

**ALKIMOS WASTEWATER TREATMENT PLANT
WASTEWATER DISPOSAL STRATEGY AND
PROPOSED OCEAN OUTLET**

REFERRAL DOCUMENT

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1. SUMMARY

1.1 BACKGROUND

In the 1970's the Water Corporation identified the need for a wastewater treatment plant to service the planned residential growth in Perth's North West Metropolitan Corridor. Following evaluation of several different options, the Corporation selected Alkimos Lot 101 as the preferred site for this wastewater treatment plant (WWTP), and finalised the acquisition of this site from the Urban Land Council in 1987.

Figure 1-1 in Appendix A shows the location of the Alkimos WWTP

In recent years there has been increasing pressure from LandCorp and other interested parties for the WWTP to be relocated. Their main argument being that the coastal Lot 101 site would be more suited to residential development.

Consequently in 1996/97 LandCorp proposed to relocate the WWTP site out of the Alkimos Eglinton Structure Plan area to accommodate residential development and a commercial node on the coast. The resolution of issues within the Structure Plan area was facilitated by the Alkimos Eglinton Liaison Group, which was chaired by the then Ministry for Planning. This Group's conclusion was that the WWTP should be accommodated within the Structure Plan area.

In June 1998 the Corporation negotiated an "in principle agreement" with LandCorp that the treatment plant could be relocated 600 metres to the east, with a 300 metre buffer, to allow some coastal development on the condition that the relocation and the increased costs of odour control (because of the smaller buffer) would be funded by the residential development.

After further negotiation the "in principle agreement" was formalised on the 29th June 2001 with the signing of the *Alkimos Eglinton Relocation, Construction and Development Agreement* between the Water Corporation, LandCorp and Eglinton Estates (the principal landowners within the structure plan area). This agreement identified the alternative site as acceptable to all parties at the time of signing, and is binding on the parties.

Subsequent to the settlement of the agreement, a number of issues have put pressure on the agreement to consider further options. These include:

1. Revision of the EPA's odour management criteria (necessitating a larger buffer size than anticipated, 600m in lieu of 300m), requiring previous planning work to be reviewed and brought up to date.
2. The Alkimos Eglinton Metropolitan Region Scheme (MRS) plan amendment was publicly advertised on the 26th September 2003. The location of the future Alkimos Wastewater Treatment Plant (AWWTP) has and will continue to generate discussion until constructed.

As a result the Water Corporation has undertaken further assessment to re-examine all reasonable options for the location of the proposed treatment plant, and to determine the best triple bottom line option.

Figure 1-2 in Appendix A shows the location of the options considered.

Options were assessed against the following WWTP location principles:

1. Transport of raw wastewater (also known as sewage) by gravity to the WWTP;
2. Staged WWTP development (treatment, reuse and groundwater recharge facilities);
3. An ocean outlet for disposal of surplus treated wastewater;
4. Secure routes for main sewers and tunnel portal locations;
5. A secure route for the onshore ocean outfall pipeline;
6. Emission control on all major WWTP process units;
7. Sustainable buffer size;
8. Secure buffer by land purchase and with compatible land zonings;
9. Developers to cover the costs of relocating the WWTP; and
10. Social acceptability.

A major factor in the planning for the new scheme was to provide for a full gravity sewer system, thus avoiding major pumping of wastewater with the associated high energy cost and emergency overflow issues. Specifically:

- Raw wastewater would be delivered to the WWTP by a system of gravity sewers flowing from the north and south.
- Sufficient hydraulic grade is available at the WWTP to enable all flow to pass through the plant under all conditions. Even during extended power failure, the wastewater would continue to receive at least primary treatment and also basic secondary treatment for up to 24 hours (secondary treatment would progressively deteriorate over this period).
- Following treatment, treated wastewater not required for reuse would then flow by gravity to the ocean via a properly designed ocean outlet.

Based on this assessment, Site A (the original site as per the existing MRS), Site B (the site subject to the MRS Amendment process) and new site B1 best satisfied the criteria.

The location of Sites A, B and B1 are shown on **Figure 1-3** in Appendix A

Projected growth in the catchment indicates that approximately 80ML/d will require treatment at the AWWTP by 2050. Ultimately plant inflows could grow to 160ML/d which is comparable to the projected long term capacity at Beenyup WWTP (150ML/d) and the current installed capacity at Woodman Pt WWTP (160ML/d).

The Water Corporation now proposes to construct Stage 1 of the AWWTP along with associated reuse/disposal facilities. It is intended that Stage 1 will service the area for the next 10-15 years before further amplification is required.

This referral document presents the three options to the Environmental Protection Authority for consideration, Site A being the Water Corporation's preferred site based on its own planning review, and Sites B and B1 being presented as an acceptable alternatives to honour the agreement between LandCorp, the Water Corporation and the Developers (Western Australian Land Authority and Alkimos Developments).

1.2 PROPONENT

The Water Corporation is the proponent for this project. The Water Corporation is responsible for the collection, treatment and disposal of wastewater from the northern corridor. The level of treatment and method of disposal is determined by public health, environmental and economic criteria (economic – as the community must be able to afford the system provided).

1.3 TIMING

The Water Corporation proposes the following preliminary timetable (Table 1-1) for the project.

Table 1-1 *Project timetable*

EVENT	TIMING
Referral to the EPA	June 2004
Undertake Scientific Studies	July 2004 to December 2004
Produce and submit Formal Assessment Document	July 2005
PER document released for public comment	October 2005
Approval by Minister for the Environment	January 2006
Commence construction	June 2007
Commission	December 2008

2. ALKIMOS WWTP

The Alkimos WWTP is located approximately 42 km north of Perth in the northern urban corridor and is situated on the coast behind the foredunes.

The AWWTP is proposed to be developed on one of three sites:

- Site A – the current site (Lot 101) purchased for this purpose in 1987 and as zoned for this use in the current Metropolitan Region Scheme (MRS); or
- Site B – an alternative site that is the subject of a current MRS Amendment, and as agreed with Landcorp.
- Site B1 – another alternative site agreed as acceptable to Landcorp.

Sites A, B and B1 are shown on **Figure 1-3** in Appendix A.

Note that there is considerable overlap between these sites, but effectively, Site B moves the WWTP approximately 750m to the east of where it would be located on Site A. Site B1 is to the north of Site B.

2.1 ODOUR BUFFER

The Water Corporation has undertaken a number of odour modelling studies for the ultimate WWTP (160ML/d).

Note that initial modelling was undertaken prior to the publishing of EPA odour modelling guidelines, and adopted less conservative criteria. This modelling indicated that only a 300m buffer was required based on 5 Odour Units @ 99.5percentile (3 minute averaging). Later modelling based on 5 Odour Units @ 99.9percentile (1 hour minute averaging) and using remote wind data indicated that a 450m buffer was required.

More recent studies use wind data collected from Site B. The current recommended buffer is 600m, based on a criterion of 5 Odour Units @ 99.9percentile (1 hour averaging). Because of concerns regarding odour ponding at Sites B and B1 (considerable excavation is required at these sites to maintain gravity sewer inflows), further advice is being sought from CSIRO on this aspect and how it affects the size and location of the odour buffers centred on these sites.

2.2 TYPE AND STAGING OF WASTEWATER TREATMENT

To position the Corporation for future reuse opportunities, it is proposed to base treatment on the extended aeration “activated sludge” process. This is an advanced secondary treatment process similar to that recently constructed at Woodman Point. The Water Corporation presently achieves a high degree of nitrogen removal from this process. However, it should be noted that energy recovery is also an important factor in the long term development of the Alkimos WWTP. This generally requires a primary treatment step in the process train to capture ‘raw sludge’ for anaerobic digestion and recovery of biogas. This in turn removes some of the carbon in the wastewater that enables full denitrification to occur in the secondary process. Based on current treatment processes, staging of the WWTP and expected nitrogen output is summarised in the table below.

2.3 KEY PROJECT CHARACTERISTICS – ALKIMOS WWTP STAGING AND BASE LEVEL OF TREATMENT

Table 2-1 Key Project Characteristics – Wastewater Treatment Plant

STAGE(and timing)	INSTALLED CAPACITY	Treated wastewater Total N (with energy recovery)	Treated wastewater Total N (without energy recovery)	Additional treatment to reclaim water for reuse
1 (2008)	10ML/d	Not applicable due to scale	<10 mg/L (annual mean)	P reduction and disinfection to suit disposal/reuse application
2 (2020)	20ML/d	Not applicable due to scale	<10 mg/L (annual mean)	As above
3 (2030)	40ML/d	Not applicable due to scale	<10 mg/L (annual mean)	As above
4 (2040)	60ML/d	May not be applicable due to scale	<10 mg/L (annual mean)	As above
5 (2050)	80ML/d	15-20 mg/L (annual mean)	<10 mg/L (annual mean)	As above
Long term	160ML/d	15-20 mg/L (annual mean)	<10 mg/L (annual mean)	As above

The WWTP will also require a considerable level of odour control in order to prevent odour nuisance outside of the 600m odour buffer.

The staged layout of the Alkimos WWTP is shown on **Figure 2-1** in Appendix A.

Note that this is indicative only of what may be installed based on current best practice. Process improvements, such as membrane separation, are likely to influence plant development beyond Stage 1. Note also that allowance has been made on the site, to the west of the activated sludge plant, for the future installation of a reclaimed water plant and storage for product water.

The plant will also produce biosolids, which will be available for use by approved agricultural and horticultural enterprises as soil conditioner.

2.4 LONG TERM REUSE/DISPOSAL PRACTICE

The strategy is to maximise reuse while maintaining a secure (24 hour/day, 365 day/year) disposal system.

By the time inflows reach 80ML/d (about 2050) approximately 29,000ML will be generated each year by the community in the catchment.

Horticulture is the major industry to the east and north of the corridor, and presents a large opportunity for reuse. Based on the Water Quality Protection Note, Irrigating Vegetated land with Nutrient-Rich Wastewater (Vulnerability Category B), this is sufficient to irrigate the following:

- 1,800ha, based on water application of 50mm per week over a 32 week irrigation season (1600mm/yr), or
- 2,400ha, based on a nitrogen application rate of 180kg/ha/yr (1200mm/yr which is limited by nitrogen concentration of 15mg/L).

This seasonal opportunity will be pursued. However all the horticultural areas are in Public Drinking Water Source Areas (PDWSAs). Currently DoE does not support recycling in current PDWSAs or areas identified as future PDWSAs until the potential long term public health effects and social acceptability issues of this option are fully explored.

For the long term the option of a very high level of treatment (microfiltration and reverse osmosis) could enable injection into the aquifers for storage and reuse. However this treatment would result in large quantities of brine solution requiring disposal.

So for either of the major reuse opportunities, only a portion of the flow is reused. To ensure the continuous safe disposal of treated wastewater, it is proposed to discharge excess treated wastewater to the ocean via a long ocean outlet.

The Corporation has concluded that the responsible approach to sensible reuse is to retain sufficient flexibility in the scheme design to facilitate (expanding) reuse for the benefit of the community. With this in mind it is proposed to develop the disposal infrastructure in stages as follows:

- Initially, until inflows reach 10-15ML/d, treated wastewater will be infiltrated on Lot 101. This is discussed in more detail in the section below;
- When inflows reach 10-15ML/d, in about 10 years, it is proposed to construct the first of two ocean outlets. This would have capacity to discharge winter flows until about 2050 (80ML/d), after which a second outlet may be required.

Features of the ocean outlet are indicated in the table below.

2.5 KEY PROJECT CHARACTERISTICS - ALKIMOS OCEAN OUTLET

Table 2-2 Key Project Characteristics – Ocean Outlet

		Comments
Capacity	80ML/d average	Peak instantaneous flow 2000L/s
Length (from shoreline)	Up to 3,500m	To be determined by engineering and environmental studies, but likely to be well beyond the offshore reef line
Diffuser length	200-400m	As above
Diffuser location (water depth)	10-20m	As above
Pipe diameter	1000-1400mm	
Nitrogen load @80ML/d	Max. 440 Tpa	Worst case based on no reuse and TN 15mg/L (annual mean)

The WWTP will be connected to the ocean outlet by a gravity outfall pipeline constructed by a combination of open cut and tunnelling techniques, depending upon depth and subsurface conditions.

The conceptual location of the outlet system is shown on **Figure 2.2** in Appendix A.

The Water Corporation believes that the potential environmental impacts of an ocean outlet at Alkimos can be readily assessed by comparison with the considerable body of research undertaken at existing metropolitan outlets. For example, in about 2050, the worst case

nitrogen load at Alkimos is lower than currently being discharged from the Beenyup Ocean Outlet which is located in the Marmion Marine Park.

2.6 INITIAL DISPOSAL/REUSE PRACTICE

It is intended to defer the large capital expenditure required for the construction of the ocean outfall system for approximately 10 years. This will also allow sufficient flows to build up for satisfactory operation of the ocean outlet system at lower flows and velocities.

Up to a capacity of 10-15ML/d, it is proposed to recharge the surface aquifer. Following treatment, the wastewater will be discharged to between five and ten infiltration lagoons on Lot 101. These lagoons will generally be sited at lower locations across the site approximately 500m from the shoreline. As far as practical they will be spread in a north-south direction to minimise groundwater mounding. The treated wastewater will be pumped to the basins on rotation, to allow for basin resting and maintenance.

The proposed on-site infiltration system is shown conceptually on **Figure 2-3** in Appendix A.

The treated wastewater filters down through the sand into the groundwater and then joins the groundwater flowing to the ocean at or west of the shoreline. The level of treatment prior to infiltration, beyond the baseline activated sludge plant, will be determined following groundwater investigation and modelling the effects of both nutrients and public health related contaminants.

This proposal can also be compared to the recently decommissioned system at the Bunbury, where approximately 7ML/d was infiltrated into lagoons located much closer to the shoreline. At Bunbury measurements showed faecal coliform levels along the adjacent shoreline well within the National guidelines for primary contact recreation. At Bunbury the nitrogen and phosphorus (nutrient) levels in the treated wastewater were higher than those found in the natural environment and this resulted in elevated nutrient levels in the nearshore area adjacent to the Bunbury WWTP. At Alkimos, natural groundwater nitrogen concentrations are expected to be higher and the treated wastewater concentrations lower than at Bunbury.

- Note that this system is only considered practical while flows are relatively low. However some components could be retained in the longer term if it is determined that part of the system can be a component of a sustainable reuse system.

3. EXISTING ENVIRONMENT

Before committing to construction of the outlet, the Water Corporation will commission an integrated suite of scientific studies designed to establish the nature of the existing marine and terrestrial environment and determine the likely impacts of the WWTP. From these studies, the Water Corporation will prepare and submit an Environmental Impact Assessment report commensurate with the level of assessment set by the EPA

3.1 ENVIRONMENTAL IMPACTS THAT WILL BE REVIEWED

The primary environmental issues associated with the proposal are:

- Social impacts (odour, noise, visual amenity, recreational use of beaches and ocean heritage etc);
- Terrestrial impacts (Bush Forever, flora, fauna, dune stability and rehabilitation, access etc);
- Groundwater impacts due to disposal by infiltration (nutrient and bacteriological enrichment, indirect impacts on marine coastal waters)
- Marine impacts due to disposal by ocean outlet (nutrient and bacteriological and toxicant enrichment)
- Physical impacts (phased construction of WWTP, installation of the undersea pipeline);
- Cumulative impacts on ocean sediments by heavy metals and organic chemicals;

**APPENDIX A
FIGURES**