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ENVIRONMENTAL MANAGEMENT PLAN (EMP) FOR THE:

PROPOSED CONSTRUCTION AND OPERATION OF OXIDATION (SEWER) PONDS IN THE TSES VILLAGE, //KARAS REGION: AN APPLICATION FOR THE ENVIRONMENTAL CLEARANCE CERTIFICATE (ECC)

MEFT Application No.: **APP-001998**

Date: **05 March 2021**

Proponent: **Dunamis Consulting Engineers & Project Managers (Pty) Ltd**

P O Box 3757 Windhoek, Namibia

DUNAMIS
CONSULTING ENGINEERS
& PROJECT MANAGERS (PTY) LTD

March 2021

DOCUMENT INFORMATION

Title: Environmental Management Plan (EMP) for the proposed Construction and Operation of Four Oxidation (Sewer) Ponds in Tses Village of the //Karas Region

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Date:	05 March 2021

SERJA' STATEMENT OF INDEPENDENCE

As the Appointed Environmental Consultant to undertake the Environmental Impact Assessment (EIA) for the proposed construction and operation of four oxidation (sewer) ponds in Tses of the //Karas Region, Serja Hydrogeo-Environmental Consultants cc declare that, we:

- do not have, to our knowledge, any information or relationship with any staff member from Dunamis Consulting Engineers & Project Manager (Pty) Ltd, the Ministry of Environment, Forestry and Tourism (MEFT)'s Department of Environmental Affairs and Forestry (DEAF) or the Competent Authority (Ministry of Agriculture, Water and Land Reform (MAWLR) that may reasonably have potential of influencing the outcome of this Environmental Assessment and the subsequent Environmental Clearance Certificate applied for.
- have knowledge of and experience in conducting environmental assessments, the Environmental Management Act (EMA) No. 7 of 2007 and its 2012 Environmental Impact Assessment (EIA) Regulation as well as other relevant national and international legislation, guidelines, policies, and standards that govern the proposed project as presented herein.
- have performed work related to the ECC application in an objective manner, even if the results in views and findings or some of these may not be favorable to the Proponent.
- have complied with the EMA and other relevant regulations, guidelines and other applicable laws as listed in this document.
- declare that we do not have and will not have any involvement or financial interest in the undertaking/implementation of the proposed project, other than remuneration for work performed to conduct the EIA and apply for the ECC in terms of the EIA Regulations' requirement as an Environmental Assessment Practitioner (EAP).

Disclaimer: Serja Hydrogeo-Environmental Consultants will not be held responsible for any omissions and inconsistencies that may result from information that was not available at the time this document was prepared and submitted for evaluation.

……

Signature:

Fredrika N. Shagama, Environmental Assessment Practitioner

Date: 05 March 2021

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LIST OF ABBREVIATIONS

Abbreviation	Meaning
BOD	Biological Oxygen Demand
CFP	Chance Find Procedure
COD	Chemical Oxygen Demand
COP Vol.6	Code of Practice Volume 6
DEAF	Department of Environmental Affairs and Forestry
DWA	Department of Water Affairs
EA	Environmental Assessment
EAP	Environmental Assessment Practitioner
ECC	Environmental Clearance Certificate
EIA	Environmental Impact Assessment

Abbreviation	Meaning
EMA	Environmental Management Act
EMP	Environmental Management Plan
GG	Government Gazette
GN	Government Notice
HDPE	High-density polyethylene
HIV/AIDS	Human Immunodeficiency Viruses and Acquired Immune Deficiency Syndrome
MAWLR	Ministry of Agriculture, Water and Land Reform
MSDS	Material Safety Data Sheet
MEFT	Ministry of Environment, Forestry and Tourism
PPE	Personal Protective Equipment
S	Section
SABS	South Arican Bureau of Standards
SANS	South Arican National Standards
SHE	Safety, Health and Environment
SPCC	Spill Prevention, Control, and Countermeasure

1 INTRODUCTION

1.1 Background and Project Location

As appointed by the Tses Village Council, Dunamis Consulting Engineers & Project Managers (Pty) Ltd (hereinafter referred to as Dunamis or the Proponent) are planning to construct four oxidation (sewer) stabilization ponds in Tses Village of the //Karas Region in southern Namibia. The site planned for the ponds' construction and operation is located on the southwestern side of the Village where the current five dilapidated oxidation ponds are. The proposed site covers an area of 50 000 square metres (m^2) or 5 hectares (ha).

The proposed sewer ponds' site is located on the southwestern side (edge) of the Tses Village. Tses Village is located between the towns of Mariental (155 km north) and Keetmanshoop (about 80 km south) along the B1 main road that connects the central and southern parts of Namibia. The site map is shown in **Figure 1**. The GPS coordinates of the existing ponds at the proposed site are presented in **Table 1** below.

Table 1: GPS coordinates of the existing oxidation ponds' site and the site for the new ponds in Tses

Pond Name or Reference	GPS Coordinates
Existing Active Pond 1 (P1)	-25.888468° 18.118139°
Existing Active Pond 2 (P2)	-25.887560° 18.117028°
Dry Pond 3 (P3)	-25.887314° 18.116566°
Dry Pond 4 (P4)	-25.887271° 18.116282°
Dry Pond 5 (P5)	-25.887132° 18.116394°

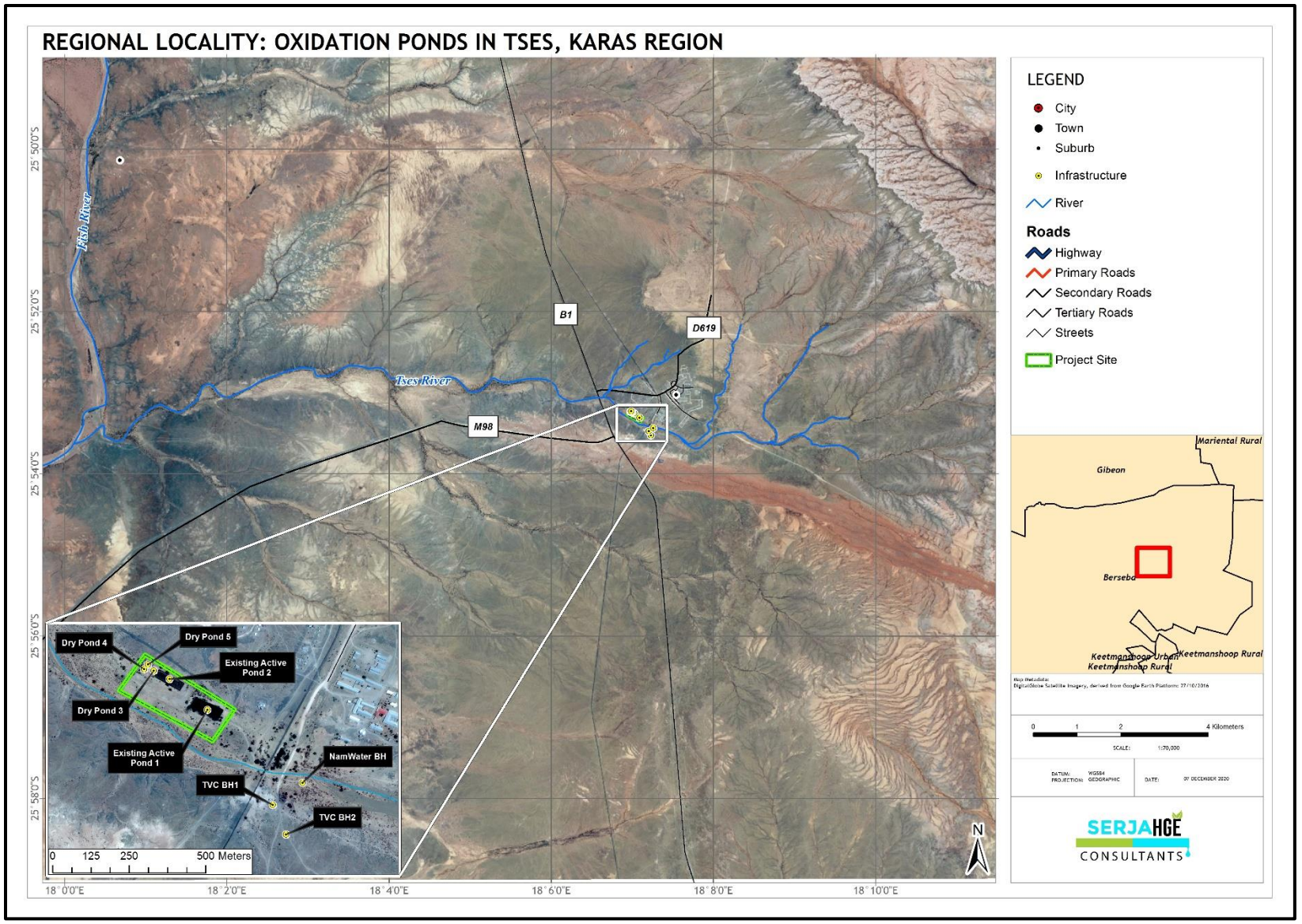


Figure 1: Locality map of the proposed sewer ponds site in Tses Village, //Karas Region

1.2 Purpose of the Draft 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 demolition of old ponds, construction of new ponds, and subsequent operational and maintenance of the new ponds.
- **Demolition** – the period during which the existing (old) ponds will be demolished to prepare for the construction of new ponds
- **Construction** – the new ponds and required operational structures and infrastructure will be erected and installed on site, respectively.
- **Operation and maintenance phase** - the period during which the new ponds are operational upon handover of site and associated operational infrastructure, and equipment to the Tses Village Council by the Proponent. The Village is also likely to be responsible for site maintenance as deemed necessary in collaboration with an external specialist in oxidation ponds' operations.

1.3 The Environmental Assessment Practitioner (Consultant)

In accordance with the Environmental Management Act (2007) of Namibia and its Regulations of 2012, the Proponent appointed Serja Hydrogeo-Environmental Consultants as an independent environmental consultant to conduct an Environmental Assessment and submit the required documents as part of an application for an Environmental Clearance Certificate (ECC) to the Environmental Commissioner. This EMP is one of the required documentations to the ECC application.

This document was compiled by Ms. Fredrika Shagama of Serja. Ms. Shagama is a qualified and experienced hydrogeologist with over 5 years of experience in water and environmental consulting and a member of the International Association of Hydrogeologists. She is also an experienced and registered Environmental Assessment Practitioner (EAP) with the Environmental Assessment Professionals of Namibia (EAPAN).

2 BRIEF DESCRIPTION OF THE PROPOSED PROJECT ACTIVITIES

2.1 Oxidation (Stabilization) Ponds Mechanism

Oxidation pond is 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 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**.

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 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 2 m) depth, where BOD reduction of a wastewater takes place by supporting algal-bacterial growth (Tharavathy *et al*., 2013).

The following project phases will be followed to implement the proposed project.

2.2 Planning and Design Phase

As part of the planning and design phase which also cover the EIA/EA study, a preliminary layout of the site drawn by the Engineers and the construction cost determined in the feasibility study by the project planners, Dunamis Consulting Engineers & Project Managers.

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, demolishing (decommissioning) activities of the existing oxidation ponds will follow as planned by the project Proponent and their construction engineers/contractors.

2.2.1 Design for the Tses Oxidation Ponds

Oxidation ponds are designed to fit the needs and conditions of the sites they would be constructed and operated in. The four ponds planned for Tses will be constructed at the same site where the five old ponds (planned for demolition) are currently. To ensure that the new ponds' construction and operation comply with the DWA Regulations, particularly the Code of Practice Volume 2: 2008 regarding the distance of the ponds from the residents, the new ponds will be constructed on the ponds' site areas that comply with this requirement, i.e., with increased distance from houses. Currently, the existing Pond 1 (eastern pond) for instance is about 200 m from the nearest eastern residence. This could be explained by the fact that these old ponds were constructed have been in operation way before the 2008 Regulations on ponds' location, hence the current distance. The ponds' site area is sufficient (5 ha) to accommodate the four new ponds and ensure compliance with the DWA' Codes of Practice for ponds' locations and specifications.

The proposed (new) ponds will be equipped with the following:

- Inlet structure to pump sewage into the pond system,
- Two anaerobic ponds of 14.1x14.1 size and 2.5 m deep,
- Two primary ponds of 52.3 x 52.8 size and 1.3 m deep,
- Two secondary ponds (size: 29.1 x 52.8 x 1.3 m deep), and
- A 102 x 116 and 1.3 m deep evaporation pond where the effluent will be dried prior to its intended use and if necessary, other uses in the environment.

2.3 Demolishing of Existing (old) Oxidation Ponds

Prior to site preparation for the construction of new oxidation ponds, the five old ponds will need to be decommissioned (demolished) as they cannot be used as they are (in their current state). This is done to ensure that no further safety, environmental and human health hazards and to provide land/space for the new ponds.

2.3.1 Handling of Existing and Incoming Sewage during Ponds' Demolition Stage

Given the fact that it is not expected for the Tses Village Council to cease the inflow of wastewater (sewage) from the sewer source to the ponds during the demolishing of old ponds and construction of the new ponds, the Proponent, Village Council, and the Demolishing and or Construction Contractor may need to decide on **carrying out progressive demolition** by determining the feasibility of either of the two options or both:

1. This will need to be done by demolishing one or two ponds at a time to ensure that there is still one or two ponds to still contain incoming wastewater from the Village 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 demolition and construction is ongoing.

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, especially the two active ponds. These solids need to be handled properly before re-using the ponds, i.e., for the construction of new ones and cleaned up.
- Cleaning up and closure of the other three inactive ponds.
- Proper demolition, capping and elimination of existing treatment components as well as disposal of waste to relevant approved waste management facilities.
- The demolition 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** 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 demolition 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 (Minnesota Pollution Agency, 2010). An example of but (Domestic) Wastewater Pond Decommissioning or Relining Plan is attached hereto as **Appendix 2** for further reading and consideration.

Once decommissioning of the old ponds is completed, the site will be prepared for construction works of the new ponds.

2.4 Construction Phase

The proposed project involves the construction of four new oxidation ponds. The anticipated associated activities will include site clearance, earthworks, concrete works, lining and fencing of the site by the appointed reputable and experienced construction contractor.

During this phase, the site will be cleared in preparation of the subsequent project activities. Earthworks will be carried out on the site areas planned for the establishment of the four 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.

Construction period: The construction activities are anticipated to last for about five months.

2.4.1 Human Resources

The project will require the following in terms of human resources and accommodation:

- **Human resources**: the construction work will require about fifteen (15) people; therefore 15 people will be temporary employed (both skilled, semi-skilled and unskilled). Priority for employment will be given to the locals for any project related job that they are qualified for or capable of carrying out.

- **Contractors' Accommodation**: the construction workforce (workers) will be accommodated in tented facilities that will be set up near the site so that they are well on time and available for site works during the working hours and days of the week.

2.4.2 Required Services Resources

The following services will be required and utilized for this phase:

- **Vehicles and machinery:** there will be light, medium, and heavy vehicles to be used for different project activities. The heavy vehicles such as trucks would be needed to transport construction materials and equipment to and from site (as needed). The light vehicles such as bakkies and small buses will be used to transport workers around, to and from site (as and when required). These light vehicles may also be used to transport or move certain project materials and substances on site. Medium vehicles such as excavators will be used to carry out earthworks and other related activities.

- **Water:** A certain amount of water will be required for concrete works and other related project activities as well as for human consumption (drinking water) on site. However, the exact volume of water required is not known at this stage. The required water will either be sourced from the Tses Village Council supply line (upon reaching an agreement with the contractor) or will be brought to site from elsewhere by the contractor.

- **Fuel:** the power required for construction works will be supplied by diesel powered generators.

- **Site access:** the oxidation ponds' site is accessible via the access road currently used to get to the existing dilapidated oxidation ponds at the site. The same access road will be used during the construction works and subsequent operational and maintenance activities.

2.4.3 Health, Waste Management, Safety and Security

- **Personal health and safety**: all construction workers will be supplied with appropriate and adequate personal protective equipment (PPE) while carrying project activities onsite.

- **First aid kits**: At least two first aid kits will be made available on site; one at the working sites and the second one at the site campsite. The workers will be equipped with basic first aid kit administrating skills.

- **Waste management (general):** all waste generated from the construction activities will be sorted, stored on site in designated waste containers and carted to the approved local landfill site (upon authorization from the facility owner/operator).
- **Human waste/sanitation:** the appointed contractor will ensure that the site is equipped with portable chemical toilets for the workers and possibly project related visitors. The toilets will need to be emptied according to the manufacturer's instruction.
- **Fire management:** At least two extinguishers will be on site and project vehicles will also be equipped with fire extinguishers.

  Site fencing: The site area will be demarcated with temporary boundary during the construction activities and then a razor mesh will be erected. 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.

2.5 Operational Phase Activities

This is the phase during which the newly constructed and equipped oxidation ponds will be operational, i.e., treating the wastewater (effluent) from the Tses Village Council wastewater system and maintenance done by the Village Council or an independent contractor. The ponds are expected to be operated 24 hours, 7 days (everyday).

2.5.1 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.

According to the Encyclopaedia Britannica (2020), 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.

2.5.2 Wastewater Treatment Output

The slurry (effluent) will be stored in the ponds. The final effluent will be treated so that it is compliant with and have a quality equal or better than the specified quality for the General Standards as laid out in the Government Gazette Regulation R553 of 5 April 1962, in Section 21(1) and 21(2) of the Water Act (Act No 54 of 1956). In other words, the remaining (dry) slurry will be treated in accordance with acceptable environmental standards so that it can be used in the environment for irrigation purposes in Tses or nearest areas where it may be required. The National Department of Water Affairs' Code of Practice (COP) Volume 6 (Vol.6) on Wastewater Re-use of July 2012 will be also used as guide to ensure that the treated effluent meets the standards and requirements for wastewater re-use.

Other post-treatment applications as listed in the COP would also be explored and considered to ensure that the volumes of treated effluent that is not taken up for irrigation does not all end piled in nature (environment) as mere waste.

2.5.3 Services Infrastructure

A. **Water:** The operational phase of the ponds will not require a significant amount of water apart from time-to-time drinking water for workers and possibly maintenance works, when and as required. This water will be provided by the Tses Village Council from their water supply line. The volume of water is insignificant therefore cannot be determined at this stage

B. **Site accessibility (Road):** The site will be accessed from the existing Village road currently used to access the existing ponds area.

2.6 Decommissioning Phase and Activities

Decommissioning referred to herein is for the decommissioning of the construction works and sites at the end of the construction 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 camping sites, storage tanks, onsite temporary offices, ablution facilities and other supporting structures erected for construction. 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 construction phase and no longer required for operational phase.

- Levelling of stockpiled topsoil and where possible, backfilling of all construction excavated pits and trenches.

3 EMP IMPLEMENTATION ROLES AND RESPONSIBILITIES

The EMP has identified the Proponent, Site Manager (based on project phase), appointed Demolition/ Construction Contractor, Safety, Health and Environment (SHE) Officer, Public Relation Officer (PRO), and Tses Village Council as important roles to guide the environmental management of the proposed ponds' activities. It should be noted that in practice, however, these roles may be assigned to and performed by one person, due to various foreseen and unforeseen circumstances.

A list of specific responsibilities and duties to be undertaken by each are provided below. It should also be noted that the above-mentioned roles are delegated roles and Dunamis Consulting Engineers & Project Managers is ultimately responsible for the overall implementation of the EMP. **However, it should also be noted that Dunamis may only be responsible for the EMP implementation from the planning, demolition of old ponds to the new ponds' construction phase. Upon site handover at the end of the construction phase, the Tses Village Council will take over this responsibility for operational and maintenance phase.**

3.1 Dunamis Consulting Engineers (The Proponent)

The Proponent will be responsible for the following during the planning, demolition, and construction:

- Managing/overseeing the implementation of this EMP and updating and maintaining it when necessary.
- Issuing fines to individuals who contravene EMP provisions and if necessary, removing such individuals from site.
- Setting up and managing the schedule for the day-to-day activities.
- Liaison with all relevant interested and affected parties/stakeholders.
- Ensuring all incidents are recorded and documented.
- Undertaking an annual review of the EMP and amending the document when necessary.

3.2 Site Manager

Overall responsibility for all activities that take place on the project site will reside with the applicable phase site manager. In this regard the following roles and responsibilities are applicable:

- The implementation of and compliance with the environmental management measures proposed in this document.
- Ensuring compliance with relevant environmental and related authorisations and license conditions.
- Identifying and appointing of appropriately qualified specialists (were necessary) to undertake the programmes in a timeous manner and to acceptable standards.

3.3 Construction Contractor

All contractor EHS representative or site supervisors (as appropriate) will:

- 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 site manager prior to initiation of activities.
- Ensure relevant staff are trained in procedures; and
- Maintain records of all relevant environmental documentation.

3.4 Tses Village Council (Oxidation Ponds' Operator)

The Village Council as the owner and operator of the proposed ponds, will be responsible for the following during the operational and maintenance (and when required during the construction phase):

- Managing/overseeing the implementation of this EMP and updating and maintaining it when necessary.
- Issuing fines to individuals who contravene EMP provisions and if necessary, removing such individuals from site.
- Setting up and managing the schedule for the day-to-day activities.
- Liaison with all relevant interested and affected parties/stakeholders.
- Ensuring all incidents are recorded and documented.
- Undertaking an annual review of the EMP and amending the document when necessary.

3.5 Safety, Health and Environmental (SHE) Officer

The SHE Officer will be responsible for the following activities:

- Planning and carrying out site inductions to the workers on-site and visitors to the worksite(s).

- Ensure that the requirements of the EMP are carried out during applicable activities throughout the project life span.
- Monitor the overall implementation of the EMP.

3.6 Public Relation Officer (PRO)

The Public Relation Officer will be responsible for the following tasks:

- Liaising between the affected residents and Proponent/Tses Village Council.
- Ensure effective communication with stakeholders (affected residents), media (if necessary) and the public.
- Managing public relations issues.

3.7 Tses Village Residents (Affected Community)

The residents will be involved in the EMP implementation by carrying out the following:

- Monitor implementation of the EMP and notify the project Proponent or ECO
- Actively participate in stakeholder forums
- Make use of the grievances mechanisms to communicate issues to the Proponent (through the PRO) and/ or to relevant authorities
- Monitor legal compliance
- Review performance reports
- Sanction poor performance and non-compliance where appropriate through directives, penalties, and fines.

3.8 Technical Staff and Consultants

The project's technical experts and consultants will be responsible to:

- Safely and effectively monitor various technical parameters related to:
    - ✓ mechanical designs of the oxidation ponds and associated facilities
    - ✓ waste management
    - ✓ water resources management
    - ✓ Soil preservation/ protection
    - ✓ oxidation ponds operations and maintenance
    - ✓ employee/ contractor health.

3.9 Archaeologist: Chance Finds Procedure Implementation Roles

The following personnel have been assigned responsibilities as per the Chance Finds Procedure (Appendix 1):

- **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.

The Proponent should assess these commitments in detail and should acknowledge their obligation to the specific management actions detailed in the Tables of the following sections

4 ENVIRONMENTAL MANAGEMENT ACTION PLANS

The environmental and social mitigations measures (management plan actions) and the list of legal requirements in terms of permitting and licensing for certain project activities are presented under this chapter. The management plan actions provided under this chapter are mainly for the adverse (negative) impacts. The aim of the plan actions is therefore to avoid these potential impacts where possible, and where impacts cannot be avoided, measures are provided to reduce the impacts' significance.

This chapter also presents the measures that will be implemented to minimize the impact from the demolishing of old ponds as well site rehabilitation of the construction of new ponds (section 4.3).

4.1 Applicable Legislation: Authorisation and Permits

This section covers information on the legal obligations (legislations, policies, and guidelines) that governs certain project activities, where permitting and/or licensing may be required from different applicable regulatory authorities - refer to **Table 2** below. The full list and description of the legal framework (where permits are required or not) is presented in the EIA Report.

Table 2: Applicable legislations in terms of permits or licenses for the proposed activities

Legislation	Provisions	Contact Details
Environmental Management Act 2007 Environmental Impact Assessment (EIA) Regulations (EIAR) (GG No. 4878)	Activities listed in Government Notice (GN) No. 29 of GG No. 4878 require an Environmental Clearance Certificate (ECC). The amendment, transfer, or renewal of the ECC (EMA S39-42; EIAR Regs19 & 20).	**The Environmental Commissioner: (Department of Environmental Affairs and Forestry (DEAF))** **Ministry of Environment, Forestry and Tourism** **Tel: (061) 284 2701**

Legislation	Provisions	Contact Details
	Amendments to this EMP will require an amendment of the ECC. **The ECC needs to be renewed every 3 years.**	
The Water Act 54 of 1956 The Water Resources Management Act No. 11 of 2013 (unpromulgated)	Since there will be no Groundwater abstraction and Use, the permit for commercial use is therefore not applicable. However, the Proponent **will be required to apply for Treated Wastewater/effluent Discharge Permit** from the Department of Water Affairs (DWA): Directorate of Water Resources Management (Water Environment Division). When issued, Proponent, the Permit should be renewed as required (as stipulated in therein).	**Mr Franciskus Witbooi (Deputy Director: Water Policy and Water Law Administration.** **Tel: (061) 208 7158** **OR** **Ms. Elise Mbandeka (Chief Hydrologist): Water Environment** **Tel: (061) 208 7167**
Road Traffic and Transport Act 52 of 1999 and its 2001 Regulations	Provides for the control of traffic on public roads and the regulations pertaining to road transport, including the licensing of vehicles and drivers. **A site access road permit from the main road (B2) should be applied for and obtained from the Roads Authority and conditions set therein to be compiled with**	**Mr Eugene de Paauw (Roads Authority – Specialist Road Legislation)** **Tel.: (061) 284 7027**
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". **A fuel storage Permit should be applied for and obtained from the Ministry of Mines and Energy (MME**)	**Carlo Mcleod (Ministry of Mines and Energy: Acting Director – Petroleum Affairs** **Tel.: (061) 284 8291**
Forestry Act (No. 12 of 2001) Nature Conservation Ordinance No. 4 of 1975 (as amended)	Permits are required for the removal of protected plants species.	**The nearest Forestry Division Office (Ministry of Environment, Forestry and Tourism)**
National Heritage Act (Act No. 27 of 2004)	Should any objects of heritage significance be identified during the demolition of old ponds and construction of new 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: (06) 301 903**

4.2 The Mitigation of Potential Adverse Environmental and Social Impacts

The management plan actions for the mitigation of potential adverse impacts are presented in **Table 3** – for the planning, demolition of old ponds, construction of new ponds and subsequent operational and maintenance phase.

The fact that there are overlaps with regards to impacts occurrence between the demolition, construction and operational phases, the impacts have not been separated for the three project phases. The required management plan actions have been presented together with key performance indicators, responsible person(s), resources or proof and the timeline of such management actions. The five forms the headings **of Table 3** and they are briefly explained as follows:

- Environmental aspect and issues for which management actions are required.
- Proposed impact mitigation measures.
- Key performance indicator (KPI) for monitoring success levels of management actions.
- Responsible person(s) for implementing the proposed management actions.
- Resources required for implementing management actions and monitoring; and
- Implementation timeframes for the proposed management actions.

Table 3: Management Plan Actions for the Planning & Design, Demolition, Construction and Operational & Maintenance Phases

Aspect	Impact	Mitigation Measure(s)	Key Performance Indicator (KPI)	Responsible Person	Resources	Timeline
PLANNING & DESIGN PHASE						
EMP implementation and training	Lack of EMP awareness and implications thereof	-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. -The Proponent should appoint a SHE Officer to be responsible for managing the EMP implementation and monitoring.	-All required Plans and systems are compiled and in place Safety, Health and Environmental (SHE) Officer is appointed -Records of EMP implementation Plans and Systems	-Proponent	-Independent Environmental Consultant: EMP compliance and auditing -DEAF: site inspections for compliance -Identification of all persons involved in the implementation of the EMP	Pre-demolition and subsequent phases
Oxidation Ponds Technology	Mechanical and design failures	-All manufactured materials will be required to bear the mark of SABS/SANS approval. -The Proponent should ensure that the new ponds machinery and equipment are designed in such a way mechanical failure 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 pond base) -The ponds' design should include odour control caps.	-Approved design according to international standards -Sufficiently designed and sized ponds	-Proponent (overall responsibility) -Planning & Design Engineer/ contractor	-Technical Expert (Planning & Design Engineer) -Wastewater treatment specialist	Pre-construction

Aspect	Impact	Mitigation Measure(s)	Key Performance Indicator (KPI)	Responsible Person	Resources	Timeline
		-The pond system should be properly designed to ensure that it has 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.				
Oxidation Ponds Location	Location and settings	-The new ponds should be designed and constructed at least 500 m to the nearest residents, specifically the houses to the east of existing Pond 1. -The boundary between the residence and ponds as well as future No-House establishment should be clearly marked by the Village Council.	-The site layout and designs are revised and finalized upon ground truthing. -The distance between the nearest houses and the new ponds site boundaries complies with the Guidelines (not less than 500 m)	-Proponent -Planning & Design Engineer -Tses Village Council	-Technical Expert (Planning & Design Engineer) -Tses Village Council	Pre-construction
Oxidation Ponds' Maintenance	Cleaning and reconditioning of ponds	-The cleaning and reconditioning works of the new ponds during the operational phase should be planned and provided for. This included the provision for maintenance and repairing of associated pond system infrastructure.	-Financial and technical provision made for the operational & maintenance and updated regularly -Provision for maintenance works -Site inspections conducted by relevant authorities -Reports and records of maintenance work and repairs undertaken	-Proponent -Planning & Design Engineer -Tses Village Councl	-Funds to carry out maintenance and repair works of the pond system -Technical Expert (Oxidation Ponds specialist) -Maintenance Engineer or Contractor -Tses Village Council -DWA and MEFT	Throughout the project life cycle
Authorizations	Lack of Permits/ Licenses	-All the required agreements and licenses or permits should be applied for and obtained	-Applicable permits and licenses to obtained from relevant authorities and kept on site for	-Proponent	-Record of permits and authorizations obtained	Prior to construction

Aspect	Impact	Mitigation Measure(s)	Key Performance Indicator (KPI)	Responsible Person	Resources	Timeline
		The permits, agreements referred to herein include: ○ Treated Wastewater (Effluent) Discharge Permit ○ Road access ○ Petroleum storage permits (if fuel is stored on site) ○ Waste disposal authorization	records keeping and future inspections			
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.	-Permits obtained -Adherence to permit conditions -Records of volumes of discharge and post-use effluent	-Proponent -Tses Village Council -DWA (issuing and regulatory authority)	-Water Consultant to assist with Permit application -Wastewater regulatory and Permit issuing authority (DWA)	Pre-demolition and operational phase
Soils	Contaminated site soils	-A Soil Scientist should be appointed to undertake a Full Soil Contamination and Impact Assessment for the site 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.	-Soil Study undertaken by a Specialist -Implementation of contamination management measures -Remedial actions taken and implemented -Soil contamination monitoring -No signs of contaminated soils	-Proponent -Tses Village Council -SHE Officer -Technical Staff/Consultant	-Technical Staff (Soil Scientist) to assess site contamination -Funds to undertake the Soil Study -Funds for site soil remediation, equipment, and related resources	Pre-demolition 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 on site to prevent the on potential contaminated run-off from reaching surface water resources during heavy rain seasons.	-Stormwater discharge points incorporated into the new ponds design -Pond capacity detection incorporated into the ponds' design	-Proponent (holds overall responsibility) -Design Engineer	-Technical staff (Wastewater treatment engineer/expert)	Pre-demolition and construction phases

Aspect	Impact	Mitigation Measure(s)	Key Performance Indicator (KPI)	Responsible Person	Resources	Timeline
		-The ponds should be equipped with a robust wastewater flow monitoring system ensure that the first sign of overflow is detected and addressed in time (for flow and capacity monitoring in the ponds).				
Communication between the Proponent and residents	Lack of communication (proper liaison) between residents/affected community and Proponent and Operator (Tses Village Council)	-The Proponent should appoint a Public Relation Officer (PRO) to liaise with the residents. -The PRO contact details should be made available at the Tses Village Council for the residents. -A clear communication procedure/plan which should include a grievance mechanism should be compiled.	-A PRO is appointed	-Proponent -PRO -Tses Village Council (for the operational phase)	-Grievance logbook -PRO appointment -PRO contact details to be provided to the affected residents -Tses residents/Affected communities	Prior to old ponds demolition and throughout the subsequent phases
Employment	Creation of employment opportunities	-Non-skilled labour should be sourced from Tses Village, in accordance with procedures approved by the relevant authorities. -Equal opportunity should be provided for both men and women.	-Number and residence of locals employed	-Proponent -Construction Contractor -Site Manager	-Record of employees -Tses Village Council to assist in identifying unemployed people -Notification via the Berseba Constituency Office or Village Council	Pre-construction activities

Aspect	Impact	Mitigation Measure(s)	Key Performance Indicator (KPI)	Responsible Person	Resources	Timeline
Specialised procurement of services	Design, Demolition & construction contractors, and services	-All services related to project activities such as demolition and construction related works that the Proponent may need, preference should be given to local providers of such services. If not available locally, the services search should be extended to a Regional level (//Karas Region) and lastly, nationally, or international, if all efforts lead to no success.	-Number of hired contractors	-Proponent -Tses Village Council (for maintenance phase)	-Record of hired or contracted companies or services providers	Pre-demolition and construction As and when required for maintenance
DEMOLITION (OLD PONDS), CONSTRUCTION (NEW PONDS) AND OPERATIONAL PHASES						
EMP implementation and training	Lack of EMP awareness and implications thereof	-EMP trainings should be provided to all new workers on site. -All site personnel should be aware of necessary health, safety, and environmental considerations applicable to their respective work -The implementation of this EMP should be monitored. -The site should be inspected, and a compliance audit done throughout **the as recommended below:** ○ **Daily - construction phase** ○ **Bi-annually - operational** -An EMP non-compliance penalty system should be implemented on site. -Upon completion of construction and site handover, the ECC should be transferred to the Site Owner/Operator (Tses Village Council) by applying for an ECC transfer with the MEFT.	-Compliance monitoring conducted daily during demolition and construction -Bi-annual compliance for operations -Timely renewal of the Environmental Clearance Certificate (ECC) every 3 years -The ECC has been transferred from the Proponent's name to the Tses Village Council as the Operator of the ponds	-Proponent -SHE Officer	-Monitoring reports ECC renewed on time -Records of EMP training conducted -Funds (N$1 000) for the transferring of the ECC from the Proponent to the Operator	Throughout the construction and operation phases -The ECC should be transferred to the Operator upon completion of construction works

Aspect	Impact	Mitigation Measure(s)	Key Performance Indicator (KPI)	Responsible Person	Resources	Timeline
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.	PRO is appointed and part of the project personnel	-Proponent -PRO	-Grievance logbook -Tses residents/Affected communities	Communication to run throughout the project activities
Soils	Site soils (land) disturbance Soil erosion	-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. -All construction pits excavated on site should be rehabilitated and returned to their pre-excavation state as possible. -Soils that are not within the intended footprints of the site areas should be left undisturbed and soil conservation implemented as far as possible. -Project vehicles/machinery should stick to access roads provide 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.	-Record any evidence of new traffic tracks outside of designated access roads by means of photograph -Record evidence of new erosion gullies (photographs)	-SHE Officer -Hired soil scientist	-Technical Staff (Soil Conservation Scientist to assess and monitor contamination levels during demolition phase	Throughout the demolition phase and construction phase operational phase -Soil contamination monitoring to be done once during demolition

Aspect	Impact	Mitigation Measure(s)	Key Performance Indicator (KPI)	Responsible Person	Resources	Timeline
		-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. -Access roads should be designed appropriately in a manner that disturbs minimal land areas as possible. -Make use of the existing road network as much as possible and avoid off-road driving.				
	Soil pollution	-During decommissioning of the existing ponds, care should be taken to ensure that the wastewater in the two active ponds do not run off into the surrounding environment. -Through clean up should be implemented to remove the wastewater currently standing on the surface of the site between the active ponds and the area rehabilitated to an appealing state or before it can be utilized for the new pond construction. -Spill control preventive measures should be in place on site to management soil contamination, thus preventing and or minimizing the contamination from reaching groundwater bodies. Some of the soil control preventive measures are: *****Identification of oil storage and use locations on site and allocate drip trays and polluted soil removal tools suitable	-Monitor depth of soil profile and contamination levels on site during demolition -No complaints of pollutants on the soils -No visible oil spills on the ground or contaminated/pollution spots owing to construction activities.	-SHE Officer -Hired (contracted) soil scientist	-Technical Staff (Soil Conservation Scientist to offer Assess and monitor contamination levels during demolition phase	Throughout the demolition and construction phases

Aspect	Impact	Mitigation Measure(s)	Key Performance Indicator (KPI)	Responsible Person	Resources	Timeline
		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 contain 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. -The site areas where hydrocarbons will be utilized, the surface should be covered with an impermeable plastic liner (e.g., an HDPE liner), carefully				

Aspect	Impact	Mitigation Measure(s)	Key Performance Indicator (KPI)	Responsible Person	Resources	Timeline
		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. -Project machines and equipment should be equipped with drip trays to contain possible oil spills when operated. -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. -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 designate 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 int the soil does not infiltrate into the site soils and eventually reach to groundwater.				

Aspect	Impact	Mitigation Measure(s)	Key Performance Indicator (KPI)	Responsible Person	Resources	Timeline
		-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). -Polluted soil must be collected and transported away from the site to an approved and appropriately classified hazardous waste treatment facility. -Washing of equipment contaminated hydrocarbons, as well as the washing and servicing of vehicles should take place at a dedicated area, where contaminants are prevented from contaminating soil or water resources. -Toilet water should be treated using one of the following methods: *****Discharged into chemical toilets and periodically emptied out before reaching capacity and transported to a wastewater treatment facility. *****A type of pit latrine (where excreta in the pit is treated to prevent the waste from being a water pollution risk).				
Water Resources	Water use (quantity)	-Water should be efficiently used by implementing water saving measures such as recycle and re-use where necessary and possible. -Water conservation awareness and saving measures should be made to all employees and become accountable.	-Proof or recording/ quantification of water saving efforts.	-Site Manager (holds overall responsibility) -SHE Officer -Construction Contractor -Tses Village Council (holds overall	-Monthly records of water used	During the construction and operational phases

Aspect	Impact	Mitigation Measure(s)	Key Performance Indicator (KPI)	Responsible Person	Resources	Timeline
				responsibility during operational phase)		
	Water resources (quality) and pollution	**SURFACE WATER** -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. -The demolition of currently active ponds should be done in such a way that no wastewater spills or leaks on the ground -The ponds should be maintained frequently to ensure that no overflow leaves the ponds undetected. -Sediments 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. **GROUNDWATER** -The base of the ponds should be properly lined with an approved and appropriate liner material 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. -The demolition 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 as	-Effluents contained and stored in designated containers -Temporary or alternative wastewater containers/facility during demolition of old ponds -Demolition of old ponds not done during rainy season -The pipeline bend at the manhole of concern in the Village manoeuvred and fixed. -Properly lined ponds -Frequent pond maintenance according to expert recommendations	-Proponent (holds overall responsibility) -SHE Officer -Demolition and Construction Contractor	-Technical Staff: Wastewater treatment expert/engineer, -Independent Water Consultant to assess contamination levels -Non-permeable material to cover the ground surface at areas where hydrocarbons and potential pollutants are utilized. -Designated waste storage containers	-Throughout all the project phases

Aspect	Impact	Mitigation Measure(s)	Key Performance Indicator (KPI)	Responsible Person	Resources	Timeline
		it is seen on the western side of Pond 1 on site. The demolition should be done but not limited to the following: *Consider carrying out progressive demolition by determining the feasibility of either of the two points or both: *This will need to be done by demolishing one or two ponds at a time to ensure that there is still a pond or two to still contain incoming wastewater from the Village sources and avoid environmental catastrophe of uncontrolled sewage overflowing into the general surrounding surface area and into the ground (groundwater). *Alternatively, provision to be made for industry standard temporary storage facilities such as sewage tanks to contain sewage while demolition and construction is ongoing. -The demolition 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. -The pipeline bend at the manhole of concern in the Village should be manoeuvred by incorporating these changes into the proposed oxidation ponds' design to ensure that wastewater flows with ease to the ponds during operations. -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.				

Aspect	Impact	Mitigation Measure(s)	Key Performance Indicator (KPI)	Responsible Person	Resources	Timeline
		-The effluent / wastewater containers or ponds should be lined to prevent dissolving waste from leaching into the ground, and potentially into groundwater systems. -A Groundwater impact assessment with a primary focus on pollution should be undertaken for the Tses Village (Tses Village Council responsibility or in collaboration with NamWater). This will be aimed at establishing the extent of pollution that may already been ongoing primarily because of the existing unlined and dilapidated ponds				
Biodiversity	Loss of Fauna and Flora	**Flora:** -Make use of the existing access roads as much as possible and avoid off-road driving. -A permit must be obtained from the Directorate of Forestry before any protected species is removed (upon findings of the Botanist/Ecologist). -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. -The movement of vehicles and machinery should be restricted to existing roads and if necessary, to newly established tracks only to prevent unnecessary damage to the site vegetation. -No onsite vegetation should be cut or used for firewood related to the project's	-Keep record of names of all protected plant species identified by independent botanist/ecologist prior to clearing any site -Keep records of all vehicle-animal collision incidences, animal poisoning through consumption of hazardous substance. -No disturbance to unmarked areas. -No complaints of livestock theft, snaring	-Site Manager -SHE Officer	-Barricading tape (to indicate working areas) -Technical Consultants (Botanist and or Ecologist) to help Identify protected species -Funds to hire an independent environmental consultant to conduct bi-annual environmental audits	-Throughout the phases -Botanist involvement prior to demolition and construction

Aspect	Impact	Mitigation Measure(s)	Key Performance Indicator (KPI)	Responsible Person	Resources	Timeline
		operations. The Proponent should provide firewood for his onsite camping workers from authorized firewood producer or seller. -Care should be taken when carrying out vegetation clearing without destroying all the site vegetation. -The Proponent should aim to use the already damaged area with little to no vegetation for the site expansion and construction and operation of new ponds. **Fauna** -Workers should refrain from killing or snaring any animal species (big or small) that may be found on and around the site. -Workers should refrain from disturbing, killing or stealing locals' animals and/or small soil animals species found on site. -Environmental awareness on the importance of biodiversity preservation should be provided to the site contractors and workers.	or killing related to the project personnel.			
Air Quality	Air quality (dust)	-The Proponent should ensure that the construction schedule is limited to the given number of days of the week, but not every day. This will keep the vehicle-related dust level minimal in the area, especially when it is windy. -A reasonable amount of water should be used to suppress the dust that may be emanating from certain site areas	-Dust suppression measures implemented --Visible efforts to curb dust	-Proponent -SHE Officer -Construction Contractors -Tses Village Council	-Grievance logbook -Dust suppression water tanks -Vehicle and machinery mechanic to ensure that vehicles and machinery do not	Throughout demolition and construction phases

Aspect	Impact	Mitigation Measure(s)	Key Performance Indicator (KPI)	Responsible Person	Resources	Timeline
		(limited to the site only) or certain parts of the local utilized gravel roads that is generating a lot of dust. -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. -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. -The vehicles carrying dusty materials should be covered to prevent materials being blown from the vehicle. -The transportation of project materials, equipment and machinery should be limited to certain days of the week only as so to reduce dust generated by heavy vehicles in the area. -Project vehicles and heavy machines should not be left idling when not in use, such that they emit air polluting gases. -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			emit harmful gases due to malfunctions	

Aspect	Impact	Mitigation Measure(s)	Key Performance Indicator (KPI)	Responsible Person	Resources	Timeline
	Odour	-Incorporate odour control technologies odour controlling caps at the ponds. -With regards to persistent odour issue, should the residents still express grievances over odour after the demolition of current ponds and construction of new ponds, the Tses Village Council should consider consulting with the affected residents to weigh the option of relocating them further from the ponds, rezone the area to industrial (from residential) and set up a no-go zone (buffer line) for future house establishment	-Odour caps installed at the ponds -Bi-annual odour interviews with residents at the northern and northeaster side of the ponds -Records of odour related grievances	Tses Village Council	-Grievance logbook	Throughout the operational phase
Noise	Noise	-The transportation of project materials, equipment and machinery should be limited to once or twice a week only, but not every day. -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 8am and 5pm during weekday to avoid noise during the night residents are resting (in 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 8am and 5pm on weekdays).	-Weekdays activities during construction -PPE provided to workers operating noisy equipment and in noisy site areas. -Complaints of excessive noise from residents	-Site Manager -SHE Officer -Construction Contractor -PRO	-Clearly written placards with construction hours in a day placed at the Village Council and near the site to the side of houses	Throughout demolition and construction

Aspect	Impact	Mitigation Measure(s)	Key Performance Indicator (KPI)	Responsible Person	Resources	Timeline
		-When operating trucks such as hauling or any high noise level machinery, workers should be equipped with personal protective equipment (PPE) such as 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	-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 shall be available in the first aid kit. -Keep a comprehensive first aid kit at the accommodation areas and working 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 and materials on site as well as health and safety risk associated with their respective jobs.	Compilation of Comprehensive Health and Safety Plan.	-Site Manager -SHE Officer -Tses Village Council	-Health and Safety Policies	Prior to site setup activities and throughout the phases

Aspect	Impact	Mitigation Measure(s)	Key Performance Indicator (KPI)	Responsible Person	Resources	Timeline
		-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 into injuries and other health and safety risks. -Workers should not be allowed on site if under the influence of alcohol. -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 so that they can look after the project equipment and vehicles that would be left on site in weekends or public holidays (when no work is done) to ensure that no unauthorized person enters the area. -To discourage the unsuspecting and uniformed local community from eyeing the empty hazardous containers, the site workers should if possible, drill holes in these containers while kept on site (before transporting the containers to the waste site). -All employees and contractors (personnel) to be trained on environmental awareness, the				

Aspect	Impact	Mitigation Measure(s)	Key Performance Indicator (KPI)	Responsible Person	Resources	Timeline
		Proponent's internal Environmental Health and Safety Policy, Environmental Management Plan, and engagement with key stakeholders, specifically the key government ministries and residents.				
	Occupational Health and Safety	-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 incidences.	-Regular health screening of workers -Bi-annual health and safety audits don	-Site Manager (holds overall responsibility) -SHE Officer	-Funds to acquire health and safety related equipment. and to pay for employee medical services -First Aid training for at least 1 personnel at each work site	Throughout the project phases and when required
	Public safety	-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 local animals. -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.	-Mesh fence constructed -Empty hazardous containers and waste container kept within the site fence boundaries and out of public reach	-Site Manager -SHE Officer -Construction Contractor	-Security personnel	Throughout all the phases
Health and safety	Accidental fire outbreak	-Portable fire extinguishers should be provided on site.	-No wildfires recorded (due to presence of workers)	-Site Manager -SHE Officer	-Fire extinguishers (1 per vehicle) and 1 per working site	Throughout the demolition and construction phase

Aspect	Impact	Mitigation Measure(s)	Key Performance Indicator (KPI)	Responsible Person	Resources	Timeline
		-No open fires to be created by project personnel. -Potential flammable areas and structures such as fuel storage tanks should be marked as such with clearly visible signage.				
Archaeology and heritage	Accidental disturbance and destruction of archaeological or heritage objects and sites	-Caution should be exercised when carrying out excavations associated with the project activities if archaeological/heritage remains are discovered. -Identified of any archaeological significant objects on the site should not be disturbed but are to be reported to the project Environmental/Safety officer or National Heritage Council offices for further instructions and actions. -Workers should be educated to not destroy or throw away but report (to the environmental/Safety officer) of any unknown object found/discovered on site. -The worksite 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 the identification of archaeological/heritage remains and the procedures to follow if such remains are discovered throughout the project activities' duration.	-Preservation of all artefacts that are discovered around project area -Cessation of work upon discovery/unearthing of unknown objects	-Site Manager --Demolition / Construction Contractor -SHE Officer -Archaeologist	-Salvage equipment -Flag tapes -GPS (site marking) -Technical Staff/Consultant (Archaeologist to help identify and advise on heritage object discovery)	As and when required, prior to site setup activities and upon encounter -Archaeologist to be present during the earth workings

Aspect	Impact	Mitigation Measure(s)	Key Performance Indicator (KPI)	Responsible Person	Resources	Timeline
Social conflicts	Job seeking, private property intrusion or damage	The Proponent should inform their workers on the importance of respecting the locals' properties by not intruding or damage their homes or yard fences. -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 -Site workers should be advised to respect the community and local's private properties, values, and norms. -No worker should be allowed to wander in people's private yards or fences without permission. -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.	-No complaints of property theft or damage related to project workers -More local workers who are familiar with the values, and way of living in the Village	-Site Manager -PRO -SHE Officer	-Grievance logbook -Employment Code of Conduct	Pre- Construction
Post-Treatment Effluent	Handling	-The effluent must be treated thoroughly and tested/analysed to ensure full compliance with the Standards before used or discharged into the environment. -The effluent logistics should be properly handled and done onsite when delivering to the intended consumers -Effluent that await to be transported from site should be stored on a	-Effluent stored on lined storage area -No mishandling of effluent on site -Records of Effluent production and distribution -Compliance with the Standards and Regulations	-Tses Village Council -Site Manager / Ponds Operator	-Technical Staff (Wastewater treatment specialist) -Local community -Farmers -Department of Water Affairs (Water	Throughout the operational phase

Aspect	Impact	Mitigation Measure(s)	Key Performance Indicator (KPI)	Responsible Person	Resources	Timeline
		designated storage area and loaded correctly without it spilling on the soils. -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.			Environment Division)	
Littering and waste management	Environmental Pollution	-Project workers should be sensitized to dispose of waste in a responsible manner and not to litter. -After each daily works, there should not be waste left scattered on site, but rather be disposed of in allocated site waste containers. -No waste may be buried or burned on site or anywhere else throughout the project lifecycle. -All domestic and general waste produced daily should be contained until such that time it will be transported to designated waste sites on a weekly basis. -The sites should be equipped with separate waste bins for hazardous and general waste/domestic. -Waste separation at source will be enforced by availing clearly labelled or differently coloured general waste (paper, plastic, organic waste) rubbish	-Site wide evaluation of the general condition of all waste storage sites must be conducted as part of the bi-annual environmental audits -A register of all waste generated on site is kept on site -All waste disposal permits from relevant authorities are available on site -No littering on and around the project site	-Site Manager -Demolition / Construction Contractor -SHE Officer	-Funds to acquire waste storage bins/ drums; and transport all waste from the site -Funds to hire an Independent environmental consultant to conduct bi-annual environmental audits -Waste storage containers	Throughout the phases.

Aspect	Impact	Mitigation Measure(s)	Key Performance Indicator (KPI)	Responsible Person	Resources	Timeline
		bins at all working areas. These must be emptied weekly at the nearest registered waste dumping site -A penalty system for irresponsible disposal of waste on site and anywhere in the area should be implemented.				
	Wastewater generated by workers and visitors (sanitation)	-Provision of toilet facilities for project workers and visitors (type of pit latrine or chemical toilet). -Emptying of chemical toilets according to the manufacturer's specifications. Treating latrine waste to render non-polluting.	Adequate toilet facilities on site.	-SHE Officer	-Chemical toilets or excavator (pit creation), waste treatment agents/chemicals	At site setup and throughout the phases
	Hazardous waste	-All hazardous materials shall be stored (on bunded area), handled and disposed of according to the applicable material safety data sheets (MSDS), as well as applicable regulations (e.g., the Health and Safety Regulations). -Hazard identification signage shall be erected at appropriate locations. -All hydrocarbon substances should be contained in designated containers on site and later disposed of at nearby approved waste sites. -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	-Site wide evaluation of the general condition of all hazardous waste storage sites must be conducted as part of the bi-annual environmental audits -A register of all waste generated on site is kept on site -All waste disposal permits from relevant authorities are available on site	-SHE Officer	-Funds to acquire waste storage bins/ drums; and transport all waste from the site -Funds to hire an Independent environmental consultant to conduct bi-annual environmental audits -Waste storage containers	Throughout the phases.

Aspect	Impact	Mitigation Measure(s)	Key Performance Indicator (KPI)	Responsible Person	Resources	Timeline
		disposed of on site or in the surroundings, i.e., unapproved waste sites. -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.				
Vehicular Traffic	Traffic safety	-The transportation of project materials, equipment and machinery should be limited to once or twice a week only, but not every day. -The heavy truck loads should comply with the maximum allowed limit while transporting materials and equipment/machinery on the public and access roads. -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. -Drivers of all project phases' vehicles should be in possession of valid and appropriate driving licenses. -Vehicle drivers should adhere to the road safety rules. -Drivers should drive slowly (40km/hour or less), and on the lookout for animals.	-Site access road permits obtained, and requirements fulfilled -No complaints from members of the public regarding vehicular traffic issues related to the project -All personnel operating the project vehicles and machinery are appropriately licensed and possession of valid driving licenses. -Demarcated areas for parking, offloading, and loading zones are on sites	-Site Manager -SHE Officer -Tses Village Council	-Vehicular traffic compliance to be included in the annual environmental audit reporting	Throughout the phases. Site access permit (s) to be applied for and obtained prior to commencement of construction

Aspect	Impact	Mitigation Measure(s)	Key Performance Indicator (KPI)	Responsible Person	Resources	Timeline
		-Project vehicles should be in a road worthy condition and serviced regularly to avoid accidents due to mechanical faults of vehicles. -Vehicle drivers should only make use of designated site access roads provided. -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 son 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 8am and 5pm.				
Social nuisance	Job seeking and crashes due to differing norms, culture, and values	-Priority of employment should be given to local people, and only if necessary and due to lack of skills in the area, out-of-	Correct and fair recruitment procedures are followed and practised.	-Site Manager -Construction Contractor -PRO	-Records of employees and their places of origins in relation to the site area	Pre-construction In special cases, during the project phases, depending

Aspect	Impact	Mitigation Measure(s)	Key Performance Indicator (KPI)	Responsible Person	Resources	Timeline
		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	More local people are employed for both skilled, semi and unskilled works Out-of-area people only employed for specialized skills that are not found in the project area. No complaints of unfair recruitment procedures. Grievance and response records			on the project needs
	Potential increase of prevalence of HIV and AIDS, as well as other sexually transmitted diseases (STIs) prevalence	-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.	-No new infections recorded linked to the project workers	-SHE Officer	-Availability of condoms onsite -Sex Education awareness placards and posters at camps	During site setup and throughout the phases

Aspect	Impact	Mitigation Measure(s)	Key Performance Indicator (KPI)	Responsible Person	Resources	Timeline
	Private and Public Property intrusion and Disturbance or Damage	-Project workers should be educated on the importance of respecting the locals' properties by not intruding or damage their homes, fences or snaring and killing their livestock. -Any workers or site employees that 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' (Proponent)'s code of employment conduct -Project workers should be advised to respect the community and local's private properties, values, and norms. -No worker should be allowed to wander in people's private yards or fences without permission. -Site workers are not allowed to kill or in any way disturb local animals.	-Harmonious interaction between the project personnel and property owners. -No complaints of property damaged, or intrusion caused by project personnel -Records of project related grievances raised	-Site Manager -Construction Contractor -PRO	-Grievance logbook and how they were addressed	Throughout the phases

4.3 Decommissioning and Rehabilitation of Demolished Ponds and Construction Sites

The Table (Table 4) below presents the rehabilitation measures to be implemented for the decommissioning of old ponds and after the completion of new ponds' construction 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-exploration, where necessary) and post-exploration/mining activities.

Table 4: Management Plan Actions for the Demolition of old ponds and Decommissioning of new ponds' construction works and sites

Aspect	Mitigation Measure(s)	Completion criteria
Existing pond structures	**DEMOLITION OF OLD PONDS** -A progressive demolition should be done by determining the feasibility of either of the two options or both: 1. This will need to be done by demolishing one or two ponds at a time to ensure that there is still one or two ponds to still contain incoming wastewater from the Village 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 demolition and construction is ongoing. **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, especially the two active ponds (P1 and P2 in Figure 1 and 2). These solids need to be handled properly before re-using the ponds, i.e., for the construction of new ones and cleaned up. -Cleaning up and closure of the other three inactive ponds (P3, P3, and P5 as shown in Figure 1 and 2 in the EIA Report). -Proper demolition, capping and elimination of existing treatment components as well as disposal of waste to relevant approved waste management facilities. -The demolition 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 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 demolition 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	-A Wastewater treatment specialist should be involved in this process -Sign off by the Wastewater treatment specialist and Department of Water Affairs

Aspect	Mitigation Measure(s)	Completion criteria
	for land use or disposal. Please refer to the **Code of Practice: Volume 6 – Wastewater Re-Use of July 2012.**	
Existing contaminated Soils	-Undertake a site-wide contaminated soil to determine the nature and extent of contamination and to identify appropriate remediation measures. -Rehabilitate contaminated by excavating contaminated material to a depth of 300 mm and remove and dispose of at the nearest capable landfill site and 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.	-A Soil Scientist should be appointed to undertake a full Soil Contamination Assessment and thus, recommending site specific remediation measures -Sign-off by the Soil Scientist upon completion of the rehabilitation/remediation of contaminated soils to ensure successful exercise and safety of site soils
Stockpiled topsoil, and disturbed areas	**POST-CONSTRUCTION DECOMMISSIONING** -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.	-All stockpiled soils are levelled, and pits backfilled
Surface infrastructure and structures	**Service infrastructure to be removed** -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 construction. 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 construction phase and no longer required for operational phase should be closed off.	-All other infrastructure decommissioned to ground level and removed from site
Waste (general and hazardous)	-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.	-All waste and associated containers removed from site and transported to designated and authorized sites

5 RECOMMENDATIONS AND CONCLUSIONS

The following recommendations and conclusions have been made with regards to the proposed establishment of the oxidation ponds in Tses.

5.1 Recommendations

The Environmental Consultant is confident that the potential negative impacts associated with the proposed project activities can be mitigated by effectively implementing the recommended management action measures and with more effort and commitment put on monitoring the implementation of these measures. It is therefore, recommended that the proposed oxidation ponds and associated activities be granted an Environmental Clearance Certificate, provided that:

- All respective management measures (mitigations) provided in the EMP be effectively and progressively implemented and backed up by consistent site monitoring of environmental components listed in the EMP to achieve full EMP implementation compliance.
- All required permits, licenses and approvals for the project activities are obtained as required (please refer to the Permitting and Licensing in the EMP).
- The Proponent and all their project workers or contractors comply with the legal requirements governing their project and its associated activities and ensure that project permits and or approvals required to undertake specific site activities are obtained and renewed as stipulated by the issuing authorities.
- All the necessary environmental and social (occupational health and safety) precautions provided are adhered to.
- Environmental (EMP) Compliance Monitoring should be conducted on a weekly basis during the construction phase by the project Safety, Health and Environmental Officer or an independent Environmental Consultant and bi-annually during the operational phase. Environmental Compliance monitoring reports should be compiled and submitted to the DEAF Portal as per provision made on the MEFT/DEAF's portal**.**

5.2 Conclusions

It is crucial for the Proponent and their contractors to effectively implementation of the recommended management measures to protect both the biophysical and social environment throughout the project phases (planning & design, decommissioning of the existing ponds, construction of new ponds and their operational & maintenance phase). All these would be done with the aim of promoting environmental sustainability while ensuring a smooth and harmonious existence and purpose of the project activities in the community and environment at large.

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

Areas of proposed development activity 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 work. 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 …. object ……must 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.

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: (DOMESTIC) WASTEWATER POND DECOMMISSIONING OR RELINING PLAN (GUIDE)

Minnesota Pollution Control Agency

Decommissioning or Relining Domestic Wastewater Ponds

Requirements and Procedures

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.

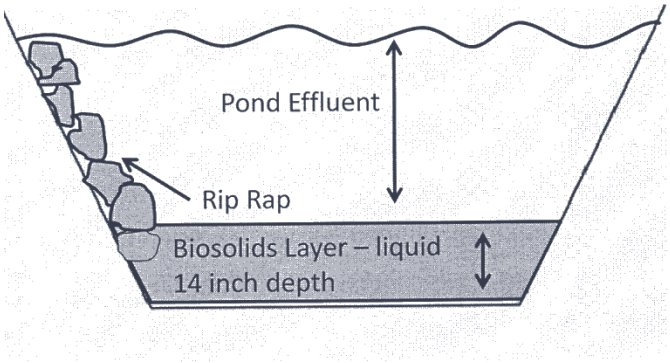
Each sample taken for analysis must be a composite sample made up of 10 sub samples. For ponds less than six acres, take at least two composite samples. For large ponds, take one composite sample per six acres at a minimum. **People experienced in sampling ponds state they prefer probing depths and sampling 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:

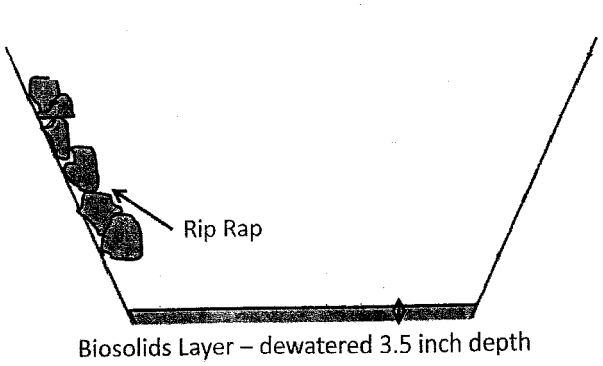
Dry tons applied	Number of samples
>0 but < 320	1
≥ 320 but < 1,650	4
≥ 1,650 but < 16,500	6
≥ 16,500	12

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 in. ÷ 12 in. per ft**.** x 3 acres x 43,560 sq. ft. per acre = 38,115 cu.ft. ÷ 27 cu.ft. per cu. yd. **~ 1411.7 cu. yds**.

Calculate the total dry tons using the "five gallon bucket test":

a. Weigh a five-gallon pail
b. Fill the pail with biosolids. We suggest filling it with equipment used to load the applicator [for example a bobcat].
c. Scrape the surface to level the biosolids
d. Weigh the loaded pail
e. Subtract the empty pail weight [wt.] from the full pail wt. = wt. of wet biosolids.
f. 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 lbs. wet wt. x 0.25 [25 percent total solids] = 13.5 lbs. dry wt. x 0.02 **~ 0.3 dry tons per cu. yd.**

The estimate was 1411.7 cu. yds. x 0.3 dry tons per cu. yd. ~ 423.5 dry tons.

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

(1.95 percent organic N x 4) + (0.05 x 20)

7.8 + 1.0 = *8.8 lbs. available N per dry ton* x 423.5 dry tons ~ *3727 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 though 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 applier who would apply under the direction of the Type IV operator.
- Visit the Agency Web site for contract appliers 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 land fill 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.