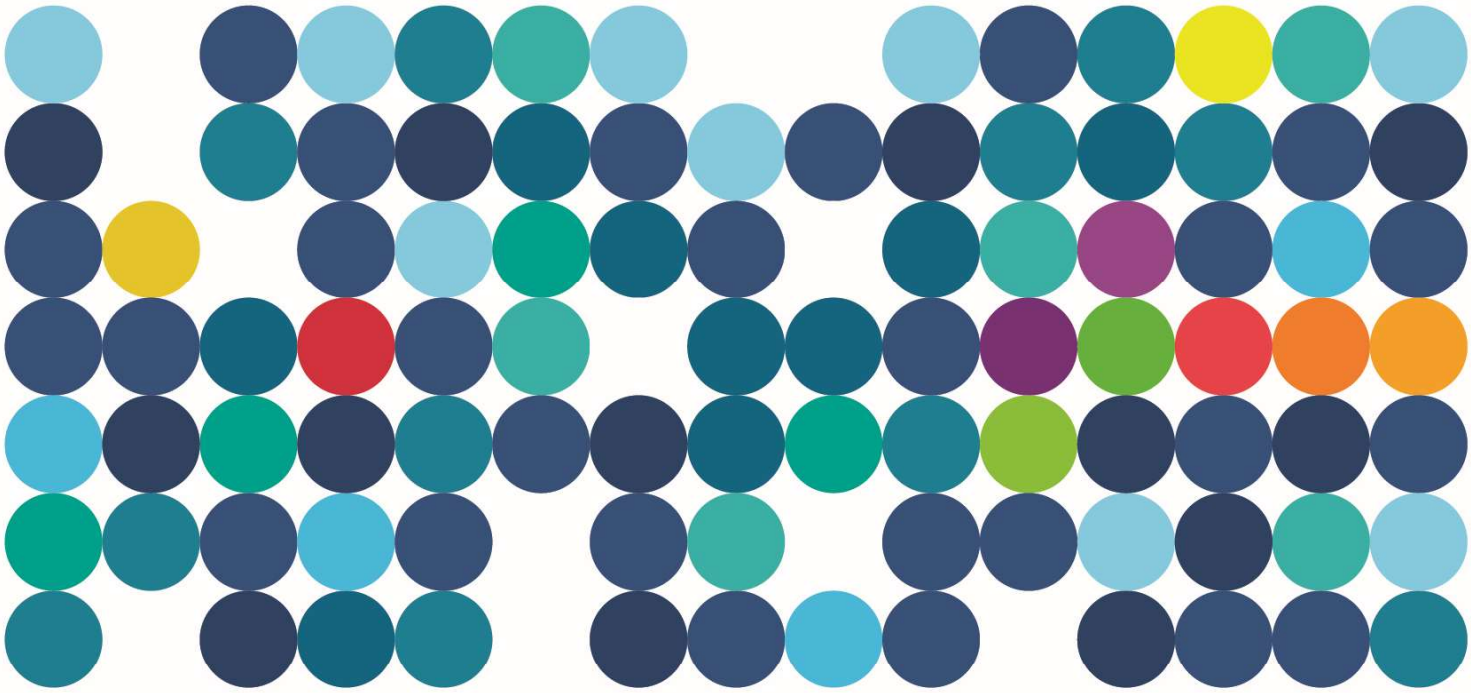
Ministerial Statement 755 2020-21 Performance and Compliance Report

Alkimos Wastewater Treatment Plant – Site B

City of Wanneroo



watercorporation.com.au

Fresh Water Thinking

WATER CORPORATION

Document History

Version	Author	Reviewed by	Date
1	H Khachar	C Byers	17/09/2021
		J. Howard	28/09/2021

Contents

1. Introduction

The Alkimos Wastewater Resource Recovery Facility (WRRF) was constructed to cater for anticipated population growth in the Alkimos catchment, which is expected to reach around 26 ML/day in 2030. The AWRRF is now fully commissioned and provides treatment to secondary quality before discharge of the treated wastewater to the ocean.

A proposal to construct the Alkimos WRRF was formally assessed by the Environmental Protection Authority (EPA) in 2007, at the Public Environmental Review (PER) level. Subsequently, Ministerial Statement (MS) 755 was released in November 2007.

Condition 4 of MS 755 describes the requirements for compliance reporting:

4-1 The proponent shall submit to the CEO environmental compliance reports annually, reporting on the previous twelve-month period, unless required by the CEO to report more frequently.

4-2 The environmental compliance reports shall address each element of an audit program approved by the CEO and shall be prepared and submitted in a format acceptable to the CEO.

4-3 The environmental compliance reports shall:

1. *be endorsed by signature of the proponent's Chief Executive Officer or a person, approved in writing by the CEO, delegated to sign on behalf of the proponents Chief Executive Officer;*
2. *state whether the proponent has complied with each condition and procedure contained in this statement;*
3. *provide verifiable evidence of compliance with each condition and procedure contained in this statement;*
4. *state whether the proponent has complied with each key action contained in any environmental management plan or program required by this statement;*
5. *provide verifiable evidence of conformance with each key action contained in any environmental management plan or program required by this statement;*
6. *identify all non-compliances and non-conformances and describe the corrective and preventative actions taken in relation to each non-compliance or non-conformance;*
7. *provide an assessment of the effectiveness of all corrective and preventative actions taken; and*
8. *describe the status of implementation of the proposal.*

4-4 The proponent shall make the environmental compliance reports required by condition 4-1 publicly available in a manner approved by the CEO.

This Performance and Compliance Report (PCR) fulfils the requirements of MS 755 condition 4 and covers the period July 2020 to June 2021 (2020-21).

2. Current Status

The Alkimos WRRF is currently operated under MS 755 and Part V Licence L8434/2010/1, discharging on average 12.75 ML/day for the July 2020 to June 2021 reporting period.

A Works Approval application was submitted to DWER on 3 August 2020 to equip the (existing) third oxidation ditch to achieve a treatment and operating capacity of 26ML/day. This staged approach is consistent with MS 755, which authorises up to 160 ML/day.

A revised Odour Management Plan (OMP) was submitted with the Works Approval application and during DWER (Regulatory Services) assessment it was identified that the proposed works may be inconsistent with MS 755. The Water Corporation subsequently undertook further, detailed assessment of odours at the WRRF and submitted a request to change Schedule 1 and Condition 12 of MS 755. The Works Approval application and request to change MS 755 are currently with DWER for assessment. The Water Corporation continue to operate the WRRF in accordance with the existing OMP.

A previous non-compliance issued to Water Corporation on 1 August 2017 relating to odour monitoring has been resolved. As per letter of 11th August 2021(Nexus-121943258), DWER acknowledges that at the Alkimos Wastewater Resource Recovery Facility Odour Dispersion Modelling (Tonkin and Taylor March 2020) and associated survey and risk assessment reports, demonstrates that odour meets the odour criterion for conditions 12-6 and 12-7 for the existing operations and the proposed capacity upgrade.

All reports, reviews and management plans relating to the Alkimos Strategic Ocean Outlet Monitoring (ASOOM) program are available on the Water Corporation's website:

https://www.watercorporation.com.au/Our-water/Wastewater/Ocean-outfall/Alkimos-monitoring-program

3. Compliance

3.1 Internal/External Audits

This PCR constitutes an internal audit by the proponent against the conditions and commitments of MS 755.

DWER conducted desktop compliance audit of MS 755 during this reporting period, after which the. Water Corporation provided a response to further information as requested by DWER on 22nd February 2021.

3.2 Complaints

There was one complaint received during the 2020-21 reporting period as per below.

Date of complaint	Details of Complaint	Corrective Actions Proposed/Taken
03/04/2021	Possible odour coming from cleaning work being carried out on Secondary Sedimentation tank	Water Corporation Communications team liaised with customer

3.3 Non-Compliances

No non compliances were identified during the reporting period.

4. Environmental Monitoring and Management

4.1 Odour Management

A revised OMP was submitted to DWER on 3 August 2020 to accompany the Works Approval application for the 26ML/day upgrade. Until the new OMP is approved, the Alkimos WRRF will operate under the existing OMP approved in 2010.

4.2 Marine Environmental Management

Marine water quality monitoring for the reporting period was undertaken in accordance with AWWTP Marine Treated Wastewater Discharge Monitoring and Management Plan (MTWDM&MP, Oceanica 2011).

In accordance with the MTWDM&MP, the following environmental quality objectives (EQOs) were assessed:

- Maintenance of Ecosystem Integrity (EQO 1);
- Maintenance of Aquatic Life for Human Consumption (EQO 2); and
- Maintenance of Primary and Secondary Contact Recreation (EQO 3 & 4).

The extent to which the EQOs were met was assessed against a suite of Environmental Quality Criteria (EQC), consisting of Environmental Quality Guidelines (EQG) and Environmental Quality Standards (EQS).

The compliance assessment summary for 2020-21 is shown in Table 3 below and demonstrates that all EQO's were met during the reporting year. The compliance summary uses colour coding to represent the extent to which the EQC were met (refer to Table 2). Note that assessment against any EQS was not required as all EQG's were met.

Detailed results of marine monitoring program for 2020-21 can be found in Appendix A.

Table 1 Compliance Report Card Legend

Management response	Legend
Monitor: EQG met: continue monitoring	
Investigative: EQG not met: assess against EQS. EQS met	
Action: EQS not met: management response required	

Table 2 2020/21 Marine Monitoring Compliance Report Card

Environmental Quality Criteria	Measurement Criteria	Assessment
EQO 1 – MAINTENANCE OF ECOSYSTEM INTEGRITY		
EQG 1	Concentrations of contaminants not to exceed the ANZECC/ARMCANZ (2000) 80% species protection guideline for bioaccumulating toxicants at the diffuser	
EQG 2	Concentrations of contaminants not to exceed the ANZECC/ARMCANZ (2000) 99% species protection guideline for toxicants (with the exception of cobalt, where the 95% species protection guideline will apply) at the boundary of the LEPA	
EQG 3	The total toxicity of the mixture for the additive effect of ammonia, copper and zinc (as per ANZECC/ARMCANZ (2000) guidelines) must be <1.0.	
EQG 4	The EQG will be exceeded if the 1 hr sea urchin test: $\frac{TDA}{DRNOEC} \leq 1.0$ *Where TDA = typical dilutions achieved (constant based on 200-fold dilution); and* *DRNOEC = number of dilutions required to achieve the no observed effects concentration (NOEC).*	
EQG 5	Ambient value of defined area during non-river flow period for chlorophyll-a is not to exceed the 80th percentile of the combined reference site data.	
EQG 6	If either Trigger A or Trigger B is not met, EQG 6 is exceeded: A. Median sediment total contaminant concentration from a defined sampling area should not exceed the guideline value for high, moderate and low ecological protection areas. B. Total contaminant concentration at individual sample sites should not exceed the guideline resampling trigger (Table 6). If so, repeat sampling will be conducted to define the extent of the contamination which will be assessed as per trigger A	5 yearly Sediment sampling data (Appendix A of this report)
EQO 2 – MAINTENANCE OF AQUATIC LIFE FOR HUMAN CONSUMPTION		
EQG 1	The median in-water thermotolerant coliform (TTC) value should not exceed 14 CFU/100 mL, with no more than 10% samples exceeding 21 CFU/100 mL measured using the membrane filtration method (Table 4, EPA 2005a).	
EQO 3 & 4 – MAINTENANCE OF PRIMARY AND SECONDARY CONTACT RECREATION		
EQG 1	The maximum value of the pooled Enterococci spp. must be less than the National Health and Medical Research (NHMRC) category A guideline value of ≤ 40 Enterococci spp. MPN/100mL for recreational water bodies (NHMRC 2008).	

4.3 Ocean Outlet Management

Ocean Outlet Management for the reporting period was undertaken in accordance with AWWTP Marine Treated Wastewater Discharge Monitoring and Management Plan (MTWDM&MP, Oceanica 2011).

4.4 Environmental Management

Environmental land management was managed by the Alkimos WRRF and Buffer Zone Environmental and Land Management Plan (LMP, Water Corporation 2013). This was developed in part to manage the conservation values of the site following the implementation of the Terrestrial Construction Management Plan required by MS 755.

The ongoing management actions required in the LMP were completed throughout the 2020-21 year, including:

- Regular inspections, repair and replacement of fencing and signage;
- Inspections of the site for vehicular damage and resultant vegetation loss; and
- Monthly security patrols.

Monthly inspections of fencing, signage and damage are scheduled as part of the Maintenance Plan for the site.

5. Stakeholder Consultation

Stakeholder consultation for the reporting period included periodic correspondence and report submissions as required.

As per condition M11.5 all reports, reviews and management plans relating to the Alkimos Strategic Ocean Outlet Monitoring (ASOOM) program are made publicly available by inclusion on the Water Corporation's website link below:

https://www.watercorporation.com.au/Our-water/Wastewater/Ocean-outfall/Alkimos-monitoring-program

This PCR report (2020-21) shall be made available on the above link after submission.

6. OEPA Audit Table

The OEPA Audit Table updated with the current status for each Ministerial condition is shown below, which includes the completed conditions as requested.

Note:

- Phases that apply in this table = Pre-Construction, Construction, Operation, Decommissioning, Overall (several phases)
- This audit table is a summary and timetable of conditions and commitments applying to this project. Refer to the Minister's Statement for full detail/precise wording of individual elements.
- Code prefixes: M = Minister's condition; P = Proponent's commitment; A = Audit specification; N = Procedure.
- Abbreviations: CAR = Compliance Assessment Report; CEO = Chief Executive Officer of OEPA; DEC = Department of Environment and Conservation; DER = Department of Environment Regulation; DIA = Department of Indigenous Affairs; DMP = Department of Mining and Petroleum; DoH = Department of Health; DoW = Department of Water, EPA = Environmental Protection Authority, Minister for Env = Minister for the Environment; OEPA = Office of the Environmental Protection Authority.
- Compliance Status: C = Compliant, CLD = Completed, NC = Non – compliant, NR = Not Required at this stage. Please note the terms NA = Not Audited and VR = Verification Required are only for OEPA use. IP = In Process may only be used by the proponent in circumstances outlined in Section 2.8 of the Post Assessment Guideline for Preparing an Audit Table.

Table 4 OEPA Audit Table

Audit Code	Subject	Requirement	How	Evidence	Phase	Timeframe	Status	Further Information
755:M1-1	Proposal Implementation	Implement the proposal as documented and described in Schedules 1, 2 and 3 of Statement 755	In accordance with above and other design and technical specifications provided in the Public Environmental Review	Compliance reports submitted in accordance with Conditions 4-1, 4-2, 4-3 and 4-4	Overall		**C**	**This Performance and Compliance Report**
755:M2-1	Proponent Nomination and Contact Details	The proponent nominated by the Minister for the Environment under S38(6) or 38(7) of the EP Act, 1986 is responsible for the implementation of the proposal			Overall		**C**	**Proponent is Water Corporation.**
755:M2-2	Proponent Nomination and Contact Details	Notify the CEO of the DEC of any change of the name and address of the proponent within 30 days of the change	In writing to CEO of the DEC	Letter notifying the CEO of change in proponent details	Overall	Within 30 days of the change	**C**	**No change in proponent name or address**
755:M3-1	Time Limit of Authorisation	Substantially commence implementation of the proposal within five years of the date of this Statement or the approval granted in this statement shall lapse and be void			Overall	Within five years of the date of Statement 755	CLD	
755:M3-2	Time Limit of Authorisation	Notify the CEO that the proposal has substantially been commenced on or before the expiration of five years from the date of the Statement		Letter notifying the CEO the proposal has been substantially commenced	Overall		CLD	
755:M4-1	Compliance Reporting	Submit compliance reports to the CEO		Compliance Report	Overall	Annually	**C**	**2019-20 MS755 PCR submitted to OEPA on 15th October 2020. This 2020-21 PCR submitted to OEPA.**
755:M4-2	Compliance Reporting	Prepare and submit an audit program approved by the CEO of DEC		Compliance Report	Overall	Due in February 2009	CLD	

Audit Code	Subject	Requirement	How	Evidence	Phase	Timeframe	Status	Further Information
755:M4-3	Compliance Reporting	Submit environmental compliance report to DEC	Environmental compliance reports shall: 1. be endorsed by signature of the proponent's Chief Executive Officer or a person, approved in writing by the CEO, delegated to sign on behalf of the proponent's Chief Executive Officer; 2. state whether the proponent has complied with each condition and procedure contained in this statement; 3. provide verifiable evidence of compliance with each condition and procedure contained in this statement; 4. state whether the proponent has complied with each key action contained in any environmental management plan or program required by this statement; 5. provide verifiable evidence of conformance with each key action contained in any environmental management plan or program required by this statement; 6. identify all non-compliances and non-conformances and describe the corrective and preventative actions taken in relation to each non-compliance or non-conformance; 7. provide an assessment of the effectiveness of all corrective and preventative actions taken; and 8. describe the state of implementation of the proposal.	Compliance Report.	Overall	Annually, unless required by the CEO to report more frequently	C	**2019-20 MS755 PCR submitted to OEPA on 15th October 2020.** **This 2020-21 PCR submitted to OEPA. PCR contains the information required in Condition 4-3.**
755:M4-4	Compliance Reporting	Environmental compliance reports to be made publicly available in a manner approved by the CEO	Carry out the following: 1) Post document on proponents website; 2) Provide document to members of the public upon request; 3).Post document on the internal Corporate EMS Portal	Provision of link to the website.	Overall	Annually, unless required by the CEO to report more frequently.	C	**Annual PCR available on the Water Corporation website:** https://www.watercorporation.com.au/Our-water/Wastewater/Ocean-outfall/Alkimos-monitoring-program
755:M5-1	Performance	Submit a Performance Review every five years after the start of construction.	Report shall address: 1. the major environmental issues associated with implementing the project; the environmental objectives for those issues; the methodologies used to achieve these; and the key indicators of environmental performance measured against those objectives; 2. the level of progress in the achievement of sound environmental performance, including industry benchmarking, and the use of best available technology where practicable; 3. investigations undertaken in relation to developing alternative options to ocean disposal of treated wastewater, including wastewater re-use; 4. significant improvements gained in environmental management, including the use of external peer reviews; 5. stakeholder and community consultation about environmental performance and the outcomes of that consultation, including a report of any on-going concerns being expressed; and 6. the proposed environmental objectives over the next five years, including improvements in technology and management processes	Performance Review submitted every five years after the start of construction	Overall	Every five years after the start of construction.	C	**5-year Performance Review Report (PRR) submitted to OEPA on 10 April 2018.**
755:M6-1	Terrestrial Construction Management Plan	Tunnelling of the overland pipeline	Use up to three launch/recovery chambers located within the footprint of the WWTP and the footprint of the launch site during tunnelling. Any intermediate chamber is to be located outside Bush Forever sites and Conservation Areas identified by the Water Corporation	Compliance Report	Construction		CLD	
755:M6-2	Terrestrial Construction Management Plan	Submit a Terrestrial Construction Management Plan that meets the objectives of condition 6-3 and requirements of condition 6-4, prior to commencement of clearing for implementation of pipeline	As per Condition 6-4	Submission of the Terrestrial Construction Management Plan.	Pre-construction	Prior to commencement of clearing for implementation of pipeline.	CLD	
755:M6-3	Terrestrial Construction Management Plan	Protect native vegetation and landforms on the site outside the area of disturbance as defined in Figure 3 in Schedule 2 and Figure 4 in Schedule 3			Pre-construction		CLD	

Audit Code	Subject	Requirement	How	Evidence	Phase	Timeframe	Status	Further Information
755:M6-4	Terrestrial Construction Management Plan	Prepare a Terrestrial Construction Management Plan	Plan shall address: 1. modification and configuration (dimension, shape and gradient) of the launch site as far as practicable to minimise the impact of the on terrestrial vegetation and formations launch site dimensions; 2. access roads; 3. sheds, amenities, and other facilities to be installed; 4. management of activities in areas outside the area of disturbance as defined in Figure 3 in Schedule 2 and Figure 4 in Schedule 3; 5. depth of burial of pipe sufficient to withstand a one-in-one hundred year storm; 6. impacts on the beach profile; 7. Bush Forever site, including *Frankenia pauciflora*; 8. Threatened Ecological Communities; and 9. rehabilitation of the launch site/s		Pre-construction		CLD	
755:M6-5	Terrestrial Construction Management Plan	Proponent shall Implement Terrestrial Construction Management Plan	As outlined in the Terrestrial Construction Management Plan	Compliance Report	Construction		CLD	Construction and TCMP actions completed. Refer to 5-year ASOOM PRR submitted to OPEA on 10 July 2013 for evidence.
755:M6-6	Terrestrial Construction Management Plan	Proponent to make the Terrestrial Construction Management Plan publicly available in a manner approved by CEO	Carry out the following: 1) Post document on proponents website; 2) Provide document to members of the public upon request; 3).Post document on the internal Corporate EMS Portal	Provision of link to the website	Construction		CLD	TCMP available on the Water Corporation website: https://www.watercorporation.com.au/Our-water/Wastewater/Ocean-outfall/Alkimos-monitoring-program
755:M6-7	Terrestrial Construction Management Plan	Prior to ground-disturbing activities the proponent shall put in place measures to delineate and protect the locations of plants, vegetation, or other areas of particular conservation significance. In carrying out rehabilitation activities, the proponent shall only use native plant species of local provenance, defined as plant material or seeds collected within ten kilometres of the project site, except with permission in writing from the CEO	As documented in the Terrestrial Construction Management Plan	Compliance Report	Construction	Prior to ground-disturbing activities	CLD	
755:M7-1	Stability of dunes	The proponent shall construct the WWTP and associated works to ensure the ongoing stability of the dunal system outside the area of disturbance as defined in Figure 3 in Schedule 2 and Figure 4 in Schedule 3		Compliance Report	Construction		CLD	
755:M8-1	Ocean Outlet Pipeline Construction Management Plan (Marine)	Prior to commencement of installation of the pipeline the proponent shall prepare and submit an Ocean Outlet Pipeline Construction Management Plan	Meet the objectives set out in condition 8-2 and meet the requirements of condition 8-3	Submission of the Plan	Pre-construction	Prior to commencement of installation of the pipeline	CLD	
755:M8-2	Ocean Outlet Pipeline Construction Management Plan (Marine)	(a) Ensure maintenance of ecological integrity of marine waters surrounding the Alkimos Project Site; (b) Ensure final area of disturbance is within area defined in Figure 5 and Table 4 in Schedule 4.			Pre-construction		CLD	

Audit Code	Subject	Requirement	How	Evidence	Phase	Timeframe	Status	Further Information
755:M8-3	Ocean Outlet Pipeline Construction Management Plan (Marine)	Ocean Outlet Pipeline Construction Management Plan (Marine).	Plan shall address: 1. route design; 2. define the spatial definition of the extent of the disturbance footprint (a) direct loss of habitat due to construction, (b) indirect loss of habitat due to construction (sediment plume impacts Ð loss of light and burial); 3. prediction and spatially definition of the long-term stable state of the marine environment following construction and taking into account indirect effects of construction and on-going impacts from the presence of infrastructure Ð i.e. predicted impacts (the extent and severity) on the marine environment of indirect impacts (construction and ongoing impact (see Note 9). 4. amount and type of material to be excavated; 5. rehabilitation of excavated trenches; 6. blasting techniques and areas where blasting occurs; 7. identify where drilling and open-cut techniques (minimising open-cut technique) are to be used for the entire pipe installation; 8. positioning of pipe-laying vessels, mooring pattern design and dredge support vessels; 9. management of benthic community in construction areas; 10. monitoring and establishment of impact from anchoring, wire and chain sweep techniques, marine dredging and supra-tidal excavation techniques used; 11. identification of areas to be dredged, excavated and the timing and duration of dredging/excavation; 12. water quality targets for criteria that will trigger management of sedimentation and protection of benthic community; 13. monitoring reporting, and mitigating impacts on natural littoral drift processes from construction activities and beach profiles during construction; and 14. the management actions and contingencies that will be implemented in the event that criteria for water quality targets required by point 12 above are not being met	The Ocean Outlet Pipeline Construction Management Plan (Marine)	Pre-construction		CLD	
755:M8-4	Ocean Outlet Pipeline Construction Management Plan (Marine)	Proponent to ensure that the diffuser is located in a position to reduce the likelihood of plume impacts on high relief algal reefs immediately to the east of the outlet	Extend pipe length by 200 metres from the end of pipe in Figure 4.17 of proponents Public Environmental Review document (Version 3, 8 November 2005).	Compliance Report	Construction		CLD	
755:M8-5	Ocean Outlet Pipeline Construction Management Plan (Marine)	Proponent to ensure extant of disturbance footprint (direct and indirect loss of habitat) is no greater than that defined in condition 8-3 (2)		Compliance Report	Construction		CLD	
755:M8-6	Ocean Outlet Pipeline Construction Management Plan (Marine)	Proponent to ensure extent of the disturbance footprint (direct impacts) is no greater than the area defined in Figure 5 and Table 4 in Schedule 4		Compliance Report	Construction		CLD	
755:M8-7	Ocean Outlet Pipeline Construction Management Plan (Marine)	Proponent to minimise indirect impacts as far as practicable within boundary as specified in Condition 8-6		Compliance Report	Construction		CLD	
755:M8-8	Ocean Outlet Pipeline Construction Management Plan (Marine)	The proponent will ensure the pipeline is laid within the area defined in Figure 5 and Table 4 in Schedule 4, and the Ôline of direct disturbance footprint will also be within the area. (see note 9)..		Compliance Report	Construction		CLD	
755:M8-9	Ocean Outlet Pipeline Construction Management Plan (Marine)	Proponent shall implement the Ocean Outlet Pipeline Construction Management Plan (Marine).	As per condition 8-3	Compliance Report	Construction		CLD	
755:M8-10	Ocean Outlet Pipeline Construction Management Plan (Marine)	Proponent to make the Ocean Outlet Pipeline Construction Management Plan (Marine) publicly available in a manner approved by CEO	Carry out the following: 1) Post document on proponents website; 2) Provide document to members of the public upon request; 3).Post document on the internal Corporate EMS Portal		Construction		CLD	OOPCMP available on the Water Corporation website: https://www.watercorporation.com.au/Our-water/Wastewater/Ocean-outfall/Alkimos-monitoring-program

Audit Code	Subject	Requirement	How	Evidence	Phase	Timeframe	Status	Further Information
755:M9-1	Seabed and Benthic Habitat Monitoring and Management Plan	Prior to commencement of construction of the Alkimos ocean outlet in the marine environment, the proponent shall prepare and submit a Seabed and Benthic Habitat Monitoring and Management Plan	To meet the objectives of condition 9-2 and the requirements of 9-3 as determined by the Minister for the Environment	Submission of the Seabed and Benthic Habitat Monitoring and Management Plan	Pre-construction	Prior to commencement of construction	CLD	
755:M9-2	Seabed and Benthic Habitat Monitoring and Management Plan	To ensure that seabed and benthic habitat loss outside the area of direct loss defined in the Plan required by Condition 8-3 (2) is avoided during construction and re-instated following construction			Overall		CLD	
755:M9-3	Seabed and Benthic Habitat Monitoring and Management Plan	The Seabed and Benthic Habitat Monitoring and Management Plan	Plan shall address: 1. Procedures for obtaining and providing to the CEO, within six months following the completion of pipeline installation, an accurate total area and geographically referenced location map of areas of seabed (sub tidal, intertidal and beaches) modification and benthic primary producer habitats lost or damaged during pipeline construction, including specific identification of any areas of loss or damage that are in excess or outside of those areas defined and predicted in the Plan required by Condition 8; 2. Prediction and spatial definition of long-term stable state of the marine environment following construction and taking into account on-going impacts from the presence of infrastructure Ð i.e. predicted impacts (the extent and severity) on the marine environment of indirect impacts (construction and ongoing impacts) (see also Condition 8-3 (3)); 3. The establishment of a quantitative annual monitoring program of the seabed and benthic habitat condition in, and adjacent to, areas of seabed and benthic primary producer habitats damaged during pipeline installation and the ongoing presence of the infrastructure; and 4. The indicator(s) and criteria to be used to trigger cessation or reduction in the frequency of monitoring after three years following construction or, in the event of the trigger level referred to in item 3 above being exceeded, after the proponent has demonstrated the success of contingency actions in reducing the rate of annual seagrass loss or damage to less than the contingency trigger level referred to in item 3 above, for three successive years; and 5. Reporting procedures.	The Seabed and Benthic Habitat Monitoring and Management Plan	Pre-construction		CLD	
755:M9-4	Seabed and Benthic Habitat Monitoring and Management Plan	Proponent to commence contingency actions to ensure that the rate of post construction seabed and/or benthic primary producer habitat loss or damage is restricted and reduced if within six months of completion of construction the marine habitat outside the area of direct impact has not returned to the state predicted in Condition 9-3 (3)		Compliance Report	Overall	Within six months of completion of construction	CLD	
755:M9-5	Seabed and Benthic Habitat Monitoring and Management Plan	Proponent shall implement the Seabed and Benthic Habitat Monitoring and Management Plan	As per condition 9-3	Compliance Report	Operation		CLD	Plan was implemented for 3 years post construction as required.
755:M9-6	Seabed and Benthic Habitat Monitoring and Management Plan	Proponent shall make the Seabed and Benthic Habitat Monitoring and Management Plan publicly available in a manner approved by the CEO	Carry out the following: 1) Post document on proponents website; 2) Provide document to members of the public upon request; 3).Post document on the internal Corporate EMS Portal	Provision of link to the website	Construction		CLD	SBHMMP (incorporated into OOPCMP) available on the Water Corporation website: https://www.watercorporation.com.au/about-us/our-performance/ocean-outfall/alkimos-monitoring-program
755:M10-1	Fauna Management	Prior to ground-disturbing activity, the proponent shall prepare and submit a Fauna Management Plan	To that meet the requirements of Condition 10-2 as determined by the Minister for the Environment	Submission of the Fauna Management Plan	Pre-construction	Prior to ground-disturbing activity	CLD	

Audit Code	Subject	Requirement	How	Evidence	Phase	Timeframe	Status	Further Information
755:M10-2	Fauna Management	Prepare a Fauna Management Plan	The Plan shall address: 1) Clearing of construction are in a step-wise fashion as plant expands; 2) Avoidance of land clearing when Carnaby Cockatoos are actively breeding or foraging in area; 3) Presence of terrestrial fauna and their translocation	The Fauna Management Plan	Pre-construction	Prior to ground-disturbing activity	CLD	
755:M10-3	Fauna Management	Proponent shall implement the Fauna Management Plan.		Compliance Report	Construction		CLD	Construction and FMP actions completed. Refer to first 5-year PRR submitted to OPEA on 10 July 2013 for evidence.
755:M10-4	Fauna Management	Proponent to make the Fauna Management Plan publicly available in a manner approved by the CEO	Carry out the following: 1) Post document on proponents website; 2) Provide document to members of the public upon request; 3).Post document on the internal Corporate EMS Portal	Provision of link to the website	Construction		CLD	FMP available on the Water Corporation website: https://www.watercorporation.com.au/about-us/our-performance/ocean-outfall/alkimos-monitoring-program
755:M11-1	Marine Treated Wastewater Discharge Monitoring and Management Plan	Prior to commissioning of the wastewater treatment plant, the proponent shall prepare and submit a Marine Treated Wastewater Discharge Management Plan	To meet the objective and Environmental Quality Objectives described in 11-2 and the requirements set out in 11-3 as determined by of the Minister for the Environment	Submission of Marine Treated Wastewater Discharge Management Plan	Operation	Prior to commissioning of wastewater treatment plant	CLD	Marine Treated Wastewater Discharge Monitoring and Management Plan (MTWDMP&MP) was developed and approved on 28 July 2010. Available on the Water Corporation website: https://www.watercorporation.com.au/Our-water/Wastewater/Ocean-outfall/Alkimos-monitoring-program
755:M11-2	Marine Treated Wastewater Discharge Monitoring and Management Plan	Prepare a Marine Treated Wastewater Discharge Monitoring and Management Plan	Plan shall address following Environmental Quality Objectives	The Marine Treated Wastewater Discharge Management Plan	Operation		**C**	**Approved MTWDM&MP meets the objectives of condition 11-2.**
755:M11-3	Marine Treated Wastewater Discharge Monitoring and Management Plan	The proponent shall prepare a Marine Treated Wastewater Discharge Management Plan	Plan shall address: 1. within the Zone of Low Ecological Protection (i.e. within a 100 metres from the diffuser as shown in figure 1, schedule 2), the proponent shall seek to achieve the ANZECC & ARMCANZ1 80% species protection guideline 'trigger' levels (as published from time to time) for bio-accumulating toxicants; 2. within the Zone of High Ecological Protection (i.e. beyond a 100 metres from the diffuser as shown in figure 1, schedule 2), the proponent shall seek to achieve the ANZECC & ARMCANZ 99% species protection guideline 'trigger' levels (as published from time to time) for toxicants (with the exception of cobalt, where the 95% guideline shall apply): 3. the establishment of indicators and associated 'trigger' levels for further investigations (environmental quality guidelines) for nutrients and social quality objectives; 4. the establishment of 'trigger' levels for the implementation of remedial and/or preventative actions to protect the water quality and the environment off Alkimos (environmental quality standards) for toxicants, nutrients and social quality objectives; 5. the monitoring and evaluation, including remodelling, of the social and environmental effects of discharging treated wastewater into the marine environment off Alkimos to assess performance in the protection and maintenance of environmental values and objectives; 6. the specific management actions that will be implemented in the event that environmental quality standards levels are not met, including the option of modifying the diffuser to increase dilution; 7. a program to undertake whole-of-effluent toxicity testing of treated wastewater; 8. the monitoring and reporting of diffuser performance in terms of achieving required number of initial dilutions within the area of low level of ecosystem protection compared to the initial dilutions in schedule 1 under low energy/calm meteorological and sea-state conditions; and 9. the protocols and schedules for reporting performance against the Environmental Quality Objectives	The Marine Treated Wastewater Discharge Management Plan.	Operation		**C**	**Approved MTWDM&MP meets the requirements of condition 11-3.**
755:M11-4	Marine Treated Wastewater Discharge Monitoring and Management Plan	Proponent shall implement the Marine Treated Wastewater Discharge Management Plan	As per Condition 11-3	Compliance Report	Operation		**C**	**See section 4.1 and Appendix A of this PCR.**

Audit Code	Subject	Requirement	How	Evidence	Phase	Timeframe	Status	Further Information
755:M11-5	Marine Treated Wastewater Discharge Monitoring and Management Plan	Proponent shall make the Marine Treated Wastewater Discharge Management Plan publicly available in a manner approved by the CEO	Carry out the following: 1) Post document on proponents website; 2) Provide document to members of the public upon request; 3).Post document on the internal Corporate EMS Portal	Provision of link to the website	Construction		CLD	MTWDM&MP available on the Water Corporation website: https://www.watercorporation.com.au/Our-water/Wastewater/Ocean-outfall/Alkimos-monitoring-program
755:M11-6	Marine Treated Wastewater Discharge Monitoring and Management Plan	If a guideline trigger level referred to in condition 11-3 is exceeded, the proponent shall report the matter to DEC within one working day of determining that this has occurred, and shall initiate an investigation against the environmental quality standards and into the cause of the exceedance in accordance with the framework developed in the Revised Environmental Quality Criteria Reference Document (Cockburn Sound) 2	To the requirements of the Minister for the Environment on advice DEC	Written correspondence with DEC, copy of investigation report to be provided to DEC and Compliance Report	Operation	Within one working day of a trigger level being exceeded	**C**	**No exceedances of guideline trigger levels referred to in condition 11-3. Refer to section 4.1 and Appendix A of this PCR.**
755:M11-7	Marine Treated Wastewater Discharge Monitoring and Management Plan	If an environmental quality standard referred to in condition 11-3 is exceeded, the proponent shall initiate a management response to determine the source and remedy the exceedance in accordance with the implementation framework for the National Water Quality Management Strategy	To the requirements of the Minister for the Environment on advice of the Department of Environment and Conservation	Compliance Report	Operation	If an environmental quality standard referred to in Condition 11-3 is exceeded	**C**	**No exceedances of guideline trigger levels referred to in condition 11-3. Refer to section 4.1 and Appendix A of this PCR.**
755:M11-8	Marine Treated Wastewater Discharge Monitoring and Management Plan	The proponent shall prior to submitting a Works Approval application for the plant: 1. estimate the expected typical physico-chemical composition and flow rates of all wastewater streams discharging into the environment from the site; 2. estimate, for all non-negligible contaminants and nutrients, the total annual loads of contaminants and nutrients in the wastewater discharge exiting the site; 3. estimate, for normal and worst-case conditions, the concentrations of contaminants and nutrients (for agreed averaging periods) in the wastewater discharge exiting the site; and 4. Establish a reporting process that is an inventory of toxicants that enter and leave the plant		Compliance Report and DEC approval letters	Pre-construction		CLD	
755:M11-9	Marine Treated Wastewater Discharge Monitoring and Management Plan	The proponent shall prior to submitting a Works Approval application for the plant provide information to show how best practicable technology and waste minimisation principles for contaminants and nutrients have been adopted for the wastewater discharge		Compliance Report and DEC approval letters	Pre-construction		CLD	

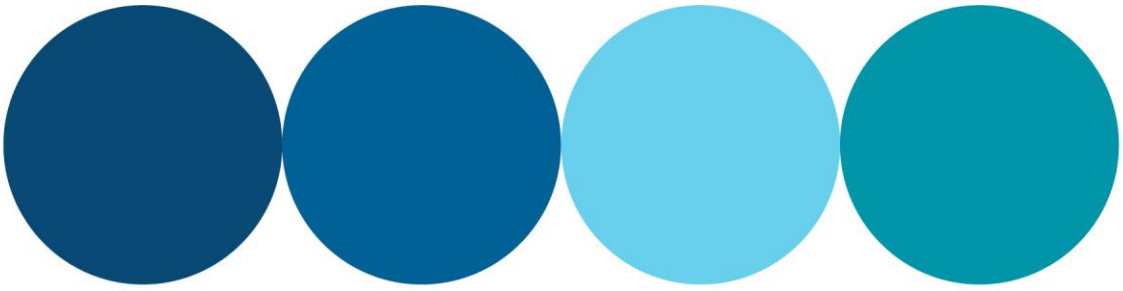
Audit Code	Subject	Requirement	How	Evidence	Phase	Timeframe	Status	Further Information
755:M11-10	Marine Treated Wastewater Discharge Monitoring and Management Plan	The proponent shall within, three months following commissioning and stabilizing of plant operations, conduct an analysis demonstrating that effluent properties are substantially consistent with predictions. Similar analyses shall also be conducted within three months following every major increase in the volume of treated wastewater discharged from the plant or any significant change in effluent characteristics		Compliance Report	Operation	Three months following commissioning, and three months after every major increase in wastewater discharge volume	**C**	**No major increase in wastewater discharge volume or significant change in effluent characteristics during 2020-21.**
755:M11-11	Marine Treated Wastewater Discharge Monitoring and Management Plan	The proponent shall develop a Contingency Wastewater Management Plan		Contingency Wastewater Management Plan	Construction		CLD	Appendix B of Marine Treated Wastewater Discharge Monitoring and Management Plan.
755:M11-12	Marine Treated Wastewater Discharge Monitoring and Management Plan	Action In the event that effluent properties are not substantially consistent with predictions (refer to condition 11-9), the proponent shall conduct toxicological studies on the actual effluent, or provide acceptable alternative information such as risk assessment, to the timing and other requirements of the Minister for the Environment	Studies and/or information shall be consistent with ANZECC requirements		Operation	If effluent properties are not substantially consistent with predictions (refer to condition 11-9)	**C**	**No concerns with effluent properties during 2020-21**
755:M11-13	Marine Treated Wastewater Discharge Monitoring and Management Plan	The proponent shall implement the Contingency Wastewater Management Plan required by condition 11-11 in the event that the findings resulting from condition 11-12 indicate that the effluent poses a significant risk to the diversity of the species and biological communities and abundance/biomass of marine life	As per condition 11-11	Compliance Report	Operation	If findings from Condition 11-12 indicate effluent poses significant risk to marine life	**NR**	
755:M11-14	Marine Treated Wastewater Discharge Monitoring and Management Plan	The proponent shall review and revise the Contingency Wastewater Management Plan		Compliance Report	Construction		**NR**	
755:M11-15	Marine Treated Wastewater Discharge Monitoring and Management Plan	The proponent shall make any revisions of the Contingency Wastewater Management Plan, as required by condition 11-11, publicly available in a manner approved by the CEO	Carry out the following: 1) Post document on proponents website; 2) Provide document to members of the public upon request; 3).Post document on the internal Corporate EMS Portal	Provision of link to the website	Construction		**NR**	
755:M12-1	Odour Management Plan	Prior to commencement of operation, the proponent shall prepare and submit an Odour Management Plan	Plan to meet the objective set out in Condition 12-2 and the requirement in Condition 12-3 as determined by the Minister for the Environment	Submission of the Odour Management Plan	Construction	Prior to commencement of operation	CLD	
755:M12-2	Odour Management Plan	Odour Management Plan	As per condition 12-3	Compliance Report	Construction		CLD	

Audit Code	Subject	Requirement	How	Evidence	Phase	Timeframe	Status	Further Information
755:M12-3	Odour Management Plan	Action The proponent shall prepare an Odour Management Plan	The Plan shall address: 1) Initial dynamic olfactometry determination; 2) The biofilter acclimation period; 3) Procedures for the replacement of the biofilter media; 4) Regular checks of biofilter loading to ensure that the biofilter is balanced and to identify any short circuits (e.g. surface flow rate measurements and smoke tests);; 5) Size of the stack; 6) Compliance with odour criteria and trigger mechanisms for remedial actions; 7) Regular qualitative determination of odour from facility; 8) Odour surveys every five years; 9) Contingency plans during upset or maintenance conditions; 10) Contingency plans in the event of exceedances; 11) Complaint registration, investigation and response	Compliance Report	Construction		CLD	
755:M12-4	Odour Management Plan	The proponent shall implement the Odour Management Plan	As per Condition 12-3	Compliance Report	Operation		**C**	**No non-compliances identified in 2020-21.**
755:M12-5	Odour Management Plan	The proponent shall make the Odour Management Plan publicly available in a manner approved by the CEO	Carry out the following: 1) Post document on proponents website; 2) Provide document to members of the public upon request; 3).Post document on the internal Corporate EMS Portal.		Construction		CLD	OMP available on the Water Corporation website: https://www.watercorporation.com.au/about-us/our-performance/ocean-outfall/alkimos-monitoring-program
755:M12-6	Odour Management Plan	The proponent shall operate the plant at all times to ensure odour at all adjacent odour sensitive premises meets criterion for odours set out in Condition 12-7		Compliance Report	Operation		**C**	**The AWRRF was operated in accordance with the OMP, ensuring the criterion for odours as specified in condition 12-7 was met. (As per letter of 11th Aug 2021, ref nexus-121943258)**
755:M12-7	Odour Management Plan	Odour Management Plan	The odour criterion referred to in Condition 12-6 shall be 5 odour units (OU) (based on the 99.9 percentile 1 hour averaging Australia Standard OU) or as specified by the CEO from time to time through amendment of the operating licence issued under Part V of the Environment Protection Act 1986	Compliance Report	Operation	As specified by the CEO from time to time	**C**	**The AWRRF was operated in accordance with the OMP, ensuring the criterion for odours as specified in condition 12-7 was met. (As per letter of 11th Aug 2021, ref nexus-121943258)**
755:M13.1	Decommissioning and Closure Plan	The Proponent shall at least two years prior to the anticipated date of decommissioning and closure, or at a time agreed by the Environmental Protection Authority, prepare and submit a Decommissioning and Closure Plan (the Plan) that meets the requirements of Condition 13-2 as determined by the Minister for the Environment		Submission of the Decommissioning and Closure Plan	Operation	At least two years prior to the anticipated date of decommissioning and closure, or at a time agreed by the EPA	**NR**	
755:M13.2	Decommissioning and Closure Plan	Prepare a Decommissioning and Closure Plan	Plan shall address: 1) Removal or, if appropriate, retention of plant and infrastructure in consultation with relevant stakeholders; 2) Rehabilitation to a standard suitable for the agreed new land use(s); and 3) Identification of contaminated areas, including provision of evidence of notification and proposed management measures to the relevant statutory authorities	Decommissioning and Closure Plan and copies of letters to relevant authorities identifying any contaminated areas and management measures.	Operation		**NR**	
755:M13.3	Decommissioning and Closure Plan	The proponent shall implement the Plan until such time as the Minister for the Environment determines, on advice of the Environmental Protection Authority, that the proponents decommissioning and closure responsibilities have been fulfilled		Compliance Report	Decommissioning	Until such time as the Minister for the Environment determines, on advice of the EPA, that the proponents decommissioning and closure responsibilities have been fulfilled	**NR**	
755:M13.4	Decommissioning and Closure Plan	The proponent shall make the Decommissioning and Closure Plan publicly available in a manner approved by the CEO	Carry out the following: 1) Post document on proponents website; 2) Provide document to members of the public upon request; 3).Post document on the internal Corporate EMS Portal.	Provision of link to the website	Decommissioning	Upon submission of the plan	**NR**	

APPENDIX A: MARINE MONITORING RESULTS – ASOOM ANNUAL COMPLIANCE REPORT (BMT, JUN 2021) – Nexus # 121176814

Alkimos Strategic Ocean Outlet Monitoring Program

2020–2021 Annual Report Card



WATER CORPORATION

This report has been prepared for Water Corporation by BMT, September 2021, Report Number R-1137_06-1.

Document history

Distribution

Revision	Author	Recipients	Organisation	No. copies & format	Date
A	L Synnot	M Lourey	BMT	1 x docm	25/06/2021
B	L Synnot	C Byers	Water Corporation	1 x pdf	22/07/2021
0	L Synnot	C Byers	Water Corporation	1 x pdf	14/09/2021

Review

Revision	Reviewer	Intent	Date
A	M Lourey	Technical and Editorial Review	19/07/2021
B	C Byers	Client Review	14/09/2021

Quality Assurance

WWW.JAS-ANZ.ORG/REGISTER

BMT Commercial Australia Pty Ltd has prepared this report in accordance with our Integrated Management System, certified to OHSAS18001, ISO14001 and ISO9001

Status

This report is 'Draft' until approved for final release by the Project Director (or their authorised delegate) as indicated below by signature. A Draft report may be issued for review with intent to generate a 'Final' version but must not be used for any other purpose.

Approved for final release:

Environment Team Lead

Date: 14/09/2021

Contents

Introduction

This annual report card documents the results of Water Corporation's 2020–2021 Alkimos Strategic Ocean Outlet Monitoring (ASOOM) program as required by the Marine Treated Wastewater Discharge Monitoring & Management Plan (MTWDM&MP, Water Corporation 2016), implemented pursuant to Condition 11–4 of Ministerial Statement 755. Results are reported in context of the Environmental Quality Management Framework (EQMF) described in EPA (2017). The results are summarised in Report Card format for each relevant Environmental Quality Objective (EQO) (Water Corporation 2016). The report cards contain colour-coded results, with the individual colours representing the extent to which the Environmental Quality Criteria (EQC) were met (Table 1). The EQC consist of Environmental Quality Guidelines (EQGs) and Environmental Quality Standards (EQSs) and are applied as indicators to assess if EQOs are met.

Table 1 Summary report card legend

Management response	Colour
Monitor: EQG/EQS met (continue monitoring)	
Investigative: EQG not met (investigate against the EQS)	
Action: EQS not met (management response required)	

Note:
1. The required response following an exceedance of either the Environmental Quality Guideline (EQG) or Environmental Quality Standard (EQS) is shown in parentheses.

EQO1 – Maintenance of Ecosystem Integrity

The EQO 'Maintenance of Ecosystem Integrity' aims to ensure the continued health and productivity of the coastal ecosystem. All EQGs for the Maintenance of Ecosystem Integrity were met (Table 2).

Table 2 Assessment against Environmental Quality Guidelines for the Maintenance of Ecosystem Integrity EQO1 for Alkimos ocean outlet

<table>
<tr><th>Indicator</th><th>Environmental Quality Guideline</th><th>Results</th><th>Compliance</th></tr>
<tr><td colspan="4">Toxicants in treated wastewater (TWW) – comprehensive treated wastewater characterisation</td></tr>
<tr><td>Bioaccumulating toxicants</td><td>Concentrations of contaminants not to exceed the ANZECC/ARMCANZ (2000) 80% species protection guideline for bioaccumulating toxicants at the diffuser</td><td>Concentrations of cadmium and mercury in the undiluted TWW stream were both below the ANZECC/ARMCANZ (2000) 80% species protection guideline (Table 2a; Appendix A).</td><td></td></tr>
<tr><td>Non bioaccumulating toxicants</td><td>Concentrations of contaminants not to exceed the ANZECC/ARMCANZ (2000) 99% species protection guideline for toxicants (with the exception of cobalt, where the 95% species protection guideline will apply) after dilution equivalent to that expected at the boundary of the LEPA</td><td>Contaminant concentrations in the TWW sampled on 19 January 2021 were lower than the ANZECC/ARMCANZ (2000) 99% species protection guidelines after dilution (1:234) equivalent to that expected at the LEPA boundary (Table 2a; Appendix B).
Table 2a Contaminants in the Alkimos treated wastewater stream prior to and after initial dilution compared to relevant guidelines
<table>
<tr><th>Contaminant</th><th>Alkimos TWW concentration[1,2]</th><th>TWW concentration following dilution [1,2,3]</th><th>Guideline[1,4,5]</th></tr>
<tr><td>Ammonia-N</td><td>3300</td><td>17.1</td><td>500</td></tr>
<tr><td>Cadmium[5,9]</td><td><0.1</td><td>–</td><td>36</td></tr>
<tr><td>Chromium[6,9]</td><td>1.2</td><td>0.005</td><td>7.7 (Cr III)</td></tr>
<tr><td>Copper[9]</td><td>7.6</td><td>0.1</td><td>2.2</td></tr>
<tr><td>Lead[9]</td><td><1</td><td>–</td><td>7</td></tr>
<tr><td>Mercury[5,9]</td><td>0.18</td><td>0.001</td><td>0.1</td></tr>
<tr><td>Nickel[9]</td><td>1.4</td><td>–</td><td>7</td></tr>
<tr><td>Silver[9]</td><td><0.8</td><td>–</td><td>0.8</td></tr>
<tr><td>Zinc[9]</td><td>46</td><td>0.3</td><td>7</td></tr>
<tr><td>Chloropyrifos[7]</td><td><0.1</td><td>–</td><td>0.0005</td></tr>
<tr><td>Endrin</td><td><0.001</td><td>–</td><td>0.004</td></tr>
<tr><td>Endosulfan sulfate[8]</td><td><0.001</td><td>–</td><td>0.005</td></tr>
<tr><td>1,2,4-Trichlorobenzene</td><td><20</td><td>–</td><td>20</td></tr>
<tr><td>Benzene</td><td><1</td><td>–</td><td>500</td></tr>
<tr><td>Naphthalene</td><td><0.01</td><td>–</td><td>50</td></tr>
<tr><td>Benzo(g,h,i)perylene</td><td><0.01</td><td>–</td><td>50</td></tr>
</table>
Notes:
1. ANZECC/ARMCANZ (2000) guidelines used as per Water Corporation (2016). Assessment against ANZECC/ARMCANZ (2000) 99% species protection guideline values (µg/L) was undertaken only for those contaminants where guideline levels were available.
2. TWW = Treated wastewater expressed in micrograms per litre (µg/L).
3. Initial dilution = 1:234 (worst case scenario for Alkimos outlet). Dilution calculations were not performed (–) on contaminants where concentrations were below the analytical limit of reporting.
4. Guidelines for marine waters are from Table 3.4.1 of ANZECC/ARMCANZ (2000). The WA EPA advises 99% species protection guidelines apply to marine waters of high level of protection.
5. The bioaccumulating toxicants cadmium and mercury must meet the 80% species protection guidelines at the diffuser (i.e. prior to initial dilution), and therefore a diluted concentration was not calculated.
6. Total chromium (Cr) dissolved in TWW is predominantly Cr III. The total chromium concentration is assessed against the Cr III guideline as analytical detection limits cannot achieve the ANZECC/ARMCANZ (2000) guideline for Cr VI (0.14 µg/L). Until detection limits required for direct comparison can be achieved by commercial laboratories, WET testing will provide a test of the toxicity of the wastewater stream (see below).</td><td></td></tr>
</table>

		7. Analytical limits for Chloropyrifos were not low enough to confirm exceedance of, or compliance with, the ANZECC/ARMCANZ (2000) guidelines. Until detection limits required for direct comparison can be attained by commercial laboratories, WET testing will provide a test of the toxicity of the wastewater stream (see Appendix C). 8. Guidelines are for endosulfan, not endosulfan sulfate (Table 3.4.1; ANZECC/ARMCANZ 2000). 9. Concentrations are dissolved metals 0.45 µm filtered.	
	The total toxicity of the mixture for the additive effect of ammonia, copper and zinc (as per ANZECC/ARMCANZ (2000) guidelines) must be <1.0.	The TTM for the additive effect of ammonia, copper and zinc after initial dilution (1:234) was 0.51 and below the ANZECC/ARMCANZ (2000) guideline value of 1.0.	■
Whole of Effluent Toxicity (WET) Testing	The EQG is exceeded if the following the 1-hour sea urchin test: $\frac{TDA}{DRNOEC} \leq 1.0$ Where TDA = Typical Dilutions Achieved (constant based on 200-fold dilution) DRNOEC = Number of dilutions required to achieve the No Observed Effects Concentration (NOEC).	For all four sampling dates the NOEC was greater than 1% TWW. The lowest NOEC during the reporting period was 25%. Only 4 dilutions with background seawater are required to achieve this NOEC which is lower than the dilutions typically achieved at the LEPA boundary (1:234; Appendix C).	■
Receiving water physico/chemical measures			
Nutrient enrichment	Ambient value of defined area during non-river flow period for chlorophyll-a is not to exceed the 80th percentile of the combined reference site data.	Median chlorophyll-a concentration in surface waters (0.25 µg/L) at the boundary of the low ecological protection area (~100 m down current) was lower than the 80th percentile of historical reference site concentrations (0.50 µg/L) Appendix E).	■
Toxicants in sediments			
Sediment quality	If either Trigger A or Trigger B is not met, the EQG for toxicants in sediments is exceeded: A. Median sediment total contaminant concentration from a defined sampling area should not exceed the guideline value for high, moderate and low ecological protection areas. B. Total contaminant concentration at individual sample sites should not exceed the guideline re-sampling trigger. If so, repeat sampling will be conducted to define the extent of the contamination which will be assessed as per trigger A.	Median concentration of toxicants in sediments did not exceed the guideline value for high, moderate and low ecological protection areas and total concentrations at individual sample sites did not exceed the guideline re-sampling trigger as per Table 6 of Water Corporation (2016) (Appendix E).	■

Note:
1. Green (■) symbols indicate the Environmental Quality Criteria (EQC) were met; amber (■) and red (■) symbols represent an exceedance of the Environmental Quality Guideline (EQG) or Environmental Quality Standard (EQS), respectively.

EQO2 – Maintenance of Aquatic Life for Human Consumption

The EQO ‘Maintenance of Aquatic Life for Human Consumption’ aims to ensure there is low risk to the health of human consumers of seafood, which may be exposed to toxicants within the treated wastewater (TWW) stream (Table 3). All EQGs for the Maintenance of Aquatic Life for Human Consumption were met (Table 3).

Table 3 Assessment against Environmental Quality Guidelines for Maintenance of Aquatic Life for Human Consumption EQO2 for Alkimos ocean outlet

Indicator	Environmental Quality Guideline	Results	Compliance
Thermotolerant Coliforms (TTC)	The median TTC bacterial concentration should not exceed 14 CFU 100 mL.	The median TTC concentration at the S2 boundary intercept was below 14 CFU/100 mL (Appendix F).	■
	No more than 10% of the samples exceeding 21 CFU 100 mL measured using the membrane filtration method.	There were no TTC samples that exceeded 21 CFU/100 mL and therefore the percentage of samples that exceeded 21 CFU/100 mL was zero (Appendix F).	■

Notes:
1. Green (■) symbols indicate the Environmental Quality Criteria (EQC) were met; amber (■) and red (■) symbols represent an exceedance of the Environmental Quality Guideline (EQG) or Environmental Quality Standard (EQS), respectively.
2. Sample size = 8 for EQC assessment - NHMRC (2008) guidelines and EPA (2005) suggest that a minimum of 100 samples over the non-river flow period are needed for accurate assessment of the microbial water quality EQC.

EQO3 – Maintenance of Primary and Secondary Contact Recreation

The EQO ‘Maintenance of Primary Contact Recreation’ aims to ensure that waters are safe for swimmers and recreational water activities including boating, water sports. All EQGs for the Maintenance of Primary and Secondary Contact Recreation were met (Table 4).

Table 4 Assessment against Environmental Quality Guidelines for Maintenance of Primary Contact Recreation EQO3 for Alkimos ocean outlet

Indicator	Environmental Quality Guideline	Results	Compliance
Faecal pathogens	The maximum value of the pooled *Enterococci* spp. must not exceed the National Health and Medical Research (NHMRC) Category A guideline value of (≤ 40 *Enterococci* spp. MPN/100 mL) for recreational water bodies (NHMRC 2008).	The maximum pooled *Enterococci* spp. value at the S3 boundary intercept was at the laboratory detection limit (<10 MPN/100 mL) and below the NHMRC (2008) Category A guideline (Appendix F).	■

Note:
Green (■) symbols indicate the Environmental Quality Criteria (EQC) were met; amber (■) and red (■) symbols represent an exceedance of the Environmental Quality Guideline (EQG) or Environmental Quality Standard (EQS), respectively.

References

ANZECC/ARMCANZ (2000) National Water Quality Management Strategy Paper No 4 – Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Volume 1 – The Guidelines (Chapters 1–7). Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand, Canberra, Australian Capital Territory, October 2000

EPA (2005) Environmental Quality Criteria Reference Document for Cockburn Sound (2003–2004) – A supporting document to the State Environmental (Cockburn Sound) Policy 2005. Environmental Protection Authority, Report No. 20, Perth, Western Australia, January 2005

EPA (2017) Environmental Quality Criteria Reference Document for Cockburn Sound – A Supporting Document to the State Environmental (Cockburn Sound) Policy 2015. Environmental Protection Authority, Perth, Western Australia, April 2017

NHMRC (2008) Guidelines for Managing Risks in Recreational Water. National Health and Medical Research Council, Canberra, Australian Capital Territory, February 2008

Water Corporation (2016) Alkimos Wastewater Treatment Plant – Marine Treated Wastewater Discharge Monitoring and Management Plan. Perth, Western Australia

Appendix A – Alkimos comprehensive treated wastewater analysis

Table A.1 Alkimos ocean outlet treated wastewater contaminants prior to and after initial dilution compared to ANZECC/ARMCANZ (2000) guidelines for marine waters

Contaminant	TWW	TWW after initial dilution	Level of protection (%species)	
			99%	80%
Microbiological (CFU/100 mL, unless indicated)				
Confirmed *Enterococci*[6]	1400 (MPN/100 mL)		n/a	n/a
Confirmed Thermotolerant Coliforms (TTC)[7]	20,000		n/a	n/a
Escherichia coli	16,000		n/a	n/a
Nutrients (µg L^{-1})				
Ammonia-N	**3300**	17.1	500	1,700
Nitrate-N+Nitrite-N	1000		ID[5]	ID
Nitrogen-Total N	5400		n/a	n/a
Phosphate-Ortho as P	2200		n/a	n/a
Phosphorous-Total P	2200		n/a	n/a
"Dissolved" Metals (0.45 µm filtered) (µg L^{-1})				
Arsenic (As)	<1		ID	ID
Cadmium (Cd)	<0.1	-	0.7	36
Chromium (Cr)	**1.2**	0.005	7.7 (Cr III) 0.14 (Cr VI)	90.6 (Cr III) 85 (Cr VI)
Copper (Cu)	**7.6**	0.1	0.3	8
Lead (Pb)	<1	-	2.2	12
Mercury (Hg)	**0.18**	0.001	0.1	1.4
Nickel (Ni)	1.4	-	7	560
Selenium (Se)	<1		ID	ID
Silver (Ag)	<0.8	-	0.8	2.6
Zinc (Zn)	**46**	0.3	7	43
Total Metals (Acid extractable; unfiltered) (µg L^{-1})				
Arsenic (As)	<1		ID	ID
Cadmium (Cd)	<0.1	-	0.7	36
Chromium (Cr)[1]	**1.5**	0.005	7.7 (Cr III) 0.14 (Cr VI)	90.6 (Cr III) 85 (Cr VI)
Copper (Cu)	**7.4**	0.1	0.3	8
Lead (Pb)	<1	-	2.2	12
Mercury (Hg)	<0.1	-	0.1	1.4
Nickel (Ni)	1.4	-	7	560
Selenium (Se)	<1		ID	ID
Silver (Ag)	<0.8	-	0.8	2.6
Zinc (Zn)	**50**	0.3	7	43
Triazine Herbicides (µg L^{-1})				
Atrazine	<0.1		ID	ID
Hexazinone	<0.1		ID	ID
Metribuzin	<0.1		n/a	n/a
Prometryn	<0.1		n/a	n/a
Simazine	<0.1		ID	ID

Phenoxy Acid Herbicides (µg L^{-1})				
Dicamba[8]	<1		n/a	n/a
MCPA	<1		ID	ID
Dichlorprop	<1		n/a	n/a
2,4-D	<1		ID	ID
2,4,5-T	<1		n/a	n/a
2,4,5-TP	<1		n/a	n/a
2,4-DB	<1		n/a	n/a
MCPP	<1		n/a	n/a
Triclopyr[9]	<1		n/a	n/a
Picloram	<1		n/a	n/a
Clopyralid	<1		n/a	n/a
Fluroxypyr	<1		n/a	n/a
Diclofop-methyl	<1		n/a	n/a
Haloxyfop-methyl	<1		n/a	n/a
Dinoseb	<1		n/a	n/a
Fluazifop	<1		n/a	n/a
Organophosohate Pesticides (µg L^{-1})				
Azinphos-Methyl	<0.1		ID	ID
Azinphos-Ethyl	<0.1		n/a	n/a
Chlorpyrifos	<0.1	-	0.0005	0.3
Chlorpyrifous Methyl	<0.1		n/a	n/a
Chlorfenvinphos (E)	<0.1		n/a	n/a
Chlorfenvinphos (Z)	<0.1		n/a	n/a
Demeton-S-Methyl	<0.1		ID	ID
Dichlorvous	<0.1		n/a	n/a
Diazinon	<0.1		ID	ID
Dimethoate	<0.1		ID	ID
Ethion	<0.1		n/a	n/a
Fenthion	<0.1		n/a	n/a
Fenitrothion	<0.1		ID	ID
Malathion	<0.1		ID	ID
Parathion (Ethyl)	<0.1		ID	ID
Parathion Methyl	<0.1		n/a	n/a
Pirimiphos-Ethyl[10]	<0.1		n/a	n/a
Pirimiphos-Methyl[11]	<0.1		n/a	n/a
Organochlorine Pesticides (µg L^{-1})				
Aldrin	<0.001		ID	ID
trans-Chlordane[12]	<0.001		ID	ID
cis-Chlordane[12]	<0.001		ID	ID
Oxychlordane[12]	<0.001		ID	ID
gamma-BHC (Lindane)	<0.001		ID	ID
alpha-BHC	<0.001		n/a	n/a
beta-BHC	<0.001		n/a	n/a
delta-BHC	<0.001		n/a	n/a
p,p-DDD	<0.001		n/a	n/a
p,p-DDE	<0.001		ID	ID
p,p-DDT	<0.001		ID	ID
Dieldrin	<0.001		ID	ID
Endrin	<0.001	-	0.004	0.02

Endrin Aldehyde	<0.001		n/a	n/a
Endrin Ketone	<0.001		n/a	n/a
alpha-Endosulfan	<0.001		ID	ID
beta-Endosulfan	<0.001		ID	ID
Endosulfan Sulfate[13]	<0.001	-	0.005	0.05
HCB (Hexachlorobenzene)	<0.001		ID	ID
Heptachlor	<0.001		ID	ID
Heptachlor epoxide	<0.001		n/a	n/a
Methoxychlor	<0.001		ID	ID
Phthalates (µg L^{-1})				
Dimethyl phthalate	<10		ID	ID
Diethyl phthalate	<10		ID	ID
Di-n-butyl phthalate	<10		ID	ID
Butyl benzyl phthalate	<10		n/a	n/a
Bis(2-ethylhexyl) phthalate	<20		ID	ID
Di-n-octyl phthalate	<10		n/a	n/a
PCB Aroclors (µg L^{-1})				
Aroclor 1016	<0.1		ID	ID
Aroclor 1221	<0.1		ID	ID
Aroclor 1232	<0.1		ID	ID
Aroclor 1242	<0.1		ID	ID
Aroclor 1248	<0.1		ID	ID
Aroclor 1254	<0.1		ID	ID
Aroclor 1260	<0.1		ID	ID
Total PCB's (as above)[14]	<0.1		ID	ID
Chlorinated hydrocarbons (µg L^{-1})				
2-Chloronaphthalene	<20		n/a	n/a
1,4-Dichlorobenzene	<20		ID	ID
1,2-Dichlorobenzene	<20		ID	ID
1,3-Dichlorobenzene	<20		ID	ID
Hexachlorobenzene	<20		ID	ID
1,2,4-Trichlorobenzene	<20	-	20	240
Hexachloroethane	<20		ID	ID
Hexachlorocyclopentadiene	<20		ID	ID
Hexachloro-1,3-butadiene[15]	<20		ID	ID
Ethers (µg L^{-1})				
4-Bromophenyl phenyl ether[16]	<20		n/a	n/a
4-Chlorophenyl phenyl ether	<20		n/a	n/a
Bis(2-chloroethyl)ether	<20		n/a	n/a
Bis(2-chloroethoxy)methane	<20		n/a	n/a
Bis(2-chloroisopropyl)ether	<20		n/a	n/a
Amines, Nitroaromatics & Nitrosamines (µg L^{-1})				
Azobenzene	<20		n/a	n/a
2,4-Dinitrotoluene	<20		ID	ID
2,6-Dinitrotoluene	<20		n/a	n/a
Nitrobenzene	<20		ID	ID
N-Nitrosodimethylamine	<20		n/a	n/a
N-Nitrosodiphenylamine	<20		ID	ID

N-Nitrosodi-n-propylamine	<20		n/a	n/a
Aniline	<20		ID	ID
4-Chloroaniline	<20		n/a	n/a
2-Nitroaniline	<20		n/a	n/a
3-Nitroaniline	<20		n/a	n/a
4-Nitroaniline	<20		n/a	n/a
Other Compounds (µg L^{-1})				
Dichlorobenzidine[17]	<20		ID	ID
2-Methylnaphthalene	<10		n/a	n/a
Isophorone	<20		ID	ID
Benzyl alcohol	<20		n/a	n/a
Carbazole	<20		n/a	n/a
Dibenzofuran	<20		n/a	n/a
BTEX (µg L^{-1})				
Benzene	<1	-	500	1300
Toluene	<1		ID	ID
Ethylbenzene	<1		ID	ID
Xylene[18]	<1		ID	ID
Total BTEX[18]	<5		n/a	n/a
Total Petroleum Hydrocarbons (µg L^{-1})				
TPH C6 - C9	<25		ID	ID
TPH C10 - C14	<25		ID	ID
TPH C15 - C28	<100		ID	ID
TPH C29 - C36	<100		ID	ID
Total TPH[19]	<250		ID	ID
Polycyclic Aromatic Hydrocarbons (µg L^{-1})				
Naphthalene	<0.01		50	120
Acenaphthylene	<0.01		n/a	n/a
Acenaphthene	<0.01		n/a	n/a
Fluorene	<0.01		n/a	n/a
Phenanthrene	<0.01		ID	ID
Anthracene	<0.01		ID	ID
Fluoranthene	<0.01		ID	ID
Pyrene	<0.01		n/a	n/a
Benz(a)anthracene	<0.01		n/a	n/a
Chrysene	<0.01		n/a	n/a
Benzo(b,k)fluoranthene	<0.01		n/a	n/a
Benzo(a)pyrene	<0.01		n/a	n/a
Indeno(1,2,3-cd)pyrene	<0.01		n/a	n/a
Dibenz(a,h)anthracene	<0.01		n/a	n/a
Benzo(g,h,i)perylene	<0.01	-	50	120
Total PAH's (as above)	<0.16			
Surfactant (µg L^{-1})				
Methylene Blue Active Substances (MBAS)[20]	<0.50		n/a	n/a

Miscellaneous other (µg L^{-1}unles indicated)				
Chlorine-Free	<10		ID	ID
Chlorine-Total	<10		ID	ID
Dissolved Organic Carbon (DOC)	8300		n/a	n/a
Total Organic Carbon (TOC)	8800		n/a	n/a
Total Suspended Solids (TSS)[21]	3000		n/a	n/a
Biological Oxygen Demand (BOD)	<5000		n/a	n/a
pH[22]	8.2 (pH)			

Notes:

1. Guidelines for marine waters are from Table 3.4.1 in ANZECC/ARMCANZ (2000). The WA EPA advises a high level of protection requires application of the 99% species protection guidelines with the exception of mercury and cadmium where an 80% species protection level applies.
2. TWW = treated wastewater.
3. Bold text represents exceedance of relevant guidelines in the undiluted TWW prior to initial dilution.
4. n/a = ANZECC/ARMCANZ (2000) Guideline or Low Reliability Value not available for this parameter.
5. ID = insufficient data to derive a reliable national guideline.
6. Primary and secondary contact guideline for recreational marine waters 35 and 230 Enterococci organisms 100 mL-1, respectively (ANZECC/ARMCANZ 2000).
7. Primary contact guideline for recreational marine waters 150 and 1,000 faecal coliforms 100 mL-1 (ANZECC/ARMCANZ 2000), respectively.
8. Recreational guideline for Dicamba = 300 µg L-1 (Table 5.2.4; ANZECC/ARMCANZ 2000).
9. Recreational guideline for Triclopyr = 20 µg L-1 (Table 5.2.4; ANZECC/ARMCANZ 2000).
10. Recreational guideline for Pirimiphos-ethyl = 1 µg L-1 (Table 5.2.4; ANZECC/ARMCANZ 2000).
11. Recreational guideline for Pirimiphos-methy = 60 µg L-1 (Table 5.2.4; ANZECC/ARMCANZ 2000).
12. Guidelines are for total chlordane, however; cis-chlordane is around 7 times more toxic than transchlordane (ANZECC/ARMCANZ 2000).
13. Guideline for Endosulphan, not Endosulphan sulfate (Table 3.4.1; ANZECC/ARMCANZ 2000).
14. ANZECC/ARMCANZ (2000) recommends using a formula to calculate total toxicity of the mixture if using total PCBs and BTEX (page 8.3–65; ANZECC/ARMCANZ 2000).
15. Environmental Concern Level (ECL) for Hexachloro-1,3–butadiene (not LRV) (definition of ECL on page 8.3–35; page 8.3-231; ANZECC/ARMCANZ 2000).
16. Recommended ECL for 4-Bromophenyl phenyl ether = 12 µg L-1 (page 8.3–232; ANZECC/ARMCANZ 2000).
17. ECL for Dichlorobenzidine (not LRV) (page 8.3–187; ANZECC/ARMCANZ 2000).
18. Guideline for o-Xylene = 350 µg L-1, for m-xylene = 75 µg L-1 and for p-xylene = 200 µg L-1 (ANZECC/ARMZANC 2000).
19. A generic estimate of 7 µg L-1 for a total petroleum hydrocarbon chronic value has been estimated using USEPA methods (page 8.3–297; ANZECC/ARMCANZ 2000).
20. Recreational guideline for MBAS = 200 µg L-1 (ANZECC/ARMCANZ 2000).
21. Suspended solids guidelines for the protection of saltwater aquaculture species = <10,000 µg L-1 (Table 4.4.2; ANZECC/ARMCANZ 2000).
22. pH guideline range for slightly disturbed inshore marine ecosystems in south-west Australia = 8.0–8.4 (Table 3.3.6; ANZECC/ARMCANZ 2000.

Appendix B – Initial Dilution Modelling Outputs for Comprehensive Treated Wastewater Analysis

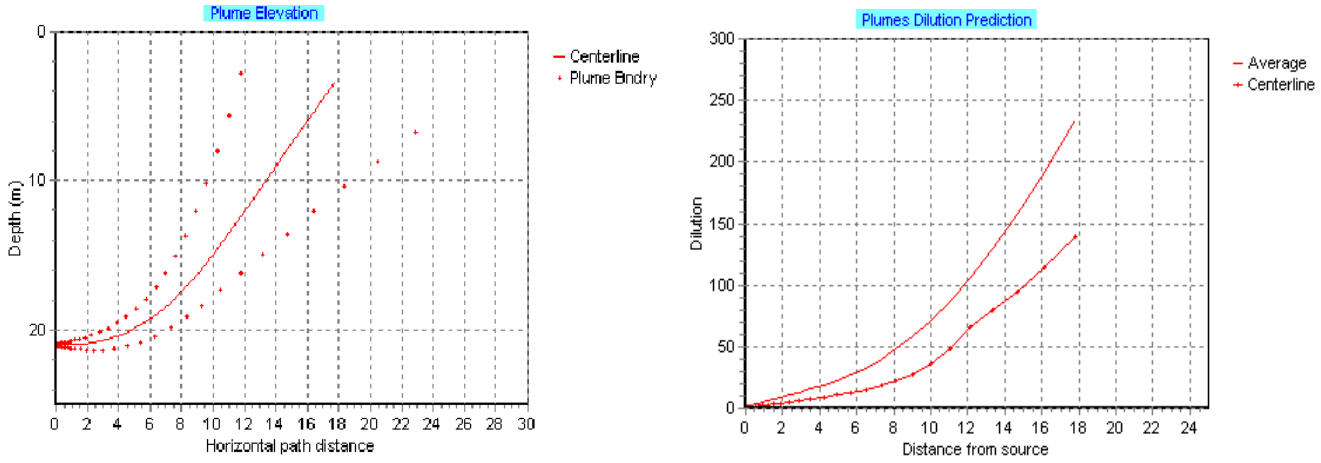
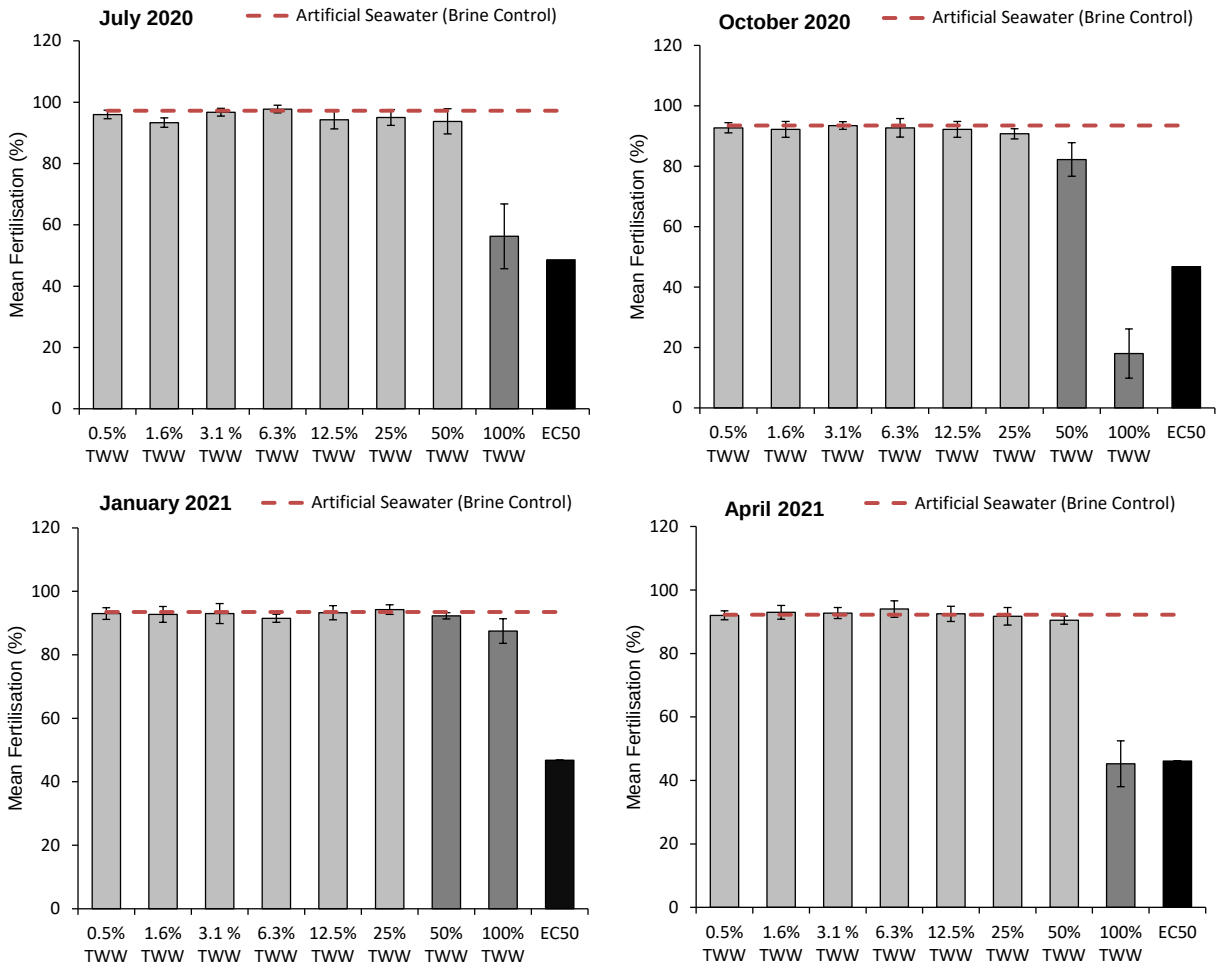


Figure B.1 **Initial dilution modelling outputs predicted average (left) and centerline dilutions predicted plume elevation (right) trajectory for Alkimos ocean outlet 19 January 2021**

```
/ Windows UM3.  /2/2021 4:45:45 PM
Case 1; ambient file c:\plumes\VP plume 15.001.db; Diffuser table record 1: ----------------------------------
      Depth     Amb-cur     Amb-dir     Amb-sal     Amb-tem     Amb-pol       Decay     Far-spd     Far-dir     Disprsn
          m         m/s         deg         psu           C       kg/kg        s-1         m/s         deg   m0.67/s2
        0.0       0.127      -49.09        22.8       36.24         0.0         0.0         0.0         0.0         0.0
       20.5       0.034      -49.09       22.59        36.4         0.0         0.0         0.0         0.0         0.0
   P-dia  P-elev V-angle H-angle   Ports Spacing AcuteMZ ChrncMZ P-depth Ttl-flo Eff-sal    Temp Polutnt
     (m)     (m)   (deg)   (deg)      ()      (m)     (m)     (m)     (m)   (MLD)   (psu)     (C) (kg/kg)
     0.1     1.0     0.0  -49.09     6.0     3.0    50.0   100.0    21.0    12.5     0.6    28.4     0.1
Froude number:      26.56
        Depth  Amb-cur    P-dia  Polutnt    Dilutn  CL-diln   x-posn   y-posn
Step      (m)   (cm/s)      (m)  (kg/kg)        ()       ()      (m)      (m)
   0     21.0      3.4      0.1      0.1       1.0      1.0      0.0      0.0;
 100    20.95      3.4    0.689   0.0138      7.16    3.578    0.987   -1.139; axial vel 0.00374
 197    17.54    4.708     3.01  0.00218     45.28    21.03    5.167   -5.963; merging,
 200    17.27    4.827     3.13  0.00205     48.05    22.53     5.33   -6.151;
 280    3.291    11.11    12.32 0.000421     234.2    139.9    11.67   -13.47; surface,
 ;
4:45:45 PM. amb fills: 2
```

Appendix C – Alkimos Ocean Outlet Whole of Effluent Toxicity Testing Results



Notes:

1. Error bars represent ±1 standard deviation.
2. TWW = treated wastewater.
3. Light grey bars represent concentrations of treated wastewater (TWW) at which there is no observed significant effect on fertilisation. Dark grey bars represent concentrations of TWW that acted to significantly reduce the success of sea urchin fertilisation.

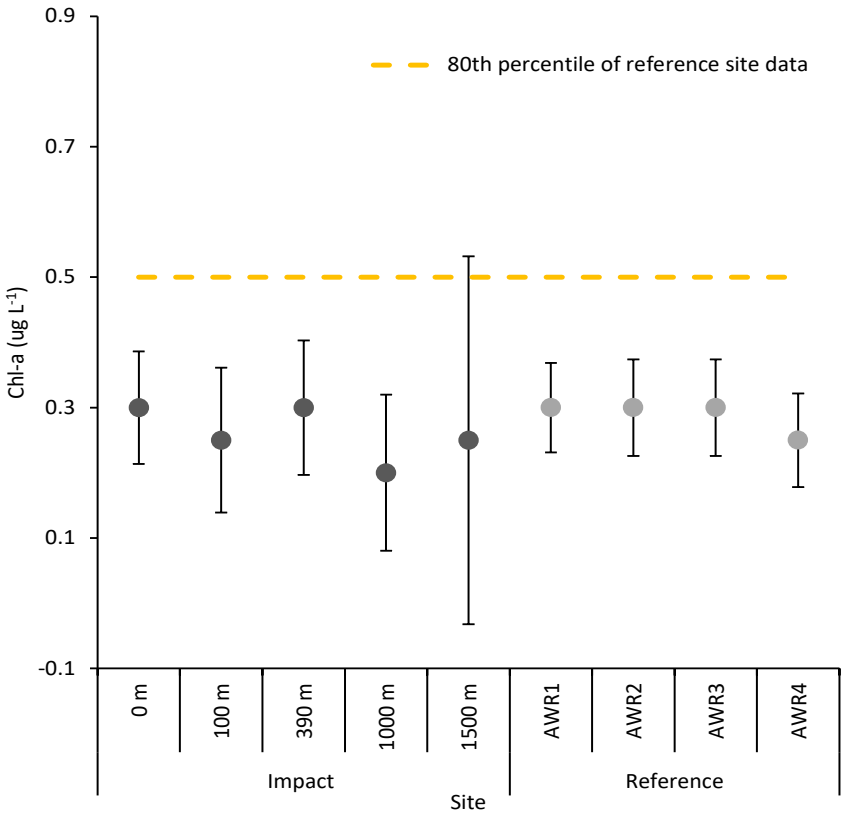
Figure C.1 Comparison of whole effluent toxicity treated wastewater dilution results to artificial seawater control for Alkimos ocean outlet

Table C.1 Calculated parameters from whole of effluent toxicity tests for Alkimos ocean outlet treated wastewater

Indicator	July 2020	October 2020	January 2021	April 2021
NOEC	50%	25%	50%	50%
Dilutions required to meet the NOEC	2	4	2	2
Dilutions required/dilution achieved	0.01	0.02	0.01	0.01
≤1	Yes	Yes	Yes	Yes

Notes:
1. NOEC = no observed effect concentration.
2. Typical dilutions achieved (constant based on 200-fold dilutions.

Appendix D – Physical measures



Notes:
1. (●) distances down current of the surface drogue based on prevailing current direction (●) reference sites.
2. Chl-a=chlorophyll-a.
3. n = 8.
4. Error bars represent ±95% confidence intervals.

Figure D.1 Median chlorophyll-a concentration in surface waters at fixed distances down current of the Alkimos ocean outlet and reference sites compared to the 80th percentile of long-term reference data

Appendix E – Alkimos Ocean Outlet 5-Yearly Sediment Quality Data

Table E.1 Median toxicant concetrations at the Alkimos ocean outlet Low Ecological Protection Aea and Reference Site compared to relevant guidelines

Toxicant	ISQG-Low	LEPA	Reference
Metals			
Aluminium	NA	280	280
Silver	1	0.5	0.5
Arsenic	20	5	5
Cadmium	1.5	0.2	0.2
Chromium	80	13	13
Copper	65	0.3	0.3
Lead	50	0.5	0.5
Mercury	0.15	0.005	0.005
Nickel	21	0.35	0.35
Zinc	200	1	1
Polycyclic Aromatic Hydrocarbons			
Naphthalene	160	0.005	0.005
Acenaphthylene	44	0.005	0.005
Acenaphthene	16	0.005	0.005
Fluorene	19	0.005	0.005
Phenanthrene	240	0.005	0.005
Anthracene	85	0.005	0.005
Fluoranthene	600	0.005	0.005
Pyrene	665	0.005	0.005
Benz(a)anthracene	261	0.005	0.005
Chrysene	384	0.005	0.005
Benzo(b)&(k)fluoranthene	NA	0.005	0.005
Benzo(a)pyrene	430	0.005	0.005
Indeno(1,2,3-cd)pyrene	NA	0.005	0.005
Dibenzo(a,h)anthracene	63	0.005	0.005
Benzo(g,h,i)perylene	NA	0.005	0.005
Polychlorinated Biphenyls (PCBs)			
Aroclor 1016	NA	0.005	0.005
Aroclor 1221	NA	0.005	0.005
Aroclor 1232	NA	0.005	0.005
Aroclor 1242	NA	0.005	0.005
Aroclor 1248	NA	0.005	0.005
Aroclor 1254	NA	0.005	0.005

Total PCBs	23	0.005	0.005

Notes:

1. Results expressed as dry weight in mg/kg.
2. LEPA = Low Ecological Protection Area.
3. LEPA sites = AS1, AS2, AS3, Reference site = ASR1 as per Water Corporation (2016).
4. Results below the respective analytical detection limits were halved to calculate median values.
5. Three replicates collected at each site within each area and median values calculated from pooled replicates for each analyte.
6. ISQG-Low = Interim Sediment Quality Guideline Low (EPA 2017).
7. NA = no trigger value available (EPA 2017).
8. As per the protocol in Water Corporation (2016), analysis of pesticides and herbicides in sediments is undertaken if detected within the Alkimos TWW. The most recent herbicide and pesticides analyses from 4 February 2020 prior to sediment sampling completed on 17 November 2020 were below the limit of analytical detection limit.

Appendix F – Biological measures

Table F.1 Thermotolerant coliforms in bottom waters at the Alkimos ocean outlet S2 boundary intercept

Sample date	Thermotolerant coliforms (CFU/100 mL)
02/12/20	<10*
14/12/20	<10*
07/01/21	<10*
19/01/21	<10*
15/02/21	<10*
22/02/21	<20
05/03/21	<10*
26/03/21	<10*
Median value	**<10**

Notes:
1. *= all data contributing to the median were below the limit of detection.
2. Sample size = 8 for EQC assessment - NHMRC (2008) guidelines and EPA (2005) suggest that a minimum of 100 samples over the non-river flow period are needed for accurate assessment of the microbial water quality EQC.
3. Median value calculated from TTC counts at the S2 boundary intercept pooled across eight sampling occasions (n=8) over December 2020 to March 2021 summer monitoring period.

Table F.2 *Enterococci* spp. concentrations in surface waters at the Alkimos ocean outlet S3 boundary intercept

Sample date	*Enterococci* spp. (MPN/100 mL)
02/12/20	<10*
14/12/20	<10*
07/01/21	<10*
19/01/21	<10*
15/02/21	<10*
22/02/21	<10*
05/03/21	<10*
26/03/21	<10*
Maximum value	**<10**

Notes:
1. *= all data contributing to the maximum values were below the limit of detection.
2. Maximum value calculated from *Enterococci* spp. counts at the S3 intercept pooled across eight sampling occasions (n=8) over December 2020 to March 2021 summer monitoring period.