

Draft Environmental Management Plan (EMP)

**Upgrading and Continued Operations Existing S. I. !Gobs Senior Secondary School
Overflow Catchment (Temporal Detention Holding Ponds) in Omaruru Town,
Erongo Region**



ECC Application No.:

APP-004529

Proponent:

Municipality of Omaruru



Project Consulting Engineer:

Trinitas Consulting Engineers CC



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Appendix 2: A Guide (An Example) of Decommissioning or Relining (Domestic) Wastewater Ponds**LIST OF ABBREVIATIONS**

Abbreviation	Meaning
DEAF	Department of Environmental Affairs and Forestry
DWA	Department of Water Affairs
EAP	Environmental Assessment Practitioner
ECC	Environmental Clearance Certificate
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EMA	Environmental Management Act
EMP	Environmental Management Plan
GG, GN	Government Gazette, Government Notice
HDPE	High-density polyethylene
HIV/AIDS	Human Immunodeficiency Viruses and Acquired Immune Deficiency Syndrome
I&APs	Interested and Affected Parties
MAWLR	Ministry of Agriculture, Water and Land Reform
MEFT	Ministry of Environment, Forestry and Tourism
PPE	Personal Protective Equipment
Reg, S	Regulation, Section
SABS	South African Bureau of Standards
SANS	South African National Standards
SHE Officer	Safety, Health & Safety Officer
TCE	Trinitas Consulting Engineers CC

1 INTRODUCTION

The Municipality of Omaruru (hereinafter referred to as the Municipality or the Proponent) operates a group of three oxidation ponds (Omaruru/Municipal, Ozondje and S. I. !Gobs Senior Secondary School overflow catchment ponds) to manage the sewage in the Omaruru Town, Erongo Region. The school overflow catchment ponds (in Figure 1-1) will be upgraded and rehabilitated for continued operations (by lining them first to bring them up to standard) before they can be used as temporal holding ponds for overflow purposes and/or sump maintenance. The Municipality intends to construct and operate a wastewater treatment Plant (WWT Plant) to treat the sewage and utilize this water for other suitable purposes in the Town. Therefore, the holding ponds are needed as emergency ponds in the event of operational stoppages due maintenance and/or repairs at both the pump stations and the WWT Plant. The combined surface area covered by the ponds to be upgraded is 9,608.37m² (0.96Ha).



Figure 1-1: Locality map of the oxidation ponds to be upgraded for continued use in Omaruru Town, Erongo Region

1.1. Aims of the EMP

Regulation 8 of the Environmental Management Act's (EMA) (7 of 2007) Environmental Impact Assessment Regulations (2012) requires that a draft Environmental Management Plan (EMP) be included as part of an Environmental Assessment (EA) process. A 'management plan' is defined as:

"...a plan that describes how activities that may have significant environments effects on the environment are to be mitigated, controlled and monitored."

An EMP is one of the most important outputs of the EA process as it synthesises all the proposed mitigation and monitoring actions, set to a timeline and with specific assigned responsibilities. It provides a link between the impacts identified in the environmental assessment process and the required environmental management on the ground during project implementation and subsequent operations. It is important to note that an EMP is a legally binding document and a person who contravenes the provisions of this EMP may face imprisonment and/or a fine. This EMP is a living document and should be amended to adapt to address project changes and/or environmental conditions and feedback from compliance monitoring.

The purpose of this document is therefore to guide environmental management throughout the following life-cycle stages of the proposed phases. The project phases are addressed in this EMP are as follows:

- Planning and design - the period during which preliminary legislative and administrative arrangements are carried out in preparation of the ground preparatory works of the ponds, construction (upgrading and rehabilitation) of the ponds, and operational and maintenance.
- Rehabilitation and upgrading – the period during which the existing ponds will be rehabilitated to prepare for the construction (upgrading) to acceptable standards. These will be upgraded and required operational supporting structures and infrastructure will be erected and installed, respectively.
- Operation and maintenance phase - the period during which the upgraded ponds are operational upon handover of site and associated operational infrastructure, and equipment to the Municipality by the Consulting Engineers/ Construction Contractor. The Municipality will be responsible for site maintenance as deemed necessary in collaboration with an external specialist in ponds' operations, where needed.

1.2. Environmental Assessment Practitioner (EAP)

Under the Environmental Impact Assessment (EIA) Regulations (2012) of the Environmental Management Act (EMA) No. 7 of 2007, the proposed project is a listed activity that may not be undertaken without an Environmental Clearance Certificate (ECC). The mentioned EMA Sections relevant to the project are as follow:

- *Listed Activity 2.1 the construction of facilities for waste sites, treatment of waste and disposal of waste.*
- *Listed Activity 8.6 the construction of industrial and domestic wastewater treatment plants and related pipeline systems.*

To comply with the EMA and its 2012 EIA Regulations, the Proponent appointed Mafuta Environmental Consultants CC to develop this EMP and submit the ECC application to the Environmental Commissioner at the Department of Environmental Affairs & Forestry (DEAF) of the Ministry of Environment, Forestry and Tourism (MEFT). The EMP alongside the ECC application will be submitted to MEFT for evaluation and consideration of the ECC.

1.3. Limitations of the EMP

This EMP has been drafted with the acknowledgment of the following limitations:

- The document was compiled as per project information presented to the Environmental Consultant by the Proponent and their Consulting engineers. It was assumed that all the information and data presented was true and accurate.
- The mitigation measures recommended in this document are based on the potential impacts identified based on the project description, site investigation and documents on similar activities globally.
- Should the scope of the proposed project change, appropriate mitigation measures will be provided accordingly.

2 BRIEF DESCRIPTION OF THE PROPOSED PROJECT ACTIVITIES

The proposed project will involve the upgrading of the Town's sewer oxidation ponds. The anticipated associated activities will include site clearance (where necessary), earthworks, concrete works, lining and fencing by the appointed reputable and experienced construction contractor. For interest's sake, oxidation (sewer) ponds or stabilization ponds, are large, shallow ponds designed to treat wastewater through the interaction of sunlight, bacteria, and algae.

The planned upgrading activities are provided under the following subheadings.

2.1. Oxidation (Stabilization) Ponds Mechanism

Oxidation ponds are one of the biological systems which are used for the treatment of wastewater. According to Khan *et al* (2018), an oxidation pond is a shallow body of water contained in an earthen basin, open to sun and air. Longer time of retention from few days to weeks is provided in the pond. The purification of wastewater occurs due to the symbiotic relationship of bacteria and algae. These ponds are classified according to the nature of the biological activity which takes place within the pond as aerobic, and anaerobic. The oxidation pond system is considered as the secondary treatment method by which natural purification and stabilization of wastewaters like domestic sewage, trade waste and industrial effluents is accelerated.

The biological treatment process in the oxidation pond mainly involves an interaction between bacteria, algae, and other organisms. This wastewater treatment method is a simple scientifically designed pond with 2-6 feet (0.6 to 2m) depth, where biological oxygen demand (BOD) reduction of a wastewater takes place by supporting algal-bacterial growth (¹Tharavathy *et al.*, 2013).

2.2. Planning and Design Phase

As part of the planning and design phase, a preliminary layout of the site was drawn by the Engineers and the construction (upgrading) cost determined in the feasibility study by the project planners (Trinitas Consulting Engineers). After the technical and administrative documentations of the planning and design phase are approved (including the ECC) and the preparations for the next phase are finalized, decommissioning activities of the existing oxidation ponds will follow as planned by the project engineers/contractors. However, the technical drawings are underway, thus, not yet available at this stage.

2.2.1. Design and Plans for the Oxidation Ponds

Oxidation ponds are designed to fit the needs and conditions of the sites they would be constructed and operated in. The oxidation ponds will be upgraded within the same area where they are now. The upgraded ponds will be operated in accordance with the Department of Water Affairs (DWA) Regulations, particularly the Code of Practice Volume 2: 2008. The oxidation ponds' site area is sufficient to accommodate the ponds' activities and ensure compliance with the DWA' Codes of Practice for ponds' locations and specifications.

The following upgrading works will be done on the existing ponds that will be fenced off as well:

- Refurbishment of two existing primary ponds and two secondary ponds embankment, and

¹ Tharavathy, N.C., M Krishnamoorthy, M., and Hosetti, B. B. (2013). Oxidation Pond: A Tool for Wastewater Treatment. Karnataka: Research & Reviews: Journal of Ecology and Environmental Sciences.

- Refurbishment and lining (with high-density polyethylene (HDPE)) of the existing evaporation pond embankment.

2.3. Pre-Upgrading of Existing (old) Oxidation Ponds

Prior to site preparation for the upgrading of the oxidation ponds, the six (6) old ponds will need to be rehabilitated as they cannot be used as they are (in their current state). This is done to ensure that there are no further safety, environmental and human health hazards and to provide land/space for the upgraded oxidation ponds.

2.3.1. Handling of Existing & Incoming Sewage during Ponds: Ground Preparatory Works

Given the fact that it is not expected for the Municipality to cease the inflow of wastewater (sewage) from the sewer source to the ponds during the upgrading and rehabilitation of the ponds, the Contractor/Upgrading Contractor may need to decide on carrying out progressive ground preparatory works by determining the feasibility of either of the two options or both:

1. This will need to be done by working one pond at a time to ensure that there is still one or two ponds to still contain incoming wastewater from the Town sources and avoid environmental catastrophe of uncontrolled sewage overflowing into the general surrounding surface area and into groundwater.
2. Alternatively, provision to be made for industry standard temporary storage facilities such as sewage tanks to contain sewage while upgrading of the ponds is carried out.

The decommissioning of these ponds will entail the following:

- The treatment of liquids as well as removal and disposal of biosolids accumulated at the bottom of the ponds. These solids need to be handled properly before re-using the ponds, i.e., for the upgrading of ponds and cleaning up.
- Cleaning up and closure of inactive ponds.
- Proper ground preparatory works, capping and elimination of existing treatment components as well as disposal of waste to relevant approved waste management facilities.
- The ground preparatory works of old ponds should also be planned and done in consultation and collaboration with the Water Environment Division at the Department of Water Affairs of the Ministry of Agriculture, Water and Land Reform (MAWLR) to ensure compliance to Regulations pertaining to handling wastewater.

The most important end component of pond ground preparatory works will be to determine the quantity and quality of the biosolids that will have to be removed from the ponds and the option that will be appropriate for land use or disposal (²Minnesota Pollution Agency, 2010). An example of the (Domestic) Wastewater Pond Decommissioning or Relining Plan is attached hereto as Appendix 2 for further reading and consideration.

2.4. Upgrading (Construction) Works

During this phase, the site aimed for the upgrading works will be prepared to enable the installation and erection of associated infrastructures and structures, respectively.

Earthworks will be carried out on the site for the upgrading of the ponds. The concrete works will be done followed by surface lining of the ponds' base to prevent leaching of effluent into the ground during the operational phase.

To ensure that the ponds are secured and protected from possible public unauthorized access, and most importantly protecting the public, especially local children, a razor mesh fence will be erected around the ponds' area.

Duration for upgrading works: The upgrading activities are anticipated to last between 6 and 12 months.

2.5. Wastewater Temporary Holding Ponds

The slurry (effluent) from the ponds will be treated in the newly constructed WWTP Plant to the quality that is equal or better than the specified acceptable as per the national standards. For consideration to be discharged into the environment, a discharge permit from the Water and Environment Division of the Department of Water Affairs (DWA) at the MAWLR will be required so that the treated water can be safely used in the environment.

The post-treatment use of wastewater can be for crop irrigation (i.e. maize, wheat, etc.), watering parks and industrial use in the Town and or surrounding areas where it may be needed.

² Minnesota Pollution Control Agency. (2010). Retrieved from Decommissioning or Relining Domestic Wastewater Ponds: Requirements and Procedures: <https://www.pca.state.mn.us/sites/default/files/wq-wwtp5-86.pdf>

2.6. Required Resources and Services Infrastructure

2.6.1. Human resources

The site upgrading work will require about fifteen (15) people who will be temporarily employed (both skilled, semi-skilled and unskilled) as the major part of the work is machine based. Priority for employment will be given to the locals for any project related job that they are qualified for or capable of carrying out.

2.6.2. Contractors' accommodation

The project workforce (workers) for the work activities will be accommodated in Omaruru Town's existing accommodation facilities (for out of town skilled workers). Local workers from the Town will be commuting from their homes. Therefore, no onsite accommodation will be required.

2.6.2. Vehicles and machinery

Light, medium, and heavy vehicles will be required for different project activities. The heavy vehicles will include water trucks, dumping and flat-black trucks, excavators, etc. These trucks will be needed to transport and or move project materials and equipment to and from site (as needed).

The light vehicles such as 4x4 pick-up trucks and small buses will be used to transport workers around, to and from site (as and when required). Medium vehicles such as excavators will be used to carry out earthworks and other related activities, where necessary.

2.6.3. Water supply

A certain amount of water will be required for concrete works and other related project activities and human consumption (drinking water) onsite. Some water may be needed for project activities such as dust suppression, if necessary, but the exact volume of water required is not known at this stage. The required water will either be sourced from the Municipality supply line.

2.6.4. Fuel Supply

Diesel will be used for machinery and equipment and fuel generator to ensure an interrupted fuel supply to the project. The fuel will be brought to site in containers from the fuel stations in the Town..

2.6.5. Site access

The ponds' site will be accessed via the existing access road currently used to access the site. The same access roads will be used during the upgrading works.

2.6.6. Occupational Health and safety

The site employees and visitors will be supplied with appropriate and adequate personal protective equipment (PPE) while onsite. The site will also be equipped with one fully furnished First Aid kit. At least three (3) people will be trained on how to administer first aid to others.

2.6.7. Accidental Fire outbreaks

A minimum of two (2) well-serviced fire extinguishers will be available onsite and two people trained on how to fight and or manage basic accidental fire outbreaks.

2.6.8. Project Waste Management

- Domestic (solid) and construction rubbles: All domestic solid waste and construction rubbles generated from the project activities will be sorted, stored on site in designated waste containers and transported to the Town's dumping site.
- Sewage (human waste): The appointed contractor will avail portable toilets for the workers and project related visitors. The toilets will need to be emptied according to the manufacturer's instructions.
- Hazardous waste: All vehicles, machinery and fuel consuming equipment onsite will be provided with drip trays to capture potential fuel spills and waste oils. The waste fuel/oils will be carefully stored in a standardized container to be disposed of at the nearest approved hazardous waste facility in the country (either at the Windhoek or Walvis Bay hazardous waste management facility).

2.6.9. Site Fencing and Security

The site area will be demarcated with a temporary boundary during the site upgrading activities and then a razor mesh will be erected in preparation for the operational phase. The razor mesh will serve both as protection of the site from potential vandalism and theft of project equipment and infrastructure. The fence will prevent unauthorized public access and protect the vulnerable community members such as unsuspecting children from drowning, playing with the wastewater and dangerous project equipment as well as preventing local animals from entering the site.

2.7. Decommissioning Phase and Activities

Decommissioning referred to herein is for the decommissioning of the upgrading works and sites at the end of the construction (upgrading) phase. The decommissioning phase will particularly entail the following:

- Dismantling and removal of all infrastructures and structures that will no longer be required for the operational and maintenance phase. These structures include storage tanks, onsite temporary offices, ablution facilities and other supporting structures erected for site upgrading. These will be transported to designated storage facilities offsite.
- Removal of all project related vehicles, machinery, and equipment from site to designated parking and storage sites off site, respectively.
- Carrying away the waste storage containers and disposal of waste to designated and approved waste management sites.
- Closure of all access roads that may have been created for the upgrading phase and no longer required for the operational phase.
- Levelling of stockpiled topsoil and where possible, backfilling of all pits and trenches excavated as part of the upgrading works.

2.8. Operational & Maintenance

Once in operation, the wastewater (effluent) from the Municipal wastewater system will be temporarily held in the newly upgraded and equipped ponds awaiting further conveying to the WWT Plant. The ponds are expected to be operated 24 hours, 7 days (daily). The ponds will be operated and maintained by the Municipality, and if necessary, external assistance of a specialized maintenance contractor will be sought to ensure smooth and efficient operations of the ponds.

The ponds will be operated and maintained by the Omaruru Municipality, and if necessary, external assistance of a specialized maintenance contractor will be sought to ensure smooth and efficient operations of the ponds.

2.8.1. Input and Treatment Process

General operating procedure of oxidation: When treating waste at the oxidation ponds, the algae that is required for the process, is grown using energy from the sun and carbon dioxide and inorganic compounds released by bacteria in the water. During the process of photosynthesis, the algae release oxygen needed by aerobic bacteria.

The mechanical aerators are sometimes installed to supply yet more oxygen, thereby reducing the required size of the pond. Sludge deposits in the pond must eventually be removed by dredging. Algae remaining in the pond effluent can be removed by filtration or by a combination of chemical treatment and settling (Encyclopedia Britannica, 2020).

2.8.2. Wastewater Treatment Output

The slurry (effluent) will be stored in the ponds, and the final effluent will be treated to the quality that is equal or better than the specified acceptable as per the national standards. For consideration to be discharged into the environment, a discharge permit from the Water and Environment Division of the DWA at the MAWLR will be required so that the treated water can be safely used in the environment to irrigate crops such as maize and wheat as well as for industrial purposes and dust suppression.

3 ENVIRONMENTAL LEGAL REQUIREMENTS: PERMITS

The legal obligations that govern the proposed project activities in terms of required permits / licenses are presented in Table 3-1 below. The detailed legal framework is presented in the environmental report.

Table 3-1: List of applicable legislations for which permitting or licensing will be required for the ponds

Legislation/Policy/ Guideline	Relevant Provisions	Required Permit/Clearance or License and Contact Details
Environmental Management Act EMA (No 7 of 2007)	Requires that projects with significant environmental impacts are subject to an environmental assessment process (Section 27). Details principles which are to guide all EAs.	The EMA and its regulations should inform and guide this EA process. Should the ECC be issued to the Proponent, it should be renewed every 3 years, counting from the date of issue. Office of the Environmental Commissioner at the DEAF for procedures to be followed.
Environmental Impact Assessment (EIA) Regulations GN 28-30 (GG 4878)	Details requirements for public consultation within a given environmental assessment process (GN 30 S21). Details the requirements for what should be included in a Scoping Report (GN 30 S8) and an Assessment Report (GN 30 S15).	Mr. Timoteus Mufeti: (Environmental Commissioner) Tel: 061 284 2701

Legislation/Policy/ Guideline	Relevant Provisions	Required Permit/Clearance or License and Contact Details
Water Resources Management Act (No 11 of 2013) and its 2023 Water Regulations	<p>The act provides for the management, protection, development, use and conservation of water resources; and provides for the regulation and monitoring of water services and to provide for incidental matters. The objects of this Act are to:</p> <p>Ensure that the water resources of Namibia are managed, developed, used, conserved and protected in a manner consistent with, or conducive to, the fundamental principles set out in Section 66 - protection of aquifers, Subsection 1 (d) (iii) provide for preventing the contamination of the aquifer and water pollution control (Section 68). The protection (both quality and quantity/abstraction) of water resources should be a priority throughout the project life cycle.</p>	<p>An effluent/wastewater discharge permit should be applied for from the Department of Water Affairs (Water Environment Division at the Ministry of Agriculture, Water and Land Reform (MAWLR)).</p> <p>Mr. Franciskus Witbooi (Deputy Director: Water Policy and Water Law Administration. Tel: +264 61 208 7158</p> <p>OR</p> <p>Ms. Elise Mbandeka (Chief Hydrologist): Water Environment Tel: +264 61 208 7167</p>
Forestry Act 12 of 2001, Amended Act 13 of 2005	Prohibits the removal of any vegetation within 100 m from a watercourse (Forestry Act S22(1)). The Act prohibits the removal of and transport of various protected plant species.	If the need to remove certain vegetation (big camelthorn trees) within the site footprint, a permit should be obtained from Omaruru MEFT' Forestry Office prior to removal.
Nature Conservation Ordinance No. 4 of 1975 (as amended)	Permits are required for the removal of protected plants species.	<p>Mr. Johnson Ndokosho (Director of Forestry Division) Tel: +264 61 208 7666</p>
Petroleum Products and Energy Act (No. 13 of 1990) Regulations (2001)	Regulation 3(2)(b) states that "No person shall possess or store any fuel except under authority of a licence or a certificate, excluding a person who possesses or stores such fuel in a quantity of 600 litres or less in any container kept at a place outside a local authority area". Therefore, <u>a fuel storage Permit should be applied for and obtained from the Ministry of Mines and Energy (MME)</u>	<p>Mr. Carlo Mcleod (Ministry of Mines and Energy: Acting Director – Petroleum Affairs Tel.: +264 61 284 8291</p>

Legislation/Policy/ Guideline	Relevant Provisions	Required Permit/Clearance or License and Contact Details
National Heritage Act (Act No. 27 of 2004)	Should any objects of heritage significance be identified during the upgrading of the ponds, the work must cease immediately in the affected sites and the necessary steps taken to seek authorisation from the Council.	Ms. Erica Ndalikokule (Head: Heritage Management) – National Heritage Council of Namibia Tel: +264 61 301 903

The following are the project's roles and responsibilities to be assigned as deemed necessary by the Proponent pertaining to the implementation of this EMP.

4 EMP ROLES AND RESPONSIBILITIES

The Municipality of Omaruru (the Proponent) is ultimately responsible for the implementation of the EMP. Alternatively, the Proponent may delegate this responsibility at any time, as they deem necessary during the project phases. The delegated responsibility for the effective implementation of this EMP will rest on the following key individuals which may be fulfilled by the same person:

4.1. Project Manager

The responsibilities of the Municipality's Project Manager during the upgrading (construction) phase and operational phase, respectively will be to:

- Implement and ensure compliance with the environmental management and mitigation measures proposed in this document.
- Manage and oversee the implementation of this EMP.
- Prevent non-compliance with the EMP and if necessary, deal with perpetrators.
- Ensure compliance with relevant environmental authorisations and license conditions.
- Implement and maintain an Environmental Management System.
- Identify and appoint appropriately qualified specialists (where necessary) to undertake the work components in a timeous manner and to acceptable standards.
- Ensure all incidents which have an environmental and social impact are recorded and documented.
- Compile 6-monthly reports on the implementation of the EMP, as a requirement for the renewal of the Environmental Clearance Certificate.
- Amend the EMP where necessary

- Manage specialized specialists including consultants who may be required on an ad-hoc basis or in terms of environmental support services and independent compliance monitoring and auditing or maintenance. Therefore, these may be contracted or appointed, as and when required

Alternatively, the Proponent may delegate an Environmental Control Officer (ECO) from within the Municipality itself or they may appoint an external ECO to ensure EMP compliance throughout the project life cycle.

4.2. Environmental Control Officer (ECO) or Safety, Health & Environmental (SHE) Officer

The Proponent should assign the responsibility of overseeing the implementation of the whole EMP on the ground for the upgrading as well as operation and maintenance to a designated member of staff or external qualified and experienced person, referred to in this EMP as the Environmental Control Officer (ECO) or Safety, Health & Environmental (SHE) Officer. The ECO will have the following responsibilities:

- Managing the implementation of this EMP and updating and maintaining it when necessary.
- Management and monitoring of individuals and/or equipment on-site in terms of compliance with this EMP.
- Issuing fines for contravening EMP provisions.
- Management and facilitation of communication between the Construction Contractor and Interested and Affected Parties (I&APs) with regard to this EMP.
- Conducting site inspections (recommended frequency is monthly during the construction phase and bi-annually for the operation and maintenance) of all areas with respect to the implementation of this EMP (monitor and audit the implementation of the EMP).
- Advising the Project Manager on the removal of person(s) and/or equipment not complying with the provisions of this EMP.
- Making recommendations to the PR with respect to the issuing of fines for contraventions of the EMP.
- Undertaking an annual review of the EMP and recommending additions and/or changes to this document.

4.3. Construction (Upgrading) Contractor and, by implication, all Subcontractors

The Contractor (Site Upgrading Contractor) is ultimately responsible for the implementation of the EMP and the action plan, onsite monitoring and evaluation of the EMP through the following

- Develop a Hazard Identification and Risk Assessment report on the on-set of the project to be approved by the Environmental Consultant.

- Developing a waste and health, safety & environment (HSE) management plans to be approved by the environmental consultant.
- Submit a monthly Environmental Performance report to the ECO.
- For this project it is envisioned that the function of the ECO will only require part time inputs.
- Ensure the relevant commitments contained in the EMP Action Plans are adhered to.
- Compile relevant procedures and method statements for approval by the applicable phase Project Manager prior to initiation of activities.
- Ensure relevant staff are trained in procedures.
- Maintain records of all relevant environmental documentation.
- Any on-site decisions regarding environmental management are ultimately the responsibility of the Contractor with consultation with the Environmental Consultant. Therefore, the Contractor must assign the role of ECO to a competent member of its site supervising team. The Contractor shall assist the ECO where necessary and will have the following responsibilities in terms of the implementation of this EMP:
 - Ensuring that the necessary environmental authorisations and permits have been obtained by the Contractor.
 - Assisting the Contractor in finding environmentally responsible solutions to problems with input from the ECO where necessary.
 - Ordering the removal of person(s) and/or equipment not complying with the EMP specifications.
 - Issuing fines for transgressions of site rules and penalties for contravention of the EMP.

5 ENVIRONMENTAL MANAGEMENT MEASURES

The procedures of non-compliance to the EMP, procedures

5.1. Amendments of the EMP

Any party involved with the project can suggest changes to the EMP via the Engineering Consultant. Such suggestions will be discussed with the Proponent. Approved changes will be drafted into the existing EMP in the form of an appendix or amendments.

5.2. Financing of Environmental Control

Financing of the environmental requirements as outlined in this document, apart from the appointment of further environmental consultants and specialists, is the sole responsibility of the Contractor appointed by the Municipality of Omaruru. Therefore, it is accepted that the cost incurred for implementing this EMP by

the Contractor would be allocated for in the tender document. Any responsibilities not defined in this document or where any uncertainties arise in this matter will be the responsibility of the Proponent.

5.3. Procedures for EMP Non-compliance

The Contractor shall comply with the environmental specifications and requirements on an ongoing basis and any failure on his/her part to do so will entitle the Project Manager to impose a penalty. This applies to the Environmental Management Plan (EMP). In the event of non-compliance, the following recommended process shall be followed:

- The Project Manager shall consult the environmental consultant and if agreed, issue a notice of non-compliance to the Contractor, stating the nature and magnitude of the contravention. A copy shall be provided to the ECO.
- The Contractor shall act to correct the non-conformance within 24 hours of receipt of the notice, or within a period that may be specified within the notice.
- The Contractor shall provide the Project Manager with a written statement describing the actions to be taken to discontinue the non-conformance, the actions taken to mitigate its effects and the expected results of the actions. A copy shall be provided to the ECO.
- In the case of the Contractor failing to remedy the situation within the predetermined time frame, the Project Manager shall impose a monetary penalty based on the conditions of contract.
- In the case of the Contractor being unable to remedy the situation due to permanent environmental damage already incurred, the Project Manager shall impose a monetary penalty based on the conditions of contract.
- In the case of non-compliance giving rise to physical environmental damage or destruction, the Project Manager shall be entitled to undertake or to cause to undertake such remedial works as may be required to make good such damage and to recover from the Contractor the full costs incurred in doing so.
- In the event of a dispute, difference of opinion etc., between any parties regarding or arising out of interpretation of the conditions of the EMP, disagreement regarding the implementation or method of implementation of conditions of the EMP etc., any party shall be entitled to require that the issue be referred to independent specialists for determination.
- The Project Manager shall always have the right to stop work and/or certain activities on site in the case of safety and EMP non-compliance or failure to implement remediation measures.

5.4. Key Potential Environmental Impacts Identified

The upgrading of oxidation ponds can be associated with some impacts, both positive and negative. The following key potential impacts have been identified and are summarized in Table 5-1 below.

Table 5-1: Summary of key potential environmental impacts per project phase

Positive impacts (benefits)	Adverse (negative impacts)
<p>-Socio-economic development through temporary job (employment) creation in the Town during the upgrading phase.</p> <p>-Improved wastewater management in the Town, thus preventing the amount of wastewater that would otherwise be uncontrollably released into the environment from existing and unlined ponds. This would improve the local public and environment health.</p> <p>-The upgraded (equipped) ponds will enable the holding of wastewater (sewage) and ensure that the amount of sewage sent/conveyed to the Plant is sufficient to ensure the Plant's efficiency without overloading it before the next load</p>	<p>-The disruption to the existing sewage handling and treatment, if the replacement treatment system is not operational or efficient simultaneously during ponds' upgrading may cause catastrophe (sewage run-off into nearby water systems and environment). Thus, resulting in soil and water pollution. In other words, the improper handling of wastewater (sewage) may lead to pollution of surrounding soils and eventually water resources systems (through wastewater runoff and infiltration).</p> <p>-General environmental pollution through mishandling of project related waste associated with site upgrading works and operational and maintenance phase.</p> <p>-Loss of biodiversity through the removal of vegetation that may be found within the footprints of the ponds' upgrading plans.</p> <p>-Air pollution by potential dust and gas emissions from project activities (excavations, heavy vehicles, and machinery).</p> <p>-Odour: Some by-products of anaerobic digestion used in wastewater treatment facilities may give off a strong, nauseating smell. This may affect the locals in proximity to the ponds.</p> <p>-Occupational health and safety: improper handling of site materials and equipment may cause health and safety risks.</p> <p>-Archaeological or cultural heritage impact through uncovering of unknown objects on site (when carrying out earthworks.</p> <p>-Accidental fire outbreaks from project activities.</p>

5.5. Aim of the Environmental Management Actions

The aim of the management actions of the EMP is to avoid potential negative impacts where possible. Where impacts cannot be avoided, measures are provided to reduce the significance of these impacts. Management actions recommended for the potential impacts listed above were based on the 3 project phases (planning, construction/upgrading and operations).

The responsible persons at the Municipality and/or their contractors should assess these commitments in detail and should acknowledge their commitment to the specific management actions detailed in the phases given under the following subchapters.

5.6. Planning & Design, Upgrading (Construction) and Operations Management and Mitigation Measures

The measures recommended to manage and mitigate environmental and social impacts for the planning & design, upgrading (construction) and operations phase are provided in Table 5-2.

Table 5-2: Management and mitigation measures for the Planning & Design, Ground preparatory works, Upgrading and Operational & Maintenance Phases

Aspect	Impact	Mitigation Measure(s)	Responsible Person	Timeline
PLANNING & DESIGN PHASE				
EMP implementation and training	Lack of EMP awareness and implications thereof	<ul style="list-style-type: none"> -A Comprehensive Health and Safety Plan for the project activities should be compiled. This will include all the necessary health, safety, and environmental considerations applicable to respective works on sites. -An EMP non-compliance penalty system should be implemented on site. -Appoint a SHE Officer to be responsible for managing the EMP implementation and monitoring for the project. 	-Proponent	Pre-ground preparatory works and subsequent phases
Oxidation Ponds Technology	Mechanical and design failures	<ul style="list-style-type: none"> -All manufactured materials will be required to bear the mark of SABS/SANS approval. -The machinery and equipment are designed in such a way mechanical failures are minimal to none. -The evaporation pond should be sufficiently sized and capable of achieving the evaporation of the sewage inflow load and thus, compliance with the Guidelines. -The ponds' design should make provision for groundwater protection (appropriate liner to prevent infiltration from the bases of the ponds) -The ponds' design should include odour control caps. -The pond system should be properly designed to ensure the capacity to treat all the sewage pumped into it and ensure that the effluent is fit and meet the Standards before it can be used for its intended application in the environment (post-treatment). 	-Proponent -Contractor, Consulting Engineers	Pre-construction

Aspect	Impact	Mitigation Measure(s)	Responsible Person	Timeline
Oxidation Ponds' Maintenance	Cleaning and reconditioning of ponds	<p>-The cleaning and reconditioning works of the upgraded ponds during the operational phase should be planned and provided for. This included the provision for maintenance and repairing of associated pond system infrastructure.</p> <p>-Financial and technical provision should be made for the operational & maintenance and updated regularly</p>	<p>-Contractor, Consulting Engineers</p> <p>-Project Manager</p>	Throughout the project life cycle
Authorizations	Lack of Permits/ Licenses	<p>-All the required agreements and licenses or permits should be applied for and obtained and kept on records. The permits, agreements referred to herein include:</p> <ul style="list-style-type: none"> ○ Petroleum storage permits (if fuel is stored on site in the volume of 600 litres and more) (who? the Contractor) ○ Waste disposal authorization (who? the Contractor) 	<p>-Proponent</p> <p>-Contractor, Consulting Engineers</p> <p>-Project Manager</p>	Pre-construction
Labour recruitment	'Outsiders' or out-of area people (businesses) are often given employment and tender opportunities at the expense of locals who can perform the same work. This may result in conflicts between locals and construction contractors	<p>-Priority for most work to be done during the construction and operational phases should be given to locals, if they have the skills to undertake the work.</p> <p>-Wherever possible, the majority of personnel should be hired locally, thus minimising the need to bring in staff from outside areas.</p> <p>-Employment of out-of-area people should only be considered if the local community does not have the required skills.</p> <p>-Employment should be conducted through the Omaruru Constituency office, as this way, the Constituency Councillor can assist the Contractor in obtaining the suitable people for construction.</p> <p>-Recruitment of workers should not be done on site, but only through the Constituency office.</p> <p>-Employment of women, marginalised people and people with disabilities should be encouraged, where possible.</p>	<p>- Contractor in partnership with the constituency councillor and or existing local development committee (if any) to determine employment considerations.</p>	<p>Pre-construction (for construction works)</p> <p>Pre-operational phase (for operations works, if external personnel is required by the Municipality)</p>

Aspect	Impact	Mitigation Measure(s)	Responsible Person	Timeline
Procurement of goods and services for Ground preparatory works & construction contractors, and services		<p>-The procurement stage for the project construction works should follow a fair and transparent process.</p> <p>-Skills transfer and capacity building should be prioritized during construction. This is important that if the construction contract is awarded to an out-of-town company, they should be instructed to team up with a local company to ensure capacity building for locals.</p> <p>-Encourage the provision of goods and services that are locally available should be sourced from the locally available businesses, especially small and medium businesses.</p> <p>-During drafting of tender documents, the consultant shall include provisions designed to maximise the use of local labour. All unskilled labour shall be sourced from Omaruru. Specific recruitment procedures shall be spelled out.</p>	<p>-Municipality of Omaruru</p> <p>-Contractor</p>	<p>Pre-construction (for construction works)</p> <p>Pre-operational phase (for operations works, if external service provider / contractor is required)</p>
Vegetation/Flora	Site clearing resulting in loss of vegetation species (protected ones)	<p>-Consult the Forestry Office in Omaruru for site inspection and counting of trees and further advice on permit application and fees to remove trees.</p> <p>-Should there be a need to remove certain protected tree species within the intended footprints of the site, a permit should be applied for and obtained from the Directorate of Forestry Office in Omaruru.</p>	<p>-Contractor</p> <p>-ECO</p>	Pre-removal of the tree(s)
Stormwater control	Risk of water pollution owing to lack of stormwater management systems (run off)	<p>-Site stormwater management plans (discharge points) should be properly designed to prevent the potentially contaminated run-off from reaching water resources.</p> <p>-To prevent waste discharges from contaminating surface and groundwater, the discharges must be diverted away from surface water and onto turf areas or other appropriate areas.</p>	<p>-Contractor</p> <p>-ECO</p>	Pre-construction

Aspect	Impact	Mitigation Measure(s)	Responsible Person	Timeline
		-The ponds should be lined to prevent waste from leaching into the ground, and potentially into groundwater.		
Social conflicts	-Nuisances caused by the Contractor -Lack of communication between contractor and community	-A meeting should be arranged with the local community once the contractor has been appointed. -The contractor shall appoint an ECO/SHE Officer from the construction team to take responsibility for the implementation of all provisions of this EMP	-Proponent -Appointed Contractor and their subcontractor(s)	Pre-construction
Construction schedule	Schedule	-A convenient construction work/schedule should be prepared and be shared with the Municipality so that they can inform the local communities of when to expect the construction works in the area.	-Contractor -Proponent	Pre-construction
Wastewater	Treated Wastewater / Effluent discharge	-A Permit to discharge treated effluent/wastewater should be applied for and obtained from the Department Water Affairs (DWA)' Water Environment Division.	-Proponent	Pre-ground preparatory works and operational phase
Soils	Contaminated site soils	-A Soil contamination should be undertaken to assess the nature and extent of contamination from existing ponds. -The appropriate and suitable measures and method(s) to remediate the contaminated site soils should be recommended by a specialist (soil scientist) and implemented accordingly and under the specialist' supervision.	-Contractor -SHE Officer	Pre-ground preparatory works of old ponds Pre-construction
Stormwater and Pond overflow management	Runoff of polluted water into the environment	-Stormwater management plans (discharge points) should be designed and implemented onsite to prevent the potential contaminated run-off from reaching surface water resources during heavy rain seasons. -The ponds should be equipped with a robust wastewater flow monitoring system to ensure that the first sign of overflow is	-Contractor	Pre-ground preparatory works and construction phases

Aspect	Impact	Mitigation Measure(s)	Responsible Person	Timeline
		detected and addressed in time (for flow and capacity monitoring in ponds).		
Communication between the Proponent and residents	Lack of communication (proper liaison) between the community and Proponent	-A clear communication procedure/plan which should include a grievance mechanism should be compiled.	-Contractor -Project Manager	Prior to old ponds ground preparatory works and throughout the subsequent phases
GROUND PREPARATORY WORKS ON OLD PONDS, UPGRADING AND OPERATIONAL PHASES				
EMP implementation and training	Lack of EMP awareness and implications thereof	<p>-EMP training should be provided to all new workers on site.</p> <p>-All site personnel should be aware of necessary health, safety, and environmental considerations applicable to their respective work</p> <p>-The implementation of this EMP should be monitored.</p> <p>-The site should be inspected, and a compliance audit done throughout <u>the as recommended below:</u></p> <ul style="list-style-type: none"> ○ <u>Daily to weekly - construction phase</u> ○ <u>Bi-annually - operational</u> <p>-An EMP non-compliance penalty system should be implemented on site.</p> <p>-Compliance monitoring conducted daily during ground preparatory works and construction.</p> <p>-The ECC should be renewed on time every 3 years, at least 1 month before it expires.</p>	-Proponent -SHE Officer	Throughout the construction and operation phases
Communication between the Proponent and residents	Lack of communication (proper liaison) between residents and Proponent	-A clear communication procedure/plan which includes a grievance and response mechanism should be compiled.	-Proponent -Project Manager -Construction contractor	Communication to run throughout the project activities

Aspect	Impact	Mitigation Measure(s)	Responsible Person	Timeline
Soils	<p>Site soils (land) disturbance</p> <p>Soil erosion</p>	<p>-The topsoil stripped from certain site areas to enable construction works and can be returned to its initial position, should be returned. This is to avoid unnecessary stockpiling of site soils which would leave them prone to erosion.</p> <p>-All construction pits excavated on site should be rehabilitated and returned to their pre-excavation state as possible.</p> <p>-Soils that are not within the intended footprints of the site areas should be left undisturbed and soil conservation implemented as far as possible.</p> <p>-Project vehicles/machinery should stick to access roads provided and or meant for the project operations but not to unnecessarily create further tracks on and around the site by driving everywhere resulting in soil compaction.</p> <p>-Soils that are not within the intended and targeted footprints of the site should be left undisturbed and soil conservation implemented as far as possible.</p> <p>-Access roads should be designed appropriately in a manner that disturbs minimal land areas as possible.</p> <p>-Make use of the existing road network as much as possible and avoid off-road driving.</p>	<p>-SHE Officer</p> <p>-Hired Soil Scientist, if any</p>	<p>Throughout the ground preparatory works phase and construction phase operational phase</p> <p>-Soil contamination monitoring to be done once during ground preparatory works</p>
	Soil pollution	<p>-During upgrading of the existing ponds, care should be taken to ensure that the wastewater in the ponds does not run off into the surrounding environment.</p> <p>-Monitor depth of soil profile and contamination levels on site during ground preparatory works and act</p> <p>-Thorough clean up should be implemented to remove the wastewater that is seen escaping from (flowing outside) the north eastern pond and the area rehabilitated to an appealing state or before it can be utilized for the ponds.</p>	<p>-Construction contractor</p> <p>-SHE Officer</p> <p>-Hired (contracted) Soil Scientist</p>	<p>Throughout the ground preparatory works and construction phases</p>

Aspect	Impact	Mitigation Measure(s)	Responsible Person	Timeline
		<p>-Spill control preventive measures should be in place on site to manage soil contamination, thus preventing and or minimizing the contamination from reaching groundwater bodies. Some of the soil control preventive measures are:</p> <ul style="list-style-type: none"> *Identification of oil storage and use locations on site and allocate drip trays and polluted soil removal tools suitable for that specific surface (soil or hard rock cover) on the sites. *Maintain equipment and fuel storage tanks to ensure that they are in good condition thus preventing leaks and spills. *The oil storage and use locations should be visually inspected for container or tank condition and spills. *Maintain a fully provisioned, easily accessed spill kit. Spill kits should be located throughout the active project sites containing the floor dry absorbent material and absorbent booms, pads, mats. *All project employees should be made aware of the impacts of soil pollution and advised to follow appropriate fuel delivery and handling procedures. *The Proponent should develop and prepare countermeasures to contain, clean up, and mitigate the effects of an oil spill. This includes keeping spill response procedures and a well-stocked cache of supplies easily accessible. *Ensure employees receive basic Spill Prevention, Control, and Countermeasure (SPCC) Plan training and mentor new workers as they get hired in each phase of the project. <p>-The site areas where hydrocarbons will be utilized, the surface should be covered with an impermeable plastic liner (e.g., an HDPE liner), carefully placed to minimize risk of puncturing, to prevent any spillages from getting into direct contact with the soils and prevent eventual infiltration into the ground and pollute groundwater.</p>		

Aspect	Impact	Mitigation Measure(s)	Responsible Person	Timeline
		<p>-Project machines and equipment should be equipped with drip trays to contain possible oil spills when operated.</p> <p>-All wastewater and hydrocarbon substances and other potential pollutants associated with the project activities should be contained in designated containers on site and later disposed of at nearby approved waste sites in accordance with MAWLR’s Water Environment Division standards on waste discharge into the environment. This is to ensure that these hazardous substances do not infiltrate into the ground and affect the groundwater quality.</p> <p>-In cases of accidental fuel or oil spills on the soils from site vehicles, machinery and equipment, the polluted soil should be removed immediately and put in a designated waste type container for later disposal as per the preceding bullet point. The removed polluted soil should either be completely disposed of or cleaned and returned to where it was taken from on site or can be replaced with a cleaner soil. This is to ensure that the pollutants contained into the soil do not infiltrate into the site soils and eventually reach groundwater.</p> <p>-In the event of a fuel (diesel) storage tank onsite in a tank mounted on a mobile trailer, drip trays must be readily available on this trailer and monitored to ensure that accidental fuel spills around fuel usage sites are cleaned up on time (soon after the spill has happened).</p> <p>-Polluted soil must be collected and transported away from the site to an approved and appropriately classified hazardous waste treatment facility.</p> <p>-Washing of equipment contaminated hydrocarbons, as well as the washing and servicing of vehicles should take place at a dedicated area offsite, where contaminants are prevented from contaminating soil or water resources.</p> <p>-Toilet water should be treated using one of the following methods:</p>		

Aspect	Impact	Mitigation Measure(s)	Responsible Person	Timeline
		<p>*Discharged into chemical toilets and periodically emptied out before reaching capacity and transported to a wastewater treatment facility in the Town.</p> <p>*A type of pit latrine (where excreta in the pit is treated to prevent the waste from being a water pollution risk).</p>		
Water Resources	Water use (quantity) misuse	<p>-Water should be efficiently used by implementing water saving measures such as recycling and re-use where necessary and possible.</p> <p>-Water conservation awareness and saving measures should be made to all employees and become accountable.</p>	<p>-Proponent -SHE Officer -Construction Contractor</p>	During the construction and operational phases
	Water resources (quality) and pollution	<p><u>SURFACE WATER</u></p> <p>-All run off materials such as hydrocarbons, wastewater and other potential contaminants should be contained on site in designated containers and disposed of in accordance with municipal wastewater discharge standards, so that they do not reach to water systems.</p> <p>-The ground preparatory works of currently active ponds should be done in such a way that no wastewater spills or leaks on the ground.</p> <p>-The ponds should be maintained frequently to ensure that no overflow leaves the ponds undetected.</p> <p>-Sediment removal from the ponds should be done at least once a year to prevent overflow due to the thick sediments settling at the bottom of the ponds.</p> <p><u>GROUNDWATER</u></p> <p>-The base of the ponds should be properly lined with an approved and appropriate liner material (HDPE) to ensure that there will be no direct contact between wastewater in the ponds and groundwater through leakages due to unlined base or liner failure and poor installation.</p>	<p>-Ground preparatory works and Construction Contractor -SHE Officer</p>	-Throughout all the project phases

Aspect	Impact	Mitigation Measure(s)	Responsible Person	Timeline
		<p>-The ground preparatory works of currently active ponds should be done in such a way that no wastewater spills or leaks on the ground. This is to reduce the infiltration of additional wastewater into the ground from the site. The ground preparatory works should be done but not limited to the following:</p> <p>*Consider carrying out progressive ground preparatory works by determining the feasibility of either of the two points or both:</p> <p><i>*This will need to be done by upgrading of one or two ponds at a time to ensure that there is still a pond or two to still contain incoming wastewater from the Town sources and avoid environmental catastrophe of uncontrolled sewage overflowing into the general surrounding surface area and into the ground (groundwater).</i></p> <p><i>*Alternatively, provision to be made for industry standard temporary storage facilities such as sewage tanks to contain sewage while ground preparatory works and construction is ongoing.</i></p> <p>-The ground preparatory works of old ponds should be done during the dry season so that the risk of wastewater running off with rainwater and eventual infiltration into the ground is prevented.</p> <p>-Stormwater management plans (discharge points) should be designed and implemented on site to prevent the potential contaminated run-off from reaching surface water resources, and or eventual infiltration into groundwater.</p> <p>-The effluent / wastewater containers or ponds should be lined to prevent dissolving waste from leaching into the ground, and potentially into groundwater systems.</p>		
Biodiversity	Loss of Fauna and Flora	<p><u>Flora:</u></p> <p>-Make use of the existing access roads as much as possible and avoid off-road driving.</p>	<p>-Contractor</p> <p>-Project Manager</p> <p>-SHE Officer</p>	<p>-Throughout the phases</p> <p>MEFT Forestry to do an inspection prior to ground</p>

Aspect	Impact	Mitigation Measure(s)	Responsible Person	Timeline
		<p>-A permit must be obtained from the Directorate of Forestry before any protected species is removed (upon inspection by MEFT's Forestry).</p> <p>-Vegetation found on the site, but not in the actual project footprints should not be removed but left to preserve biodiversity on the site area.</p> <p>-The movement of vehicles and machinery should be restricted to existing roads and if necessary, to the newly established tracks only to prevent unnecessary damage to the site vegetation.</p> <p>-No onsite vegetation should be cut or used for firewood related to the project's operations. The Proponent should provide firewood for his onsite camping workers from authorized firewood producers or sellers.</p> <p>-Care should be taken when carrying out vegetation clearing without destroying all the site vegetation.</p> <p>-The Proponent should aim to use the already damaged area with little to no vegetation for the site expansion and upgrading of the ponds.</p> <p><u>Fauna</u></p> <p>-Workers should refrain from killing or snaring any animal species (big or small) that may be found on and around the site.</p> <p>-Illegal hunting (poaching) of wildlife and around the site is strictly prohibited.</p> <p>-Workers should refrain from disturbing, killing or stealing locals' animals and/or small soil animals species found on site.</p> <p>-Environmental awareness on the importance of biodiversity preservation should be provided to site contractors and workers.</p>		<p>preparatory works and construction</p>
Air Quality	Air quality (dust)g	-Ensure that the construction schedule is limited to the given number of days of the week, but not every day. This will keep the	-Contractor	Throughout ground preparatory works

Aspect	Impact	Mitigation Measure(s)	Responsible Person	Timeline
		<p>vehicle-related dust level minimal in the area, especially when it is windy.</p> <p>-A reasonable amount of water should be used to suppress the dust that may be emanating from certain site areas (limited to the site only) or certain parts of the local utilized sandy roads that are generating a lot of dust.</p> <p>-All access roads leading to the site should have speed limits of no more than 40km/h to minimise the amount of dust generated by the vehicles, which will in turn minimise air quality concerns to any potential receptors, particularly the residents south of the site.</p> <p>-Dust masks, eye protective glasses and other respiratory personal protective equipment (PPE) such as face masks should be provided to the workers on site operating or working at the excavated areas, where they may be exposed to dust.</p> <p>-The vehicles carrying dusty materials should be covered to prevent materials being blown from the vehicle.</p> <p>-The transportation of project materials, equipment and machinery should be limited to certain days of the week only so as to reduce dust generated by heavy vehicles in the area.</p> <p>-Project vehicles and heavy machines should not be left idling when not in use, such that they emit air polluting gasses.</p> <p>-Project vehicles and machinery should be maintained through regular servicing to ensure that they do not release harmful and air polluting fumes while on and off site</p>	<p>-Project Manager -SHE Officer</p>	<p>and construction phases</p>
	<p>Odour nuisance</p>	<p>-Incorporate odour control technologies odour controlling caps at the ponds.</p>	<p>-Contractor</p>	<p>During construction</p>
<p>Noise</p>	<p>Noise nuisance</p>	<p>-The transportation of project materials, equipment and machinery should be limited to once or twice a week only, but not every day.</p>	<p>-Project Manager -Contractor -SHE Officer</p>	<p>Throughout ground preparatory works and construction</p>

Aspect	Impact	Mitigation Measure(s)	Responsible Person	Timeline
		<ul style="list-style-type: none"> -Noise from project vehicles and equipment on site should be reduced to acceptable levels. -Excavations and all activities that are likely to increase noise levels should be conducted between 08h00 AM and 17h00 PM during weekdays to avoid noise during the night residents are resting (on weekends) and sleeping (during the night). -The construction times should be set such that, no such activities are carried out during the night or very early in the mornings (to be limited between 08h00 AM and 17h00 PM on weekdays). -When operating trucks such as hauling or any high noise level machinery, workers should be equipped with personal protective equipment (PPE), i.e., earplugs to reduce noise exposure. These PPE should be regularly checked/tested for effectiveness and on detected malfunction, should be replaced as soon as possible. 		
Health, Safety and Security	General health and safety associated with project activities	<ul style="list-style-type: none"> -The Labour Act's Health and Safety Regulations should be complied with. -All items for treatment as specified in the material safety data sheets (MSDS) for hazardous materials should be available in the first aid kit. -Keep a comprehensive first aid kit at the worksites sites. -Establish an emergency rescue system for evacuation of injured people, if needed. -Emergency procedures for accidents shall be communicated to all workers. -Ensure that all workers know where the first aid kits are located and who is trained in administering in first aid. -As part of their induction, the project workers should be provided with an awareness training of the risks of mishandling equipment 	<ul style="list-style-type: none"> -Contractor -Project Manager -SHE Officer - 	Prior to site setup activities and throughout the phases

Aspect	Impact	Mitigation Measure(s)	Responsible Person	Timeline
		<p>and materials on site as well as health and safety risks associated with their respective jobs.</p> <ul style="list-style-type: none"> -Heavy vehicle, equipment and fuel storage site should be properly secured, and appropriate warning signage placed where visible. -An emergency preparedness plan should be compiled, and all personnel appropriately trained. -Workers should not be allowed to drink alcohol prior to and during working hours as this may lead to mishandling of equipment which results in injuries and other health and safety risks. -The site to be equipped with "danger" or "cautionary" signs for any potential danger or risk area identified on site. -A security guard or guards should be part of the team to look after the project equipment and vehicles that would be left on site in afterhours, weekends or public holidays to ensure that no unauthorized person enters the area. -All employees and contractors (personnel) to be trained on environmental awareness, internal Environmental Health and Safety Policy, Environmental Management Plan, and engagement with key stakeholders and interested & affected persons. 		
	Occupational Health and Safety	<ul style="list-style-type: none"> -When working on and moving around the site, employees and visitors should be properly equipped with adequate personal protective equipment (PPE) such as coveralls, gloves, safety boots, earplugs, dust masks, safety glasses, etc. -The Proponent must avail adequate and appropriate PPE to all workers and visitors. -Timeously recording and reporting of all health and safety incidents. 	<ul style="list-style-type: none"> -Contractor -Project Manager -SHE Officer 	Throughout the project phases and when required

Aspect	Impact	Mitigation Measure(s)	Responsible Person	Timeline
	Public safety	<p>-A razor mesh fence should be erected around the ponds' area to secure it and prevent possible public unauthorized access, especially local children as well as animals.</p> <p>-Empty hazardous containers that may be used onsite should be securely kept on site, inside the boundary wall before transporting the containers to the nearest approved waste site.</p> <p>-Loads should be securely fastened to the vehicles while in transit (being transported to and from site).</p>	<p>-Contractor -Project Manager -SHE Officer</p>	Throughout all the phases
Health and safety	Accidental fire outbreak	<p>-Portable fire extinguishers should be provided on site.</p> <p>-No open fires to be created by project personnel.</p> <p>-Potential flammable areas and structures such as fuel storage tanks should be marked as such with clearly visible signage.</p>	<p>-Contractor -Project Manager -SHE Officer</p>	Throughout the ground preparatory works and construction phase
Archaeology and heritage	Accidental disturbance and destruction of archaeological or heritage objects and sites	<p>-Caution should be exercised when carrying out excavations associated with the project activities if archaeological/heritage remains are discovered.</p> <p>-Identified of any archaeological significant objects on the site should not be disturbed but are to be reported to the project SHE Officer or National Heritage Council offices for further instructions and actions.</p> <p>-Workers should be educated to not destroy or throw away but report (to the SHE Officer) any unknown object found/discovered on site.</p> <p>-The Project Manager should familiarise themselves with the National Heritage Council's Chance Find Procedure (please refer to Appendix 1 of this document) and if uncertain about the procedure should receive training by a suitably qualified archaeologist with respect to identifying archaeological/heritage</p>	<p>-Contractor -SHE Officer</p>	<p>As and when required, prior to site setup activities and upon encounter</p> <p>-Archaeologist to be present during the earth workings</p>

Aspect	Impact	Mitigation Measure(s)	Responsible Person	Timeline
		remains and the procedures to follow if such remains are discovered throughout the project activities' duration.		
Social conflicts	Job seeking, private property intrusion or damage	<p>-The Proponent should inform their workers on the importance of respecting the locals' properties by not intruding or damaging their homes or yard fences.</p> <p>-Any workers or site employees that will be found guilty of intruding peoples' properties should be called in for disciplinary hearing and/or dealt with as per their employer' (Proponent)'s code of employment conduct</p> <p>-Site workers should be advised to respect the community and local's private properties, values, and norms.</p> <p>-No worker should be allowed to wander in people's private yards or fences without permission.</p> <p>-Site workers are not allowed to kill or in any way disturb local livestock or animals that may be seen on and around the site.</p>	<p>-Construction contractor</p> <p>-Project Manager</p> <p>-PRO</p> <p>-SHE Officer</p>	Pre- Construction
Post-Treatment Effluent	Handling	<p>-The effluent must be treated thoroughly and tested/analysed to ensure full compliance with the Standards before used or discharged into the environment.</p> <p>-The effluent logistics should be properly handled and done onsite when delivering to the intended consumers</p> <p>-Effluent that awaits to be transported from site should be stored on a designated storage area and loaded correctly without it spilling on the soils.</p> <p>-Other options of utilizing the effluent should be investigated and implemented to ensure that effluent is sufficiently treated to the Standards and utilized for other applications in the environment.</p>	<p>-Proponent</p> <p>-Site/Project Manager</p> <p>-SHE Officer</p>	Throughout the operational phase
	Environmental Pollution	-Project workers should be sensitized to dispose of waste in a responsible manner and not to litter.	-Project Manager	Throughout the phases.

Aspect	Impact	Mitigation Measure(s)	Responsible Person	Timeline
Littering and waste management		<p>-After each daily work, there should not be waste left scattered on site, but rather be disposed of in allocated site waste containers.</p> <p>-No waste may be buried or burned on site or anywhere else throughout the project lifecycle.</p> <p>-All domestic and general waste produced daily should be contained until such time it will be transported to designated waste sites on a weekly basis.</p> <p>-The sites should be equipped with separate waste bins for hazardous and general waste/domestic.</p> <p>-Waste separation at source will be enforced by availing clearly labelled or differently coloured general waste (paper, plastic, organic waste) rubbish bins at all working areas. These must be emptied weekly at the Town's waste dumping site.</p> <p>-A penalty system for irresponsible disposal of waste on site and anywhere in the area should be implemented.</p>	<p>-Ground preparatory works / Contractor</p> <p>-SHE Officer</p>	
	Wastewater generated by workers and visitors (sanitation)	<p>-Provision of toilet facilities for project workers and visitors (type of pit latrine or chemical toilet).</p> <p>-Emptying of chemical toilets according to the manufacturer's specifications. Treating latrine waste to render non-polluting.</p>	<p>-Contractor</p> <p>-SHE Officer</p>	At site setup and throughout the phases
	Hazardous waste	<p>-All hazardous materials shall be stored (on bunded area), handled and disposed of according to the applicable Material Safety Data Sheet (MSDS), as well as applicable regulations (e.g., the Health and Safety Regulations).</p> <p>-Hazard identification signage shall be erected at appropriate locations.</p> <p>-All hydrocarbon substances should be contained in designated containers on site and later disposed of at nearby approved waste sites.</p>	<p>-Contractor</p> <p>-SHE Officer</p>	Throughout the phases.

Aspect	Impact	Mitigation Measure(s)	Responsible Person	Timeline
		<p>-Hazardous waste, including emptied chemical containers should be safely stored on site where they cannot be accessed and used by uniformed locals for personal use. These containers can then be transported to the nearby approved hazardous waste sites for safe disposal. No waste should be improperly disposed of on site or in the surroundings, i.e., unapproved waste sites.</p> <p>-As an emphasis on the preceding point, empty hazardous substance containers should not be disposed of anywhere on the project site or its surrounding, but instead they should be kept at a designated storing place on site until such time that they can be safely taken to the nearest approved hazardous waste sites.</p>		
<p>Vehicular Traffic</p>	<p>Traffic safety</p>	<p>-The transportation of project materials, equipment and machinery should be limited to once or twice a week only, but not every day.</p> <p>-The heavy truck loads should comply with the maximum allowed limit while transporting materials and equipment/machinery on the public and access roads.</p> <p>-The site access road(s) should be upgraded to an unacceptable standard to be able to accommodate project related vehicles and access permits obtained from the Roads Authority.</p> <p>-Drivers of all project phases' vehicles should be in possession of valid and appropriate driving licenses.</p> <p>-Vehicle drivers should adhere to the road safety rules.</p> <p>-Drivers should drive slowly (40km/hour or less), and be on the lookout for animals.</p> <p>-Project vehicles should be in a road worthy condition and serviced regularly to avoid accidents due to mechanical faults of vehicles.</p> <p>-Vehicle drivers should only make use of designated site access roads provided.</p>	<p>-Contractor -Project Manager</p>	<p>Throughout the phases</p>

Aspect	Impact	Mitigation Measure(s)	Responsible Person	Timeline
		<ul style="list-style-type: none"> -Vehicle's drivers should not be allowed to operate vehicles while under the influence of alcohol. -Sufficient parking area for all project vehicles should be provided for and clearly demarcated on sites. -The Proponent should make provision for safe materials and equipment offloading and loading areas on sites. -No heavy trucks or project related vehicles should be parked outside the project site boundary or demarcated areas for such purpose. -Truck movements, frequency, times, and routes should be carefully planned and scheduled – please refer to the next point. -To control traffic movement on site, deliveries from and to site should be carefully scheduled. This should optimally be during weekdays and between the hours of 8h00 AM and 17h00 PM. 		
Social nuisance	Job seeking and crashes due to differing norms, culture, and values	<ul style="list-style-type: none"> -Priority of employment should be given to local people, and only if necessary and due to lack of skills in the area, out-of-area people can be given some of the work. -The locals to be employed during the project phases should be provided with the necessary training of skills required for the project to avoid bringing in many out-of-area employees. -The workers should be engaged in health talks and training about the dangers of engaging in unprotected sexual relations which results in contracting HIV/AIDS and other sexual related infections. -Out-of-area workers that may be employed (due to their unique work skills) on site should be sensitized on the importance of respecting the local values and norms, so that they can co-live-in harmony with the local communities during the duration of their employment on site. 	<ul style="list-style-type: none"> -Contractor -Project Manager 	<p>Pre-construction</p> <p>In special cases, during the project phases, depending on the project needs</p>

Aspect	Impact	Mitigation Measure(s)	Responsible Person	Timeline
	Potential increase of prevalence of HIV and AIDS, as well as other sexually transmitted diseases (STIs) prevalence	<ul style="list-style-type: none"> -The workers should be engaged in health talks and training about the dangers of engaging in unprotected sexual relations which results in contracting HIV/AIDS and other sexual related infections. -Provision of condoms and sex education through distribution of pamphlets. These pamphlets can be obtained from local health facilities. 	<ul style="list-style-type: none"> -Contractor -SHE Officer 	During site setup and throughout the phases
	Private and Public Property intrusion and Disturbance or Damage	<ul style="list-style-type: none"> -Project workers should be educated on the importance of respecting nearby properties. No intruding or damaging fences or snaring and killing of livestock. -Any site employees who will be found guilty of intruding peoples 'privately owned properties should be called in for disciplinary hearing and/or dealt with as per their employer's code of employment conduct. -Project workers should be advised to respect the community and local's private properties, values, and norms. -Site workers are not allowed to kill or in any way disturb local animals. 	<ul style="list-style-type: none"> -Contractor 	Throughout the phases

5.7. Decommissioning and Rehabilitation of Ponds and Construction Sites

Table 5-3 below presents the rehabilitation measures to be implemented for the preparatory works of the old ponds and after the completion of upgrading works to meet the requirements of the Environmental Management Act. It is crucial for the Proponent to ensure that they make provision of both financial and technical resources for progressive rehabilitation (for post-upgrading, where necessary).

Table 5-3: Management Plan Actions for the Ground preparatory works of old ponds and Decommissioning of ponds' rehabilitation and upgrading works

Aspect	Mitigation Measure(s)	Completion criteria
Existing pond structures	<p><u>PREPARATORY WORKS PRIOR TO THE ACTUAL UPGRADING WORKS</u></p> <p>-A progressive ground preparatory works should be done by determining the feasibility of either of the two options or both:</p> <ol style="list-style-type: none"> 1. This will need to be done by upgrading one or two ponds at a time to ensure that there is still one or two ponds to still contain incoming wastewater from the Town sources and avoid environmental catastrophe of uncontrolled sewage overflowing into the general surrounding surface area and into the ground (groundwater) 2. Alternatively, provision to be made for industry standard temporary storage facilities such as sewage tanks to contain sewage while ground preparatory works and construction is ongoing. <p><u>The decommissioning of these ponds will entail the following:</u></p> <ul style="list-style-type: none"> -The treatment of liquids as well as removal and disposal of biosolids accumulated at the bottom of the ponds. These solids need to be handled properly before re-using the ponds, i.e., for the ponds' upgrading and cleaning up. -Cleaning up and closure of any inactive ponds or ditch/trench onsite. -Proper ground preparatory works, capping and elimination of existing treatment components as well as disposal of waste to relevant approved waste management facilities. -The ground preparatory works of old ponds should also be planned and done in consultation and collaboration with the Water Environment Division at the DWA of the MAWLR to ensure compliance to Regulations pertaining to handling Wastewater. If required, a Permit should be applied for and obtained from the Division. -The most important end component of pond ground preparatory works will be to determine the quantity and quality of the biosolids that will have to be removed from the ponds and the option that will be appropriate for land use or disposal. Please refer to the Code of Practice: Volume 6 – Wastewater Re-Use of July 2012. 	<p>-A Wastewater Treatment Specialist should be involved in this process</p> <p>-Sign off by the Wastewater Treatment Specialist</p>
Existing contaminated Soils	<p>-Undertake a site-wide contaminated soil to determine the nature and extent of contamination and to identify appropriate remediation measures.</p>	<p>-A Soil Scientist should be appointed to undertake a full Soil Contamination Assessment and thus, recommending site specific remediation measures</p>

Aspect	Mitigation Measure(s)	Completion criteria
	<ul style="list-style-type: none"> -Rehabilitate contamination by excavating contaminated material to a depth of 300mm and remove and dispose of it at the nearest approved waste management facility. -Treat organic contamination by means of biological remediation via the establishment of a bioremediation site and monitor soil quality against a selected control site. 	<ul style="list-style-type: none"> -Sign-off by the Soil Scientist upon completion of the rehabilitation/remediation of contaminated soils to ensure successful exercise and safety of site soils
<p>Stockpiled topsoil, and disturbed areas</p>	<p><u>POST-CONSTRUCTION/UPGRADING DECOMMISSIONING</u></p> <ul style="list-style-type: none"> -All construction related excavated pits and trenches that will not be utilized for the subsequent phase should be backfilled. -The stockpiled topsoil on and around the site due to the project activities should be levelled. -Provision of both financial and technical resources for site rehabilitation should be made. 	<ul style="list-style-type: none"> -All stockpiled soils are levelled, and pits backfilled.
<p>Surface infrastructure and structures</p>	<p><u>Service infrastructure to be removed</u></p> <ul style="list-style-type: none"> -All infrastructures and structures that will no longer be required for the operational and maintenance phase should be dismantled and removed from site. These structures include camping sites, storage tanks, onsite temporary offices, ablution facilities and other supporting structures erected for upgrading (refurbishment). These will be transported to designated storage facilities offsite. -All project related vehicles, machinery, and equipment should be removed from site to designated parking and storage sites off site, respectively. -All access roads that may have been created for the upgrading works and no longer required for the operational phase should be closed off. 	<ul style="list-style-type: none"> -All other infrastructure decommissioned to ground level and removed from site.
<p>Waste (general and hazardous)</p>	<ul style="list-style-type: none"> -All waste storage containers should be removed, and waste disposed of at designated and approved waste management sites. -Temporary sanitation facilities should be carried away by a designated sewer removal expert or according to the toilet manufacturer's handling instruction. -Decontaminate hazardous waste storage tanks and containers at a dedicated decontamination bay at the nearest capable facilities. A pre-disposal permit should be obtained from the facility operator. -Remove oil drums and petroleum products off site for resale/use. 	<ul style="list-style-type: none"> -All waste and associated containers removed from site and transported to designated and authorized sites.

6 ENVIRONMENTAL MONITORING

Monitoring is the primary way of establishing how well the management system is operating. In other words, to maintain a low significance rating of potential impacts through implementation of management action plans, it is worthwhile that regular monitoring of the mainly affected environmental components is conducted.

6.1. Environment Management Plan Recommendations

To ensure a healthy and safe environment onsite, a plan for environmental management has to be instituted through monitoring. This involves the collection and analysis of relevant environmental data as well as periodic documentation and reporting.

- External Auditing: The key to a successful EMP is appropriate monitoring and review to ensure effective functioning of the EMP and to identify and implement corrective measures in a timely manner. In the event that discrepancies are identified, the problem must be investigated and attended to. All the results obtained during environmental monitoring must be documented for audit purposes.
- An audit of the environmental management actions undertaken is essential to ensure that it is effective in operation, is meeting specified goals, and performs in accordance with relevant regulations and standards. Audits should be conducted during project implementation phases to ensure adherence to the management measures contained in the EMP.

6.2. Physical Environmental Monitoring

The following components have been identified suitable for monitoring in terms of the oxidation pond's activities during its operational phase:

- Water (both surface and groundwater),
- Dust (and odor during operations)
- Soils, and
- Waste (wastewater/effluent, slurry/sludge).

The list of environmental components to be monitored and their details are given in Table 6-1.

Table 6-1: Environmental monitoring program for the construction and operational phases

Component	Parameter	Project Phase	Frequency	Location
Groundwater	Water quality: Ammonium nitrogen, chloride, nitrate-nitrogen, nitrite-nitrogen, potassium, total dissolved phosphorus, pH, electrical conductivity (EC), bicarbonate, calcium, dissolved organic carbon, magnesium, sodium, sulphate, total dissolved solids, an ion balance, and Escherichia coli	Operational	Quarterly (in April and then October)	Readings should be taken from all nearby boreholes within 2km of the project site. The right boreholes to be tested for water quality would be upstream (north of the site) and downstream (south of the site).
Surface water	Water quality	Operational	Monthly (during rainy season, i.e., January to March)	In the nearest open water bodies (Omaruru River)
Soil	Phosphorus, nitrate nitrogen (NO ₃ -N), EC, pH and Chloride	Operational	Bi-annually	Next to sewage/wastewater tanks or dams sites, and truck loading and offloading areas
Effluent / wastewater	pH, electrical conductivity, orthophosphate-P, potassium, sodium adsorption ratio, total nitrogen, total phosphorus, Total Suspended Solids (TSS) and Total Dissolved Solids (TDS)	Operational	Bi-annually (every 6 months)	At the effluent collecting and storing ponds or dams. This will mainly be determined by the effluent discharge permit from the Department of Water Affairs.

6.3. Occupational Health and Safety Monitoring Program

Occupational health and safety monitoring program should include the following:

6.3.1. Surveillance of the working environment

The Proponent should document compliance using an appropriate combination of portable and stationary sampling and monitoring instruments. Generally, monitoring should be performed during commissioning of facilities or equipment and at the end of the defect and liability period, and otherwise repeated according to the monitoring plan.

6.3.2. Surveillance of workers health

When extraordinary protective measures are required, workers should be provided appropriate and relevant health surveillance prior to first exposure and at regular intervals thereafter. The surveillance should, if deemed necessary, be continued after termination of the employment.

6.3.3. Training

Training activities for employees and visitors should be adequately monitored and documented (curriculum, duration, and participants). Emergency exercises, including fire drills, should be documented adequately. Service providers and contractors should be contractually required to submit adequate training documentation to the Proponent before commencing with their tasks at the site.

6.3.4. Accidents and diseases monitoring

The Proponent, Engineering Consultant or Contractor should establish procedures and systems for reporting and recording:

- Occupational accidents and diseases, and
- Dangerous occurrences and incidents.

These systems should enable workers to report immediately to their immediate supervisor any situation they believe presents a serious danger to life or health. The systems and the Proponent should further enable and encourage workers to report to management all:

- Occupational injuries and near misses,
- Suspected cases of occupational disease, and
- Dangerous occurrences and incidents.

All reported occupational accidents, occupational diseases, dangerous occurrences, and incidents together with near misses should be investigated with the assistance of a person knowledgeable/competent in occupational safety. The investigation should:

- Establish what happened;
- Determine the cause of what happened; and
- Identify measures necessary to prevent a recurrence.

6.3.5. Contingency Plan

An emergency is an unplanned event when a project operation loses control, or could lose control of a situation that may result in risks to human health, property, or the environment, either within the facility or in the local community. Emergencies do not normally include safe work practices for frequent upsets or events that are covered by occupational health and safety. The Emergency Preparedness and Response Plan should include the following basic elements:

- Administration (policy, purpose, distribution, definitions, etc.),
- Organization of emergency areas (command centres, assembly points, fire suppression equipment and escape plans),
- Roles and responsibilities,
- Communication systems,
- Emergency response procedures and Emergency resources,
- Training and updating,
- Checklists (role and action list and equipment checklist), and business Continuity and Contingency.

7 RECOMMENDATIONS

Mafuta Environmental Consultants recommend that an ECC be issued for the upgrading of oxidation ponds in Omaruru, subject to the following:

- All management and mitigation measures provided in the EMP should be implemented and monitored accordingly.
- The Municipality should strive for continuous improvement and implement new measures (by continuously updating the EMP, as deemed necessary) to ensure effective environmental management, sustainability and protection throughout the project life span.

- All required permits, licenses and approvals for the upgrading of oxidation ponds should be obtained as required.
- The Proponent, site employees and contractors involved in the project activities comply with the legal requirements governing this type of project and its associated activities.
- All the necessary environmental and social (occupational health and safety) precautions provided should be adhered to.

APPENDIX 1: CHANCE FINDS PROCEDURE (AFTER KINAHAN, 2020)

Areas of project activities are subject to heritage survey and assessment at the planning stage. These surveys are based on surface indications alone, and it is therefore possible that sites or items of heritage significance will be found during development (operations and decommissioning) works. The procedure set out here covers the reporting and management of such finds.

Scope: The “*chance finds*” procedure covers the actions to be taken from the discovery of a heritage site or item to its investigation and assessment by a trained archaeologist or other appropriately qualified person.

Compliance: The “chance finds” procedure is intended to ensure compliance with relevant provisions of the National Heritage Act (27 of 2004), especially Section 55 (4): “*a person who discovers any archaeological objectmust as soon as practicable report the discovery to the Council*”. The procedure of reporting set out below must be observed so that heritage remains reported to the NHC are correctly identified in the field.

The Project Manager/Supervisor must report the findings to the following competent authorities:

- **National Heritage Council of Namibia: Head Office: +264 61 244 375**
Technical Office +264 61 301 903
- **National Museum (+264 61 276 800)**
- **National Forensic Laboratory (+264 61 240 461)**

Responsibility:

Operator:	To exercise due caution if archaeological remains are found
Foreman:	To secure site and advise management timeously
Superintendent	To determine safe working boundary and request inspection
Archaeologist	To inspect, identify, advise management, and recover remains

Procedure:

Action by person identifying archaeological or heritage material

- a) If operating machinery or equipment stop work
- b) Identify the site with flag tape
- c) Determine GPS position if possible
- d) Report findings to foreman

Action by foreman

- a) Report findings, site location and actions taken to superintendent
- b) Cease any works in immediate vicinity

Action by superintendent

- a) Visit site and determine whether work can proceed without damage to findings
- b) Determine and mark exclusion boundary
- c) Site location and details to be added to project GIS for field confirmation by an archaeologist

Action by Archaeologist

- a) Inspect site and confirm addition to project GIS
- b) Advise NHC and request written permission to remove findings from work area
- c) Recovery, packaging and labelling of findings for transfer to National Museum

In the event of discovering human remains

- a) Actions as above
- b) Field inspection by archaeologist to confirm that remains are human
- c) Advise and liaise with NHC and Police
- d) Recovery of remains and removal to National Museum or National Forensic Laboratory, as directed.

**APPENDIX 2: A GUIDE (AN EXAMPLE) OF DECOMMISSIONING OR RELINING
(DOMESTIC) WASTEWATER PONDS**

Purpose

The purpose of this fact sheet is to describe regulatory requirements and provide guidance for the decommissioning or relining of domestic wastewater treatment ponds.

These requirements may include (but are not limited to):

- removal and disposal of biosolids
- sealing/capping of any groundwater monitoring wells
- proper demolition, capping, and elimination of treatment components

Permittees with a domestic wastewater treatment pond system that are eliminating the use of ponds (either through replacement with a new treatment system, or closure of the treatment system altogether) **cannot abandon the ponds “as is”**, due to potential safety, environmental and human health hazards. Biosolids accumulated on the pond bottom contain a number of pollutants, nutrients, and pathogenic organisms that must be handled properly before abandoning or re-using the structure.

When are Ponds Decommissioned?

After domestic wastewater ponds cease to receive wastewater for treatment and all the flows are conveyed to another facility, the biosolids in them are subject to one of the following rules and must meet requirements for use or disposal.

Rules and Regulations that Apply

- 40 Code of Federal Regulation [CFR], ch. 503 *Standards for the Use of Disposal of Sewage Sludge*. This rule covers the options for the use or disposal of biosolids that are based on risk assessments done by the Environmental Protection Agency. This rule forms the basis of Minn. R. ch. 7041 for land application.
- Minn. R. ch. 7041 – Biosolids Management Rule. This rule covers biosolids that are applied to the land for treatment and beneficial use. It also applies to the biosolids in a wastewater treatment pond once it ceases to receive wastewater.
- Minn. R. ch 4725 – Wells and Borings. This rule addresses the abandonment of wells.
- Minn. R. ch 7035. Solid Waste Rules. This rule addresses land filling biosolids.

If a permittee is considering keeping a pond for biosolids storage, it must meet stringent seepage requirements and is a permitted facility under Minn. R. ch. 7041.0900.

Planning

When planning to decommission or reline a pond (s), contact all parties that are involved in the process so things can run smoothly. This is particularly important when a pond is relined as the timing of biosolids removal becomes critical in the process. Persons involved in the process are the consulting engineer, wastewater operator, Type IV operator, and the permittee’s administrative personnel and the Agency’s engineer, biosolids coordinator, permit writer, and enforcement staff. The biosolids coordinator may visit the site in order to understand the site conditions and discuss possible scenarios with individuals working on the project. Each project seems to be somewhat different.

Good planning cannot take place without a Preliminary Assessment (see page 2) of the quality and quantity of biosolids in the ponds. This assessment should be done in the Facility Planning phase of the construction project in order to:

- determine feasibility of an option for use or disposal
- more accurately calculate funding needs of the project
- provide a basis for the construction bid item

Permits

The permittee will be required to submit an approvable plan for decommissioning the ponds in their NPDES/SDS permit. The plan must be based on information from the **Preliminary Assessment** and describe (but not limited to) the following:

- the time frame for decommissioning the ponds including date/s for Final Measurement and Sampling
- the analytical parameters for the final sampling event
- how the biosolids will be removed (liquid/solid or both)
- the quantity of biosolids estimated to be in the pond/s
- the quality of biosolids, include analytical data taken to date
- what method/s are planned for use or disposal
- how much land is needed, the dates for having a Type IV operator employed, and when site applications will be submitted for review and approval **if biosolids are to be land applied** .

When writing the plan, the permittee should consider a time frame of approximately two years to complete the project. This may vary depending on:

- the time of year when all wastewater will be conveyed to the other facility or the initiation of operation date
- the alternative/s chosen for use or disposal
- the amount of time necessary to discharge pond effluent and dry out, apply, or dispose of the biosolids

This amount of time is needed because even if some biosolids are removed in a liquid state, to remove **all** biosolids, the ponds need to dry out. In order to dewater the pond (s), it is important to keep a viable discharge point in the permit whether it is directly to surface water – likely the current discharge point-or-through a new plant that may have a different discharge point.

Permits will remain in effect until the decommissioning is complete – this includes submitting Discharge Monitoring Reports, any other specific reports, and payment of annual permit fees.

How to do a Preliminary Assessment

As mentioned previously, a preliminary assessment of the quantity and quality of the biosolids must be done in order to estimate the volume of biosolids that will have to be removed, and to determine what option is appropriate for use or disposal. It will also provide an estimate of number of dry tons in the ponds which affects the number of final samples that have to be taken if the biosolids are land applied. If pollutant concentrations are greater than that allowed for land application, the biosolids must be evaluated for land filling.

Quantity and quality: Develop a grid system to check the thickness or depth of the biosolids layer and for collecting samples. When setting up a grid system consider the size of the pond/s, their current condition based on operator knowledge of biosolids accumulations due to wind and depth around dikes, inlet structures, and age and condition of the pond (s). A “Sludge Judge” is used for visual observation of depths and sampling - taking care **not** to include liner material or liner cover material in samples that can skew the analysis and volume estimates. It is usually easy to distinguish between biosolids and the other sediments because of their black color.

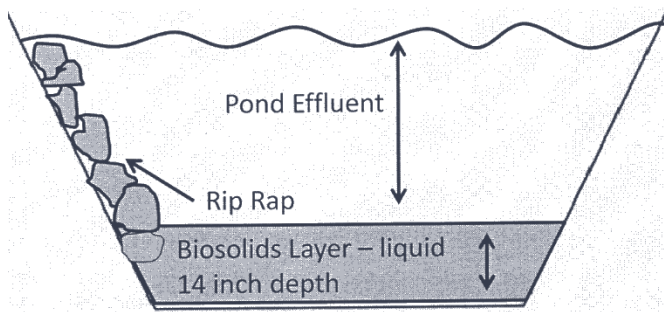
Each sample taken for analysis must be a composite sample made up of 10 sub samples. For ponds less than six acres, take at least two composite samples. For large ponds, take one composite sample per six acres at a minimum. **People experienced in sampling ponds state they prefer probing depths and sampling of the biosolids during a time when the pond is frozen, if possible, instead of from a boat.**

Parameters for analysis [Minn. R. ch. 7041.1500, subp 2] on a **dry weight basis** are:

- ✓ Total Solids [TS]
- ✓ Volatile Solids, Percent of TS
- ✓ pH
- ✓ Percent Total Kjeldahl Nitrogen (TKN)
- ✓ Percent Ammonia Nitrogen
- ✓ Percent Phosphorus
- ✓ Percent Potassium
- ✓ Concentration of metals in mg/kg of arsenic, cadmium, copper, lead, mercury, molybdenum, nickel selenium, and zinc
- ✓ PCBs if the ponds were built before 1984

After sampling, it is possible to estimate the dry tons of biosolids in the pond/s, determine whether or not the biosolids can be applied to the land, and how much nitrogen is available in biosolids which determines how many acres are needed for application.

Example: Preliminary measurement and sampling



Be sure to measure and sample the biosolids layer only – **no liner, no effluent.**

- Pond is three acres
- Liquid biosolids are 5 percent total solids
- TKN = 2.5 percent
- Ammonia N = 0.08 percent
- Metals meet the ceiling concentrations:

Metal	Ceiling concentration in mg/kg dry wt.*
Arsenic	75
Cadmium	85
Copper	4300
Lead	840
Mercury	57
Molybdenum	75
Nickel	420
Selenium	100
Zinc	7500

*If any one of the metals is over the ceiling concentration, the biosolids cannot be applied to the land. If PCB’s levels are over 50 mg/kg, biosolids cannot be applied to the land and are considered a hazardous waste.

Liquid Biosolids

- **calculate the volume of biosolids:**
14 in. x 3 acres x 27,154 gallons per acre in. = 1,140,468 gallons

Convert gallons to dry tons:

1,140,468 gallons x 8.34 lbs. per gallon = 9,511,503 lbs. ÷ 2000 lbs. per ton = 4,755.8 tons x 0.05 percent total solids = **237.8 dry tons**

- Calculate the amount of available nitrogen in biosolids with this formula:
(organic N x 4) + (ammonia N x 20) = available nitrogen in one dry ton
[organic N = TKN – ammonia-N: 2.5 percent – 0.08 percent = 2.42 percent]
(2.42 percent x 4) + (0.08 percent x 20) = 9.68 + 1.6
Available nitrogen ≈ 11.3 lbs./ton [estimate]
x 237.8 dry tons ~ 2687 lbs. available nitrogen in all the biosolids

Dewater (Drying) for Final Measurement and Sampling

The final measurements and sampling of the biosolids are done **after** drying down and **before** the biosolids are moved around in the pond bottom for any reason [except to create a trench for dewatering] - so timing the pond/s dry down with respect to a construction schedule is critical. These are called “cake” (versus liquid) biosolids and can be moved with basic earthwork equipment and could be applied with a manure type spreader. If ponds are being decommissioned, some cities have done all this work on their own.

As mentioned above, it may be necessary to create a few trenches that drain to a sump area to remove excess effluent. If you have to deal with a synthetic liner, contact the biosolids coordinator and Agency engineer about possibly slitting the liner to allow for drainage. If the pond bottom is not sealed well and there is infiltration of ground water into the pond, it may be difficult to dewater. In that case, for small ponds, all the contents usually have to be pumped out during a dry time of year and land applied or transferred to another facility in the liquid state. If the pond is large, other methods of dewatering the area may have to be investigated.

After dewatering, it should be possible to differentiate the pond bottom [liner] from the biosolids – an actual visual observation. After taking measurements and getting the samples, the biosolids are generally windrowed in the pond to prepare them for removal and to help keep them as dry as possible. Removal of the biosolids can be based on visual observation of the pond bottom versus the biosolids [which are generally black]. If the pond bottom is determined to be quite level, an elevation can be specified for removal. If the pond is to be relined, the plans may indicate taking out more of the pond liner with the biosolids than if it was to be decommissioned. Any material mixed with biosolids becomes biosolids.

The minimum number of final samples to take for analysis is based on the dry tons to be applied. However, the overriding requirement is that the sample (s) is/are representative of the biosolids that are applied. This means that the person taking samples must consider any potential variability in the biosolids quality within the pond (s).

In the case above, we previously estimated there were about 237.8 dry tons. The minimum number of samples is one made up of ten subsamples and analyzing for at least TKN, ammonia –N, and total solids on this second round of testing as well as sampling to demonstrate that pathogen reduction has been met. Compliance with pathogen reduction standards is demonstrated by taking a set of seven individual samples (at the minimum sampling frequency as for other parameters) that are analyzed for fecal coliform using the most probable number [MPN] method [SM 9221E]. The geometric mean of those seven samples must be less than two million MPN per gram of total solids.

All other parameters **may** have to be analyzed for again depending on the quality of analytical data and the date the preliminary sample/s were taken.

The minimum number of samples required is:

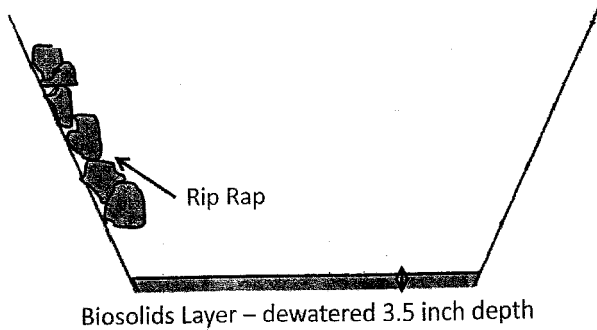
Dry tons applied	Number of samples
>0 but < 320	1
≥ 320 but < 1,650	4
≥ 1,650 but < 16,500	6
> 16,500	12

With the data from this sampling event, the calculations for volume and nutrients can be refined if the biosolids are to be land applied.

Since the biosolids are now dewatered and will be moved and/or applied on a cubic yard basis, the cubic yards have to be converted to dry tons in order to do any calculations because all analyses are reported on a dry weight basis. Cubic yards are converted to dry tons by using a “five gallon bucket test”.

Recalculate the volume and dry tons biosolids in the dewatered state and pounds of nitrogen it contains if it is to be land applied.

Example: Final Measurement and Sampling



- Pond is three acres
- Dewatered biosolids are 25 percent total solids
- TKN = 2.0 percent
- Ammonia N = 0.05 percent

Dewatered (Cake) Biosolids

Calculate the volume of biosolids:

$3.5 \text{ in.} \div 12 \text{ in. per ft.} \times 3 \text{ acres} \times 43,560 \text{ sq. ft. per acre} = 38,115 \text{ cu.ft.} \div 27 \text{ cu.ft. per cu. yd.} \sim \mathbf{1411.7 \text{ cu. yds.}}$

Calculate the total dry tons using the “five gallon bucket test”:

- Weigh a five-gallon pail
- Fill the pail with biosolids. We suggest filling it with equipment used to load the applicator [for example a bobcat].
- Scrape the surface to level the biosolids
- Weigh the loaded pail
- Subtract the empty pail weight [wt.] from the full pail wt. = wt. of wet biosolids.
- Find the dry wt. of the biosolids:

Wet wt. x percent total solids [as decimal]

Determine the dry wt. of biosolids per cu. yd. using this formula:

Dry wt. of biosolids x 0.02 = dry tons per cu. yd.

Example: $54 \text{ lbs. wet wt.} \times 0.25 \text{ [25 percent total solids]} = 13.5 \text{ lbs. dry wt.} \times 0.02 \sim \mathbf{0.3 \text{ dry tons per cu. yd.}}$

The estimate was $1411.7 \text{ cu. yds.} \times 0.3 \text{ dry tons per cu. yd.} \approx \mathbf{423.5 \text{ dry tons.}}$

Now recalculate the available nitrogen using the analysis taken from the dewatered biosolids: (same formula as used before)

$(1.95 \text{ percent organic N} \times 4) + (0.05 \times 20)$

$7.8 + 1.0 = 8.8 \text{ lbs. available N per dry ton} \times 423.5 \text{ dry tons} \sim \mathbf{3727 \text{ lbs. total available N.}}$

The total amount of nitrogen in the mass of biosolids is used to determine the number of acres needed to apply biosolids.

The final mass of biosolids with the soil that gets mixed in with it is not sampled. It is not possible to get a good representative sample once the two are mixed because the mixture is not homogenous. **This is why it is re-measured and sampled before it is moved around and mixed with soil.**

How many acres are needed depends on the crop to be grown, yield goal, previous crop grown, method of application, and soil organic matter content. A Type IV Operator [land application type certification] should be taking over by this point to continue the process of making the calculations for maximum available nitrogen application [MANA] rates, determining site suitability, taking soil samples, completing site application forms, overseeing the actual application, and completing the annual report. If any of the old pond area is going to be proposed as a reclamation application site, the Type IV must also check to see if a request for modification of suitable slope or soil conditions has to be made when applying for site and application approval. **Site approvals take a minimum of 30 days.**

All proposed areas of application must go through the site approval process. Site approvals go through a 30-day notification period, and are tied to the permittees NPDES/SDS permit for enforcement purposes.

Application example: How many acres are needed for application at a certain MANA rate?

For corn with a MANA rate of 150 lbs. of nitrogen per acre – the calculation above indicates there are **3727 lbs. total available N ÷ 150 lbs. per acre that can be applied ~ 24.8 acres are needed.**

Depending on the crop and its associated MANA rate, the acres needed may increase or decrease.

Where do I find a Type IV Operator?

Any treatment facility that has a mechanical plant that generates biosolids continuously would have or subcontract with a Type IV Operator to handle their biosolids land application program.

- Contact a nearby municipality or sanitary district with a mechanical treatment plant. In this situation, the contractor would provide the actual applicator who would apply under the direction of the Type IV operator.
- Visit the Agency Web site for contract applicators that are Type IV certified.
<http://www.pca.state.mn.us/index.php/waste/waste-and-cleanup/cleanup-programs-and-topics/topics/land-application-of-industrial-by-products.html?menuid=&missing=0&redirect=1>
- Some engineering firms have a staff person that is Type IV certified.
- Industrial facilities that land apply various industrial by-products may also have Type IV Operators. These operators would provide services like those from a municipality.

Removal and Application or Disposal

Timing of removal and application may be hindered by weather and where the biosolids are to be applied. The biosolids must be incorporated in the soil to meet standards for vector attraction reduction, and there are timing issues related to application and seeding a site that the Type IV Operator will know about.

If it is not possible to apply the biosolids in a timely manner, the windrowed biosolids can be stored in the pond or on the inner dike of the pond to keep them dry and out of the way of construction. It is possible, under certain site conditions, to store biosolids for up to seven months on a site where it is to be applied. Discuss this with the Type IV Operator before he/she completes the site application forms.

Application to **agricultural sites** is always at agronomic rates (recommended nitrogen application rate for the crop).

Reclamation Sites - In general, reclamation sites are treated like agricultural sites for nitrogen application.

In some reclamation cases, it may be possible to apply at a greater than an agronomic rate. This type of proposal would be submitted with the site application form. The reason for applying more biosolids to a reclamation site is related to supplying enough organic matter to sustain vegetative cover for a long time.

If the biosolids nitrogen content is very low, it is sometimes possible to apply at high volumetric rates on either kind of site. The rate is then limited to amounts similar to specifying a depth of topsoil for a construction site. That would be a maximum of six inches. If the depth cannot be completely incorporated, it is necessary to seed and mulch the site to aid in creating a barrier condition to prevent movement of biosolids off the site and to comply with vector attraction reduction requirements. All sites applied to during summer months need to be seeded within 14 days of application.

Examples of reclamation sites that provide final biosolids treatment would be:

- The pond construction site – **after removal** of the biosolids, the dikes can be pushed in and leveled and graded for positive drainage for land application.
- It may be possible to provide positive drainage on the pond site to provide suitable conditions [aerobic soils] for plant growth without removing all the dikes and leave some or all of the biosolids in place (discuss this with the biosolids coordinator).
- Mining sites such as gravel pits
- Sites that have been stripped of topsoil for some other reason.
- Daily cover at landfills, particularly if there is a lot of soil removed with the biosolids. This would actually be considered as land filling if the landfill is lined as mentioned previously. In this case, a site approval is not necessary.
- Used in the final cover at a landfill - this would require a site approval.

After biosolids application, public access must be restricted for one year.

Disposal

The biosolids can be dewatered and taken to a landfill that meets the lined landfill standards of solid waste rules if the landfill agrees to accept them. They are then considered to be in compliance with 40 CFR. 503. A landfill in Minnesota will require biosolids to pass the “paint filter test”, pass the toxicity characteristics leaching procedure [TCLP] test, and meet Class B pathogen reduction standards. Check with landfills for acceptance before planning on this option.

What about the rip rap and Synthetic liners or liners with bentonite in them?

- Riprap can be dozed when and if the dikes are pushed in, or it can be salvaged. If there are biosolids on it, it can be washed and/or left to dry in the sun for at least 30 days.
- If all the biosolids are removed, the pond can then be left “as is” with rip rap in place.
- Synthetic liners must be removed and taken to a landfill. In some cases, it has been possible to recycle them at a plastics recycling business.
- Liners with bentonite in them and that are scraped up with the biosolids could cause problems if the mixture was applied to cropland. This mixture may have to be land filled or applied on land owned by the permittee.

Final inspection

Once all of the solids are removed, applied, or disposed, a final inspection by Minnesota Pollution Control Agency may be necessary to ensure that the work was completed in compliance with regulations. In some cases, photo documentation of the completed job is sufficient. The permittee can now use the ponds or fill, level, or grade the site. If other alternative uses are proposed, the permittee may be required to conduct a water balance on the ponds, and may be required to maintain a permit.

If the ponds are completely removed from service and the permittee does not hold a permit for a new facility, they should submit appropriate documents for permit termination.