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# ALKIMOS WASTEWATER TREATMENT PLANT AND OCEAN OUTFALL

EPA Assessment Number SITE A – 1582, SITE B - 1529

## RESPONSE TO PUBLIC SUBMISSIONS ON PUBLIC ENVIRONMENTAL REVIEW

The public submission period for the Water Corporations' Alkimos Wastewater Treatment Plant (AWWTP) and Ocean Outfall proposal, Public Environmental Review (PER) commenced on 8 November 2005 for a period of eight weeks, ending on 23 January 2006.

The Environmental Protection Authority (EPA) received 14 submissions on the project (See Attachment 1).

The principal issues raised in the submissions related to environmental and social issues. Many submissions were framed in the form of statements and the essence of these is reproduced here. It may be helpful to the proponent to view these in the form of questions where possible and respond accordingly.

Although not all of the issues raised in the submissions are environmental, the proponent is asked to address all issues, comments and questions, as they are relevant to the proposal.

In summary the key issues were identified as:

### 1. General

1.1 The proposal

### 2. Biophysical Environment

- 2.1 Geoheritage
- 2.2 Fauna (Carnaby's Black Cockatoo's & Terrestrial Fauna)
- 2.3 Conservation of Flora & Vegetation
- 2.4 Site Rehabilitation
- 2.5 Fire & Pest Control
- 2.6 Groundwater
- 2.7 Benthic Habitat
- 2.8 Energy Usage

### 3. Pollution

- 3.1 Wastewater Discharge (Ocean Outfall)
- 3.2 Air Quality – Odour Emissions

### 4. Social Surroundings

- 4.1 Land Development Issues
- 4.2 Justification – Alternatives
- 4.3 Indigenous Consultation
- 4.4 Economics

### 5. Other

- 5.1 Water Re-Use
- 5.2 Construction of WWTP & Ocean Outfall

### 6. Matrix Table - Identifying issues raised by public and various groups in response to PER

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## **Appendices**

Appendix 1: Alkimos MRS Site B Map

Appendix 2: Alkimos Hydrology Final Report (Rockwater 2004)

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## 1.0 GENERAL

From the submissions received, five indicate support for the construction of AWWTP at Site A with three submissions supporting the Site B proposal. The remaining submissions were undecided or neutral and mainly commented on various positive and negative aspects for both sites.

All submissions indicated support for the re-use of water and questioned the Water Corporation's intentions. The Majority of the submissions addressed the geoheritage and flora and fauna issues associated with the construction of the plant, including the impacts on the parabolic dunes, Carnaby's Cockatoos and Bush Forever land. A significant number of the submissions also addressed a range of pollution related issues such as odour and treated wastewater discharge from the proposed ocean outfall. Social impacts associated with land development and other issues were also raised.

Responses to the issues are provided below:

### 1.1 The Proposal

#### 1.1.1 **Launch Site 2 has been summarily dismissed because of cost and complexity (Section 2, page 19), when allied to the need to provide airflow channel from Site B this site it appears to be the most preferable option (Submission 13).**

- A. The towed ocean outlet can be launched from either Site 1 or Site 2. However Launch Site 2 poses more constraints when compared to Launch Site 1B. Launch Site 1B is in direct alignment with the preferred route (to minimise disturbance of reef and marine habitat) for the Alkimos Ocean Outlet (AOO), whereas Site 2 is approximately 350 metres to the south. Site 2 requires removal of more sensitive vegetation than Site 1, and leads to a pipeline route that requires more excavation of reef. Also, the seabed inshore of the reef is shallower on the alignment from site 2 compared to the alignment from Site 1. For these reasons, Site 1 was preferred to Site 2.

Regardless of the chosen AWWTP site, it is Water Corporation's intention to launch the initial ocean outlet from Site 1B. If Site B is chosen and if an odour channel is constructed in the future, a subsequent ocean outfall may be launched from Launch Site 2.

#### 1.1.2 **Proposed launch site 1B would have less impact on coastal habitat (Submission 2, 7).**

- A. Launch Site 1B will have less impact on coastal habitat. To launch from Site 2 will necessitate the destruction of the proposed coastal Regional Open Space and limestone cliffs that are a feature of the Alkimos beach, whereas at Site 1B the disturbance will be limited to a swale in the coastal dune which can be rehabilitated.

#### 1.1.3 **Launch site Option 2 seems to be environmentally more acceptable option in respect of its impact on terrestrial ecosystems (Submission 3).**

- A. Site 1B is preferable to Site 2. Launch site 1B can be oriented to align with the preferred sea floor route, with reduced disturbance of terrestrial habitat, coastal dune formations and reef structures. Launch site 2 however requires more destructive and complex excavation of the nearer offshore reefs at Eglinton Rocks to achieve the desired alignment.

#### 1.1.4 **The buffer zone for site A is largely contained in the Water Corporation's land holdings. You can place conditions on the Water Corporation to maintain the buffer in its natural state and enhance it where destruction by Homo Sapiens has already occurred. For Site B the Water Corporation would have to purchase**

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**huge tracks of land (or exchange it plus, no doubt, big dollars for the developer) before you can realistically impose similar conditions (Submission 11).**

- A. The 1977 MRPA plan in 1977 and the Metropolitan Region Scheme (MRS) plan in 1994 had located the AWWTP at site A. However land planning drivers in the late 1990's, particularly by the other landowners to enhance the beach usage for development and commercial purposes created an all round compromise resulting in the site B location.

It is the Water Corporation's intention to acquire and manage for conservation purposes (to the extent required by the Environmental Protection Authority (EPA)) the buffer zones as delineated within the PER. For Site A this will require limited extra acquisition, for Site B significantly more. The cost the acquisition of the Site B buffer will be off-set by the sale of the developable land on the Water Corporation's existing Lot 101.

- 1.1.5 The Western Australian Planning Commission (and therefore the Department for Planning and Infrastructure) has already indicated support for Site B for the development of the Alkimos Wastewater Treatment Plant through its current planning initiatives associated with MRS Amendment 1029/33, although it is noted that there are some environmental benefits to Site A (Submission 13).**

- A. The Water Corporation is working towards giving effect to it at Site B (see responses 1.1.6 and 1.1.7). However, the Water Corporation has proposed an alternate site, Site A, as a fall-back position should technical, financial, environmental or social constraints render Site B unavailable to it to develop the AWWTP in the timeframes necessary to service the planned development of the Northwest Corridor.

- 1.1.6 It appears from the MRS Amendment 1029/33 and from the substantive comments in the PER document, the proposed site for the AWWTP is to be at Site B.**

**“At a high level meeting held in September 2004 between the Developers, the Water Corporation and the DPI, Site B was chosen as the agreed site for the AWWTP so that the land most desirable for urban development, to the west, could be available for residential development. Site A remained as a fallback position should any fatal flaws be identified with Site B” (Section 1.1.7.5, WC PER)**

**The MRS amendment proposed by the EPA suggests that in order to maintain ecological linkages it would be necessary to reserve a significant section of the Alkimos landscape. Site B appears to intrude quite far into this reservation. At public meetings held with the Water Corporation it appears as if there could be further adjustment to the site location and consideration for Site B to be moved west and south of the proposed Site B identified in the PER. So in effect we could be looking at ‘Bananas in Pyjamas’ – B1 and B2! (Submission 5)**

- A The Water Corporation recognises the EPA's desire to protect the geological time sequence of the Quindalup Dune system at Alkimos, and the unique geological, landform and scientific values they represent. The Water Corporation has explored the possibility of moving the site of proposed AWWTP to the South and West to avoid the areas identified as of high conservation significance by the Environmental Protection Authority in Bulletin 1207 Alkimos-Eglinton MRS Amendment No. 1029/33 (Area 9).

Representations by the Department of Planning and Infrastructure (DPI), LandCorp and developers during the MRS appeals process have indicated that the planning and social benefits postulated to be accrued from the development will be seriously

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compromised by such a move making the development unviable. Therefore, the Water Corporation believes the AWWTP could remain in the original position (Site B) proposed in the PER. The reasons for this include wider social benefit and better planning outcomes balanced against the purely environmental imperatives as enunciated in the EPA Bulletin. The Water Corporation believes that any environmental impact from remaining at Site B can be adequately offset as follows:

1. The Water Corporation, through engineering measures will reduce as far as practicable the slope (and therefore the real extent of disturbance to the Q3 Quindalup Dune) of the batter on the eastern end of Site B as delineated by the yellow line on the attached plan. This will still result in the disturbance (loss) of 8 hectares of the Q3 Dune within the EPA's Area 9 conservation area.

2. The Water Corporation will agree to dedicate other areas within its buffer zone to be managed for conservation purposes to offset that disturbance. Those areas are:

- 19 hectares of Q3 Quindalup Dune system delineated by the hatched area 1 on the attached plan, located to the immediate South and West of the AWWTP site resulting in a 2.4:1 offset of like for like geomorphological structure; and
- 43 hectares of Banksia woodlands located immediately North of the EPA's Area 9 conservation area bounded by the AWWTP buffer, delineated as the hatched area 2 on the attached plan.

3. The Water Corporation is amenable to Ministerial conditions being applied to require the continued management of the areas identified for conservation purposes in perpetuity within the buffer, with the following caveats:

- That the opportunity to construct an odour channel to the west of the site to mitigate the odour ponding phenomenon not be constrained by the conservation areas; and
- The ability to traverse the conservation areas for the installation of essential linear infrastructure (pipes and power) and access roads to the AWWTP not being compromised. The Water Corporation would commit to avoidance of the affected areas, sensitive route planning, minimal disturbance and rehabilitation where practicable to maximize the conservation values.

**1.1.7 The EPA in their report suggested that important ecological linkages are environmentally unacceptable, as evidenced by the recommendation to reserve Area 9 (MRS Appendix 6). From the MRS Report it appears to the EPA that Site B is environmentally unacceptable and can only be environmentally acceptable through the inclusion of substantial assets of land to be reserved (Submission 5).**

A. The Water Corporation recognises the EPA's desire to protect the geological time sequence of the Quindalup Dune system at Alkimos, and the unique geological, landform and scientific values they represent. The Water Corporation has explored the possibility of moving the site of proposed AWWTP to the South and West to avoid the areas identified as of high conservation significance by the EPA in Bulletin 1207 Alkimos-Eglinton MRS Amendment No. 1029/33 (Area 9).

Representations by the DPI, LandCorp and developers during the MRS appeals process have indicated that the planning and social benefits postulated to be accrued from the development will be seriously compromised by such a move making the development unviable. Therefore, the Water Corporation believes the AWWTP could remain in the original position (Site B) proposed in the PER. The reasons for this include wider social benefit and better planning outcomes balanced against the purely environmental imperatives enunciated in the EPA Bulletin. The Water Corporation

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believes that any environmental impact from remaining at Site B can be adequately offset as follows:

1. The Water Corporation, through engineering measures will reduce as far as practicable the slope (and therefore the real extent of disturbance to the Q3 Quindalup Dune) of the batter on the eastern end of Site B as delineated by the yellow line on the attached plan. This will still result in the disturbance (loss) of 8 hectares of the Q3 Dune within the EPA's Area 9 conservation area.

2. The Water Corporation will agree to dedicate other areas within its buffer zone to be managed for conservation purposes to offset that disturbance. Those areas are:

- 19 hectares of Q3 Quindalup Dune system delineated by the hatched area 1 on the attached plan, located to the immediate South and West of the AWWTP site resulting in a 2.4:1 offset of like for like geomorphological structure; and
- 43 hectares of Banksia woodlands located immediately North of the EPA's Area 9 conservation area bounded by the AWWTP buffer, delineated as the hatched area 2 on the attached plan.

3. The Water Corporation is amenable to Ministerial conditions being applied to require the continued management of the areas identified for conservation purposes in perpetuity within the buffer, with the following caveats:

- That the opportunity to construct an odour channel to the west of the site to mitigate the odour ponding phenomenon not be constrained by the conservation areas; and
- The ability to traverse the conservation areas for the installation of essential linear infrastructure (pipes and power) and access roads to the AWWTP not being compromised. The Water Corporation would commit to avoidance of the affected areas, sensitive route planning, minimal disturbance and rehabilitation where practicable to maximize the conservation values.

**1.1.8 Site A is cheaper to establish and construct, while providing fewer expensive technical and engineering fixes to operate (Submission 5).**

A. The excavation and sensitive disposal of approximately 3,000,000 cubic metres of sand and limestone poses some serious technical and significant financial differentials between Site B when compared to Site A. However, the intention is that the sale of coastal land by developers to the west of Site B would partially offset the higher cost of developing Site B. The shortfall will potentially be funded by a special head-works contribution (developer contribution) and/or government contribution that reflect the additional value to the community through commercial and retail activities.

Both sites will require the same operating effort if the appropriate buffer size is applied particularly for odour ponding. Site B may require an odour channel or other odour mitigation and management due to the odour ponding phenomenon. Site A does not have an odour ponding issue and will not rely on additional odour control measures.

**1.1.9 There is an agreement in place with a number of the AE Landowners and the Water Corporation for the *Alkimos Water Treatment Plant (AWTP)* to be relocated to Site B. This agreement has been in place for a number of years giving effect to MRS Amendment 1029/33. The understanding of all parties to the agreement to relocate to Site B is that Site A is included in the AWTP-PER as a fallback position at the request of the EPA. The preferred position of all key stakeholders since 2000 is Site B and to this end all planning and comprehensive site analysis, associated research and community consultation undertaken since this time has been to facilitate the MRS Amendment 1029/33.**

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**Consideration is given to promote and reinforce that Site B is the preferred location by all key stakeholders (Submission 6).**

- A. The Water Corporation acknowledges the agreement, and is working towards giving effect to it at Site B (see responses 1.1.6 and 1.1.7). However, the Water Corporation has proposed an alternate site, Site A, as a fall-back position should technical, financial, environmental or social constraints render Site B unavailable for it to develop the AWWTP in the timeframes necessary to service the planned development of the Northwest Corridor.

**1.1.10 Site B and its associated buffer facilitates a superior environmental outcome than Site A in relation to vegetation, flora and geoheritage and this outcome should be clearly reflected in future documentation (Submission 6).**

- A. Site B does not offer greater conservation opportunities than Site A from an ecological or geoheritage perspective, merely different opportunities.

The buffer zone surrounding Site A would enable partial conservation of three of the four geological/ecological phases (Q1, Q3 and Q4) augmenting and providing linkages with the conservation of the third phase (Q2) identified in the MRS process (Area 9). The AWWTP would be built over a Spearwood limestone enclave containing a Priority 3 species (*Sarcozona bicarinata*) which is widely distributed elsewhere within the buffer zone of the AWWTP, and thus can be adequately protected.

The buffer zone surrounding Site B would enable the opportunity to conserve some of the near coastal complexes in the oldest phase (Q1) and second phase (Q3) of the Alkimos cusped forelands and nested parabolic dune system. It also offers the opportunity to partially augment the Bush Forever Site 397 to the north, but offers little or no opportunity to achieve a contiguous linkage between all phases, given it does not encompass the youngest phase (Q4) of the Alkimos system. Furthermore, Site B significantly impacts on the confluence of the second (Q3) and third (Q2) phases of the Quindalup dune system identified by the EPA in Bulletin 1207 Alkimos-Eglinton MRS Amendment No. 1029/33 (Area 9), which the Water Corporation believes may be compensated by offsets.

**1.1.11 The buffer area for Site A immediately abuts Bush Forever Site 397 on the west and north and thereby increases the effective size of Site 397. However, the north side parabolic dune vegetation forms an important linkage role for animal movements, contains several priority flora taxa, and connects Bush Forever sites 397 and 130, enhancing value of each, so that clearing of this for urban development will have wide ramifications. EPA Bulletin 1207 proposes that if the WWTP is located at Site B then this dune formation should be protected. This is a significant benefit that can only be provided by locating the WWTP at Site B (Submission 13).**

- A. Site B does not offer greater conservation opportunities than Site A from an ecological or geoheritage perspective, merely different opportunities. The areas identified by the EPA as being areas of environmental significance relevant to the AWWTP in EPA Bulletin 1207, being Areas 9 and 6c, provides for a contiguous linkage from Bush Forever Site 397 to 130 irrespective of the location of the AWWTP. To locate the AWWTP at Site B will cause disruption to the high value landform (the Q2/Q3 conjunction) which may be able to be offset as proposed in responses 1.1.6 and 1.1.7. Site A better augments the EPA's conservation objectives without the requirement for offsets.

**1.1.12 Site B allows for residential development close to the coast and enables a proposed commercial/retail node (i.e. a beachside village) within the south-west corner of the buffer, enhancing the status of the beach as a regional focal point, and providing significant sustainability benefits by enabling the operation of a**

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**direct and frequent bus service to, and from, the proposed railway station at Alkimos (Submission 13).**

A.

The Water Corporation's objective in agreeing to include Site B as a potential WWTP site in its PER is to assist developers maximise the planning and development opportunities in the Alkimos area. However, the Water Corporation has retained Site A as a fall-back site should technical, financial, environmental or social constraints render Site B unavailable for it to develop the AWWTP in the timeframes necessary to service the planned development of the Northwest Corridor.

Site B allows for a residential development and coastal node to the west of the AWWTP. Under the Site A option, these developments would be moved south and north of the Alkimos beach area. The town centre and train station would remain in the virtually the same location. Bus services would still be able to be operated to adjoining destinations such as the beach, coastal developments etc.

The Water Corporation has explored the possibility of moving the site of proposed AWWTP to the South and West to avoid the areas identified as of high conservation significance by the Environmental Protection Authority in Bulletin 1207 Alkimos-Eglinton MRS Amendment No. 1029/33 (Area 9).

Representations by the DPI, LandCorp and developers during the MRS appeals process have indicated that the planning and social benefits postulated to be accrued from the development will be seriously compromised by such a move making the development unviable. Therefore, the Water Corporation believes the AWWTP could remain in the original position (Site B) proposed in the PER with offsets as proposed in responses 1.1.6 and 1.1.7.

**1.1.13 Site A enables development of the beach front at a reduced scale from that envisaged under Site B, in particular food premises and a lifesaving club will be incompatible uses and therefore, with Site A, the beach will be unsafe for swimming and could not support the bus service discussed above (Submission 13).**

A.

Kiosks, surf life-saving clubs, beach parking, active recreational facilities and the like would all be considered compatible land-uses within the buffer on the beach front. High value restaurants, housing and the like would not. Commercial centres could be located to the south and north of the buffer boundary.

The beach would not be "un-safe" as all normal lifesaving services will be able to be provided in a location not affected by the proximity of the AWWTP or the ocean outlet. The land behind the beach front would not be available for residential development, and virtually left in its natural state.

**1.1.14 On balance, site A would have less environmental impact. In its findings on the MRS amendment, the EPA has recommended moving the site B to the west. This may overcome some of the problems but further investigation is needed (Submission 10).**

A.

This is a reasonable interpretation of the EPA's findings in Bulletin 1207 given the conservation value they have placed on Area 9. Any proposition by the Water Corporation to move from Site B to anywhere other than Site A would require further evaluation by the EPA. The Water Corporation has explored the possibility of moving the site of proposed AWWTP to the South and West to avoid the areas identified as of high conservation significance by the EPA, however representations by the DPI, LandCorp and developers during the MRS appeals process have indicated that the planning and social benefits postulated to be accrued from the development will be seriously compromised by such a move making the development unviable. Therefore, the Water Corporation believes the AWWTP could remain in the original position (Site B) proposed in the PER with offsets as proposed in responses 1.1.6 and 1.1.7.



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**1.1.15** The PER should have included the following: 1. a map with a scale along the lines of Plan 01, Appendix B (not like Figure 3.11, Section 3, page 29) for each site A and B with land use, spoil disposal areas, coastal buffers, odour buffers, temporary construction site for launching the ocean outlet, major roads, urban railway etc., and 2. the report from the AWWTPCC (Submission 11).

A. Location of spoil from the excavation has not been addressed fully in the PER, as it is not the responsibility of the Water Corporation. The land developers will utilise the spoil to terra-form the developments outside the Water Corporation's buffer to prepare the area for urban development. The other information requested is in the relevant locations within the PER document.

**1.1.16** From the Proponent's own scoping document and sustainability assessment it would appear that Site A is much more sustainable when examining the social, economic and environmental benefits of locating the WWTP at either site. The Site B option appears to sever important ecological linkages and the evidence of dunal succession. This would compromise the integrity for the benefit of the few who would pay for a sea view to support their elite lifestyles (Submission 5).

A. An over-riding consideration from a whole of government context is to ensure the viability of the proposed development as a whole (the "best planning outcome", involving urban and commercial development, transportation energy and wastewater treatment services).

The Water Corporation has presented a sustainability assessment for Sites A and B in the PER (Table 4.1). The assessment shows that there are significant technical, social, economic and environmental differences between the Site A and Site B. Due to the possibility of these differences not being acceptable, the Water Corporation has proposed Site A as a fall-back site. The Water Corporation has also explored the possibility of moving the site of proposed AWWTP to the South and West to avoid the areas identified as of high conservation significance by the EPA subsequent to the release of the PER. However, representations by the DPI, LandCorp and developers during the MRS appeals process have indicated that the planning and social benefits postulated to be accrued from the development will be seriously compromised by such a move making the development unviable.

The excavation and sensitive disposal of approximately 3,000,000 cubic metres of sand and limestone poses some serious technical and significant financial differentials between Site B when compared to Site A. However, the intention is that the sale of coastal land by developers to the west of Site B would partially offset the higher cost of developing Site B. The shortfall will potentially be funded by a special head-works contribution (developer contribution) and/or government contribution that reflect the additional value to the community, for example, through commercial and retail activities.

Water Corporation is unable to comment on lifestyle values.

## **2.0 BIOPHYSICAL ENVIRONMENT**

### **2.1 Geoheritage**

**2.1.1** Site B damages the integrity of the significant landforms due to the extensive excavation required (Submission 2, 7).

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- A. The location of the AWWTP at Site B creates disruption to the high value landform (the Q2/Q3 conjunction). The EPA has identified the geological time sequence of the Quindalup Dune system at Alkimos, and the unique geological, landform and scientific values they represent as areas of high conservation significance in Bulletin 1207 Alkimos-Eglinton MRS Amendment No. 1029/33 (Area 9).

The Water Corporation believes that any environmental impact from remaining at Site B can be adequately offset as follows:

1. The Water Corporation, through engineering measures will reduce as far as practicable the slope (and therefore the real extent of disturbance to the Q3 Quindalup Dune) of the batter on the eastern end of Site B as delineated by the yellow line on the attached plan. This will still result in the disturbance (loss) of 8 hectares of the Q3 Dune within the EPA's Area 9 conservation area.

2. The Water Corporation will agree to dedicate other areas within its buffer zone to be managed for conservation purposes to offset that disturbance. Those areas are:

- 19 hectares of Q3 Quindalup Dune system delineated by the hatched area 1 on the attached plan, located to the immediate South and West of the AWWTP site resulting in a 2.4:1 offset of like for like geomorphological structure; and
- 43 hectares of Banksia woodlands located immediately North of the EPA's Area 9 conservation area bounded by the AWWTP buffer, delineated as the hatched area 2 on the attached plan.

3. The Water Corporation is amenable to Ministerial conditions being applied to require the continued management of the areas identified for conservation purposes in perpetuity within the buffer, with the following caveats:

- That the opportunity to construct an odour channel to the west of the site to mitigate the odour ponding phenomenon not be constrained by the conservation areas; and
- The ability to traverse the conservation areas for the installation of essential linear infrastructure (pipes and power) and access roads to the AWWTP not being compromised. The Water Corporation would commit to avoidance of the affected areas, sensitive route planning, minimal disturbance and rehabilitation where practicable to maximize the conservation values.

**2.1.2 Site B would have an environmentally unacceptable impact on geoheritage values of the site, as it would damage the integrity of the parabolic dune due to the extensive excavation of 3 million cubic metres of limestone required to accommodate the WWTP at this site. In addition, this option fails to protect in the buffer the youngest dune formations and would open to disturbance the chronological sequence of the whole dune complex (Submission 3).**

- A. The EPA has identified the geological time sequence of the Quindalup Dune system at Alkimos, and the unique geological, landform and scientific values they represent as areas of high conservation significance in Bulletin 1207 Alkimos-Eglinton MRS Amendment No. 1029/33 (Area 9). The location of the AWWTP at Site B creates disruption to the high value landform (the Q2/Q3 conjunction) which may be able to be offset as proposed in responses 1.1.6, 1.1.7. and 2.1.1. To locate the AWWTP at Site A augments the EPA's conservation objectives and offers the opportunity to protect to some extent the youngest phases (Q4) of the dune system, although these are identified by the EPA in Bulletin 1207 as being of conservation significance and are likely to be placed within the conservation estate irrespective of the location of the AWWTP.

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The excavation and sensitive disposal of approximately 3,000,000 cubic metres of sand and limestone poses some serious technical difficulties. Location of spoil from the excavation has not been addressed fully in the PER, as it is not the responsibility of the Water Corporation. The land developers will utilise the spoil to terra-form the developments outside the Water Corporation's buffer to prepare the area for urban development.

**2.1.3 Site A provides a greater opportunity for protection of coastal habitats without the threat of housing development and would better protect geoheritage values by retaining four landform units and linking areas identified by the EPA (Submission 2, 7, 4).**

- A. The EPA has identified the geological time sequence of the Quindalup Dune system at Alkimos, and the unique geological, landform and scientific values they represent as areas of high conservation significance in Bulletin 1207 Alkimos-Eglinton MRS Amendment No. 1029/33. The location of the AWWTP at Site B creates disruption to the high value landform (the Q2/Q3 conjunction) which may be able to be offset as proposed in responses 1.1.6, 1.1.7 and 2.1.1. To locate the AWWTP at Site A augments the EPA's conservation objectives and offers the opportunity to protect to some extent the youngest phases (Q4) of the dune system, although these are identified by the EPA in Bulletin 1207 as being of conservation significance and are likely to be placed within the conservation estate irrespective of the location of the AWWTP.

**2.1.4 The Site A buffer offers the opportunity to preserve a greater variety of dune habitat, providing a greater range of intact and well vegetated ecosystems, internationally significant geoheritage landforms (Submission 5).**

- A. The EPA has identified the geological time sequence of the Quindalup Dune system at Alkimos, and the unique geological, landform and scientific values they represent as areas of high conservation significance in Bulletin 1207 Alkimos-Eglinton MRS Amendment No. 1029/33. The location of the AWWTP at Site B creates disruption to the high value landform (the Q2/Q3 conjunction) which may be able to be offset as proposed in responses 1.1.6, 1.1.7. and 2.1.1.

To locate the AWWTP at Site A augments the EPA's conservation objectives and offers the opportunity to protects to some extent the youngest phases (Q4) of the dune system, although these are identified by the EPA in Bulletin 1207 as being of conservation significance and are likely to be placed within the conservation estate irrespective of the location of the AWWTP.

**2.1.5 Site A protects the chronological sequence from the youngest dunes to the older ones and if the EPA's recommendation to include the ecological link (Site 9 in the Bulletin 1207) into the Parks and Recreation Reservation, this would provide a better environmental outcome. It is recommended that inclusion of site 9 is essential (Submission 3).**

- A. The Water Corporation will, regardless of whether the AWWTP is built on Site A or Site B, recognise and manage for conservation purposes the portion of Area 9 delineated by the EPA that lies within its buffer for conservation purposes.

**2.1.6 The geoheritage values have received little attention in detailed land use planning of the Alkimos – Eglinton area, though they were documented as long ago as 1979. More recent work by Semeniuk points to the lack of representation of these landform types in the conservation estate. A sequence of dune landforms and habitats at Alkimos need to be reserved to maximise protection of biodiversity and geoheritage values (Submission 10).**

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- A. The Water Corporation has identified and reported on the geoheritage significance of the area in the PER. The value has been recognised in the EPA's Bulletin 1207 and the extent of the areas to be reserved for conservation therein. The Water Corporation recognises the interest and significance attributed to the geo-heritage landforms in the Alkimos region, and will be bound by the recommendations of the EPA and decisions of the Minister for Environment regarding conservation of these values for its AWWTP.

**2.1.7 The coastal dune formations in the Alkimos area have been identified as having national, and even worldwide significance as detailed in the PER (refer to PER section 3 pp 25-26 – Semeniuk V & C Research Group – A description of coastal and marine zones of the Alkimos area). As discussed above the EPA response to MRS Amendment 1029/33 (i.e. Bulletin 1207) has proposed that this formation be protected by the creation of a new Parks and Recreation reservation connecting Bush Forever Sites 397 and 130. Locating the WWTP at Site A does not easily afford the same opportunity (Submission 13).**

- A. This assertion is incorrect and misleading. The areas identified by the EPA as of environmental significance in EPA Bulletin 1207, being Areas 9 and 6c, provides for a contiguous linkage from Bush Forever Site 397 to 130 irrespective of the location of the AWWTP. Site B does not offer greater conservation opportunities than Site A from an ecological or geoheritage perspective, merely different opportunities.

The buffer zone surrounding Site A would enable partial conservation of three of the four geological/ecological phases (Q1, Q3 and Q4) augmenting and providing linkages with the conservation the third phase (Q2) identified in the MRS process (Area 9). The AWWTP would be built over a Spearwood limestone enclave containing a Priority 3 species (*Sarcozona bicarinata*) which is widely distributed elsewhere within the buffer zone of the AWWTP, and thus can be adequately protected.

The buffer zone surrounding Site B would enable the opportunity to conserve some of the near coastal complexes in the oldest phase (Q1) and second phase (Q3) of the Alkimos cusped forelands and nested parabolic dune system. It also offers the opportunity to partially augment the Bush Forever Site 397 to the north, but offers little or no opportunity to achieve a contiguous linkage between all phases, and not encompassing the youngest phase (Q4) of the Alkimos system.

To locate the AWWTP at Site B also creates disruption to the high value landform (the Q2/Q3 conjunction) which may be able to be offset as proposed in responses 1.1.6 and 1.1.7.

**2.1.8 The majority of Site B is situated within a depression in the Alkimos Dune System, although part of the facility is located on the dune system itself, and will impact on the second (Q3) and third (Q2) phases of the Alkimos Dune System. The PER states that approximately 3,000,000 cubic metres of earth would be required to be excavated. Significant excavation of the dunes on the eastern side of the Site B and battering will be required to position the treatment plant to allow gravity wastewater inflow (Submission14).**

- A. The provision of gravity conveyancing of the large quantities of sewage to the AWWTP, and the gravity flow through the plant to ocean disposal of the advanced secondary treated wastewater in the event of system failure is fundamental to the protection of public health. To achieve this, the excavation and sensitive disposal of approximately 3,000,000 cubic metres of sand and limestone will be necessary at Site B. Location of spoil from the excavation has not been addressed fully in the PER, as it is not the responsibility of the Water Corporation. The land developers will utilise the spoil to terra-form the developments outside the Water Corporation's buffer to prepare the area for urban development.

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The EPA has identified the geological time sequence of the Quindalup Dune system at Alkimos, and the unique geological, landform and scientific values they represent as areas of high conservation significance in Bulletin 1207 Alkimos-Eglinton MRS Amendment No. 1029/33. The location of the AWWTP at Site B creates disruption to the high value landform (the Q2/Q3 conjunction) which may be able to be offset as proposed in responses 1.1.6, 1.1.7. and 2.1.1.

**2.1.9 Site A sits mostly within an area of dune swale that is Degraded to good condition (Submission 14).**

- A. The AWWTP at Site A would be built over a Spearwood limestone enclave containing some Priority 3 species (*Sarcozona bicarinata*) which is widely distributed elsewhere within the buffer zone of the AWWTP, and thus can be adequately protected.

**2.1.10 Site A is located predominantly in a hollow within the Quindalup dunes, and will impact on the second phase (Q3) of the Alkimos Dunal System. The PER states that 180,000 cubic meters of earth will be excavated, which will have a limited impact on the dune system (Submission 14).**

- A. The impact upon the Q3 second phase Quindalup Dune formations is limited, with large portions of Q3, adjacent to the Q1 (oldest phase) and Q4 youngest phase lying within the proposed buffer for Site A, thus providing conservation opportunities for these values that could link to the Area 9 conservation values (Q2 or third phase) identified by the EPA in Bulletin 1207.

Approximately one third of the area of site A impacts on the second phase (Q3) of the Alkimos dunal system although the Q3 phase surrounding site A remains intact. By contrast site B occupies nearly all of the Q3 phase and totally severs the linkage with the adjacent Q2 phase.

**2.2 Fauna**

**2.2.1 Urban development around Perth is removing feeding grounds for the threatened Carnaby's Black Cockatoo. A strategy is needed to maintain and manage feeding grounds for the long-term survival of the species (Submission 2, 7).**

- A. The AWWTP will have limited impact upon the feeding habitat of the Carnaby's Black Cockatoo, consisting of only a 28.2 ha footprint, a small proportion of which is the habitat. The Water Corporation is a supporting member/co-ordinator of the Cockatoo Care program. The proposed buffer around both sites offer opportunities for some conservation of the feeding habitat of Carnaby's Cockatoo, however in the context of the overall urban development of approximately 1300 ha outside the buffers, these opportunities are small.

**2.2.2 Site B protects areas of Banksia and Dryandra that are important feeding habitat for Carnaby's Cockatoo (Submission 2, 7).**

- A. *Banksia* and *Dryandra spp* are important feeding habitat for Carnaby's Cockatoo. The Water Corporation will minimise disruption (due to the footprint of the plant) of these habitats as far as practicable. Furthermore, the proposed buffer around both sites offer opportunities for some conservation of the feeding habitat of Carnaby's Cockatoo, however in the context of the overall urban development of approximately 1300 ha outside the buffers, these opportunities are small.

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**2.2.3** The area covered by the Alkimos Eglinton urban development is covered in substantial tracts of Banksia woodland complex, Dryandra heath land and Tuarts, both mallee form and forest. This complex of rich biodiversity provides extensive feeding and foraging and breeding grounds for many terrestrial birds, reptiles and mammals. Carnaby's Cockatoo and Baudin's Cockatoo are both listed as 'Schedule 1, Fauna that is rare or is likely to become extinct' under the Wildlife Conservation Act 1950. Carnaby's Cockatoo is listed as 'Nationally endangered' under the Environmental Protection and Biodiversity Conservation Act 1999, Baudin's Cockatoo is likely to be so listed in the near future. It is vital that any ecological connectivity between Yanchep National Park and the coastal heath and dune flora be retained, in order to preserve these two species of cockatoo. This means that the decision to Site the Alkimos Waste Water Treatment Plant must be made using a triple-bottom line approach to sustainability (Submission 5).

A. The Water Corporation cannot comment on the acceptability (or otherwise) of the proposed broad scale urban development (delineated in the MRS Amendment 1207) on the Carnaby's Cockatoo feeding habitats. The Water Corporation has presented a sustainability assessment for Sites A and B in the PER (Table 4.1). Recognising the high biodiversity and feeding habitat of the Carnaby's Cockatoo, the Water Corporation will be referring the project to the Department of Environment and Heritage as required by the EPBC Act prior to conclusion of the State environmental impact assessment process. The Water Corporation will minimise disruption (due to the footprint of the plant) of these habitats as far as practicable. Furthermore, the proposed buffer around both sites offer opportunities for some conservation of feeding habitat of Carnaby's Cockatoo, however in the context of the overall urban development of approximately 1300ha outside the buffers, these opportunities are small.

**2.2.4** Concerns that decisions are being sought on developments, such as this one and the future urban development at Alkimos-Eglinton that will result in significant loss of habitat for Carnaby's Black Cockatoos. This Endangered species, protected under the *Environmental Protection and Biodiversity Conservation Act 1999* and the *Wildlife Conservation Act 1956*, is threatened by these development proposals without any publicly available adequate information on the size of the population of these birds, without any estimation of the sustainable size of the feeding habitat necessary to support them, or an assessment of the regional impact of the proposed clearing.

**It is recommended that no further decisions on development proposals are made until adequate assessment of the continuous loss of feeding and potential breeding habitat of the Carnaby's Black Cockatoos is done in the Perth Metropolitan Region (Submission 3).**

A. No data is available and regarding the population size or breeding and feeding/foraging range of *Calyptorhynchus latirostris* (Carnaby's Cockatoo) in the greater Alkimos area, or the areal extent necessary to be reserved to sustain the population (or assist it to recover). The Water Corporation will take a maximum of 28.2ha, a small proportion of which will involve some feeding habitat. This needs to be viewed in the context of up to 1300ha to be cleared for the urban development the AWWTP will eventually service. The Water Corporation will minimise disruption (due to the footprint of the plant) of these habitats as far as practicable. Furthermore, the proposed buffer around both sites offer opportunities for some conservation of feeding habitat of Carnaby's Cockatoo, however in the context of the overall urban development of approximately 1300 ha outside the buffers, these opportunities are small.

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- 2.2.5 Site B sits within an area of dunes and swale that contains various heathland, shrubland and woodland habitats. The proposed Site B earthworks will significantly impact on important feeding habitats, especially Banksia woodland, for the Endangered Carnaby's Cockatoo (Submission 14).**
- A. The Water Corporation will take a maximum of 28.2ha at Site B, a small proportion of which will involve some feeding habitat. It will involve the excavation of up to 3,000,000 cubic metres of sand and limestone within this area. However, the areal extent of the impact needs to be viewed in the context of the large tracts of land to be cleared for the urban development that the AWWTP will eventually service. The Water Corporation will minimise disruption (due to the footprint of the plant) of these habitats as far as practicable within its control. Furthermore, the proposed buffer around both sites offer opportunities for some conservation of feeding habitat of Carnaby's Cockatoo, however in the context of the overall urban development outside the buffers, these opportunities are small.
- 2.2.6 Adoption of Site B also avoids triggering the Commonwealth Environmental Protection and Biodiversity Act 1999 because the Site B buffer will facilitate the protection of foraging habitats of the Carnaby's Cockatoo, via: Habitats "4 and 5 found predominantly within the Site B buffer are extremely important in terms of conservation." (Section 7, page 10) (Submission 13)**
- A. Contrary to this assertion, the Commonwealth Department of Environment and Heritage has expressed interest in the AWWTP project, and wishes to make the determination whether or not it triggers the EPBC Act as a "controlled action". Thus excavation of Site B may trigger the EPBC Act due to the taking of the Banksia woodlands to the immediate east of the WWTP site because of the extensive batters necessary to stabilise the site. The Water Corporation will not pre-empt the decision of the Commonwealth Minister for Environment and Heritage, and will refer the AWWTP project to the Commonwealth for a determination. The opportunity to offset any habitat losses elsewhere within the buffer will be canvassed within that referral.
- 2.2.7 It is unacceptable that fauna assessment is based on one site visit and a desktop assessment instead of a rigorous assessment as recommended in the EPA's Guidance No 56 (Environmental Protection Authority 2004). According to the Guidance No 56, in general fauna surveys conducted for baseline information should be multiple surveys conducted in each season appropriate for the region and the faunal group (page12) (Submission 3).**
- A. The flora and fauna surveys were undertaken by competent professionals in close consultation with the relevant Environmental Protection Authority Service Unit officers.
- 2.2.8 The PER compares the two sites A and B in respect of the habitat preferred by different types of fauna. Without the more detailed information on the fauna actually present it is difficult to compare the sites, as one site might offer a greater variety of habitat that could be protected within the proposed buffer. But if you take into account the requirements of individual species of fauna it might not achieve much because the habitat favoured by the certain species will not be large enough to accommodate a viable population of that species. In fact, an option that would provide an opportunity to conserve a large area of a smaller variety of habitats might offer a better environmental outcome (Submission 3).**
- A. The commentator has correctly identified the quandary choosing the "best" environmental outcomes given that Site B does not offer greater conservation opportunities than Site A from an ecological or geoheritage perspective, merely different opportunities. The flora and fauna surveys were undertaken by competent

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professionals in close consultation with the relevant Environmental Protection Authority Service Unit officers. In the context of the wider urban development front surrounding the AWWTP and its buffer (irrespective of which site is chosen), the impact of the AWWTP is relatively small and represents the provision of essential strategic infrastructure to service the planning and development approved in the corridor. Thus, in this context the Water Corporation believes sufficient study has been undertaken to enable the EPA to draw appropriate conclusions and recommendations regarding the AWWTP.

## **2.3 Conservation of Flora and Vegetation**

### **2.3.1 The Site A buffer has a greater proportion of bush land in good condition and of conservation significance than that for Site B (section 4 page 10) (Submission 2, 7, 4).**

- A. The buffer zone surrounding Site A would enable partial conservation of three of the four geological/ecological phases (Q1, Q3 and Q4), augmenting and providing linkages with the conservation the third phase (Q2) identified in the MRS process (Area 9). The AWWTP would be built over a Spearwood limestone enclave containing a Priority 3 species (*Sarcozona bicarinata*) which is widely distributed elsewhere within the buffer zone of the AWWTP, and thus can be adequately protected.

The buffer zone surrounding Site B would enable the opportunity to conserve some of the near coastal complexes in the oldest phase (Q1) and second phase (Q3) of the Alkimos cusped forelands and nested parabolic dune system. It also offers the opportunity to partially augment the Bush Forever Site 397 to the north, but offers little or no opportunity to achieve a contiguous linkage between all phases, and not encompassing the youngest phase (Q4) of the Alkimos system. To locate the AWWTP at Site B also creates disruption to the high value landform (the Q2/Q3 conjunction) which may be able to be offset as proposed in responses 1.1.6 and 1.1.7.

Thus Site B does not offer greater conservation opportunities than Site A from an ecological or geoheritage perspective, merely different opportunities.

### **2.3.2 Alkimos area is one of the last large areas of coastal bush land in the Perth region and we are belatedly looking at planning for conservation. A significant conservation reserve should be established as envisaged in 1970's (Submission 2, 7).**

- A. The wider planning policy issue of the expanding urban front in the Northwest Corridor, and the impact it has on high ecological and geoheritage values is not a matter for the Alkimos Wastewater Treatment Plant PER, rather was most appropriately considered in the MRS Amendment and the EPA's Bulletin 1207. The Water Corporation's efforts at assisting in any conservation initiatives should be seen in this context albeit relatively small.

### **2.3.3 The MRS Amendment recommends the bulldozing of much of this precious ecological asset while saving small patches of biodiversity. Where is the 'sense of place' that informs so much of the Governments much vaunted 'Network City' Policy? (Submission 5)**

- A. The Alkimos area, especially that bounded by the parabolic dune system is of high ecological and geoheritage value with extraordinary plant diversity and species richness. The wider planning policy issue of the expanding urban front in the Northwest Corridor that will impact upon this area is not a matter for the Alkimos Wastewater Treatment Plant PER, rather was most appropriately considered in the MRS Amendment 1029/33 and the EPA's Bulletin 1207. The Water Corporation's efforts at assisting in any conservation efforts should be seen in this context albeit relatively small.



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**2.3.4** The PER claims that *Nuytsia floribunda* Closed Low Heath (Nf) is found only at Site B. It characterises the *Nuytsia floribunda* (Christmas Tree) found in this location as “shrubs and heaths” (Section 3, page 13) and distinguishes these from the trees, which are relatively common throughout the area. The report does not make clear whether *Nuytsia floribunda* shrubs are a new sub-species, not previously recorded, or simply juvenile or artificially stunted specimens. It is most unlikely that a new sub-specie (sic) has been discovered – if only because it would no doubt have been ‘claimed’ by the botanist concerned – and therefore it must be assumed that these are simply juvenile specimens of no real significance. A detailed flora survey information describing the new sub-specie and be provided with a further opportunity to comment on this aspect (Submission 13).

A. The flora and fauna surveys were undertaken by competent professionals in close consultation with the relevant Environmental Protection Authority Service Unit officers. The work undertaken, and subsequent consultation is considered sufficient given the the small footprint of the AWWTP relative to the proposed urban development. The *Nuytsia floribunda* Closed Low Heath (Nf) “only found” at Site B, being characterised in this location as “shrubs and heaths” as distinguished these from “trees”, are most likely exhibiting the concept of phenotypic plasticity identified Clausen, Kerk and heisey in the 1940’s. This concept suggests that different forms of species of identical genetic makeup are possible from differences in soil fertility, mineralization, rainfall, wind regimes, impact of salt spray and the like. That the tree-forms are within pollinating range of the shrub and heath form is highly unlikely to be other than a manifestation of this phenotypic plasticity.

**2.3.5** Site B offers substantially less conservation opportunities for habitat protection than Site A, something vital when considering threatened species known to reside and migrate to the area (Submission 5).

A. The buffer zone surrounding Site A would enable partial conservation of three of the four geological/ecological phases (Q1, Q3 and Q4), augmenting and providing linkages with the conservation the third phase (Q2) identified in the MRS process (Area 9). The AWWTP would be built over a Spearwood limestone enclave containing a Priority 3 species (*Sarcozona bicarinata*) which is widely distributed elsewhere within the buffer zone of the AWWTP, and thus can be adequately protected.

The buffer zone surrounding Site B would enable the opportunity to conserve some of the near coastal complexes in the oldest phase (Q1) and second phase (Q3) of the Alkimos cusplate forelands and nested parabolic dune system. It also offers the opportunity to partially augment the Bush Forever Site 397 to the north, but offers little or no opportunity to achieve a contiguous linkage between all phases, and not encompassing the youngest phase (Q4) of the Alkimos system. To locate the AWWTP at Site B also creates disruption to the high value landform (the Q2/Q3 conjunction) which may be able to be offset as proposed in responses 1.1.6 and 1.1.7.

Thus Site A does not offer greater conservation opportunities than Site B from an ecological or geoheritage perspective, merely different opportunities.

**2.3.6** The two options might provide very similar outcomes for the protection of flora and fauna within the buffer zone. The PER concludes that the vegetation and flora within the Site A buffer is more important and significant than the vegetation and flora within the Site B buffer (see Section 4, page 10) (Submission 3).

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- A. The buffer zone surrounding Site A would enable partial conservation of three of the four geological/ecological phases (Q1, Q3 and Q4), augmenting and providing linkages with the conservation the third phase (Q2) identified in the MRS process (Area 9). The AWWTP would be built over a Spearwood limestone enclave containing a Priority 3 species (*Sarcozona bicarinata*) which is widely distributed elsewhere within the buffer zone of the AWWTP, and thus can be adequately protected.

The buffer zone surrounding Site B would enable the opportunity to conserve some of the near coastal complexes in the oldest phase (Q1) and second phase (Q3) of the Alkimos cusped forelands and nested parabolic dune system. It also offers the opportunity to partially augment the Bush Forever Site 397 to the north, but offers little or no opportunity to achieve a contiguous linkage between all phases, and not encompassing the youngest phase (Q4) of the Alkimos system. To locate the AWWTP at Site B also creates disruption to the high value landform (the Q2/Q3 conjunction) which may be able to be offset as proposed in responses 1.1.6 and 1.1.7.

Thus Site B does not offer greater conservation opportunities than Site A from an ecological or geoheritage perspective, merely different opportunities.

**2.3.7** **Whichever site is chosen, there should be a linked conservation reserve that covers significant landforms and habitats, extending beyond the EPA's current proposal to include most of the wastewater treatment plant buffer zone (Submission 2, 7).**

- A. The Water Corporation will, regardless of whether the AWWTP is built on Site A or Site B, recognise and manage for conservation purposes the portion of Area 9 delineated by the EPA in Bulletin 1207 and augment it with any other conservation initiatives required by the EPA within the AWWTP's buffer zones for conservation purposes as a result of this assessment.

**2.3.8** **There is strong support that the whole buffer zone around the future WWTP should be retained for bushland conservation. More detailed information about the fauna present in the area might be helpful in determining the future land use within the buffer, as there might be pressure to allow other 'compatible uses' (See Section 6, page 12) (Submission 3).**

- A. The Water Corporation will, regardless of whether the AWWTP is built on Site A or Site B, recognise and manage for conservation purposes the portion of Area 9 delineated by the EPA in Bulletin 1207 and augment it with any other conservation initiatives required by the EPA within the AWWTP's buffer zones for conservation purposes as a result of this assessment.

**2.3.9** **Clearing of bushland habitat will affect biodiversity and threatened species, increasing water and energy demand and increasing emissions of greenhouse gases and air pollutants. These impacts are recognised and changes have been proposed. The 1987 Review of the Perth Corridor Plan recommended curtailing the north-west corridor in the vicinity of Alkimos to achieve a more consolidated urban form. Then in 2002 the public demonstrated its concern at urban sprawl, supporting an Urban Growth Boundary, at the *Dialogue with the City*, the Ministry for Planning initiative seeking to find better management of urban growth. Despite this, urban development north beyond Alkimos and south beyond Mandurah is proceeding.**

With less than 28% of bushland of the coastal plain portion of metropolitan Perth remaining, areas such as Alkimos-Eglinton provide one of the very few opportunities to protect what used to be here for future generations (as at 2000). The area has great potential for conservation because of the range and condition of habitats and landforms present and the opportunity to link the coastal reserve with other significant conservation reserves north, east and south (Submission 3).

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- A. The Alkimos area, especially that bounded by the parabolic dune system is of high ecological and geoheritage value with extraordinary plant diversity and species richness. The wider planning policy issue of the expanding urban front in the Northwest Corridor that will impact upon this area is not a matter for the Alkimos Wastewater Treatment Plant PER (this assessment), rather was most appropriately considered in the MRS Amendment 1029/33 and the EPA's Bulletin 1207. The Water Corporation's efforts at assisting in any conservation efforts should be seen in this context albeit relatively small.

The total required to be cleared for the WWTP is in the order of 28.2 ha. The area to be cleared for urban and commercial purposes exceeds 1300 ha. The Water Corporation will, regardless of whether the AWWTP is built on Site A or Site B, recognise and manage for conservation purposes the portion of Area 9 delineated by the EPA in Bulletin 1207 and augment it with any other conservation initiatives required by the EPA within the AWWTP's buffer zones for conservation purposes as a result of this assessment.

**2.3.10 It is clear from the bulletin that the location of Site B and its associated buffer (notwithstanding the need for minor modifications to accommodate the footprint for Site B) will provide more opportunity to preserve the areas identified as regionally significant bushland (identified as Area 9 within the bulletin) within the public purpose zoning proposed under the MRS Amendment (Submission 6).**

- A. This assertion is incorrect and misleading. The areas identified by the EPA as of environmental significance in EPA Bulletin 1207, being Areas 9 and 6c, provides for a contiguous linkage from Bush Forever Site 397 to 130 irrespective of the location of the AWWTP. Site B does not offer greater conservation opportunities than Site A from an ecological or geoheritage perspective, merely different opportunities.

The buffer zone surrounding Site A would enable partial conservation of three of the four geological/ecological phases (Q1, Q3 and Q4) augmenting and providing linkages with the conservation the third phase (Q2) identified in the MRS process (Area 9). The AWWTP would be built over a Spearwood limestone enclave containing a Priority 3 species (*Sarcozona bicarinata*) which is widely distributed elsewhere within the buffer zone of the AWWTP, and thus can be adequately protected.

The buffer zone surrounding Site B would enable the opportunity to conserve some of the near coastal complexes in the oldest phase (Q1) and second phase (Q3) of the Alkimos cusped forelands and nested parabolic dune system. It also offers the opportunity to partially augment the Bush Forever Site 397 to the north, but offers little or no opportunity to achieve a contiguous linkage between all phases, and not encompassing the youngest phase (Q4) of the Alkimos system.

To locate the AWWTP at Site B also creates disruption to the high value landform (the Q2/Q3 conjunction) which may be able to be offset as proposed in responses 1.1.6 and 1.1.7.

**2.3.11 The Water Corp has advised they will own the land including the buffer. It's concerning that other areas they own are not managed except to keep people out and installing an annual firebreak. It would need to be ensured that they actually manage the area properly for long term conservation (Submission 4).**

- A. The Water Corporation will ensure that an appropriate management regime will be put in place to deliver the EPA's conservation objectives within the buffer zone.

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**2.3.12 Site B maximises the opportunity to achieve the recommendations of the EPA's bulletin in relation to vegetation, flora and geoheritage in this area (Submission 6).**

- A. This assertion is incorrect and misleading. The areas identified by the EPA as of environmental significance in EPA Bulletin 1207, being Areas 9 and 6c, provides for a contiguous linkage from Bush Forever Site 397 to 130 irrespective of the location of the AWWTP. Site B does not offer greater conservation opportunities than Site A from an ecological or geoheritage perspective, merely different opportunities.

The buffer zone surrounding Site A would enable partial conservation of three of the four geological/ecological phases (Q1, Q3 and Q4) augmenting and providing linkages with the conservation the third phase (Q2) identified in the MRS process (Area 9). The AWWTP would be built over a Spearwood limestone enclave containing a Priority 3 species (*Sarcozona bicarinata*) which is widely distributed elsewhere within the buffer zone of the AWWTP, and thus can be adequately protected.

The buffer zone surrounding Site B would enable the opportunity to conserve some of the near coastal complexes in the oldest phase (Q1) and second phase (Q3) of the Alkimos cusped forelands and nested parabolic dune system. It also offers the opportunity to partially augment the Bush Forever Site 397 to the north, but offers little or no opportunity to achieve a contiguous linkage between all phases, and not encompassing the youngest phase (Q4) of the Alkimos system.

To locate the AWWTP at Site B also creates disruption to the high value landform (the Q2/Q3 conjunction) which may be able to be offset as proposed in responses 1.1.6 and 1.1.7.

**2.3.13 The EPA recently examined Natural values in the area in relation to proposed amendments to the scheme and proposed retention of some sites to better represent geoheritage and vegetation habitat values. We welcome this investigation but feel the EPA has taken a minimalist approach in deciding what bushland is worthy of retention. Given the natural values at stake and the need to maintain functional ecosystems amidst an urbanising landscape, it is important that a relatively large and contiguous area be secured for conservation (Submission 10).**

- A. The Water Corporation has identified and reported on the geoheritage and ecological significance of the Alkimos area in its PER. Those values have been recognised in the EPA's Bulletin 1207, and the extent of the areas to be reserved for conservation recommended therein. The Water Corporation recognises the interest and significance attributed to the geo-heritage landforms and biodiversity in the Alkimos region, and will be bound by the recommendations of the EPA and decisions of the Minister for Environment regarding conservation of these values for its AWWTP. However, uncertainty still remains in this regard. For example, no data is available and regarding the population size or breeding and feeding/foraging range of *Calyptorhynchus latirostris* (Carnaby's Cockatoo) in the greater Alkimos area, or the areal extent necessary to be reserved to sustain the population (or assist it to recover).

The Water Corporation will take a maximum of 28.2ha, a small proportion of which will involve some feeding habitat. This needs to be viewed in the context of up to 1300ha to be cleared for the urban development the AWWTP will eventually service. The Water Corporation will minimise disruption (due to the footprint of the plant) of these habitats as far as practicable. Furthermore, the proposed buffer around both sites offer opportunities for some conservation of feeding habitat of Carnaby's Cockatoo, flora and fauna habitat and geoheritage values. However in the context of the overall urban development of approximately 1300 ha outside the buffers, these opportunities are relatively small

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**2.3.14** The PER appears to include a discrepancy in information on vegetation clearing for both Sites A and B and preferred launch site option 1b. Table 2.1 of the PER indicates clearing of 23.2ha and 28.2ha respectively, whereas Table 4.14 indicates 21.5ha and 30.4ha. This discrepancy needs to be clarified and/or corrected (Submission 8).

A. The correct values are found in Table 2.1. The values cited in table 4.14 are an editorial oversight.

**2.3.15** Site B would require clearing 28.2ha of biodiversity to create a footprint of 14ha for the plant and an odour buffer ranging between 600 to 800m; Site A requires a total of 23.2 ha of clearing (6.2) and an odour buffer of 600m. Site B clearing and engineering would activate the relatively stable dunal systems present on the eastern edge of the site; this would lead to dune blowout and loss of remnant vegetation to the east (Submission 5).

A. The risk of disturbing the stable dune formations at site B is acknowledged. The batters of Site B will be minimised to reduce the encroachment to the east, and stabilised to minimise the risk of blow-out. The Water Corporation will avoid, minimise or rehabilitate any terrestrial impacts upon high value ecological values identified by the EPA as worthy of conservation in accordance with best practise.

## **2.4 Rehabilitation**

**2.4.1** Site B will leave a greater footprint in the landscape that will require significant investment in bushland restoration (Submission 3).

A. The Water Corporation will avoid, minimise or rehabilitate any terrestrial impacts upon high value ecological values identified by the EPA as worthy of conservation in accordance with best practise.

**2.4.2** Site 1B seem to be the preferred option even though it will result in clearing of significant flora *Sarcozona bicarinata* (P3), diverse limestone vegetation FCT 26a with locally significant *Astroloma microcalyx* (P3) and *Conostylis pauciflora* subsp *euryrhipis* (P3). In addition it will encroach into regionally significant bushland within *Bush Forever Site 397*. The Water Corporation is claiming that upon completion, there will be no visible evidence of the pipeline and that the launch site will be revegetated (see Section 2, page 20), the lost biodiversity cannot be reinstated (Submission 3).

A. Launch site 1B will, as will all other options (Launch sites 1A and 2), encroach upon Bush Forever Site 397 where the ocean outlet crosses the coastal reservation. The Water Corporation will endeavour to utilise "cutting edge" technologies (directional drilling, tunnelling etc) to avoid these impacts if found technically viable. Launch site 1B is preferable to site 2. It can be oriented to align with the preferred sea floor route, with reduced disturbance of terrestrial habitat, coastal dune formations and reef structures. Launch site 2 however requires more destructive and complex excavation of the nearer offshore reefs at Eglinton Rocks to achieve the desired alignment. Any terrestrial impacts upon high value ecological values identified by the EPA will be rehabilitated in accordance with best practise.

**2.4.3** It is expected that the rehabilitation of areas affected by works associated with the construction and operation of the WWTP will be carried out in accordance with established best practise, this includes detailed analysis of local communities and their specific location preferences, harvesting of topsoil for re-use, and replanting/seeding in accordance with the findings of the initial analysis. Battering of slopes at a constant grade and profile should be avoided. Profiles should be developed with complement the remaining dune formation

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**and the properly maintained for some years until stable floristic communities, reminiscent of those removed, have been established (Submission 13).**

- A. The Water Corporation will rehabilitate disturbed areas that are identified by the EPA as having high conservation values, in accordance with best practise.

## **2.5 Fire and Pest Control**

### **2.5.1 The proponent should ensure appropriate management bushland of the buffer zone to control weeds and feral animals and minimise fire (Submission 2, 7).**

- A. The Water Corporation will ensure appropriate management of the buffer zone to control weeds and feral animals and minimise fire risk in accordance with best practise.

## **2.6 Groundwater**

### **2.6.1 The only option that appears to have been evaluated in any detail in the PER from an environmental impact perspective is the infiltration of the treated wastewater to the aquifer via infiltration ponds. The conclusion is drawn that this option is not viable due to the potential impact on the marine environment of the (worst case scenario) nitrogen concentrations entering the coastal environment through the groundwater pathway. The groundwater modelling carried out to inform this evaluation is not presented in the PER on any technical level (Submission 14).**

- A. The Water Corporation has included the Rockwater (2004) modelling with this response (Appendix 2).

The viability of the infiltration option was not based solely on the potential for marine Impacts. The experience of the Water Corporation with other coastal infiltration schemes in similar geological environments was that infiltration is only suitable for flows up to about 20 ML/d. On-site infiltration of 80 ML/d is not a feasible option. Due to the lack of year round local reuse options for this volume of treated wastewater, the Water Corporation found that only other viable alternative is marine disposal. The Corporation's preference is to secure Alkimos flows for future MAR or other reuse options (see Section 2.3.3). MAR will require a marine outlet for the saline reject resulting from Reverse Osmosis (RO) processes, and also to enable safe disposal peak winter treated wastewater flows that are beyond the capacity of the downstream MAR process trains (expected to be Microfiltration and RO).

Infiltration would not be able to cater for growth beyond about 20 ML/d, at which point ocean disposal would be needed. The Water Corporation believes that the impacts associated with ocean disposal will be acceptable and by implementing ocean disposal from the outset, it will avoid unnecessary effects on groundwater quality and potential increases in nutrient concentrations in the nearshore. Further, it is not possible to accurately predict adverse impacts resulting from infiltration (e.g. localised nutrient enrichment of the nearshore caused by preferential flow through solution channels). By progressing with ocean disposal alone, the Water Corporation has minimised the extent of the potential effects on the marine environment and the risk of adverse impacts.

Furthermore, the footprint of the required infiltration basins within the sensitive terrestrial environment with unique geoheritage formations and associated flora and fauna communities further inhibited the potential for infiltration.

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2.6.2 The PER suggests that combinations of a number of scenarios were modelled. One scenario was “Treated wastewater quality between 6 mg/l and 10 mg/L with and without denitrification occurring in the aquifer”.

This statement does not specify what parameter, or parameters, the quoted concentration range relates to, nor does it provide any technical justification for selecting that range. Similarly, on page 14 of 60 concentrations of nitrogen are quoted (1.5 and 5 mg/L), however, it is unclear what form of nitrogen these values relate to (Submission 14)

A. The quoted parameter is Total Nitrogen and the range (6 to 10 mg/L) is selected based on what is practically achievable, given the treated wastewater characteristics in Perth. The form of nitrogen leaching to marine waters will be predominantly Nitrate-N.

2.6.3 There is insufficient detail in the PER describing how the results listed at the bottom of page 13 of 60 were arrived at. It is therefore not possible to provide informed advice/comment on the analysis applied to arrive at the conclusions listed (Submission 14).

A. The Water Corporation has included the Rockwater (2004) modelling report with this response (Appendix 2).

2.6.4 On page 14 of 60 the proponent concludes:  
“The Water Corporation has rejected infiltration as an interim option for disposal and treated wastewater due to the uncertainty surrounding the:

- fate and transport of nutrients to near shore;
- probability of exceedance of the high E2 level and protection at the beach”.

No information is provided in the PER to describe the risk assessment process applied by the proponent to arrive at the second point above. Therefore it is not possible to comment on the validity or otherwise of the proponent’s conclusions. It would however appear that the logic applied in the PER to arrive at the second point above is internally inconsistent. In the left hand column on page 14 the PER states “The end result of the dilution is that the influence of groundwater will be *very difficult to measure* immediately away from the seabed where it emerges”. In contrast, text in the right hand column of the same page states “It is likely that this [nutrient enriched groundwater discharge to the nearshore marine environment] would result in *measurable change* in nutrient related water quality at the shoreline” and “...groundwater discharging over approximately 1,500m of coast may result in localised increases in primary productivity in the nearshore region” (Submission 14).

A. The following clarification is provided:

Nitrogen Loading Issue: Infiltration will increase the concentrations of bio-available nitrogen in the groundwater. Primary productivity in the marine environment is limited by the availability of nitrogen and therefore, where the groundwater enters the ocean, there will be potential for increases in phytoplankton biomass in the water column, increases in algal biomass on adjacent reefs and increases in epiphyte loading on any adjacent seagrasses.

Impact: The level of increase in groundwater nitrogen concentrations is likely to be low due to the high level of treatment at the AWWTP (~7 mg.N/L) and is likely to be below levels subject to anthropogenic influence elsewhere along the metropolitan coast. The groundwater is discharging to an energetic environment and mixing will be rapid. There are no seagrass beds adjacent to the shoreline. There is negligible risk of phytoplankton blooms occurring. However, there is a risk that phytoplankton biomass may increase by detectable amounts at the shoreline sampling sites. The

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environmental consequence of this would be insignificant; however, there is a small risk that locally derived Environmentally Quality Criteria may be exceeded from time to time as the beach will be classified as having a high (E2) level of ecological protection.

Nutrient removal Issue: The heterogeneous nature of the sand and limestone matrix that the groundwater travels through to the coast means that the rate of denitrification will vary. The load of nitrogen to the coast could be less than or greater than that predicted with the denitrification rates derived by Rockwater (2004).

The Water Corporation does not foresee phosphorus being a problem as Tamala Limestone has a high adsorptive capacity and elevated phosphorus concentrations are rarely seen in groundwater (Rockwater, 2004). Further, it is well established that productivity in Perth's coastal waters is limited by the availability of nitrogen and not by the availability of phosphorus (Lord and Hillman 1995).

Impact: The most conservative impact assessment would assume that all the nitrogen that is discharged to the ponds ends up at the coast. This would change concentrations from about 1.5 mg/L to about 5 mg/L. If it assumed that this groundwater discharges to the shoreline, this may result in a measurable change in nutrient related water quality at the shoreline.

In summary, hydrogeological investigations into the onshore impact of infiltration at the Alkimos WWTP have shown that infiltration is technically sound. In particular:

- Infiltrated treated wastewater would not flow east towards the proposed Eglington borefield;
- Groundwater mounding would be minimal, ~ 0.2 m beneath the infiltration ponds;
- Infiltrated treated wastewater would take a minimum of 4 months to reach the coastline, suggesting high virus and bacteria removal; and
- Nitrogen loadings to the coast should be low if denitrification rates found in similar schemes in WA occur at Alkimos.

The following management measures were proposed however given that infiltration was dropped as an option due to a number of factors discussed above (see 2.6.1) the monitoring and management regime was not included in the PER:

#### Nitrogen Loading

The Water Corporation will determine the monthly load of each contaminant in the treated wastewater discharged from the plant (except pH and bacteria) using flow weighted data. The loads will be based on the treated wastewater discharge rate and the concentration; with the daily flow rate estimated in cubic meters per day (m<sup>3</sup>/day). Monthly and annual average loads of each contaminant shall be reported in the annual monitoring report, in kilograms per day (kg/day).

In addition, the Water Corporation will monitor nitrogen concentrations (as ammonia and nitrate+nitrite) in the AWTP monitoring bores and at the marine water quality monitoring sites.

In the event that results of nitrogen sampling shows that denitrification is not occurring to the expected levels, then the shoreline water quality monitoring data will be closely interrogated to check for nutrient related effects. The results will be discussed with the DoE and additional monitoring/studies may be implemented if required."

The potential impact on marine water quality was not the sole reason for dropping the infiltration option. Rather, it was the fact that an ocean outlet would be required regardless of whether an infiltration scheme was commissioned (refer to response to 2.6.1).

## **2.7 Benthic Habitat**



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2.7.1

There are several examples in the PER in which the EPA's Guidance Statement (GS) No.29 has been misapplied. The GS No.29 explicitly states that the "EPA expects a hierarchy of principles to be addressed by all proponents and the EPA will apply these to its consideration of proposals that could cause damage/loss of BPPH". The GS also states that the cumulative loss thresholds for benthic primary producer habitats (BPPH) in each management unit will be applied only after proponents can demonstrate to the EPA that all options to avoid/minimize damage/loss of BPPH have been considered. The proponent has not demonstrated in the PER that it has applied the EPA's fundamental principles of impact avoidance and minimisation and best practice in the context of BPPH protection. The proponent must set out how the EPA's principles of assessment (see Section 5.2 of GS No.29) have been applied before the cumulative loss of BPPH can be considered further (Submission 14).

A.

The fundamental principles of impact avoidance and minimisation are supported. However, the treated wastewater must go somewhere. At this point in time considerable research is proposed to overcome the EPA's and HDWA's conservative approach with respect to aquifer recharge, which is the only sensible option available for the storage of winter flows. If and when the EPA, HDWA and community accept recharge of groundwater aquifers, then the discharge of treated wastewater to the ocean can be minimised, but not totally eliminated.

The pipe route was selected to avoid, where possible, major reef features, to minimise the damage caused to benthic habitat primary producer habitats as well as to minimise engineering costs.

2.7.2

An area of concern is one where the proponent has made significant, and untested, assumptions about the distribution and extent of benthic habitats within the 50 km<sup>2</sup> management unit. The proponent has extrapolated the extent of 'vegetated habitats' within the entire management unit based on information gathered for small mapped (~20%) and ground-truthed (~ 6.6%) areas within the management unit. For a proposal of this type, it would normally be expected that proponents determine the extent and distribution of benthic habitats in the entire defined management unit. Where assumptions are made, it is expected that substantial technical information is provided to support those assumptions. Technical information is not supplied in the PER to substantiate assumptions relating to BPPH distribution.

The proponent should clarify whether the predicted loss of, and/or serious damage to, BPPHs present in the PER accounts for the pipeline trench footprint only, or whether peripheral impacts associated with sidecasting of dredged material and turbidity/sedimentation effects have also been taken into account. The proponent should ensure that all direct and indirect loss/serious damage are included in the calculations made to determine cumulative loss (Submission 14).

A.

The Water Corporation disagrees with this comment. It is not practical to ground truth 50km<sup>2</sup> of benthic habitat, especially within an area as spatially heterogeneous as the nearshore waters of Alkimos. Therefore detailed groundtruthing was undertaken along the corridor of the proposed pipeline only, to provide detailed information on the habitats potential impacted by the proposal. An area to the north of the pipeline corridor was also surveyed using towed video and a similar distribution of habitats was recorded. Therefore the types of habitat present and their relative coverage within the region can be reliably estimated. The coverage of vegetated versus unvegetated habitat in shallow waters (<20m) can be readily mapped from aerial imagery, and this was done for a 9.7km<sup>2</sup> area surrounding the proposed pipeline. Examination of aerial photography of the entire 50km<sup>2</sup> management unit shows that the proportion of vegetated versus unvegetated habitats remains similar throughout

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the region. Therefore the coverage of BPPH within the management unit can be accurately estimated.

If the extrapolation of the extent of 'vegetated habitats' within the entire management unit from information gathered for a small mapped area (~20%) is genuinely not acceptable to the EPA, then the potential losses of BPPH can be estimated as a percentage of the mapped area only:

- Direct losses of BPPH within mapped area of 9.7km<sup>2</sup> = 2.3 ha = 0.5% (Note: Disturbed areas will be re-colonised within a relatively short timeframe)

If the extrapolation of the extent of each vegetated habitat type within the entire management unit based on information gathered for a small ground-truthed area (~6.6%) is genuinely not acceptable to the EPA, then the potential losses of BPPH can be estimated as a percentage of the ground-truthed area only:

- Direct losses of BPPH within ground-truthed area = 2.3 ha = 1.33% (Note: Disturbed areas will be re-colonised within a relatively short timeframe)

This demonstrates that even within the ground-truthed area (0.00023km<sup>2</sup>) losses of BPPH only slightly exceed 1%. Within the management unit losses of reef, high relief reef, wrack and Amphibolis spp. & reef will not even approach 1%.

The Alkimos project was fortunate in that full water penetration photography was obtained for the area, providing reasonable confidence in the results. This is more likely to be the exception than the rule for other projects in WA. The Oceanica benthic habitat mapping report is included with this response.

Turbidity/sedimentation impacts were not estimated as the construction method was not known (tunnelling or trenching).

## 2.8 Energy

### 2.8.1 **Water Corporation should be commended that biogas recovery will contribute to 40% of energy requirements, however the PER does not address other use of alternative 'green' energy sources for the AWWTP. Water Corporation should ensure that it will use green energy sources and continually seek to improve energy efficiencies and minimise greenhouse gas emissions from the AWWTP (Submission 8).**

- A. The Water Corporation has proposed a predominantly gravity conveyancing system in the interests of reducing energy consumption (and public health risk) thereby reducing greenhouse gas emissions. As the plant scales up in volumes of waste treated, energy recovery technologies (use of biogas) will be employed to further reduce the demand on conventional power supplies, further reducing greenhouse gas emissions per unit sewage treated. The Water Corporation is committed to use of alternative energy sources when available and wherever practicable.

### 2.8.2 **Energy and water efficiency needs to be incorporated into the built environment, such as passive solar design and water harvesting for all housing, waterwise landscaping and drainage swales in local open space instead of deep sumps (Submission 10).**

- A. The Water Corporation has proposed a predominantly gravity conveyance system in the interests of reducing energy consumption (and public health risk) thereby reducing greenhouse gas emissions and pursues further energy efficiencies in the design and operation of its infrastructure.

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The Water Corporation continues to promote and encourage water efficiency in the built environment and the construction of the Alkimos WWTP will not preclude the further development of water efficient strategies nor will these strategies eliminate the need for the AWWTP.

### **3.0 POLLUTION**

#### **3.1 Treated wastewater Discharge (Ocean Outfall)**

##### **3.1.1 It is somewhat unclear what the proponent is seeking approval for in terms of proposed ocean discharge (Submission 14).**

- A. The proponent is seeking approval to construct a 3.5 km long ocean outlet, with a 300m long diffuser. A large pipeline diameter (in the range of 1000 mm to 1200 mm) is needed to allow the treated wastewater to flow through the outfall by gravity.

##### **3.1.2 It has been proven that treated water pumped into various parts off the coast has had a deleterious effect on the seabed (Submission 1).**

- A. The Water Corporation disagrees with this assertion which infers that the discharge of highly treated wastewater to the marine environment is somehow bad and unacceptable. The purpose of this PER process is to assess the effects of ocean discharge on the marine environment and determine the parameters that are acceptable for such a practice to be permitted. The Water Corporation has a long and successful history of such practices, with no unacceptable deleterious effects on the seabed.

The comprehensive monitoring work for Perth's Long-term Ocean Outlet Monitoring (PLOOM) program has examined potential impacts on the seabed through a variety of means (routine sediment contamination studies, seagrass health studies and algal studies). None of the studies has found any suggestion of deleterious effect on the benthic ecosystem near the outlets due to treated wastewater discharge.

This is primarily a result of:

- The high level of initial treatment;
- The fact that the plume is buoyant, and has to mix up through the water column before it can influence the seabed (i.e. it is highly diluted before it is 'seen' by the seabed);
- The diffusers to be installed (no less than 10 m in depth);
- The dispersive, open waters generally act to rapidly disperse the plumes; and
- The deliberate siting of the outlets in sandy areas, where the mobile nature of the seabed near the outlets means that any algal growth on the seabed is continually lost to large scale sand movement.

The major findings of the PLOOM programme can be summarised as follows:

- Nutrient-related water quality undergoes consistent seasonal changes, with highest background concentrations of nitrate+nitrite and filterable reactive phosphorus occurring in winter.
- Nitrogen is the nutrient limiting primary productivity in Perth's coastal waters, with nitrogen limitation most pronounced in summer.
- Currents above the outlets tend to flow parallel to the coast from south to north and are wind-driven.
- There is a 'signature' of elevated nitrogen concentrations in the water column 'downstream' (north) from the diffusers.
- There are small increases in phytoplankton biomass (measured as water column chlorophyll a concentration) north of the outlets which are attributed to the outlets,

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but concentrations are below national (ANZECC/ARMCANZ, 2000) guidelines for nearshore waters.

- There is enhanced periphyton growth up to 2 km north of the outlets.
- Hydrodynamic modelling has predicted the extent of bacterial contamination with accuracy suitable for using the results to generate environmental licence conditions.
- The outlets do not result in bacterial contamination of Perth's beaches.
- Sand movement appears to be the dominant factor influencing macroalgal communities growing on the seabed near the Ocean Reef outlet.
- There is no detectable contamination of sediments or biota by metals or pesticides from treated wastewater discharged from the outlets.
- Ecotoxicological testing of treated wastewater samples from the outlets found that in no case was there any toxicity observed at the test concentrations representing the dilution achieved at the edge of the outlet mixing zones.

These findings for the period from 1995 to 2005 coincided with the highest concentrations of nutrients (and nutrient loads) discharged from Perth's ocean outlets since monitoring began in the 1960s. Nutrient loads to Perth's coastal waters decreased substantially in 2002, due to an upgrade from primary treatment to advanced secondary treatment at Woodman Point WWTP and, to a lesser extent, treatment improvements at Beenyup WWTP.

**3.1.3 The discharge of treated wastewater into the ocean is a concern because it wastes a valuable resource and it may affect marine ecology and quality of coastal waters. According to the PER monitoring of benthic community structure around the Ocean Reef outfall has not found significant adverse effects (section 4 page 21) (Submission 3).**

- A. This statement is correct. Ideally, if there was a guaranteed user for the entire treated wastewater flow for the life of the WWTP, the Water Corporation would not have to dispose of treated wastewater to the ocean. Unfortunately, there are currently no potential users who can take all the flow all the time. The Water Corporation will continue to seek re-use options for the treated wastewater, however, there will always be a need for a proven, low risk disposal system for disposal of any treated wastewater that cannot be re-used.

The Water Corporation recognises that the discharge of treated wastewater to the marine environment may pose some risk through the introduction of excess nutrients, pathogens and contaminants. As such the Water Corporation operates all of its ocean outlets in accordance with relevant regulatory frameworks and undertakes a rigorous monitoring program which examines the treated wastewater characteristics and ecotoxicity and the water and sediment quality. The results are reported publicly and presented to stakeholders and regulators on a regular basis. The monitoring program has found that although the influence of the treated wastewater can be detected in the water column, there are no impacts on the seabed (benthic impacts).

Water Corporation policy is to seek options for and to maximise the sensible and sustainable reuse of treated wastewater.

**3.1.4 A precautionary approach to the use of water would manage the risk to the environment and the economy by valuing re-use of water above the search for new sources, while encouraging water conservation. The disposal of treated wastewater to the ocean is a waste of resources and has harmful affect to the marine environment (Submission 5).**

- A. Refer to Response to 3.1.2 and 3.1.3.

**3.1.5** There is brief mention of a pipeline construction option, which involves blasting and the need to manage potential associated noise and vibration impacts on marine mammals. The proponent should contact the federal Department of Environment and Heritage (DEH) to discuss requirements relating to the EPBC Act. In addition, the DEH Ports and Marine Section should be contacted regarding the possible need for a Sea Dumping permit to side cast any dredged material (Submission 14).

A. This is correct. The Water Corporation will seek Commonwealth Approvals for the project in relation to EPBC Act matters and Sea Dumping matters. The Water Corporation, concurrent with the PER Process is referring the project to the Commonwealth Department of Heritage and Environment for determination of whether it constitutes a controlled action under the Environment Protection and Biodiversity Conservation Act 1999. The requirement for sea dumping permits will be canvassed at that time.

**3.1.6** Most of the environmental impact predictions made in the PER in relation to the discharge of treated wastewater (TWW) are drawn from information contained in monitoring reports prepared for the proponent as part of the Perth Long Term Ocean Outlet Monitoring Program (PLOOM). In general, the proponent concludes that the likelihood of ecological problems arising from the proposal is low. Detail of the proponent’s analysis of PLOOM data for the purpose of producing the PER and the assumptions it makes in relation to the application/transferability of PLOOM data to Alkimos are not sufficiently described in the PER (Submission 14).

A. The following table is an updated form of a preliminary risk assessment provided to Water Corporation by Oceanica in 2004. Further details on comparisons between water and sediment quality are contained in the Oceanica draft synthesis report (which discusses all marine data collected as part of the studies for the PER assessment) which is available on request.

The Beenyup WWTP and its associated Ocean Reef outlet is probably the most similar to the Alkimos proposal in terms of treated wastewater quality, flows and receiving marine environment. It is on this basis that an initial environmental risk assessment was undertaken by comparing Ocean Reef outlet with the Alkimos proposal.

This preliminary assessment found that environmental impacts at Alkimos are likely to be similar or smaller than those at the Ocean Reef outlet. The key factors which lead to the likelihood of reduced risks are:

1. There is a more energetic marine environment at Alkimos (Ocean Reef outlet has high reef partially surrounding which reduces flushing);
2. The diffuser will be located in deeper water, thus improving initial dilution;
3. The diffuser will be located further offshore, further reducing an already negligible risk of beach contamination and interaction with recreational activities;
4. The flow of treated wastewater is smaller;
5. Improvements in level of treatment due to ongoing improvements in treatment technologies mean concentrations of nitrogen are likely to be lower; and
6. The Alkimos outlet will not be located in a marine park.

**Preliminary Environmental Risk Assessment: Alkimos vs. Ocean Reef**

Characteristic	Alkimos	Beenyup WWTP / Ocean Reef outlet	Impact at Alkimos	Comments

<b>Flow (ML/d)</b>	80 (2050)	110 (2004)	Less	Long term capacity at Beenyup WWTP is 150 ML/d
<b>Water Depth (m)</b>	20	10	Less	Water depth is the key factor in determining dilution.
<b>Initial dilution</b>	~1:200	~1:100	Less	Will be better as diffuser will be in deeper water than Ocean Reef.
<b>Length (km)</b>	3.5	1.8	Less  Greater	Will be further offshore than Ocean Reef, therefore less risk of human health impacts.  Greater length means greater direct loss of habitat beneath pipe.
<b>Flushing of outlet area</b>	Beyond any lagoon areas	In Marmion lagoon area with some enclosure by reef	Less	Residence times will be less at Alkimos as outlet extends beyond offshore reef line.
<b>Total Nitrogen (av.) (mg/L)</b>	~10-20	~20-25	less	Alkimos will be able to make use of most recent technology to maximise nitrogen removal efficiency.
<b>Total Phosphorus (av.) (mg/L)</b>	10	10	Same	Phosphorus is not a significant factor in the assessment as it is not the nutrient limiting productivity in the water column.
<b>Extent of influence: nutrients</b>	To be established using modelling, however, increased mixing, smaller flows and reduced nitrogen concentrations should see nutrient effects measured over a reduced area.	Up to 2km north	Less	The increased mixing, smaller flows and reduced nitrogen concentrations should see nutrient effects measured over a reduced area.
<b>Human health</b>	Outfall situated so that the Alkimos Reef (used for surfing and diving) is not impacted	Primary contact criteria met within 200 m	Same/less	Enterococci counts will be similar from the Alkimos WTTTP. Extent offshore may be marginally less due to increased mixing and smaller flows.
<b>Heavy Metals</b>	Residential TWW	Residential TWW	Same/less	The wastewater catchment will be largely residential and light industry, as per Beenyup

				WWWTP. Ecotox and sediment testing at Beenyup has shown that there are no issues with contaminants. Higher initial dilution and lower flows should mean lower concentrations of toxicants after initial dilution.
<b>Benthic habitat (nutrient effects)</b>	Sand	Sand/Seagrass/ low relief reef	Same/less	There is no evidence to suggest any impact on benthic habitat at Beenyup. Discharge to 20 m water depth where seabed is dominated by sand coupled with higher dilution and lower flows means a lower risk of nutrient effects on habitat.
<b>Management Objectives</b>	The outlet will not be located in a Marine Park.	The outlet is located in Marmion Marine Park.	Less	There are additional management considerations and community perception issues associated with locating an outlet in a marine park.

**3.1.7** In section 4.1.9.4, it is suggested that criteria for naturally occurring substances in high ecological protection areas (HEPA) would generally be met when "...concentrations are equal to or less than the 80<sup>th</sup> percentile of the data distribution from a suitable reference site (in this case background water quality) for at least 50% of the time". Please clarify (Submission 14).

A. The document "Perth's Coastal Waters: Environmental Values and Objectives" (EPA 2000) notionally put forward that the majority of Perth's Coastal Waters should be managed to meet a High Level of Ecological Protection (E2). The EPA's 2005 document "Environmental Quality Criteria Reference Document for Cockburn Sound (2003 – 2004)", states that:

"For nutrients and physical stressors (e.g. dissolved oxygen, light attenuation coefficient, temperature, salinity and pH) the approach for high ecological protection areas is to compare the median of the test site data with the 20th and/or 80th percentiles (depending upon the stressor under consideration) of an equivalent reference distribution, or with the default guideline trigger values provided in this document."

In this case, median (50<sup>th</sup>ile) concentrations were compared to the 80<sup>th</sup>ile.

**3.1.8** The proposal presented in the PER includes a low ecological protection area (LEPA) about the outfall and is therefore not consistent with the EQOs established for waters in the vicinity of Alkimos (Submission 14).

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**The SWQMS Document 6 states that when a proposal involving a LEPA is submitted to the EPA for assessment, the proponent would need to demonstrate the need for a mixing zone. The proponent would also need to give reasons why it should not be seen as a method of discharging inadequately treated wastewater to the environment. Further work is required in these areas (Submission 14).**

- A. The proposal requires the modification of the notional EQOs for the region. This is a fundamental requirement for development in Western Australia. The aim of the SWQMS Document 6 was not to put all future marine developments off limits, e.g.

“There is a tendency among some to automatically assume that the highest level of protection should be applied to areas that are deemed pristine. Unless a pristine area is deemed to have a high conservation and/or high ecological value, such an assumption should not be made automatically. If that assumption were correct, the ramification would be that most of WA’s pristine coastline would be potentially quarantined from most anthropogenic activities. The corollary of this is that some areas that are already disturbed but have very high conservation and/or ecological value may not be given the appropriate level of protection.” (pp10-11)

In the EPA’s 2000 working document, “Perth’s Coastal Waters: Environmental Values and Objectives”, it was put forward that the broad objective for Perth’s coastal waters is that they should be managed to meet an EQO of “High Ecological Protection”. There was some allowance for existing outlets through the depiction of notional mixing zones by the EPASU (which were not subject to the same public discussion process), however there was no discussion regarding the process for establishing future mixing zones. The EPA 2000 document was deliberately titled ‘A working document’ to acknowledge the additional work required. As such, the statement that all of Perth’s Coastal Waters outside of the EPA’s notional mixing zones have been “established” as “High Ecological Protection” areas is premature.

It is not best practice when undertaking ocean disposal to reduce contaminant, nutrient and bacterial levels to the extent that a mixing zone is not required. Best practice is to use the process of initial dilution to demonstrate lack of environmental harm at the edge of defined mixing zones. Should there be no mixing zone allowed there would be an excessive dollar, energy and greenhouse cost in treatment for no environmental gain.

The role of the Water Corporation is to ensure that the ecosystem is not compromised through the implementation of its proposal and that any mixing zone required is kept to the minimum size needed. To do this, treated wastewater will be treated to maximize nitrogen removal, however best practice yields results of approximately 5 mg/L (mostly as nitrate-N), which is still more than two orders of magnitude greater than background levels in the ocean. The proposal will reduce nitrogen to the maximum extent that is practical, given the carbon source available.

The Water Corporation has undertaken the studies underpinning the PER to ensure that areas of high marine conservation value will not be impacted. The operation of an ocean outlet for the public good requires the definition of a mixing zone. The Water Corporation has sought to establish the zone in an area where there will be no adverse ecological impact and such that the size of the zone is minimised.

- 3.1.9 The proponent’s conclusion that there is no need to define zones about the outfall where social objectives related to seafood safe for human consumption and primary contact recreation, because these activities do not occur in the vicinity of the proposed outlet is not backed up by justification or data (Submission 14).**



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- A. The relevant policy is contained in the NHMRC's 2005 document "Guidelines for Managing Risks in Recreational Water".

In this, recreational activities are classified by the degree of water contact as follows:

1. Whole-body contact (primary contact) — activity in which the whole body or the face and trunk are frequently immersed or the face is frequently wetted by spray, and where it is likely that some water will be swallowed or inhaled, or come into contact with ears, nasal passages, mucous membranes or cuts in the skin (e.g. swimming, diving, surfing or whitewater canoeing).
2. Incidental contact (secondary contact) — activity in which only the limbs are regularly wetted and in which greater contact (including swallowing water) is unusual (e.g. boating, fishing, wading), and including occasional and inadvertent immersion through slipping or being swept into the water by a wave.
3. No contact (aesthetic uses) — activity in which there is normally no contact with water (e.g. angling from shore), or where water is incidental to the activity (such as sunbathing on a beach).

Sanitary Inspections (combined with microbial assessment), are recommended in the Guidelines for Recreational Water Managers (RWM's), to classify designated recreational water bodies. The inspections require performing risk analysis on influences such as ocean outlets, drains, pump stations, etc.

Sewage-related risk arises from the likelihood of pollution and (where pollution occurs) the degree of inactivation through treatment. Sewage discharges, or outfalls, may be classified into three principal types:

- those where discharge is directly onto the beach (above low-water level and intertidal areas);
- those where discharge is through 'short' outfalls (discharge is into the water but sewage-polluted water is likely to contaminate the recreational water area);
- those where discharge is through 'long deepwater' outfalls (sewage is diluted and dispersed, and the design criteria for the outfall ensure that sewage is unlikely to pollute recreational water areas).

Direct discharge of crude, untreated sewage (e.g. through short outfalls that carry a mixture of raw sewage and stormwater) into recreational areas presents a serious risk to public health.

The Guidelines (Table 5.10 on p84) provide a risk rating of "low" for the probability of sewage reaching designated recreational waters from effective ocean outlets with secondary treated wastewater.

The closest recreational activity to the proposed ocean outlet location occurs on the Alkimos Reef (surfing and diving). The modelling work found that there would be no exceedence of primary contact human health criteria at Alkimos Reef.

- 3.1.10 The Wastewater 2040 strategy said that the volume of wastewater discharged to Perth's coastal waters could treble within 50 years. Further attention should be given to the implications of increased ocean disposal of wastewater. It represents a waste of water and nutrients that could be used to meet the needs of growing population. It may also harm the marine environments the load of pollutants increase (Submission 10).**

- A. A Refer sections in PER on reuse, and sections on marine impacts.

The Water Corporation is putting significant effort into increasing reuse in the Perth Metro area.

The Water Corporation disagrees with this assertion which infers that the discharge of highly treated wastewater to the marine environment is somehow bad and

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unacceptable. The purpose of this PER process is to assess the effects of ocean discharge on the marine environment and determine the parameters that are acceptable for such a practice to be permitted. The Water Corporation has a long and successful history of such practices, with no unacceptable deleterious effects on the seabed.

**3.1.11 Perth's wastewater strategy was drawn up 10 years ago it deserves a review given pressure on water resources and the government's recent commitment to increase wastewater use (20% by 2012) (Submission 2,7).**

A. Wastewater 2040 Strategy provides a broad framework for the wastewater system and the Water Corporation direction is based on it together with recent changes in the wider external environment such as the State Water Strategy.

It is intended to update Wastewater 2040 in 2007. The Water Corporation is working towards the targets in the State Water Strategy and reuse of treated wastewater has now reached 14%.

**3.1.12 One issue not addressed in the PER is the discharge of endocrine disruptors into the marine environment. Endocrine disruptors can affect sexual development and reproduction, with impacts on aquatic fauna documented overseas. The Water Corporation should assess the load and impact of endocrine disruptors emitted to the environment through ocean disposal of treated wastewater (Submission 10).**

A. The effect of endocrine disruptors in industrial and sewage effluents has become a recent focus of attention. Endocrine disruption has been attributed to:

- some persistent organochlorines (PCBs, dioxins, DDT, chlorophenols and some pesticides),
- nonyl phenol ethoxylates,
- nonyl phenol (a breakdown product of industrial detergents),
- phthalate esters,
- phytoestrogens and
- pulp mill effluent.

Some metals/metalloids (arsenic, cadmium, lead, mercury) and PAHs are also suspected endocrine disruptors. The majority of significant endocrine disruption effects reported in the literature involve the discharge of wastewater into rivers or estuaries, especially when the discharge is a large proportion of stream flow.

Research indicates the majority of endocrine disrupting activity in domestic treated wastewater is due to natural estrogens (e.g. estradiol and estrone), synthetic estrogens (used in birth control and hormone replacement prescriptions) and natural androgens (e.g. testosterone) or their breakdown products, unless a large proportion of industrial treated wastewater is present. Secondary treatment of domestic sewage using an activated sludge process removes the majority of estrogenic and androgenic activity in treated wastewater. Endocrine disruptors are not considered an environmental risk in Perth's coastal waters as treated wastewater from the Beenyup, Subiaco and Woodman Point WWTPs has undergone secondary treatment using an activated sludge process, contains a small proportion of industrial treated wastewater, and is discharged well offshore into a well mixed marine environment (refer Perth Long-Term Ocean Outlet Monitoring Programme (2001/02): Treated Wastewater Characterisation. DAL Science & Engineering, October 2002).

**3.1.13 The lack of recent public review of wastewater management options is a source of concern during the review period for the PER (Submission 10).**

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- A. The Water Corporation has conducted extensive public consultation and engagement regarding the AWWTP project, as evidenced in Section 5 of the PER.

Also, as a key stakeholder in the process, the Water Corporation has participated in a wide community consultation regarding treated wastewater re-use that was undertaken by the EPA and reported in Bulletin 1199 Section 16 Advice – Manage Aquifer Recharge using Treated Wastewater on the Swan Coastal Plain of 2005.

Section 2.2.3 of the PER describes some of the re-use options considered by the Water Corporation during these processes.

**3.1.14 The Water Corp put the blame on why the water has to be discharged and not reused on the Health Department and others. This conflict between departments needs to be resolved and a whole of government approach adopted to review best practise and set more realistic guidelines for use of treated wastewater (Submission 4).**

- A. The Water Corporation supports the precautionary approach taken by the regulators. There is no blame involved. The requirements in terms of protection of public health is the responsibility of the Department of Health. The Water Corporation has no problems with the requirements set and is prepared to work within these. It should be noted that one of the most profound measures taken over the last millennium to protect public health was to separate water supply from waste discharge. The re-connection of this fundamental cycle needs to be undertaken with caution.

Given Western Australia's high reliance on groundwater as a potable water supply, a high degree of certainty is justifiably required by the Health Department and government before community "social licence" can be obtained. This will require revision and change of existing policies, scientific studies to relevant government agencies satisfaction, subsequent social acceptance and political will to implement.

**3.1.15 The PER describes alternatives to ocean discharge, including managed aquifer recharge and irrigation however the alternatives are considered to be unfeasible or unacceptable to the proponent. This conclusion would need to be demonstrated to the satisfaction of the EPA and shown that it is consistent with Government policy and objectives. Where this is the case, under the SWQMS Document 6, the proponent is expected to demonstrate that discharge of wastewater would not impact on the EVs and EQOs established for the receiving environment (Submission 14).**

- A. The proposal requires the modification of the notional EQOs for the region. This is a fundamental requirement for development in Western Australia. The aim of the SWQMS Document 6 was not to put all future marine developments off limits, e.g.

"There is a tendency among some to automatically assume that the highest level of protection should be applied to areas that are deemed pristine. Unless a pristine area is deemed to have a high conservation and/or high ecological value, such an assumption should not be made automatically. If that assumption were correct, the ramification would be that most of WA's pristine coastline would be potentially quarantined from most anthropogenic activities. The corollary of this is that some areas that are already disturbed but have very high conservation and/or ecological value may not be given the appropriate level of protection." (pp10-11)

In the EPA's 2000 working document, "Perth's Coastal Waters: Environmental Values and Objectives", it was put forward that the broad objective for Perth's coastal waters is that they should be managed to meet an EQO of "High Ecological Protection". There was some allowance for existing outlets through the depiction of notional mixing zones by the EPASU (which were not subject to the same public discussion

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process), however there was no discussion regarding the process for establishing future mixing zones. The EPA 2000 document was deliberately titled 'A working document' to acknowledge the additional work required. As such, the statement that all of Perth's Coastal Waters outside of the EPA's notional mixing zones have been "established" as "High Ecological Protection" areas is premature.

It is not best practice when undertaking ocean disposal to reduce contaminant, nutrient and bacterial levels to the extent that a mixing zone is not required. Best practice is to use the process of initial dilution to then meet the regulatory criteria at the edge of defined mixing zones. Should there be no mixing zone allowed there would be an excessive dollar, energy and greenhouse cost in treatment for no environmental gain.

The role of the Water Corporation is to ensure that the ecosystem is not compromised through the implementation of its proposal and that any mixing zone required is kept to the minimum size needed. To do this, wastewater will be treated to maximize nitrogen removal, however best practice yields results of approximately 5 mg/L (mostly as nitrate-N), which is still more than two orders of magnitude greater than background levels in the ocean. The proposal will reduce nitrogen to the maximum extent that is practical, given the carbon source available.

The Water Corporation has undertaken the studies underpinning the ERMP to ensure that areas of high marine conservation value will not be impacted. The operation of an ocean outlet for the public good requires the definition of a mixing zone. The Water Corporation has sought to establish the zone in an area where there will be no adverse ecological impact and such that the size of the zone is minimised.

#### **In reference to the Hydrodynamic Modelling Completed (Submission14);**

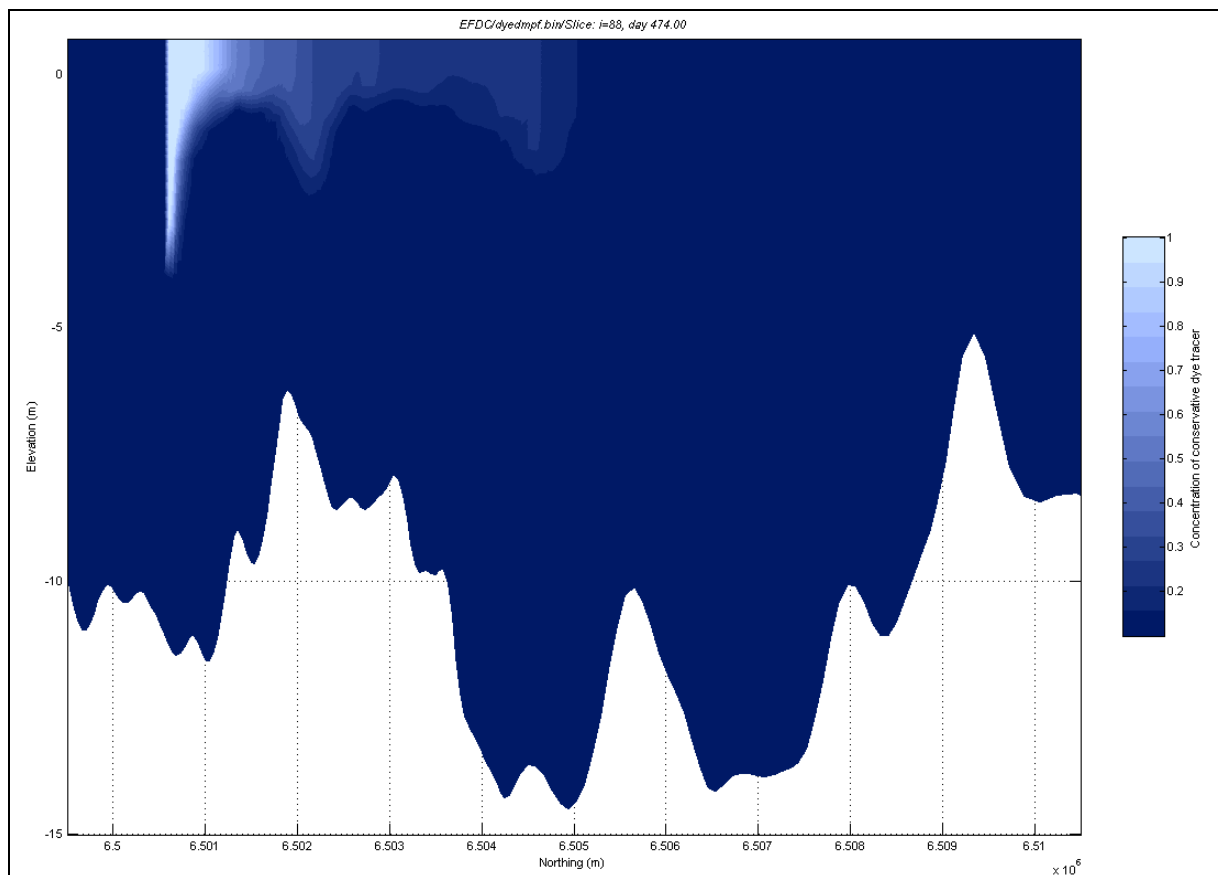
##### **3.1.16 The results from the hydrodynamic modelling are not provided and as such, more information is required for EIA.**

A. The hydrodynamic modelling results are fully described in the Worley Parsons (2005) modelling report. Due to its size, the report by Fugro on currents measured for the purpose of validating the numerical model will only be provided on request.

- **Vertical mixing of the plume – no information is given as to the vertical structure/mixing of the TWW plume and how it might affect the exposure of benthic organisms (particularly those inhabiting reef structures elevated off the surrounding seabed) to nutrient enriched water or impact light attenuation through the water column?**

The hydrodynamic modelling predicted the TWW plume would behave as expected for a buoyant plume. That is the modelled plume rises through the water column forming a relatively narrow vertical column above the discharge location and spreads out into a surface layer. The thickness of the surface layer depends on environmental conditions, particularly the degree of stratification and occurrence of wind-induced mixing events. The Oceanica water quality monitoring found that the waters offshore were not stratified.

Note that the TWW discharge was not introduced at the seabed. As the model used for this part of the work is a far-field model, the vertical discharge location was adjusted to match the modelled near-field dilution results at the water surface.



**Figure 1. Vertical slice through diffuser discharge, orientated along shore, showing plume confined to surface layers**

Under calm or low wind conditions, the fresh treated wastewater plume will rise to the surface (undergoing significant dilution as it rises) and then be dispersed in the surface waters. Under stronger wind conditions, the plume will be rapidly mixed in the water column and will not reach the water surface. The numerical modelling examined the potential for the plume to reach nearby reefs. The reason for the longer (3.5 km) outlet configuration being selected was to minimise the risk of the plume reaching the nearby reefs.

- **How has the farfield model been reconciled with the near field model (unspecified) for correct nitrogen concentration and mass flux from the discharge point?**

The mass flux of nitrogen was represented by a conservative tracer with a constant concentration of 100 in the TWW discharge. Consequently, the mass flux of any conservative component of the discharge, for example nitrogen, is conserved and any reductions in the tracer concentration are due to dilution.

The achievement of the appropriate level of dilution in the far-field model was checked against the predicted dilutions in the near-field model by running the far field model under the same discharge and background conditions as the near-field model. The concentration of the tracer was extracted from the surface model cell containing the discharge. The position of the discharge was then adjusted vertically to ensure the dilution achieved at the surface matched the dilution predicted in the near-field modelling. In the modelled scenarios moving the discharge point vertically in the water column is an appropriate way to achieve the required surface concentration

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because the total mass flux into the model is conserved and the discharge rapidly forms a buoyant surface plume.

- **What near-field model was applied to predict initial dilutions? Please give details of the application and results of this model.**

The near-field modelling of the TWW discharge to predict initial dilutions was carried out by Consulting Environmental Engineers (CEE 2005). WorleyParsons reviewed the design using the US EPA approved model CORMIX.

The Cornell Mixing Zone Expert System (CORMIX) is a software system for the analysis, prediction, and design of aqueous toxic or conventional pollutant discharges into diverse water bodies. It is a recommended analysis tool in key US EPA guidance documents on the permitting of industrial, municipal, thermal, and other point source discharges to receiving waters. The system's major emphasis is on predicting the geometry and dilution characteristics of the initial mixing zone so that compliance with water quality regulatory constraints may be judged, although it also predicts the behavior of the discharge plume over larger distances, subject to simplified oceanographic assumptions.

Key features of CORMIX include prediction of the geometry and dilution characteristics of the treated wastewater flow resulting from a discharge that is:

- Of an arbitrary density (positively, neutrally, or negatively buoyant),
- In an arbitrary location with arbitrary geometry, and
- Into an ambient receiving water body that may be stagnant or flowing and have ambient density stratification of different types.

Overall, WorleyParsons found that, when modelled using the following parameters in CORMIX for the discharge density: treated wastewater density 999 kg/m<sup>3</sup>, seawater density 1025 kg/m<sup>3</sup>, and in low background currents, initial dilutions of 200 to 300:1 could be achieved with the release of the discharge in water 23 m deep. This was in agreement with the work by CEE (2005), allowing for differences between the models used by CEE and WorleyParsons.

- **Justification is needed for the omission of wave pumping from the input forcings input to the model**

Nearshore circulation may be driven by a number of different forces, including wind driven currents, tidal currents, wave pumping, alongshore pressure gradients etc. Given the complexity of nature, a hydrodynamic model must necessarily make some simplifications and prioritize the relative importance of different forces to create a manageable yet reliable prediction of the real world.

To identify the relative importance of input forcing a review of the general regional oceanography and near shore circulation at Alkimos was undertaken prior to hydrodynamic modelling of the proposed TWW discharge at Alkimos (WorleyParsons 2005a). The review was based on the following documents:

- Brown & Root Services Asia Pacific Pty Ltd. 2000. Perth Long-term ocean outlet monitoring (PLOOM) Programme 2000: Project M1: Hydrodynamic and Transport Modelling Final Report 1996-2000. Prepared for Water Corporation of Western Australia. Ref PE6026-DO-007, Rev.0
- Lord, D.A. and Hillman, K. 1995. Perth Coastal Waters Study Summary Report. Distributed by The Water Authority of Western Australia.

The PLOOM study characterised oceanographic conditions at Swanbourne, Woodman Pt and Ocean Reef outfalls. The conditions at Ocean Reef are likely to be

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more similar to the proposed outfall site at Alkimos than conditions at Swanbourne and Woodman Pt, which are both further away and dissimilar in bathymetry. In summary, the nearshore circulation at Ocean Reef was characterised as follows:

- The area experiences a complex combination of wind-forcing, tidal and wave pumping, basin seiching, long period motions and gravitational currents.
- The relative strength of the individual mechanisms varies with meteorological conditions and seasonal changes.
- Wind is the dominant forcing mechanism.
- The circulation in the lagoon is predominantly barotropic.
- During summer southerly winds dominant, while during winter the wind speed and direction are more variable.
- As winds are predominately southerly, northward currents dominate. During summer, up to 60% of the variance in the current field may be explained by the wind field.
- Wind speeds greater than 3-5 m/s are sufficient to dominate the flow dynamics.
- Tidal current speeds are only around 0.02 m/s and tidal influence is therefore negligible.
- Wave energy within the Whitfords lagoon is low due to dissipation or reflection off the reef line. Attenuation of significant wave heights by up to 40-60% have been reported.
- Baroclinic forcing on circulation is negligible as while temperature stratification occurs due to diurnal heating and cooling, the column is generally vertically mixed in temperature in the morning as a result of convective cooling and wind mixing.

Given the above characterisation of the physical environment and hydrodynamics, the key forcing likely to affect plume dispersion and transport at Alkimos appears to be variability in wind conditions. Wave pumping was not expected to be a significant forcing when compared to wind over a seasonal time scale and can therefore be excluded from the input forcings.

- **Justification is needed for the omission of the longshore steric gradient as a forcing to the model – previous work by Pattiarachi suggests that currents may be less correlated with wind in winter than in summer due to the effects of a sea level gradient associated with the Leeuwin Current.**

The hydrodynamic model was calibrated against currents recorded between April and the end of June, at a time when the sea level gradient associated with the Leeuwin Current is increasing. If currents were correlated to a sea level gradient rather than strongly correlated to winds, excluding the longshore gradient should have produced a consistent bias either above or below the recorded currents. This was not observed during model calibration. We would attribute this to the near shore, shallow location of the current recordings. In this type of environment it is known frictional damping reduces the impact of the sea level gradient on currents.

- **Justification is required as to how the 50 x 50m model grid resolves the patchiness of bathymetry such that the model will reliably represent the movement of water within bathymetrically complex parts of the model domain.**

The model bathymetry was based on hydrographic survey data supplied by the Water Corporation. This data covers only those areas with sufficient water depth for ship-

based soundings. Additional digitising of unsurveyed reefs was undertaken by WorleyParsons from marine charts WA 986 and WA 1076. The area of the digitised reef features varied from approximately 3,800 m<sup>2</sup> up to 83,000 m<sup>2</sup>, which is equivalent to between 1 and 33 of the 50 x 50 m model cells. As such, the model grid is fine enough to resolve the patchiness of the bathymetry.

The reliability of the predicted movement of water within the bathymetrically complex parts of the model was assessed against current data recorded at an inner reef site. Mooring A was located approximately 1.85 km offshore between Eglinton Rocks and the -15 m contour, in a water depth of 12 m. The comparison between the measured and modelled currents at Mooring A was generally good, with mean modelled current speeds within 0.01 m/s of the measured speeds (WorleyParsons 2005). Overall, the good match between measured and modelled current speeds indicated the model was reliably representing the movement of water within bathymetrically complex parts of the model.

- **Wind data – a hill top station is used – where is this station located? Justification is required to support the assertion that wind data from the hill top station is representative of the on-water winds at standard height of 10m. No discussion is provided on page 32 of 60 in relation to the representativeness of wind direction at Swanbourne and Alkimos (only speed).**

The hill top wind station named Weather Station 100 and is located at RL 30.58, 374274.90m E and 6501680.11m N (GDA94). It is located approximately 1 km inshore. WorleyParsons considers this data is the most appropriate for use in modelling as it is the closest available data to the area of interest and is relatively close to the coast.

Wind data was supplied to WorleyParsons after processing for quality assurance and correction to the standard height of 10 m by the Water Corporation. Queries concerning the detail of pre-processing and quality assurance should be directed to the Water Corporation.

The long-term representativeness of wind direction at Alkimos could not be directly assessed as a long-term data set is not available at the site. Consequently, to establish whether the records were likely to be representative of long term trends, analysis of 2005 data against longer term records was undertaken using data from the Bureau of Meteorology's Swanbourne station. The analysis involved comparison of the total wind speed and direction record at Swanbourne for selected months.

The analysis involved calculation of wind speed summary statistics for the modelled months, comparisons of wind roses for the modelled months and preparation of joint frequency tables for wind speed and direction for the modelled seasons. The full analysis is presented in WorleyParsons (2005). However a brief summary, including seasonal JFTs, is presented here.

In general, the mean wind speed recorded for each of the months January to May 2005 is close to the mean of all months between 1999 and 2005 (ie. the mean of all Januarys compares well to the mean wind speed in January 2005). The maximum difference in mean wind speeds is 11% in the comparison of March 2005 to all March records. Therefore, it seems reasonable to assume the average wind speeds calculated for January to May 2005 are representative of the longer term average conditions.

The other summary statistics also indicate the distribution of wind speed records in January to May 2005 around the mean is similar to the longer term record.

**Table 1. Summary statistics for wind speed. All speeds reported in m/s**

Month	Summary statistics of Wind speed (m/s)											
	Dec	Dec	Jan	Jan	Feb	Feb	Mar	Mar	Apr	Apr	May	May



		04		05		05		05		05		05
<b>Mean</b>	6.06	5.98	6.08	6.28	5.73	5.69	5.29	4.70	4.94	4.78	5.13	4.99
<b>Min</b>	0.00	0.00	0.00	1.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>20%ile</b>	4.17	4.17	4.17	4.17	3.61	3.61	3.61	3.06	3.61	3.06	3.06	3.61
<b>Median</b>	6.11	6.11	6.11	6.11	5.56	5.56	5.28	4.72	4.72	4.72	4.72	4.72
<b>80%ile</b>	7.78	7.78	7.78	8.33	7.78	7.78	7.22	6.67	6.11	6.11	6.67	6.11
<b>95%ile</b>	9.17	9.17	9.17	9.72	9.17	9.17	8.33	8.33	8.33	7.78	10.28	7.78
<b>98%ile</b>	10.28	9.72	10.28	10.83	9.72	9.72	9.17	9.17	10.28	10.52	12.22	10.28
<b>Max</b>	12.78	12.78	13.89	12.22	12.78	11.39	11.94	10.83	20.00	15.83	19.44	19.17

The seasonal JFTs indicate that during the summer of 2004/2005, the distribution of wind speeds was less than 1% different to the distribution of wind speeds between 1999 and 2005. However, there were fewer southerly winds and more easterlies, although the difference in occurrence for all directions was less than 5% over the season.

In the autumn of 2005, the distribution of wind speeds was less than 3% different to the distribution of each of the wind speeds between 1999 and 2005. The distribution of directions was also similar.

**Table 2. Summer Seasonal JFT of wind speed and direction at Swanbourne, 1999 to 2005**

<b>Dir (°)/Spd (m/s)</b>	<b>0-3</b>	<b>3-6</b>	<b>6-9</b>	<b>9-12</b>	<b>12+</b>	<b>Total</b>
<b>N</b>	0.55	0.43	0.24	0.06	0.00	1.28
<b>NE</b>	0.40	1.01	0.58	0.01	0.00	2.01
<b>E</b>	0.84	8.69	12.76	1.23	0.01	23.53
<b>SE</b>	1.16	12.65	3.36	0.11	0.00	17.28
<b>S</b>	1.18	12.72	9.88	2.17	0.03	25.99
<b>SW</b>	0.49	6.25	13.67	3.40	0.02	23.84
<b>W</b>	0.41	2.62	1.21	0.11	0.00	4.36
<b>NW</b>	0.24	0.97	0.48	0.03	0.00	1.72
<b>Total</b>	5.28	45.34	42.18	7.14	0.07	100.00

**Table 3. Summer Seasonal JFT of wind speed and direction at Swanbourne, for the months of December 2004, January and February 2005**

<b>Dir (°)/Spd (m/s)</b>	<b>0-3</b>	<b>3-6</b>	<b>6-9</b>	<b>9-12</b>	<b>12+</b>	<b>Total</b>
<b>N</b>	0.82	0.25	0.27	0.05	0.00	1.40
<b>NE</b>	0.30	0.78	0.23	0.02	0.02	1.35
<b>E</b>	0.71	6.37	9.53	1.49	0.00	18.09
<b>SE</b>	1.19	11.93	1.63	0.07	0.00	14.82
<b>S</b>	1.28	14.96	12.67	2.68	0.07	31.65
<b>SW</b>	0.66	5.43	15.96	3.02	0.02	25.10
<b>W</b>	0.41	3.55	1.51	0.30	0.00	5.77
<b>NW</b>	0.18	0.98	0.55	0.07	0.02	1.81
<b>Total</b>	5.57	44.25	42.35	7.70	0.14	100.00

**Table 4 Autumn Seasonal JFT of wind speed and direction at Swanbourne 1999 to 2005**

<b>Dir (°)/Spd (m/s)</b>	<b>0-3</b>	<b>3-6</b>	<b>6-9</b>	<b>9-12</b>	<b>12+</b>	<b>Total</b>
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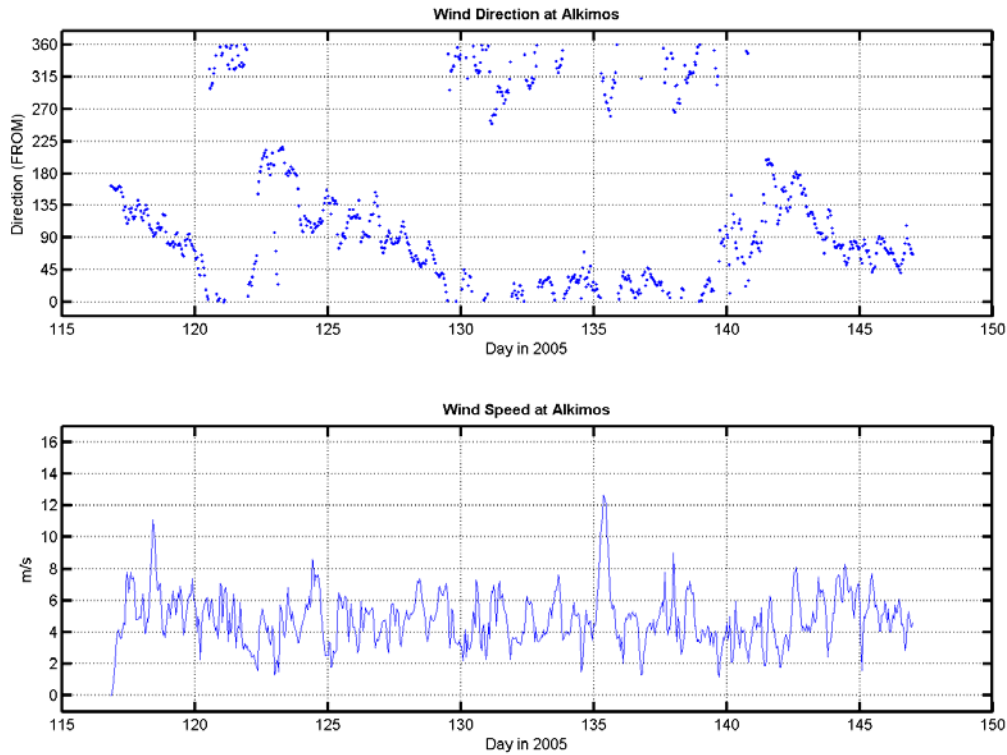
<b>N</b>	1.34	3.36	1.28	0.12	0.00	6.10
<b>NE</b>	1.06	3.56	1.41	0.01	0.00	6.05
<b>E</b>	2.21	19.58	8.46	0.50	0.00	30.76
<b>SE</b>	2.01	12.27	1.12	0.01	0.00	15.40
<b>S</b>	1.55	10.13	3.70	0.46	0.05	15.89
<b>SW</b>	0.66	5.90	5.14	0.89	0.10	12.70
<b>W</b>	0.71	3.35	2.01	1.14	0.56	7.77
<b>NW</b>	0.49	1.99	1.53	1.03	0.28	5.33
<b>Total</b>	10.03	60.15	24.66	4.16	0.99	100.00

**Table 5. Autumn Seasonal JFT of wind speed and direction at Swanbourne, for the months of March, April and May 2005**

<b>Dir (°)/Spd (m/s)</b>	<b>0-3</b>	<b>3-6</b>	<b>6-9</b>	<b>9-12</b>	<b>12+</b>	<b>Total</b>
<b>N</b>	1.87	6.61	1.23	0.07	0.00	9.78
<b>NE</b>	1.33	3.37	1.35	0.00	0.00	6.04
<b>E</b>	2.38	15.94	8.94	0.74	0.00	28.00
<b>SE</b>	3.24	11.72	1.11	0.02	0.00	16.09
<b>S</b>	1.99	10.19	2.68	0.49	0.39	15.75
<b>SW</b>	0.81	7.54	3.71	0.02	0.15	12.23
<b>W</b>	0.84	3.66	1.67	0.27	0.07	6.51
<b>NW</b>	0.52	3.00	1.65	0.22	0.22	5.60
<b>Total</b>	12.97	62.02	22.33	1.84	0.84	100.00

- **Validation of the model is only for late autumn/ early winter conditions – a validation for summer conditions is required.**

The wind record from Alkimos for the current meter deployment was used for model calibration. The time series of wind speed and direction is provided in Figure 3 below. The record shows two periods of high winds, corresponding to storm events in late April and mid May. It also shows a few events typical of summer conditions, with easterlies and southerly and south-south westerly winds. As a whole, the results indicated the model was responding appropriately to different wind conditions and additional validation for summer conditions is not considered necessary.

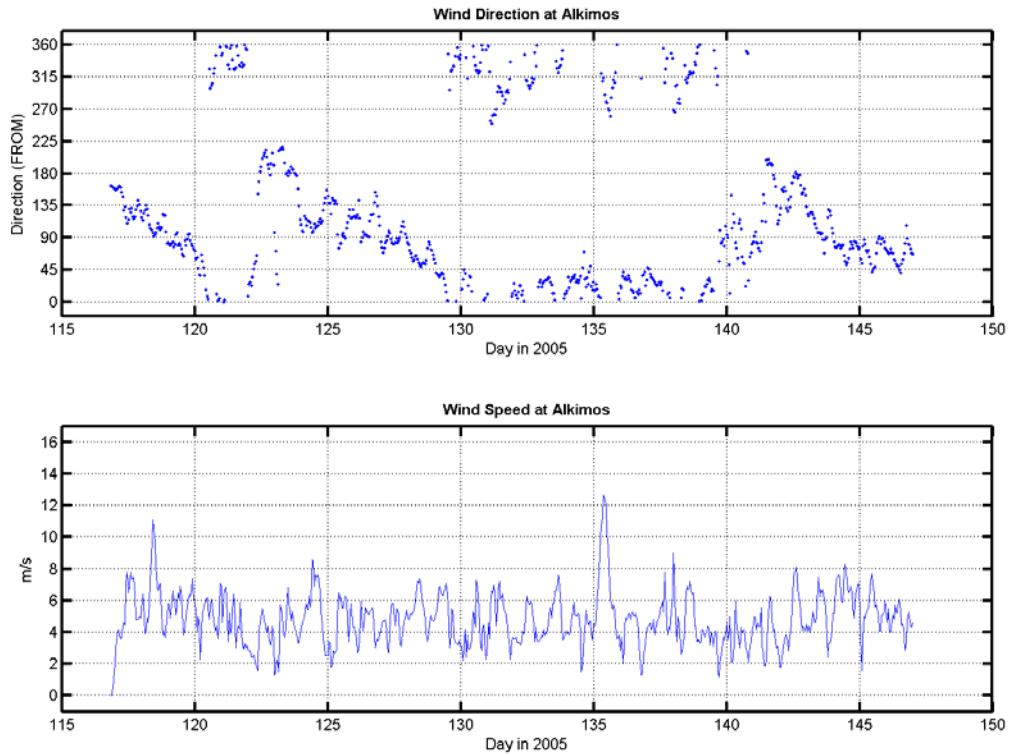


**Figure 2. Wind speed record for the period 28 April to 28 May 2005, data supplied by Water Corporation from Station 100 at Alkimos**

- **Exploration of the mean error, RMS error, scattergram plots and progressive vector plots are required to quantify the error between the measured and predicted model results (Submission 14).**

An analysis of the mean error and RMS error was reported in WorleyParsons (2005) to quantify the error between the measured and predicted model results as reproduced below.

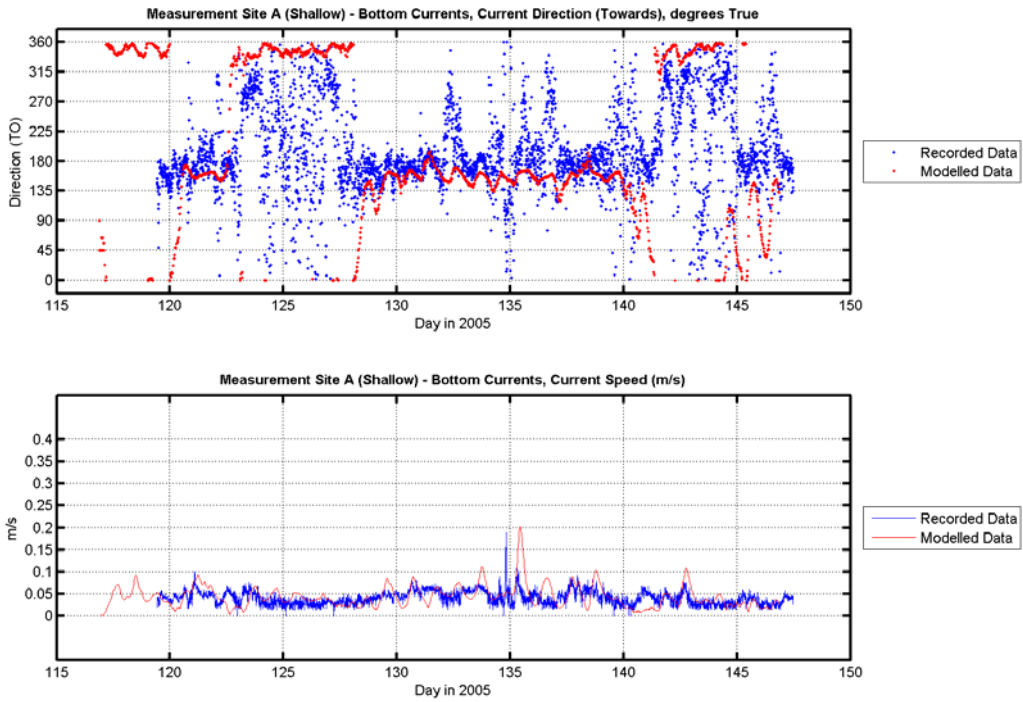
Note, in the following discussion wind directions are quoted as direction FROM and currents are shown as direction TO. That is, a northerly wind is expected to produce a southerly current.



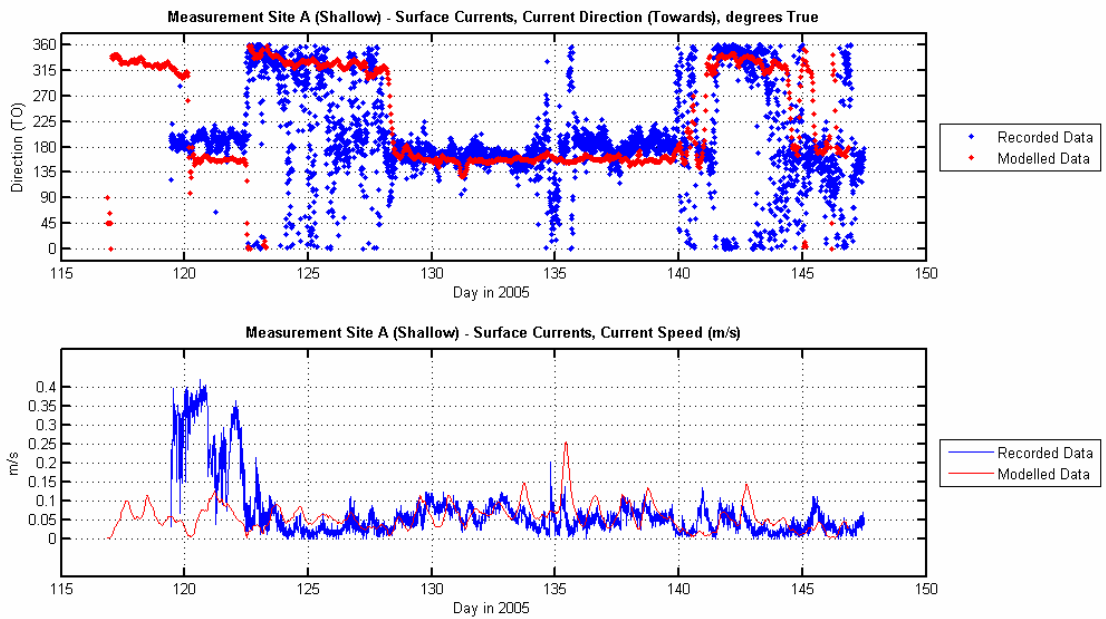
**Figure 3. Wind speed record for the period 28 April to 28 May 2005, data supplied by Water Corporation from Station 100 at Alkimos.**

Time series comparison plots of modelled and recorded near-bottom and near-surface current speeds and directions are provided for both moorings (Figure 7 to Figure 7)

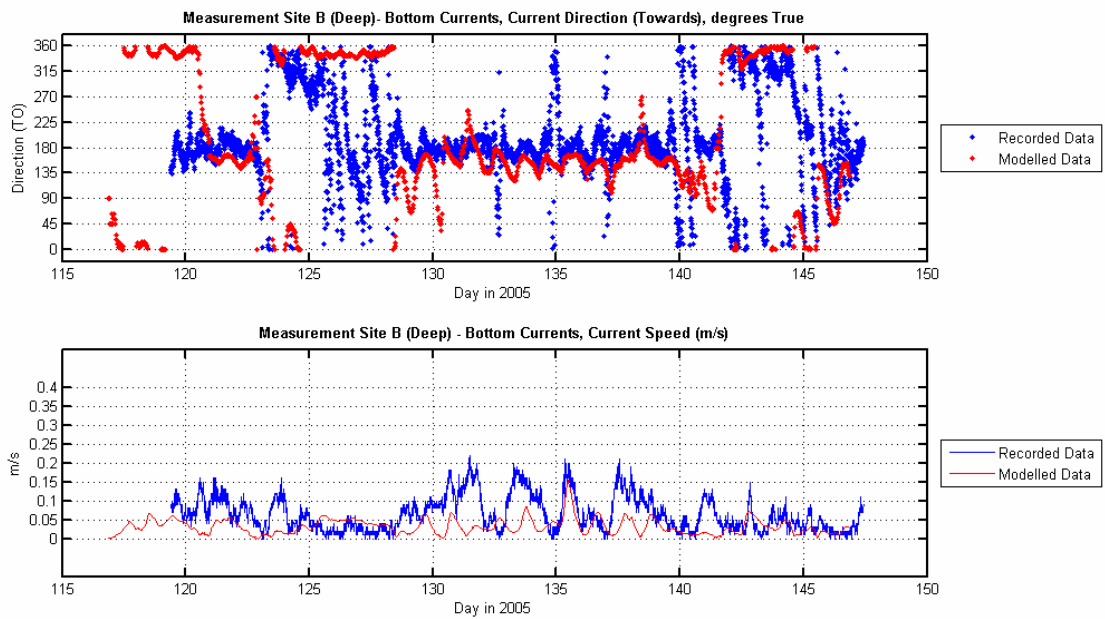
The time series plots of speed and direction generally show a good match between the modelled and recorded data, particularly at Mooring A within the reef environment. However, the greatest divergence between the modelled and recorded current speeds occurs at the beginning of the calibration period in the surface record at Mooring A.



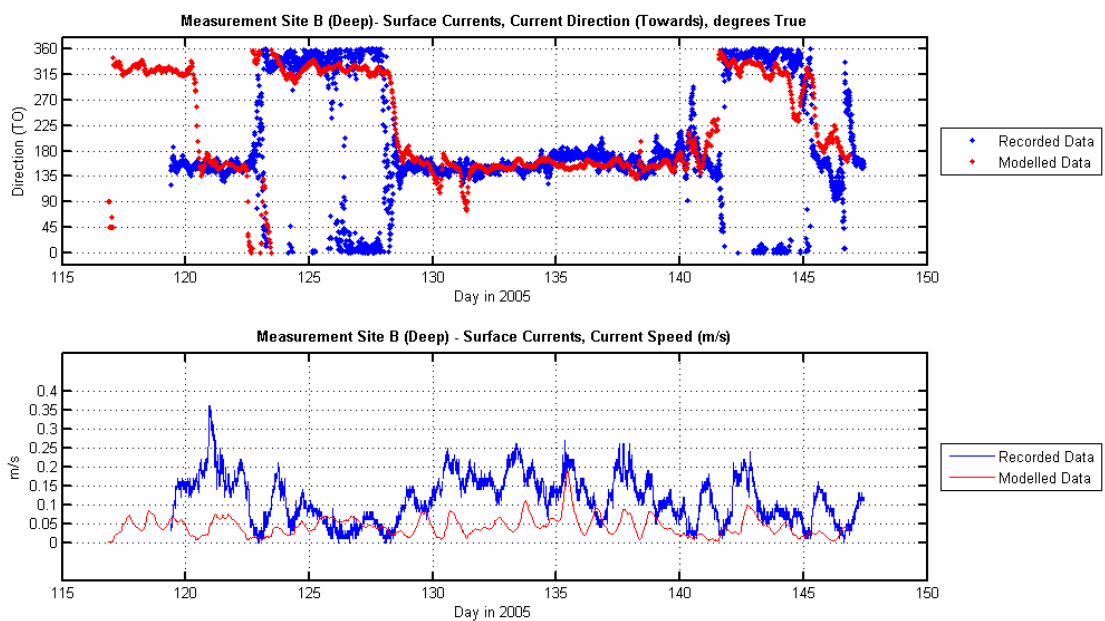
**Figure 4. Time series comparison of bottom current direction and speed at Mooring A**



**Figure 5. Time series comparison of surface current direction and speed at Mooring A**



**Figure 6. Time series comparison of bottom current direction and speed at Mooring B**



**Figure 7. Time series comparison of surface current direction and speed at Mooring B**

**Table 6. Comparison of summary statistics for recorded and modelled current speeds at Mooring A**

Statistic	Bottom Current Speed		Surface Current Speed	
	Recorded (m/s)	Modelled (m/s)	Recorded (m/s)	Modelled (m/s)
Minimum	0.00	0.00	0.00	0.00
10%ile	0.02	0.02	0.01	0.02
Mean, $\pm$ Std Dev	0.04 $\pm$ 0.02	0.04 $\pm$ 0.03	0.07 $\pm$ 0.08	0.06 $\pm$ 0.03
Median	0.04	0.04	0.05	0.05

95%ile	0.07	0.09	0.30	0.11
98%ile	0.07	0.10	0.36	0.14
Maximum	0.19	0.20	0.42	0.26
RMS error		0.025		0.086

**Table 7. Comparison of summary statistics for recorded and modelled current speeds at Mooring B**

Statistic	Bottom Current Speed		Surface Current Speed	
	Recorded (m/s)	Modelled (m/s)	Recorded (m/s)	Modelled (m/s)
Minimum	0.00	0.00	0.00	0.00
10%ile	0.02	0.01	0.03	0.01
Mean/Std Dev	0.07 ± 0.05	0.03 ± 0.02	0.11 ± 0.06	0.04 ± 0.03
Median	0.06	0.03	0.11	0.04
95%ile	0.16	0.06	0.22	0.08
98%ile	0.17	0.08	0.24	0.10
Maximum	0.22	0.15	0.36	0.19
RMS error		0.058		0.096

- **There is no discussion of potential cumulative impacts associated with the proposed outlet in combination with existing nutrient sources such as groundwater and/or other discharges from WWTPs.**

The PLOOM program has demonstrated that the influence of the Ocean Reef Outlet does not extend north to Alkimos. As such, the Alkimos Outlet will not have a 'cumulative' impact with the Ocean Reef Outlet. All other outlets are more distant and there is no connection between those outlets and Alkimos. Further, the Alkimos Outlet discharges past the offshore reef line, which contains water that does not directly pass the Ocean Reef Outlet.

The fact that the outlet is ~ 3.5 km offshore and that groundwater in the region has very low nutrient levels, suggests that the risk of cumulative impacts caused by the interaction of groundwater and treated wastewater is negligible.

- **Only summer/autumn scenarios are provided – why no winter ones? In winter there will be more northerly and westerly winds which would act to expand the plume envelope south and towards the shore. Long periods of calm weather also occur in winter influencing dilution of the TWW. Predictions of plume dilution and dispersion should be made for winter months.**

The worst case conditions for dispersion occur in autumn. Environmentally there are limited concerns with winter conditions and the EPA's management framework is currently aimed solely at summer conditions. In winter, the background nutrient concentrations are highest, high levels of complete mixing occur with a frequency of ~5-7 days, the recreational activity is minimum.

- **Confirm the nature of the current meters (i.e. that they don't involve a vane)**

Both near-bottom and near-surface currents were recorded at the two sites. Mooring A consisted of two Aanderaa Recording Current Meters (RCM) located at depths of 3m and 9 m below MSL. Mooring B consisted of an up-ward looking RDI 300kHz Workhorse (WH) Acoustic Doppler Current Profiler (ADCP) at 20 m below mean sea level.

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The near-field modelling was carried out by CEE using a merging plume model that has been published in peer-reviewed journals and verified by comparison of the predicted dilution with the measured dilution for several actual outfalls.

### 3.2 Odour

#### 3.2.1 **Site B poses greater risk of odour problems for future residents. The proposed odour channel is unproven and may require clearing of coastal dunes (Submission 2, 7).**

- A. The use of an odour channel to mitigate and control odour impacts generated by the ponding phenomenon is purely hypothetical at this stage. However the increased risk can be managed by increasing the buffer, as is proposed. In future, if an odour channel is proven beyond doubt to be technically viable and environmentally acceptable, it may be possible to relax the 800m buffer required to the west and north-west to 600m.

#### 3.2.2 **Despite the wider buffer on the western end of the Site B, this option poses greater risk of odour problems if urban development is allowed between the coast and the WWTP site. The proposed odour channel is unproven and if not effective might require clearing of coastal dunes in the future (Submission 3).**

- A. The use of an odour channel to mitigate and control odour impacts generated by the ponding phenomenon is purely hypothetical at this stage. The increased risk can be managed by increasing the buffer, as is proposed. It is correct that an odour channel, if implemented, will require clearing of high value vegetation.

#### 3.2.3 **In the case of Alkimos, a major road regional center is proposed quite near to the WWTP and it is particularly important that this center is not subject to odours from the WWTP (Submission 13).**

- A. The Water Corporation agrees that sensitive land uses should be segregated from the odour sources, hence the proposition for an odour buffer of 600m at Site A and 600m with 800m to the west and north west at Site B.

#### 3.2.4 **The Water Corporation regards the buffer zone as 'a community asset' and therefore it would be appropriate for the city to strive to create a green hub accommodating a variety of important social and environmental features (Submission 8).**

- A. The Water Corporation has explored a range of compatible land uses it could offer for use within the buffer zone. However, the final "community asset" opportunities available will depend on the amount of land remaining after the EPA's conservation objectives have been met.

#### 3.2.5 **The Site B option appears to expose more proposed houses, businesses, social and cultural uses to a rather inadequate odour buffer area. This would require the government to spend more on odour control to limit exposure to odour across a wide area of the metropolis. Increased costs the public are currently unwilling to outlay through taxation, when the issue can be solved through correct siting in the first instance (Submission 5).**

- A. It is true that Site B exposes more odour sensitive premises to the west; however the increased risk can be managed within the 800m buffer, as is proposed.



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**3.2.6 Site A will expose fewer humans to potential odour issues while preserving full access to the coast for the many, rather than a few rich elites. Access to biodiversity and geoh heritage is a question of intergenerational equity; it is the responsibility of those present to preserve precious assets for the next generations (Submission 5).**

A. Intergenerational equity is one of the objects of the Environmental Protection Act. A multi-criteria analysis incorporating environmental impacts, social benefit and capital and future economics forms the basis of a sustainability assessment. The Water Corporation has undertaken a sustainability comparison between Site A and Site B in Table 4.1 of the PER.

The Water Corporation can not comment on lifestyle values.

**3.2.7 It is noted that some documentation within the PER cites weather data from Perth Airport, for odour management purposes, which is much further inland and subject to wind shear disturbances from the Darling Scarp. It is essential that appropriate meteorological data is input to any modelling of odour behaviour for the WWTP. If the Water Corporation's on-site stations cannot provide a sufficiently long period of records, a site with similar coastal influences to Alkimos should be utilised as a data source (Submission 13).**

A. All odour modelling for the proposed Alkimos treatment plant used winds and meteorological data measured at two sites at Alkimos. No data from Perth airport was used.

**3.2.8 Should modelling suggest that a buffer of 600 metres may not be adequate, there is limited flexibility in the planning for land uses beyond the 600 metre notational buffer. Consequently, the Water Corporation will need to manage odours to comply with the 600-metre buffer (Submission 13).**

A. A 600m buffer is required for site A. A larger buffer of 800m to the west and North West is required for site B. Water Corporation is confident that it can manage odours within these buffer zones. It is agreed that, once this buffer is set, the Water Corp will have to manage within this constraint.

**3.2.9 The proposed buffer for Site B, including the 800m component, may be appropriate, although that has not been demonstrated either for the existing basin or an excavated basin. The 800-metre distance is an educated guess, which Water Corporation should be required to accept responsibility for (Submission 14).**

A. Water Corporation will accept the responsibility for managing its operations within the 600m buffer (800m to the west and north-west), subject to securing the proposed distances.

**3.2.10 The likely success of an odour channel from Site B is unknown (not modelled to date). Short-term odour events (10 to 20 minutes) may be an issue if ponding in an excavated basin is not adequately mitigated by a channel (Submission 14).**

A. The use of an odour channel to mitigate and control odour impacts generated by the ponding phenomenon is purely hypothetical at this stage. The Water Corporation is not currently proposing an odour channel, although such an option has been

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discussed. It is a possible future addition that may be able to reduce the odour buffer at site B from 800m in the west and north-west to 600m.

**3.2.11 The rationale behind site B is making coastal land available for residential development, however any residents may be at risk of exposure to odour given uncertainties over ponding and the odour channel idea. The wind data used in the modelling was not obtained from the Alkimos area (Submission 10).**

A. All odour modelling for the proposed Alkimos treatment plant used winds and meteorological data measured at two sites at Alkimos. The use of an odour channel to mitigate and control odour impacts generated by the ponding phenomenon is purely hypothetical at this stage. The Water Corporation is not currently proposing an odour channel, although such an option has been discussed.

**3.2.12 A commitment from the Water Corporation should be established ensuring that it will continually investigate new technologies for odour management which may therefore reduce buffer requirements in the future (Submission 8).**

A. The Water Corporation has a Process Expertise Group (PEG), whose role is to stay abreast of emerging wastewater technologies, including odour mitigation and management technologies.

**3.2.13 The odour ponding assessments undertaken to date have been based on inaccurate site characteristics. The buffer at Site B should be maintained to a maximum of 600 metres in all directions until firstly an odour ponding phenomena is actually identified within the actual ultimate topography and secondly all solutions to alleviate the ponding be considered (Submission 6).**

A. It is not prudent to restrict the buffer to the west and north west to 600m. The precautionary principle would suggest the establishment of the odour buffer out to 800m in those directions, with a commitment to reduce the buffer to the appropriate size with the emergence of more reliable information and performance over time. The odour ponding process has been clearly identified from the wind and air temperature measurements made at two monitoring stations at the proposed Site B. Thus there is no doubt that ponding occurs now, and will continue to occur when the basin is deepened. The best way to manage ponding is to provide a greater buffer zone downwind of the site (i.e., to the west and north west). An alternative solution is to provide the odour release channel, which involves removing one side of the basin to allow cold air to drain horizontally from the basin thereby minimising the risk of formation of a vertically stratified pond. The use of an odour channel to mitigate and control odour impacts generated by the ponding phenomenon is purely hypothetical at this stage. The Water Corporation is not currently proposing an odour channel, although such an option has been discussed.

**3.2.14 Under the Commission's Statement of Planning Policy No 4.1 *Draft State Industrial Buffer Policy* of June 2004 (Draft SPP 4.1) at section 5.3 it states 'The proposed buffer area is considered to have met the objectives of the policy once it has been agreed on by the WAPC in consultation with local governments and other appropriate regulatory authorities.' It is the Commission's position that in this instance it is the EPA's responsibility to propose an appropriate buffer and the Commission's responsibility to determine how to prevent incompatible uses establishing within the buffer. In this instance the EPA has, in Bulletin 1207, defined an appropriate odour buffer for Site B as 600 metres, in all directions.**

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In arriving at this decision the EPA had regard to the fact that the plant is going to be built in stages over a long timeframe, the likelihood that odour management would improve over time, and the fact that the research from which the odour ponding conclusions had been drawn had not correctly incorporated the actual terrain in the calculations, nor the possibility of creating an 'air flow channel' by modifying that terrain (i.e. the low dunes immediately to the west of Site B). The Commission supports these conclusions and is making arrangements (through MRS Amendment 1029/33) to ensure that appropriate land use controls apply within the proposed buffer (Submission 13).

- A. The proponent understands that the EPA has made an interim decision to provide a buffer zone of 600 m for Site A and 600 to 800 m for Site B.

The EPA recommendation is taken out of context. Page IV of the EPA Bulletin 1207 states:

"The EPA recommends that a 600m buffer measured from the boundary of the WWTP should be reserved for Public Purposes, to prevent the siting of odour sensitive land uses within an area likely to be impacted by unacceptable odour levels from the WWTP.

An 800m buffer west and north west of the WWTP measured from boundary of the WWTP should be reserved for Public Purposes if the site is subject to ponding and an odour channel is not provided."

- 3.2.15** There has been some useful community survey work at Subiaco and more recently at Woodman Point that has supported the use of 5 OU 1-hour average 99.9 percentile as the limit of odour acceptability for WWTPs. This is Water Corporation's selected criterion it is suggested that Water Corporation accepts responsibility for its ultimate adequacy, i.e. nuisance / offensive odours to be contained within the associated buffer. It does not follow that 5 OU 1-hour average 99.9 percentile corresponds to "distinct" odour intensity as stated. This statement attempts to link the criterion to the EPA's withdrawn odour guidance No. 47, however the assignment of "distinct" to 1-hour averages is one of the main flaws leading to the odour guidance being withdrawn. In our view, the community surveys mentioned above obviate the need to attempt to define the odour intensity associated with the 5 OU 1-hour average 99.9 percentile criterion (Submission 14).

- A. It is agreed that the community surveys are a valuable indication of the validity of the 5 OU 1-hour average 99.9 percentile odour criterion used by the Water Corporation. The Corporation has established at several treatment plants that the 5 OU contour, predicted using the Ausplume model and a local wind file, at 99.9 percentile frequency and 1-hour averaging, delineated the outer extent of odour complaints or nuisance for a wastewater treatment plant. It also is agreed that no further work is needed to relate the 5 OU criterion to the 'distinct' level of odour.

- 3.2.16** The CSIRO produced quantitative estimates (for the current, not deepened basin) of odour concentrations, which one might have expected to see reproduced in the PER in summary form at least. The estimates of 40% increase in odour and 800 metre buffer requirements are educated guesses that Water Corp needs to take responsibility for with respect to ultimate adequacy

Re the paragraph:

The Water Corporation will complete investigations on the impact of odour ponding and receive a consolidated report and recommendations from CEE. This will follow further discussions with DoE on the methodology adopted by CEE to interpret the additional effect of ponding at Site B.

Results of this work have not been seen (Submission 14).

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- A. The CSIRO work reported was based on the first year of wind and meteorological records at the Alkimos site. The CSIRO is currently examining the wind and meteorological records for a longer period. The proponent is continuing to work with CSIRO, CEE and DoE to examine the ponding process at Alkimos. A consolidated report is still scheduled to be prepared and submitted to DoE.

The “educated guesses” by CEE that led to the recommended 800 m buffer zone are based on field studies and investigations of ponding in the Koonung valley and Mullum Mullum valley over the last 10 years, and analysis of two years of wind and meteorological measurements at Alkimos. It is agreed that the Water Corporation has the responsibility to confine noticeable odour to within the defined buffer zone, and will make every effort in designing, equipping and operating treatment plants to achieve this objective in a sustainable manner.

**3.2.17 In reference to the sentence “Odour modelling was carried out using the latest version of the Ausplume model, and following DoE procedures.” The modelling for site B using Ausplume was not “in accordance with DoE procedures”. To be true, the modelling would need to have followed the DoE’s Odour Methodology Guideline (2002) which in turn requires a proponent to do modelling in accordance with the current Air Quality and Air Pollution Modelling Guidance Notes. One of the points from these notes reads (in part)**

▪ **Model capability**

*The models and/or worst case calculation procedures and data employed in the assessment must be demonstrably capable of simulating, or accounting for, all of the features which are important in the context of determining the air quality impact of the project. The proponent is responsible for identifying and properly accommodating these. The following list may not be exhaustive but is provided for checking purposes:*

*(11 dot points follow including):*

- *topographic influences - impact of plumes on elevated terrain, effect on spatially varying wind fields, valley winds (anabatic and katabatic winds), ponding of air in stable conditions;*

**Ausplume cannot simulate topographic features like ponding more sophisticated field investigation and modelling is required (Submission 14).**

- A. The comment is correct in that Ausplume cannot directly simulate ponding. Thus a CSIRO model was used to simulate ponding and two additional models (Ausplume and a CSIRO line source model) were used to predict odour levels downwind of the pond, representing the release of odour from the surface of the pond formed by stratified air within a deep basin. The CSIRO has advised that both models are reasonable approximations. The Ausplume model simulated the emissions from the surface of the pond as a set of area sources.

**3.2.18 The meteorological measurements, and hence the interpretation of the ponding process, at Alkimos relate to the present topography of the site and not to a basin that has been deepened to allow construction of a treatment plant at a lower elevation. We do not have information on the frequency and magnitude of emissions from a deeper pond (Submission 14).**

- A. It is anticipated that the process by which odour is sheared from the surface of a deeper pond will be the same as the surface of the existing basin at Alkimos.

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**3.2.19** The PER emphasises the importance of gravity feed to the WWTP, a justification given for the coastal location of the plant at Alkimos (Section 1 page 12). With gravity feed the plant at 160ML/day would generate 15,795 tonnes of CO<sub>2</sub> equivalent (per annum presumably) (Section 4 page 48). No figures are given for greenhouse gas emissions from an equivalent plant with wastewater pumped to it – this would be useful for comparison (Submission 10).

A. This is dependent on the location of the pumping station in relation to the WWTP. As an example (Munster Pumping Station), at 160ML/d a 20m lift would require three 600kW pumps (greenhouse emissions are estimated at 6,000 CO<sub>2</sub>e tonne).

## **4.0 SOCIAL SURROUNDINGS**

### **4.1 Land Development**

**4.1.1** Planning for the WWTP is a complex issue. Greatly concerned that there is not a real commitment to manage the continued urban growth across the Swan Coastal Plain in a more sustainable way (Submission 3).

A. This subject is outside the PER. The Water Corporation responds to (is not the driver of) the land planning policy decisions of the Western Australian Planning Commission in providing services for urban areas. In the case of Alkimos WWTP it has made every attempt to integrate the WWTP into the MRS.

**4.1.2** If Alkimos is the only solution then there really needs to be a halt on housing development until better methods are found (Submission 4).

A. This subject is outside the PER. The Water Corporation responds to (is not the driver of) the land planning policy decisions of the Western Australian Planning Commission in providing services for urban areas. In the case of Alkimos WWTP it has made every attempt to integrate the WWTP into the MRS. Stopping urban development is not within the control of the Water Corporation, and hence it by legislation (its operating licence) has to provide services for rezoned urban land.

**4.1.3** Why can't the developer use some of the land for localised treatment plants? I want to stipulate that they aren't to clear more land to achieve this but be included in the area to be developed (Submission 4).

A. Large centralised plants such as Alkimos provide efficiencies in terms of capital and operating costs, and importantly, buffer area. Land footprint is minimised because multiple plants would each require buffer zones not in proportion to the smaller amounts of flows.

Locating WWTP's is a very inflexible process due to the many competing criteria, such as land use, engineering constraints, and environmental constraints. As such it is important to identify and secure WWTP sites many years in advance of the urban development front. The Alkimos site (Site A) was first identified in the late 1970's and subsequently purchased in 1986.

**4.1.4** This area is on of the last large areas of coastal bushland left in the Perth region. When it has been planned since the 1970's that urban growth is going to go in this direction why it is only now that conservation reserves are being considered? (Submission 4)

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A. The planning of the 1970's (see Section 3.3.7 of the PER) recognised the biodiversity and geoheritage values of the area, and took them into account. Subsequent regional planning has seen these values incrementally reduced.

**4.1.5 If Site B is adopted, developers will try everything to get hold of the land situated between the Site B buffer and the coast to develop for housing. This will greatly compromise any opportunity to retain a series of dune landforms from the coast back into the hinterland (Submission 4).**

A. The Water Corporation cannot comment upon the future aspirations or perceived intent of developers. Much of the land to the west of site B (buffer) will be owned by Water Corporation so that it will have control over future encroachment within buffer zones; the remainder will be available for urban development.

**4.1.6 At the presentation there was a variety of suggested land uses for the buffer. Even a golf course was discussed. That seems very incompatible with conservation and no guarantee that the land uses will be restricted (Submission 4).**

A. The Water Corporation has explored a range of compatible land uses it could offer for use within the buffer zone. However, the final "community asset" opportunities available will depend on the amount of land remaining after the EPA's conservation objectives have been met. At the public presentation possible concepts were illustrated, such as a golf course. Conservation area definition has to occur first before any other land can be assessed for other uses. Other land uses will be explored in the District Structure Planning and Town Planning Scheme processes.

**4.1.7 Third pipe systems should be mandatory for ALL new developments, urban fringe suburbs are consistently characterised by profligate water use while establishing new exotic gardens and any progress towards the adoption of 'fit-for-use schemes' should be mandatory (Submission 5).**

A. Third pipe systems are a very high cost and the risk of cross connection has led to this approach being banned, for instance in Utrecht in the Netherlands. Other options for integrated water management more suited to local WA conditions, for instance the use of neighbourhood bores to supply fit for purpose groundwater to garden watering, are under consideration.

**4.1.8 The plant would appear highly visible in the landscape to residents (WC, Section Seven PER images) and would be incongruous in any urban landscape (Submission 5).**

A. Aspects of the plant will be visible; however the design will address visual aspects to preserve harmony with the landscape. An example of recent design is the odour stack at the Subiaco WWTP in Shenton Park.

**4.1.9 The location of Site A and its associated buffer (the distance from the footprint of Site A to the coastline of the Alkimos Regional Beach as depicted in Plan 9, Appendix B of the PER is approximately 300 metres) will have a significant affect on usage of the Alkimos Regional Beach by the community and limit the development of this beach as a regional focal point including the provision of major public landscape and urban design elements to cater for expected regional patronage (Submission 6).**

A. All fundamental beach activities will be unrestricted, and it could equally be argued that there will be easier access for genuine beach users. There will be no nuisance for beach goers, and it is unlikely that genuine beach goers will be discouraged by the

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presence of the WWTP. In contrast residences are places where people are for very long periods, day and night. This is why the odour criteria is very stringent for odour sensitive premises, such as residential housing.

**4.1.10 Site A does not allow for the development of the Alkimos Coastal Node and its associated commercial and community benefits. In a study undertaken by the AE Landowners (Alkimos Wastewater and Eglinton Groundwater Treatment Plants - Total Community Cost Benefit Analysis: Woodward Clyde 1999 Updated 2005) the ongoing community benefits from the potential development of the Alkimos Coastal Node adjacent to the beach (considering factors such as employment, beach usage by the community, beach retail culture etc) could generate around \$500M of benefit to all layers of the community over time (Submission 6).**

A. Site A does not allow development of the coastal node in this particular location as it places odour sensitive premises within the plant buffer.

The "Total Cost Benefit Analysis" needs to be read in full to understand that it does not take into account the economic externalities. For example, the major component of the "ongoing community benefit" is the accumulated retail sales (from the Alkimos Node) expressed as a Present Value. Another large component is the employment and commuting benefits. In reality, all or at least most of this economic activity/benefit will occur elsewhere in a free market economy. Yet the "Total Cost Benefit Analysis", with respect to retail sales for example, assumes that only 30% of this activity will be duplicated outside the immediate area if the Coastal Nodes did not exist in this location (p3-6). This study is misleading if quoted out of context, as it is in Submission 6.

**4.1.11 The location of Site B and its associated 600 metre buffer allows for the full development potential including a strong public domain along the Alkimos Regional Beach supported by a vital and vibrant hub at the Alkimos Coastal Node. Notwithstanding that Site A is a fallback location; consideration should be given to restrict the buffer impact of Site A on the Alkimos Regional Beach and the Alkimos Coastal Node (Submission 6).**

A. The proposed buffer size at B is not 600m in all directions. It extends to 800m to the west and North West. A reduction in the buffer size, for either Site A or Site B, would disproportionately limit the future capacity of the WWTP. This is not an acceptable position as the Corporation has an obligation to service growth in wastewater services beyond the medium term, and has already invested large sums of money on behalf of the State in the installation of existing infrastructure (pump stations and sewage reticulation) based upon forward planning to establish the WWTP at Alkimos over many years.

**4.1.12 In September 2004, the Water Corporation, the developers and DPI committed to pursue Site B so that land to the west of the plant could be used for residential development. Site A remains a fall back option in the event of unmanageable environmental, technical or commercial constraints emerging for Site B. This decision resulted in MRS Amendment 1029/33 Alkimos-Eglinton, which was assessed in EPA Bulletin 1207 (Submission 13).**

A. The Water Corporation acknowledges the agreement, and is working towards giving effect to it at Site B (see responses 1.1.6 and 1.1.7). However, the Water Corporation continues to propose an alternate site, Site A, as a fall-back position should technical, financial, environmental or social constraints render Site B unavailable to it to develop the AWWTP in the timeframes necessary to service the planned development of the Northwest Corridor.

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**4.1.13 How was this decision arrived at, and was your department involved with the AWWTPCC (ES page iii)? The sole reason for this decision seems to be in Section 4 Page 8 in 4.1.1.4. (Submission 11)**

- A. This decision had been debated at various planning forums including the Western Australian Planning Commission (WAPC) in the late 1990's. In 1998 the WC advised the WAPC subcommittee that it would consider relocation of the WWTP 600m inland from its original planned location at site A if the relocation costs were met. The WC, LandCorp and Eglinton Estates funded a Cost Benefit Analysis in 1999 that showed there was a considerable cost benefit to the community if a commercial node and housing was located on the beachfront. In 2001 an agreement was made to relocate the WWTP subject to the odour buffer being satisfactory to the EPA and the WC and the cost of relocation being borne by the developers, not Government.

The Alkimos Waste Water Treatment Plant Consultative Committee reviewed the WWTP location. The Water Corporation was a representative stakeholder. Desired urban development to the west of the WWTP particularly a commercial node, was a primary driver for that decision. The Water Corporation can operate a WWTP at either site B or site A with virtually the identical plant design.

**4.1.14 The distance between the WWTP at the site B and the proposed city center is very close – 1.5 kilometers or so. Just imagine a WWTP of the size proposed for Alkimos the same distance away from Joondalup City Center! You should ensure that as much distance as possible is provided between the city center and the plant! (Submission 11)**

- A. Noted. The location of the city centre from the WWTP is a factor just like any other land use.

**4.1.15 No urban development on the Western Side of the plant at Site B would, in perpetuity, eliminate 25% of any future concerns from local residents, whether these concerns are real or imaginary. Concerns folk have living close to the Beenyup and Subiaco facilities should be reviewed. Put yourself in a position of the future resident folk, who have no say in this matter at this point in time, and in 30 years time the present developers, planners, and politicians will all be but a faint memory (Submission 11).**

- A. It is the responsibility of the West Australian Planning Commission to ensure that these matters are taken into consideration to protect the long term interests of the residents in the area. The Water Corporation responsibility will be to manage odours to an acceptable level to within the boundary of the buffer. It is agreed though that urban development on the west side of the WWTP will increase the number of residents surrounding the WWTP, and there is a higher risk of odour nuisance to the west if insufficient buffer is provided. The EPA has recommended a 600m buffer with 800m on the west and northwest side. The Water Corporation proposed this buffer distance and considers it to be an appropriately conservative buffer based on modelling and actual experience at other major plants such as Subiaco and Beenyup.

**4.1.16 The link between Neerabup and Yanchep National Parks along Wanneroo Road needs to be protected –includes privately held land previously proposed for regional open space but vulnerable to intensive land use on the absence of planning controls (Submission 10).**

- A. The matters concerning giving effect to protection of ecological linkages and areas at a regional scale is not the province of this PER. Consideration of these matters correctly lies with the EPA's deliberations on the MRS Amendment 1029/33



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- 4.1.17** What happened to the greenbelt coastal strip along the northern coastline for protection? At one stage this was planned to be 300 meters! The node at Alkimos especially needs this coastal protection (Figure 3.13 Section 3 page 32) and it would not come from urban development. Such a greenbelt coastal buffer would all but eliminate any residential development for site B (Submission 11).
- A. The matters concerning giving effect to protection of ecological linkages and areas at a regional scale are not the province of this PER. Consideration of these matters correctly lies with the EPA's deliberations on the MRS Amendment 1029/33.
- 4.1.18** Recent Water Corporation brochure material on the potential development of the buffer zone is of concern. The extent and type of facilities being promoted has not been tested and it is doubtful that they could be accommodated on the land. Many are or national and international standards and the cost of provision would be enormous. The brochure material is somewhat misleading and may well cause community expectations of the level and extent of facility being raised unnecessarily (Submission 8).
- A. It is agreed that land uses inside the buffer would have to be carefully evaluated before they were approved. The Water Corporation has explored a range of compatible land uses it could offer for use within the buffer zone. However, the final "community asset" opportunities available will depend on the amount of land remaining after the EPA's conservation objectives have been met through this PER Process. These land-uses are only concepts at this stage and need further evaluation. Since land in an urban setting is valuable, it should be evaluated for compatible uses, including conservation.
- 4.1.19** If the land is to be used for recreational purposes the land must be ceded to the Crown or City and the issue of who meets the cost of facility provision and ongoing maintenance must be determined. Any development of the buffer must be linked to discussions relating to the Regional and District level recreation facility provision for the area. If it is determined that regional level facilities are appropriate in the buffer, then responsibility for this should rest with the State (Submission 8).
- A. The Water Corporation will ensure that an appropriate management regime will be put in place to deliver the EPA's conservation objectives within the buffer zone. The WC will own all the land in the required buffer so that it is unable to be rezoned without its consent. It will agree to lease land for compatible uses.
- 4.1.20** If extensive urban development is to proceed then it is urged that the corporation works with the natural topography rather than removing it, to retain some sense of place, requiring a site responsive approach to neighbourhood and building design (Submission 10).
- A. Site A will require the excavation of 180,000 cubic metres of material over an area of 15 ha, nestled within the dunes. Site B will require the excavation of 3,000,000 cubic metres of material over a footprint of 19 ha, higher in the dune formations. The Water Corporation will only undertake earthworks necessary to construct the WWTP. Otherwise compatible land uses inside the buffer, outside of conservation areas, may require some alteration of landform.
- 4.1.21** If extensive urban development is to proceed there is a need to promote access by walking, bicycle and public transport by focusing the city center around the train station, providing a comprehensive and safe pathway network and using grid-based local street layout (Submission 10).

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A. This is subject to the District Structure Planning by DPI and the landowners which is currently underway and should be substantially progressed by June 2006.

**4.1.22 If extensive urban development is to proceed a wide habitat corridor from the coast at Eglinton through to Yanchep National Park (Ningana wedge) will need to be retained, with infrastructure and transport routes through the corridor minimised and the interface with proposed development carefully planned (Submission 10).**

A. Severance of linkages in the proposed conservation estate due to transport routes, although requiring careful consideration in their design are matters concerning giving effect to protection of ecological linkages and areas at a regional scale. This is not the province of this PER. Consideration of these matters correctly lies with the EPA's deliberations on the MRS Amendment 1029/33.

**4.1.23 If extensive urban development is to proceed then there is a need to encourage local employment including provision for home based businesses and affordable space for small businesses, especially new starters – to minimise travel demand and enhance community (Submission 10).**

A. This is not the province of this PER. This is a matter for the DPI.

**4.1.24 New Coastal Assets are examining options for future marina developments along this section of the coast, but none of the options are impacted upon by the proposed pipeline (because any marina will be located in sheltered waters whereas the outfall is deliberately sited to pass through the gap in the reef) (Submission 13).**

A. The Water Corporation cannot comment on the potential impacts of any proposed marina on its pipeline, as it is not privy to any planning or considerations of such a proposal.

**4.1.25 The recreational benefits of developing a coastal village with appropriate facilities are considered to be beneficial to the general public. There are identified transport sustainability benefits although the social benefits are also important. Not only do these include the provision of an attractive space to socialise, but also the community building activities of a surf club, encouragement of physical activity and the sense of place (Submission 13).**

A. Noted.

**4.1.26 When the site has been established and the batters and site surrounds sensitively landscaped (see above), and when the urban development and its landscaping is in place the location of the WWTP at Site B, hidden within a 'horseshoe' of high dunes, will be unremarkable. Conversely, the location of the plant at Site A, with its obvious loss of enjoyment of a spectacular regional swimming beach, will be a matter of consternation to the ordinary public forever (Submission 13).**

A. Kiosks, surf life-saving clubs, beach parking, active recreational facilities and the like would all be considered compatible land-uses within the buffer on the beach front. The land behind the beach front would not be available for residential development, and virtually left in its natural state. High value restaurants and the like would not be compatible. Commercial centres could be located to the south and north of the buffer boundary.

The beach would not be "un-safe" as all normal lifesaving services will be able to be provided in a location not affected by the proximity of the WWTP or the ocean outlet.

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Thus Site A option will not compromise the use of the beach. It will though make it a different experience. The main loss is residential development, and a commercial node in the desired location on the coastal point. The coastal commercial node would have to be moved out of the buffer area by a few hundred metres.

## 4.2 Justification- Alternatives

### 4.2.1 **If the water is made available, using safe methods, there is no need for the 'plant' to be placed on the coast. In fact it would be more beneficial to place further in land to be more accessible to a greater range of users (Submission 1).**

- A. The demand for recycled water is generally seasonal, while the treatment plant produces a wastewater stream year round with higher flows in wet weather. Land is not available for surface storage and current levels of knowledge preclude aquifer storage. An ocean outfall is required to discharge treated wastewater when there is no demand. Water quality requirements to protect health and environment would probably require RO treatment. This produces a saline reject stream, and the safest and most environmentally sustainable management for this is to discharge to ocean.

### 4.2.2 **It appears that the Water Corporation has purchased the land and been installing pipes etc as if it was a forgone conclusion that this huge piece of infrastructure was to be built in this site. There seems to be a sketchy review of the many other sites looked at for siting the plant and no information on what the costs of pumping over distances are as an alternative to coastal siting (Submission 4).**

- A. Substantially more than a "sketchy review has been undertaken over many years by numerous agencies. The location for the WWTP at Site A was planned as far back as 1977 (refer to 1977 MRPA plan). The current MRS, until this amendment is approved shows the WWTP at site A. The Water Corporation is guided by these planning instruments in providing its assets to serve the growth of urban land.

Many alternative sites were reviewed between 1982 and 2003.

- In 1982 the site was selected after evaluating six coastal and inland locations on environmental and economic terms
- In 1986 160 ha of land was purchased for the WWTP which was located within a proposed green belt
- In 1989 LandCorp engaged Camp Scott Furphy to consider relocating the WWTP either to the north or south along the coast
- In 1990 R O'Conner and Associates undertook an Aboriginal Heritage survey of the proposed WWTP site
- In 1990 The Water Corporation engaged Gutteridge Haskin and Davey to undertake a land use study
- In 1991 LandCorp engaged Feilman Planning Consultants to prepare a structure plan for lot 102
- In 1992 the DEP granted Works Approval for the first stage of a WWTP
- In 1995 The Alkimos Eglington Joint Venture engaged SKM to review the location of the WWTP. 11 sites were assessed
- In 1996 Fielman Planning Consultants reviewed the findings of the SKM report
- In 1997 SKM extended their report to review 3 more sites
- In 1997 the Corporation engaged GHD to review the location of the WWTP
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- In 1999 Woodward Clyde was engaged by Alkimos Eglington Joint Venture to undertake a Cost Benefit analysis
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  - In 2003 The Water Corporation assessed five sites for the WWTP
  - In 2003 The Water Corporation assessed another two sites for the WWTP

Constraints and critical issues considered for the location of WWTP sites include

- Having gravity flow into and through the plant to reduce pumping costs and greenhouse gas emissions. This also ensures security and continuity of operation in the event of power or mechanical failure
- An ocean outfall to handle any flows that cannot be reused such as waste stream from RO treatment or excess wet weather flows when demand for reuse is reduced
- Secure routes for incoming sewers
- Availability of land for both the WWTP and an associated buffer
- Sustainable in the long term
- Environmental impact
- Social impact
- Long term cost to the community

The Alkimos site was best able to satisfy the many constraints that any WWTP site encounters.

**4.2.3 What seems to have been overlooked within this Public Environmental Review is the option of having staged waste water treatment plants coming on-line when demand was required, being much smaller in the landscape and individual power use, but also offering much easier integration of waste water treatment and reuse capacities in the areas that are using the water (Submission 5).**

A. Large centralised plants such as Alkimos provide efficiencies in terms of capital and operating costs, and importantly, buffer area. Land footprint is minimised because multiple plants would each require buffer zones not in proportion to the smaller amounts of flows.

Locating WWTP's is a very inflexible process due to the many competing criteria, such as land use, engineering constraints, and environmental constraints. As such it is important to identify and secure WWTP sites many years in advance of the urban development front. The Alkimos site (Site A) was first identified in the late 1970's and subsequently purchased in 1986.

A number of smaller plants will each have their own requirements for land and will each need a substantial buffer. There will still be a need to dispose of the waste stream from RO treatment (as currently planned for MAR) or excess wet weather flows when demand for reuse is reduced. Each plant will have its own impact on:

- Sustainability in the long term
- Environmental impact
- Social impact
- Long term cost to the community
- Land required for the plant and buffer

These impacts are likely to be greater in total than a single WWTP.

The Alkimos WWTP will be staged as required by incoming flows as development proceeds.

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**4.2.4 On page 18 of 20 in Section 2.4.2, the PER suggests that a temporary groyne or jetty would be built across the beach offshore to the 3- 4m depth contour. The potential for environmental impacts associated with this proposed structure are not identified or discussed in the PER (Submission 14).**

A. The impact of a temporary jetty is expected to be minimal. A temporary groyne is an option, but the disadvantage, of course, is that it will interrupt sand migration during the construction period. A temporary groyne will only be considered if impacts are acceptable to the EPA and alternative launch technologies are unavailable.

**4.2.5 An alternative option may be to site the new treatment plant to the pine forest – parallel to the Gngara Road which has the advantage of being nestled by pine trees. The pine trees, in effect would act as a buffer (Submission 9).**

A. This is an option, however it will eventually require approx 10million kWhr per year of additional energy to lift the wastewater from the urban zone (where it is generated), to the mound. Siting of a WWTP within a Priority 1 drinking water catchment is currently against government policy.

There would be additional capital and operational expenditure to transport excess wastewater and the saline waste stream from potential RO treatment to a suitable disposal point. Pumping the wastewater to the pine plantation and the waste away again would have a higher risk of failure in the event of power or electrical failure resulting in unacceptable public health risk to drinking water supplies and from exposure to raw sewage.

**4.2.6 Treated wastewater liquid could be piped to the nearest entrance of the existing sewage pipes and the new sewage pipes be laid to intercept the existing water pipeline presently used for fresh water to Kalgoorlie. Furthermore, some of the untreated wastewater is to be provided to the mining industries presently using the water from the Mundaring Weir for purposes other than human consumption.**

**A further advantage of using the existing freshwater pipe to Kalgoorlie, is in the use of the nearby train that can haul the treated sludge in the adjacent fields for use in new agriculture of non-food items, cotton, hemp, wild flowers and various tree species (Submission 9).**

A. Pumping treated wastewater to Kalgoorlie would require substantial energy input and subsequent production of greenhouse gases. It would need a considerable storage dam to accommodate the flow from the treatment plant when demand was not as high as the incoming supply.

Pumping treated wastewater into a system also used for direct human consumption is a high risk solution.

**4.2.7 Alternative locations have been suggested. The PER says that 23 sites have been considered for the WWTP since 1996, however it does not provide details (Section 1 page 12/13). A recent review of “all reasonable options” for the WWTP is referred to, though the reasons given for rejecting alternatives are brief (Section 1 page 14). A more comprehensive review of alternatives should have been included in the PER process.**

**Issues to address in selecting an appropriate location for a WWTP should include:**

**- Energy consumption and greenhouse gas emissions from transport of wastewater to (impacts of gravity feed vs. pump feed)**

- 
- Proximity to and the potential impact on sensitive ecosystems such as remnant bushland and wetlands, karst systems and associated stygofauna – including effects of pipe infrastructure
  - Protection of water resources – avoid priority water supply catchments and watersheds of significant wetlands and other water dependent ecosystems
  - Effect on existing and potential land uses including health, safety and amenity of people living or working in proximity to site – odour and spillage are concerns for WWTP facilities – and opportunities for conservation in the buffer zone
  - System resilience – capacity to deal with power failure that could affect wastewater flow to plant or operation of the plant and ultimate disposal. Options to minimise environmental and public health impacts are important
  - Potential for wastewater reuse – so location near potential users of treated wastewater could be important (Submission 10).

A. A substantial review has been undertaken over many years by numerous agencies. The location for the WWTP at site A was planned as far back as 1977 (refer to 1977 MRPA plan). The current MRS, until this amendment is approved shows the WWTP at site A. The Water Corporation is guided by these planning instruments in providing its assets to serve the growth of urban land.

Many alternative sites were reviewed between 1982 and 2003.

- In 1982 the site was selected after evaluating six coastal and inland locations on environmental and economic terms
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- Availability of land for both the WWTP and an associated buffer
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- Environmental impact
- Social impact
- Long term cost to the community

The Alkimos site was best able to satisfy the many constraints that any WWTP site encounters. Alternative sites that were assessed, particularly those that were further inland, failed to meet more of the criteria. Generally these sites had a higher impact on the local environment, were less economical, had a greater need for wastewater to be pumped or were higher risk to operate.

**4.2.8 A more detailed review of locations considered could have enhanced the rigour of the PER process and public understanding of the issues involved (Submission 10).**

A.

A substantial review has been undertaken over many years by numerous agencies. The location for the WWTP at site A was planned as far back as 1977 (refer to 1977 MRPA plan). The current MRS, until this amendment is approved shows the WWTP at site A. The WC is guided by these planning instruments in providing its assets to serve the growth of urban land.

Many alternative sites were reviewed between 1982 and 2003.

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### **4.3 Indigenous Consultation**

**4.3.1 While the ethnographic and archaeological aspects of Aboriginal Heritage issues are addressed in the PER at Sections 3 and 4 without significant findings, consultation with indigenous representatives over Native Title issues is contentious and unresolved according to Section 4. It is recommended that all possible steps be followed to solve outstanding current cultural concerns in order to ensure that proper recognition and consideration is given to any indigenous issues (Submission 13).**

A. The Water Corporation will ensure all indigenous and native title issues are concluded to the requirements of the Department of Indigenous Affairs

### **4.4 Economics**

**4.4.1 In terms of economic sustainability, at Site B there are substantial additional costs for excavation (\$25m extra) along with extra costs for odour control (\$6m) and for the required longer land section of outfall pipe (\$5m). However, these will be directly compensated by the opportunities for coastal development on the seaward side of the proposed Site B WWTP (Submission 13)**

A. The estimates for the extra cost for site B civil works are order of cost only and are based on minimal geotechnical investigations. Depending upon the properties of the rock to be encountered, excavation costs may increase and there may be additional cost for processing oversize rock for placing as subdivisional fill. Costs could be offset by the value of coastal land released for development

The costs do not reflect the disposal of the spoil, as this is considered the province of the developers under the agreement.

**4.4.2 Economically it would appear that Site B would cost more to excavate and construct. The Site B option involves the removal of an estimated 3 million cubic meters of sand, soil and limestone from the environment to lower the treatment plant to the required extent for the gravity sewer and outfall to operate, Failure to lower the treatment plant at Site B to Site A level would result in huge power costs to maintain a pumped sewerage system. The**



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**environmental, social and economic costs should power fail would be enormous (Submission 5).**

- A. The Water Corporation recognises the importance of a gravity solution as environmentally responsible regarding long term energy costs and to avoid catastrophic events in the event of power or equipment failure.

## **5.0 OTHER**

### **5.1 Water Re-Use**

#### **5.1.1 Water re-use should be pursued. For example through: Public parks and gardens and re-filtering through natural sand and lime stone into the water table (Submission1).**

- A. The irrigation of parks is an option that can be facilitated by the proposed works. Re-filtering to the water table is also an option which was discounted due to uncertain effects, albeit minor, however this can also be implemented in the future.

The Water Corporation is progressing a number of research projects in conjunction with health and environmental regulators investigating the water quality improvements associated with infiltrating treated wastewater. Depending on the outcomes of this research large scale infiltration to the aquifer may be feasible in the future. Flexibility is the key here.

#### **5.1.2 As industry is a greater user of water than the general public, by approx 80% why could they not have been encouraged (forced) to use the treated water? (Submission 1)**

- A. If suitable industries were to be located within economic range of reuse, then treated wastewater could be made available.

The great majority of industry which could use recycled water is in Kwinana. The Water Corporation has successfully introduced a treated wastewater recycling plant in Kwinana to provide good quality water to local industries and will continue pursue other opportunities where appropriate.

Planning for the Beenyup/Alkimos catchment will allow supply of recycled water to eg Neerabup industrial area when this is financially viable.

#### **5.1.3 The board should not lose sight of the fact that Western Australia, the Perth Metro area in particular, is critically short of a natural water supply. Instead of depleting natural sources to a dangerous and non renewable level more thought and effort should be put into reuse (Submission 1).**

- A. The Water Corporation is putting significant effort into increasing reuse in the Perth Metro area where this can substitute for public drinking water. The Kwinana Water Reclamation Plant is now approaching capacity, supplying about 6GL/yr of recycled water to industry.

The Water Corporation has also recognised recycled water as a potential source option via MAR into the Gnangara Mound, with the earliest date of implementation being 2014, and are working with Departments of Health and Environment to better understand risks and define regulations for this approach.

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**5.1.4 Thirty years is too long to wait for significant reuse of water from the Alkimos plant (PER section 1 page 15) (Submission 2, 7).**

A. It is anticipated that significant reuse will occur from Alkimos well before this time. The Water Corporation has committed to having an indirect potable supply of recycled water using MAR as a source option by 2014. Flows from Alkimos could form a part of this approach, but costs would be high as flows in 2014 will be small (less than 10ML/d, which would lead to poor economies of scale). Given the unknowns, thirty years was indicated in the PER as an upper bound, however it could happen as early as 2014.

**5.1.5 Apparently it could be 20-30 years before most summer wastewater flows from the Alkimos WWTP could be reused (section 1 page 15). Two to three decades is too long to wait for serious reuse of wastewater given Perth's water situation (Submission 10).**

A. It is anticipated that significant reuse will occur from Alkimos well before this time. The Water Corporation has committed to having an indirect potable supply of recycled water using MAR as a source option by 2014. Flows from Alkimos could form a part of this approach, but costs would be high as flows in 2014 will be small (less than 10ML/d, which would lead to poor economies of scale). Given the unknowns, thirty years was indicated in the PER as an upper bound, however it could happen as early as 2014.

**5.1.6 In this day and age it seems unbelievable that we are not doing more to embracing alternative wastewater technologies such as household re-use and use successful models set up around the world to solve the problem. Thirty years is far too long to wait for significant re-use of water (Submission 4).**

A. It is anticipated that significant re-use will occur from Alkimos well before this time. The Water Corporation has committed to having an indirect potable supply of recycled water using MAR as a source option by 2014. Flows from Alkimos could form a part of this approach, but costs would be high as flows in 2014 will be small (less than 10ML/d, which would lead to poor economies of scale). Given the unknowns, thirty years was indicated in the PER as an upper bound, however it could happen as early as 2014.

With respect to household reuse, third pipe systems are a very high cost and the risk of cross connection has led to this approach being banned, for instance in Utrecht in the Netherlands. Other options for integrated water management are more suited to local WA conditions, for instance the use of neighbourhood bores to supply fit for purpose groundwater to garden watering, are under consideration.

**5.1.7 Genuine consideration of alternative wastewater technologies (e.g. household re-use) and alternatives to the Alkimos sites was excluded. These should have been part of the community consultation process (Submission 2, 7).**

A. The existing urban development in the Mindarie / Quinns area continues to grow quickly and facilities are urgently needed at Alkimos to treat the wastewater from these houses. The construction of Alkimos WWTP will not preclude the development of alternative treatment strategies at household level and any alternative strategies will not eliminate the need for the WWTP. Options for integrated water management which are more likely to be suited to local WA conditions include the use of neighbourhood bores to supply fit for purpose groundwater to garden watering, and these are under consideration.

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**5.1.8 This section offers a brief summary of considerations alternative sites and alternative wastewater technologies that might have replaced the current proposal of the wastewater treatment facility at Alkimos. These discussions should have been part of the community consultation, as we are not convinced by justifications given for rejections of some alternatives in these sections. A more detailed review of locations considered could have enhanced the rigour of the PER process and public understanding of the issues involved (Submission 3).**

A. A substantial review has been undertaken over many years by numerous agencies. The location for the WWTP at Site A was planned as far back as 1977 (refer to 1977 MRPA plan). The current MRS, until this amendment is approved shows the WWTP at Site A. The Water Corporation is guided by these planning instruments in providing its assets to serve the growth of urban land.

Many alternative sites were reviewed between 1982 and 2003.

- In 1982 the site was selected after evaluating six coastal and inland locations on environmental and economic terms
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- Long term cost to the community

The Alkimos site was best able to satisfy the many constraints that any WWTP site encounters.

**5.1.9 While we support the Water Corporation's intentions to seek options for reuse of the treated wastewater for various purposes, we do not accept the suggested timeframe of 20-30 years (page 15) for water recycling being implemented. Many believe wastewater recycling needs to be considered as a top priority (Commonwealth of Australia, 2005 and a whole-of-government approach is needed to maximize wastewater reuse (Submission 3).**

A. It is anticipated that significant reuse will occur from Alkimos well before this time. The Water Corporation has committed to having an indirect potable supply of recycled water using MAR as a source option by 2014. Flows from Alkimos could form a part of this approach, but costs would be high as flows in 2014 will be small (less than 10ML/d, which would lead to poor economies of scale). Given the unknowns, thirty years was indicated in the PER as an upper bound, however it could happen as early as 2014. It is agreed that a whole of government approach is needed to maximise treated wastewater re-use. Water Corporation is working with government and key regulatory agencies to progress this issue.

**5.1.10 We recommend the introduction of an immediate education campaign to inform the public about the benefits, economics and safety of using recycled water as a condition of any approval of wastewater treatment plant in the north-west corridor (Submission 3).**

A. The Water Corporation is currently working with government and key regulatory agencies to progress this issue.

**5.1.11 The commitment to implement treated wastewater recycling as a priority would eliminate the risk of contamination of coastal waters and impacts on the marine environment. It is recommended therefore that the WWTP be designed for tertiary and quaternary treatment from the outset (Submission 3).**

A. The current levels of treatment utilised for marine discharge does not cause adverse impact (refer PLOOM studies). The re-use of treated wastewater will not eliminate the need for ocean disposal as is currently proposed. This is due to water reclamation technologies only being able to produce up to 75% of the volume treated, the other 25% concentrate will still require disposal (in the case of MAR using RO). Furthermore, seasonal peak flows above advanced treatment capacity will need to be catered for, as will emergency bypass. Therefore the ocean discharge capability is essential to safe operations of a WWTP. The WWTP will be adaptable to add these phases of treatment when required.

**5.1.12 Opportunities for reducing usage and promoting re-use should be actively promoted by the lead water agency in Western Australia, the Water Corporation, Department of Water and Department of Environment. Although mentioned in the PER document at 2.3.4, this proposal fails to actively plan for and implement innovative wastewater reuse schemes and is a tragic oversight by the Water Corporation and the Department of Planning and Infrastructure (Submission 5).**

A. Water Corporation has committed to having an indirect potable supply of recycled water using MAR as a source option by 2014. Flows from Alkimos could form a part of this approach, but costs would be high as flows at this time would be small. Nevertheless, flows from Alkimos have been earmarked for recycling via MAR.

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5.1.13

**Coupled with the initiatives proposed by the Water Corporation in terms of their re-use options (under 2.3.3 of the AWTP-PER) consideration should be given as to whether an alternative facility (to complement the AWTP) be constructed in a more strategic location (say within the catchments which require pumping) to firstly minimise the high cost and high risk of pumping untreated wastewater and secondly to maximise the options for re-use. For instance could a facility be constructed in proximity to the eastern edge of the Gngangara Mound to accommodate any future MAR proposals? (Submission 6)**

A. A large number of sites were considered;

- In 1982 the site was selected after evaluating six coastal and inland locations on environmental and economic terms
- In 1986 160 ha of land was purchased for the WWTP which was located within a proposed green belt
- In 1989 LandCorp engaged Camp Scott Furphy to consider relocating the WWTP either to the north or south along the coast
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The Alkimos site was best able to satisfy the many constraints that any WWTP site encounters. Establishment of AWWTP does not preclude construction of other plants

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at inland sites in the future if issues such as odour buffers, management of flows which exceed demand can be resolved satisfactorily.

Alkimos WWTP can be used as a source for MAR schemes. As public confidence in these schemes increases it may be feasible to use MAR in other areas. However, such development does not remove the current or future need for a WWTP at Alkimos.

The option of constructing a WWTP on the eastern edge of the Gnangara Mound will require significant additional energy to lift the wastewater from the urban zone (where it is generated), to the mound. Siting of a WWTP within a Priority 1 drinking water catchment is currently against government policy.

There would be additional capital and operational expenditure to transport excess treated wastewater and the saline waste stream from potential RO treatment to a suitable disposal point. Pumping the wastewater to the mound and the waste away again would have a higher risk of failure in the event of power or electrical failure.

**5.1.14**      **Insufficient information is provided to assess the extent the proponent has gone towards considering alternatives to an ocean outlet for the discharge of the treated wastewater. Proponents seeking approval for ocean discharge should be using best practice technologies and exploring and considering all viable alternatives to discharge of freshwater to the ocean. A large number of the alternatives listed in the PER do not appear to be relevant at this stage in the project eg reducing grey water waste or limiting population growth. Alternatives such as upgrading the treatment level so as to allow MAR and wetland recharge to be viable options from health and environmental protection perspectives should also have been considered (Submission 14).**

A.            The EPA has provided strategic advice on the issue of MAR using recycled water. The Water Corporation has concluded that, with current levels of knowledge, RO would probably be required to gain environmental approval for MAR at most locations on the Swan Coastal Plain. A 100% MAR scheme involving RO will still require discharge of RO reject (which includes salts and the residual nutrients not removed in the upstream treatment processes) to the marine environment.

The Water Corporation is progressing a number of research projects in conjunction with health and environmental regulators investigating the water quality improvements associated with infiltrating treated wastewater. Depending on the outcomes of this research large scale infiltration to the aquifer may be feasible in the future. Flexibility is the key here.

**5.1.15**      **Given that some of the catchments identified in the AWTP-PER are not gravity based and given the re-use options identified in the AWTP-PER, consideration should be given to other future wastewater facilities in appropriate areas to minimise pumping of untreated wastewater and maximise re-use potential (Submission 6).**

A.            The plan is flexible enough that other future wastewater facilities could be built to facilitate local re-use. The critical factor in this is identifying and acquiring the necessary land for the necessary treatment plant and odour buffer.

**5.1.16**      **We are greatly concerned that there seems to be a reluctance to pursue water-recycling options due to assumptions that the public is not ready for it. The House of Representatives Standing Committee on Environment and Heritage has also identified this as one of the unfortunate situations when they began the inquiry into the development of sustainable cities (Commonwealth of**

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**Australia, 2005). Here we have just missed one great opportunity to find out the community's acceptance of using treated wastewater for other purposes than just its disposal into the ocean (Submission 3).**

- A. Large scale re-use will be only viable with social acceptance, technical security, protection of public health, policy adjustment and political will together with provision of adequate funding. This will occur in the future, however achieving that license is outside the boundaries of the PER.

The Water Corporation has committed to having an indirect potable supply of recycled water using MAR as a source option by 2014. Flows from Alkimos could form a part of this approach, but costs would be high as flows in 2014 will be small (less than 10ML/d, which would lead to poor economies of scale). Given the unknowns, thirty years was indicated in the PER as an upper bound, however it could happen as early as 2014. The Water Corporation is working with government and key regulatory agencies to progress this issue.

- 5.1.17 Nowhere does the PER consider the option of upgrading the level of treatment provided at the proposed Alkimos WWTP. However, in the draft ESD, the proponent commits to "Principles of environmental protection [to] provide the framework for addressing...groundwater recharge as the preferred method of short to medium term treated wastewater management subject to ongoing studies to establish environmental acceptability".**

**By limiting the wastewater treatment plant to advanced secondary treatment, it would appear that reuse of the wastewater from this plant in the near future would be limited (Submission 14).**

- A Re-use will only be limited by demand, and community and regulator acceptance. The treatment technology will be readily adaptable for reuse. Such reuse needs to be sustainable which includes being affordable to the community.

- 5.1.18 Water recycling options should be included in the Treatment Plants design. Such recycled water could be pumped back into the aquifer. Clearly there are a number of other uses of such water that could also be considered (Submission 12).**

- A The plant is designed to incorporate further treatment to allow recycling in the future.

- 5.1.19 The proximity of the Alkimos WWTP to proposed urban development and a major horticultural area provides an opportunity for reuse. The irrigation of horticultural areas provides an opportunity for reuse. The irrigation of active open space, third pipe systems for residential and commercial development and irrigation of horticultural crops should be considered. The apparent lack of serious attention to these possibilities in planning the Alkimos Wastewater scheme is of concern (Submission 10).**

- A The Water Corporation currently re-uses 14% of wastewater treated and will continue to look for opportunities to re-use treated wastewater from each of its WWTPs. The Alkimos WWTP will be another source of treated wastewater in the NW corridor that could be used as suggested.

The Water Corporation has committed to having an indirect potable supply of recycled water using MAR as a source option by 2014. Flows from Alkimos could form a part of this approach, but costs would be high as flows in 2014 will be small (less than 10ML/d, which would lead to poor economies of scale).

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With respect to household re-use, third pipe systems are a very high cost and the risk of cross connection has led to this approach being banned, for instance in Utrecht in the Netherlands. Other options for integrated water management are more suited to local WA conditions, for instance the use of neighbourhood bores to supply fit for purpose groundwater to garden watering, are under consideration.

**5.1.20 The Wastewater 2040 strategy was adopted some ten years ago. This strategy should be reviewed given the increased need for wastewater reuse and greater community concern about sustainability – for example State Water Strategy target for 20% wastewater reuse by 2012 (Submission 10).**

A Wastewater 2040 Strategy provides a broad framework for the wastewater system and the Water Corporation direction is based on it together with recent changes in the wider external environment such as the State Water Strategy.

It is intended to update Wastewater 2040 in 2007. The Water Corporation is working towards the targets in the State Water Strategy and reuse of treated wastewater has now reached 14%.

**5.1.21 A commitment should be made from The Water Corporation to pursue recycling of treated wastewater from commencement of operation of the AWWTP, with appropriate performance targets to be included in the EPA and Ministerial approval conditions for AWWTP (Submission 8).**

A The Water Corporation is constantly looking for opportunities for treated wastewater re-use and the Alkimos Wastewater Treatment Plant will be no exception. However it is inappropriate that conditions be applied to broader re-use issues through this project.

**5.1.22 The Water Corporations philosophy in relying on coastal locations and ocean outfalls for WWTP is arguably dated given the State Water Strategy objectives for recycling/ reuse of treated wastewater (Submission 8).**

A The demand for recycled water is generally seasonal, while the treatment plant produces a wastewater stream year round with higher flows in wet weather. Land is not available for surface storage and current levels of knowledge preclude local aquifer storage. An ocean outfall is required to discharge treated wastewater when there is no demand, and for the disposal of saline reject in the case of MAR systems involving RO.

If the wastewater is treated to a lower level (without RO) suitable for direct irrigation and horticultural use it would only be needed during the dry summer months. During the rest of the year an alternative outlet for the treated wastewater would be required.

The source of the wastewater is in the urban corridor, and the proposed WWTP location minimises conveyance energy by avoiding large inefficient wastewater pumping systems.

**5.1.23 Opportunities which warrant investigation are possible use by the City's important agricultural industries in Carabooda area and industrial use in Neerabup Industrial Area. A further opportunity is usage for irrigation of public open spaces, particularly those within the buffer zone, which is not referred to within the PER report (Submission 8).**



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- A Currently the Water Corporation re-uses 14% of treated wastewater and will continue to look for opportunities to re-use treated wastewater from each of its WWTPs. The Alkimos WWTP will be another source of treated wastewater in the NW corridor that could be used as suggested.

The Water Corporation is progressing a number of research projects in conjunction with health and environmental regulators investigating the water quality improvements associated with various techniques including infiltrating treated wastewater and direct re-use (e.g. Magillvray Oval in Shenton Park).

Planning for the Beenyup/Alkimos catchment will allow supply of recycled water to eg Neerabup industrial area when this is financially viable

The Water Corporation is providing support to the DPI on water recycling options as part of investigating the viability of creating a horticultural precinct in Carabooda, with direct piping of recycled water as the recommended approach for supply. The Corporation notes that there is significant uncertainty regarding how such a scheme would be funded, for instance, what price growers would be prepared to pay for recycled water. The project is not currently part of the Corporation's five year Strategic Development Plan and thus is not funded.

## 5.2 Construction of WWTP & Ocean Outfall

### 5.2.1 **There is little information provided in this section of the PER (and no cross references to other relevant sections are provided) regarding the proposed location, placement and construction of the proposed pipeline on which to base informed comment on the potential for impacts on coastal processes due to construction or presence of a pipeline across the beach and nearshore. It is noted that the Atteris report (Appendix C) suggests that there is sometimes a need for special construction methods to "limit the construction footprint and protect the shoreline from erosion during construction". This is not reflected nor discussed further in the PER document (Submission 14).**

- A. The statement referred to in the Atteris report (that there is sometimes a need for special construction methods to "limit the construction footprint and protect the shoreline from erosion during construction") relates to a general construction practise applied when a pipeline is built across a sandy shoreline by open cut trenching, whereby a sheetpiled cofferdam is used to shore the trench such that the construction footprint is minimised. Given that the shoreline geology is likely to be dominated by shallow limestone rock it is not expected to be technically feasible to apply sheetpiled shoring.

The Atteris report presents a range of potentially feasible solutions, including open cut trenching without shoring, pipe-jacking and horizontal directional drilling, however a final selection of the shore crossing construction method cannot be made without having a better understanding of the geotechnical conditions at the crossing location. Certain construction methods, in particular pipejacking and horizontal directional drilling cannot be applied in unfavourable conditions, for example when cavernous rock is present, when the rock is highly fractured, or when the underground is dominated by a coarse granular material such as gravel and/or cobbles.

A geotechnical survey is currently underway, and the survey data will be used during the next phase of engineering to assess the best construction method whereby minimising environmental impact will be a key consideration.

A Construction Management Plan and an Environmental Management Plan will be a requirement of the contract, and it is expected that these will be issued to DoE for their approval of aspects relevant to environmental impacts.

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**5.2.2** If the “spoil” from Site B were distributed evenly over the remaining 132 ha this would raise the ground level by 2.27 meters! This is a huge volume! It is stated in Table 4.1 Social Issues 2, page 6 of Section 4 *Cut material to be spread over development area as nominated by developer, and ‘to the specification of the developer – Section 7, Page 4!* This total volume of material will be available at the outset – will the developer be ready to accept it and where? If it doesn’t meet the developer’s specification, where will it go? (Submission 11)

A. Location of spoil from the excavation has not been addressed fully in the PER, as it is not the responsibility of the Water Corporation. Land developers have provided assurance that the material will be utilised as spoil to terraform developments outside the Water Corporation’s buffer to prepare the area for urban development.

**5.2.3** Page 18 of 20 (Section 2) of the PER suggests the proponent’s proposed construction method is the ‘bottom pull’ method, resulting in the need to excavate and backfill a trench through the ‘inner’ and ‘middle’ reef systems. Later on the same page, it is suggested that the construction method will largely be selected by the contractor and therefore the details of construction will not be finalised until after the award of the construction tender. Limited descriptions of construction methods are also provided on page 20 of 20 (Submission 14).

A. The most straight forward construction method for an ocean outfall of this size is the prefabrication of outfall sections onshore, and launching them by bottom-tow method. This method will require seabed preparation (trenching or levelling) along the outfall alignment. Alternative construction methods may be feasible, as presented in the Atteris report, however technical feasibility cannot be proven until additional site (geotechnical and metocean) data has been collected, and the use of specialist marine equipment, possibly sourced from overseas, is secured under contractual agreement.

**5.2.4** It is suggested on several occasions in the PER that the longer 3.5 km long ocean discharge pipeline is the proponent’s preferred option. However, there are statements in the PER such as “The 2km pipeline (Option 1b) may be extended to 3.5km in the future, particularly with increased outflows as the area serviced by the Alkimos WWTP becomes more populated” (Page 19 of 60, Section 4.1.7.2) which introduce uncertainty into what is proposed.

The proponent should clearly describe the diffuser design and performance characteristics of the diffuser and include information about these parameters in the key characteristics table.

The types of information required include:

- details of methodology (e.g. type of dredge, how dredged material would be disposed or stored? (Note that given the high energy marine environment at Alkimos, the proposal to side cast material for later use for backfilling is questionable), how would backfilling be undertaken?);
- are drilling muds proposed to be used? If so, what type of muds and how will they, and drill cuttings, be managed to avoid environmental impacts.
- volumes of various geological materials to be dredged;
- predicted duration and timing of dredging;
- cause-effect pathways associated with the key stressors related to construction (eg. effects of turbidity and sedimentation on benthic primary producers);
- predicted boundaries for zones where habitat would be 1) directly lost and irreversibly damaged, 2) damaged, but likely to recover over the short term

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and 3) the area beyond which there would be no detectable ecological impacts;

- **how the proposal will be managed to ensure the impacts are no greater than predicted and/or approved, should the Minister for Environment decide that the proposal should be allowed to proceed (Submission 14).**

- A. The proponent plans to construct an ocean outfall that is 3.5 km long, including a 300 m long diffuser (as set out in Figure 4-5 of the PER). The method of construction will be determined from offers from experienced marine contractors, taking account of environmental concerns and constraints, cost and other factors. The Corporation seeks to retain flexibility in this regards, but wants the environmental constraints defined so they can be included in the tender requirements. The existing ocean outfalls that serve Perth, and the outfall completed recently in Bunbury, were all constructed by the being towed offshore into an excavated trench. Thus the PER has been written around this construction alternative.

An alternative construction method for outfalls is to use horizontal directional drilling – this was recently used in Dongara to install gas and water pipeline beneath the shoreline and the Venus bay outfall was recently completed in Victoria using this technique. However the large diameter and length of the proposed outfall at Alkimos, and the possible presence of caves in the limestone forming the seabed, are a source of risk and mean that a horizontal directional drilling alternative may not be technically feasible. The Corporation is examining alternatives, but seeks to retain flexibility in the event that there are major obstacles to drilling.

**5.2.5 Further information is required detailing construction, location of infrastructure (temporary and permanent) and longer-term management of the proposed pipeline in order to allow informed advice to be provided on the potential impacts of the proposal on coastal processes (Submission 14).**

- A. This cannot be done until the final alignment and construction method has been selected.

A Construction Management Plan and an Environmental Management Plan will be a requirement of the contract, and it is expected that these will be issued to DoE for their approval of aspects relevant to environmental impacts.

**5.2.6 It is clear from the PER (Section 3, page 13 et al) that “Micro-tunnelling through or under the dunes is a preferred option to avoid impacting the [*Frankenia pauciflora*] vegetation or the limestone cliffs.” This should result in minimised impact on affected vegetation and substrates during construction and the least possible post-construction visual impact. Micro-tunnelling or directional drilling (Section 2, page 19) should be mandatory and any necessary temporary infrastructure such as groynes or jetties should be completely removed post-construction and re-habilitated to an appropriate standard (Submission 13).**

- A. Micro-tunnelling is currently not a viable option for the proposed length and diameter. Directional drilling is a possible option, however the large diameter and length of the proposed outfall at Alkimos, and the possible presence of caves in the limestone forming the seabed, are a source of risk and mean that a horizontal directional drilling alternative may either not be technically feasible or may require several parallel boreholes to be installed. The Water Corporation is examining this alternative, but seeks to retain flexibility in the event that there are major obstacles to drilling.

**5.2.7 A management plan to clearly outline environmental management responsibilities should be prepared early in the planning process. The management plan should detail and guide landscape excavation works and remediation, including proposed battering, flora rehabilitation and maintenance and clearly detail or recommend a management agent for all affected public**

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**land with where relevant, a specified timeframe for management (Submission 13).**

- A. A construction management plan will be prepared.

**6.0 SUMMARY TABLE OF SUBMISSIONS**  
**MATRIX IDENTIFYING ISSUES RAISED BY PUBLIC AND VARIOUS GROUPS IN RESPONSE TO PER**

= Support for Site A  
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SECTION	ISSUES	SUBMISSION NUMBER														Sub Total
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	
<b>1.1</b>	<b>The Proposal</b>															
1.1.5, 1.1.9, 1.1.10, 1.1.11	Clear Site B support						X							X		
1.1.8, 1.1.14, 1.1.16	Clear Site A support					X					X					
1.1.12, 1.1.13	Site B enables greater development opportunities for the coast													X		
1.1.1, 1.1.3	Launch site 2 is most preferable environmental option - coupled with the odour channel			X										X		
1.1.2	Launch site 1B has less impact on coastal habitat		X						X							
1.1.4	Buffer Zone for Site A is largely contained in WCs land holdings - can maintain it in natural state													X		
1.1.7	Site B is environmentally unacceptable					X										
1.1.6, 1.1.14	Public meetings by Water Corporation suggested further adjustments to the site location - including moving it West & South					X					X					
1.1.15	PER should have included map with each site/land use/coastal buffers etc													X		
<b>2.1</b>	<b>Geoh Heritage</b>															
2.1.6, 2.1.7	Dune landforms need to be preserved to maximise protection of Geoh Heritage and biodiversity values										X			X		
2.1.3, 2.1.4, 2.1.5, 2.1.9, 2.1.10	Site A protects coastal habitats and geoh Heritage values		X	X	X	X		X						X		
2.1.1, 2.1.2, 2.1.8	Site B damages the integrity of significant landforms due to required excavation		X	X				X						X		
<b>2.2</b>	<b>Fauna</b>															
2.2.8	An option to conserve a large area of a smaller variety of habitats might offer a better environmental outcome			X												
2.2.7	Fauna assessment was unacceptable, multiple surveys required			X												
2.2.1-2.2.5	Impacts on feeding grounds and habitat of Carnaby's Cockatoos (Banksia & Dryandra)		X	X		X		X						X		
2.2.6	Site B buffer facilitates protection of habitats 4 & 5 foraging habitats for Carnaby's Cockatoos													X		
<b>2.3</b>	<b>Conservation Of Flora and Fauna</b>															
2.3.4	Nutysia floribunda Closed Low Heath significant to Site B - Only claims detailed flora survey is required													X		
2.3.5	Site B offers less conservation opportunities for habitat protection than Site A					X										

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2.3.3	MRS recommends bulldozing of this ecological asset while preserving small patches of biodiversity					X										1
2.3.1, 2.3.6	Site A buffer has a greater proportion of bushland in good condition		X	X	X			X								4
2.3.15	Site B requires larger clearing and engineering which could lead to loss of vegetation					X										1
2.3.10	Site B and associated buffer will preserve bushland areas						X									1
2.3.8	The whole buffer zone surrounding WWTP should be retained for bushland conservation			X												1
2.3.9	Alkimos - Eglinton provide one of metropolitan Perth remaining areas providing opportunity to protect what will be used by future generations			X												1
2.3.2, 2.3.7, 2.3.11, 2.3.13	Conservation reserve should be established & managed (envisaged in the 1970s)		X		X			X			X					4
2.3.12	Site B maximises the opportunity to achieve the recommendations of The EPA's bulletin in relation to vegetation, flora and fauna						X									1
2.3.14	The PER includes a discrepancy in information regarding vegetation clearing								X							1
<b>2.4</b>	<b>Site Rehabilitation</b>															
2.4.1	Site B will leave a greater footprint in landscape and require significant bushland restoration			X												1
2.4.3	Rehabilitation of areas affected by works are expected to be carried out in accordance with best practise procedures												X			1
2.4.2	Site B clears significant flora. <i>Sarcococca bicarinata</i> Encroach into regionally significant bushland within bush forever site 397 - upon completion no visible evidence of pipeline will exist			X												1
<b>2.5</b>	<b>Fire &amp; Pest Control</b>															
2.5.1	Management of buffer bushland to control weeds and feral animals and minimise fire		X					X								2

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<b>2.6</b>	<b>Groundwater</b>															
2.6.1, 2.6.2, 2.6.3	No groundwater monitoring data presented in PER regarding impact of infiltration of the wastewater to the aquifer via infiltration ponds														X	1
2.6.4	No information describing risk assessment procedures to explain the occurrence of the high E2 level and protection at the beach														X	1
<b>2.7</b>	<b>Benthic Habitat</b>															
2.7.1	Several examples in PER have misapplied the EPA's guidance statement - Setting out of EPA's principles of assessment by proponent need to be applied before the cumulative loss of BPPH														X	1
2.7.2	Assumptions regarding the distribution and extent of benthic habitats within 50km2 management unit														X	1
<b>2.8</b>	<b>Energy Usage</b>															
2.8.1	The Water Corporation should ensure that green energy will be used and continually improved								X							1
2.8.2	Energy and water efficiency needs to be incorporated into the built environment										X					1
<b>POLLUTION</b>																
<b>3.1</b>	<b>Wastewater Discharge</b>															
3.1.1	Unclear as to what proponent is seeking approval for in terms of proposed ocean discharge														X	1
3.1.2	Wastewater pumped off coast has a deleterious effect on seabed	X														1
3.1.3, 3.1.4, 3.1.10, 3.1.11, 3.1.14	Wastewater into the ocean wastes a valuable resource and affects the marine ecology/ review of wastewater strategy		X	X	X	X		X			X					6
3.1.5	Contact to DEH to discuss requirements relating to EPBC Act.														X	1
3.1.6	PLOOM data not sufficiently described														X	1
3.1.7	Clarification of section 4.1.9.4														X	1
3.1.8	Proponent needs to demonstrate a need for a mixing zone as a LEPA is included														X	1
3.1.9	The conclusion that there is no need to define zones about the outfall is not backed up by justification or data.														X	1

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3.1.12	Discharge of endocrine disruptors into the marine environment										X					1
3.1.13	Lack of public review of wastewater management options									X						
3.1.15	The PER describes alternatives to ocean discharge however the alternatives are considered to be unfeasible or unacceptable to the proponent. This conclusion would need to be demonstrated to the EPA and consistent with Government policy and objectives.													X		1
3.1.16	Hydrodynamic Modelling													X		1
<b>3.2</b>	<b>Odour</b>															
3.2.1, 3.2.2, 3.2.5, 3.2.6	Site B poses greater risk of odour problems for future residents.		X	X		X		X			X					5
3.2.3	A major road regional center is proposed near the WWTP, it is important the center is not subject to odours												X			1
3.2.4	The Buffer zone should be seen as a 'community asset' planning should focus to create green hub and social and environmental features							X								1
3.2.7, 3.2.15, 3.2.17	A site similar to the coast of ALKIMOS should be utilized as a data source for modelling/ site modelling not carried out using latest version of Ausplume												X	X		2
3.2.9, 3.2.16	600 meter buffer has not been demonstrated for existing basin or excavated basin - 800 meters is an educated guess													X		1
3.2.10, 3.2.1, 3.2.2	Success of odour channel for site B is unknown/ educated guess		X	X				X							X	4
3.2.12, 3.2.14	Water Corp needs to ensure they investigate new technologies for odour management								X					X		2
3.2.20	No figures are given for greenhouse gas emissions for comparison to an alternative pumped system									X						1
3.2.19	Air Quality technical advice issues													X		1
3.2.8, 3.2.13	If modelling suggests a 600m buffer is not adequate - there is limited flexibility in planning for land uses - Water Corporation will need to manage odours to comply with the 600m buffer						X							X		2
<b>SOCIAL SURROUNDINGS</b>																
<b>4.1</b>	<b>Land Development concerns</b>															
4.1.1, 4.1.2, 4.1.16, 4.1.22	Concerns regarding the commitment to manage the continued urban growth across an coastal plain			X	X						X					3
4.1.5, 4.1.6	Concerns regarding the development of land in the site B buffer zone				X											1
4.1.11, 4.1.12, 4.1.13	Site B and 600m buffer allows for full development potential of Alkimos coastal node						X				X		X			3
4.1.3, 4.1.7	Third pipe systems for all new developments/localised treatment plants				X	X										2
4.1.4	Conservation of coastal bushland conservation reserve considerations				X											1



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4.1.9, 4.1.10, 4.1.17	Site A affects the usage of the Akimos Regional beach and limit beaches development/limits development of Akimos Coastal Node and associated commercial and community benefits						X								X			2
4.1.18	Brochure material on potential development is misleading - could cause raised community expectations								X									1
4.1.19	The Land must be ceded to the Crown or City if it is to be used for recreational purposes								X									1
4.1.20	Urban development should work with natural topography retaining some sense of place										X							1
4.1.21	If Urban development is to continue appropriate infrastructure eg bike paths, walking tracks should be in place										X							1
4.1.23	Local employment including provision for home based businesses and space for small businesses										X							1
4.1.24	Future marina developments													X				1
4.1.25	Recreational benefits of developing the coastal node													X				1
4.1.8, 4.1.14, 4.1.15, 4.1.26	Plants visibility to residents - incongruous in any urban landscape					X						X		X				3
<b>4.2</b>	<b>Justification - Alternatives</b>																	
4.2.1	Plant should be placed further inland for better accessibility to a greater range of users	X																1
4.2.2, 4.2.7, 4.2.8	Issues involving the sketchy review of other sites looked at for the siting of the plant and selection for the appropriate location				X						X							2
4.2.3	Over looked in the PER are options for staged WWTP coming on line when demand was required					X												1
4.2.4	Environmental impacts for the suggestion of a temporary groyne or jetty have not been identified															X		1
4.2.5	An alternative to the proposed sites could be to site the treatment plant in the pine forest									X								1
4.2.6	Treated effluent could be piped to Kalgoorlie									X								1
<b>4.3</b>	<b>Indigenous Consultation</b>																	
4.3.1	All possible steps to be followed to solve outstanding current cultural concerns														X			1
<b>4.4</b>	<b>Economics</b>																	
4.4.1, 4.2.2	In terms of economic sustainability, at site B there are substantial additional excavation costs					X									X			2

**5.0 SUMMARY TABLE OF SUBMISSIONS**  
**MATRIX IDENTIFYING ISSUES RAISED BY PUBLIC AND VARIOUS GROUPS IN RESPONSE TO PER**

= Support for Site A  
 = Support for Site B  
 = Neutral

SECTION	ISSUES	SUBMISSION NUMBER														Sub Total	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14		
<b>5.1</b>		<b>OTHER</b>															
<b>Water - Re-use</b>																	
5.1.1,5.1.3, 5.1.7, 5.1.12, 5.1.14, 5.1.18, 5.1.19, 5.1.21, 5.1.23	Alternative water re-use should be pursued through public parks and gardens and re-filtering through natural sands into water table/active planning for and implement innovative WW reuse schemes rather than the depletion of natural water supply	X	X			X			X	X		X		X		X	8
5.1.2	Industry should be encouraged to use the treated wastewater	X															1
5.1.4, 5.1.5, 5.1.6, 5.1.9	30 years is too long to wait for reuse of water from the Alkimos Wastewater Treatment Plant		X	X	X			X			X						5
5.1.7, 5.1.8	Discussion of alternative wastewater technologies should have been part of the community consultation - in consideration of alternative site.		X	X				X									3
5.1.10, 5.1.16	An Education campaign is required to inform the public about the benefits, economics and safety of using recycled water.			X													1
5.1.13, 5.1.15	Alternative facility to be constructed in a more strategic location to maximise options for re-use						X										1
5.1.11	WW recycling will eliminate risk of contamination of coastal waters and impacts on marine environment			X													1
5.1.17	Limiting wastewater treatment to advanced secondary treatment will appear reuse of the wastewater from this plant in future will be limited.															X	1
5.1.20, 5.1.22	Waste water strategy to be reviewed given the need for Wastewater re-use / reliance on Ocean Outfalls is outdated								X		X						2
<b>5.2</b>		<b>CONSTRUCTION ISSUES</b>															
5.2.1	Little information is provided regarding the proposed location, placement and construction of pipeline- therefore hard to comment of potential impacts on coastal processes															X	1
5.2.2	Where will the spoil from Site B go?										X						1
5.2.3, 5.2.5	Construction method selected by contractor - limited descriptions															X	1
5.2.4	Descriptions of the diffuser design and performance characteristics are required															X	1
5.2.6	Micro-tunnelling or directional drilling should be mandatory to result in minimal impacts on vegetation and cliff landforms													X			1
5.2.7	Management Plan - clearly defining environmental management responsibilities of works, timeframes and management agent etc														X		1



