely as predicted effects on light attenuation are also minimal, and it is further noted that the seagrass meadows in Mangles Bay survived an extended period of much worse water quality during the 1970s and early 1980s. See also response to comment 62 in Section 3.

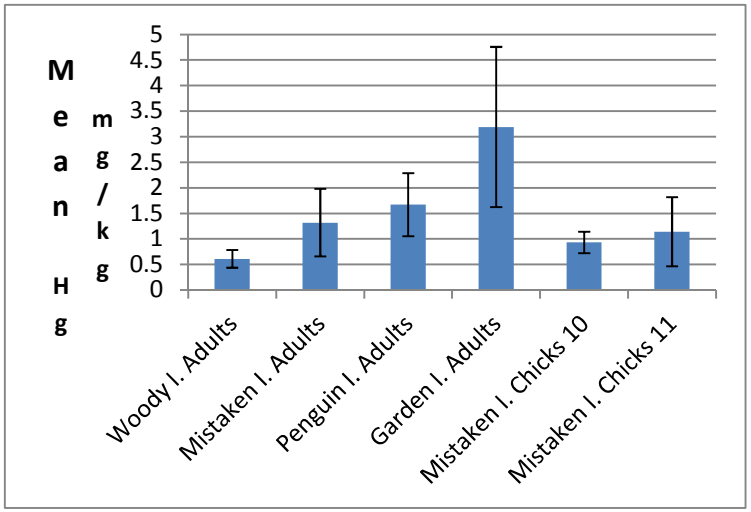
	Respondent (sub #)	Submission and/or issue	Response to comment
113	Dr van Keulen; Conservation Council of WA; Public	The fine organic sediments in Mangles Bay form a relatively unstable substrate for seagrass growth and it is likely that this, together with high epiphyte loads caused by relatively high ambient nutrient levels, is responsible for the relatively poor seagrass growth in the area. The loose nature of the sediments in Mangles Bay also presents a risk to the long-term stability of the seagrass meadows in the area; the seagrasses are not well-anchored and are susceptible to mechanical disturbance. The dredged access channel will bisect the already fragile seagrass meadow in Mangles Bay, changing the topography and local flow characteristics. It is anticipated that the low density sediment that the seagrasses are growing in will be more vulnerable to resuspension as a result of the new channel, increasing the risk of erosion and further loss of the abutting seagrass meadow. The wash from additional boating traffic travelling along the access channel can be expected to compromise the stability of the seagrass meadows abutting the channel. The marina is proposed to be able to accommodate larger yachts and commercial vessels and these may produce sufficient drag as they traverse the channel to disturb the bottom and adjacent sediments. This may result in accelerated erosion of the already unstable seagrass along the channel, leading to a destabilisation of the channel margins. Apart from the higher than anticipated loss of seagrass, this also has implications for the frequency of maintenance dredging, as sediment may slump into the channel. Ultimately, any additional disturbance caused by dredging the access channel may be sufficient to destabilise the seagrass, resulting in a wider zone of influence than currently predicted and ultimately fragmentation of the entire meadow.	Sediment analysis showed that sediments in the area of the proposed channel primarily comprise sandy substrate rather than fine organic sediments. Evidence of such sediment instability as described would have been evident by now in the numerous mooring scars in the area, especially given the considerable amount of recreational boat traffic that already occurs. See also response to comment 44 in Section 2.
114	Public	The loss of sea grass is highly likely to be greater than predicted, particular as the increased boats will be over 8m: *However boating activity in shallow areas can scar seagrass beds, increase sediments in suspension and cause bottom-shear stress that will erode seagrass beds (Marsh et al. 2003). Thus the amount of seagrass lost post-construction of the marina could be greater than that projected, and the impact on fish and hence penguins could increase over time.* (Cannell 2011 p9)	This area already experiences a high degree of boat traffic. Some of the existing traffic in the area from the yacht and fishing clubs will use the channel which should reduce scarring. Figure 2.1 in the PER shows scarring from informal boat launching, which would be redirected to the new channel. Also, additional boats using the marina will enter and exit via the channel, not over seagrass meadows. Seagrass monitoring post-construction will check whether the amount of seagrass loss is greater than predicted, in which case contingency measures will be triggered.
115	Public	Seagrass is a better absorber of carbon dioxide than rainforests. The impacts from the loss of this carbon sink have not been considered.	The loss of seagrass will be offset within 7-10 years by planting at least an equal area of seagrass.

	Respondent (sub #)	Submission and/or issue	Response to comment
116	Cockburn Sound Management Council Officer Submission; Friends of Point Peron	We are uncertain about the basis of numbers used to describe the mooring scars and associated seagrass loss in Mangles Bay (Table 51 pp 258). Not all scars are easily identified through aerial imagery. The field that is still within 'Mangles Bay' has a number of scars toward Hymus Street and deeper waters and these appear not to have been included. Existing seagrass scars that are currently not adjacent or centred on existing moorings have not been assessed for seagrass regrowth which goes to the core assumption that seagrass rehabilitation is a matter of time i.e. 5 to 7 years. Many of these scars have been in existence for much longer periods of time (e.g. barge scars) and this indicates that regrowth may be less than stated in the PER. This has implications for environmental offsets and seagrass loss and restoration. In addition, it is our understanding that all illegal moorings have been removed over the last two years since the area was gazetted as a Mooring Control Area (MCA). It is also the understanding that all moorings will be required to install environmentally sensitive non-seagrass destructive moorings over the next few years. The issue of replanting in mooring scars and the removal or replacement of moorings needs to be clarified and confirmed if this approach will be taken.	Rehabilitation of mooring scars was listed in the PER as one of the potential sites for rehabilitation, along with other sites in Cockburn Sound. As the moorings in Mangles Bay have to be replaced by environmentally sensitive moorings over the next few years, it is likely that natural infill of seagrass will take place – as reported in Section 12 of the PER. In this case, greater overall environmental benefit may be gained by transplanting areas other than the mooring scars. The agreed approach on seagrass transplantation will be clarified as part of the final offsets package, which is to be decided with OEPA and other stakeholders including the CSMC.
117	Cockburn Sound Management Council Officer Submission	The PER indicates that survival in test plots that were previously mooring scars had 48.9% (i.e. approx 50%) survival after 12 months of monitoring. Longer monitoring is required to substantiate "successful re-colonisation" or sprig replanting.	At the time of the PER, the most recent results were included for rehabilitation of the scars. It is important to note that rehabilitation of seagrass in other parts of Cockburn Sound show that once transplants survive 1 to 2 years then they are likely to remain. In addition those sprigs transplanted within the mooring scars that survived have begun to infill and expand and therefore have been successful.
118	Cockburn Sound Management Council Officer Submission; Public; Hon Lyn MacLaren MLC; Naragebup Marine Working Group	Mangles Bay seagrasses are already severely stressed. The PER indicates that there would be only a marginal increase in turbidity associated with dredging and while the work of Collier *et al* (2009) indicates *P. sinuosa* can tolerate long periods of shading, it is unknown if existing seagrass meadows can tolerate further stress due to dredging or with future potential export of phytoplankton related turbidity from the proposed marina. There is no qualitative or quantitative data provided by the proponents to indicate ambient levels of physiological health in the resident stressed seagrass meadows. In addition, disturbance by dredging and the potential for longer term erosion of seagrass edges due to propeller wash has the potential to affect the resilience of the remaining area.	The health of seagrasses in Mangles Bay reflects the relative nutrient enrichment of the waters, due in turn to the relatively sheltered nature of the area. There is some difference in government department views on the condition of seagrasses in Mangles Bay: some view it as highly stressed, others view it as in good condition (for the sheltered nature of the environment) albeit fragmented by mooring scars. Irrespective, the dredging-related turbidity is both highly localised, minimal and of short duration. The seagrasses most likely to be affected by dredge plumes are also in shallow water and receive well in excess of their minimum light requirements. Refer to Appendix 2 – Section 2 of Strategen document “Response to Key Marine and Groundwater Issues Raised in Submissions on the Mangles Bay PER”. See previous comments on propeller wash and seagrass erosion of edges in response to comment 113 in Section 4.

5. Marine fauna

	Respondent (sub #)	Submission and/or issue	Response to comment
119	Public; Cape Peron Community Vision Working Group; Preserve Point Peron for the People.	What is the predicted impact of the seagrass loss on nursery values and fish/crab stocks? This also has the potential to affect other marine species like mammals and birds who rely on the area to forage. Changes to water quality and loss of habitat have the potential to impact fish and invertebrates and should not be allowed.	Loss of habitat/nursery area due to seagrass loss as a result of the proposal will be offset by transplanting seagrass in other areas. Changes to water quality in Mangles Bay are expected to be minimal (refer to responses to comment 62 in Section 3).
120	Public; Hon Lyn MacLaren MLC	Little penguin numbers are reducing and the likely cause is lack of food. This development will reduce fish stocks even further due to a loss of marine habitat. Deaths reached four times the normal level in the second half of 2011, the main reason being starvation. The metropolitan populations of penguins are unique compared to others and have the highest conservation status of all populations.	See response to comments 108 and 109 in Section 4 with respect to loss of seagrass being offset. The death of penguins through starvation referred to is believed to be linked to the strong La Nina conditions and a strong Leeuwin current in the summer of 2010 and 2011, and the associated 'marine heat wave' that probably led to a decline in the fish stocks that the Little Penguins rely on for food. It should also be noted that Mangles Bay is not a key habitat for penguins, although it may be used for foraging (refer to report by B. Cannell 2012 in PER Appendices for foraging areas).
121	Public	The PER predicts increased stress on the local dolphin population, which should be considered as unacceptable.	The PER does not identify the shallow waters of Mangles Bay as a key foraging or nursery habitat for dolphins, and predicts relatively low levels of stress on local dolphins if appropriate management measures in place as recommended (refer to report on dolphins by H. Finn in PER Appendices
122	Public	What is the risk that the canals will become inhabited by bull sharks, which will pose threats to users and swimmers of the waterway?	Bull sharks are widespread in temperate and tropical waters, and are found in estuaries (e.g. the Swan River) as well as coastal areas. The risk of shark attack is very low in general, and the marina will have a negligible effect on risks in local waters.
123	Dr van Keulen (97) Public	The reduction and fragmentation of foraging areas for larger marina fauna, in particular dolphins and penguins is a risk of this proposal. Removal of the seagrass will place pressure on the larger fauna by reducing the amount of foraging area (and presumably the amount of prey). The proposed access channel will bisect the seagrass meadow in Mangles Bay, which is acknowledged to be an important shelter and nursery area for various fish and invertebrate species (McLean, 2012); some of these are key prey organisms of penguins and dolphins (Cannell, 2012). Both these groups feed on the edges of the seagrass meadow and it is likely that fragmentation of this habitat will make foraging more difficult. With increased boat traffic along the new channel there will also be an increased risk of boat strikes on marine fauna trying to feed across the two halves of the seagrass meadow. Continued loss or fragmentation of feeding areas will be expected to compromise the broader viability of Cockburn Sound for foraging by populations of these marine fauna.	Noted. See responses to comments 121 and 122 in Section 5 on the value of the shallow waters of Mangles Bay as foraging area for marine fauna such as penguins and dolphins, and response to comment 44 in Section 2 on the likelihood of fragmentation of seagrass meadow.

	Respondent (sub #)	Submission and/or issue	Response to comment
124	Conservation Council of WA; Naragebup Marine Working Group	Long-established research indicates that Mangles Bay (as a sheltered seagrass environment in an otherwise exposed coastline) is an important fish nursery, at least on the scale of Cockburn Sound. For some species e.g. King George Whiting it may be critical nursery habitat for much of the west and even the south coast. The area supports stocks of the principal commercial and recreational fish species and critical non-exploited forage fishes such as anchovies, the principle prey species for the Little Penguins from the Garden Island colony (B. Cannell Appendix - Potential Impacts of Mangles Bay Tourist Precinct on Little Penguins). Mangles Bay is used as a reference site to determine the annual recruitment strength of a range of targeted fish species precisely because of it functional importance (See Appendix – Mclean (Oceanica) Potential impacts of the proposed Mangles Bay marina based tourist precinct on fish and invertebrates). Given the importance of the Mangles Bay to both fisheries and marine wildlife the current declining trend in the indicators requires more attention and the potential for the additional ecological stresses generated by this development to trigger the total demise of the seagrass meadow is of major concern.	The comments are noted and the potential loss of important fish nursery habitat is a valid concern. However note that there is minimal risk of the proposal causing adverse impacts to seagrasses, let alone the total demise of the Mangles Bay seagrass meadow. Please refer to Appendix 2 – Section 4 of Strategen document "Response to Key Marine and Groundwater Issues Raised in Submissions on the Mangles Bay PER" for justification of the above conclusion. Furthermore, It is proposed to offset the seagrass loss anticipated as a result of the development proceeding by both: • Transplanting an equivalent amount of seagrass back into the Mangles Bay/Southern Flats region and • Establishing fish enhancement devices at other locations on the southeastern shore of Cockburn Sound. Refer to Appendix 2 – Section 3 of Strategen document "Response to Key Marine and Groundwater Issues Raised in Submissions on the Mangles Bay PER" for details of seagrass loss offset package
125	Conservation Council of WA; Preserve Point Peron for the People; Western Australian Fishing Industries Council; Hon Lyn MacLaren MLC; Department of Water; Naragebup Marine Working Group	Recent sampling conducted by the Sentinel Penguins program (Conservation Council WA Citizen Science Program) indicates that there are elevated levels of mercury in the aquatic food chain at the southern end of Cockburn Sound. Some individual penguins have feather concentrations around proposed toxic effect levels.  	The primary mechanism for mercury bioaccumulation in penguins is likely to be via their food rather than water, and the penguins forage over most of Cockburn Sound. The highest concentrations of mercury in Cockburn Sound sediments are associated with the deep central basin (water depths 15–20 m), particularly at the southern end, but concentrations still meet national guidelines for ecological protection. Compared to the deep basin, the sediments to be dredged for the proposal have lower mercury concentrations (refer to response to comment 104 in Section 3). The dredging program targets a small volume of sediments with low mercury concentrations, will be of short duration and will dispose of the sediments on land: any water-borne contamination will be a negligible source of mercury compared to potential dietary sources from food foraged over most of Cockburn Sound.

	Respondent (sub #)	Submission and/or issue	Response to comment
		Mercury concentrations in the Garden Island population are higher than other populations in south-western Australia, suggests that mercury contamination may be a hitherto undetected issue in forage fishes in the southern half of Cockburn Sound, including the Mangles Bay area.  Since Mangles Bay is the sink where most fine sediments and contaminants circulating in Cockburn Sound are ultimately stored it is potentially a major source of methyl mercury generation, especially given the area is eutrophic and its organic sediments may become anoxic under certain conditions. Dredging of the sediments in Mangles Bay may significantly enhance this ecological hazard. Anoxic conditions in the organic sediments of Mangles Bay would be expected from time to time, and these sediments may serve as a focus for Hg methylation and bio-transfer to the southern waters of Cockburn Sound. Dredging in Mangles Bay could produce a significant Hg contamination hazard, particularly for localized top predators like the Garden Island Little Penguins. The PER states "*No adverse effects expected due to contaminant release during dredging and disposal, as contaminant levels in the sediments to be dredged meet all relevant ecological and human health guidelines.".* To validate this statement toxicity assessment screening should be considered to assess cumulative impacts to biota in the vicinity of the marina (note: TBT exceeded EQG). Assessment of this hazard would require sampling Hg in the resident biota of the Mangles Bay seagrass meadow, preferably choosing indicators from different trophic levels.	

	Respondent (sub #)	Submission and/or issue	Response to comment
126	Public	Saline intrusion into Lake Richmond, which could alter water quality, could affect the birdlife that uses this lake.	Lake Richmond has been demonstrated from the modelling not to be impacted by Saline intrusion. This has been confirmed by independent peer review.
127	Public	There will be increased impacts to marine fauna from increased noise, crowding and physical disturbance including undesirable practices such as dolphin feeding and killing or damaging marine fauna and the eggs of larvae of fish and invertebrates by propellers and propeller wash.	Management measures to reduce these risks have already been identified in the PER, including measures such as education of the public. It should also be noted that these impacts already exist and are currently unmanaged.
128	Public (192)	The proposal will significantly affect fishery nursery areas and alter local marine ecology to the determinant of marine conservation and recreational and commercial fishers: • McLean 2012 p15 states *Removal of shallow seagrass habitat by dredging or degradation of the remaining habitat through changes to water quality will impact juvenile fish species that utilise the Mangles Bay area as a nursery, which will result in lower recruitment. Mangles Bay is also a source population for many south coast populations (Valesini et al. 2004).* • *likely to lead to higher levels of recreational fishing that will place pressure on already heavily targeted species and indirectly on non-targeted species, and potentially cause a change in fish assemblage composition. (page 296 PER ii)* • *Historical degradation and loss of seagrass beds in Mangles Bay may have left the bay in with a reduced capacity for recruitment of blue swimmer crab (Johnston et al. 2008). Additional degradation of this habitat that results from dredging, water quality changes and boating activity associated with the marina development could further reduce the capacity of the bay to act as a suitable nursery area. (McLean 2012 p15)* • *Increased boating activity in the shallows can also increase the level of wash, turbulence and turbidity. Eggs and larvae may be washed up on the shore, disturbed by propellers or current action (Sandström et al. 2005). As Mangles Bay is a significant nursery area for blue swimmer crabs and other decapod and capitellid species, such activity may have a large impact on invertebrate recruitment.* The PER argument for minimal impact is based on a dubious assumption that is repeated multiple times *The proposed development will result in a small increase (1%) in the number of vessels able to access Cockburn Sound and the SIMP in the next 10–15 y ears* however this is based on a total of all boats in Western Australia, most of which will never go near Mangles Bay. The marina will more than double ownership of boats over 7.5m in the Cockburn, Kwinana and Rockingham regions. These figures do not include additional boats due to the Port Rockingham marina development, so this is still an underestimate. As the marina boats will all be vessels over 8 metres these boats will all have greater impact than the average trailerable boat.	Many of these impacts were based on a risk assessment that involved identification of the potential risks and potential effects, and management measures to address them. Offsets for the loss of seagrass habitat are discussed in responses to comments 107, 108 and 109 in Section 4, and the predicted minimal impacts on water quality in comment 62 in Section 3. The 1% increase in vessels is not based on a total of all boats in Western Australia: as described in Section 16 of the PER, the calculations were based on boating estimates in the Cockburn Sound/Warnbro Sound(i.e. Shoalwater islands Marine Park) region using data for areas defined in DPI (2009) as: • 'Cockburn', using Cockburn 50% as representing the southern portion, which includes Coogee and Henderson (access Woodman Point boat ramp and Challenger Beach boat ramp) • 'Kwinana'' • 'Rockingham', which extends from Rockingham to Singleton Calculations in Section 16 of the PER also provide a breakdown of trailerable and non-trailerable boat numbers, and the cumulative impacts of the Mangles Bay and Port Rockingham marinas.

	Respondent (sub #)	Submission and/or issue	Response to comment
129	Cockburn Sound Management Council Wetlands Conservation Society	In general there is a lack of quantitative data, and in particular, standing crop biomass or productivity information to gain a sense of possible impacts to the food chain or higher order predators caused by the total loss of approximately 7ha of habitat (sand and seagrass). For example a review of an Honours and PhD data by Wildsmith in the early 2000's indicates approximately 50,000 individuals of polychaete and crustacean infauna per m2 (not epibenthos) is found in seagrass areas close to Mangles Bay beaches. If this represents 500 grams of wet biomass per m2 then approximately 35 tonnes of infauna wet biomass could potentially be removed from 7ha of seagrass and sandy areas due to the proposed development. The preceding calculation is conservative as it does not include large epifauna or other benthic invertebrates (epibenthic). It does indicate though that 3.5 tonnes of forage fish will potentially be removed from the area based on a 10% trophic efficiency value. This would suggest that 350kg of large predators such as penguins and fish would be reduced by the removal of this habitat. This is an example of how a quantitative environmental impact assessment for the location could help provide insights into the environmental impacts. This example should not be misused because up-to-date site specific monitoring data, has not been taken in proposed affected areas including halo areas. It was also difficult to assess marine impacts because of the lack of current quantitative data on marine flora and fauna. Given the sensitive and highly productive nursery habitat found in this area, calculations of animal standing crops and biomass would have enabled impacts on the fauna and productivity to be better assessed. For example, there is a lack of data on fish standing crops for the most abundant and recreationally important species utilising the shallows of Mangles Bay, e.g. King George whiting, blue manna crab, forage fish etc. Furthermore, a quantitative assessment of the impact of losing approximately 7ha of habitat (ca 6ha of seagrass and 1tia of sand) and having potentially degraded adjacent habitat areas (i.e. extended moderately degraded hales) is not provided. This makes it difficult to make an objective assessment of impacts on food chains, food availability and the general supporting habitat for a range of ecosystem inhabitants such as piscivorous birds and recreational popular fish predators, as well as for cetaceans. There is insufficient evidence to eliminate this concern.	Such calculations are difficult to undertake and interpret meaningfully for a variety of reasons, as follows: • Fish, penguins and dolphins range over large areas in Cockburn Sound (and beyond) and take prey from a variety of benthic and pelagic sources. To realistically calculate potential impacts, consideration has to be given to all their food sources. • Removal of one type of habitat does not mean a total loss of productivity, as there is some (albeit different) value in the new habitat that must also be considered. • There is considerable interannual variation in the production of plankton, seagrass and epiphyte, benthic invertebrates and fish. For example, extensive studies in Owen Anchorage in a range of habitats found 2 to 3-fold variation in seagrass and epiphyte production and the biomass of benthic invertebrates and fish between summer 1997 and summer 1998 (Walker et al 2000). • Regional effects such as El Nino/La Nina events and recruitment patterns can cause ecosystem-wide effects of a scale that overwhelm the significance of events at a small spatial scale. The increased death rate of penguins in 2011 is one such example. Even at the simplest level, it can be seen that any impact of the temporary loss (given the proposed rehabilitation) of 5.66 ha of the ~100 ha of seagrass in Mangles Bay (i.e. ~5.66% of local seagrass habitat) will be 'diluted' to a much smaller number when considered over realistic spatial scales for ranges of key fish species, penguins and dolphins. For these reasons, the approach to EIA is more simply based on habitat loss and habitat offsets.
130	Cockburn Sound Management Council Officer Submission	It would have been helpful in Section 13.3.2 to have the data summarised in a table to show the findings of a range of benthic and invertebrate surveys for shallow water habitat in Cockburn Sound carried out between 1978 and 2008. There is no discussion of how much the abundance and biomass may change because of the marina.	There is no Section 13.3.2 in the PER and suggest that this comment actually refers to Section 1.3.2 of the report by McLean 2012 on Marine Invertebrate fauna. Request for data summary noted.
131	Cockburn Sound Management Council Officer Submission; Hon Lyn MacLaren MLC	The issue of boat strikes to little penguins, and to a lesser extent, to dolphins is a relevant and a growing risk. It is expected there will be substantial increases in boating activity in Mangles Bay following the development of this marina aside from background increases in use created by catchment population growth. We believe the marina will result in more than "some increase" in recreational boat traffic in Cockburn Sound and the SIMP. There are no supporting calculations or documentation to estimate the increase in quantitative terms. Cumulative impacts need to be addressed and have not been done so in the PER.	It is difficult to provide cumulative impacts based on how much increase in boat traffic is predicted due to population growth in the area, compared with the construction of the marina as both are intertwined. The calculations and the basis for them are presented in Section 16 of the PER, as is cross-referenced in Section 13 of the PER.

	Respondent (sub #)	Submission and/or issue	Response to comment
132	Cockburn Sound Management Council Officer Submission Hon Lyn MacLaren MLC	Section 13.4 (p.293) understates the strong possibility of poor water quality, nutrient enrichment and bottom anoxia as well as the accumulation of metals and antifoulant biocides in the sediment of the marina. The discussion of chemical contamination and bioaccumulation (Section 13.5.7 p.299) is not sufficiently detailed to describe sources and estimate impacts on local marine fauna. The detection limits for mercury in sediment are not good enough to assess the risk because of the capacity of this metal to bio-magnify in higher order consumers.	Section 10 of the PER discusses sediment and water contamination in more detail. The assessment is considered realistic as it is backed up by data on the level of contamination in other Perth marinas (refer to response to comment 99 in Section 3), and oxygen levels in the Jervoise Bay Northern Harbour (refer to response to comment 66 in Section 3). Nor was chemical contamination considered a key environmental risks to fish, invertebrates, little penguins and dolphins in Mangles Bay, in a risk assessment workshop for the proposal held with scientific experts (as documented in Section 13 of the PER). Refer to response to comment 125 in Section 5 for mercury in sediments.
133	Cockburn Sound Management Council Officer Submission	There is a lack of relevant information on the sources of recreational boat pressure. In Table 61 (p.297) there are no numbers provided for peak times at the Cruising Yacht Club and Mangles Bay Fishing Club ramps. A few hours of monitoring over several summer weekends would have helped provide robust estimates in this Table. We would like to know on what basis the estimation of 1% increase in the number of vessels able to access Cockburn Sound and the SIMP in the next 10 to 15 years was derived, as stated in several sections of the PER (particularly Section 13.5).	The intention was to obtain representative data from the CYC and MBFC but they were unable to provide this information. The comment about survey has been noted, but as the level of usage is not predicted to change greatly, the predictions made still hold. The basis for the 1% increase is provided in Section 16 of the PER: • The DoT predicts that total boat ownership in the suburbs adjacent to Cockburn Sound and Warnbro Sound will increase from ~8,500 in 2012 to ~12,500 in 2025. Most of these boats (~8,100 in 2012 and ~11,750 in 2025) are trailerable boats (mooring pens not required). • The DoT's data for trailerable boat usage indicate approx. 20% of registered boats are launched each day during peak holiday times in summer. A similar level is assumed for non-trailerable boats. Predicted use would thus be ~2,500 boats during peak times in 2025 • The marina will not result in any further increases in trailerable boats other than those due to the regional population growth predicted by the DoT, but will potentially result in an additional 128 non-trailerable boats in the medium-term (by 2018) because it will provide mooring pens surplus to predicted demand, and so result in more boats than predicted by regional population growth. In the medium-term (by 2018), the marina will thus increase recreational boat traffic – over and above that already predicted due to the regional population growth - by approximately 26 boats/day during peak times in summer, all due to large vessels. This would represent about 1% of total recreational boat traffic in Cockburn Sound and Warnbro Sound.
134	Department of Fisheries	Construction of the proposed marina and associated residential development will result in a significant increase in recreational beach and boat based fishing effort in the vicinity of Cockburn Sound and the Shoalwater Islands. Recreational fishing effort is managed and monitored by the Department as a matter of course, as part of on-going EBFM arrangements. However the proponent is encouraged to promote public awareness of sustainable recreational fishing practices regulations and management strategies in the area, including through the proposed 'marine science centre'.	Noted and agreed.

	Respondent (sub #)	Submission and/or issue	Response to comment
135	Department of Fisheries	The proposed marina is of a significant size which will cater for large ocean going recreational vessels. These vessels are considered to present a high biosecurity risk because they are relatively slow moving, and could have been moored for long periods of time in foreign ports. Disturbed benthic habitat within the relatively complex marina and canal estate layout is such that it is likely to form an optimum site for introduced marine pests to establish, which could then contaminate Cockburn Sound and other ports and marinas around the State. In the future it is likely that the Department of Fisheries will enforce Introduced Marine Pest management requirements on recreational vessels. In the event of the detection of a marine pest, the proponent would be required to work with the Department of Fisheries to develop and implement a management strategy. In addition, the proponent should promote awareness among the boating community about the risks of introducing marine pests, to report pests and preventative measures.	Noted and agreed
136	Department of Fisheries; Cockburn Sound Management Council Officer Submission	The PER doesn't adequately address the threats associated with introduced marine pests (IMPs). Therefore prior to any dredging or equipment entering State Waters and/or the project area, the Proponent shall arrange for a risk assessment (in accordance with a procedure approved by the Department of Fisheries) to assess the risk that the vessel or equipment is harbouring an IMP. If directed by the Department, the risk assessment and all associated documentation must be submitted to the Department for a determination of the risk rating of the vessel or equipment. If no direction is made by the Department, the company is to perform its own risk assessment but retain all paperwork for possible auditing by the Department. If the risk posed is unacceptable, actions to reduce the risk to an acceptable level (as determined by the Department) should be applied, as approved by the Department. If the risk posed cannot be reduced to an acceptable level, the vessel or equipment must not mobilise unless and until: • an introduced marine pest inspection (performed in an approved manner) has been undertaken by a suitably qualified biofouling inspector (on advice from the Department of Fisheries), no introduced marine pests are detected, a report of the inspection is retained, and the vessel and/ or equipment then mobilises within seven days; or • other arrangements as determined by the Department. • If an introduced marine pest is found during the inspection, the vessel or equipment must be cleaned and then re-inspected by a suitably qualified biofouling inspector to ensure all pests have been removed. Once all such vessels and/ or equipment are deemed to present an acceptable risk (i.e. vessel is re-assessed), or other arrangements as determined by the Department have been implemented, mobilisation can occur. However, the Department **may** require that it issue vessel clearances before mobilisation.	Noted. Inspection of dredge vessels for IMPs by DoF is already included in CEMP. The Operational Environmental Management Plan (OEMP) for the marina will also include an Introduced Marine Pest Strategy, to be developed in accordance with DoF requirements.

	Respondent (sub #)	Submission and/or issue	Response to comment
		In the event that introduced marine pests or significant amounts of fouling organisms or sediment (as deemed by a suitably qualified biofouling inspector) are found on a vessel or equipment in Mangles Bay Marina, the following management actions will be taken: • the DoF and OEPA must be notified within 24 hours of any known or suspected marine pest detection in State waters • the proponent will be required to co-operate with the DoF to develop and implement an Introduced Marine Pests Management Strategy • potential vessel management options include, but are not limited to, removal of vessel or equipment from coastal or State waters, dry docking and cleaning of vessel or in water cleaning. All of these options would be required within specific timeframes and will be under the direction of DoF. In-water cleaning in West Australian State waters and Commonwealth waters will not be approved when introduced marine pests are detected or suspected on vessel or equipment • if cleaning occurs, a post-clean inspection performed by suitably qualified biofouling inspector will be required and submitted to DoF for assessment to ensure all pests have been removed • once all such vessels and/ or equipment are deemed to present an acceptable risk (i.e. vessel is re-risk assessed), or other arrangements as determined by the DoF have been implemented, mobilisation can occur. However, the DoF may require that it issue vessel clearances before mobilisation. • the proponent will also required to co-operate with the DoF to develop and implement an Introduced Marine Pest Strategy. This will be designed to prevent and wherever practicable, the establishment and spread of the IMP, aiming to contain and potentially eradicate the IMP, and to minimise the risk of the IMP being transferred to other locations within WA. Potential marine pest management options include but are not limited to close-off and treatment of the marina wrapping of pylons and vessels, and restrictions on vessel movements. The proponent shall provide to the DoF all necessary information, as determined by the DoF, for the Introduced Marine Pest Management Strategy. Reporting timeframes will be agreed by the Department, the proponent and the CEO of the EPA.	

	Respondent (sub #)	Submission and/or issue	Response to comment
137	Recfishwest	Recfishwest is concerned that a simple desk top study on marine fauna is insufficient in terms of collecting relevant site-specific information in determining the impacts of dredging and additional fishing pressure. A survey specifically focussed on fish and invertebrate fauna within the zone of impact and influence is required to: 1. Accurately identify species within the zone 2. Quantify direct impacts 3. Identify potential impacts 4. Identify non-commercially or non-recreationally important 'keystone' species 5. Identify species movements, migrations and spawning times 6. Guide impact mitigation strategies Sufficient on-ground studies must be conducted to accurately determine the composition of aquatic species in the Mangles Bay precinct. Recfishwest would like the opportunity to assess these findings once obtained. It is of great concern that the development will destroy this vital area that is so imperative to the West Coast stock of King George Whiting. Recfishwest believes that if the marina goes ahead as planned, the proponent will need to re-stock juvenile King George Whiting into Cockburn Sound. Studies into the feasibility of re-stocking King George Whiting are currently under-way, and stocking will likely be possible within 2 years.	The desktop study was undertaken with the inputs from experts in the Department of Fisheries. The study show the development will not destroy the fishery value of Mangles Bay, either through effects on water quality (refer to comment 62 in Section 3) or habitat (refer to comments 107, 108 and 109 in Section 4).
138	Department of Environment and Conservation (260)	Dolphins are known to forage along the groyne structures of the Peel-Harvey Estuary System, but are often competing with large numbers of recreational fishers seeking the same resources. This issue has not been given adequate consideration by the proponent and it is not clear what public access will be facilitated on marina breakwaters. This requires clarification to enable an understanding of the potential impact of resource competition and potential for entanglements. Resident Indo-Pacific bottlenose dolphins in Cockburn Sound have to deal with significant stresses, including increased commercial and recreational vessel movement, increased competition for prey with humans and direct human interactions, including illegal feeding and entanglement in discarded fishing gear. The food requirements of dolphins are considerable, making them sensitive to factors that make it more difficult for them to find and capture prey. The placement of a rock structure over previous seagrass habitat may result in new feeding opportunities for dolphins, but may also introduce recreational fishers as new competitors for resources.	These issues (entanglement, illegal feeding etc) were considered during the risk assessment for the PER and management measures suggested to reduce the risk.
139	Recfishwest	King George Whiting larvae begin accreting over October and September within Mangles Bay; as such no dredging should be conducted after mid-October. Recfishwest does not oppose the proposed period of dredging as it will create minimal conflict between other users in the area, provided it does not influence important larvae settlement periods.	Dredging is not proposed after mid-October. Noted that timing of dredging is not opposed by Recfishwest.

6. Terrestrial water quality

6.1 Surface water and Lake Richmond

	Respondent (sub #)	Submission and/or issue	Response to comment
140	Public	Studies undertaken show a 3.8cm drop in lake water levels. What scenario modelling was this based on – best, average or worst case. If a worst case scenario happens and a greater drop occurs, what sort of contingency methods will the proponent implement to mitigate this impact? Have studies been undertaken to investigate the likely success of these mitigation measures?	Lake levels are mainly controlled by the base sea water level, seasonal water table levels, the weir height for the outlet drain and the seasonal inflow from the three stormwater drains. The drop in water table level related to the modified seawater level at the marina is less significant than these other influencing factors and will happen gradually over a period of 8 to 10 years after marina construction.
141	Public	What is the likelihood that the introduction of saline water closer to the lake and at a higher but fluctuating tidal pressure, combined with the canal being constructed under wet conditions, will drain the lake?	It is not physically possible for this scenario to occur. The modelled seawater interface at -12 mAHD after marina construction indicates that its migration eastwards from the marina is not sufficient to affect the lake salinity. It is further estimated that the toe of the seawater wedge at base of SBS will be at least 400 m distant from LR after marina construction. Note that the deepest part of the lake bed is 8 m above the base of the SBS. The outlet drain from the lake is at 0.58 mAHD and the average long term lake level is 0.74 mAHD whereas the marina will be at sea level, marginally below the current water table level. Refer Figures 2 and 3 in ERM Detailed Response to Groundwater Submissions document
142	Public; Preserve Point Peron for the People.	The impacts of climate change have not been considered, particularly with regard to higher sea levels expected, and reduced infiltration due increased hardstand areas. This should be included in the calculations for drainage. Run-off should be considered a threat rather than something that will only occur in an extreme event such as 1 in 100 years as stated in the PER. Climate change predicts increased storminess and these events are likely to occur on a more frequent basis.	The higher seawater levels from predicted global warming will increase the water table and lake levels, compensating to some extent for the lower water table levels resulting from predicted reduced recharge. Any increased storm frequency and intensity will increase stormwater runoff to Lake Richmond from the east unrelated to the marina refer to Appendix 4 of Strategen document “Response to Key Marine and Groundwater Issues Raised in Submissions on the Mangles Bay PER”) for further detail.
143	Department of Water	If stormwater is proposed to be discharged into the Lake Richmond outlet drain, measures would need to be implemented to ensure that stormwater does not back up in the drain and reach Lake Richmond, thus impacting the local environment (including Thrombolites). In the event that contaminants in stormwater exceed the relevant guidelines, toxicity screening of stormwater and the associated sediments should be considered. Will there be any back flow of sea water into Lake Richmond through the drain?	Stormwater has been discharging into Lake Richmond via the existing stormwater drains since the early 1960s. Nevertheless, the hydraulics of the Lake Richmond overflow drain have been modelled to demonstrate that the hydraulic performance of the lake can remain unaffected. This will need to be reviewed in further detail if stormwater from the development is to discharge into this drainage outlet also. However the drainage line will be constructed to prevent back flow from the ocean.

	Respondent (sub #)	Submission and/or issue	Response to comment
144	Dr van Keulen; Public	Drainage from the new development does not appear to have been adequately considered. The destination of surface runoff has not been identified and may influence the Lake and groundwater; the significant land clearing and building proposed may affect groundwater recharge rates and therefore groundwater flow rates (and possibly direction). Additional contaminants can be predicted to enter the groundwater and/or drainage from surface runoff from increased development; these will likely end up in Lake Richmond or Mangles Bay. The management of greater than 1:1 year storm events flowing to the road drainage system is a concern as this in effect allows untreated water to run directly into stormwater receiving environments. In addition, climate change is likely to result in increased and stronger coastal storms. As such the approach for having these greater than 1:1 events flow through road drainage is likely to result in localized flooding in residential areas and increase flow of nutrients and pollutants into receiving environments.	The drainage system will be designed in accordance with the Local Water Management System (LWMS) document (which is in accordance with Council and DOW requirements) and where the 1 in 5 year rainfall event is detained. Stormwater runoff for events greater than 1 in 5 year ARI's will be directed to the marina water body where they will rapidly flush from the system owing to their buoyancy. It is noted that all of the marina development is located down-gradient of the lake with stormwater from the development discharging away from the lake. Hence it is not possible for runoff to drain into Lake Richmond.
145	Department of Planning	The discharged stormwater contaminant levels need to be environmentally acceptable and any need to include gross pollutant traps should be accommodated within the road reserve and not the foreshore reserve. All stormwater and wastewater drainage should be pre-treated prior to any discharge into the foreshore reserve and all drainage infrastructure should be within the development area. No drainage from the proposal is to enter Lake Richmond.	Agreed. Pre-treatment of stormwater is a standard requirement and included in the LWMS document. No stormwater will discharge to the Lake.
146	Public	Run-off from the increased accumulated pollutants on these roads will impact Lake Richmond, the remaining coastal bush and community health, particularly given the increased traffic.	Refer to response to submission 144 and 145
147	Public	While it is acknowledged that the proposal is outside the wetland, the buffer described is at the minimum (50M) with the proposal itself also being at the minimum optimal distance to protect ecosystem function especially for protection from pollution (e.g. petroleum hydrocarbons, surfactants) ie. 200 m. Given that a road network will exist within the 200m buffer between the proposed marina and the wetland it is possible to suggest that the buffer is inadequate to satisfactorily protect the Lake Richmond site form deleterious indirect effects of traffic movement and associated hazards such as pollutant discharge.	Refer to response to submission 144 and 145

	Respondent (sub #)	Submission and/or issue	Response to comment
148	Department of Water (255)	The proposed 50m buffer as shown in Figure 28 does not follow the wetland buffer guideline as referenced (Western Australian Planning Commission, 2005). Due to the presence of two TECs and the uniqueness of the lake, it is likely to be considered nationally important in which case a buffer distance such as 200m is recommended to ensure the values of the wetlands are maintained. The proponent shall liaise with Department of Environment and Conservation (DEC) to determine an adequate wetland buffer.	Noted. The proponent will consult the Department of Environment and Conservation in relation to the wetland buffer, should the proposal be approved.
149	Public	The PER makes no reference to the structure of Lake Richmond. It is a combination of a perched and flow through wetland.. Given the base of Lake Richmond is likely to be limestone it should be investigated. The construction works may cause breaks in the base of the lake, destroying the perched area of the lake and dramatically affecting water levels.	The base of Lake Richmond at -13 mAHD is approximately 8 m above the top of the limestone at -21 mAHD. The base of the lake itself is not limestone.
150	Hon Lyn MacLaren MLC	One of the success criteria for the Government's interim recovery plan for the thrombolites is that water quality and levels in Lake Richmond be maintained 1 According to the project's PER documents, the project is expected to result in an estimated reduction in groundwater levels at Lake Richmond of 0.032 m (3.2cm) during construction and 0.038 m (3.8cm) during operation. However, the baseline study on which this is based relies on a single year's data (April 2010 to March 2011). In 2003 and 2011 the water quality in Lake Richmond was found to be unsatisfactory. The proposal is likely to exacerbate the Lake's water quality problems, due to the increased population in the area.3 2	The Lake's water quality is not at risk from the proposal because it is up-gradient from the Proposal, and water level modifications are minimal and well within the range of natural and historic water level variation.
151	Department of Water	A District Water Management Strategy is to be prepared by the proponent to accompany the Metropolitan Regional Scheme (MRS) amendment in accordance with *Better Urban Water Management (WAPC 2008)*.	Agreed and noted. The preparation of a District Water Management Strategy will be address as part of the Metropolitan Scheme Amendment required for the proposal.
152	Department of Water	Principles of stormwater management to be implemented in future design (i.e. rain events resulting in discharge to the marina) and relevant future monitoring (water quality for Lake Richmond outlet drain), to determine appropriate design response should be included in the PER. A monitoring program relevant to proposed discharge of stormwater to marina (inclusive of sediment and water quality monitoring) should be determined as part of this PER.	Agreed and noted. A stormwater monitoring program in line with relevant standards and guidelines will developed via the planning process.

	Respondent (sub #)	Submission and/or issue	Response to comment
153	Department of Water	It is proposed that the existing Lake Richmond Outlet Drain that drains into Mangles Bay will be relocated as part of the proposal. The drain will be realigned as a closed pipe system. The PER document states that the realignment will not impact upon the water levels in Lake Richmond, however there may be impacts associated with a closed pipe system draining directly to the receiving marine environment. For instance, the existing open drain has the opportunity for the drainage water to screen pollutants and take up nutrients from plant matter contained within the drain and to allow infiltration of surface water into the groundwater. However, a closed pipe system will discharge water from Lake Richmond (which includes stormwater and groundwater from surrounding urban areas) directly into Mangles Bay without any treatment or infiltration. Monitoring has shown that nitrogen and phosphorus levels in the lake exceeds the ANZECC guidelines. Water quality resulting from the realigned closed pipe outlet should be addressed in the PER.	The superior nutrient stripping benefits of the open drain over a closed pipeline are acknowledged. To mitigate the loss of this value, the Proponent initially proposed a purpose built nutrient stripping wetland on POS in the development, but the Water Corporation declined to manage the facility. The Proponent has subsequently committed to contributing to a nutrient inventory of drains leading into Lake Richmond as a first step toward identifying locations where nutrient stripping of source waters to the Lake might be undertaken.
154	Department of Water	The predicted decline of 0.032m and 0.038m (construction and operation) in lake levels does not constitute a significant risk in ecology for Lake Richmond. However, it is the view of the Department that modelling to determine these figures is based on insufficient monitoring data, thus there is an inherent risk of in accuracy. Furthermore, the assumption that an extended decline in lake level is unlikely to cause an impact because it is within the inter-annual variation in low water levels, is not a valid statement.	The low water level (as well as the mean and high water level depictions) are based upon 38 years data from the Department of Water and one year of data from MWH.

	Respondent (sub #)	Submission and/or issue	Response to comment
155	Department of Water (255)	The following quote within the first paragraph *"There are no data for hydrocarbons in groundwater, and although these types of contaminants are more common in road runoff, the Department of Water's study of stormwater quality discharging at Perth beaches (DoW 2007) found hydrocarbon levels below laboratory detection limits in stormwater discharging at Rockingham beaches, so it is also unlikely that stormwater is a significant source...."* is misleading. It is correct that the DoW 2007 study did not find hydrocarbons above levels of reporting. However, this study was a snapshot study, and it is acknowledged that the first flush was not captured in the sampling regime. Therefore the contaminant load at the time of sampling may not have been reflective of the contaminants discharged in the stormwater (thus peak concentrations are likely to have been missed). Additionally, much of the sampling in the DoW 2007 study was conducted in 2004 which was a year with 'below average' rainfall. Therefore, it is considered that there is not enough information to state whether stormwater is a significant source of hydrocarbons or not. The DoW 2007 study (samples taken in 2004) was not designed to provide baseline information for a marina development at Mangles Bay. Further monitoring, or at minimum the appropriate stormwater design response, would be required to determine that stormwater is not a significant source of hydrocarbons to the area.	The advice is noted. An LWMS is currently being designed to satisfy the requirements of the City and the DoW. If considered advisable, hydrocarbon monitoring of stormwater discharges will be undertaken and incorporated in the marina OEMP.
156	Department of Water	One of the mitigation measures listed in section 10.7 is "*better management of stormwater drains entering Mangles Bay*". This is a positive attribute of this proposal, however, it will not be possible to measure the outcome of this against the EPA objectives and Shoalwater Islands Marine Park objectives for marine water quality and sediment quality unless there is an appropriate baseline dataset available. No evidence of an appropriate baseline dataset has been presented in this PER and would need to be generated pre-development before this could be determined post-development. The historic DoW references provided (DoW 2007 & DoW 2009) contain inadequate and/or irrelevant information.	The proponent considers that addressing nutrient input at the source is a better use of funds. Refer response to submission 153
157	Department of Water	Predicted decreases in Lake Richmond surface water level of 0.032m and 0.038m (construction and post construction) has been inferred to be the same as the nearby modeled groundwater level. Surface water levels experience greater seasonal fluctuations (~0.8m) than those observed in SBS bores (0.3m). As such, this may not be a valid assumption. As this is arguably the most important factor of the PER a more supported relationship is sought.	The predicted water level decrease is superimposed on the seasonal water table fluctuations.

	Respondent (sub #)	Submission and/or issue	Response to comment
158	Department of Environment and Conservation	Decisions about the environmental impacts on Lake Richmond from the construction of the marina should be based on the position of the saltwater-freshwater interface nearest the lake, not only on changes in the surface water level of the lake.	The toe of the predicted saltwater – freshwater wedge after the proposed marina development has been completed is more than 400 m distant of the lake and at the base of the SBS. Note that the lake bed at its deepest point is 8 m above the base of the SBS. However additional monitoring bores to further define the saltwater-freshwater interface near Lake Richmond will be installed as the part of the monitoring proposed for the development.

6.2 Groundwater

	Respondent (sub #)	Submission and/or issue	Response to comment
159	Public Cape Peron Community Vision Working Group	The raising of the salt water and its inland intrusion will affect surrounding bores, vegetation and thrombolites. What is the risk that the groundwater quality will be negatively affected by the proposal, thereby Lake Richmond. A risk assessment should be undertaken, where realistic risks are allocated to all possible failure mechanisms.	The seawater interface will migrate inland directly adjacent to the footprint of the marina. Elsewhere the position of the interface, including seawards from Lake Richmond, will not be materially affected.
160	Public	A simple walk along the beach shows that there is substantial limestone in the area, therefore the assertion that the land is primarily made of sand is incorrect.	A limestone outcrop is recognised west of the marina. This is confirmed by Rockingham bore logs plotted by GSWA. Geotechnical investigations and groundwater studies demonstrate the Tamala limestone is at a greater depth than the proposed 4.0m excavation depth for the marina.
161	Wetlands Conservation Society; Dr van Keulen (97); Department of Planning; Department of Environment and Conservation; Naragebup Marine Working Group	The proponent has not considered climate change – the location of the salt water interface will depend on rainfall, sea level rise and local groundwater use, all of which will change the current modelled assumptions. With rainfall in the southwest of Western Australia already reduced and predicted to continue to fall (Climate Commission, 2011), groundwater recharge rates will decline in future years. This will exacerbate any potential salt water intrusion impacts. Sea level rises of up to 1 m are predicted by 2100 (Department of Climate Change, 2009), with recorded sea level rises in southern Western Australia being higher than the global average. At these predicted rates, enhanced salt water intrusion into the groundwater will be considerably greater than predicted based on present models and the integrity of Lake Richmond may be expected to be compromised. As a minimum, consideration should be made of the likely impacts of a 1 m sea level rise on groundwater flows and salt water intrusion; this is likely to require additional research, as there is considerable uncertainty over the existing groundwater modelling.	Climate change effects were not addressed in the PER because they were considered to be unrelated to the construction of the marina. They will happen naturally with or without the marina. Any climate change induced sea level rise will in effect raise groundwater and lake water levels. Any reduction in rainfall may lower end of summer water levels in the Lake. This will happen irrespective of whether or not the marina is constructed. The marina will not exacerbate these climate change effects. The influence of the marina will remain as currently predicted irrespective of future climate change. The effect of climate change on groundwater levels and the location of the seawater interface have been addressed in detail in Appendix 4 of Strategen document “Response to Key Marine and Groundwater Issues Raised in Submissions on the Mangles Bay PER”. Note that the existing groundwater modelling is not uncertain and in fact has been considered to be reliable by independent peer reviewer Dr Phil Wharton of Rockwater Pty Ltd. Dr Wharton’s peer review is presented in Appendix 5 of Strategen document “Response to Key Marine and Groundwater Issues Raised in Submissions on the Mangles Bay PER”.

	Respondent (sub #)	Submission and/or issue	Response to comment
162	Public	The ESD commitment of 'Modelling predictions of best, worst and most likely scenarios of the proposal, including potential effects over time and effects on other water users, Lake Richmond and groundwater dependent ecosystems' has not been undertaken. Modeling construction methods that are not being used hardly constitutes 'Modelling predictions of best, worst and most likely scenarios of the proposal'. There is not modelling for the range of climate scenarios despite the advice in ESD commitments page 4 and the modelling that is supposed to fulfil this advice, commitments 33, 34, 35. What happens when sea levels raise by 0.9m, or rainfall continues to decline, or levels of the Serpentine River fall?	The water level scenarios (high, low, mean) are related to the regional MODAEM model, not the local SEAWAT model, and were not used for simulations. The SEAWAT model is a transient model, which incorporates high, mean, and low water levels automatically. For the SEAWAT model, a seasonal average was presented. A worst-case water level scenario is not an issue, because the goal of the modelling is to determine differences in water levels relative to existing levels, as driven by a given development scenario, not absolute water table elevations at some given time. Also see above response re climate change. In terms of modelling scenarios the initial and most cost effective option for marina construction was by dewatering. This was subsequently rejected because of the predicted short term impacts on water level drawdowns in Lake Richmond. A wet excavation method is now proposed. This method creates a slight but gradual decrease in water level drawdown in the lake over a period of 8 to 10 years as the water table adjusts to the new sea level baseline extending further inland coincident with the footprint of the marina. Also see related comment on potential lake water level rise should sea levels increase because of climate change.
163	Public	A rough estimate of the perimeter of the marina gave a length of wall as approximately 2674m so the average 380 m3 /d equates to a water loss of approximately 142 litres per metre of marina wall per day or 71 litres per low tide. This would require the assumption that the marina wall is 100% impervious. However construction techniques are not perfect and leaks would be hard to detect particularly as both side of the piling may be hidden from easy view with the wet construction method. Significant leaks could occur without being detected which have the capacity to alter the assumed marina discharge rate by orders of magnitude. Approximately half of the marina wall is within the modelled pre-existing 0.3m low water groundwater contour so there would be reasonable pressure behind any leak. However there is no sensitivity analysis on this aspect of the model which there has to be for the model to be acceptable. This estimate appears very low, and per metre of piling the loss of 142 litre is less than a tap dripping 100ml per minute, this is probably not even enough to form a steady flow from a tap! Very minor defects in construction could make model estimates wildly inaccurate.	The seawater in the marina is a density barrier to freshwater inflow irrespective of the permeability of the marina walls. Freshwater will rise to the surface at the seawater interface and primarily be lost as evapotranspiration.
164	Dr van Keulen; Public	There appears to be considerable variability in the groundwater flow rate in the area. The model uses one value for the discharge rate of water via the marina: '*The modelled total groundwater discharge rate to the MBM on average is 380 m 3 /d, which is modelled to increase to 570 m 3 /d (a 50% increase) in winter and decrease to 250 m 3 /d (a 50% decrease) in summer*.' (ERM 2011) There is no discussion on how this was calculated or sensitivity analysis of how errors in this assumption might affect the model. Higher figures are used in the water quality study for the marina – up to 940 m3/d (p20 oceanic baseline data report 2012).	The water quality in the marina is not sensitive to groundwater discharge as a large proportion will be lost by evapotranspiration and the flux of fresh groundwater will be very small in comparison to the daily flux of seawater.

	Respondent (sub #)	Submission and/or issue	Response to comment
165	Dr van Keulen; Public	The combined marina and Sepia Depression Ocean Outfall Landline (SDOOL) duplication by the Water Corporation will have a combined effect of 0.25m during the construction phase according to the consultant's report. The impacts of this have not been adequately acknowledged by the proponents as it is not possible to examine the marina impact without also considering the SDOOL impact as the marina cannot be developed without realignment of the SDOOL. This may impact the shoreline communities within the lake, including the thrombolites.	The SDOOL impact on water levels in Lake Richmond has been calculated and applies only to the SDOOL construction phase. The potential for recharge of abstracted groundwater during the SDOOL dewatering has also been considered and could cause a marginal increase in lake water level. After SDOOL construction the water table and lake levels will re-establish to their pre-construction levels with the recognition that a slight but gradual decrease in lake water level will be superimposed over an 8 to 10 year period following marina construction.
166	Water Corporation	The PER states that the impact of the SDOOL duplication on Lake Richmond water levels as a result of dewatering is 0.25m. This is incorrect as modelling undertaken by the Water Corporation indicates that water levels will drop by 9mm. This modelling utilised the same model and consultants utilised by the proponent. The conclusion presented in the EPR that the cumulative impact of the two proposal is predominately due to the construction of the SDOOL is therefore incorrect. The potential for the Mangles Bay Marina project to impact the water levels in the long term on Lake Richmond are far greater and more significant than the Water Corporation's short term impact.	Revised modelling by the Water Corporation following lodgement of the PER shows that with direct groundwater recharge the reduction of water levels within Lake Richmond can be minimised to 9 mm. Furthermore the reduction will only be during the construction period.
167	Water Corporation	Option 3 on page 73 of the alternative alignment for the SDOOL shows the pipeline above the groundwater for the entire route. This however contradicts existing data for the SDOOl, which is approximately 2.5m below ground water level at Point Peron. This detail needs to be verified.	The groundwater level along the realignment of the SDOOL has been determined from the groundwater studies. A longitudinal section for the proposed realignment of the SDOOL with groundwater levels has been plotted to confirm the groundwater sits below the invert of the pipe.
168	Public	What is the predicted post development groundwater level and how long will it take to achieve this. Local bores have changed and the amount of water available has decreased from other dewatering projects in the region. There is also a risk that local groundwater bores will become unusable and will need to be mitigated against into perpetuity.	Refer to the comment above (submission no. 167). It is also proposed that a survey of local groundwater bores be undertaken prior to construction and selective monitoring of water levels and water quality undertaken.
169	Conservation Council of WA	The peer review makes a number of comments that reflect negatively on the competency of the hydrological investigations and explain why a great deal of caution should be applied to making critical decisions based on the results. *' There have been no useful determinations made of the aquifer parameters in the project area, in particular the horizontal hydraulic conductivity of the Tamala Limestone and vertical permeability of the silty sand/clay layer between the TL and the Safety Bay Sand'.* So can we reasonably assess the risk to the aquatic ecosystem in Lake Richmond or not?	The Peer Review has recognised that the model is fit for the specific purpose of assessing water level and salinity changes in the SBS. If the marina were to be constructed by an extensive dewatering program rather than by wet excavation, then further definition of the Tamala Limestone aquifer parameters could have been considered.

	Respondent (sub #)	Submission and/or issue	Response to comment
170	Conservation Council of WA	*'Water levels and water quality measured in these bores will be dominated by those in the TL which has much higher hydraulic conductivity, and generally higher heads. This can be seen by the increase in salinities with time throughout the depth profiles of bores such as MB10 and 12. The bores should be cemented up to the base of the SBS to prevent saline water from flowing up through them into the SBS'.* This 'stuff-up' provides a useful illustration, not only of the environmental impact of the environmental assessment, but also the risk of saline water intrusion from the TL aquifer including into Lake Richmond from either providing access to the surface or drawing down the buoyant water in the Safety Bay sands (including increased discharge through the marina / canal complex.	The recommendation to seal the cross connecting bores is noted. The Mangles Bay project will seal the bores which cross-connect the Tamala Limestone aquifer and the SBS prior to construction.
171	Conservation Council of WA	'*There are probably also private bores in areas west and east of the planned marina that were not surveyed that could potentially be impacted by the construction of the marina and introduction of seawater into it'* Why has this work not been done? These impacts should be quantified.	Further census of private bores will be undertaken prior to construction.
172	Conservation Council of WA	Doubt on the parameterization of the model is indicated by the following comment. *'The adopted vertical hydraulic conductivity of the silty sand layer of 0.00013m/d for a 3m thick bed is too low and unrealistic'* These unrealistic assumptions need to be corrected in the modeling before the EPA completes its assessment.	The adoption of wet excavation avoids dewatering and the transfer of saline water from the TL into the SBS. No further modelling is not considered necessary.
173	Conservation Council of WA	The risk associated with the high uncertainty with the hydrological interpretation is summarized in the conclusion as follows: *'The value of hydraulic conductivity used in the TL in the project area is considered to be too high, and an unrealistically low value of vertical conductivity has been used for the silty sand and the thin, probably discontinuous, clayey aquitard between the TL and SBS'.* *'If the vertical conductivity of the aquitard is much higher than has been assumed there could be higher groundwater flows to the marina, particularly if it is dewatered, with the additional flows originating from the TL. This could result in some salinity increases to the lower part of the SBS'.*	The marina will not be dewatered and therefore upward flow from the TL will not occur as the dense seawater within the marina, and directly adjacent to it, will prevent any upward flow.
174	Public	The Rockwater Peer Review (2011) states '*The root mean square error in the calculated water levels of 9 % exceeds the limit of 5 % recommended by Middlemis (2000)'* page 5. However the ERM report misrepresents this as '*The root mean square of the residuals is 0.149 m which is much lower than the 1 m range recommended in the MDBC guideline (Middlemis, 2000)*' (page 18 ERM 2011). It is a mathematical absurdity to expect any absolute figure to cover any and all applications of a modelling tool like Seawat. As it is the root mean square residual of this model (0.149m) is almost 400% greater than the difference the model claims to measure (0.038m). The 1 metre figure being greater than the seasonal variation of the system being modelled.	The model calibration results for the SBS water levels give the mean sum of the residuals as 0.053 m, which is 3% of the natural water table range of 1.75 m. The root mean square of the residuals is 0.149 m. This is much lower than the 1 m range recommended in the MDBC guideline (Middlemis, 2000) and significantly lower than the 3 m for the DoW's regional groundwater model for the Rockingham area.

	Respondent (sub #)	Submission and/or issue	Response to comment
175	Public	The peer review by Rockwater contain a number of criticisms • "There have been no useful determinations made of aquifer parameters in the project area, in particular the horizontal hydraulic conductivity of the Tamala Limestone (TL) and vertical permeability of the silty sand / clay layer between the TL and Safety Bay Sand (SBS)". At page 4 he states that "The report …forms a solid basis for the numerical groundwater model, except for a lack of hydraulic paramaters based on local field data" • "Saline water in the lower part of the SBS might originate from upward groundwater flow from the TL. This might have been shown by the modeling results if the adopted vertical hydraulic conductivity of the aquitard between the aquifers was higher" (page 4) • "Sensitivity analysis was carried out for the SBS but not the TL. The TL has been downplayed as an aquifer in the ERM reports, as in the project area it contains saline water indicating that tidal flows dominate over groundwater flows. However, from Lake Richmond to the east, sand and limestone of the formation forms a fresh---water aquifer" (pages 4 and 5) • "The second last paragraph of page 6 states that saline conditions in the TL extend inland to approximately the groundwater divide….This is not the case…"(page 5) • "The adopted vertical hydraulic conductivity for the silty sand layer…is too low and unrealistic" (page 5) • "The root mean square error in the calculated water levels of 9% exceeds the limit of 5% recommended by Middlemis (2000)" (page 5) • The horizontal hydraulic conductivity value used for the TL in the project area (3,000 m/d) is beyond the range given in Davidson and Yu (2008) of 100 to 1,000 m/d, with a value of around 50 m/d said to be more applicable to regional groundwater flow due to the presence of sandy facies and low-permeability zones. Lower values were used in the model at Point Peron (1,000 m/d) and east of Lake Richmond (200 m/d) (page 5). • There are also mistakes both in on ground works and in interpretation of reference material Overall the Review offers only the most grudging acceptance that the model is acceptable. The errors indicated above indicate a lack of reliability in the modelling and therefore the predict results.	• Subsequent to the MWH investigation ERM completed a nest of three wells (LR1, 2 and 3) near the northeast margin of Lake Richmond. The groundwater heads in the SBS showed minimal vertical change and no influence from tidal fluctuation. The salinity increased from EC 1,700 to EC 3,000 at the base, salinities comparable to those recorded from the lake prior to the installation of stormwater inlet drains and therefore may represent legacy lake salinities rather than upward seepage from the TL. • An aquiclude was identified separating the TL from the SBS. The TL EC was 13,000 and the groundwater head was 0.3 m above that in the SBS and also exhibited daily fluctuation coincident with sea tides. • These 3 LR monitor wells clearly showed limited hydraulic connection between the TL and SBS and no connection between the TL and Lake Richmond. • The numerical parameters used for the TL and the confining layer allowed a mathematical calibration of water levels in the SBS and prediction of water levels in the SBS and Lake Richmond under various dewatering and construction scenarios which, under the wet excavation scenario for marina construction, has been the key output from the modelling. • The parameters used for the TL are clearly open to question but do not influence the model in terms of prediction of water level and salinity predictions in the SBS and Lake Richmond. The Peer Review confirms that the model is fit for this purpose. • The monitor bores cross connecting SBS and TL installed in the initial exercise are an unnecessary complication and should be sealed. • Further conclusions from the peer reviewer are presented in Appendix 5 of Strategen document "Response to Key Marine and Groundwater Issues Raised in Submissions on the Mangles Bay PER"). Subsequent peer review of the matters raised in submissions has supported the adequacy of the model results.
176	Conservation Council of WA	If the EPA were to apply the precautionary principle it would recommend against this project based on the uncertainties presented in assessing the impact on the hydrology of the area, including the aquatic ecosystem in Lake Richmond. Any attempt to reduce those uncertainties to an acceptable level would require a thorough regional assessment of the geological and hydrological structure of the Tamala limestone and its relationship to the aquifer in the Safety Bay Sands.	The relationship between the TL and the SBS is reasonably well understood on a regional scale from other studies and was recognised in the initial 2D MODAEM regional model.
177	Department of Water	The use of large scale regional geological mapping (figure 4) is not an appropriate level of accuracy to inform modelling for a proposal of this nature. Site-specific mapping should be created illustrating localised geological forms.	Site-specific mapping is not required for an area where geological subcrop maps (GSWA Bulletin 142), borehole data and downhole geophysical logs are already available.

	Respondent (sub #)	Submission and/or issue	Response to comment
178	Friends of Point Peron/Hands off Point Peron (131);	The stratigraphy is incorrect lithologically. Firstly, bore logs on stratigraphy are poorly presented. They are of various scales and thus not readily comparable. Secondly, I cannot accept the validity of the stratigraphy and lithology. Having myself drilled several hundred stratigraphic bores and emplaced some 150 piezometers in this area, and described and defined the stratigraphic units in this area, I find the stratigraphy to be over-simplified; and Lithologically incorrect (e.g., the identification of 'sandstone' in the logs, and the lack of muddy sand layers and lenses in the stratigraphic interval between -2 m AHD and ~ 10 m AHD, i.e., the level of the Becher Sand); Thirdly, sampling lithology every one-metre will result in an over simplified stratigraphy and in loss of stratigraphic detail. Such detail is needed for hydrogeological interpretation and management. These matters above are not innocuous because without detailed stratigraphy and good lithological description (see wetland stratigraphy in this region by C A Semeniuk 2007) there can be no foundation for good hydrogeological interpretation and management. The relationship of hydrological preferred pathways between Lake Richmond and the sea cannot be assessed if the seawater/freshwater interface is brought very close to Lake Richmond; Fourthly, for many of the bores, there is slotting along the entire piezometer. This will tend to homogenize any of the various piezometric heads and aquifer flow rates deriving from the different stratigraphic layers. It means that the piezometric monitoring undertaken for the PER is too simplified for the complex stratigraphy present, and cannot be used with any confidence. Data provided in the PER suggests that the research necessary to seek out the piezometric complications, in order to fully understand the hydrogeology in this sub-region (especially around Lake Richmond) in order to safely determine that excavating a marina in sand will not compromise Lake Richmond, was not undertaken.	The comments on the slotting are considered valid and are recognised. However the variations in microstratigraphy and lithology are not considered to be of consequence in defining the broad hydrologic parameters used in the numerical model. The parameters used for the SBS are similar to those used in other regional numerical models and of necessity defines average parameters within defined model layers. If thin muddy sand layers and lenses do occur in the Becher Sand (but have not been identified on downhole geophysical logs) this would be a conservative factor in determining the water level drawdown associated with the marina.

	Respondent (sub #)	Submission and/or issue	Response to comment
		The stratigraphy around Lake Richmond will be complex because Lake Richmond itself formed as a barred lagoon along an oceanographically complex coast and as such it may be expected to have and be bordered by complex stratigraphy. This complex stratigraphy needs to be determined and the ensuing complex hydrogeology also needs to be determined if the seawater/freshwater interface is to be brought close to the Lake. In this regard, the PER is wholly inadequate. Fifthly, a major flaw in the PER is the lack of hydrogeology to explain the maintenance of the stromatolites/thrombolites along the northside Lake Richmond. A major change of hydrological and hydrochemical structure in the northside Lake Richmond will alter the hydrological mechanisms that maintain the stromatolites/thrombolites, and these stromatolites/thrombolites are renowned globally unique features. A proper robust hydrogeological and hydrochemical study is a prerequisite to ensuring/determining whether altering the hydrology and hydrochemistry of groundwater by excavating a marina so close to Lake Richmond will not, or will, compromise the stromatolites/thrombolites. *I am of the opinion that the stratigraphy and hydrology undertaken in the PER are not of sufficient quality to assess and predict the impacts of altered hydrology on Lake Richmond and the stromatolites/thrombolites.* Given the critical nature of the hydrogeological processes and products in maintaining Lake Richmond, this component of the PER is very unsatisfactory and if development proceeds on the present information there is a real risk the salinity peripheral groundwater hydrodynamics of Lake Richmond and the globally significant thrombolites will be compromised.	
179	Friends of Point Peron/Hands off Point Peron (131);	The prevalent occurrence of limestone fragments in the drill holes proximal to Mangles Bay is an interesting feature of the report. I doubt that there are limestone fragments in the sand (more likely they are to be platy calcareous algae fragments). My interpretation is that there has been a misidentification of carbonate grains, and this may signal a change in drillers, or drill core loggers, or even drill retrieval techniques. If I am correct, it shows the inconsistency of data collection across the area. If I am incorrect, it shows the rapid facies change that can occur within small scales stratigraphically. These rapid facies changes have not been addressed in the PER as intimated above, and they would be crucial to interpreting and managing hydrogeology.	It is not considered that any implied facies changes will critically influence the interpretation and management of the hydrogeology within the scale adopted for the numerical model.

	Respondent (sub #)	Submission and/or issue	Response to comment
180	Friends of Point Peron/Hands off Point Peron (131);	The data in the PER used for the groundwater modelling is not rigorous enough or of a high enough standard to be used in such an environmentally sensitive area to ensure the protection of Lake Richmond and the thrombolites. The data for the modelling are derived from a particularly dry year, which will produce anomalous results. Figure 8-9 of C A Semeniuk (2007) shows the significance of direct (empirical) measurements in a study of the effects of rainfall on groundwater levels, and how the water table differentially responded, phenomena that would not be made evident with simplistic water levels and with simplistic lithology used in groundwater modelling in this region.	The Proponent's consultants (ERM) dispute the assertion that the groundwater modelling undertaken for the impact assessment was not rigorous enough. The data used to calibrate the model included historical Department of Water (DoW) water level records for the Cape Peron area spanning a period of some 38 years, PLUS two years of water level data from a monitor bore east of Lake Richmond (1985/86) , PLUS 12 months of onsite monitoring water level data. These longer term data sets are more than sufficient to account for the rainfall conditions experienced at the site in the past 12 months. The calculated permeability and other parameters for the SBS are comparable to those used in the DoW's Perth Regional Aquifer Modelling Systems (PRAMS), Peel Harvey Regional Aquifer Modelling System (PHRAMS) and Murray models. It is therefore considered by the Proponent's consultants (ERM) that the model inputs are reliable. In addition the Proponents consultants consider that the model predictions are reliable. Note that the adequacy of the modelling and the reliability of its findings has been supported by independent peer reviewer Dr Phil Wharton of Rockwater Pty Ltd (refer to Appendix 5 of Strategen document "Response to Key Marine and Groundwater Issues Raised in Submissions on the Mangles Bay PER").
181	Public	Is 12 months a suitable time frame for collecting data to reflect what average conditions are over a long period of time?	Refer to response to submission 180

	Respondent (sub #)	Submission and/or issue	Response to comment
182	Public	It appears to be accepted by the consultants engaged by the proponent (MWH, ERM and Rockwater) that: a) There are two key layers that need to be considered carefully for hydrological purposes – the Safety Bay Sand layer (SBS) and the Tamala Limestone layer (TL) below. b) The hydrological characteristics of the SBS and the TL are very different from each other c) The TL's hydrological characteristics are not uniform, but vary greatly from one place to another, due to the heterogeneous physical characteristics of the TL. Therefore it follows that in order to predict with reasonable accuracy the likely and 'worst case' hydrological changes that would occur as a result of implementing the Proposal it is necessary to base the modeling on reliable data about a) The three dimensional locations of the SBS and TL in the project area and between the project area and Lake Richmond; and b) The actual hydrological characteristics of the TL in the relevant area and its surroundings. The proponent appears not to have conducted the necessary additional fieldwork to obtain this information. Instead the proponent's consultants appear to have drawn tenuous and in some cases conflicting inferences about such matters, based on inadequate site□specific fieldwork. Annexure A, figure 1. indicates that only 4 wells were drilled between the southernmost location of the proposed canals and Lake Richmond – wells MB 1, 5, 11 and 12. The dimensions of this area are approximately 500m by 400m (i.e. 20 hectares). The proponent therefore seems to have instead relied heavily upon general regional□scale data.	Refer to the second part of the response to Submission 180. Note that dewatering will not be undertaken for excavation of the marina water body. Hence impacts on lake water levels and seawater interface are minimal and only occur within the Safety Bay Sands aquifer. The location and hydrological characteristics of Tamala Limestone is not pertinent to assessing the impacts of the proposed marina "wet excavation" construction method.

	Respondent (sub #)	Submission and/or issue	Response to comment
		The proponent has produced only four geological cross sections (refer Figures 3--6 attached to ERM annex C). This would seem to be manifestly inadequate. Furthermore, the cross sections are inferred from scant data and are of questionable reliability and utility for the reasons set out below. Cross section A to A (Figure 3): a) Contains no data about the upper and lower depths of the TL between wells MB6 and MB12. This is a distance of approximately 850m over which the depths and contours of the TL drawn on Figure 3 would therefore appear to be highly speculative. b) Contains no data about the upper and lower depths of the TL between well MB1 and LR2. This is a distance of approximately 700m over which the depths and contours of the TL drawn on Figure 3 would therefore appear to be highly speculative. c) In the whole of cross section A to A, which comprises a distance of approximately 1,750m, there are only 3 measurements of the upper and lower depths of the TL. Cross section B to B (Figure 4): a) Traverses a distance of approximately 375m between MB04 and MB10 with only one measurement of the upper depth of the TL and no measurements of the lower depth of the TL. Cross section C to C (Figure 5): a) Passes through wells MB12 and MB01, hence duplicating that part of cross section A to A. b) Traverses a distance of approximately 330m between wells MB09 and MB07 without any measurements of the upper and lower depths of the TL.	
		Cross section D to D (Figure 6): a) Contains only one measurement of the upper depth of the TL (at MB05) and no measurements of the lower depth. The upper depths and contours of the TL between MB06 and MB05 (a distance of approximately 920m) drawn in Figure 6 therefore appear to be highly speculative. b) Does not even speculate on the lower depths and contours of the TL in this cross section. In conclusion it appears that: a) The proponent's well data is inadequate to provide confidence in the accuracy of these cross section diagrams b) There are insufficient geological cross sections c) The proponent's knowledge of the 3 dimensional location and properties of the TL in the area of the Proposal and surroundings is very limited d) These deficiencies must inevitably reduce the reliability of the proponent's predictions and risk assessment	

	Respondent (sub #)	Submission and/or issue	Response to comment
183	Dr de Boorder (173)	In the Mangles Bay project area, the top of the Tamala Limestone has been observed in eight of the 16 new bore holes at a depth of between 22 and 26 m below ground level [3]. Reinterpretation of the available bore logs in conjunction with electrical conductivity logs has tentatively defined the thickness of the Limestone in the Mangles Bay project area between 3.5 and 7 m [4]. It is overlain by the Safety Bay Sand which is expected to host the proposed marina. In outcrops, as at Point Peron, Garden Island and Penguin Island, the highest part of the Tamala Limestone is characterized by a very hard calcrete layer, up to about one meter thick. This hard layer overlies the level containing the distinct fossilised taproots. From the mainland, this layer is seen to gently undulate on Penguin Island and Garden Island and the smaller islands between Penguin Island and Point Peron. ***Implication*** *The occurrence of the characteristic unit of fossillised taproots, often in combination with an overlying hard calcrete layer, just above sealevel around the Cockburn Sound, suggests an originally large horizontal to sub horizontal extent in the wider Rockingham area. This suggestion raises the question why the top of the Tamala Limestone now occurs at a depth level of about 25 m AHD in the project area.*	The question of why the TL surface is where it has been found to be, is not within the scope of a typical assessment study. The TL is recognised to be present at, and close to, the surface directly west of the marina (as confirmed by GSWA bore data). The known location of TL in the project area has been incorporated into the numerical model.
184	Dr de Boorder (173)	The top of the Limestone crops out just above sea level at Cape Peron, John Point, on Penguin Island, on Garden Island and, on the mainland to the east, in the Henderson Cliffs, with an unexplained vertical difference of some 25 m relative to the level of this top in the project area. It is unknown if this difference in level is due to a smooth gradient or to abrupt steps controlled by faults. These are at least two possible explanations: 1. the area of Cockburn Sound is part of a Cockburn Sound Warnbro Depression, as a swale between two coastal dune ridges [5] and 2. the area corresponds to a depression which resulted from subsidence of the bedrock along steep faults of the eastern margin of the Perth Basin. These two different explanations, options or models, have not been explicitly addressed in the course of the preparatory project research. The first explanation implies a relatively stable subsurface. The second explanation may involve instability. The “conceptual regional hydrogeologic profile” after ‘Smith 2001’, missing in the references but probably referring to ‘Smith and Hick (2001)’, which was used as the basis for the hydrological modelling [4, Figure 3], resembles the first model. The same diagram contains, however, the suggestion that the Eastern Tamala Limestone Outcrop in the Kwinana area has moved upwards along steep faults (thin, dashed subvertical lines) relative to neighbouring blocks. I infer similar faults along the Point Peron block of Tamala Limestone at the western end of the cross section. The conceptual basis used in the Mangles Bay hydrological modelling [4, Figure 3, stated to be based on ‘Smith, 2001’, derived from a Watercorp powerpoint presentation] probably relates to the crosssections A, B, C, and D of Smith and Hick [8] which are based on, amongst others, Davidson [7]. These cross sections express widespread uncertainty (question marks) about the geological configurations in the Cockburn Sound’s subsurface, while cross section B shows a possible steep fault below the Sound which in cross section C shows a distinct dip to the west. The sources of this information remain unclear.	Refer to response to submission 183.

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		This second explanation finds support from the setting of the Rockingham area within the faultcontrolled eastern margin of the Perth Basin along the west coast of the Continent [1]. Moreover, McPherson and Jones [6] stipulate that "The Perth Basin is generally intensely faulted with most faults having north to northwest trends and throwing both to the east and west". Suspected vertical displacements in the largely unknown subsurface of the Cockburn Sound and surroundings [7, 8], have not yet been taken into account in the preparatory research concerning the Mangles Bay Marina Based Tourist Precinct. There is no guarantee that the cover sediments, including the Tamala Limestone, are not affected by movements along these faults in the basement because of the brittle nature of the Limestone. ***Implications*** *The uncertainties concerning the nature and the spatial distribution of the Tamala Limestone in the subsurface of the project area and its surroundings have a bearing on the hydrological modelling. The conceptual basis used in the Mangles Bay hydrological modelling [4, Figure 3] is not necessarily the only realistic one [see also 14]. In view of its heterogeneity, it is of concern how the Tamala Limestone in the subsurface of the project area and its surroundings compares to its behaviour in the outcrops (Annex A, Figures 1 8). In order to understand the exceptional difference in depth levels of the Tamala Limestone in the areas around the Cockburn Sound and the Mangles Bay project area, the processes (explanations 1 and 2 above) which have caused this difference should be further investigated and eliminated prior to groundwater modelling.*	

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185	Dr de Boorder (173)	In addition to dissolution by groundwater, the larger cavities in the Tamala Limestone are caused by collapse of the limestone [9], especially in areas where dissolution occurred along fractures and faults. Dissolution and associated collapse of limestone complexes (karst processes) are capable of damaging man-made features by developing sink holes. Some cases have recently been reported in the Coastal Plain both to the north and to the south of the Mangles Bay project area [10]. The secondary porosity of these limestones has been registered in the course of the preparatory research reported in the documents subject to this PER. The risks associated with the porosity of the Tamala Limestone have been known for some time [9, 10]. These risks have, however, not been assessed for this PER, despite the general questions to development managers and the advice by Geoscience Australia [11]: • *'Will the proposed land use trigger sinkhole development?'* • *'Will in-filled sinkholes remain inactive through the anticipated lifetime of the proposed land use?* • *'Ensure that housing and roads are not constructed on or near caves',* and despite the ***precautionary principle*** of the Environmental Protection Act 1986 (Annex B of this submission; see also [12]. The cavities are difficult to predict, but they can be detected with geophysical sounding methods (e.g., induced polarization, resistivity, shallow seismics). These methods can also produce continuous vertical cross sections which trace top and bottom of pronounced layers like the Tamala Limestone in the subsurface and steps indicative of faulting. Additional verification drilling is required. ***Implications:*** *While it appears that the principal faults of the eastern margin of the Perth Basin are no longer active, there is no certainty in this matter. Moreover, the recent destructive subsidence of properties in the Coastal Plain [10] does demonstrate localised instability of the subsurface. In addition to natural faulting in the bedrock, the transport and pile driving operations as anticipated by* 5 *the Proponent [13] could trigger comparable movements in the shallow subsurface. In addition to mechanical damage to properties, any rupture of the subsurface Tamala Limestone may bring about an increase in the salinity of groundwater in higher levels due to upward leakage of saline groundwater, as is illustrated by the observations in the recent drill holes [3] where electrical conductivity is monitored as a proxy for salinity.* The risks of associated subsurface instability have, however, not been assessed and measures to minimise these have not been defined. The risks of subsurface instability should be defined in order to formulate measures to minimise them.	No indication of large cavities has been identified in the TL in this area and generally such cavities occur close to or above historical water table levels. As there will be no dewatering during marina construction and all excavation will be at least 10 m above the top of the TL (-22 mAHD and 20 m+ below water table level) the potential for subsidence is limited.

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186	Dr de Boorder (173)	It is recommended 1. to further assess the uncertainties about the subsurface Tamala Limestone in the Rockingham area with geophysical methods and additional verification drilling in order to minimise the associated risk and 2. to apply for a subsurface stability certificate from an independent engineering institution that can be accepted by a reliable insurance company. The first step in further investigations is to acquire a continuous cross□section with geophysical methods from Cape Peron to East Kwinana, to a depth of at least 40 meters , along the line used in the hydrological modelling [4], in order to know, instead of guess, the position and the thickness of 6 the Tamala Limestone, with special attention to any major cavities and faults, fractures and ruptures in it. The geophysical survey should be followed up by drill holes every hundred meters along the same line to verify the geophysical results and to obtain further insight into the nature of the Rockingham subsurface in general and the Tamala Limestone in particular. In addition to any environmental questions, these holes should be capable of solving geotechnical questions. These two surveys should form the basis for any further investigations away from the principal survey line.	The Proponent does not consider this work to be necessary. Geotechnical investigations by GHD show there is no Tamala Limestone in the area to be excavated. Only SBS have been encountered in the groundwater and geotechnical studies to date.
187	Public	The groundwater model is inaccurate and results are quoted to an accuracy 0.0005 of a metre, with no error estimate required! In fact they are so accurate that '*Assuming that a change in groundwater levels leads to an equivalent change in lake water levels (a worst-case scenario), this would result in a decrease in lake levels of 0.032 m (3.2 cm) during construction and 0.038 m (3.8 cm) during operation'* (page 96 PER part I). So the worst case scenario is that the model is 100% accurate and the real world acts exactly as the model is programmed to do.	This comment recognises that the numerical model implies a greater accuracy than can be achieved by any numerical model. The actual model output has been presented.
188	Public	The model is 100% insensitive to hydraulic conductivity - this in itself is anomalous and is very likely an artifact of the use of inadaquate data points and time series. It can only make sense if the model assumes constant unlimited recharge from the Serpentine River, however there is no assessment of the sensitivity of the model to levels in the Serpentine or to rainfall, nor is there description of what values are used for these rather important model parameters. There is already significant evidence of declining rainfall modelling should specifically be done to account for this both in the immediate vicinity and recharge zone and for varying levels of the Serpentine River	The model is not sensitive to hydraulic conductivity, because it is based upon watershed boundary conditions. Use of watershed boundary conditions enables the model to be independent of what are often limited data sets for specific locations within the watershed; and yet provides modelling with strong reliability, because the boundary conditions are inherently more reliable. The Serpentine River is a gaining stream that does not recharge water back to the aquifer. The Serpentine River is not a part of the saltwater intrusion models for the MBM and SDOOL construction simulations, because the river is located east of the natural groundwater divide that is the eastern model boundary for MBM and SDOOL-related simulations (Annex A, Figure 4). Rainfall is inherently taken into account in the model, through the equivalent recharge rate assumed in the regional model. The relative constancy of the equivalent recharge rate across the modelled region is discussed in Section 3.2.1 of the ERM report, in addition to the factors that comprise it. The equivalent recharge rate is derived from historical stream flow data.

	Respondent (sub #)	Submission and/or issue	Response to comment
189	Public	The model is only calibrated from 4 bores plus Lake Richmond, (the majority of bores put in for the assessment not being acceptable for this purpose). This is inadequate for an accurate model. Only two of those bores are in close proximity to the marina area and 2 to the west of Lake Richmond and on these there is an inadequate time span of measurement. The results of the model are likely to be a result of faulty calibration due to too few data points with inadequate time series for those data points. These issues are intensified as the bores used are in two pairs with only a very small distance between the bores in each pair so one could almost say that the model is calibrated to only 3 points. Maximum error in calibration is in the area closest to Lake Richmond. (table 3 annexe D ERM 2011). However from the calibration table, results are modelled to and calibrated to give results for existing levels of Lake Richmond. This suggests the model parameters are chosen to give a specific result - which does not bode well for accuracy. Particularly as sensitivity analysis was only done for one parameter, though there are a large number of parameters used that could affect model results. With a time series of data being only one year for the bores close to the marina accurate calibration is unable to tested adequately	The model used all available and suitable wells and data for calibration. A total of 9 wells were used (Annex D, Table 3 of ERM report), including three wells located immediately around the proposed marina, and one east of Lake Richmond. The bores are not paired and are not close together. The closest wells (MB2 and MB13) are approximately 170 m apart (Annex A, Figure 1). The maximum error observed is not for a well calibration point that is located near Lake Richmond. Instead, it is for wells DR-3B, 13, and 14, which are located well to the east of Lake Richmond. The model calibration was not to Lake Richmond levels any more than it was to any of the nine wells also used for calibration (Annex D, Table 2). As explained in Section 4.2.2, because a regional groundwater modelling approach was used, the number of unknown parameters for which a sensitivity analysis is necessary (because of data uncertainty) is minimised. It is noted that calibration was undertaken using data from three years, not one.
190	Public	For the one parameter sensitivity analysis was done for, hydraulic conductivity, there is an irregular result of zero sensitivity. This by itself casts questions on the validity of the model. Particularly as the test pumping was conducted for hydraulic conductivity at 2 sites with results at the low end and high end of expectation, however these results were ignored (p59 PER). So while on ground investigations suggest a highly heterogeneous aquifer in terms of hydraulic conductivity the model assumes it is homogeneous. This might be all right if there were data from a large number of bores in the target areas, with a significant time span of measurements, however this is not the case. When calibration is done to a single years observation it is little wonder the model turns out a favourable result.	The pumping tests undertaken were not considered reliable because of mud invasion of the SBS during drilling. Additionally the model is not sensitive to hydraulic conductivity, because the model is instead based upon watershed boundary conditions and water table elevation data were used for the model, as indicated above. It is noted that calibration was undertaken using data from three years, not one.

	Respondent (sub #)	Submission and/or issue	Response to comment
191	Public	The model predicts 100% intrusions of sea water at -12m AHD west of the marina, while it is capable of modelling intrusion at least 2 m intervals for the existing salinity conditions why is this not done for post construction salinity conditions? From the direction of flow of groundwater and the contours given in both pre and post construction maps it is likely that 80-90% of the groundwater flow that currently goes to the area west of the marina will be permanently cut off. So this area will be mostly dependant on rainfall for fresh water and so very susceptible to drought conditions particularly as the model suggests extensive seawater intrusion. The obvious conclusion is that sea water intrusion would 100% up to the 0m AHD on the western side of the marina. This is not an acceptable either in terms of assessment or result. The model does not extend out to the end of Cape Peron as it should, because it is a Tamala Limestone out crop, for this to be relevant then the clay layer thought to exist over the deep tamala limestone layer must extend all the way up the side of the out crop - there is no evidence for this, and it is exceedingly unlikely. As this area is currently fed by a ground water flow that is only marginally brackish according to the model, there will very likely be significant salt water intrusion in this area and so additional saltwater intrusion into the lower aquifer: this also requires modelling.	The SEAWAT model is not able to model intrusion at 2-m or smaller vertical intervals. It is able to model intrusion at midpoints of model vertical cells. A separate deliverable dated 28 September 2011 indicated post-construction salinity at -0.25 m (the midpoint of the first cell). The midpoint of the second cell (with increasing depth) is -12 m AHD. The SEAWAT software limits vertical representations to eight possible cells, and these must be applied over the 30-m overall model thickness involving multiple formations. Annex A, Figure 9 of the ERM report indicates that saltwater intrusion has already occurred at -12 m AHD to a great degree west of the marina, with values of 5 to 25 g/l, which make the water unfit for potable or irrigation uses. The model meets calibration criteria for acceptability. The model did include Cape Peron, as indicated in Figure 5 of the ERM report. The parameters used as inputs to the model from this Pt. Peron Limestone outcrop were presented in Annex D, Table 2. Annex A, Figure 9, as noted above, and indicates that considerable salinity is already present beneath Cape Peron.
192	Cockburn Sound Management Council Officer Submission	We have concerns with the data used to model the altered saltwater/freshwater inter-face near Lake Richmond. This has led to lack of confidence in the reliability of model predictions. Our main concern is based on a lack of explanation or rationale for the most critical north-western interface between Lake Richmond and the adjacent distal end of the proposed marina. Sampling has not described the heterogeneity of the Safety Bay sands and Tamala limestone, particularly with regard to hydraulic conductivity, complex differential flows at different depths and possibly salinity differences. The recent bore network data set is also too short in duration and it may not have captured conditions of a non-severe drought year as occurred in 2010-2011. Another year of sampling would have provided groundwater monitoring data that is not affected by severe drought conditions. This would have provided greater ambient average values and strengthened conclusions.	Additional monitoring will be undertaken prior to construction.

	Respondent (sub #)	Submission and/or issue	Response to comment
193	Cockburn Sound Management Council Officer Submission	Additional analysis of the modelling results is required to explain why the predicted long-term lowering of the water level in Lake Richmond (0.038 m decline) is small compared to the lowering of the water table within the MBM (0.5 m decline at the closest point to Lake Richmond). The existing mean water table elevation in the area of the MBM varies from around 0.1 m AHD at the shoreline to approximately 0.5 m AHD at the southern end of the MBM. A mean water table decline of up to 0.5 m is therefore predicted at the closest point of the MBM to Lake Richmond, which is approximately 500 m away. The predicted decline of lake level of 0.038 m is around 7-8% of the maximum potential mean water table decline of 0.5 m at the MBM. This seems to be quite small and is without explanation in the report; therefore, we suggest additional analysis and explanation of the modelling to provide more confidence in the predicted impact on Lake Richmond. There is insufficient information in the report to make a thorough assessment of this result but some thoughts are provided below. The margin of Lake Richmond is approximately 800 m from the existing shoreline, both to the north of the lake (Mangles Bay shoreline) and to the west of the lake (Shoalwater Bay shoreline). The closest point of the MBM will therefore be approximately 300 m closer to the lake than the existing shoreline; or in other words, the coastal boundary (0 m water table contour) will be around one-third closer at this location. Why then does the construction of the MBM have a negligible predicted impact on the lake level? Water table contours in Figures 6, 7 and 8 (ERM 2011) suggest that Lake Richmond fluctuates seasonally between a groundwater "flow-through" pattern and a groundwater "discharge" pattern. The real and predicted interaction between the lake and the aquifer is three-dimensional. Not only are the groundwater capture and release zones of the lake (that part of the aquifer contributing groundwater discharge to the lake, and the part that receives recharge from the lake, respectively), wider than the lake but they are also deeper than the lake. Lake Richmond is uncharacteristically deep compared to most lakes on the Swan Coastal Plain (the lakebed extends to a maximum depth of approximately -15 m AHD, which is approximately 70% of the aquifer depth). The capture and release zones of the lake are very likely to extend to the full depth of the SBS aquifer. . One possible explanation for the modelling results is that the lake water level is influenced more by the inflow of groundwater from the upstream capture zone to the southeast than by the shoreline boundary conditions, or perhaps it is influenced more by evaporation and evapotranspiration in the lake than by discharge to the remote coastal boundary.	A 0.038-m decline relative to a reduction of 0.5 m is more than an order of magnitude smaller than the 0.5-m decline. Thus, the 0.038-m decline was characterized as “small.” The Peer Reviewer derived similar results using less complex modelling tools. The models incorporated the geometries noted as well as other complex discharge/recharge functions, which cannot be properly represented in more simple analyses. Among other factors, near the MBM, the Safety Bay Sand aquifer thickness is reduced because of the presence of underlying saltwater wedge. Thus, any effect of dewatering (which can typically be depicted as a simple well function), becomes a steeper logarithmic curve when saline water underlies freshwater. The radial impact of the dewatering is consequently significantly reduced, as fresh water is caused to flow over top of saline water. This is a 3-D model, although the figures of necessity show data in two dimensions.

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194	Cockburn Sound Management Council Officer Submission	Two issues relating to model calibration data are noted. Thirty-year-old measurements of water table elevation from 1984-85 are used to calibrate the model without analysis of their suitability as calibration targets under existing groundwater conditions. Furthermore, measurements of groundwater salinity in seven monitoring wells that are screened in both the Safety Bay Sand (SBS) and Tamala Limestone (TL) aquifers are used, even though these measurements are unlikely to represent conditions in both of these aquifers because of the connection that has been made between them.	Additional monitoring was completed over a 12 month period by MWH and incorporated into the model.
195	Cockburn Sound Management Council Officer Submission	One possible additional risk not considered in the modelling report is the potential for temporary ingress of saline groundwater from the TL aquifer into the SBS aquifer during trench dewatering for the SDOOL. This could occur if local connections exist between the aquifers as a result of local discontinuities in the aquitard. An assumption is made throughout the modelling that the aquitard is continuous within the project area but this might not be the case.	Additional monitor wells will be installed prior to construction. However all monitor wells did intersect an aquitard between the TL and the SBS including the LR nest of bores later installed on the northeast margin of Lake Richmond.

	Respondent (sub #)	Submission and/or issue	Response to comment
196	Cockburn Sound Management Council Officer Submission	A number of technical aspects of the modelling are poorly documented in the modelling report. For completeness a brief list of technical information lacking in the reporting is given below. • The thicknesses of the main hydrostratigraphic unit (SBS, aquitard and TL) and the elevations of their upper and lower boundaries are not described. It is evident from Figures 5 and 10 (ERM 2011) that the units are probably modelled as having uniform thickness and horizontal contacts. It appears that the SBS-aquitard contact occurs at a depth of approximately -22 m AHD and the aquitard-TL contact occurs at a depth of approximately-25 m AHD. • There is no discussion regarding the sensitivity of predicted groundwater salinity and the saltwater interface position to variation of the assumed dispersion parameters. • The method used to simulate Lake Richmond is not described. Specifically: 1. How is the lake water body represented? 2. What are the recharge boundary conditions for the lake and how are they implemented; do they include direct rainfall, rainfall runoff and surface water inflow from the drain inlets? 3. What are the discharge boundary conditions for the lake and how are they implemented; do they include evaporation and surface water outflow to Cockburn Sound? • The model boundary conditions used to represent the marina during and following sheet piling, temporary wall construction and wet excavation are not described. • Similarly, the model boundary conditions used to represent trench dewatering for the construction of the SDOOL are not described. The time-varying groundwater recharge rate is also not described; for example, it is not clear whether seasonal variation of the groundwater recharge is assumed to be identical each year or varies each year according to seasonal rainfall.	Refer to Annex D, Table 2 of the ERM report for inputs used in the model to depict each unit, as well as Annex B, Figures 3 through 6 for cross-sections based upon bore logs. Groundwater salinity (except for legacy salinity) is based upon one consistent number, which is ocean salinity. Dispersion is considered by the authors of the SEAWAT model to be a much less significant factor than it is in routine groundwater modelling. Because the ocean salinity is relatively consistent, no sensitivity analysis is needed for the ultimate source of most of the salinity present. The dispersivity input of 1 m (see Annex D, Table 2) is not significant. This value is a model-calibrated parameter based on observed salinity data and is not subject to sensitivity analysis. Lake Richmond is simulated as an open water body with no boundary conditions. The boundary conditions for the model, because of the nature of the model, are the sea level on the west and the no-flow boundary (the groundwater divide) on the east. For the drainage basin as a whole, evaporation and precipitation are included in the modelling analysis. Please see Secs 3.2.1 and 3.2.2 of the ERM report for a discussion of equivalent recharge and helpful information on other aspects of modelling inputs. The text in these sections will answer the questions raised. The same equivalent recharge is used across the modelled area. The depth of MBM sheet piling and the timeframes and nature of dewatering were given in Section 1.1; the outlines of the water features to be excavated are shown in Annex A, Figure 1. The depths of SDOOL construction and the timeframes and nature of dewatering and excavation were given in Section 1.2. The proposed construction route for the SDOOL is shown in Annex A, Figure 1. Use of further localized assumptions as boundary conditions for the sheet piling or trench construction would introduce further uncertainty into the model.
197	Department of Water	The PER states *"that 2010 was a particularly dry year in the Rockingham area".* Therefore, further monitoring is required to provide a reliable groundwater dataset and to support the groundwater modelling. For a proposed large-scale marina development, with potential impacts to groundwater and Lake Richmond, a monitoring period in the order of five years is considered more appropriate. The ability to create a longer dataset by correlating site groundwater information to DoW long-term monitoring bores is limited as the closest is 3.5km from the site.	Additional monitoring will be undertaken prior to construction
198	Department of Water	Figure 10 does not illustrate all the bores described in section 6.2.3. Of the 16 bores installed for this proposal, none have been located in the Safety Bay Sands in the vicinity of Lake Richmond or within the high value groundwater dependent vegetation that is going to be retained. As such, there is limited data to consider impacts to these environmental assets. Bore DR16 is annotated on maps but it is not clear where this is screened and how long the data record is for that bore. In regards to salinity at local bores, actual data should have been obtained from City of Rockingham regarding the water quality of abstraction bores Wells 1, 7 and 8.	The LR bores described in the ERM conceptual model (27 June 2011) investigated the SBS on the northeast margin of Lake Richmond. Further census will be completed and data records accessed prior to construction.

	Respondent (sub #)	Submission and/or issue	Response to comment
199	Department of Water	Twelve of the 16 monitoring bores are located within the proposal area. Presumably some of these will be de-commissioned during the construction phase or are not positioned correctly to adequately monitor impacts to groundwater. New monitoring bores should be constructed and monitoring commenced prior to the construction phase. This should be reflected in the Construction Environmental Management Plan.	Agreed. Additional monitoring will be undertaken prior to construction.
200	Department of Water	With regard to groundwater levels, the PER describes a groundwater level variation for measured bores between 0.05 and 0.95 mAHD being comparable to surface water level variation in Lake Richmond over the same period. This infers groundwater levels vary seasonally by 0.9m, and is referenced further in the document in sections 6.3.4 and 6.3.5. This figure is incorrect as these two readings are taken from a low and a high level reading of two different bores. As illustrated in figure 9.1 – Groundwater levels of the *Draft Report – Cape Peron Groundwater Study* prepared by MWH, seasonal variability in each individual bore does not exceed ~0.3 m (in a dry year). In addition, discussion of groundwater levels should differentiate between the shallow Safety Bay Sands bores and the Tamala Limestone bores as they represent different aquifer units. The document lacks methodology for assessing the risk of impacts as has been used for similar proposals assessed by the OEPA. Based on the information provided, the proponents have not supported their claims that groundwater declines will not impact on GDEs.	It is agreed that the MWH groundwater monitoring report shows that seasonal water level variation in individual bores does not exceed ~ 0.3m. The actual water level variation in Lake Richmond was monitored for the same period by MWH and showed a variation of ~0.9m. The two sets of data are presented in different reports (MWH 2011 a and d). Unfortunately the PER indicated that the data were both presented in the one report (MWH 2011a). The extensive data set on water levels in Lake Richmond is reported in the MWH surface Water Monitoring report (MWH 2011 d). Our apologies for the confusion. Assessment of potential impacts on GDEs can be clarified using information presented in the PER and the ERM groundwater report. The PER indicates the location of TECs (figure 45) which are also GDEs. Reference to the ERM Groundwater Modelling Report shows that four groundwater monitoring bores are located within these TECs/GDEs (MB 7, MB 10, MB11 and MB 12). Figures 8 and 9 of the ERM report show the predevelopment groundwater contours and salinity distribution respectively. They show that lowest groundwater level in the vicinity of these bores is 0.2m AHD and salinity is less than 1g/L. Figures 22 and 23 of the ERM report present the modelled groundwater contours and salinity respectively during the operational phase of development subsequent to construction of the marina. These latter figures show that groundwater characteristics of the four bores located within the TECs/GDEs will not change markedly as a result of marina development. It is therefore assumed that GDEs will also be exposed to the 38mm reduction in water level towards the end of summer predicted for Lake Richmond. Given the short term nature of this reduction each year, it is considered likely that the vegetation will survive. Hence no significant adverse impact on GDEs is anticipated.

	Respondent (sub #)	Submission and/or issue	Response to comment
201	Department of Water (255)	Regarding the impacts of construction using wet excavation on groundwater bores, the seasonal variation of 0.9m described in the first paragraph, relates to the comment above in section 6.2.4. The variation of 0.9m is not from the same bore (the figure is taken across the entire series of 14 bores), therefore this bench-mark level cannot be used to justify changes in water levels during or post construction of the marina. Observing the high and low groundwater level from the same bore gives seasonal variation of up to 0.4m. Also, the 12 month dataset from a very dry period is not adequate to confirm a sites hydrological cycle. The comment that a 0.4m change in low water levels is generally less than natural variability and therefore a *"small impact"* is not valid. Natural variability and a decline in absolute minimum groundwater levels are not comparable hydro-ecological linkages (i.e., vegetation that experiences seasonal variability of two meters every year may not be able to tolerate a decline in minimum groundwater level of that amount). Furthermore, depending on the rate of decline and the baseline data used, a change in low water levels of 0.4m has a medium to high risk of causing impacts to groundwater dependent vegetation such as the TECs situated on shallow groundwater (Froend and Loomes, 2004). It appears that data collected during the 2010 monitoring period has been used to determine wet and dry baseline conditions. Because of the very dry conditions experienced during this period this will result in an under-estimation of predicted groundwater decline and thus an inaccurate indication of the potential impacts to the GDEs. Also within this section, an assumption was made regarding small lot sizes and the unlikely use of bores for households between Well 7, 8 and Rotary Park. However, block sizes vary with group housing and singular houses on blocks from 700m2 to 1100 m2 . Therefore, it is likely that many households between the wells and Rotary Park will have bores for irrigation, therefore using this assumption is misleading. An accurate groundwater use survey should be carried out across the proposal area as well as the area of influence to acquire a indicative understanding of all the groundwater users in the area.	Refer to previous response regarding water level variation in Lake Richmond and groundwater impacts to GDEs. Please refer to Appendix 4 of Strategen document "Response to Key Marine and Groundwater Issues Raised in Submissions on the Mangles Bay PER" for further detail regarding impacts to private domestic bores.
202	Department of Water	Regarding the impacts of operation on groundwater salinity that the proponent will develop a Groundwater Quality Management Plan to address impacts of changes in salinity on groundwater and its users. However, these potential impacts are pertinent to the assessment of environmental risk presented by this proposal. Therefore, issues pertaining to groundwater, the saltwater interface and Lake Richmond should be addressed to highlight the degree of impact, mitigation and relevant offsets.	The groundwater modelling shows Lake Richmond will not be impacted by groundwater salinity changes during or post development. For further information, please refer to Strategen document "Response to Key Marine and Groundwater Issues Raised in Submissions on the Mangles Bay PER" and Appendix 4 of Strategen document "Response to Key Marine and Groundwater Issues Raised in Submissions on the Mangles Bay PER".

	Respondent (sub #)	Submission and/or issue	Response to comment
203	Department of Water	The monitoring period for Lake Richmond that was used for this report was from January 2010 to March 2011 which was only 14 months. A dataset of only just over a year that includes only one winter peak and summer low is not considered sufficient to inform accurate conclusions regarding the potential impacts of the marina to Lake Richmond's hydrological regime and water quality. This limited data is also considered insufficient for hydrogeological modeling, hence there is inherent risk of inaccurate modeled outputs. As described in section 6.2.3 of the PER, 2010 was a particularly dry year. Thus it is recommended a longer period of monitoring is undertaken given the scale and nature of the proposal and proximity to sensitive receptors.	Other DoW records were used but realistically the use of the 2010 dry season records is a conservative approach and more applicable to future climate change scenarios.
204	Department of Water	Additional information is required regarding the method used to determine the reduction in lake level. If the historical average minimum is 0.2mAHD (MWH 2011) and modeled minimum groundwater levels is 0.1mAHD (as indicated in Figure 22), this equates to a reduction in minimum surface water levels of 0.1m, rather than the stated 0.032m.	The modelled reduction in level is cumulative on top of natural lake water level fluctuations i.e. 0.032 m additional drawdown to the lowest lake level of -0.1mAHD. The lake varies in levels between -0.1 and 0.85mAHD during the monitoring period.
205	Department of Water	No details are presented on the construction information for the bores providing historical local water level information ("DR bores"). "DR" monitoring bores have been used to calibrate the model. These bores appear to have been installed in 1983 to monitor the impacts of dewatering. These bores were only monitored for a period of 2 years. The report does not discuss if the data from these bores is representative of current groundwater conditions. The regional groundwater contours are likely to be derived from regional monitoring bores which in this area are "T" or Lake Thomson series monitoring bores. These bores are primarily screened in the Tamala Limestone or across both the Safety Bay Sand and Tamala Limestone. No direct reference is made to the location or construction details of any long term DoW regional monitoring bores in the vicinity of the proposal or in the modeling area. In addition, while the Rockingham Sand has been mentioned, no discussion has been made on the local relationship between it, the Tamala Limestone and any impacts on the saltwater interface.	The information used was derived from the DoW WIN database and referenced as such in the ERM report. By using this data in conjunction with the 2010 monitoring data, a reasonable understanding of current groundwater conditions is obtained. In fact the 2010 data on its own is probably more representative of future drier climate conditions.

<table>
<tr><th></th><th>Respondent
(sub #)</th><th>Submission and/or issue</th><th>Response to comment</th></tr>
<tr><td>206</td><td>Department of Water</td><td>ERM suggests the Safety Bay Sand (SBS) is separated from the Tamala Limestone (TL) by a 0.5m to 1.5m flat lying clay aquitard. This aquitard is believed to maintain the saltwater interface below the SBS. The following points relate to this suggestion:
• The occurrence of this layer is not reflected in the gamma logs. The gamma logs may have been cased which means they are not reliable indicators of lithological contrasts.
• The lithology logs were compared with the geological cross-sections which indicate the depth of the clay layer across the study area. The bores are super-imposed across the geological cross section. The lithology logs indicate most bores intercept sand (6 bores), silty sand (2 bores) or sandy silt (2 bores) at the depths at which the clay layer is drawn in the cross sections (Table 1). The lithology logs do not match the geological cross sections. In fact the only bore that penetrates clay at any depth is LR1.
• Evidence of the existence of the clay layer needs to be demonstrated e.g. plasticity tests, coring.
• Accession report 394-02 reports that the SBS and TL are both unconfined and are in hydraulic connection with each other in the vicinity of Secret Harbour which is south of the Mangles Bay development.

Table 1: Lithology logs for depths at which the clay layer is drawn in the cross sections.
<table><tr><th>Lithology</th><th>Sand</th><th>Silty sand</th><th>Sandy silt</th><th>Silty clay</th></tr><tr><td>Bores</td><td>MB05
MB09d
MB10
MB12
LR2
LR3</td><td>MB1
MB11</td><td>MB03
MB07</td><td>LR1</td></tr></table></td><td>Gamma and induction logs have been completed in the bores, as is appropriate for cased holes, and the aquitard clearly identified.
LR1 was the monitor bore subsequently installed and supervised by ERM and lithology recorded during drilling. However the downhole geophysical logs do indicate that a similar aquiclude was consistently intersected in all other monitor bores which extended to the TL.
The TL is unconfined west of the marina where it rises to the surface but elsewhere it is confined as evidenced by tidal influences on water levels.</td></tr>
</table>

	Respondent (sub #)	Submission and/or issue	Response to comment
207	Department of Water; Department of Environment and Conservation	The number and location of bores installed is considered insufficient to provide an adequate understanding of subsurface conditions and to constrain the conceptual model given the complexity of the site and scale of the project. In addition, there are insufficient monitoring bores outside the project area particularly surrounding Lake Richmond. Long bore screens through both the Safety Bay Sand and Tamala Limestone will not provide representative water levels. In particular, monitoring bores MB1, MB7, MB10, MB11 and MB12 are located in the vicinity of the mapped TECs. These bores have been identified as being inappropriately constructed by Rockwater (2011) and therefore not representatively monitoring water levels and water quality in the Safety Bay Sand aquifer supporting the TECs. These bores have not only cross-connected aquifers, but have screened both systems. As such, data sourced from these wells and presented in the PER may give misleading outcomes. This is of particular concern given the location of these wells in relation to TECs. These bores should be appropriately decommissioned in accordance with the *Minimum Construction Requirements for Water Bores in Australia (third edition*) produced by the National Uniformed Drillers Licensing Committee 2011. These bores should be replaced with ones that have been appropriately constructed as to provide ongoing monitoring with appropriately derived triggers and contingency actions. Nested multiple bores at the same site with narrow bore screens is the accepted method, preferably in transects across the saltwater wedge. In the existing bores, packers should have been used to seal off the rest of the bore screens when sampling to ensure the integrity of data collected	These are valid comments and appropriate actions have been recommended as indicated in prior responses.
208	Department of Water; Department of Environment and Conservation	The limited duration of monitoring (12 months) is insufficient to inform a project of this scale, particularly as the data was collected during a particularly dry period. This has been used to define baseline maximum and minimum conditions. This creates a high degree of uncertainty in the understanding of the system and the outcomes of the modeling. The limited duration of monitoring has previously been raised by the DoW in response to the Environmental Scoping Document. It is recommended that a longer dataset (optimally five years) is collected to provide a higher degree of certainty and to be consistent with other proposals of this nature and scale which have been through the PER process in recent times.	Monitoring is planned to continue as is the installation of additional monitor bores. Further information is included in Strategen document “Response to Key Marine and Groundwater Issues Raised in Submissions on the Mangles Bay PER” and Appendix 4 of Strategen document “Response to Key Marine and Groundwater Issues Raised in Submissions on the Mangles Bay PER”.
209	Department of Water	Due to the limited results obtained from the pump testing attempts, no site specific aquifer parameters have been collected to support the conceptual and numerical model. Neither the *Groundwater Modeling and Impact Assessment Report* (ERM, 2011) nor the *Revised Conceptual Model Report* (ERM, 2011) describe heterogeneity of the safety bay sand and how that relates to vertical and horizontal flow. However, the adopted horizontal hydraulic conductivity values used in the model for the Safety Bay Sand are within published values but the values used for the Tamala Limestone are significantly higher	Gamma and induction logs have been completed in the bores, as is appropriate for cased holes, and the aquitard clearly identified. LR1 was the monitor bore subsequently installed and supervised by ERM and lithology recorded during drilling. However the downhole geophysical logs do indicate that a similar aquiclude was consistently intersected in all other monitor bores which extended to the TL. The TL is unconfined west of the marina where it rises to the surface but elsewhere it is confined as evidenced by tidal influences on water levels.

	Respondent (sub #)	Submission and/or issue	Response to comment
210	Department of Water	Using the *Murray Darling Basin Commission Groundwater Flow Modeling guideline*, (Aquaterra Consulting Pty Ltd, 2000), the following comments are made in relation to the SEAWAT model: • No calibration or sensitivity analysis of the Tamala Limestone has been undertaken. The justification for this is tidal fluctuation however limited data has been collected to support this statement. If this is the case, the amplitude over time should be documented. • The lack of sensitivity of the Safety Bay Sand to hydraulic conductivity change has not been discussed and requires explaination. • A conceptual and volumetric water balance has not been provided. A water balance not only provides a diagrammatic indication of the major components of the system and demonstrates an understanding of the conceptual model and consideration of all fluxes, it also provides a tool for measuring model calibration performance. • Hydrographs showing modelled vs actual and predicted water levels for each monitoring bore should be provided particularly in the vicinity of the TECs. • Groundwater modelling should include future climate scenarios as suggested in DoW comments relating to the Environmental Scoping Document. • Groundwater use does not appear to have been incorporated into the modelling. The incorporation of cumulative abstraction inputs would improve confidence in the scenarios. • Modelled salinity distribution under existing conditions at various depths have been provided however modelled estimates of salinity post marina construction with depth have not been provided.	Under the wet excavation scenario and also recognising the strong tidal influence on water levels in the TL, calibration and sensitivity analysis of the TL was not considered appropriate or necessary. The model sensitivity is mainly influenced by recharge rather than the kh of the SBS. There will be no groundwater abstraction during marina construction. A major flux to Lake Richmond is from the two stormwater drains – the main SE inlet drain extends east to the Rockingham Shopping Centre and the second NE inlet drain to the Rockingham Senior High School. The groundwater abstractions and stormwater drains are components which are completely unrelated to the marina development as are the impacts of future climate change scenarios and have not been included in the groundwater model. Salinity at -12 mAHD has been modelled and presented for the post marina development construction.
211	Department of Water	The information in regional groundwater use section is contradictory to the information contained within the PER document. The assessment of domestic use appears incomplete and does not make any effort to quantify domestic bore users. The assumption that licensed irrigation bores in the area are screened in the Rockingham Sand or Leederville formation is incorrect and made without evidence to support the statement. This information should have been obtained from the DoW and the City of Rockingham should be contacted for the screened interval for the bores irrigating public open space. All bores are licensed to the superficial aquifer (therefore could not be taking from the Leederville Aquifer) and the majority of bores do not exceed 15m depth. A basic assessment has identified 23 licensed drawpoints with a total abstraction volume of 317,450kL within 2 km of proposal. This has been appropriately discussed in the PER document.	42 abstraction bores under 23 licenses are recognised within 2 km of the marina. It is agreed that further definition of the aquifers being utilised is required. Further census work is proposed prior to construction commencing.
212	Department of Environment and Conservation	The proponent should use the computer program SEAWAT for modelling instead of the Finite Element Subsurface Flow System model, as SEAWAT is a more widely accepted industry standard for doing numerical modelling of saltwater-freshwater interfaces in an area with complex geometry, such as a marina with canals.	SEAWAT has in fact been used for the 3D modelling.

	Respondent (sub #)	Submission and/or issue	Response to comment
213	Department of Environment and Conservation	Further work should be undertaken to determine the degree of up-coning (induced rise of the saltwater-freshwater interface) that could be tolerated in the system before Lake Richmond becomes susceptible to saltwater intrusion. This work should form the basis of trigger levels or management targets that could guide the ongoing management of the lake, and the conservation of TECs and habitat values.	A simple modelling exercise demonstrates that the toe of the seawater wedge does not extend more than 200 m east of the marina (more than 400 m from Lake Richmond) and the lake is not susceptible to seawater intrusion.
214	Department of Environment and Conservation	The proponent assumes that the hydraulic conductivity of the Safety Bay Sands is homogenous and does not vary. This is potentially an incorrect assumption, as it is very likely that conductivity across the aquifer is variable.	This is recognised and an average value for hydraulic conductivity adopted. A sensitivity analysis indicates that variable kh does not materially influence the model output.
215	Department of Environment and Conservation (260)	A preliminary assessment of the movement of the saltwater-freshwater interface carried out using the Glover Analytical Solution (Domenico and Schwartz 1990) suggests that the position of the saltwater-freshwater interface beneath Lake Richmond may be very sensitive to the geometry of the canals and marina, and to recharge and groundwater use in the catchment area. The analysis suggests that under current rainfall conditions, the depth of the saltwater freshwater interface could rise by about 1.2 metres near Lake Richmond. Additionally, if local average rainfall declined by about 25 per cent, the interface could rise by a further 1.3 metres, resulting in a total rise of 2.5 metres. Increase in groundwater use in the area could also cause the interface to rise further. Calculations carried out with the Glover Analytical Solution suggest that Lake Richmond may become less resilient to changes in the water balance of the catchment after construction, particularly if there is a substantial decline in freshwater flow due to increased bore use or a decline in rainfall. Using the Dupuit-Ghyben-Herzberg Principle, the saltwater-freshwater interface is likely to rise by about 40 times the water level decline, or by about 1.2 metres in the superficial aquifers. This rise is the same as that predicted using the Glover Analytical Solution.	The bed of Lake Richmond is at maximum depth -13 mAHD. Salinity at the base of the SBS adjacent to the lake at -20 mAHD is EC 3,000 and in the TL is up to 13,000. The SBS is separated from the TL by an aquitard (see previous comment on tidal response of TL water levels) and the seawater wedge is at least 400 m from the lake. The predicted scenario in this comment is therefore invalid.

7. Terrestrial fauna and flora

7.1 Fauna

	Respondent (sub #)	Submission and/or issue	Response to comment
216	Public; Dr van Keulen; Preserve Point Peron for the People.	What is the consequence or risk of reduced habitat availability and connectivity for those species remaining in the Bush Forever area? Fragmentation is a serious issue and there is little option for nearby resettlement.	The faunal assemblage at the site is considered typical of the area. The five EPBC Act listed birds observed in the fauna survey are Migratory, and are likely to use the site on a transitory basis. One reptile of conservation significance (P3) was found. Initial clearing/development of any area is likely to cause the direct or indirect (e.g. loss of cover causing increased rates of predation) death of sedentary fauna species, mostly frogs and small reptiles. Birds and highly mobile species such as macropods are likely to move into adjacent bush. However, it is unknown whether they can establish populations/home ranges in habitat that is occupied by other resident species. The overall size of fauna populations at the site is likely to be reduced, though some species may adapt to reside in higher densities in the modified habitats that are produced as a result of the Proposal. Additionally some opportunistic species may even immigrate into the study area following implementation of the Proposal. These are likely to be generalist species, or species positively affected by increased water points (e.g. frogs, some birds/granivores, possibly macropods, and lizards/reptiles).
217	Public; Urban Bushland Council	The coastal landforms in the Swan Coastal Plain region are especially rich in species and populations of herpetofauna (refer the work of How and Dell). The Strategen report clearly identifies several species of fauna which utilise or have the potential to utilise this site. Even good to degraded condition vegetation provides some habitat value and what is more important overall is the maintained connectivity and cohesion of the site to continue to support these species. The increase in people and pets poses a risk to the wildlife in the conservation estate. These populations are more likely to be intact even in the disturbed and degraded areas of the Bush Forever site. The UBC therefore recommends that the habitat for this herpetofauna at Pt Peron is a **critical asset** to be retained and protected in its entirety in the Bush Forever site. Notably these populations may be quite intact even in the disturbed and more degraded vegetation of the Bush Forever site.	Statistical analysis of the ENV (2011) survey indicated that herpetofauna surveys were representative of abundance in the Proposal Area. The overall size of herpetofauna populations at the site is likely to be reduced, as a result of the Proposal; however, given the small scale of impact, the commonality of the habitat within the survey area and wider surrounds no net regional impacts to herpetofauna are expected. A number of management measures identified in Section 9.6 of the PER will be implemented to minimise the impact of both the Proposal construction and operation phases on the on fauna.

	Respondent (sub #)	Submission and/or issue	Response to comment
218	Urban Bushland Council	*Lerista lineata* is listed as a Priority 3 species, which means it requires further survey before its conservation status can be definitely determined. This species could be at risk by loss of habitat. It is not acceptable to lose habitat for this species without knowing its status. An independent survey, funded by Government, of the Perth Lined Skink should be carried out in the region.	The Lined Skink persists even in small remnants of native vegetation and may exist in gardens where soils are sandy (Bamford 2005). The Skink is also found in the Port Kennedy Scientific Park (DEC 2010a). The Proposal will remove 34.2 ha of the Skink's preferred Coastal Heath Habitat. However, extensive areas of this habitat will remain adjacent to the Proposal area within the RLRP and Port Kennedy Scientific Park, approximately 5 km to the south of the site. It is therefore considered that the Proposal will have a minor impact on the Skink. Additionally up to 47 ha of the Coastal Heath Habitat is proposed to be rehabilitated in the vicinity of the Proposal area, which will increase the potential habitat for this species.
219	Urban Bushland Council	The IUCN Red List notes that the population trend of the carpet python is 'decreasing.' The conservation status of the species is listed as Schedule 4 and the species is specially protected under the Wildlife Conservation Act 1950`. Loss of populations of the Carpet Python are totally unacceptable.	Carpet Python was not observed during fauna investigations; however the species is considered likely to occur in the Proposal area. Initial reduction in habitat may have a minor impact on Carpet Python individuals; however, a number of management measures identified in Section 9.6 of the PER will be implemented to minimise the impact of both the Proposal construction and operation phases on the carpet python such as: • relocating individuals prior to clearing where practicable • providing suitable areas as conservation offsets including the rehabilitation of up to 54 ha of native vegetation in the vicinity of the Proposal
220	Urban Bushland Council	*Ctenotus gemmula* was considered for the IUCN Red list of Threatened Species. While it has been assessed as 'Least Concern' there is a rider that "Monitoring of the species should be carried out because if threat levels increase, significant population declines may occur." This should occur regardless of whether or not the proposal proceeds.	The same source also states that habitat loss does not appear to be causing a significant decline of this species to warrant a threat category. Should the Proposal be implemented, monitoring of fauna will be considered to assess if threat levels to this species are increasing.

	Respondent (sub #)	Submission and/or issue	Response to comment
221	Urban Bushland Council (127) Public (194)	The population trend for *Isoodon obesulus* under the IUCN list is 'decreasing'. Quenda survival depends on an adequate home range of up to 7 ha for males and about 2 ha for females. (Cronin; *Australian Mammals).* The PER suggests that *Isoodon obesulus Fusciventer* (quenda) favours wetland habitat over coastal shrubland and thus will benefit from the development. In fact Quenda are known to occupy a number of habitats including coastal shrubland as evidenced by several recordings across the Swan Coastal plain (Nature Map, Ecoscape 2009). Indeed this species is known to be territorial and a presumption that individuals living in the coastal shrublands can simply move into the Lake Richmond area fails to acknowledge any existing populations within Lake Richmond and the impact on competition between individuals for shelter, food and reproductive partners. It is well known that female Quendas in times of stress will eject their young from the pouch. In other developments Quenda have been relocated eg from Fiona Stanley Hospital site, Murdoch, but the areas to where they have been relocated are probably already occupied. We believe that loss of habitat for this species is another reason that the proposal is environmentally unacceptable and should be rejected.	The Proposal will result in a small reduction in Quenda habitat due to clearing of 34.2 ha of Coastal Heath habitat. Up to 47 ha of the Coastal Heath habitat is proposed to be rehabilitated in the vicinity of the Proposal area, which will provide viable habitat for this fauna. The proximity of this rehabilitation area to Lake Richmond and improvement of linkages to the water body is considered likely to mitigate the impact to this species by the Proposal.
222	Urban Bushland Council; Public; Friends of Point Peron	The 2011 results of the Great Cocky Count conducted on 7 April 2011 found that numbers of Carnaby's Cockatoo have declined by 34% on the Swan Coastal Plain and average roost sized has also declined. The four follow-up monthly surveys carried out following the Great Cocky Count confirmed the population decline. The Point Peron Bush Forever site and the proposed development area has some tuart and these are Carnaby's habitat. In addition, there has been a significant increase in foraging black cockatoos in tuart, acacia woodlands and on sheoaks in the suburbs of Rockingham, Peron, Shoalwater and Safety Bay over the last 18 months, particularly at Lake Richmond. The PER states that for Black cockatoos no foraging habitat exists within the proposal site as no Banksias, Marris or Jarrahs are present. This is in fact incorrect as detailed in recent guidelines produced by SEWPaC 2011 which acknowledged that Tuarts are a food source. Black cockatoos appear to be establishing new territories in the local area and the preservation of all remaining tuart woodland sites in the Rockingham region is essential to the long-term preservation of the species, particularly given the large scale loss of tuart woodland on the Swan Coastal Plain and the recent loss of the Baldivis pine roost. Up to 1000 birds are now displaced as a result.	Noted. Table 21 of the PER also states that the Proposal does not propose to clear any tuart species. Subsequent to the PER being published, a survey for Black Cockatoo habitat was conducted. The survey found several potentially suitable habitat trees. These trees were also the subject of investigations by the Water Corporation, and a subsequent application for removal to SEWPaC, as part of the SDOOL realignment. This action has already been approved by the EPA and SEWPaC as advised by the Water Corporation and does not form part of the Proposal.

	Respondent (sub #)	Submission and/or issue	Response to comment
223	Department of Environment and Conservation (260); Urban Bushland Council; Public	Information presented in the PER is inconsistent in relation to the clearing of trees that may be potential habitat for the threatened Carnaby's black cockatoo. On page 312, the proponent indicates that there will be no clearing of individual tuart trees, however on page 440 the proponent states that *"Clearing of approximately 1 ha of woodland assessed as providing potential roosting habitat for Black Cockatoo species"* will occur. This inconsistency should be clarified, and impacts on black cockatoo habitat avoided.	As above
224	Public; City of Rockingham	The proponent proposes to relocate fauna however they haven't properly surveyed the area and where would they relocate them to. Has habitat availability been assessed at this new location to ensure that it has capacity for an increased population? More detail needs to be provided on conservation significant relocation programs, specifically for species such as the quenda and lined skink.	A detailed construction environmental management plan will be developed. This will include consideration of fauna surveys and trapping methods for subsequent relocation of fauna in consultation with the DEC.
225	Public	No survey has been conducted to determine the impact of the proposal on amphibian populations particularly for reduced habitat availability and increased mortality due to traffic.	No conservation significant amphibians are expected to potentially occur or were recorded as occurring in the Proposal area (ENV 2011a). A number of management measures identified in Section 9.6 of the PER will be implemented to minimise the potential impact of both the Proposal construction and operation phases on amphibians and other terrestrial fauna. In addition, the surrounding areas (including Lake Richmond) will continue to provide habitat for amphibian species.
226	Public	Insufficient invertebrate surveys have been conducted as it has not been determined whether the priority listed bee and cricket species are associated with this site.	A desktop study of potential invertebrate fauna abundance was undertaken by Bamford (2005) as a component of the terrestrial fauna assessment. No threatened invertebrates were identified within the search area investigated (Bamford 2005). Despite the absence of species, Bamford (2005) identified the following five species of conservation significant invertebrate fauna as having been recorded east of the study area: • *Synemon gratiosa* (graceful sun-moth) – Schedule 1 (WC Act); Endangered EPBC Act 1999 (C'wlth). • *Neopasiphae simplicio*r (native bee) – Schedule 1 (WC Act); .Critically Endangered EPBC Act 1999 C'wlth). • *Leioproctus douglasiellus* (native bee) – Schedule 1 (WC Act). • *Throscodectes xiphos* (cricket) – Priority 1 (WA DEC). • *Hylaeus globuliferus* (bee) – Priority 3 (WA DEC). With the exception of the GSM, all species appear to be associated with understorey species of Banksia woodland that is not present within the study area (Bamford 2005).

	Respondent (sub #)	Submission and/or issue	Response to comment
227	Public; Hon Lyn MacLaren MLC; Urban Bushland Council	The impact on key host flora (*Lomandra maritima)* will have a direct impact on the conservation and preservation of federally listed endangered Graceful Sun Moth (GSM). *Lomandra maritima* is not a species readily propagated in restoration activities and the ability of this plant to be successfully re-integrated into a rehabilitation project is largely unknown. Impacts of vegetation clearing on high density areas of *Lomandra* sp. are unacceptable for the long term survival of this moth species in a local context. The argument in table 22 that GSM habitat is already fragmented and thus there is no impact on the population is flawed when in fact additional clearing will only further place this population at risk. Table 23 suggests that the regional population is unlikely to be impacted. This statement needs to be justified as this species is known to be under significant threat from habitat loss and populations are known to be greatly reduced and highly fragmented (DEWHA 2009).	Only one individual GSM was recorded within the Proposal area. Nearby areas have been subject to more extensive GSM surveys (for example, Scientific Park) and have recorded more abundant instances of GSM. This justifies the statement that the regional population will not be at risk. Further to this, the Proponent is willing to offset impact to GSM habitat through research into species conservation at Scientific Park, or other suitable habitat areas.
228	City of Rockingham	It is noted that the PER does not mention seasonality of faunal assemblages and therefore potential variability of biodiversity in the Proposal area. The level 2 field survey that occurred within the Proposal area was a single season (spring) investigation. It is recommended that further investigations are undertaken and details provided to the EPA on seasonality of faunal assemblages.	Due to the survey being conducted during the 'spring' season of the Swan Coastal Plain the number of recorded species was acceptable, compared to the potential number recorded in other times of the year. The warm climatic conditions at the time of the survey resulted in a good representation of ground dwelling reptiles and mammals being recorded. All ENV surveys were conducted according to EPA guidance for terrestrial fauna surveys.
229	Cockburn Sound Management Council Officer Submission	It would be desirable for voids that become exposed due to construction to be assessed for stygofauna or troglofauna.	Subterranean fauna is assessed in Section 21.2.1 and 21.2.2 of the PER. It was concluded that it is unlikely that development of the Proposal at Mangles Bay will threaten persistence of any species of stygofauna as the spatial extent of the impacts associated with the Proposal will be very small at the scale of which species are likely to be distributed (Bennelongia 2011). The impact footprint is not expected to exceed 75 ha; thus, the spatial extent of impact footprint is several orders of magnitude less than the likely range of a restricted stygofauna species. To provide context, Harvey (2002) defined SREs as species with ranges <1,000,000 ha. Subterranean Ecology (2010c) found that there is a very low likelihood of troglofauna being present at the Proposal area and impacted by the Proposal. For this reason no further troglofauna investigations (surveys) have occurred.
230	Department of Planning	The DEC should be consulted on whether clearing shoreline habitat and coastal vegetation will significantly impact fauna species.	The DEC have been and will continue to be consulted by the Proponent to discuss and address (where practicable) issues of vegetation clearing.

	Respondent (sub #)	Submission and/or issue	Response to comment
231	Department of Environment and Conservation (260)	The proponent has understated the fauna conservation value of the Cape Peron area. DEC considers the Cape Peron area to be regionally significant fauna habitat with the highest fauna assemblage of comparable sites on the Swan Coastal Plain. A number of range limited conservation significant fauna are likely to be impacted by development within the proposal area. These include: • the Priority 3 listed species jewelled ctenotus *{Ctenotus gemmula),* lined skink *(Lerista lineata)* and black-striped snake *(Neelaps calonotus);* • the Priority 5 listed quenda *(Isoodon obesulus fusciventer),* which has a noted decline over the past two years in the Swan region; • migratory birds listed under Schedule 3 of the Wildlife Conservation (Specially Protected Fauna) Notice 2012; and, • the specially protected carpet python *(Morelia spilota imbricata)* listed under Schedule 4 of the Wildlife Conservation (Specially Protected Fauna) Notice.	While desktop studies identified that the listed species had the potential to occur within the Proposal area, further assessment on the likelihood of their presence in the Proposal area was undertaken based on fauna surveys. Table 25 of the PER outlines the potential impact to these conservation significant species. A number of management measures identified in Section 9.6 of the PER will be implemented to minimise these potential impact of both the Proposal construction and operation phases on terrestrial fauna,

7.2 Flora and vegetation communities

	Respondent (sub #)	Submission and/or issue	Response to comment
232	Public; Wildflower Society of WA	The limestone to sandy tombolo transition is the only one of its kind for remnant bushland in south western Australia. There are no other tombolos south of Rockingham and as such it has a unique assemblage of vegetation overlapping floristically with other Quindalup Dune assemblages. What is important is the maritime setting in which calcareous Quindalup Dunes are directly juxtaposed against the Pleistocene limestone. Elsewhere to the north where similar landscapes are present, there is not the direct limestone to sand transition in a relatively low and there is not the same carbonate to quartz ratio. Also as one progresses north, there is a change in vegetation floristically. This makes the area in question distinct and unique in SW Australia floristically.	Tombolos (strips of sandy land connecting an island to the mainland) are not given environmental protection status. The significance of the Quindalup Dune assemblage is thoroughly discussed in the documentation. In all reports: Keating & Trudgen (1986), Bennett (2005) and ENV (2010), particular mention is made to the Point Peron area being toward the northern geographic ranges for some flora – e.g.: *Diplolaena dampieri*. In the summary of the ENV report (2010), it is advised that the Quindalup Dune assemblage is of state significance and in the recommendations (ENV 2010) this and other communities found on site are considered to be of state significance and should be taken into consideration regarding any development.

<table>
<tr><th></th><th>Respondent (sub #)</th><th>Submission and/or issue</th><th>Response to comment</th></tr>
<tr><td>233</td><td>Wetlands Conservation Society; Dr van Keulen; Urban Bushland Council; Public</td><td>There is the potential for the development to disrupt the hydrology of the bushland; changes to local drainage can result in changes to micro-habitats which host pockets of specific flora and fauna. Changes in groundwater conditions, resulting from increased salt water intrusion, will be expected to impact the root zones of coastal trees, affecting tree health and consequently the integrity of coastal vegetated ecosystems. Although saltwater intrusion and 'salt entering the root zone of potentially salt sensitive native species' is flagged as an issue (p72) there is no assessment of the extent or effects of this in section. However while salinity changes outside the proposal area has not been assessed it does not stop the proponent making unsubstantiated comments such as 'vegetation outside the area to be cleared is not expected to be impacted (Section 8.4).' p168 The proponent has also not considered climate change and these effects will be exacerbated by future sea level rises. More accurate groundwater modelling that takes into consideration predicted sea level rises will help in understanding the likely impacts on coastal vegetation; the information obtained thus far appears inadequate to fully predict these impacts. The effect on the long term health and survival of coastal trees and the risk of compromising the integrity of the retained bushland within the development doesn't appear to have been considered.</td><td>Salt water intrusion is predominant beneath the footprint of the marina and immediately adjacent. Along the foreshore away from the marina the wedge at most will only move marginally inland and the toe of the wedge will be at about -20 mAHD, well below the root zone of GDEs.
Sea level rises and any related impacts on coastal vegetation are unassociated with the marina development.
ENV (2010) presents a table (shown below) with the list of species that are potentially susceptible to ground water changes, and discusses the potential sensitivity to groundwater conditions. The species listed are either, those that are known wetland species e.g.: Ficinia nodosa; or those that occur in maritime environments and are obviously tolerant to water tables that contain higher levels of salt e.g.: Lepidosperma gladiatum.
These comments are based on habitat preferences.
<table>
<tr><th>Family</th><th>Species</th><th>Susceptible to Changes in Groundwater Levels</th><th>Susceptible to Changes in Groundwater Quality</th></tr>
<tr><td>Cupressaceae</td><td>Callitris preissii</td><td></td><td>X</td></tr>
<tr><td>Poaceae</td><td>Spinifex hirsutus</td><td>X</td><td></td></tr>
<tr><td>Poaceae</td><td>Spinifex longifolius</td><td>X</td><td></td></tr>
<tr><td>Cyperaceae</td><td>Ficinia nodosa</td><td>X</td><td></td></tr>
<tr><td>Cyperaceae</td><td>Lepidosperma gladiatum</td><td>X</td><td></td></tr>
<tr><td>Cyperaceae</td><td>Lepidosperma sp. Coastal Dune (R. J. Cranfield 9963)</td><td>X</td><td></td></tr>
<tr><td>Restionaceae</td><td>Desmocladus flexuosus</td><td></td><td>X</td></tr>
<tr><td>Myrtaceae</td><td>Agonis flexuosa</td><td>X</td><td></td></tr>
<tr><td>Myrtaceae</td><td>Eucalyptus gomphocephala</td><td>X</td><td></td></tr>
<tr><td>Myrtaceae</td><td>Melaleuca lanceolata</td><td>X</td><td></td></tr>
<tr><td>Frankeniaceae</td><td>Frankenia pauciflora</td><td>X</td><td></td></tr>
<tr><td>Epacridaceae</td><td>Leucopogon parviflorus</td><td></td><td>X</td></tr>
</table></td></tr>
</table>

	Respondent (sub #)	Submission and/or issue	Response to comment
234	Urban Bushland Council	Destruction of any part of FCT30b is an unacceptable impact and should not be permitted. Tuart has been extensively cleared for developed and is still suffering serious decline/	Noted. Table 21 of the PER also states that the Proposal does not propose to clear any tuart species. Subsequent to the PER being published, a survey for Black Cockatoo habitat was conducted. The survey found several potentially suitable habitat trees. These trees were also the subject of investigations by the Water Corporation, and a subsequent application for removal to SEWPaC, as part of the SDOOL realignment. This action has already been approved by the EPA and SEWPaC as advised by the Water Corporation and does not form part of the Proposal
235	Urban Bushland Council	Any risk to disturbance of water levels and water quality, both in terms of nutrients and especially salinity is totally unacceptable due to the potential to impact FCT19.	Historical evidence shows extensive changes to the water level and quality of Lake Richmond, with minimal impacts on thrombolites and FCT19. It is considered that this risk is very minor, given the variable water level history of Lake Richmond. In addition, water levels can be manually manipulated through changes to the weir, thus avoiding any change in water level that may impact vegetation.
236	Public (144)	The clearing of this area of Bush Forever is in contravention to all 10 of the clearing principles	Any clearing of Bush Forever will be offset through land acquisition and rehabilitation in accordance with EPA and DEC guidance.
237	Public	The statement that “approximately 48% of the pre-European extent of the Quindalup Complex remains in the metropolitan area and 5.2% meets IUCN reserve criteria” is taken out of context. It is now acceptable that 30% of an original ecosystem must be maintained to ensure its health and survival. This vegetation complex is highly fragmented in the city and not adequately protected. Removing 40% of the vegetation in the local area will have a huge impact.	The PER assessment refers to the most current documentation available on Bush Forever, and is therefore current and correct as far as practicable. Given that the clearing of Bush Forever will be offset by rehabilitation and land acquisition in accordance with DEC and EPA policy, this is not considered to be a significant environmental issue.
238	Public (194); Friends of Point Peron	This proposal specifically targets areas of high quality vegetation (figure 49 p121). 70.4% of vegetation categorised as very good is within the project area and will be cleared, with only a very small proportion classified as good being retained in the project area. This is defined as '*Development will result in the clearing of up to 40 ha of remnant vegetation which has experienced varying degrees of disturbance, including extensive weed invasion* (p132). Over 80% of the project area contains vegetation categorised as good to very good (p 114). Contained within the area to be cleared, is about 40% of the graceful sun moth habitat including almost 60% of the area of densest habitat (p153), leaving mostly habitat of relatively low quality. This development makes a mockery of Bush Forever and will leave only a mostly depauperate open space. The economics of ecosystems and biodiversity from a major global study draws attention to the tangible benefits of biodiversity and to highlight the growing costs of biodiversity loss and ecosystem degradation (Nature Vol 462/19 Nov 2009).	Any clearing of vegetation for the marina development will be offset through land acquisition and rehabilitation in accordance with EPA and DEC guidance.

	Respondent (sub #)	Submission and/or issue	Response to comment
239	Public	The Bush Forever survey undertaken by Keating and Trudgen in 1986, which resulted in 60% of the flora taxa being sampled with no significant species being found, does not take into consideration recent identified relationships between flora species which may in themselves, not be significant but which support fauna which are significant and under threat such as the Graceful Sun Moth.	Fauna surveys, including GSM surveys, have been conducted in the Proposal area and potential impacts to relevant conservation significant fauna are identified and assessed in Section 9 of the PER. Further to this, the Proponent is willing to offset potential impacts to fauna through land acquisition and rehabilitation, and specifically to GSM through research into GSM conservation at Scientific Park, or other suitable habitat areas.
240	Public; Cockburn Sound Management Council Officer Submission	There is insufficient attention to terrestrial ecosystem services that are currently provided by the habitat areas that will be lost through development. Some are relatively high quality and some are semi-degraded. A quantitative assessment of these losses would help to enable the true environmental impacts of the proposal to be gauged. What is the consequence of loss of larger plants (due to poor water quality) on the remaining ecosystem structure and function?	Flora and vegetation within the Proposal area has been studied and the potential increase in groundwater salinity is not anticipated to impact any vegetation communities that are not already expected to be affected by clearing of habitat. Clearing of habitat and indirect loss of habitat by change in groundwater quality will be offset through rehabilitation and land acquisition.
241	Department of Water	The specific risk to impacts to groundwater dependent vegetation should also be addressed by the proponent. The Department believes there is insufficient information provided within the PER to conclude that groundwater declines will not impact upon Lake Richmond, other GDEs, groundwater users and other environmental values of groundwater.	Refer to response to submission 200 regarding assessment of groundwater impacts on GDEs. The impact of groundwater impact on the Lake Richmond thrombolite community is addressed in Appendix 4 of Strategen document "Response to Key Marine and Groundwater Issues Raised in Submissions on the Mangles Bay PER". 42 abstraction bores under 23 licenses are recognised within 2 km of the marina. It is agreed that further definition of the aquifers being utilised is required. Further census work is proposed prior to construction commencing.
242	Department of Water	The predicted decline in lake level due to the decrease in groundwater levels caused by the proposed marina (for the mean impact scenario – table 11) is likely to cause an additional 1.3ha of exposed area that was previously inundated. That is quite a large area and may impact upon TECs, GDEs and fauna (aquatic and terrestrial) associated with the lake. Also, the modelled reduction in groundwater of 0.032m and 0.038m will result in a loss of range of the two TECs (FCT 19 Sedgelands in Holocene dune swales and Thrombolites) as they both require periodical inundation and the high water mark is expected to be reduced. Whilst it is acknowledged that the area is small, an estimate of the loss of habitat for these TECs against the current extent should be documented.	An assessment of the impact of the predicted water level reduction on the thrombolite community of Lake Richmond is presented in Appendix 4 of Strategen document "Response to Key Marine and Groundwater Issues Raised in Submissions on the Mangles Bay PER". This impact prediction is supported by Professor Lindsay Collins of Curtin University. Refer to the response to submission 200 regarding the likely effect on TECs/GDEs.
243	Urban Bushland Council; Hon Lyn MacLaren MLC	Rottnest Island pine is killed by fire and is very slow growing, and is restricted to a very small number of locations including Garden and Rottnest Islands. Destruction of any area of FCT30a, particularly one in a conservation reserve, is not an acceptable impact, particularly given the nature of the species.	Historical evidence shows that the particular area of FCT30a has been damaged by fire, cleared, and has rehabilitated very well in both circumstances. This shows resilience in the FCT30a in the Proposal area. Regardless, the proponent has reduced the impact by clearing on the FCT30a in the Proposal area, and is prepared to offset a very small amount of proposed clearing with an equal amount of rehabilitation. This rehabilitation will increase connectivity of the FCT30a habitat at the site, and the proven resilience of FCT30a in the area predicts rehabilitation success.

	Respondent (sub #)	Submission and/or issue	Response to comment
244	Department of Environment and Conservation (260)	*Callitris preissii* (or *Melaleuca lanceolata*) forest and woodlands of the Swan Coastal Plain have been substantially reduced in the Perth metropolitan region and exist in only small remnants along the coast and on Garden and Rottnest islands. Direct impacts on the *Callitris preissii* (or *Melaleuca lanceolata*) forests and woodlands of the Swan Coastal Plain TEC at Cape Peron could be avoided by realigninq/removinq the canal finqer closest to the mapped occurrence of the TEC (as mapped AECOM and DEC). This may avoid the clearing of 1.93 hectares of the 4.3 hectares occurring at Cape Peron, and reduce the potential impact of saltwater intrusion on the TEC (as shown in Figure 23, page 68 and Figure 26, page 71).	As above, clearing of FCT30a will be offset with rehabilitation.
245	Department of Environment and Conservation (260)	The proponent should provide a reference for the statement that "Approximately 48% of the pre-European extent Quindalup Vegetation Complex remains in the Metropolitan area". DEC suspects that this estimate may **be** dated and inaccurate. Significant clearing of coastal vegetation has occurred in recent years and may have resulted in a reduction of the figure quoted.	The reference quoted is Gibson et al (1994). It is acknowledged that the reference is dated. Discussions on clearing of vegetation types and associated offsets will be conducted with DEC prior to any clearing taking place.
246	Friends of Point Peron	The PER makes much of the consolidation and rehabilitation of the TEC FCT 30a. However 1.93 hectares will be lost for a potential gain after rehabilitation of 1.61. A net loss. And it is clear from ENV 2011 that the *Callitris preissii* is vulnerable to changes in ground water quality. So the project is likely to put at risk the very TEC that it purports to be saving.	As above (response 243 and 244), clearing of FCT30a will be offset with rehabilitation.
247	Friends of Point Peron	ENV in fact state that “the project proponents are strongly advised to be aware of the sensitivities to community concerns as to locally significant species”. In neither the PER nor the stakeholder consultation process was there any attempt to elicit whether there are in fact community concerns and certainly to my knowledge the Rockingham Regional Environment Centre was not consulted.	The proposal is a government initiative, through LandCorp. Extensive community consultation has been undertaken at various stages during development of the proposal. Further to this, the public (including the Rockingham Regional Environment Centre) has been invited to comment on the proposal at the ESD and PER stages. Further to this, Cedar Woods has invited the public to contact them through the media and via a telephone help line.

	Respondent (sub #)	Submission and/or issue	Response to comment
248	Public; Preserve Point Peron for the People; Wildflower Society of WA	The proposal will be an ecological disaster for the thrombolites and poses too much risk. The close proximity of the canals will impact water quality. How will any impacts be mitigated and how successful will any mitigation be given the difficulties associated with mitigating impacts from polluted groundwater?	Modelled reduction in water levels at Lake Richmond is 0.0038m to the additional 0.95m natural variation. Impact during construction is 0.0032m during the construction period. Water levels can be manually manipulated through changes to the weir, thus avoiding any change in water level that may impact the TECs. In addition to these management measures, Lake Richmond has been the subject of many historical changes in water level and water quality. Originally a brackish water system, Water Corporation's drainage inputs drastically affected water levels, and also changed the lake to a freshwater system, with little obvious impact on thrombolites and Holocene dune swales Potentially polluted groundwater will not be an issue as the groundwater below the marina will flow into the marine environment, not Lake Richmond. The outflow will contain nutrient loads that would normally be discharged into the marine environment by groundwater flows if the marina was not present. At present, Lake Richmond acts as a pseudo compensation basin for Water Corporation drains, and currently receives high levels of nutrient and pollutant inflow..
249	Conservation Council of WA	The significance of the thrombolite community is significantly greater due to the fact that equivalent microbiolites in Lake Cooloongup and Lake Clifton are severely impacted and are unlikely to survive.	Noted
250	Conservation Council of WA (116)	The proponent has downplayed the threat posed to the thrombolites by suggesting the assemblages have developed in seawater and are tolerant of high salinities. Lake Richmond was cut off from the sea prior to the thrombolites colonising Lake Richmond. Evidence suggests the thrombolites in Lake Richmond developed in high pH (8.3-9), low salinity (<1.4 ppt) environments rich in calcium, bicarbonate and carbonate from groundwater flowing through Holocene dune sands (Moore 1993, Moore pers. comm). The water in the Tamala Aquifer has a geochemistry similar to seawater and dissimilar from the carbonate/bicarbonate rich water in Lake Richmond that presumably flow in from the superficial groundwaters in the Safety Bay Sands. Intrusion of seawater from the salt water wedge or saline groundwater from the Tamala Limestone aquifer will fundamentally change the aquatic ecosystem in Lake Richmond.	It is accepted that any suggestions that the Thrombolites are tolerant of saltwater is incorrect. Mention of high salinities in Lake Richmond should have referred only to the formation of the Lake itself during the Pleistocene era. The subsequent comments are noted and accepted as correct quotes from Moore 1993. However the Proponent does not accept that the Proposal will pose a significant risk to the Thrombolite community currently existing in the Lake. The Proponent's hydrogeological consultants (ERM) have clearly demonstrated that there is no risk of saline intrusion into the Lake as a result of the Proposal. This conclusion is supported by the independent peer reviewer, Dr Phil Wharton. Refer to Appendix 4 and 5 of Strategen document "Response to Key Marine and Groundwater Issues Raised in Submissions on the Mangles Bay PER".
251	Department of Environment and Conservation (260)	The PER does not discuss the impacts of the clearing associated with the service corridor on the TECs. The proposal should not result in any loss of stromatolite like microbialite community TEC or sedgelands in Holocene dune swales of the southern Swan Coastal Plain TEC at Lake Richmond from work carried out within the service corridor	The Proposal will not result in direct impacts to TEC's at Lake Richmond (Thrombolites, and Holocene dune swales). Water Corporation works and subsequent impacts have been assessed under Water Corporations environmental assessment.

	Respondent (sub #)	Submission and/or issue	Response to comment
252	Friends of Point Peron	ENV 2011 states several qualifications of its study of vegetation at the Cape. First that it "considers the number of flora taxa reported here is not an accurate representation of the potential amount of flora species present within the survey site. ENV only established 16 quadrats within FCTs and did not survey vegetation units which would have created a more robust species list and thus a better representation of the flora species present." A complete vegetation survey should be undertaken.	Detailed mapping studies were previously conducted by Keating & Trudgen (1986) and Bennett (2005) using a significant number of quadrats both outside and within FCTs. In addition to the 16 quadrats established by ENV, traverses across the entire site over two days in a grid matrix were conducted to search for significant flora (ENV 2010). The previous flora and vegetation work undertaken with a large number of quadrats and the additional work undertaken by ENV is considered to constitute a complete and thorough vegetation survey.

8. Conservation estate

	Respondent (sub #)	Submission and/or issue	Response to comment
253	Public	For developers to say that it is degraded and weedy is a week excuse and only parts are like this. Kings Park is also degraded in many areas yet it is still viewed as an important asset. The Rockingham City Council has placed no effort into improving this area in line with public sentiment. Money should be made available to rehabilitate the area.	The condition of the vegetation in the Proposal Area was determined by independent flora and vegetation specialist, and not by the Proponent. Rehabilitation of remaining vegetation will be part of the offsets package put forward by the proponent, including rehabilitation to connect Cape Peron with the larger area of Rockingham Lakes Regional Park.
254	Public; Cape Peron Community Vision Working Group; Maritime Workers Union; Preserve Point Peron for the People; Wildflower Society of WA; Hon Lyn MacLaren MLC	This area should be kept as bushland for the people and as 'bush forever' as it was originally intended and not privatised for the benefit of a few. It's our 'Kings Park by the Sea'. Government and Cedar Woods should not be taking this land away from the public. The project is totally irreconcilable with the natural geography and biology of Mangles Bay. Areas such as this Bush Forever site are becoming more valuable as increasing areas of bushland are cleared on the Swan Coastal Plain. Cedar Woods should be exemplary corporate citizens and members of the local community - such a proposal requires acceptance of their intentions and potential role in the local community. There is an enormous responsibility to demonstrate their intentions are in everyone's best interests, not simply the interests of their shareholders and an as yet unidentified future clientele.	The proposal is a government initiative, through LandCorp. Community consultation has been undertaken at various stages during development of the proposal. Any conservation area that is impacted by the proposal will be offset in consultation with, and under the guidance of, the Environmental Protection Authority (EPA), the Department of Environment and Conservation (DEC), and the Department of Sustainability, Environment, Water, Population and Communities (SEWPaC).
255	Public; Cape Peron Community Vision Working Group; Maritime Workers Union; Hon Lyn MacLaren MLC	The area should be designated an A class nature reserve for everyone's enjoyment. This is public land and should remain so.	The proposal is a government initiative, through LandCorp. Community consultation has been undertaken at various stages during development of the proposal. Any conservation area that is impacted by the proposal will be offset in consultation with, and under the guidance of, the EPA, the DEC, and SEWPaC.
256	Public	Constructing this proposal is an act of social irresponsibility on the part of the developers and Government. Progress for progress' sake and for short term gain with long term consequences is not how progress should be achieved. Changes to the conservation estate should benefit the many not just the privileged few.	The proposal is a government initiative, through LandCorp. Community consultation has been undertaken at various stages during development of the proposal. Any conservation area that is impacted by the proposal will be offset in consultation with, and under the guidance of, the EPA, the DEC, and SEWPaC. Affordable holiday accommodation will be made available as a part of the proposal, and public facilities such as restaurants and shops at the marina will be for use of all members of the public.
257	Public	There are very few areas in the Perth Metropolitan Area that incorporate adjacent marine and terrestrial protected areas and the areas should not be reduced.	The proposal is a government initiative, through LandCorp. Community consultation has been undertaken at various stages during development of the proposal. Any conservation area that is impacted by the proposal will be offset in consultation with, and under the guidance of, the EPA, the DEC, and SEWPaC.

	Respondent (sub #)	Submission and/or issue	Response to comment
258	Urban Bushland Council Public; Wetlands Conservation Society	The statement in the PER that "the proposal is not expected to impact the regional significance of the Cape Peron Bush Forever site 355" is quite incorrect and there will be very significant impacts on site 355. Bush Forever sites were chosen to protect regionally significant bushland and the loss of this site and the loss of regionally and globally significant geoheritage sites will impact on regional significance.	Conservation areas that are impacted by the proposal will be offset in consultation with, and under the guidance of, the EPA, the DEC, and SEWPaC.
259	Urban Bushland Council	The Mangles Bay proposed development is completely counter to the requirements of SPP 2.8, which "requires that proposals impacting on bush forever sites should, amongst others, ensure that all reasonable steps have been taken to **avoid,** minimise or mitigate any likely adverse impact (direct or indirect) on regionally significant bushland, consistent with the SPP. Requirement of the SPP include: Focus development within cleared, degraded and less intact areas of bushland and where possible avoid fragmentation of the bushland area and provide for ecological linkage". This will cause loss of Bush Forever. Minimising impact on seagrass will impact Bush Forever and not amount of mitigation or offsetting can compensate for loss of coastal bushland.	The Rockingham Lakes Regional Park Management Plan (2010) refers to the Proposal Area as "Area subject to further planning (indicative)" in reference to a marina development. This indicates that the proposal has been recognised by agencies in planning for future development. Any conservation area that is impacted by the proposal will be offset in consultation with, and under the guidance of, the EPA, the DEC, and SEWPaC.
260	Public; Urban Bushland Council; Hon Lyn MacLaren MLC	The report comments that "The volume of people that use the area every day has contributed to the degradation of the vegetation both directly through trampling and spread of weeds and indirectly through the need for additional infrastructure such as roads and amenities (ENV 2010)." As such an additional development of this nature will only further impact on the natural values of the area and require substantial resources to manage appropriately. This indirect impact should be adequately considered.	Comment is noted. The proposal is a government initiative, through LandCorp. Community consultation has been undertaken at various stages during development of the proposal. Any conservation area that is impacted by the proposal will be offset in consultation with, and under the guidance of, the EPA, the DEC, and SEWPaC.
261	Public (194)	Increasingly it is also acknowledged that for ecosystems to be resilient they must be connected in the landscape. According to the Strategen report the Cape Peron site is recognized as forming a linkage with Bush Forever Site 358, *Lake Richmond* (29 ha total area; approximately 27 ha vegetated), which is to the east; and is a part of Greenways 1, 93 and 97. Connectivity is crucial for long term sustainability of populations which require opportunities for genetic exchange, foraging opportunities and seed dispersal. Fragmentation of natural landscapes diminishes the resilience of that ecosystem. High population and development growth rates in many communities have led directly to degradation of the local and regional ecosystems that often provide resilience to those communities (pg 13 Beatley 2009). The proposed loss of 40ha vegetation and subsequent increased fragmentation of Point Peron as a functional ecosystem is unacceptable.	Any conservation area that is impacted by the proposal will be offset in consultation with, and under the guidance of, the EPA, the DEC, and SEWPaC. The offsets package for the Proposal includes rehabilitation measures, which will increase the connectivity of Point Peron and the remaining areas of Rockingham Lakes Regional Park and Bush Forever 355.

	Respondent (sub #)	Submission and/or issue	Response to comment
262	Department of Environment and Conservation (260)	Connectivity of bushland is important to facilitate fauna movement across a range of habitat types, and to provide potential escape routes if animals are threatened **by** fire or clearing, particularly on the Swan Coastal Plain where there is limited remnant vegetation. The proponent should commit to maintaining a vegetated ecological connection between Cape Peron and Lake Richmond to help facilitate fauna movement between the two remnant bushland areas.	Comment is noted. The Rehabilitation Plan contained within the offsets package will address the connectivity of bushland.
263	Department of Planning	It is extremely important that Bush Forever area 358 is protected in its entirety and the proposal has no impacts on Bush Forever area 358.	There are no expected impacts on Bush Forever Area 358 (Lake Richmond)
264	Department of Planning	The Policy Co-ordination and Development team (who administers SPP 2.8) considers the proposal to be inconsistent with the policy measures of SPP 2.8, as the proposal will directly impact a TEC and Graceful Sun Moth habitat and the clearing of 40 ha of regionally significant bushland is inconsistent with the current overall purpose and intent of the Rockingham Lakes Regional Park and Bush Forever area 355. As such, the proposal is not currently supported by the PCD team	Clearing of GSM habitat, Rockingham Lakes Regional Park, and Bush Forever will be offset by land acquisition, rehabilitation, management and research commitments, all of which are outlined in DEC and EPA guidance.

9. Contaminated sites

	Respondent (sub #)	Submission and/or issue	Response to comment
265	Public; Cape Peron Community Vision Working Group	What is the risk of acid sulphate soils impacting on infrastructure? Bores in the local area smell of sulphur if they are not dug deep enough.	Section 20.2.1 of the PER highlights that the risk of ASS at the site is low. Further ASS investigations will be implemented to confirm the absence of ASS during the planning phase.
266	Public	With the predicted fall in Lake Richmond water levels, will acid sulphate soils become exposed. How will this affect the TECs associated with Lake Richmond. Will exposure of ASS impact the continuing supply of fresh water which is rich in calcium and bicarbonate/carbonate that thrombolites rely on (ie will it affect water chemistry)?	Water levels at Lake Richmond are predicted to drop by 0.0038m. Historical evidence shows drops and rises of the water level at orders of magnitude larger than this, thus the impacts from this drop are expected to be insignificant. Additional, Section 20.2.1 of the PER highlights that the exposure of ASS/PASS around Lake Richmond are unlikely to cause environmental harm due to the high buffering capacity of the soils within the area. Therefore, exposure of ASS/PASS at Lake Richmond due to the predicted fall in the water level is not expected to impact the groundwater or surface water quality in the surrounding area.
267	Cockburn Sound Management Council Officer Submission; Department of Health	Possible existing areas of sediment contamination in the vicinity of the Cruising Yacht Club, Mangles Bay Fishing Club and holiday camps should be tested adequately with enough replication to ensure that environmental guidelines are adhered to and met, if soil remediation is required.	A PSI of the Proposal area identified that three localised areas of potential contamination may occur. Section 20.4.4 of the PER states that the Proponent will conduct further investigations at these sites prior to and during construction of the marina and, if necessary, remedial works will be undertaken as appropriate.
268	Department of Health	DOH notes the Strategen 2010 Preliminary Site Investigation Report,supports the recommendation for further soil investigations (and if necessary groundwater) of the 'hot spots' as outlined on page 48 of the report. In addition DOH requests clarification and if necessary further investigation of the possibility of asbestos contamination of the overall site. These actions should be based on the *Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia - May 2009* (the Guidelines). The Guidelines were prepared by the DOH and published in conjunction with the Department of Environment and Conservation (DEC) under the *Contaminated Sites Act 2003.* Application of the Guidelines is particularly important where there is the possibility of former or existing buildings having contained asbestos, or if there is uncontrolled fill and illegal dumping associated with the site. All these possibilities exist for the proposed Mangle Bay Tourist Precinct DOH would expect a response in regard to the potential asbestos issue.	Section 20.4.4 of the PER states that the Proponent will conduct further investigations prior to and during construction of the marina and, if necessary, remedial works will be undertaken in accordance with relevant and applicable guidelines.

10. Noise and air quality

	Respondent (sub #)	Submission and/or issue	Response to comment
269	Public; Preserve Point Peron for the People; Friends of Point Peron	What is the impact of construction noise, particularly the movement of large trucks for those living close to the development and the road? Has the effect of noise and vibration of the pile driving and excavation on the nearby residents been considered? This should be modelled.	Construction noise is regulated via Regulation 13 of the Environmental Protection (Noise) Regulations 1997. It outlines the expected management of noise during construction, such as activities to be undertaken between 7am and 7pm, and in accordance with section six of Australian Standard 2436-1981. The proponent has indicated in the PER that these regulations will be the main guidance used for the management of construction noise. Due to the nature of the noise being intermittent and relatively short-term (within the proposed stages), and considering the provisions of the Environmental Protection (Noise) Regulations 1997, the need to model the effect of noise and vibration of the pile driving and excavation on nearby residents is not considered to be necessary. The impacts and management of these impacts are addressed in the CMP.
270	Public; Preserve Point Peron for the People; Department of Health	What effect will the dust from the excavated rock and soil have on nearby residents? It is not clear how the suppression measures (i.e., water dampening) will be triggered given there is no mention of how dust levels will be determined. DOH has determined that visual inspection is not an effective means by which to monitor dust levels. The proponent needs to give some further thought to how dust impacts on nearby residents will be determined and how the information will be used in the dust management process, given the duration of the project. It is recommended that the proponent provides written evidence that a dust management plan will be developed and provided to the City of Rockingham and the Department of Health for review,	The potential for the highest dust impacts will be during construction activities. The main type of dust that will be generated is Total Suspended Particulates (TSP) which is considered primarily to be "nuisance dust" (A guideline for the development and implementation of a dust management program, DEC 2008). As construction activities will be relatively short-term (within the proposed stages) and would emit "nuisance dust", or TSP, daily visual dust lift inspections are considered to be effective in observing "nuisance dust" and initiating mitigation measures. Longer-term dust impacts are unlikely given the proposed soil stabilisation techniques to be employed on site. A complaints management system will be established to ensure any complaints are captured and acted upon. The CMP addresses effects and management of dust impacts during construction.
271	Department of Health; Public	It is essential that groynes / breakwaters are designed to minimise the accumulation of seagrass. Seagrass accumulation has caused considerable public health concerns and nuisance complaints in Port Geographe, Busselton, due to poorly designed breakwaters. The decomposition of seagrass that accumulates along the breakwaters within this area releases hydrogen sulphide (H_2S) into the environment. This has resulted in a multi million dollar investment by local and state government to alleviate health concerns caused by the seagrass accumulation.	Large amounts of wrack (seagrass) do not accumulate in Mangles Bay at present (despite the presence of the Causeway). This should not change. Therefore, it is unlikely that large accumulation of seagrass will occur and result in unacceptable releases of H_2S

	Respondent (sub #)	Submission and/or issue	Response to comment
272	Department of Environment and Conservation (260)	The proposal will result in Memorial Drive being upgraded and realigned to become a primary road for the area. The traffic volume on this road will be significantly increased from the current level of 1,000 vehicles per day (vpd) to between 5,000 and 6,000 vpd. As a result, the road traffic noise level from this road will increase by at least seven decibels at the existing noise sensitive premises along Memorial Drive. The increased traffic noise level may be higher than an acceptable level and needs to be assessed and managed by the proponent. The proponent will need to assess and provide information on how it will manage the impact of increased traffic noise on the existing noise sensitive premises along Memorial Drive.	Noise is regulated via the Environmental Protection (Noise) Regulations 1997. During operations, the need for noise management from increased noise traffic will be addressed during the development of the Operational Environmental Management Plan.
273	Public	From personal observation, the traffic noise generated by Naval Base traffic on Point Peron Road (four times a day) is well over 70 dB(A). Main Roads WA allows a 60 dB(A) standard for roads and the suggested allowance for residential properties is 55 dB(A) by day and 40-45 dB(A) at night. It is difficult to see any of these standards being applied to Boundary Road and Lakes Street residents. However, residents within the canal development will likely be shielded from these noises by a high wall.	During operations, the need for noise management from increased noise traffic will be addressed during the development of the Operational Environmental Management Plan.

11. Social values

11.1 Recreational access

	Respondent (sub #)	Submission and/or issue	Response to comment
274	Public; Cape Peron Community Vision Working Group	The area reserved for the Cruising Yacht Club in the new marina proposal will not accommodate the existing number of boats. The number of hard stands will be reduced from 250 to around 80. This will exacerbate the problems of not enough facilities to accommodate boating in the Rockingham area and it is unlikely that people will be able to afford the 7-8 times price difference in this lower socio-economic area.	The marina will provide a site for the consolidation of the Mangles bay Fishing Club and The Cruising Yacht Club. A seabed lease accommodating up to 250 boats will also be provided to the club to construct pens. A study to the size, location and seabed lease area was undertaken which supports a 3.5ha club site with provision for a boat stacker, wet pens, hardstand, sullage and fuel facilities, boat ramp, club house, chandlery, spray shed and lifter, The study was undertaken with consideration of the comparable Mandurah Ocean Marina and Hillary Marina. Furthermore inputs from the Marina Working Group were included to determine the club location and dimensions. The consolidated club will be required to demonstrate their operations will be commercially viable before the site it handed over. Furthermore the amount for a club pens will be determined within their approved business case. An additional pen number up to 150 will also be available to the public to lease. Furthermore it is anticipated DoT will retain approximately half of the existing swing moorings within the Mangles Bay Mooring Control Area, with fees payed on a cost recovery basis.
275	Public	No jet skis in this area and limited fishing.	The use of jet skis in the area will be determined by Department of Transport. The Department of Fisheries will control fishing access.

	Respondent (sub #)	Submission and/or issue	Response to comment
276	Public (87)	Significant research over the past few decades has been undertaken into benefits of human-nature contact. Results have shown that interactions with nature improve our physical and well-being and may help prevent disease. There is also good evidence that nature contact evokes emotional, cognitive and behavioural responses that are conducive to happiness and contentment, including reducing stress, increased focus and enhance feelings of well being and increase health-orientated behaviours. It can also benefit social and spiritual well being. Urban landscapes on the other hand, have less positive and in some cases negative effects on health. The proposal area offers the type of human-nature interactions that researchers have demonstrated are essential to human well-being. The proposal area provides a great diversity of sensory experiences and opportunity for a range of different activities, many of which will be lost as a result of this proposal. As the population of Rockingham expands, demand will be for more open space and contact with nature, not less. The United Nations agreed in 2011/2012 that natural assets should not be sold off but rather we should be benefitting from the interest generated from those assets in their natural state and that development should be based on well-being more than monetary gain. This issue has not been adequately considered and should be incorporated in the assessment.	The Proposal will increase vegetation interaction opportunities in the area with the enhancement of the balance of the Cape Peron area. A significant area of Rockingham Lakes Regional Park, Bush Forever, and GSM habitat will remain. Furthermore, the Proposal offsets plan includes rehabilitation that will increase connectivity between Point Peron and remaining areas of vegetation, increasing opportunity for people to interact with nature in the area.
277	Public; Hon Lyn MacLaren MLC Preserve Point Peron for the People. Friends of Point Peron	The beach in front of the proposal is in good condition and is heavily used by a range of groups and individuals. Access is unrestricted which will not be case once the development proceeds. The proponent should be required to ensure existing recreational use of the beach from end to end by being required to install a bridge of some kind across the entry channel.	Installing a pedestrian bridge across the marina entry channel is not practical. A walkway will be provided along the main marinas edge and access and public use of Mangles Bay will be enhanced.
278	Public; Hon Lyn MacLaren MLC	Increased visitation will have an increased impact on the Regional Park. Removing such a large area of the park will concentrate people into a smaller area making it more difficult to maintain the viability of the remaining area.	The proposal will provide a number of different areas that will be made available to the public for recreational use. Visitors may be more likely to use these areas, lessening impact on the regional park.
279	Cockburn Sound Management Council	In Section 16.3 (p.373) the discussion of long-term minimisation impact options does not take into account the cost of losing over 46ha of public domain land (Bush forever and Regional Park land). Although the PER lists a number of benefits of the project, many of these could be provided without the development. The options section does not adequately explain why a marina should be located in this sensitive area compared to other locations in Cockburn Sound. Discussion of predicted boat trailer and other recreational boat usage, with and without the marina, in Section 16.4.3, needs to clarify **predicted boat numbers.**	The proposal in its current form has been through several manifestations over a period of several decades, with the current location being the optimal position. The marina has been designed as an inshore marina to reduce the loss of seagrass which would occur with an open coastal marina. The offset package was formulated to counteract the impact of the proposal, and contributes towards net benefits to the region, including the provision of public open space and rehabilitation of degraded areas of vegetation. Predicted boat numbers are covered under points 292 and 300.

	Respondent (sub #)	Submission and/or issue	Response to comment
280	Friends of Point Peron	Proposal will involve the loss of the oval at the intersection of Memorial Drive – loss of community asset.	The oval is proposed to be planted in accordance with the proposed offsets to the clearing of the TEC (FCT 30a). An area of active Public Open Space is located directly south of the existing oval area, which will serve as a buffer to Lake Richmond and to provide a community asset.

11.2 Heritage

	Respondent (sub #)	Submission and/or issue	Response to comment
281	Public	The area has significant cultural and natural heritage value for the Aboriginal people. Many of these values and/or sites will be impacted or even destroyed by this development.	The Proponent will continue consultation and discussions with heritage site informants and the Native Title Claimants for the area throughout the planning, development and implementation stages of the Proposal in accordance with the conditions of the Section 18 consent. Consultation has occurred with the outcomes included within the Section 18 consent notice under the AH Act to commence ground disturbing work in the proximity of the heritage sites.
282	Public; Cape Peron Community Vision Working Group	The project threatens the geographic and topographical heritage of the Cape. There will be the loss of European heritage Turtle Factory located on Point Peron Rd, which became the first local Catholic school. Also the historic Alfred Hines Children's home building will be left out of context if this project goes ahead – this devalues heritage.	"Both the Turtle Factory and Point Peron Recreation Camp buildings are listed under Management Category 'D' of the Rockingham Municipal Heritage Inventory (CoR 2008) which is defined as '*significant, but not essential to an understanding of the history of the district*' (CoR 2008). The Point Peron Recreation Camp buildings will not be disturbed by the Proposal but the Turtle Factory will require removal as part of the development." p. 358. A heritage impact assessment to obtain approval to remove the structures once belonging to the Turtle Factory will be undertaken.
283	Public; Cape Peron Community Vision Working Group	The proposed project will directly impact upon several Indigenous site and there is the belief locally that the developers have not been open, transparent and equitable in relation to which local elders they are talking to and that some do not want to see this project go ahead but have been unable to speak up.	Consultation with the indigenous community has taken place throughout the review process, detailed in Table 65, p. 363. "In consultation conducted to-date as part of the heritage assessments of the Proposal area, Aboriginal representatives have outlined a number of recommendations with regard to the heritage sites located within and adjacent to the Proposal area." P. 358
284	AIW Recreation Centre; Hon Lyn MacLaren MLC	The heritage value of the AIW camps has been overlooked by the proponents. This heritage value is currently being assessed by the National Trust WA.	The AIW Camp is leased from the State. The Mangles Bay Proposal is a State initiative and the AIW and RSL Camps are required to be removed for the development. Feedback is being sought to the criteria for the assessment being undertaken by the National Trust WA.

	Respondent (sub #)	Submission and/or issue	Response to comment
285	Public	The Mooribirdup Ceremonial Grounds (AIH site ID 22888) will be destroyed by the proposal and will affect the Rotary Park Rockingham site (ID3471). This should not occur.	"The site 'Mooribirdup Ceremonial Grounds' is currently defined by informants as existing within the Proposal area but a recent survey by Brad Goode & Associates (2011) did not identify this site as occurring at this location. As the site was unable to be verified during the 2011 investigations, and the majority of the consulted Nyungar informants did not support the existence of such a site, it is recommended that the site be placed into the DIA stored data system (Brad Goode & Associates 2011). Although this site lies wholly within the Proposal area, there is no strong opposition to the Proponent applying for a section 18 approval to disturb this site. " p. 357
286	Hon Lyn MacLaren MLC	The area of the proposed development contains a listed Aboriginal Heritage site which is part of a mythological songline associated with the Waugal. Two of the five Aboriginal groups consulted said that they would oppose the development because the marina channel would break the path of the rainbow serpent spirit.	"Two groups consulted to date have indicated that the Proposal will not be supported due to the potential disturbance of the spiritual values of the area, including the breakage of the 'Waugal songline' and the mingling of salt-water and fresh-water spirits (Brad Goode & Associates 2011). The Proponent will continue discussions with these groups to ensure that their concerns are considered and that appropriate mitigation and management measures can be developed prior." p. 357. Furthermore the wet excavation technique proposed for the development prevents the saltwater intrusion into Lake Richmond.
287	Hon Lyn MacLaren MLC	The community recognises Point Peron as a site representative of both local and state intangible heritage values. UNESCO states that intangible cultural heritage is recognised when community, groups and individuals create, maintain and transmit their heritage. Passed on from one generation to another the appreciation, enjoyment and preservation of the natural environment by both Aboriginals and Europeans is part of the intangible cultural heritage of Point Peron. This site provides a sense of identity and continuity, providing a link from our past, through the present, and into our future. Intangible cultural heritage contributes to social cohesion, encouraging a sense of identity and responsibility which helps individuals to feel part of one or different communities and to feel part of society at large. The importance of intangible cultural heritage has not been acknowledged in the PER.	The proponent has conducted community consultation throughout the project iterations, and this has included addressing issues of Aboriginal Heritage. Consultation with the indigenous community has taken place throughout the review process, detailed in Table 65, p. 363. "In consultation conducted to-date as part of the heritage assessments of the Proposal area, Aboriginal representatives have outlined a number of recommendations with regard to the heritage sites located within and adjacent to the Proposal area." p. 358 Further to this: "The Proponent will continue consultation and discussions with heritage site informants and the Native Title Claimants for the area throughout the planning, development and implementation stages of the Proposal. Consultation will also occur prior to the application for a section 18 consent notice under the AH Act to commence ground disturbing work in the proximity of the heritage sites." p. 358.

11.3 Amenity

	Respondent (sub #)	Submission and/or issue	Response to comment
288	Public	This is an area where people come to relax, walk and enjoy nature. This proposal will not facilitate this and destroy the ability to do this.	Lake Richmond and Point Peron will still be available to the public to enjoy and the offsets package will provide a number of other areas to be made available for recreational use.
289	Cockburn Sound Management Council Officer Submission	The visual amenity survey could have included a view point from the lookout near the Anchorage overlooking Lake Richmond to provide a realistic idea of a medium to long-term viewscape looking toward the northwest and Point Peron.	Comment is noted.
290	Hon Lyn MacLaren MLC	The proposed development will undoubtedly adversely affect the visual amenity of the area. The PER documents Keating and Trudgen argue that: Although disturbed, this vegetation is still one of the features of the Point Peron area that makes it the desirable recreation destination that it obviously is...It plays an important role in complementing the attractions of the beaches and the ocean. If it were removed and replaced by developments then the area would essentially be no different than, say, Cottesloe. The area would still be used, but would suffer a definite loss of appeal	Comment is noted, however, the impact will be managed through using landscape location, orientation, materiality and height.

11.4 Public health and safety

	Respondent (sub #)	Submission and/or issue	Response to comment
291	Public	The nine years it will take for construction to be completed is of concern to the community and these impacts hasn't been considered by the proponent.	The impacts on the community during the construction of the Proposal will be considered as a part of the Construction Management Plan (CMP), and health and safety will be paramount during construction activities. Construction will be staged, so as to provide benefits during construction.
292	Public	There will be increased risk of interactions between large and small water craft if this proposal goes ahead and has not been looked at by the proponent.	Comment is noted, however, the risk of interactions between watercraft will be the same as the current Mangles Bay area. Signage and controls within the marina water body will reduce the risk of boat strikes.

	Respondent (sub #)	Submission and/or issue	Response to comment
293	Department of Health; Public	The proponent needs to address mosquito breeding prevention/control issues: a) The proponent work with the City of Rockingham and ratepayers in the region to ensure effective mosquito management is further developed and adequately funded for the locality; b) The proponent work with the State and Federal agencies owning crown land across the proposed development in the region to ensure effective mosquito management is further developed and adequately funded for the locality; c) The City of Rockingham ensures they have sufficient resources to continue mosquito management for the future of the development following the handover of responsibility from the developer; d) New residents be warned of the risk of mosquito-borne disease and the potential for nuisance mosquitoes via an appropriately worded notification on any newly created property titles;	The comments are noted and will be addressed as appropriate. Note that: 1. Management of mosquitoes proposed to be incorporated into the CEMP within community issues management plan (regarding community awareness and prevention), and the surface water management plan (regarding infiltration basins). 2. Crown land in the region is separately managed and requires liaison between the City and the managing agency. 3. Continued availability of resources for management after handover not within scope of this PER. 4. Recommendations were formulated in accordance with current DoH guidelines. Insect access prevention measures shall be considered in construction of accommodation.
		The proponent must ensure proposed infrastructure and site works do not create additional mosquito breeding habitat as follows: a) Changes to topography resulting from earthworks (e.g. the installation of pipelines, footpaths, roads etc) must prevent run-off from creating surface ponding as it may become mosquito breeding habitat; b) Constructed water bodies (drainage infrastructure, infiltration basins and swales, settling ponds, wetlands, etc) must be iocated, designed and maintained so they do not create or contribute to mosquito breeding; and c) The *Chironomid midge and mosquito risk assessment guide for constructed water bodies* (Midge Research Group, 2011j should be referred to during the early stages of planning to ensure that the potential for on-site mosquito breeding is minimised, d) The proponent/s should use built form design measures in the construction of accommodation and recreational areas to protect future visitors from mosquitoes. e) Built form design measures (insect screening on doors and windows and screened outdoor enclosures), public education packages and public signage are included as part of the State and local government, conditions of approval.	

12. Commercial fishing and aquaculture

	Respondent (sub #)	Submission and/or issue	Response to comment
294	Western Australian Fishing Industries Council	Within Mangles Bay, licence holders in the Cockburn Sound Line and Pot (CSLPF) primarily target squid and octopus. Mangles Bay has long been considered an important fishing area due to the good quality of the seagrass inhabiting abundant levels of squid and octopus. It also provides shelter from strong south-westerly winds allowing fishing to occur when it is too rough to fish further north. Some licence holders have advised WAFIC that 75% of their CSLPF octopus catch and 35% of their squid catch is caught from Mangles Bay. While not all CSLPF licences are active, the product from these individuals is highly valued as it is the only place in Western Australia where squid is available to the market on the day it is caught. While licence holders have the capacity to fish other parts of Cockburn Sound, they cannot concentrate their fishing effort in the northern part of the fishery without having an impact on squid and octopus resources and reducing their viability. There is agreement amongst licence holders to spread fishing effort across the extent of the Sound (and a condition on some licences to restrict fishing from south of Woodman Point) to ensure stocks are not overfished. Referring to Figure No. 56 and the proposed area defined by a yellow line, it is anticipated that existing fishing grounds and licence holders' viability will be reduced as a result of this development.	The use of Mangles Bay by commercial squid and octopus fishermen is noted, as is the effect on their viability of a loss of ~ 6ha of seagrass habitat. In recognition of this loss, the Proponent has proposed an offsets strategy which includes artificial fish enhancement measures.
295	Western Australian Fishing Industries Council	There are approximately 12 licence holders in the Cockburn Sound Crab Fishery, all of which are actively fishing. Feedback from licence holders is that approximately 20% of their crab catch is caught from the shallow sea grass area of Mangles Bay. WAFIC understands that crab fishers have always fished amongst the existing boat moorings due to the high abundance of crabs in this area. Based on the information we have received from our members, WAFIC believes that the CSCF licence holders will be the most affected commercial fishery by this proposed development in terms of loss of fishing access.	The submission is noted and it is acknowledged that commercial crab fishers will be affected by loss of access to fishing grounds within the navigation channel. Seagrass replanting of 6ha will provide a direct offset to the loss incurred from navigation channel.
296	Western Australian Fishing Industries Council	WAFIC is aware that commercial fishers and mussel growers currently utilise the Mangles Bay Fishing Club to store equipment relevant to their fishing businesses. WAFIC understands that the mussel growers have provided a submission relating to these premises. WAFIC requests that these facilities to carry out their commercial fishing operations are maintained.	Cedar Woods has met with the existing commercial mussel operators and has committed to providing: • Loading and unloading point. • Boat pen storage within the marina. The commitment has been provided to maintain mussel operations from Mangles Bay location. Note a hardstand area for the commercial mussel operations is not included.

	Respondent (sub #)	Submission and/or issue	Response to comment
297	Western Australian Fishing Industries Council	There is broad recognition within the Cockburn Sound fishing industry of the significance of Mangles Bay as a fish nursery for species such as Blue Swimmer Crabs, white bait, octopus, squid and King George Whiting. These species support a number of commercial fisheries in WA. WAFIC considers it highly inappropriate that a development of this scale is proposed in Mangles Bay. Particularly as this area has been identified by the Department of Fisheries as a fishery nursery of Statewide significance and that it likely acts as a source for fisheries located well beyond the immediate area.	The proposal aims to better control, monitor and manage effects from boating activity, including fishing. The proposed availability of information on fishing controls and increased surveillance at the boat launching facilities and pens should assist in sustaining fish populations. The majority of fishing is also primarily undertaken on boats less than 7.5m which are on trailers which demand is independent of the marina. The calculations were based on boating estimates in the Cockburn Sound/Warnbro Sound (i.e. Shoalwater islands Marine Park) region using data for areas defined in DPI (2009) as: • 'Cockburn', using Cockburn 50% as representing the southern portion, which includes Coogee and Henderson (access Woodman Point boat ramp and Challenger Beach boat ramp) • 'Kwinana'' • 'Rockingham', which extends from Rockingham to Singleton Calculations in Section 16 of the PER also provide a breakdown of trailerable and non-trailerable boat numbers, and the cumulative impacts of the Mangles Bay and Port Rockingham marinas.

13. Cumulative impacts

	Respondent (sub #)	Submission and/or issue	Response to comment
298	Public; Hon Lyn MacLaren MLC	There is very little public open space left of this nature in Rockingham and this will remove a large portion of that remaining. This is particularly an issue due to the current expansion in the Rockingham area. In particular, Direction 2031 does not add any new parks to Perth over the next 20 years and the loss of this one must be considered in a cumulative and regional context.	The respondent seems to have confused regional and local public open space and the intent of Directions 2031. This Strategy was not intended to provide a framework for the provision of future areas of 'Regional Open Space'. It is an urban growth strategy for Perth not dissimilar to the various growth strategies which have come before. It should be noted that in this regard, all new areas of urban development are required to make a standard Public Open Space contribution and this Proposal will be no different.
299	Public; Friends of Point Peron	The Standing Committee on Environment and Public Affairs 2006 in response to a petition on the then proposed marina at Point Peron noted the likely cumulative pressures on Cockburn Sound from the proposed desalination plant, the proposed new island port and the proposed marina canal estate development. The proponent has not made comment on the broader cumulative effects and has addressed this development impact in isolation. This development will add pollution and place further pressure on the already strained Cockburn Sound ecosystem. New developments around the sound need to be carefully considered (and there are presently numerous developments that will have impact being undertaken/proposed) as it is quite likely that a 'tipping point' will be reached and water quality, aquatic life and anthropogenic use of the water body could be severely compromised.	Noted. Each proposal is considered by all relevant government agencies prior to implementation, ensuring cumulative impacts are considered.
300	Department of Environment and Conservation (260)	The increase in the number of larger (>7.5 metres) recreational vessels penned and moored at the proposed marina will be cumulative to the increase in trailered recreational vessels for the Rockingham area estimated by the Department of Transport. In 2007, it was estimated that there were 50 boats per 1,000 people in the City of Rockingham (Department of Transport 2008). This equates to more than 5,000 boats, most of which are less than 7.5 metres and **able** to be trailered. The construction of the proposed marina to cater for larger than 7.5 metre vessels will result in a new and higher level of vessel usage in the Rockingham area (cumulative to the vessels associated with the approved Port Rockingham marina).	The proposed development will result in a small increase (1%) in the number of vessels able to access Cockburn Sound. The calculations were based on boating estimates in the Cockburn Sound/ Warnbro Sound (i.e. Shoalwater islands Marine Park) region using data for areas defined in DPI (2009) as: • 'Cockburn', using Cockburn 50% as representing the southern portion, which includes Coogee and Henderson (access Woodman Point boat ramp and Challenger Beach boat ramp) • 'Kwinana'' • 'Rockingham', which extends from Rockingham to Singleton Calculations in Section 16 of the PER also provide a breakdown of trailerable and non-trailerable boat numbers, and the cumulative impacts of the Mangles Bay and Port Rockingham marinas. The increase to the number of boats on trailers have been addressed with a boat launching facility within the proposed club site in addition to Cedar Woods improving the existing Point Peron Boat ramp.

14. Offsets

14.1 Marine

	Respondent (sub #)	Submission and/or issue	Response to comment
301	Cockburn Sound Management Council Officer Submission	Offsets for seagrass and terrestrial vegetation need to be substantial and have regional significance. The ratio of proposed direct and indirect offsets will need careful and balanced negotiation. For example, few specific proposals are provided to compensate for the loss of 70ha of prime coastal land from the conservation estate. It is not appropriate for these proposals to be left to be discussed at a later date; as the proponents propose, when there will no longer be the opportunity for public input.	The proposed seagrass offsets are believed to be reasonable on the two-fold basis that (i) seagrass transplantation has an established track record and (ii) the expense of transplantation is such that there may be more ecological benefit in other marine offsets rather than additional transplants.
302	Cockburn Sound Management Council Officer Submission	Management measures, performance standards and approaches to address cumulative impacts are difficult issues that need to be thoroughly and properly developed with appropriate offsets identified that are proportional to their importance. For those issues relevant to the Departments of Fisheries and Environment and Conservation, it will be a challenge to implement meaningful offsets to account for impacts to fauna	Agreed. The proponent has already commenced discussions about offsets with stakeholders.
303	Public	Rehabilitation of seagrass would not be as much benefit to the local fishing population as the establishment of artificial reefs. These should be considered adjacent to the development.	Agreed that the value of artificial reefs should be considered when determining offsets.
304	Public; Friends of Point Peron	The diversity of epiphytic algae on seagrass leaves can be very great, hence their contribution to sediment production leading to the formation of sediment banks, (such as at Shark Bay, WA) and the impact upon beach erosion can also vary greatly. A comparison of *P. australis* to *P. sinuosa* found *P. sinuosa* provided a home for a far greater range of epiphytic algae and invertebrate species than *P. australis*. The *P. sinuosa* leaves also provide a greater surface area for colonisation and they live longer. To accept *P. australis* for *P. sinuosa* for an offset seems a little like swapping a Rolls Royce for a Mini. Why should this happen?	We are unsure of the basis for these comments without having a reference provided as to their source. Such comparisons are easily confounded by differences in key characteristics such as site depth, proximity to reefs, exposure to wave energy etc. *P. australis* has a larger (i.e. broader) leaf than *P. sinuosa*, but meadows of *P. australis* and *P. sinuosa* often have similar biomass and productivity: the shoot and leaf densities of *P australis* are just ~ half that of *P. sinuosa*. Ecological succession of seagrass has shown that *P. sinuosa* is a climax species that moves in after colonisation by *P. australis* and other species (see also response to comment 109 in Section 4). We further note that seagrass rehabilitation trials have shown that *P. sinuosa* colonises after the transplanted *P. australis* has established.

	Respondent (sub #)	Submission and/or issue	Response to comment
305	Cape Peron Community Vision Working Group; Dr van Keulen (97); Public; Hon Lyn MacLaren MLC	The assertion that the marina will alleviate the mooring scars in Mangles Bay is highly questionable given that there is no guarantee the moorings will be removed and even if they are that the seagrass would regenerate in these areas. The PER states that the infilling of mooring scars would take approximately seven years without the addition of transplants. A time saving of maybe 2 -3 years is not a viable offset when the same result will be achieved by doing nothing. Replanting the mooring scars at Mangles Bay is likely to be problematic at best as the transplantation process is stressful to the seagrass and requires good conditions at the recipient site to allow rapid recovery of the transplanted plants. A key principle for successful seagrass rehabilitation is that the underlying problem causing seagrass loss should be removed before transplanting can be considered (Fonseca et al., 1998). In this instance, the natural seagrass meadow in Mangles Bay is in an unhealthy state due to low water quality and poor sediment condition and rehabilitation operations should not be considered until the condition of the recipient site improves. This is not an achievable outcome in the short term.	The rehabilitation of mooring scars was only one option for transplant areas to be considered. It is agreed that other areas may be more beneficial for transplantation and this is will be considered (see also response to comment 115 in Section 4).
306	Dr van Keulen (97)	The large-scale seagrass rehabilitation programme on Southern Flats has resulted in the transplantation of 3 ha of seagrass over a period of five years; the programme is considered the most successful in Australia, with overall survival of around 70-80% (Verduin et al., 2011). However parts of the Southern Flats site were not able to be successfully replanted for unknown reasons (possibly sediment or nutrient related), despite repeated attempts. Storm damage reduced survival and damaged sections had to be replanted. Transplantation was only successful after extensive experimentation and refinement of techniques over many years. Southern Flats or the mooring scars in Mangles Bay may not successful.	Agreed. Pilot studies would need to be undertaken to assess site suitability for any rehabilitation to be undertaken in relation to this proposal.

	Respondent (sub #)	Submission and/or issue	Response to comment
307	Dr van Keulen (97)	The cost of seagrass rehabilitation is significant. One of the issues encountered during the Southern Flats transplantation programme was the need to increase the density of transplants from 1 m spacing between transplant units to 0.5 m spacing. This was found to be necessary to achieve target shoot densities within the required timeframe set in the Ministerial Conditions for the project and arises from the need to have adequate shoot densities to achieve a return of ecosystem functionality. Ecosystem functions for seagrass meadows include overall productivity, support for associated organisms and physical factors that include seabed stability and internal support for continued meadow growth and colonisation. Increasing transplant shoot density greatly increases the effort required and will significantly add to the overall cost of the proposed offset programme. Estimates of costs for transplanting seagrass in Western Australia are between $84,000 and $168,000 per hectare, depending on spacing of transplants (Paling et al., 2009). To be sure of long term success in seagrass transplantation, monitoring is required for an extended period (five years is considered a minimum and ten years would be a more realistic target). The transplanted seagrass appears to be vulnerable to storm damage for a considerable period after planting, presumably due to the lack of a mature rhizosphere that helps to stabilise the entire meadow. The cost quoted by Paling et al. (2009) does not include monitoring costs.	It is agreed that the cost of rehabilitation is significant and the cost of transplanting when using commercially qualified divers is higher than those provided by Paling et al. (2009), which are largely based on using volunteer divers. Also noted that these costs do not include monitoring costs.
308	Conservation Council of WA; Hon Lyn MacLaren MLC; Public; Preserve Point Peron for the People.	Seagrass rehabilitation is difficult and success is not guaranteed, particularly on such a large scale. No detail regarding the offset has been provided, particularly regarding the length of time the proponent expects to complete the rehabilitation works. The finer, organic sediment in Mangles Bay is not sufficiently stable and it is more likely to take 10-15 years to successfully establishment replacement meadows, if successful at all. This will not mitigate the food-chain impacts on other ecosystem components including current fish and marine wildlife populations cause by the loss of primary production. What measures will be in place to ensure that the predicted seagrass rehabilitation will be successful? How long will the proponent be expected to undertake rehabilitation if it isn't successful and has trouble establishing. This is an attempt to circumvent the EPA's Benthic Primary Producer Habitat Policy and the project should be deferred until the replacement seagrass meadow has been established and demonstrated to be ecologically functional.	It is agreed that while the techniques have been successfully developed as to how to do transplantation, success is not guaranteed and as noted in the response to comment 7 above, pilot studies in the area to be rehabilitated will need to be conducted. There are precedents for rehabilitation in terms of performance criteria, and contingences for additional planting if these are not met. Rehabilitated areas are also required to be monitored regularly to determine success. The Proponent will endeavour to initiate seagrass transplanting works prior to proceeding to project construction, to allow use of seagrass in the footprint as donor material and at least some establishment of replacement meadow. Also the possibility of using other temporary means such as artificial seagrass to provide habitat while natural meadows establish is currently being investigated
309	Public	While the proponents have identified other possible areas for seagrass replanting they haven't provided sufficient background information: is the water quality good enough to provide an equivalent ecology? if the water quality is good enough will it displace an existing habitat?	Further details are to be provided in a separate seagrass rehabilitation plan, including identification of suitable areas and the need to conduct pilot studies to determine site suitability. Refer to Appendix 2 – Section 3 of Strategen document "Response to Key Marine and Groundwater Issues Raised in Submissions on the Mangles Bay PER" for further detail.

	Respondent (sub #)	Submission and/or issue	Response to comment
310	Public Wildflower Society of WA; Cockburn Sound Management Council Recfishwest	Given that in the Standing Committee Report 2006 provided a recommendation (9) that: the government adopts a cautious approach to any claims of success about seagrass rehabilitation in Cockburn Sound at this stage", the proposed offset ratio should be considerably higher than 1:1 - 6ha is insufficient because of the problems of seagrass survival and surrounding water quality as well as other interacting biological and physical factors which could affect replanting success. In addition the Strategen report details that an overall success rate of 48.2% survival for seagrass rehabilitation was achieved suggesting that rehabilitation will not be easy and will take significant time to establish if at all. Survival rates at all sites (Table 53) showed a continued downward trend suggesting that using this data to confirm success of seagrass rehabilitation, is at this time preliminary (max 12 month monitoring) and does not give a guaranteed long term outcome. In addition, the PER proposes that completion criteria for any seagrass rehabilitation program be linked to a specific percentage survival of planting units for four years, to confirm that survival and growth are sufficient to attain 6 ha of seagrass of 75% average cover within 10 years following planting. This performance target is lower than expected given that the position of the EPA is no net loss of seagrass. The federal government also set performance targets at 90% for several offset packages. Offset success criteria are based on achieving no net loss- 75% still represents a loss. The CSMC and Officers strongly supports greater multiples than 1:1 replacement of seagrass because of the need to contribute to strategic aims of increasing seagrass coverage in Cockburn Sound i.e. as outlined to meet the EPA's EAG No.3 - Strategic Aims.	Refer to response to comment 301 in Section 14: the proposed ratio for seagrass rehabilitation is considered reasonable, as other options for marine offsets may be of more overall ecological benefit. Natural regrowth of seagrass occurs in mooring scars once the mooring is replaced with an environmental friendly design, therefore transplantation in areas other than mooring scars may deliver greater overall ecological benefit (see also response to comment 116 in Section 4) The performance criterion of 75% average cover is related to the fact that no seagrass meadow has 100% cover over a large spatial scale. 1 hectare of seagrass with 75% cover is likely to be equivalent to 1 hectare of natural meadow: it does not represent a net loss.
311	Public	The PER states that "As the seagrass losses will be offset with seagrass rehabilitation, there is not expected to be any significant impact on marine flora". However given that the offset area may take a minimum of seven years to rehabilitate how will the direct and immediate impacts on marine ecosystem function in the interim be managed?	Noted: this interim gap is unavoidable and so any seagrass transplantation is proposed to commence as soon as possible if the proposal is approved. The gradual infill in mooring scars as they are replaced with seagrass-friendly moorings will help to buffer any effects due to the interim loss, but trying to detect or manage any effects due to the interim loss would be very difficult (see also response to comment 129 in Section 5). There is the possibility of using other habitat offsets such as artificial reefs or artificial seagrass (refer to responses to comments 303 and 314 in Section 14): the potential value of such measures would need to be considered when determining offsets. Refer to Appendix 2 – Section 3 of Strategen document "Response to Key Marine and Groundwater Issues Raised in Submissions on the Mangles Bay PER" for further detail.

	Respondent (sub #)	Submission and/or issue	Response to comment
312	Public; Department of Environment and Conservation (260)	How will the proponent offset the impacts to marine fauna? Given the acknowledged loss of seagrass and bare sediment habitat and the time lag between re-establishing seagrass the impact on fish species is significant. This report also acknowledges Mangles Bay as a vital fish nursery. The PER also identifies the food requirement of dolphins as high and that they utilize the seagrass meadows and that any loss of seagrass will have a direct impact on this species. DEC should be consulted in order to determine offsets to mitigate the impacts on seagrass habitat that supports prey species upon which dolphins, sea lions, little penguins and other marine life within Cockburn Sound depend.	The seagrasses of Mangles Bay are only one habitat visited by dolphins, sea lions, little penguins and other marine life, and available information does not identify it as one of the most important habitats in Cockburn Sound and the SIMP for these fauna. Other factors such as El Nino/La Nina cycles also have a far more profound effect on the fish targeted by penguins and dolphins. The time lag between loss of seagrass and re-establishing seagrass WRT the impact on fish species in Mangle Bay is acknowledged – see response to comment 311 above. It is agreed that DEC should be consulted about offsets.
313	Public	The indirect impact on potential food sources for Little Penguins through impacts on the Mangles Bay shallow flats which is a fish nursery and the general lack of sufficient data to fully determine the importance to penguins of the shallow flats of Mangles Bay suggests that more studies are required and that the full direct or indirect impacts cannot be assessed at this time. It will be difficult to determine an offset given the immediate impact cannot be mitigated by offsets that may take several years to achieve the functionality of an established seagrass meadow.	See response to comments 311 and 312 above. It is agreed that more information is always useful, but available data indicate other areas in Cockburn Sound are more important feeding areas for little penguins.
314	Recfishwest; Hon Lyn MacLaren MLC	Increased fishing pressure as a result of the marina and boat ramp facilities is recognised. However, Recfishwest believes that while the implementation of education materials within the marina and provisions for the monitoring of recreational fishing effort are laudable, this will not sufficiently offset the impact of increased fishing pressure. Instead, the proponent should look to provide offsets for the project impacts such as fish stocking or habitat enhancement structures. Investment in these initiatives will deliver meaningful offsets to the recreational fishing community and provide longer-term benefits for the environment.	The potential value of fish stocking and habitat enhancement structures will be considered when determining offsets. Note also the potential value of artificial reefs and artificial seagrass (refer to response to comment 303 in Section 14.1).

14.2 Terrestrial

	Respondent (sub #)	Submission and/or issue	Response to comment
315	Cockburn Sound Management Council Officer Submission	Offsets for seagrass and terrestrial vegetation need to be substantial and have regional significance. The ratio of proposed direct and indirect offsets will need careful and balanced negotiation. For example, few specific proposals are provided to compensate for the loss of 70ha of prime coastal land from the conservation estate. It is not appropriate for these proposals to be left to be discussed at a later date; as the proponents propose, when there will no longer be the opportunity for public input.	Any residual impact will be offset in consultation with, and under the guidance of, the EPA, DEC, and SEWPaC. For further detail, please refer to the Mangles Bay Offsets Strategy document.

	Respondent (sub #)	Submission and/or issue	Response to comment
316	Department of Environment and Conservation	The proposal will result in the loss of approximately 52 hectares of the Rockingham Lakes Regional Park (inclusive of land of various tenure and vesting), including 43 hectares of land reserved under the Conservation and Land Management Act 1984 (CALM Act) and vested with the Conservation Commission of Western Australia. This includes land protected under the Bush Forever program at Cape Peron, namely site 355. The proposal may also have detrimental impacts on the Lake Richmond portion of Rockingham Lakes Regional Park, which is also protected under Bush Forever (site 358). It is recommended that this loss be recognised as a very significant permanent loss of public conservation land under management for recreation and nature conservation in the Perth metropolitan region's system of regional parks and be acknowledged as a significant residual environmental impact of the proposal.	Any residual impact will be offset in consultation with, and under the guidance of, the EPA, DEC, and SEWPaC. For further detail, please refer to the Mangles Bay Offsets Strategy document.
317	Department of Environment and Conservation (260)	That, if the proposal is approved, an appropriate offsets package be developed on the advice of DEC, to mitigate the impacts on: • land reserved under the CALM Act and vested in the Conservation Commission of Western Australia; • land in the Rockingham Lakes Regional Park; • TEC 'Callitris preissii (or Melaleuca lanceolata^ forests and woodlands of the Swan Coastal Plain'; • Priority Ecological Community Acacia shrubland on taller dunes, Swan Coastal Plain; • regionally significant fauna habitat; • fauna listed as threatened or specially protected including the graceful sun-moth and Carnaby's black cockatoo; and,	Any residual impact will be offset in consultation with, and under the guidance of, the EPA, DEC, and SEWPaC. For further detail, please refer to the Mangles Bay Offsets Strategy document.
318	Public	What is the expected timeframe for terrestrial rehabilitation of areas? What will happen to the fauna currently utilising areas proposed to be cleared as it will affect quenda, reptiles and other species.	Any residual impact will be offset in consultation with, and under the guidance of, the EPA, DEC, and SEWPaC.
319	Public; Cockburn Sound Management Council Officer Submission	No offsets are proposed for greenhouse gas emissions that will result from the clearing of vegetation. The PER would be more informative if mass or volume measurements were made on cleared vegetation biomass. This would help calibrate carbon release and carbon storage loss from the existing vegetation.	No guidelines currently exist for estimating greenhouse gas emissions. EPA guidance statement 19 – Environmental offsets: “does not apply to offsets associated with greenhouse gas emissions or other pollutant emissions. There are currently no state greenhouse gas offset policies or guidance notes” p. 438
320	Wetlands Conservation Society; Preserve Point Peron for the People.	The proponent should offer a sum comparable to the land value to the site they are taking away from the WA public. The proposed offset ration of 1:1.5 is unrealistic as it is the value and type of land that is important. This land has high economic, social and environmental values and the offset should be like for like – the offset should have similar values.	An offsets package will be decided with the EPA, DEC and SEWPaC to ensure appropriate ratios are utilised and include both direct and indirect offsets for significant environmental impacts. For further detail, please refer to the Mangles Bay Offsets Strategy document.

	Respondent (sub #)	Submission and/or issue	Response to comment
321	Public	Offsets for this proposal should be greater than 1:1.5 ratio as both federally and state listed threatened species will be impacted on. SEWPaC have demanded offsets in the vicinity of 10:1 ratio when developments impact on threatened species. The long term viability of the offset package is in question and to ensure a positive net environmental gain as described in the EPA guidelines the ratio required should be significantly higher.	An offsets package will be decided with the EPA, DEC and SEWPaC to ensure appropriate ratios are utilised and include both direct and indirect offsets for significant environmental impacts. For further detail, please refer to the Mangles Bay Offsets Strategy document.
322	Wetlands Conservation Society; Public	The offset strategy lacks detail, particularly with regard to revegetation. This has not enabled people to comment on it.	The Offsets Strategy is still in draft format and will be finalised in consultation with the EPA, DEC and SEWPaC. For further detail, please refer to the Mangles Bay Offsets Strategy document.
323	Urban Bushland Council	The statement that "Provision of infrastructure for passive recreation within the Cape Peron Area" is an offset which will "counterbalance an adverse residual environmental impact" is nonsense and is unacceptable. The UBC does not accept that indirect 'offsets' should be regarded as offsets at all.	SEWPaC and the EPA recommend implementing packages of direct and indirect offsets to counterbalance adverse residual environmental impacts.
324	Public (194)	Dixon 2011 states that "the lure of beachside living continues to be a major impact on coastal ecology with the Perth metropolitan coastline having the highest degree of artificial fragmentation and ecological decline". Offsets to mitigate environmental impacts are very difficult to achieve success in and require a substantial long term (greater than 10 years) commitment from stakeholders to achieve success criteria if at all. In addition offsets cannot mitigate immediate impacts as they take a substantial time frame to establish if at all.	An offsets package will be decided with the EPA, DEC and SEWPaC to ensure appropriate direct and indirect offsets are implemented for significant environmental impacts. These will be undertaken over a range of timeframes. For further detail, please refer to the Mangles Bay Offsets Strategy document.

	Respondent (sub #)	Submission and/or issue	Response to comment
325	Department of Environment and Conservation (260)	A trial Lomandra spp. translocation program should be developed as a mitigation measure for impacts on the graceful sun-moth. The Lomandra should be translocated from the development site to a nearby area, with a monitoring program to determine translocation success. In relation to the proposed rehabilitation of Lomandra spp. within the regional park, the proponent is to clarify whether Lomandra seedlings/seeds are available to enable successful introduction of this species to other areas, and what the potential success rate will be. The graceful sun-moth is a threatened species at risk of becoming locally extinct in the Cape Peron area if the proposal is approved. This population exists as a completely isolated population. DEC is aware that there is limited habitat for this species within the Rockingham Lakes Regional Park. Many of the areas where the moth remains in the metropolitan region are subject to development pressures. The loss of this population, no matter how small, represents a significant residual risk to the conservation of the species in the Perth metropolitan region. With respect to the status of the graceful sun-moth, additional survey work in 2011 led to its ranking as a threatened species being revised from endangered to vulnerable. Additional survey work carried out in 2012 will be analysed to determine if the species meets the criteria for listing as threatened.	Appropriate management measures for the Graceful Sun Moth will be included in the Offsets Strategy. If considered necessary by the EPA, DEC and SEWPaC this may include a trial Lomandra spp. translocation program. For further detail, please refer to the Mangles Bay Offsets Strategy document.
326	Public	The ability to successfully recreate *Lomandra maritmia* populations within an area which does not currently support this species is of a concern. Underlying site conditions may prevent the successful establishment of this species. In addition where would plant material for propagation of this species be sourced and how would the collection of that material not further impact on both plant and moth populations. The ability to readily propagate *Lomandra maritima* is unknown and as such the presumption that it can simply be re-instated is of concern	Appropriate management measures for the Graceful Sun Moth will be included in the Offsets Strategy. If considered necessary by the EPA, DEC and SEWPaC this may include a trial Lomandra spp. translocation program. For further detail, please refer to the Mangles Bay Offsets Strategy document.
327	Cockburn Sound Management Council Officer Submisison	Section 8.6 (p. 131) notes parties to be consulted with in regard to future terrestrial offset packages. This area lies within the CSMC management boundary and the CSMC should be included in the list to be involved in any future offsets discussions and negotiations.	Relevant environmental legislation does not require inclusion of the CSMC in future offsets discussions and negotiations. However it is noted that CSMC has been consulted throughout the development of the PER to date.

	Respondent (sub #)	Submission and/or issue	Response to comment
328	Cockburn Sound Management Council Officer Submission	The community has reported in the past and currently reports increased sightings of black cockatoos in Shoalwater and nearby coastal Rockingham where there are copses of trees, including Tuart and Banksia, and mid storey shrubs. Information from the Western Australian Museum also indicates that as habitat in the scarp, jarrah and Wheatbelt woodlands decline, coastal habitat becomes more valuable, particularly for feeding and roosting. We would not support a loss of habitat that supports these rapidly declining bird populations and recommends that addressing this issue be part of any offset package.	Subsequent to the PER being published, a survey for Black Cockatoo habitat was conducted. The survey found several potentially suitable habitat trees. These trees were also the subject of investigations by the Water Corporation, and a subsequent application for removal to SEWPaC, as part of the SDOOL realignment. This action has already been approved by the EPA and SEWPaC as advised by the Water Corporation and does not form part of the Proposal.
329	Cockburn Sound Management Council Officer Submission	There are no appropriate offsets that would compensate for a loss of thrombolites due to deterioration in water depths and the water quality of Lake Richmond, The thrombolites are a priceless and irreplaceable local asset, arguably the last 'healthy' colony in the region and they must not be put at risk.	The conservation value of the Thrombolites is acknowledged and the Proponent has gone to substantial effort to design and construct the project, to minimise potential for adverse impact. Groundwater investigations which have been peer reviewed and supported, conclude that there is no risk of saltwater intrusion and only very minor seasonal reduction in water level. The Thrombolite community is considered to not be at risk; hence an offset is not required. However the Proponent has committed to contribute to an inventory of nutrient input via stormwater in an effort to improve quality of water draining into the Lake. It is considered management of nutrient at the source is more effective than at the Lake Richmond Outfall drain.
330	Public	The $5M proposed as an offset should be for improvement of the adjacent area. Land acquisition should be funded separately.	The $5 million funding will be provided for a range of activities including rehabilitation and the acquisition of land with comparable or greater conservation value to secure the land for conservation.
331	Department of Planning	The PER acknowledges the requirements under SPP 2.8 for offsets however, State Strategic Policy considers the proponent has interpreted the requirements incorrectly. The offsets package contain a portion of land acquisition of the same or greater ecological function, vegetation type and significance which constitutes a minimum of 75% of the total offset package. The offset package should be determined through liaison with the DEC, OEPA, City of Rockingham and the DoP.	The offset package is being determined through liaison with the EPA, DEC and SEWPaC. These agencies then have the facility to refer to the City of Rockingham and DoP for comment if necessary. For further detail, please refer to the Mangles Bay Offsets Strategy document.
332	Department of Water	Components of the 'offset package' should also consider the (1) impacts towards the decrease in groundwater levels (impacting upon GDEs, surrounding groundwater users and reduced water levels in Lake Richmond), (2) increase in saltwater intrusion (increasing salinity in groundwater and impacts to surrounding groundwater users), (3) impacts to groundwater quality resulting from the intensification of land-based development and (4) impacts from the proposed relocation of the Lake Richmond outlet drain piped directly into Mangles Bay (i.e. removing the opportunity the open drain achieved in regards to nutrient removal and infiltration to groundwater prior to disposal into Mangles Bay).	An appropriate offset package will be negotiated with relevant Agencies during the review process to ensure all significant environmental impacts are adequately managed/mitigated or offset. For further detail, please refer to the Mangles Bay Offsets Strategy document.

	Respondent (sub #)	Submission and/or issue	Response to comment
333	Friends of Point Peron	To “maintain the abundance of species diversity” the proponent should be required to fund the collection of seed from every species in the project area and fund the growth of seedlings and their planting and care for at least one year.	The majority of species found in the proposal area are commercially propagated and not endemic to this area. Only endemic species not already commercially propagated would require seed collection from the proposal area, yet many native species cannot yet be propagated from seed.

15. Consultation

	Respondent (sub #)	Submission and/or issue	Response to comment
334	Public	Consultation with the occupiers of the AIW site has not occurred yet we are one of the most affected groups since the footprint for the proposal overlaps this site. Cedar Woods should look to relocate the camp to another Point Peron location.	LandCorp and Cedar Woods has and continues to consult with the AIW leaseholder about the Mangles Bay Proposal. The most recent briefing was to inform of the PER advertising on the 24th January 2012. Furthermore the AIW were a representative of the Stakeholder Reference Group (SRG). AIW Committee advised they would formalise their request to government for an alternative site recognising their existing lease will expire prior to construction commencing. More generally Cedar Woods is always available to be approached and provides regular updates in the media and invites contact through a telephone information line and website.
335	Wetlands Conservation Society	They proponents have not consulted a single conservation group, not even the Conservation Council of WA or the Rockingham Regional Environment Centre. The Wetlands Conservation Society were also not consulted and we have a long-standing interest in this site.	Consultations were undertaken in 2005 and 2006 which included a considerable number of community groups including the Naragebup Environmental Centre, Hands Off Point Peron and Preserve Point Peron. Cedar Woods and LandCorp has continued to consult with the groups throughout the process including the Stakeholder Reference Group (SRG). Conservation Council of WA has declined Cedar Woods offer of a briefing and clarification of the environmental study findings. More generally Cedar Woods is always available to be approached and provides regular updates in the media and invites contact through a telephone information line and website.
336	Public	Community support for the proposal is being overstated and consultation with the community has taken the form of 'being informed' rather than 'being consulted.	Consultation in 2005 and 2006 identified a good level of support for the project on the basis it can address the environmental items. Furthermore the dedicated information line showed a good level of support for the proposal. Further market research will be undertaken during the planning phase which to demonstrate the social, economic and environmental benefits of the Mangles Bay Proposal. More generally Cedar Woods is always available to be approached and provides regular updates in the media and invites contact through a telephone information line and website.
337	Public	As part of its accounting for the human environment, the EPA should consider the opinions of the residents of Rockingham and insist that the proponent conduct an independent survey of community views before deciding to give approval to this proposal.	Research will be undertaken during the planning phase to demonstrate support for the proposal on the basis of the social, economic and environmental benefits of the Mangles Bay Proposal.

16. Traffic

	Respondent (sub #)	Submission and/or issue	Response to comment
338	Public	There are few recorded traffic volumes available for the roads in the general area and those that are available are generally 6 – 8 years old. Hence, most of the presented traffic volumes are very speculative. Unless there has been a 'correction factor' added, they are very likely to be low, rather than high. Normal daily traffic volumes are given as 2,700 – 3,000 vpd; which actually occur several times a day. Traffic is already a problem in the early and late afternoons with access to and from Garden Island. People will seek alternative routes through local streets to avoid the congestion likely to be experience to the detriment of local amenity and safety. Adequate traffic and road works should be planned.	The 2700-3000 vehicles per day (vpd) estimate of Garden Island traffic flows was provided by authorities at Garden Island based on their own traffic count information for 18 October 2010 to 18 February 2011. A daily traffic flow of more than 3000 vpd occurred on only 3 days in this period with the highest recorded flow being 3200 vpd on Tuesday 26 October. At least 40 days during this period recorded traffic flows less than 2700 vpd. The forecast increase of this traffic to 4000 vpd was also provided by authorities at Garden Island. Detailed design of key intersections on the road network serving the proposed development will be undertaken as the planning for this project progresses, and will be designed to safely and efficiently accommodate the future traffic flows of the development, the naval base and other land uses in this area. . The Local Structure Plan (LSP) will be subject to more detailed traffic impact assessment which may include the upgrade of surrounding roads.
339	Public; Preserve Point Peron for the People.	Has the proponent considered the amenity issues involved with construction traffic? Large trucks moving to and from the proposal site will impact local amenity, use and enjoyment of the area as well as through increased noise.	The LSP will provide further visual analysis of the proposed development. The final design development will take into consideration further studies to ameliorate the impact through location, orientation and materiality. The assessment will also include the amenity issues involved with construction traffic in the analysis.
340	Public	The Rae Road option would pass the local school and would aggregate an already dangerous option with regards to usage by children, where they often cross at unattended areas.	Noted. In the traffic report, the school zone was noted and, accordingly, the report considered Safety Bay Road to be the preferred route option for heavy vehicles.
341	Public	Will the proposed roads be able to cope with increased traffic predicted from HMAS Stirling? The Navy trucks large equipment to and from the base and supply and safety needs to be considered. There is also the possibility that the extra distance personnel need to travel will increase the amount of money in travel allowance the Navy needs to pay.	The traffic report indicated that a single carriageway two-lane road with appropriate intersection treatments will be able to accommodate the traffic from the proposed development as well as existing naval base traffic flows. However, future expansion of naval base facilities will likely increase the total traffic volumes during this critical period. Therefore, provision is made for future construction of a second 7 m road carriageway to upgrade Memorial Drive to two lanes each way, if and when required to service peak traffic flows from the naval base. The proponent cannot comment on any increases in travel allowances for the Navy.

	Respondent (sub #)	Submission and/or issue	Response to comment
342	Public; Preserve Point Peron for the People.	Re-routing traffic will impact the amenity and comfort of residents. A recent traffic survey of Lake Street (January 2012) from 0630-0700 found that over 70% of drivers were travelling over 60 km/h, where the posted speed limit is 50 km/h. In the latter part of that AM Peak (0700 – 0730), as Naval Ratings began to realise they may be late, that percentage rose to over 80%. One vehicle was recorded as travelling at 104 km/h, though most were in the 65-75 km/h bracket. This poses significant risk to local residents.	Existing speed control issues on the existing local road network are a matter for the police and/or the City of Rockingham to address. The plan for Memorial Drive includes advice from Navy for the future upgrade to cater for increased traffic.
343	Public	The report assumes peak traffic flows from the canal development will occur after 0800 hours. While this is very convenient from Cedar Woods, it is not reality. The potential residents of the canal development are very likely to travel to Perth for work, unless they are retired. In all probability, the canal development and Naval Base peak flows will coincide.	Available travel survey information confirms that household traffic generation is lower in the 7-8am period than 8-9am. The traffic analysis in the traffic report assumes the traffic generated by this site during 7-8am will be 70% of the traffic generated during 8-9am, which is considered a reasonable assumption.
345	Public	The statement of the Transcore 2011 Cape Peron – Proposed Marina and Residential Development Traffic Report states that the design and operation of the site access point will be evaluated in later planning stages, once detail traffic forecast can be made. No detailed consideration has obviously been made and the effects on local roads and residents should be thoroughly studied as part of the environmental impact assessment process.	The traffic report states that “the design and operation of site access points will be evaluated in later planning stages once land uses are refined and a detailed traffic forecast can be calculated.” It is standard practice for the details of projects such as these to be refined and designed in progressively greater detail as the planning of the proposal progresses. It is considered that the level of analysis that has been undertaken to date is appropriate for the current stage in the planning and environmental approval process.
346	Public	Single access and exit via Memorial Drive severely restricts access in the case of an emergency such as a bush fire or rescue of trapped persons.	If an emergency access route is required through the site this would be able to be accommodated as part of the detailed design. To be thoroughly reviewed during LSP process as the plan is finalised.
347	City of Rockingham	The Traffic Report (Construction) (Traffic Report') compiled by Transcore (2011) fails to demonstrate that construction traffic will not have a significant impact on local roads, and that the regional and local traffic implications of the proposal have been adequately considered. Various issues have been identified in the Traffic Report which should be addressed, as outlined below. • Page 3 of the Traffic Report discusses traffic counts for Point Peron Road, which were recorded 7 years ago. The PER should be updated with current peak hour counts at key locations along Point Peron Road, in order to confirm the current traffic conditions.	• Peak period traffic counts will be required at existing key intersections including on Point Peron Rd for more detailed traffic analysis of the future traffic flows and intersection design as planning for this development progresses. These counts will coincide with peak periods of activity at Garden Island naval base, likely to be the October-February period that was counted in 2007.

	Respondent (sub #)	Submission and/or issue	Response to comment
347 (cont)	City of Rockingham (cont)	• Page 4 of the Traffic Report discusses traffic counts, provided by HMAS Stirling, of around 2,700-3,000 vehicles per day coming and leaving the Navy Base, however a 2007 traffic count undertaken by the City, on behalf of HMAS Stirling, recorded between 4,110 and 4,243 vehicles coming and leaving the Navy Base per day in 2007. This raises questions over the accuracy of the projected increase to 4,000 vpd by 2018 as stated in the report. • Pages 9 and 11 of the Traffic Report state that Parkin Street and Rae Road have sealed shoulders. This is not the case, with no shoulders marked along the length of Parkin Street or Rae Road. The PER should be updated to reflect this.	• The 2700-3000 vehicles per day (vpd) estimate of Garden Island traffic flows was provided by authorities at Garden Island based on their own traffic count information for 18 October 2010 to 18 February 2011. A daily traffic flow of more than 3000 vpd occurred on only three days in this period with the highest recorded flow being 3200 vpd on Tuesday 26 October. The forecast increase of this traffic to 4000 vpd was also provided by authorities at Garden Island and represents an increase of one third in existing traffic levels. City of Rockingham traffic counts on the causeway in 2007 recorded between 4110 and 4243 vpd as stated. If the one third increase is applied to that count it would suggest future Garden Island traffic could be up to 5660 vpd instead of 4000 vpd. However, the highest hourly traffic flow recorded by the City of Rockingham count was 913 vph, compared to 1200 vph assumed in the traffic report (based on the 2011 counts). The traffic report analysis is based on these higher peak hour flows, hence, the conclusions are not affected by the City's 2007 counts. • Noted.
347 (cont)	City of Rockingham (cont)	• Page 11 of the Traffic Report discusses traffic count figures for Rae Road from 2006, which do not take into account some significant residential development that has since occurred in the area. Counts undertaken by the City in 2007 recorded 5, 500vpd east of Waimea Road (increase over the counts in the report of around 12%) and 11060 vpd West of Read Street (an increase of around 125%), which should be reflected in the PER. • Page 18 of the Traffic Report states that there will be two 18 month periods when. 1,000,000m^3 of spoil will be transported from the Proposal site. This does not match the statement on page 27 of the PER document which states that earth works will be conducted over a 7-9 year period and only 800,000m^3 of spoil will be removed. A more accurate time table for the construction traffic should be provided in the PER, along with the quantity of material to be removed from the Proposal site. A calculation breakdown showing how the volume estimate was devised would also be beneficial to the City, and should be included in the PER. • Page 18 of the Traffic Report does not provide the likely start time of the 18 month period (time of year) or the expected lag time between the periods. This should be included in the PER. • The Traffic Report discusses the preferred route for construction traffic without providing details of a likely destination for spoil. There is also no reference to the fact that both Safety Bay Road and Parkin Street are currently used by trucks hauling sand from Point Peron, at certain times of the year.	• The traffic flows on Rae Road reported in the traffic report were only for the western section near Safety Bay Road. More recent Main Roads WA counts (August 2011) recorded average weekday traffic flows of 5,084 vpd east of Safety Bay Road and 11,422 vpd west of Read Street. These sections of Rae Road are very different in character; the western section has abutting residential development with direct access whereas the eastern section has no direct access from abutting residential development and is more suited for the higher traffic flows it carries. • Detailed design of movements on the road network serving the proposed development will be undertaken as the planning for this proposal progresses. This will include the schedule and calculation breakdown of the volume estimate. • An indicative development schedule has been included Table 3 of the PER. • The PER outlines the spoil (if not to be used onsite) will be recycled for use as fill at a number of project sites. These sites will be determined as the planning for this proposal progresses. • It is noted that Safety Bay Road and Parkin Street are currently used by trucks hauling sand from Point Peron, at certain times of the year. Detailed design of movements on the road network serving the proposed development will be undertaken as the planning for this proposal progresses, and will be designed to safely and efficiently accommodate the future traffic flows of the development, the naval base and other land uses in this area.

	Respondent (sub #)	Submission and/or issue	Response to comment
347 (cont)	City of Rockingham (cont)	• Page 27 of the Traffic Report makes no mention of the likely performance issues, at the intersection of Memorial Drive and Safety Bay Road. The current intersection of Point Perori Road and Safety Bay Road can have some noticeable levels of service issues during peak times and this is before an estimated additional 7,000 vpd are added to the network. The report does not consider the impact of an additional 7,000vpd on the existing road network (Safety Bay Road, Lake Street and Parkin Streets in particular). • The proposed cross section of Memorial Drive (7m) on Page 28 of the Traffic Report, does not adequately cater for commuting cyclists who would prefer to ride on the carriageway. It should also be noted that the proposed cross section does not-match the required road cross section for a Neighbourhood connector road A (over 3000vpd) which requires a boulevard treated carriageway configuration. A 7m wide single carriageway width is not supported due to not meeting the Liveable Neighbourhood's requirements for bus routes and AustRoad requirements for on-street cycling.	• Detailed design of key intersections on the road network serving the proposed development will be undertaken as the planning for this proposal progresses and will be designed to safely and efficiently accommodate the future traffic flows of the development, the naval base and other land uses in this area. • The need for on-street cycle lanes in addition to the shared path that has been proposed in the traffic report is debatable, especially considering that a 3m wide Principal Shared Path and no on-road cycle lanes is considered appropriate on higher order roads such as Kwinana Fwy. If necessary, the proposed shared path could be increased from a 2.5 to a 3 m wide path rather than adding on-street cycle lanes. The Liveable Neighbourhoods cross-section for a Neighbourhood Connector A includes a 2 m central median. This median provides for right turn traffic movements at driveways to abutting properties that would otherwise interrupt the free flow of through traffic on these roads. There will not be direct driveway access to this road so this need for a continuous median is removed. Footnote 7 under that cross section (Figure 17 in Liveable Neighbourhoods) acknowledges that the median may be omitted in some circumstances. Given the initial single carriageway road is proposed as an initial treatment, until it needs to be upgraded to a full dual carriageway, further adds to the justification for omitting the median in this interim period.

17. Ongoing management and conditions

	Respondent (sub #)	Submission and/or issue	Response to comment
348	Public; Preserve Point Peron for the People; Department of Health; Department of Water; Department of Transport; Friends of Point Peron	What is the arrangement for long term management and maintenance of the canals and dredging and has the local authority (or other agency) confirmed that they will take on this responsibility? We are aware the City of Rockingham have expressed the view that it is not able to take on the role of waterways manager. Funding needs to be available to enable ongoing management and maintenance of the proposed artificial waterway, including its access channel. It is fundamental that where water quality is affected who/whom and how will particular water quality issues be managed and remediated. The Department of Transport can offer advice regarding income streams for waterways management.	It is acknowledged that the marina water body manager is yet to be determined. If the proposal is approved, the marina will be developed in accordance with WAPC Development Control Policy 1.8 (Canal Estates and Artificial Waterways Development) .This policy requires the development of Construction and Operational Environmental Monitoring and Management Plans for the marina. These plans will identify management responsibilities, along with an environmental quality management framework specifying environmental values, environmental quality objectives, levels of protection and environmental quality criteria to be met to maintain acceptable water and sediment quality in the marina.
349	Public; Maritime Union of Australia	Will the proponent provide a financial bond to ensure that any costs required for ongoing management will be assured should something happen, eg. like the Geographe Bay Marina proposal. How long would the proponent be liable to finance any environmental problems that arise?	Through the Development Agreement for the marina management the proponent has a responsibility to fund and undertake management works for a five year period.
350	Public; Cape Peron Community Vision Working Group; Preserve Point Peron for the People; Friends of Point Peron	Will the ratepayers of Rockingham be forced to pay increased rates for management of the marina? What is the estimated cost to maintain the marina through dredging – its currently costs $200 000/year to maintain the boat ramp beside the causeway? Costs should be specified and agencies identified.	The costs to maintain and manage the marina will be determined within a business case to provide funding sources against expenditures. The costs will be specified during the amendment process of the Town Planning Scheme (TPS). If any increase in rates are required to address additional costs would be provided through a specified area rate and would not affect general ratepayers within the City. Given the low level of sediment movement in Mangles Bay, maintenance dredging is not likely to be required on a regular basis, nor frequently.
351	Public	Undertaking monitoring during and after construction will be too late – it should be done prior to the proposal going ahead.	As detailed throughout the PER, monitoring of nearby surface water, groundwater, soil and sediment has been conducted throughout the development process. This investigation process has been undertaken in order to make assertions about the suitability of the site, and formulate criteria to assess the impact of operations upon commencement and throughout the construction phase. Monitoring programmes will be established and will commence prior to construction to provide a baseline against which subsequent scale of impacts can be determined.

	Respondent (sub #)	Submission and/or issue	Response to comment
352	Recfishwest (257)	Recfishwest recommends that a condition be implemented for the long term responsibility of manual and periodic removal of seagrass wrack build-up from around breakwaters. Decomposing seagrass wrack is unsightly and malodorous and will depreciate the amenity of the area if it were to remain onshore for long periods of time. The decomposition process also reduces the dissolved oxygen content in a water body, this could be toxic to marine life and cause death, particularly when associated with high temperatures.	Large amounts of wrack (seagrass) do not accumulate in Mangles Bay at present (despite the presence of the Causeway). This should not change. Therefore, it is unlikely that large accumulations of seagrass will occur and result in unacceptable impacts (i.e., odorous, unsightly or toxic). Regular manual removal is not likely to be necessary, but periodic removal after storms may be required if considered necessary to maintain the amenity of the beachfront. It is important to note that the value of wrack to the marine environment is recognised by DEC and OEPA and therefore measures to remove it from the environment would not be supported. If the wrack is moved it would need to be able to re-enter the marine environment in another suitable location
353	Department of Transport	An adequate channel siltation monitoring program should be implemented to assist in the development of future dredge management plans.	Agreed and noted.
354	Department of Environment and Conservation (260)	That if the proposal is considered acceptable, a condition of approval be applied that • states that turbidity generated by construction and dredging activities associated with the proposal does not result in a loss of seagrass biomass in the Shoalwater Islands Marine Park. • requires the proponent to monitor seagrass biomass in the Shoalwater Islands Marine Park immediately to the west of the causeway.	Conditions of approval will be determined by the EPA and the Minister for the Environment in the Ministerial Statement. However it is anticipated that this request will be incorporated into the Construction Environmental Monitoring Plan as a staged approach, with monitoring at sites in the marine park only triggered if it impacts are detected at sites presently proposed for monitoring in Mangles Bay.
355	Department of Fisheries (208)	The development of the marina will impact on water quality and likely result in poor flushing at the end of the proposed canals. The Department recommends that post construction water quality monitoring to be undertaken to ensure water quality is maintained at an acceptable level.	Noted and the need for post-construction water quality monitoring is accepted. Post-construction water quality monitoring will be addressed during the development of the Operational Environmental Management Plan for this proposal, as required under Development Control Policy 1.8 - Canal Estates and Artificial Waterways Development.
356	Cockburn Sound Management Council Officer Submission (201)	In Section 13.7.6 and 13.7.7 (pp. 302-303), there is little discussion of contaminant accumulation in marina sediments or cycling within the enclosed water body of the marina. Further, no actual marina inspection process is outlined that will address the detection of marine pests or high levels of fouling organisms on vessels in the marina. This is an issue that will need to be a component of future marina management plans.	Noted. The need for contaminant accumulation and monitoring of marine pests and fouling organism levels will be addressed during the development of the Operational Environmental Management Plan.
357	Friends of Point Peron (215)	Before EPA approval the proponent should be required to establish baselines for seagrass meadows in Mangles Bay and wherever else the proponent might offer to create an offset that include every epiphyte as well as shoot density and species diversity.	Some baseline data has been obtained for shoot density as this is the EPA chosen health indicator for *Posidonia* in Cockburn Sound. Appropriate offsets and monitoring requirements will be determined in consultation with the EPA, DEC and SEWPaC.

	Respondent (sub #)	Submission and/or issue	Response to comment
358	City of Rockingham (195)	Trial of seagrass transplantation at a smaller scale than that projected as part of the proposal has had limited success at locations other than Albany. A monitoring program will be important to assess the survival of the transplants. The Seagrass Transplantation Plan will require careful consideration of a suite of factors to ensure the offset is effective. This will particularly be relevant given that natural recovery of *Posidonia* in areas directly impacted by dredging is unlikely, or at best, will be very slow. In this regard, the success of this management measure cannot be guaranteed.	Noted. A comprehensive seagrass rehabilitation plan will be developed (subject to environmental approval for the Proposal) describing the rehabilitation sites, seagrass species to be used, transplanting units and techniques, spacing of planting units and the proposed monitoring and management measures for the transplanted seagrass.
359	Recfishwest (257); Friends of Point Peron (215)	The monitoring plan stipulates that the re-planted seagrass will be monitored through high-resolution imagery for 2 years post construction (page xvi), however transplantation trials showed that complete seagrass colonisation may take 4 - 5 years. Recfishwest proposes that 2 years of monitoring is not sufficient to accurately determine the success of the seagrass transplantation. Ground truthing also needs to be conducted to establish the health of seagrasses, including their coverage of epiphytes, which cannot be deducted from digital imagery alone. Recfishwest expects at least 5 years of monitoring (although it is also likely that the time period necessary for monitoring these is of the order of 10-15 years due to the specific conditions in Mangles Bay), both digital and on-ground. Before approval the EPA needs to ensure that criteria for use in monitoring seagrass plantings are adequate in terms of the objectives of the biodiversity and abundance of epiphytes. There should also be a condition which stipulates a contingency offset, should the transplant process prove unsuccessful.	Agreed: in situ monitoring of transplanted seagrasses is proposed. The purpose of the aerial imagery is to confirm whether seagrass loss as a result of the marina is within the limits predicted for the proposal. There are EPA precedents for other seagrass transplantation programs in WA, including contingencies if performance measures are not met.
360	Cockburn Sound Management Council Officer Submission (201)	There are no physiological measures of "stress" in the adjacent Mangles Bay seagrass area, closest to the areas that will receive marina water discharges. This would enable assessment of the extra stress poor water quality discharges will have on already stressed seagrass meadows and to improve understanding of the impact of the small increases in localised poor water quality. It is therefore not known whether they will trigger a tipping point or extensive seagrass meadow death. The operational management plan for the marina will need to incorporate measures, summarised in bullet points at the bottom of page 223 (section 10.6.2), and ensure that the future management body/entity will be fully responsible for their implementation.	We are not aware of any physiological measures of stress in seagrasses that can be specifically linked to water quality only. Nor does the majority of the seagrass literature advocate measures of seagrass as an early warning of stress, because they are too variable. The proposed approach is to instead measure light climate and chlorophyll levels, as these target the main cause-effect pathway.

	Respondent (sub #)	Submission and/or issue	Response to comment

361	Department of Environment and Conservation (260)	That with respect to pile driving and rock dumping:
		• The proponent commit to engaging a dedicated Marine Fauna Observer (MFO) during pile driving and rock dumping (in addition to during dredging) who shall:
		  ○ demonstrate a knowledge of marine wildlife species in the Perth metropolitan region, particularly species listed under the Wildlife Conservation Act and associated notice;
		  ○ be on duty at all times during pile driving and rock dumping; and,
		  ○ maintain a log of observations of marina fauna, including injured or dead fauna (of any species) within 1,000 metres of pile driving or rock dumping, which is to be submitted to DEC at the completion of construction works.
		• That no pile driving or rock dumping commence until the MFO has verified that no dolphins or sea lions have been observed within a radius of 1,000 metres of pile driving and construction during the 30 minute period immediately prior to the commencement of pile driving or rock dumping.
		• That if the MFO observes a dolphin or sea lion entering within 1,000 metres of pile driving or rock dumping, the pile driving or rock dumping is to be suspended.
		• That pile driving and rock dumping work that has been suspended, shall not recommence until the dolphin or sea lion has moved on of its own accord beyond 1,000 metres from the pile driving or rock dumping, or has not been seen within 1,000 metres for 30 minutes.
		• That pile driving and rock dumping only occur during daylight hours to enable an adequate level of observation by the MFO. That pile driving and rock dumping occur outside the months of September to March to avoid the peak dolphin calving period.
			Conditions of approval will be determined by the EPA and the Minister for the Environment in the Ministerial Statement. The Proponent questions the need for such restrictions on construction works, particularly given the lack of justification for such.
			These items will also be addressed in the CEMP.

	Respondent (sub #)	Submission and/or issue	Response to comment
362	Department of Fisheries (208)	The Department suggests the following as a condition of development: • The significance of the Mangles Bay for fisheries is evidenced by the fact that it is been a critical sampling site for both crab and finfish species for the Department over the past 20 years. It is a highly significant 'hot spot' for recruitment by juveniles of many commercially and recreationally important species, including fish and crabs and, as such, is a critical fish and crab nursery area within the metropolitan region. Therefore the proponent should engage with the Department of Fisheries to undertake monitoring of finfish and crab populations pre and post development to the satisfaction of the Department of Fisheries. Results of all work should be made available to the Department as part of on-going Ecosystem based Fisheries management (EBFM) data base for the Cockburn Sound and South West Bioregion; • The results of dredge plume monitoring during construction, and coastal dynamics monitoring following construction should be made available to the Department; • There be a firm commitment to remove existing swing moorings within Mangles Bay within a specified period following construction of the marina; • That seagrass replanting be undertaken on a 1:2 ratio, in consultation with the Cockburn Sound Management Council, and the Department be kept informed of the trial and on-going monitoring; and • That any dredging proposed as part of the development be undertaken following discussion with the Western Australian Fishing Industry Council (WAFIC) and Recfishwest to minimise impact on commercial and recreational fishing activity.	Conditions of approval will be determined by the EPA and the Minister for the Environment in the Ministerial Statement. In response to the bullet points offered, the Proponent : • Is willing to contribute to such a study in some way, but is not willing to undertake the study unless it is accepted as a major offset for habitat loss. • Agrees to keep the Department informed of results of monitoring programmes • Understands that that is the intention and responsibility of DoT • Disagrees with the seagrass replanting ratio requested and has proposed an alternative that provides fish enhancement devices in addition to seagrass transplants. The proposed ratio in the PER is believed to be reasonable, as there is more ecological benefit to be gained in other marine offsets rather than additional transplants. • Accepts the need to liaise with WAFIC to minimise adverse impact on commercial and recreational fishing activity.
363	Department of Water	An Urban Water Management Plan (UWMP) is required as a condition of subdivision and/or development applications to present the final drainage design and water sensitive urban design best practice.	Once rezoning and LSP have been approved, the land may then be developed and subdivided. At the subdivision stage, State and Local Government regulators may set conditions for subdivision that must be signed off by the regulators prior to the developer receiving Certificates of Title and being able to sell the lots. This includes environmental conditions, such as the preparation of a Construction Environmental Management Plan (CEMP) and Urban Water Management Plan.
364	Department of Water	There doesn't appear to be any details or commitments for post-construction management. Impacts on surface water, groundwater and the environment can potentially continue post-construction until an new equilibrium is reached. It is expected that monitoring will be continued by the proponent for a period determined adequate in the PER.	Post construction management measures will be addressed during the development of the Operational Environmental Management Plan. Monitoring of post-construction impacts will be undertaken as specified by Ministerial conditions

	Respondent (sub #)	Submission and/or issue	Response to comment
365	Department of Water	Regarding the management measures and performance standards in section 6.5, point number four states *"Bores surrounding the marina will be monitored quarterly for water levels and salinity during construction, and three years following construction"*. It is not clear which bores this statement is in reference to. If it is monitoring bores intended to identify impacts of the marina, the proposed frequency of quarterly monitoring for a proposal of this magnitude is considered to be insufficient.	A new bore monitoring programme will be established and the monitoring frequency will be adjusted to be commensurate with the risk of impact. That is, greater frequency during construction to provide warning of adverse impact with reduced frequency once a steady pattern is developed.
366	City of Rockingham (195)	The PER does not document evidence that the hydraulic characteristics of the substrate of Lake Richmond have been investigated however this is not seen to be a limiting factor to the conclusions reached. To address these uncertainties, however, it is recommended that during construction, and into the long term, appropriate groundwater level and quality monitoring be undertaken in the area between the proposed development and Lake Richmond. Any significant changes to groundwater parameters should be flagged and appropriate remediation undertaken. Trigger levels to quantify 'significant changes' to groundwater/lake levels and/or water quality will need to be established prior to development. Should significant divergence from predicted groundwater level or water quality be observed during monitoring, the numerical groundwater model may require updating, with subsequent re-evaluation of its predictions.	Noted and the need for groundwater monitoring between the proposal and Lake Richmond is accepted. Details of post-construction water quality and groundwater level monitoring will be provided during the development of the OEMP.
367	Department of Environment and Conservation (260)	A condition should be applied that requires the proponent to develop an appropriate groundwater monitoring program, in consultation with DEC, to determine the extent of saltwater movement, over time, towards threatened ecological communities (TEC): stromatolite-like microbialite community (ranked critically endangered); and sedgelands in Holocene dune swales of the southern Swan Coastal Plain (ranked critically endangered); and Callitris oreissii (or Melaleuca lanceolata) forests and woodlands of the Swan Coastal Plain (ranked vulnerable).	As noted in the previous response, the need for groundwater monitoring between the proposal and all sensitive receptors is accepted. Details of post-construction water quality and groundwater level monitoring will be provided during the development of the Operational Environmental Management Plan.
368	Department of Environment and Conservation (260)	If the development is approved, a condition should be applied that • requires the proponent to translocate fauna of conservation significance. Translocation effort should be supported by monitoring to gauge success. • address the risk to fauna entrapment in trenches. This would include the development and implementation of monitoring and best practice management.	Conditions of approval will be determined by the EPA and the Minister for the Environment in the Ministerial Statement. The Proponent recognises the need to protect fauna of conservation significance where possible. These items will also be addressed in the CEMP.

	Respondent (sub #)	Submission and/or issue	Response to comment
369	Friends of Point Peron (215)	Weed management strategies need to be expanded to take into account the abilities of *Euphorbia terracina* to reproduce in the Cape Peron Park. Spraying mature plants is ineffective as they die back but revive even more strongly after the next rains. Because *Schinus terebinthifolia* is spread so easily by birds and because it is so resilient by suckering as well as seeding in the Cape, the proponent needs to conduct a survey on foot to locate all surviving plants and eradicate them completely by hand. Other weeds may be needed to be included here but FPP does not have expertise in them.	Noted. Weed management strategies will be provided during the development of the Operational Environmental Management Plan.
370	Department of Environment and Conservation (260)	That if the proposal is considered acceptable, a condition be applied that • restricts the direct and identifiable indirect impacts of the proposal on the Callitris preissii (or Melaleuca lanceolata,) forests and woodlands of the Swan Coastal Plain TEC to specifically defined limits. • requires the proponent to undertake both baseline monitoring and a long-term monitoring program designed in consultation with DEC, to detect any decline in the extent or condition of the Callitris preissii (or Melaleuca lanceolata) forests and woodlands of the Swan Coastal Plain TEC that may be attributable to indirect effects associated with the development proposal. • the proponent be required to make a long-term (greater than 10 years) commitment to mitigate or ameliorate any significant detrimental impacts on the Callitris preissii (or Melaleuca lanceolata) forests and woodlands of the Swan Coastal Plain TEC that are found to be attributable to indirect effects associated with the development proposal and that development should be managed to restrict impacts within the specifically defined limits referred to above. • there be no loss of the stromatolite like microbialite community TEC and the sedgelands in Holocene dune swales of the southern Swan Coastal Plain TEC at Lake Richmond.	Conditions of approval will be determined by the EPA and the Minister for the Environment in the Ministerial Statement. . In response to the dot points offered, the Proponent: • Accepts the need to be restricted to specifically defined limits • Accepts the need undertake a 5 year monitoring program designed in consultation with DEC, to detect any decline in the extent of sensitive terrestrial habitats • Accepts the need to make a 5 year commitment to mitigate or ameliorate any significant detrimental impacts on sensitive terrestrial habitats • Accepts that there should be no loss of Thrombolites as a result of the proposal. However it is noted that water levels and quality in Lake Richmond are beyond the Proponent's capability and responsibility to control and that Thrombolites may be impacted by factors outside the proposal responsibility. The Proponent recognises the importance of the Thrombolites and to wishes to protect them, and to this end has offered to contribute to a nutrient inventory of drains discharging into the Lake, and is currently negotiating a research grant with Curtin University to study Thrombolite ecology in Lake Richmond.

	Respondent (sub #)	Submission and/or issue	Response to comment
		• requires the proponent to develop and implement a long-term monitoring program designed in consultation with DEC. The program should detect any decline in the condition, composition, or extent of the stromatolite like microbialite community TEC and the sedgelands in Holocene dune swales of the southern Swan Coastal Plain TEC at Lake Richmond that may be attributable to direct or indirect impacts including hydrological change (quantity and quality) associated with the development. • that the proponent be required to make a long-term (greater than 10 years) commitment to mitigate or ameliorate any impacts on the stromatolite like microbialite community TEC and the sedgelands in Holocene dune swales of the southern Swan Coastal Plain TEC at Lake Richmond that is attributable to direct or indirect impacts including hydrological change associated with the development proposal. • These conditions are required due to potential inaccuracies with the groundwater modelling data. Precautions should be in place to ensure the conservation of these TEECS over the full extent of the construction period.	
371	Cockburn Sound Management Council Officer Submission (201)	Consideration should be given to the feasibility of transplanting *Lomandra* grass plugs to include possible buried GSM larvae before clearing the land that contains GSM habitat. This could be a CEMP component.	Conditions of approval will be considered by the EPA and the Minister for the Environment in the Ministerial Statement.
372	Department of Environment and Conservation (260)	The proponent should develop and resource a plan for the ongoing management of iron monosulfide black oozes (IMBOs) that are likely to develop in the marina complex after construction. IMBOs are biochemical precipitates that often grow in artificial water bodies after construction, particularly under conditions where there is poor flushing and ongoing groundwater discharge of nitrogen and iron. IMBO accumulations can cause deoxygenation and the release of nutrients into the water column when disturbed, often triggering fish kills and algal blooms. IMBOs need careful (and expensive) ongoing management to prevent environmental problems.	There is no indication that IMBO's have developed yet in ocean flushed marinas. IMBO's tend to be a concern in estuarine waters which suffer regular eutrophication. However the accumulation of organic matter and nutrient levels in sediments within the water body will be monitored. Details of the monitoring programme will be provided in of the OEMP.
373	Cockburn Sound Management Council Officer Submission (201)	Appropriate quality of water should be used for dust suppression (fresh versus saline) and items such as absorbency mats and bunding should be utilised for the storage of any material and plant that may leak or create environmental contamination by accident or storage.	Noted. The need for appropriate water quality for dust suppression will be addressed during the development of the Operational Environmental Management Plan.

	Respondent (sub #)	Submission and/or issue	Response to comment
374	Department of Health (243)	A recreational water quality monitoring arid management program should be developed and implemented in accordance with the National Health and Medical Research Guidelines for Managing Risks in Recreational Waters, to monitor microbial and chemical contaminates in recreational waterways that may experience contamination from the site. This should include background monitoring prior to construction, during construction and following operation. The proponent should liaise directly with the Department of Health and the City of Rockingham on the development of the monitoring and management plan.	Noted. The need for appropriate water quality monitoring will be addressed during the development of the Operational Environmental Management Plan.
375	Friends of Point Peron (215)	Approval by the EPA should be only given after CEMP's for all risks have been evaluated.	Environmental risks are assessed through the EPA process. CEMPs are not required until the subdivision approval stage.

	Respondent (sub #)	Submission and/or issue	Response to comment
376	Department of Water	The Department provides the following comments on the CEMP. **Section 3.2 Review and reporting** 1. Any changes to the Construction Environmental Management Program should also be referred to the DoW for review. **Section 5.4 Management actions (table 2)** 1. Table 2 should include a column for "Approving Authority" to describe who will be reviewing the monitoring data, programs and plans. 2. Item 16: add to action "which will include triggers based on modeled predictions and management actions should these triggers be reached". 3. Item 17: add to action "which will include triggers based on modeled predictions and management actions should these triggers be reached". 4. Item 18: the reporting commitments are inadequate. The proponent should be required to assess and report against triggers tri-annually and report all results annually. **Section 5.5 Monitoring and corrective actions** 1. For Table 3 Groundwater monitoring regime, this table should also include all the environmental monitoring requirements from table 2. 2. Monitoring and management actions lack the level of detail required. Trigger levels should be provided for specific bores and be based on modeled predictions. Two tiers of trigger levels are recommended with contingency actions proposed at each level including re-sampling and or investigation to modification of the activities on site. The proponent is advised to liaise with the DoW for further guidance. 3. Also, the frequency of analysis for dewatering effluent is insufficient and not comparable to other similar projects of this magnitude.	The Proponent : • anticipates that the DEC will refer all surface and groundwater related matters to the DoW. • Notes and accepts the advice given in items 3,4, and 6 • Proposes twice-yearly report of results and assessment against trigger levels for item 5 • Agrees that re-sampling should be included as contingency at reaching investigation level for item 7 • Agrees to consider more frequent monitoring of dewatering effluent for item 8
376	Department of Water	**Section 6.4 Management actions (table 4)** 1. No reporting requirements have been listed for surface water monitoring. Reporting should be the same as those detailed for groundwater (table 2).	The Proposal will integrate reporting of surface water monitoring with groundwater monitoring in an annual report.

	Respondent (sub #)	Submission and/or issue	Response to comment
377	Department of Environment and Conservation (260)	That if the proposal is considered acceptable, the conditions of approval require DEC to be consulted on the: • Terrestrial biodiversity and habitat management plan. • Marine biodiversity and habitat management plan. • Graceful sun-moth management plan. • Dust management plan. • Noise and vibration management plan. • Fire management plan. • Contaminated sites and ASS management plan. • Rehabilitation management plan.	DEC will be consulted in the formulation of amendments to existing management plans presented in the CEMP.

18. Peer review

	Respondent (sub #)	Submission and/or issue	Response to comment
378	Conservation Council of WA Public	The EPA should require an independent peer review of the hydrological investigations and the validity of the modelling assumptions. The peer review by Rockwater is not independent as it is clear that the reviewer had been previously involved in parts of the investigations and had already influenced the modelling approach taken.	A peer review was recommended by the Department of Water in February 2011. Rockwater provided the peer review of the hydrogeological modelling in September 2011. Since this time Rockwater have been engaged to provide further comment on groundwater issues at the site. The peer review by Dr Phil Wharton of Rockwater is presented in Appendix 5 of the Strategen summary response to OEPA /CSMC on water quality issues document
379	Cockburn Sound Management Council	There is no peer review undertaken for the marina-dredging-sediment model component.	A peer review of the marina-dredging-sediment model has since been undertaken by Dr Jason Antenucci of Hatch consultants and is provided in Appendix 6 of the Strategen summary response to OEPA /CSMC on water quality issues document
380	Hon Lyn MacLaren MLC	The coastal process modelling should be peer reviewed.	A peer review of the coastal process modelling has since been undertaken by Dr Matt Elliot of Damara WA.Pty Ltd and is in Appendix 1 of Strategen document “Response to Key Marine and Groundwater Issues Raised in Submissions on the Mangles Bay PER”.