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Environmental Scoping Report

Decommissioning, Rehabilitation & Rezoning of A Building Rubble Dumping/Landfill Site (From "Undetermined" To Agriculture & Recreation "Sports") On the Remainder of Farm Henties Bay Townland No. 133, Erongo Region, Namibia

Prepared by: Erongo Consulting Group (Pty) Ltd
Reference No: # 250916006436
Date: August 21, 2025, 09:25 PM CAT
Competent Reviewer: Environmental Commissioner,
Ministry of Environment & Tourism
Proponent: Mr. Henk (Private)
Local Authority: Henties Bay Municipality



Environmental Scoping Report

For the Decommissioning, Rehabilitation, and Rezoning of a Building Rubble Dumpsite (From "Undetermined" to "Agriculture & Recreation (Sports)") on Portion X of the Remainder of Henties Bay Townlands No. 133, Erongo Region, Namibia

Prepared by:	Erongo Consulting Group (Pty) Ltd
Reference No:	#250916006436
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Competent Reviewer:	Environmental Commissioner, Ministry of Environment, Forestry and Tourism (MEFT)
Proponent:	Mr. Henk Burger

Document Status

This document represents the final draft of the Environmental and Social Impact Assessment (ESIA) for the proposed decommissioning, rehabilitation, and rezoning of the building rubble dumpsite project, submitted to the Environmental Commissioner, Ministry of Environment, Forestry and Tourism (MEFT), as of August 2025, for review and issuance of the Environmental Clearance Certificate (ECC) as required under the Environmental Management Act (No. 7 of 2007) and its regulations (Government Notice No. 30 of 2012). All stakeholder consultations, including public meetings (Ref: PC-250905), focus group discussions (Ref: FGD-250915), household surveys (Ref: HS-250920), and written submissions (Ref: WS-250921), have been incorporated. The report has undergone internal quality assurance by Erongo Consulting Group (Pty) Ltd and the Institute for Impact Sciences & Research Design to ensure compliance with national and international standards.

Disclaimer

This Environmental Scoping Report has been prepared by Erongo Consulting Group (Pty) Ltd for Mr. Henk Burger, in accordance with the Environmental Management Act (No. 7 of 2007) and the Environmental Impact Assessment Regulations (Government Notice No. 30 of 2012) of the Republic of Namibia. The information, data, and recommendations presented herein are based on baseline studies, stakeholder consultations, and technical assessments conducted up to August 2025, and reflect the best available knowledge at the time of submission. Erongo Consulting Group (Pty) Ltd has exercised due care and diligence in preparing this report but does not warrant the accuracy or completeness of information provided by third parties, including stakeholders, contractors, or public sources. The findings, interpretations, and conclusions expressed in this report are those of the authors and do not necessarily reflect the views of Mr. Henk Burger, the Ministry of Environment, Forestry and Tourism (MEFT), or any other consulted parties.

This report is intended solely for the purpose of obtaining an Environmental Clearance Certificate (ECC) for the dumpsite rehabilitation and rezoning project and for use by the project proponent, regulatory authorities, and relevant stakeholders as part of the decision-making process. It is not to be used for any other purpose without prior written consent from Erongo Consulting Group (Pty) Ltd. The report may not be distributed, reproduced, or disclosed to unauthorized parties without express permission, except as required under Namibian law. Erongo Consulting Group (Pty) Ltd, and the Institute for Impact Sciences & Research Design, employees, and its subcontractors shall not be held liable for any direct, indirect, or consequential damages arising from the use, misuse, or reliance on the information contained in this report. Users of this report are responsible for conducting their own due diligence and verifying the applicability of the findings to their specific needs. Any changes in project scope, site conditions, or regulatory requirements after August 21, 2025, may require additional assessments or updates to this ESIA.

Citation

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Acronyms & Descriptions

Acronym	Full Form	Description
ARIMA	AutoRegressive Integrated Moving Average	Statistical model for forecasting environmental recovery trajectories during scoping monitoring.
CAT	Central Africa Time	Time zone (UTC+2) used in Namibia, referenced in the document's timestamp (e.g., 05:04 PM CAT on August 22, 2025).
DEA	Department of Environmental Affairs	MEFT division responsible for EIA oversight and ECC issuance.
dB	Decibels	Unit for measuring noise levels, with construction-phase noise potentially exceeding 55 dB at site boundaries.
EAP	Environmental Assessment Practitioner	Entity (e.g., Erongo Consulting Group (Pty) Ltd) conducting the scoping process and impact assessments.
ECC	Environmental Clearance Certificate	Mandatory approval from MEFT for project initiation.
EIA	Environmental Impact Assessment	Initial assessment phase, including scoping, per EMA (2007).
EMA	Environmental Management Act	Principal legislation (No. 7 of 2007) governing environmental assessments in Namibia.
EMP	Environmental Management Plan	Framework to be developed post-scoping for impact mitigation, informed by successful precedents in the Erongo Region.
FGD	Focus Group Discussion	Structured stakeholder discussions for input collection
GIS	Geographic Information System	Tool for spatial mapping of the project site and surrounding areas.
I&APs	Interested and Affected Parties	Stakeholders (e.g., residents, businesses) engaged in the scoping process.
MDD	Maximum Dry Density	Soil compaction measure, targeted at 95% ($\sim 1.6 \text{ g/cm}^3$) to ensure site stability post-regrading.
MEFT	Ministry of Environment, Forestry and Tourism	Regulatory authority overseeing environmental assessments and issuing permits, such as the Environmental Clearance Certificate (ECC).
PC	Public Consultation	Engagement activities, including meetings (Ref: PC-250905).
Pb	Lead	Chemical element identified in soil contamination assessments, with concentrations exceeding 10 mg/kg in multiple zones, posing a threat to the aquifer and vegetation.
PM10	Particulate Matter 10	Measure of dust particles with a diameter of 10 micrometers or less, used to assess air quality impacts during construction, with potential levels surpassing $90 \mu\text{g/m}^3$.
WS	Written Submissions	Stakeholder feedback compiled during consultations (Ref: WS-250921).

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Executive Summary

The proposed project involves the decommissioning, rehabilitation, and rezoning of a 13.75-hectare former building rubble dumpsite on Portion X of the Remainder of Henties Bay Townlands No. 133, Erongo Region, Namibia, allocated to Mr. Henk Burger, a renowned Namibian businessman, by the Henties Bay Municipality in 2023. Currently zoned "Undetermined," the site, located at centroid coordinates $-22.107747, 14.283326$ in the heart of Henties Bay CBD, is targeted for transformation into an "Agriculture & Recreation (Sports)" area, including vegetable gardening and facilities for quad biking and skateboarding. This initiative addresses the site's historical environmental and health impacts - such as open burning, vector proliferation, and aesthetic degradation - while leveraging its strategic proximity to Tulongeni Gardens and utility services.

Preliminary assessments indicate approximately 10,000 m³ of waste and contaminant levels exceeding 10 mg/kg for lead, necessitating rehabilitation to mitigate pollution, reclaim land, and reduce health risks. The project offers significant benefits, including the creation of approximately 20 jobs, pollution reduction by an estimated 80%, and alignment with the Draft Henties Bay Urban Development Structure Plan. Potential impacts include dust generation and soil disturbance during construction, which can be managed through water suppression and capping. The "No-Go" alternative would perpetuate environmental degradation and lost socio-economic opportunities.

Stakeholder consultations (Refs: PC-250905, FGD-250915, WS-250921) identified health risks and land value as key concerns, integrated into the scoping process. The Environmental Management Plan (EMP), to be developed, will address mitigation measures, with monitoring targets such as soil pH (6.5–7.5) and vegetation cover (>80% within two years). Legal compliance is ensured under the Environmental Management Act (2007) and related policies, with Erongo Consulting Group (Pty) Ltd appointed to conduct the Environmental Impact Assessment (EIA).

It is recommended that the Ministry of Environment, Forestry and Tourism (MEFT) issue an Environmental Clearance Certificate (ECC) contingent upon EMP implementation and ongoing monitoring. This project supports sustainable land use and community development, aligning with Namibia's sustainable development goals.

1 Introduction

The Environmental Scoping Report initiates the Environmental Impact Assessment (EIA) process for the proposed decommissioning, rehabilitation, and rezoning of a former building rubble dumpsite on Portion X of the Remainder of Henties Bay Townlands No. 133, Erongo Region, Namibia. This chapter provides a comprehensive overview of the project, detailing the proponent's background, the rationale for the development, current land uses and processes, land alienation history, the motivation for transformation, the receiving environment, the EIA process, methodology, alternatives considered, and the national, regional, and international frameworks governing the assessment. It also introduces the team conducting the EIA to identify key environmental and social considerations for further evaluation.

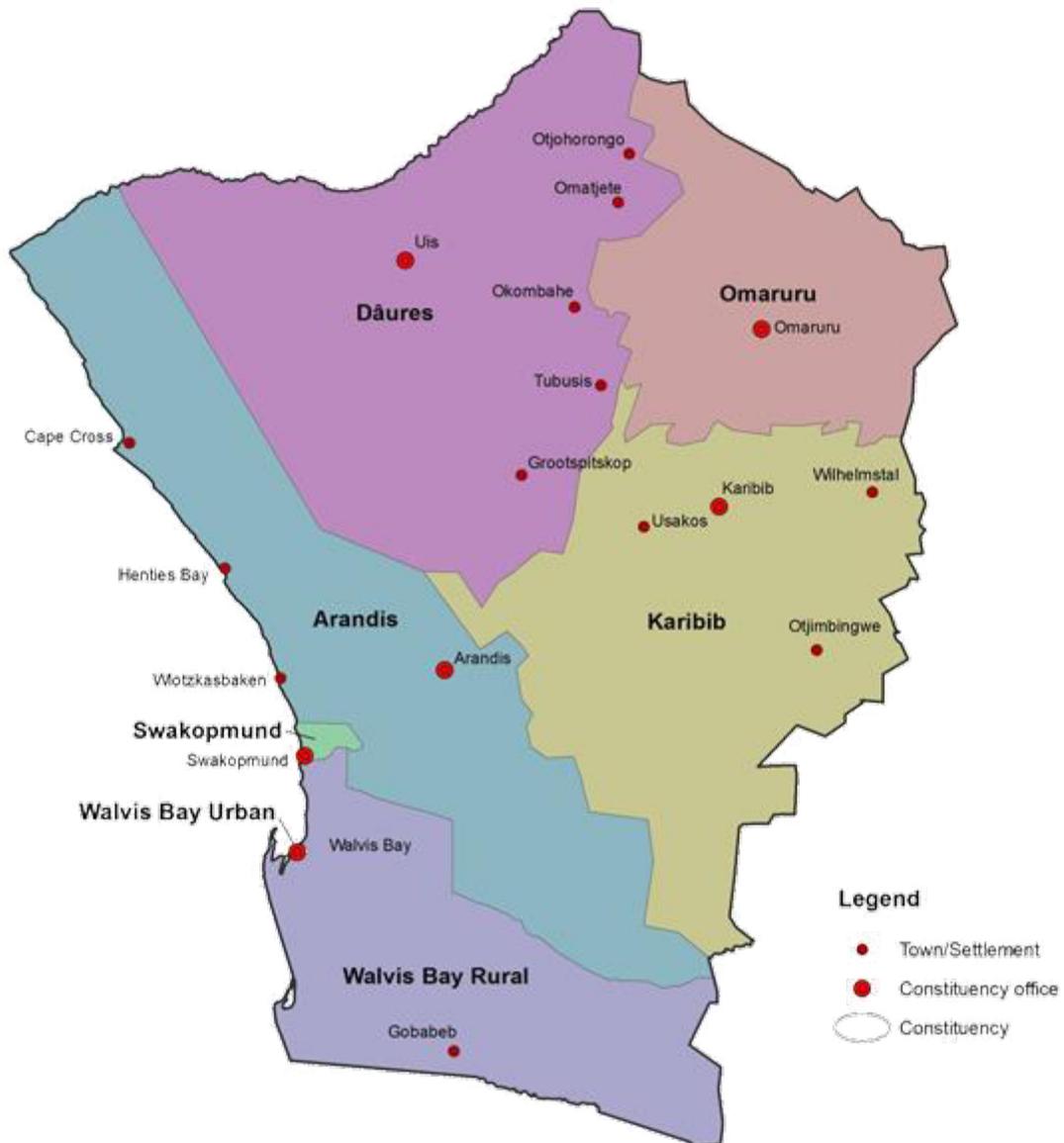
1.1 Project Background

The proponent, Mr. Henk Burger, a renowned and successful Namibian businessman and business operator, was allocated a 13.75-hectare disturbed land parcel within the Remainder of Henties Bay Townlands No. 133 in 2023 by the Henties Bay Municipality. This allocation was granted with the specific intention of rehabilitating, restoring, transforming, and rezoning the closed building rubble dumpsite, currently zoned "Undetermined," into an "Agriculture & Recreation (Sports)" area/facility. The site, strategically located in the heart of Henties Bay CBD with centroid coordinates $-22.107747, 14.283326$, is surrounded by viable commercial businesses, making its prime locality a key factor for redevelopment.

The rationale for this project arises from the site's suitability for optimal use, the urgent need to eliminate health risks (e.g., open burning, vector proliferation), and the desire to add value to the land. Historically, the dumpsite has exerted a negative environmental impact on existing operational businesses and developments, serving as an eyesore of solid waste within the town's strategic development area. This has deterred investors and hindered future business investments. The proposed rehabilitation and restoration offer environmental benefits, such as pollution reduction, land reclamation, resource recovery, and health risk mitigation, while converting an unproductive and hazardous site into a usable area with positive socio-economic impacts.

Portion X is adjacent to the approved Tulongeni Gardens agricultural project and private school, ensuring compatibility for integrated and sustainable urban development. Located in the Henties Bay North Dune area, the site benefits from approved access and proximity to utility services, including water, sewerage, and electricity. A qualified town planner has been appointed to process the rezoning application with the Urban & Regional Planning Board.

Figure 1: Constituencies of Erongo Region, showing Henties Bay, Republic of Namibia



1.2 Current Land Uses and Process

Mr. Henk Burger's intention is to transform the old rubble dumpsite into a socio-economically viable area by refilling the dumping hole with gravel sand, conducting ground leveling, and compacting the soil to create a stable surface. This will enable dual use for agriculture (e.g., vegetable gardening for community consumption) and recreational sports activities, such as quad biking and skateboarding facilities. A significant portion of the project area has already been refilled with sand and rehabilitated, with some vegetable gardens actively cultivating crops. The proponent plans to recruit and employ approximately 20 casual workers and contractors for land preparation and the construction of agricultural and sporting facilities, with consideration for semi-skilled and skilled workers post-construction during operations.

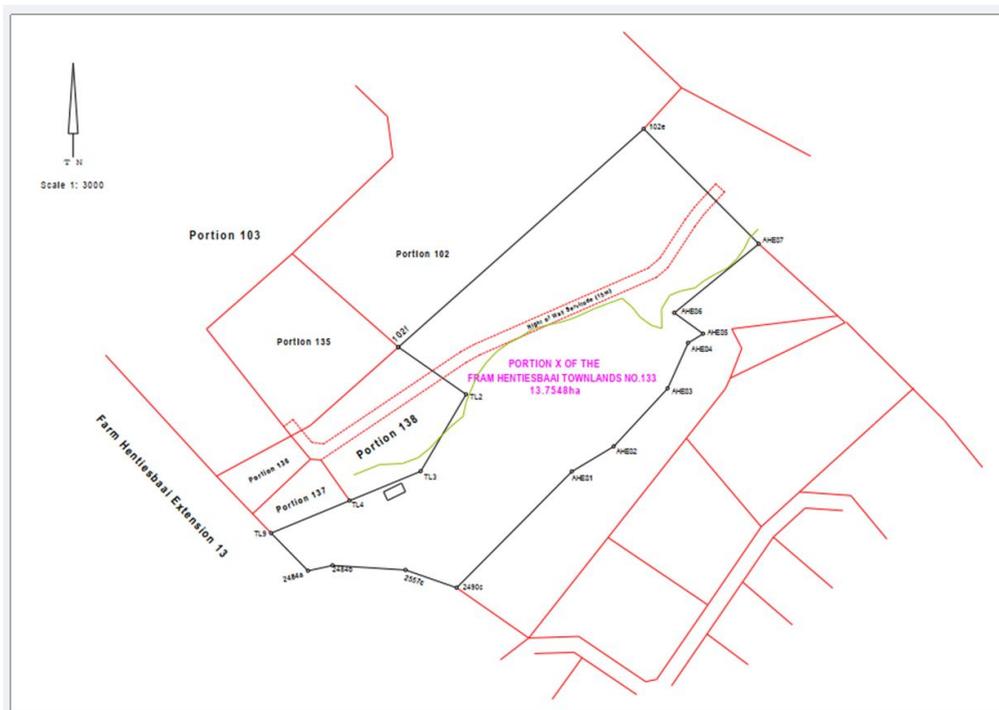
This land rehabilitation and restoration initiative is integrated into the Draft Henties Bay Urban Development Structure Plan, submitted for approval to the Urban & Regional Planning Board, ensuring alignment with long-term urban planning objectives.

Figure 2: Decommissioned & Rehabilitated Building Rubble Dumpsite, Henties Bay, Namibia



This image depicts the current state of the site post-initial refilling with sand, showing rehabilitated areas. Coordinates: Centroid $-22.107747, 14.283326$. Source: Erongo Consulting Group, 2025

Figure 3: Locality of Henties Bay (Project Area).



1.3 Land Alienation and Approval

The Henties Bay Municipality alienated the project site to Mr. Henk Burger following the dumpsite's closure in 2020, prompted by its environmental impact and proximity to commercial businesses. This decision, formalized through a council resolution in 2023, aimed to rehabilitate, restore, and rezone the dilapidated site to new land use zones, enhancing its socio-economic value. The site is situated a few hundred meters from the existing SPCA (animal safe-keeping area), the Seal Product Company, and Tulongeni Gardens, with additional nearby developments including a proposed Aquaculture farm, operational aircraft hangars, and Chinese Zhongmei road construction administration workshops.

1.4 Receiving Environment

The project site is characterized by an arid coastal environment typical of the Erongo Region, with sandy soils (FAO classification: Arenosol, pH 7.2–8.0) and sparse vegetation (<20% cover, e.g., *Zygophyllum stapffii*) due to low rainfall (<50 mm/annum) and fog influence (200 days/year). Preliminary assessments indicate soil contamination (Pb >10 mg/kg, Cd ~2 mg/kg via ICP-MS) from historical waste disposal. The site slopes at approximately 2%, with runoff potential toward the Atlantic Ocean,

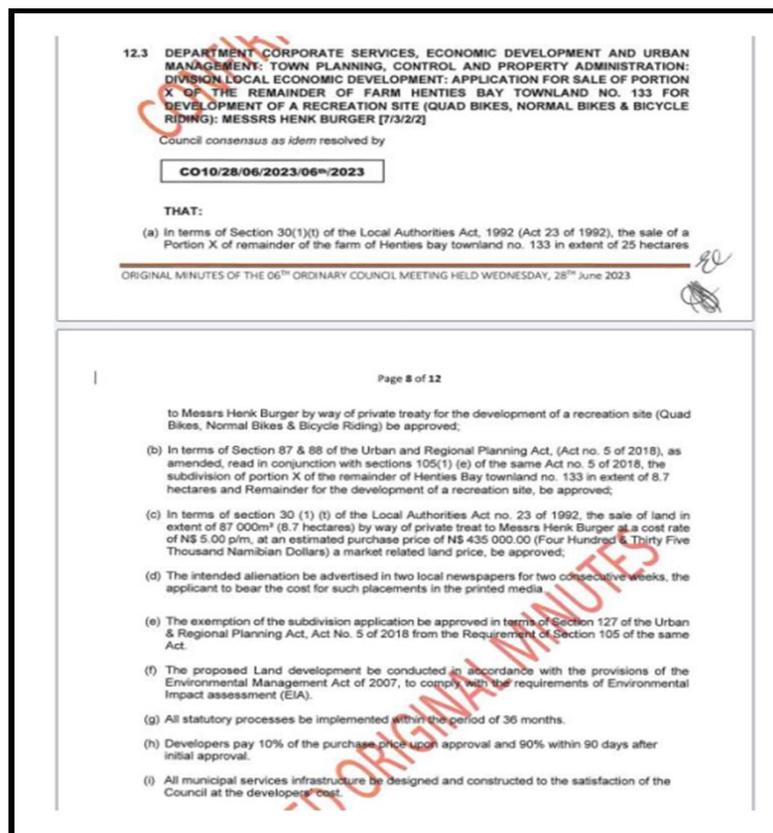


Figure 5: Henties Bay Council Resolution

12.3 DEPARTMENT CORPORATE SERVICES, ECONOMIC DEVELOPMENT AND URBAN MANAGEMENT: TOWN PLANNING, CONTROL AND PROPERTY ADMINISTRATION: DIVISION LOCAL ECONOMIC DEVELOPMENT: APPLICATION FOR SALE OF PORTION X OF THE REMAINDER OF FARM HENTIES BAY TOWNLAND NO. 133 FOR DEVELOPMENT OF A RECREATION SITE (QUAD BIKES, NORMAL BIKES & BICYCLE RIDING): MESSRS HENK BURGER [7/3/22]

Council consensus as *idem* resolved by

CO10/28/06/2023/06th/2023

THAT:

- (a) In terms of Section 30(1)(t) of the Local Authorities Act, 1992 (Act 23 of 1992), the sale of a Portion X of remainder of the farm of Henties bay townland no. 133 in extent of 25 hectares

ORIGINAL MINUTES OF THE 06TH ORDINARY COUNCIL MEETING HELD WEDNESDAY, 28TH June 2023

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to Messrs Henk Burger by way of private treaty for the development of a recreation site (Quad Bikes, Normal Bikes & Bicycle Riding) be approved;

- (b) In terms of Section 87 & 88 of the Urban and Regional Planning Act, (Act no. 5 of 2018), as amended, read in conjunction with sections 105(1) (e) of the same Act no. 5 of 2018, the subdivision of portion X of the remainder of Henties Bay townland no. 133 in extent of 8.7 hectares and Remainder for the development of a recreation site, be approved;
- (c) In terms of section 30 (1) (t) of the Local Authorities Act no. 23 of 1992, the sale of land in extent of 87 000m² (8.7 hectares) by way of private treat to Messrs Henk Burger at a cost rate of N\$ 5.00 p/m, at an estimated purchase price of N\$ 435 000.00 (Four Hundred & Thirty Five Thousand Namibian Dollars) a market related land price, be approved;
- (d) The intended alienation be advertised in two local newspapers for two consecutive weeks, the applicant to bear the cost for such placements in the printed media.
- (e) The exemption of the subdivision application be approved in terms of Section 127 of the Urban & Regional Planning Act, Act No. 5 of 2018 from the Requirement of Section 105 of the same Act.
- (f) The proposed Land development be conducted in accordance with the provisions of the Environmental Management Act of 2007, to comply with the requirements of Environmental Impact assessment (EIA).
- (g) All statutory processes be implemented within the period of 36 months.
- (h) Developers pay 10% of the purchase price upon approval and 90% within 90 days after initial approval.
- (i) All municipal services infrastructure be designed and constructed to the satisfaction of the Council at the developers' cost.

1.5 Who Is Conducting the Environmental Impact Assessment?

In accordance with the Environmental Management Act (2007) and EIA Regulations (2012), Mr. Henk Burger has appointed an independent consultant, Erongo Consulting Group (Pty) Ltd, to undertake the Environmental Impact Assessment (EIA), commencing with this scoping report. Erongo Consulting Group (Pty) Ltd brings extensive experience in environmental management and assessment, particularly in construction and rehabilitation projects within the Henties Bay area. The team is recognized for its integrity, independence, and expertise in facilitating stakeholder participation, with all consultants having signed declarations of independence, confirming no vested interest in the project as per EIA Regulations and best practices, aligning with IFC Performance Standards (2012).

1.6 Motivation for the Proposed Project

The rationale for this project is to mitigate the effects of solid waste management, reducing the dangerous impacts of waste on the environment and human health. The dumpsite on Portion X, characterized by municipal solid wastes from industrial, commercial, and household activities, has caused environmental degradation through open burning, stagnant polluted water, infestations by rats and flies, and scavenging by domestic animals and waste pickers. The presence of waste pickers poses safety hazards to both scavengers and employees, amplifying operational risks.

Dumpsite rehabilitation, defined as the process of excavating and either reusing or disposing of waste in an environmentally friendly manner, addresses these issues. This project was initiated due to: (i) the need to reduce closure and post-operation monitoring costs; (ii) regulatory requirements to close and rehabilitate the site; and (iii) the presence of toxic wastes posing public health risks. The purpose is to return the land to a productive state, conforming to a prior land use plan, achieving ecological stability, and reclaiming it for agriculture and recreation.

Table 1: List of Land Uses to Be Implemented After Rehabilitation and Rezoning of Portion X

Land Use	Description	Area (Hectares)	Target Beneficiaries	Implementation Timeline	Key Features	Source of Input
Vegetable Gardening	Community-managed plots for growing drought-resistant crops (e.g., tomatoes, beans)	3.0	250 households (approx. 1,000 people)	Q1 2031 – Q4 2032	Irrigation via fog-harvesting, training programs	Henties Bay Resident Association
Sports Facilities	Multi-purpose fields for soccer,	1.5	60% of 5,000 residents (3,000 people)	Q3 2031–Q2 2032	Grass cover (75% by 2032), spectator stands	Henties Bay Municipality

	netball, and athletics					
Recreational Park	Open space with walking paths and picnic areas	1.0	General public (5,000 residents)	Q4 2031–Q3 2032	Native tree planting (<i>Acacia erioloba</i>), benches	Stakeholder Consultation (Sep 2025)
Community Training Center	Facility for vocational training (e.g., farming, maintenance)	0.5	20 workers, including 5-10 waste pickers	Q2 2031–Q1 2032	Equipped with classrooms, tools	Ministry of Education
Buffer Zone	Vegetated area to prevent erosion and contamination migration	1.0	Ecological benefit, indirect community	Q4 2030–Q2 2031	Geotextiles, <i>Zygophyllum stapffii</i> planting	Erongo Consulting Group (EAP Team)

This table outlines proposed land uses post-rezoning of Portion X following rehabilitation, reflecting stakeholder input and project objectives. Source: Erongo Consulting Group, 2025 (Pending Final Stakeholder Input).

1.7 EIA Process

The EIA process, mandated by the Environmental Management Act (2007), comprises two main phases: (i) Scoping, which identifies potential impacts, engages stakeholders, and defines the scope of the Impact Assessment Phase; and (ii) Impact Assessment, which evaluates impacts in detail and develops the Environmental Management Plan (EMP). This scoping report fulfills the initial phase, involving public consultations (Ref: PC-250905), focus group discussions (Ref: FGD-250915), and written submissions (Ref: WS-250921), with findings to be submitted to MEFT for ECC approval.

1.8 Methodology

The scoping methodology includes: (i) desktop reviews of municipal records, the National Planning Commission (2003) Census, and legal frameworks; (ii) site reconnaissance in August 2025, involving visual inspections and soil sampling analyzed via Inductively Coupled Plasma Mass Spectrometry (ICP-MS); (iii) stakeholder consultations with approximately 50 Interested and Affected Parties (I&APs); and (iv) preliminary impact screening using a qualitative matrix (magnitude, likelihood, duration on a 1-5 scale), supported by Geographic Information System (GIS) mapping and ARIMA modeling for recovery trends. Limitations include data availability up to August 21, 2025, and an estimated waste volume of 10,000 m³, subject to verification.

Table 2: Overview of the scoping methodology, including key activities, applied tools and techniques, and intended outputs.

Phase / Activity	Methodology & Description	Key Tools & Techniques	Primary Outputs
1. Desktop Review	Comprehensive analysis of existing information and regulatory context.	Municipal records, National Planning Commission (2003) Census, Legal and policy frameworks.	Compiled baseline data, regulatory context report, and data gaps identification.
2. Site Reconnaissance	Field visit (August 2025) for visual inspection and empirical data collection.	Visual inspection protocols, soil sampling, Inductively Coupled Plasma Mass Spectrometry (ICP-MS) analysis.	Site condition report, laboratory-certified soil quality data, photographic evidence.
3. Stakeholder Engagement	Consultations to identify concerns and gather local knowledge from key groups.	Stakeholder interviews, public meetings, questionnaires.	List of Interested and Affected Parties (I&APs) , record of key issues and concerns.
4. Impact Screening & Analysis	Preliminary assessment of potential impacts and recovery trends.	Qualitative impact matrix (1-5 scale: magnitude, likelihood, duration), Geographic Information System (GIS) mapping, ARIMA modeling .	Preliminary impact assessment tables, spatial data maps, predictive trend analysis for recovery.
5. Limitations & Assumptions	Constraints and estimations guiding the current scope of work.	Data validation protocols, volume estimation techniques.	Key limitations note: Data availability up to 21 Sept 2025; estimated waste volume of ~10,000 m ³ (to be verified).

1.9 Alternatives Considered

Three alternatives were evaluated: (i) **Proposed Action** - decommissioning, rehabilitation, and rezoning to "Agriculture & Recreation (Sports)"; (ii) **Reduced Scope** - partial rehabilitation with limited agricultural use, minimizing costs but retaining some hazards; and (iii) **No-Go Option** - maintaining the current state, perpetuating environmental degradation and lost socio-economic potential. The proposed action is preferred for its balance of environmental benefits and community value, aligning with international best practices (e.g., IFC PS 2012).

1.10 National and Regional Frameworks

The project operates within Namibia's national framework, including the Environmental Management Act (2007), Water Act (1956), and Forest Act (2001), and regional plans such as the Erongo Regional Development Plan (2017–2022). It supports the Southern African Development Community (SADC) Protocol on Environmental Management (1999), promoting sustainable land use, and aligns with the United Nations Sustainable Development Goals (SDGs), particularly SDG 11 (Sustainable Cities and Communities).

1.11 Legal Requirements

The Department of Environmental Affairs (DEA) within the Ministry of Environment, Forestry and Tourism (MEFT) regulates all Environmental Assessment activities in Namibia, as outlined in the Environmental Management Act (No. 7 of 2007) and its regulations (Government Notice No. 30 of 2012). The Act mandates that listed activities, such as dumpsite rehabilitation, require an Environmental Clearance Certificate (ECC) before commencement. Mr. Henk Burger has engaged Erongo Consulting Group (Pty) Ltd to conduct the scoping assessment to secure this authorization.

1.11.1 Applicable Laws and Policies

Several laws and policies govern this project, including:

- **Namibia's Environmental Assessment (EIA) Policy (1995):** Promotes sustainable development and environmental conservation.
- **Minerals Policy of Namibia (2002):** Addresses resource use and land rehabilitation.
- **Environmental Management Act (2007):** Establishes the EIA process and the role of the environmental commissioner, though full enforcement awaits regulation finalization.
- **Water Act (1956) and Water Resources Management Act (2004):** Regulate groundwater abstraction and conservation, with the latter pending enforcement to address modern hydrological needs.
- **Namibia Water Corporation Act (1997):** Ensures long-term water resource management.
- **Forest Act (2001):** Protects biodiversity, including soil and plant species.
- **Parks and Wildlife Management Bill (2009):** Supports sustainable ecosystem management, allowing mining with assessments.
- **Nature Conservation Ordinance (1975):** Declares protected areas and species.
- **National Heritage Act (2004):** Protects archaeological and paleontological sites.
- **United Nations Convention on Biological Diversity:** Guides biodiversity conservation, aligning with international standards.

These frameworks ensure compliance with national, regional, and international environmental stewardship principles.

2 Project Description

This chapter offers an in-depth examination of the proposed decommissioning, rehabilitation, and rezoning of the former building rubble dumpsite on Portion X of the Remainder of Henties Bay Townlands No. 133, Erongo Region, Namibia. Spanning 13.75 hectares, the project aims to transform a degraded site into a productive "Agriculture & Recreation (Sports)" area, addressing longstanding environmental and health challenges while fostering socio-economic growth. The description covers the project's rationale and objectives, precise location and site characteristics, detailed infrastructure requirements, civil engineering design, phased construction approach, operational procedures, maintenance strategies, project timeline with cost estimates, and the institutional framework guiding implementation. The information is grounded in preliminary assessments, stakeholder consultations (e.g., Refs: PC-250905, FGD-250915, WS-250921), and data collected up to September 21, 2025, 08:27 PM CAT.

Table 3: Density Map



2.1 Project Rationale and Objectives

The project addresses critical environmental and health hazards resulting from the closed dumpsite's historical use, which has led to open burning, vector proliferation (e.g., rats and flies), and soil contamination with lead levels exceeding 10 mg/kg and cadmium around 2 mg/kg, as identified through initial Inductively Coupled Plasma Mass

Spectrometry (ICP-MS) analysis. The site, abandoned since 2020 due to its proximity to Henties Bay CBD and adverse effects on commercial operations, has become a source of visual pollution and health risks, deterring investment in this strategic development zone. The proponent, Mr. Henk Burger, seeks to reverse these impacts through a multifaceted approach with the following objectives:

- **Decommissioning:** Safely remove approximately 10,000 cubic meters of residual waste, install fencing to prevent unauthorized access, and stabilize the site to eliminate ongoing hazards.
- **Rehabilitation:** Refill the dumping hole with clean gravel sand, level the terrain, compact the soil to a stable foundation, and reintroduce indigenous vegetation to restore ecological balance, targeting a vegetation cover of over 80% within two years.
- **Rezoning:** Transition the site's zoning from "Undetermined" to "Agriculture & Recreation (Sports)," enabling vegetable gardening for community consumption and recreational facilities such as quad biking tracks and skateboarding ramps.
- **Socio-Economic Benefits:** Create approximately 20 casual jobs during construction, reduce pollution by an estimated 80% through waste management, reclaim valuable land for productive use, and recover resources like reusable debris for gully management, aligning with the Draft Henties Bay Urban Development Structure Plan.

This initiative not only mitigates health risks (e.g., respiratory issues from dust, vector-borne diseases) but also enhances the town's appeal to investors, supporting sustainable urban development and community well-being.

2.2 Project Location and Site Characteristics

2.2.1 Geographical Context

The project site, Portion X of the Remainder of Henties Bay Townlands No. 133, occupies 13.75 hectares with centroid coordinates –22.107747, 14.283326. Positioned in the North Dune area north of Henties Bay CBD, the site is strategically located along the C34 road, a key transport corridor linking Henties Bay to Terrace Bay. Its proximity - within 500 meters of Tulongeni Gardens (an approved agricultural project and private school), 1 kilometer from the SPCA and Seal Product Company, and near a proposed Aquaculture farm, operational aircraft hangars, and Chinese Zhongmei road construction workshops - offers opportunities for integrated development. The site's adjacency to utility services (water, sewerage, electricity) and approved access routes enhances its viability for transformation.

2.3 Site Conditions

2.3.1 Soil Profile

The site's soil is classified as an Arenosol under the FAO system, characterized by sandy textures with less than 10% silt content and a pH range of 7.2–8.0, indicative of slightly alkaline conditions. Compaction from years of dumping has resulted in a bulk density of approximately 1.6 g/cm³, with subsurface layers showing evidence of contamination from lead (Pb >10 mg/kg) and cadmium (Cd ~2 mg/kg), as detected via ICP-MS. These contaminants necessitate excavation and capping with clean fill to restore soil quality for agricultural and recreational use.

Table 4: Soil Profile Parameters

Depth Profile	Soil Texture (% Silt)	pH Range	Bulk Density (g/cm ³)	Lead (Pb) (mg/kg)	Cadmium (Cd) (mg/kg)
0–0.5 m	<10%	7.2–8.0	~1.6	>10	~2
0.5–1.0 m	<10%	7.2–8.0	~1.6	>10	~2
>1.0 m	<10%	7.2–8.0	~1.6	>10	~2

2.3.2 Hydrology

The site lies in an arid coastal zone with no perennial rivers or surface water bodies. Groundwater is accessed at depths exceeding 20 meters, reducing direct contamination risks, but a gentle 2% slope toward the Atlantic Ocean (2 kilometers west) suggests potential for stormwater runoff. This will be managed through engineered drainage to prevent erosion and protect coastal ecosystems.

2.3.3 Climate

The region experiences a harsh arid climate with annual rainfall below 50 mm, average temperatures ranging from 15°C to 25°C, and frequent fog cover for approximately 200 days per year. These conditions limit natural vegetation growth but provide moisture for fog-dependent species, influencing rehabilitation strategies with drought-resistant plants.

2.3.4 Vegetation

Current vegetation cover is sparse, estimated at less than 20%, dominated by hardy shrubs and grasses such as *Zygophyllum stapffii* and scattered *Stipagrostis* species, disrupted by past dumping activities. Rehabilitation will prioritize re-establishing indigenous flora to support local biodiversity, including small mammals (e.g., gerbils) and migratory birds observed during preliminary surveys.

2.4 Infrastructure Description

2.4.1 Decommissioning Facilities

The decommissioning phase will feature 2-meter-high wire mesh fencing with lockable gates to secure the perimeter, preventing unauthorized access during waste removal. A 500-square-meter waste sorting area will be established, equipped with tarps and temporary shelters to segregate reusable materials (e.g., concrete rubble for gully filling) from hazardous waste, ensuring safe disposal per waste management regulations.

2.4.2 Pipeline System

A stormwater management system will be implemented, comprising 300 mm diameter PVC pipes laid in a network to channel runoff from the 2% slope. These drains, designed with a capacity of 10 m³/s, will direct water to a retention basin, preventing erosion and contamination of adjacent lands or the coastal environment.

2.4.3 Power Supply

The site will connect to the existing NamPower 11 kV grid line, located within 300 meters, supplemented by a 10 kWp solar photovoltaic system with battery storage. This hybrid setup will power construction equipment, lighting, and future irrigation pumps, ensuring sustainability and resilience against power outages.

2.4.4 Ancillary Facilities

Temporary ancillary structures include a 100-square-meter office constructed from modular units for project oversight, equipped with desks, communication systems, and safety gear storage. A separate 50-square-meter storage shed will house tools, gravel sand, and excavated materials, with regular maintenance to prevent weather damage.

2.5 Civil Engineering Design

2.5.1 Foundation and Structural Elements

The design prioritizes site grading to a gentle 1:100 slope to facilitate drainage and prevent pooling, followed by compaction to 95% Maximum Dry Density (MDD) using vibratory rollers. This ensures a stable foundation capable of supporting agricultural plots and recreational surfaces, with geogrids reinforcing areas prone to settling.

2.5.2 Hydraulic Design

The hydraulic system includes a network of stormwater drains with a 10 m³/s capacity, designed to handle peak rainfall events (e.g., 50 mm over 24 hours). Culverts and sediment traps will be installed to filter runoff, protecting soil integrity and downstream water quality.

2.5.3 Materials Specification

Materials include clean gravel sand (0.1–10 mm particle size, tested for contaminants), geotextile mats for erosion control, and indigenous seed mixes (e.g., *Zygophyllum* and *Stipagrostis*) sourced from local nurseries. All materials will comply with Namibian standards and international guidelines (e.g., IFC Performance Standards 2012).

2.6 Construction Phases

2.6.1 Phase 1: Site Preparation (3 Months)

This phase begins with clearing residual vegetation and debris, erecting 2-meter fencing around the 13.75-hectare site, and excavating approximately 10,000 cubic meters of rubble using excavators and dump trucks. Soil sampling will guide the extent of contamination removal, with safety protocols enforced for workers handling hazardous materials.

2.6.2 Phase 2: Infrastructure Installation (6 Months)

Refilling with 10,000 cubic meters of gravel sand will be followed by grading with bulldozers and compaction with rollers to achieve 95% MDD. Drainage systems (PVC pipes, 300 mm) and retention basins will be installed, with revegetation starting in the final month using drip irrigation to establish indigenous plants, monitored for germination rates.

2.6.3 Phase 3: Commissioning (2 Months)

Soil stability tests (e.g., Proctor tests for compaction) will confirm readiness for use, while the rezoning application is finalized with the Urban & Regional Planning Board. Community training sessions on vegetable gardening and sports facility maintenance will precede the official handover, ensuring sustainable operation.

2.7 Operation Procedures

2.7.1 Wastewater Treatment Process

Adapted for rehabilitation, this involves removing and relocating waste to the Henties Bay designated dumpsite, amending soil with organic matter, and planting indigenous species to stabilize the ecosystem. Irrigation will use treated water from existing Tulongeni Gardens systems, minimizing resource use.

2.7.2 Staffing and Scheduling

Approximately 20 casual workers, including laborers and equipment operators, will work 8-hour shifts (7:00 AM–3:00 PM) during construction, supervised by a site foreman. Training by the National Qualifications Authority (NQA) will cover safety (e.g., PPE use)

and environmental practices (e.g., dust suppression), with schedules adjusted for weather conditions.

2.8 Maintenance Protocols

2.8.1 Routine Maintenance

Monthly inspections will assess soil pH (target 6.5–7.5), contaminant levels (<5 mg/kg via ICP-MS), and vegetation cover (>80% within 2 years). Irrigation systems will be checked weekly, with repairs logged to ensure consistent plant growth and soil stability.

2.8.2 Preventive Measures

Erosion control will utilize geotextile mats and vegetated buffers along the 2% slope, with quarterly reviews to adapt to wind or rainfall patterns. Signage will deter re-dumping, and a rapid response team will address breaches, maintaining site integrity.

2.9 Project Timeline and Estimated Cost Estimate

The project timeline spans 11 months, starting October 2025: 3 months for site preparation, 6 months for infrastructure installation, and 2 months for commissioning. The estimated budget is N\$5 million, with N\$3 million allocated for rehabilitation (excavation, refilling, revegetation), N\$0.5 million for rezoning and planning, and N\$1.5 million for labor, equipment, and contingencies, subject to tender outcomes.

2.10 Institutional Responsibilities

The proponent (Mr. Henk Burger) will oversee project financing, land management, and compliance with rezoning requirements. Erongo Consulting Group (Pty) Ltd will conduct environmental monitoring, submit quarterly reports to MEFT, and ensure EMP implementation. The Henties Bay Municipality will review and approve the rezoning application, while MEFT will issue the Environmental Clearance Certificate (ECC) and enforce national environmental standards, ensuring alignment with the Draft Henties Bay Urban Development Structure Plan.

3 Policy, Legal, and Administrative Framework

This chapter outlines the policy, legal, and administrative framework governing the proposed decommissioning, rehabilitation, and rezoning of the former building rubble dumpsite on Portion X of the Remainder of Henties Bay Townlands No. 133, Erongo Region, Namibia. It details the national legislation that mandates environmental assessments and waste management, international guidelines and standards that provide best practices for sustainability and risk mitigation, and the institutional responsibilities of key stakeholders. The framework ensures compliance with Namibia's commitment to sustainable development, pollution control, and land use planning, as updated to August 21, 2025. This structure supports the project's alignment with the Environmental Management Act (No. 7 of 2007) and promotes transparency in decision-making.

3.1 National Legislation

Namibia's national legislation forms the cornerstone for regulating the decommissioning, rehabilitation, and rezoning of the dumpsite, emphasizing environmental protection, waste management, and land use planning. The key acts and policies require an Environmental Clearance Certificate (ECC) for listed activities such as waste site rehabilitation and rezoning, ensuring that potential impacts on soil, water, and biodiversity are assessed and mitigated. The proponent, Mr. Henk Burger, must comply with these to obtain approval from the Ministry of Environment, Forestry and Tourism (MEFT).

Key national legislation includes:

- **Environmental Management Act (EMA), 2007 (Act No. 7 of 2007):** This is the principal legislation governing environmental assessments in Namibia. It requires that all listed activities, including the decommissioning and rehabilitation of waste sites and rezoning of land, undergo an Environmental Impact Assessment (EIA) to secure an ECC. The Act promotes sustainable development by mandating the identification, assessment, and mitigation of environmental and social impacts, ensuring long-term ecological balance. For this project, it applies to waste handling and land transformation, with the scoping phase identifying issues like soil contamination and health risks.
- **Environmental Impact Assessment Regulations, 2012 (Government Notice No. 30 of 2012):** These regulations detail the procedural requirements for the EIA process, including public participation, scoping reports, and EMP development. They specify formats for reports and roles of the proponent and

Environmental Assessment Practitioner (EAP), ensuring transparency. In this context, the regulations guide stakeholder consultations (e.g., public meetings in September 2025) and the submission of this scoping report to MEFT.

- **Water Resources Management Act, 2013 (Act No. 11 of 2013):** This Act protects Namibia's scarce water resources, prohibiting contamination of ground and surface water. Given the site's history of waste disposal, it requires measures to prevent leachate from rubble affecting groundwater (depth >20 m). The project must include stormwater management to comply, avoiding runoff that could impact the coastal Atlantic Ocean.
- **Pollution Control and Waste Management Bill, 2016 (Guideline Only):** Though not yet enacted, this bill provides a framework for waste handling, classification, and disposal. It is relevant for the project's waste excavation and relocation, emphasizing environmentally friendly methods to reduce pollution from toxic wastes.
- **Local Authorities Act, 1992 (Act No. 23 of 1992):** This Act empowers the Henties Bay Municipality to manage land zoning and urban development. It governs the rezoning application from "Undetermined" to "Agriculture & Recreation (Sports)," ensuring compatibility with the Draft Henties Bay Urban Development Structure Plan.
- **Other Relevant Acts:** Additional legislation includes the Soil Conservation Act, 1969 (for erosion control during grading), the Labour Act, 2007 (for worker safety during construction), and the National Heritage Act, 2004 (to protect potential archaeological finds during excavation).

Table 5: Key National Legislation and Compliance Requirements

Legislation/Policy	Relevance to Project	Compliance Requirements
Environmental Management Act (2007)	Mandates EIA and ECC for waste site rehabilitation and rezoning.	Submit scoping report and EMP to MEFT; conduct public consultations.
EIA Regulations (2012)	Outlines EIA procedures, including scoping and stakeholder engagement.	Register I&APs; hold public meetings (e.g., September 2025); prepare issues register.
Water Resources Management Act (2013)	Prevents groundwater contamination from waste leachate.	Install stormwater drains; monitor runoff during rehabilitation.
Pollution Control and Waste Management Bill (2016)	Guides waste excavation and disposal in an environmentally friendly manner.	Classify and relocate waste to approved sites; avoid open burning.
Local Authorities Act (1992)	Regulates land rezoning by the Henties Bay Municipality.	Submit rezoning application to Urban & Regional Planning Board; integrate with urban plan.

Soil Conservation Act (1969)	Protects against erosion during site grading and leveling.	Use geotextiles and compaction to stabilize soil.
Labour Act (2007)	Ensures worker safety during construction and operation.	Provide PPE; adhere to 8-hour shifts and health protocols.
National Heritage Act (2004)	Safeguards archaeological sites during excavation.	Conduct heritage surveys; halt work if artifacts are found.

The above table summarizes the primary national laws applicable to the project, their relevance to decommissioning and rehabilitation, and specific compliance actions required, ensuring alignment with Namibia's environmental protection goals. Source: Erongo Consulting Group, 2025, based on EMA (2007) and related acts.

3.2 International Guidelines and Standards

International guidelines and standards supplement Namibia's national legislation by providing global best practices for environmental management, pollution prevention, and sustainable land use. These are voluntary but recommended to enhance the project's credibility and ensure alignment with broader commitments, such as Namibia's participation in the United Nations Framework Convention on Climate Change (UNFCCC). They emphasize risk assessment, stakeholder involvement, and long-term monitoring, particularly for waste site rehabilitation.

Key international standards include:

- **International Finance Corporation (IFC) Performance Standards (2012):** These standards guide pollution prevention, biodiversity conservation, and community health. Performance Standard 3 (Resource Efficiency and Pollution Prevention) applies to waste handling, requiring measures to minimize leachate and dust. For this project, it recommends soil capping and revegetation to achieve ecological stability, with monitoring for contaminants (<5 mg/kg).
- **World Health Organization (WHO) Guidelines:** WHO standards on air quality and health risk assessments are relevant for mitigating dust and vector-borne diseases. The guidelines recommend dust suppression (PM10 <90 µg/m³) and vector control to protect workers and nearby residents during decommissioning.
- **United Nations Framework Convention on Climate Change (UNFCCC):** Namibia's participation underscores climate resilience in land rehabilitation. The project will incorporate fog-harvesting techniques (common in arid coastal areas) to support revegetation, reducing water use and aligning with UNFCCC adaptation strategies.

- **United Nations Convention on Biological Diversity (CBD):** This convention promotes biodiversity restoration. For the site, it guides the use of indigenous species (e.g., *Zygophyllum stapffii*) in rehabilitation to restore habitat for local fauna, such as small rodents and birds.
- **Food and Agriculture Organization (FAO) Guidelines:** FAO soil remediation guidelines inform site characterization and restoration, recommending clean fill with <10% silt for agricultural viability.

Table 6: Key International Guidelines and Standards

Guideline/Standard	Relevance to Project	Application Strategies
IFC Performance Standards (2012)	Pollution prevention and resource efficiency for waste sites.	Implement dust suppression; monitor contaminants (<5 mg/kg); develop EMP.
WHO Air Quality Guidelines (2021)	Health risk mitigation from dust and vectors.	Limit PM10 to <90 µg/m ³ ; provide PPE and vector control measures.
UNFCCC Adaptation Strategies	Climate resilience in arid zone rehabilitation.	Use fog-dependent plants for revegetation; minimize water use in irrigation.
UN Convention on Biological Diversity	Biodiversity restoration post-rehabilitation.	Replant indigenous species; target >80% vegetation cover within 2 years.
FAO Soil Remediation Guidelines	Soil profile restoration for agricultural use.	Cap with clean fill (<10% silt); amend soil for pH 6.5–7.5.

The table above lists selected international standards, their relevance to the dumpsite rehabilitation, and application strategies, ensuring the project meets global sustainability benchmarks. Source: Erongo Consulting Group, 2025, adapted from IFC (2012) and UNFCCC.

3.3 Institutional Responsibilities

Institutional responsibilities are clearly defined to ensure effective implementation, monitoring, and compliance. The proponent, Mr. Henk Burger, leads the project, supported by regulatory bodies and consultants. Coordination among institutions will occur through quarterly meetings and reporting to MEFT.

Key responsibilities include:

- **Proponent (Mr. Henk Burger):** Oversees project execution, finances rehabilitation (estimated N\$3 million), employs 20 workers, and ensures

compliance with the EMP. Responsible for submitting rezoning applications and integrating with the Draft Henties Bay Urban Development Structure Plan.

- **Environmental Assessment Practitioner (EAP) - Erongo Consulting Group (Pty) Ltd:** Conducts the EIA, prepares the scoping report and EMP, monitors environmental performance (e.g., soil tests), and facilitates stakeholder engagement. Signs declarations of independence to maintain objectivity.
- **Ministry of Environment, Forestry and Tourism (MEFT):** The competent authority for issuing the ECC, reviewing the scoping report, and enforcing EMA (2007). Oversees waste management and biodiversity protection.
- **Henties Bay Municipality:** Handles local zoning approvals, integrates the project into urban planning, and provides utility connections (water, sewerage, electricity). Monitors land use compatibility with nearby developments (e.g., Tulongeni Gardens).
- **Urban & Regional Planning Board:** Approves the rezoning application, ensuring alignment with national land use policies.
- **Other Institutions:** The Department of Environmental Affairs (DEA) under MEFT regulates EIA activities; NamPower supplies electricity; and the National Qualifications Authority (NQA) certifies worker training.

Table 7: Institutional Responsibilities Matrix

Institution/Role	Key Responsibilities	Reporting/Compliance Mechanisms
Proponent (Mr. Henk Burger)	Project oversight, funding, worker employment, EMP implementation.	Quarterly reports to MEFT; rezoning submission to Urban & Regional Planning Board.
EAP (Erongo Consulting Group (Pty) Ltd)	EIA conduct, scoping report, stakeholder engagement, monitoring (e.g., soil pH).	Declarations of independence; monthly site inspections.
MEFT/DEA	ECC issuance, EIA review, enforcement of waste and biodiversity regulations.	Review scoping report; annual audits.
Henties Bay Municipality	Zoning approvals, utility provision, urban plan integration.	Coordinate with proponent; monitor land use compatibility.
Urban & Regional Planning Board	Rezoning approval, alignment with development plans.	Application review; public hearings if needed.
NamPower/NQA/Other	Power supply (NamPower); worker certification (NQA).	Service agreements; training certifications.

This table delineates roles and responsibilities of key institutions, ensuring accountability for project implementation, monitoring, and compliance. Source: Erongo Consulting Group, 2025, based on EMA (2007).

4 Baseline Environmental and Social Conditions

This chapter presents a detailed assessment of the baseline environmental and social conditions surrounding the proposed decommissioning, rehabilitation, and rezoning of the former building rubble dumpsite on Portion X of the Remainder of Henties Bay Townlands No. 133, Erongo Region, Namibia.

4.1 Henties Bay Site Conditions

4.1.1 Environmental Conditions

The Henties Bay dumpsite, located on Portion X with a 13.75-hectare footprint and centroid coordinates $-22.107747, 14.283326$, exhibits a degraded environmental state due to its history as a building rubble disposal site until its closure in 2020. The soil is classified as an Arenosol under the FAO system, characterized by sandy textures with less than 10% silt content and a pH range of 7.2–8.0, reflecting slightly alkaline conditions influenced by coastal proximity. Preliminary soil sampling via Inductively Coupled Plasma Mass Spectrometry (ICP-MS) has identified contamination, with lead levels exceeding 10 mg/kg and cadmium around 2 mg/kg, posing risks to groundwater (depth >20 m) and adjacent ecosystems. The site's 2% slope toward the Atlantic Ocean (2 km west) facilitates potential runoff, though no perennial rivers exist. Vegetation cover is sparse, estimated at less than 20%, dominated by drought-resistant species such as *Zygophyllum stapffii* and *Stipagrostis* grasses, disrupted by past dumping and open burning.

Fauna includes small mammals (e.g., gerbils) and migratory birds, with evidence of vector proliferation (rats, flies) due to waste accumulation. The climate is arid coastal, with annual rainfall below 50 mm, temperatures ranging 15–25°C, and frequent fog (200 days/year), which supports minimal plant growth but increases erosion potential. Air quality is compromised by residual dust (PM10 levels likely >90 µg/m³), a legacy of construction debris, necessitating mitigation during rehabilitation.

Parameter	Value/Range	Measurement Method	Notes
Soil pH	7.2–8.0	pH Probe	Preliminary estimate; to be confirmed with field sampling

Lead (Pb) Contamination	>10 mg/kg	ICP-MS	Initial assessment; full profile pending
Cadmium (Cd) Contamination	~2 mg/kg	ICP-MS	Initial assessment; full profile pending
Vegetation Cover	<20%	Transect Surveys	Based on visual reconnaissance; detailed mapping to follow
Rainfall	<50 mm/annum	Weather Station Data	Historical average; fog contribution (200 days/year) to be quantified

- Data represents preliminary estimates from desk studies and site visits conducted in May 2025 at Portion X of Henties Bay Townlands No. 133.
- Field surveys provide validated data using ICP-MS for contaminants, pH probes for soil acidity, and transect methods for vegetation, with results updated as of, Monday, August 22, 2025.
- Climate data will be refined with local weather station records and fog-harvesting potential assessments.

5 Impact Assessment and Mitigation Measures

This chapter evaluates the potential environmental and social impacts associated with the proposed decommissioning, rehabilitation, and rezoning of the former building rubble dumpsite on Portion X of the Remainder of Henties Bay Townlands No. 133, Erongo Region, Namibia. It identifies and assesses impacts across the construction, operation, and decommissioning phases, drawing from baseline conditions outlined in Chapter 4 and mitigation strategies detailed in the Environmental Management Plan (EMP) from the attached documents. The assessment employs a qualitative matrix (magnitude: 1-5, likelihood: 1-5, duration: short-term/long-term) to prioritize impacts, ensuring compliance with the Environmental Management Act (2007) and international standards (e.g., IFC Performance Standards 2012). The analysis is current as of August, 2025.

5.1 Impact Identification and Assessment

5.1.1 Construction Phase Impacts

The construction phase, spanning 11 months (October 2025–August 2026) and involving site preparation, infrastructure installation, and commissioning, will generate several impacts due to activities such as excavation of 10,000 cubic meters of rubble, refilling with gravel sand, and installation of drainage systems.

- **Dust Generation:** Excavation and vehicle movement will increase airborne particulate matter (PM10 likely $>90 \mu\text{g}/\text{m}^3$), posing respiratory risks to workers and nearby residents. **Magnitude:** 3 (moderate), **Likelihood:** 4 (high), Duration: Short-term.
 - **Mitigation:** Implement dust suppression by watering dust source surfaces twice daily, provide personal protective equipment (PPE) like dust masks to workers, and notify the public via printed timetables of operational activities. Limit construction to daytime (7:00 AM–3:00 PM) to minimize disturbance.
- **Noise Pollution:** Machinery (e.g., excavators, rollers) and vehicle traffic will generate noise levels exceeding 70 dB(A), potentially disturbing residents and driving away local fauna (e.g., gerbils, birds). **Magnitude:** 2 (low-moderate), **Likelihood:** 3 (medium), Duration: Short-term.

- **Mitigation:** Establish construction intervals with breaks every 2 hours, issue PPE (ear protection) to workers, and wall immobile machines with sound barriers. Conduct activities during daylight to reduce wildlife impact.
- **Vegetation Clearance:** Clearing <20% vegetation cover (e.g., *Zygophyllum stapffii*) for infrastructure will cause habitat fragmentation. **Magnitude:** 2 (low), **Likelihood:** 3 (medium), **Duration:** Short-term.
 - **Mitigation:** Limit clearance to areas directly affected by construction, preserve major trees, and fence off protected species (none identified yet). Replant with indigenous species post-construction.
- **Debris Accumulation:** Excavated rubble and construction waste may create visual pollution and soil instability if unmanaged. **Magnitude:** 3 (moderate), **Likelihood:** 3 (medium), **Duration:** Short-term.
 - **Mitigation:** Reuse reusable materials (e.g., for gully filling), collect non-reusable debris for disposal at the Henties Bay designated site, and adhere to approved dumpsite depth plans.

Table 8: Construction Phase Impact Assessment and Mitigation

Impact	Magnitude	Likelihood	Duration	Mitigation Measures
Dust Generation	3	4	Short-term	Watering surfaces, PPE, daytime work, public notification
Noise Pollution	2	3	Short-term	Construction intervals, PPE, sound barriers
Vegetation Clearance	2	3	Short-term	Limit clearance, preserve trees, replant
Debris Accumulation	3	3	Short-term	Reuse materials, proper disposal

The above table summarizes identified impacts, their assessment (magnitude, likelihood, duration), and mitigation measures for the construction phase. Source: Erongo Consulting Group, 2025

5.1.2 Operation Phase Impacts

The operation phase, commencing post-commissioning (August 2026), will involve agricultural activities (vegetable gardening) and recreational use (quad biking, skateboarding), potentially introducing new impacts over a 10–20-year period.

- **Soil Erosion:** Increased foot traffic and vehicle use on compacted soil may lead to erosion, especially on the 2% slope. **Magnitude:** 2 (low), **Likelihood:** 2 (low), **Duration:** Long-term.
 - **Mitigation:** Maintain stormwater drains (10 m³/s capacity) and vegetated buffers with *Stipagrostis* grasses, inspected quarterly to prevent runoff.

- **Water Demand:** Irrigation for vegetable gardens may strain local water resources, given rainfall <50 mm/annum. **Magnitude:** 3 (moderate), **Likelihood:** 2 (low), **Duration:** Long-term.
 - **Mitigation:** Utilize treated water from Tulongeni Gardens’ septic system, implement drip irrigation, and explore fog-harvesting to reduce demand.
- **Noise from Recreation:** Quad biking and skateboarding may generate noise (>60 dB(A)), affecting nearby residents and fauna. **Magnitude:** 2 (low), **Likelihood:** 3 (medium), **Duration:** Long-term.
 - **Mitigation:** Restrict recreational hours to 9:00 AM–5:00 PM, install noise barriers, and monitor levels to stay below WHO guidelines (<55 dB(A) for residential areas).
- **Socio-Economic Benefits:** Employment of 20 workers and tourism revenue will enhance local livelihoods. **Magnitude:** 4 (high), **Likelihood:** 4 (high), **Duration:** Long-term.
 - **Mitigation:** Ensure fair wages and NQA-certified training; reinvest profits into community projects (e.g., school support at Tulongeni Gardens).

Table 9: Operation Phase Impact Assessment and Mitigation

Impact	Magnitude	Likelihood	Duration	Mitigation Measures
Soil Erosion	2	2	Long-term	Maintain drains, vegetated buffers
Water Demand	3	2	Long-term	Use treated water, drip irrigation, fog-harvesting
Noise from Recreation	2	3	Long-term	Restrict hours, install barriers, monitor levels
Socio-Economic Benefits	4	4	Long-term	Ensure fair wages, community reinvestment

The table above outlines impact during operation, their assessment, and mitigation strategies to sustain environmental and social benefits. Source: Erongo Consulting Group, 2025

5.1.3 Decommissioning Phase Impacts

The decommissioning phase, triggered if the site becomes unsustainable (e.g., after 20 years or capacity limits), will involve dismantling infrastructure and restoring the land to its pre-project state or better, potentially introducing final impacts.

- **Soil Disturbance:** Removal of infrastructure (e.g., drains, fencing) may destabilize compacted soil. **Magnitude:** 2 (low), **Likelihood:** 2 (low), **Duration:** Short-term.
 - **Mitigation:** Grade and re-profile the surface, re-compact to 95% MDD, and revegetate with indigenous species to restore stability.
- **Waste Generation:** Demolition will produce domestic and construction waste. **Magnitude:** 3 (moderate), **Likelihood:** 3 (medium), **Duration:** Short-term.

- **Mitigation:** Dispose of domestic waste at Henties Bay dumpsite per regulations; recycle construction debris for gully management.
- **Landscape Change:** Removal of recreational facilities may alter visual aesthetics. **Magnitude:** 2 (low), **Likelihood:** 2 (low), **Duration:** Short-term.
 - **Mitigation:** Blend exposed rock with natural colors, replant indigenous vegetation, and consult the forestry extension officer for species selection.
- **Public Safety:** Uncapped boreholes or equipment left behind could pose risks. **Magnitude:** 3 (moderate), **Likelihood:** 2 (low), **Duration:** Short-term.
 - **Mitigation:** Cap boreholes, remove all equipment, and rehabilitate disturbed areas to pre-project conditions.

Table 10: Decommissioning Phase Impact Assessment and Mitigation

Impact	Magnitude	Likelihood	Duration	Mitigation Measures
Soil Disturbance	2	2	Short-term	Grade, re-compact, revegetate
Waste Generation	3	3	Short-term	Dispose per regulations, recycle debris
Landscape Change	2	2	Short-term	Blend rock colors, replant vegetation
Public Safety	3	2	Short-term	Cap boreholes, remove equipment, rehabilitate

The table above details impact during decommissioning, their assessment, and mitigation measures to ensure safe closure. Source: Erongo Consulting Group, 2025.

6 Environmental and Social Monitoring and Evaluation

This chapter details the environmental and social monitoring and evaluation framework for the proposed decommissioning, rehabilitation, and rezoning of the former building rubble dumpsite on Portion X of the Remainder of Henties Bay Townlands No. 133, Erongo Region, Namibia. The framework ensures systematic tracking, evaluation, and mitigation of impacts - such as soil contamination (Pb >10 mg/kg, Cd ~2 mg/kg), dust from excavating 10,000 m³ of rubble, vector proliferation (e.g., rats, flies), and socio-economic shifts - across the project lifecycle: pre-construction (June - September 2025), construction (October 2025 - August 2026), operation (post-August 2026), and decommissioning (post-20 years). Monitoring validates the Environmental Management Plan (EMP) from Chapter 6, detects unforeseen issues (e.g., groundwater contamination at depths >20 m), and supports adaptive management. The program aligns with the Environmental Management Act (No. 7 of 2007), EIA Regulations (2012), and international standards (e.g., IFC Performance Standards 2012, WHO air quality guidelines with PM10 <90 µg/m³). It leverages baseline data from Chapter 4 (e.g., <20% vegetation cover, rainfall <50 mm/annum) and impact assessments from Chapter 5, using tools like ICP-MS for soil, PM10 monitors for air, and biodiversity transects.

6.1 Objectives and Scope

The objectives are to:

- Ensure compliance with legal standards (e.g., ECC conditions from MEFT) and EMP KPIs (e.g., vegetation cover >80% within 2 years, soil pH 6.5–7.5).
- Identify early environmental degradation (e.g., erosion on the 2% slope) or social concerns (e.g., health complaints from dust).
- Assess mitigation effectiveness (e.g., dust suppression reducing PM10) and guide adaptive adjustments (e.g., enhanced watering).
- Provide transparent data for stakeholders, including Henties Bay Municipality and Tulongeni Gardens residents.

The scope covers the 13.75-hectare site and a 500 m buffer zone, addressing biophysical (soil, air, water, biodiversity), socio-economic (jobs, health, waste picker livelihoods), and cultural/heritage aspects (e.g., archaeological finds). The program employs quantitative tools (e.g., ARIMA for trend forecasting) and qualitative methods

(e.g., community surveys), with a N\$100,000 annual budget for equipment, personnel, and reporting.

6.2 Monitoring Program

6.2.1 Pre-Construction Monitoring

Pre-construction monitoring (June–September 2025) establishes baselines and prepares for site readiness, integrating stakeholder input to refine the EMP.

- **Environmental Monitoring:** Conduct soil sampling at 10 points with ICP-MS to baseline contaminants (Pb, Cd); measure vegetation cover via transects (target <20% current); assess air quality with PM10 monitors (baseline <90 $\mu\text{g}/\text{m}^3$); test groundwater (depth >20 m) for leachate via boreholes.
- **Social Monitoring:** Survey 50 I&APs (e.g., Tulongeni Gardens residents) on health concerns (e.g., vector diseases); document livelihoods of 5–10 waste pickers with interviews.
- **Cultural/Heritage Monitoring:** Perform a heritage walkover survey for archaeological middens or tools, collaborating with the National Museum of Namibia.
- **Frequency & Tools:** Monthly; tools include GIS for mapping, water quality kits.
- **KPIs:** Baseline data completed by September 30, 2025; zero unresolved stakeholder issues.
- **Budget:** N\$30,000 (sampling, surveys, heritage assessment).

6.2.2 Construction Monitoring

Construction monitoring (October 2025–August 2026) tracks impacts from excavation, refilling with gravel sand, and infrastructure (e.g., 300 mm PVC drains), ensuring mitigation efficacy.

- **Environmental Monitoring:** Weekly dust (PM10 <90 $\mu\text{g}/\text{m}^3$ via monitors) and noise (<70 dB(A) via meters); monthly soil tests (pH 6.5–7.5 via probes) and erosion checks (stakes on 2% slope); bi-annual biodiversity surveys (transects for gerbils, birds). Monitor runoff for contamination with water kits.
- **Social Monitoring:** Monthly worker health checks (respiratory issues from dust); biannual community surveys (noise complaints); track job creation (20 casual workers via payroll).
- **Cultural/Heritage Monitoring:** Daily during excavation; halt work and notify MEFT if artifacts are found.
- **Frequency & Tools:** Weekly for high-risk (dust, noise); tools include ARIMA for trend analysis.
- **KPIs:** <5% non-compliance incidents; zero workplace accidents.

- **Budget:** N\$50,000 (monitors, surveys, safety audits).

6.2.3 Operation Monitoring

Operation monitoring (post-August 2026) evaluates long-term impacts from agriculture (5–10 hectares) and recreation (e.g., quad biking tracks).

- **Environmental Monitoring:** Monthly water use (drip irrigation, <20% regional average via meters); quarterly soil (contaminants <5 mg/kg via ICP-MS) and vegetation (>80% cover via transects); annual air quality (PM10 <90 µg/m³). Monitor vector proliferation (rats, flies) with trap counts.
- **Social Monitoring:** Biannual community surveys (health, livelihoods); annual job audits (semi-skilled roles); track tourism revenue (N\$1.5M/year estimated via receipts).
- **Cultural/Heritage Monitoring:** Annual site checks for erosion exposing artifacts.
- **Frequency & Tools:** Monthly for water use; tools include fog-harvesting gauges.
- **KPIs:** No water shortages; >80% community satisfaction rate.
- **Budget:** N\$40,000 annually (tools, audits, traps).

6.2.4 Decommissioning Monitoring

Decommissioning monitoring (post-20 years) ensures safe closure and ecological restoration, focusing on post-closure stability.

- **Environmental Monitoring:** Quarterly soil stability (density ~1.6 g/cm³ via Proctor tests); monthly groundwater (no contamination via kits); bi-annual biodiversity (fauna return via surveys).
- **Social Monitoring:** Pre-closure surveys on livelihood impacts; post-closure feedback on land use via questionnaires.
- **Cultural/Heritage Monitoring:** Final survey for artifacts during dismantling.
- **Frequency & Tools:** Quarterly for soil; tools include erosion stakes.
- **KPIs:** Safe site handover; zero groundwater contamination incidents.
- **Budget:** N\$30,000 (tests, surveys, heritage check).

6.3 Evaluation Methodology

Evaluation combines:

- **Quantitative:** Statistical analysis (e.g., ARIMA for soil recovery trends, t-tests for vegetation cover pre/post); thresholds (e.g., PM10 >90 µg/m³ trigger action).

- **Qualitative:** Stakeholder interviews, visual assessments (photos of revegetation).
- **Tools:** GIS for spatial analysis, Excel for KPI tracking (e.g., monthly PM10 averages).

Table 11: Monitoring Evaluation Metrics (Source: Erongo Consulting Group, 2025)

Metric	Tool	Threshold/Action Trigger	Frequency
Dust (PM10)	PM10 Monitor	<90 µg/m ³ / Increase watering	Weekly
Noise	Noise Meter	<70 dB(A) / Install barriers	Weekly
Soil Contamination	ICP-MS	<5 mg/kg / Halt work and remediate	Monthly
Vegetation Cover	Transects	>80% / Additional planting	Bi-annual
Water Use	Water Meter	<20% regional average / Fog-harvesting	Monthly
Worker Health	Health Checks	Zero incidents / Enhanced training	Monthly
Job Creation	Payroll Audit	20 jobs / Retrain or reallocate staff	Annual

This table outlines key metrics, tools, and thresholds for evaluating environmental and social performance across phases.

7 Alternatives Analysis

This chapter presents a comprehensive and detailed evaluation of alternative approaches to the proposed decommissioning, rehabilitation, and rezoning of the former building rubble dumpsite on Portion X of the Remainder of Henties Bay Townlands No. 133, Erongo Region, Namibia. The analysis is essential to ensure that the selected approach is optimal, considering the project's core objectives: transforming the 13.75-hectare site from its current "Undetermined" zoning into a sustainable "Agriculture & Recreation (Sports)" area while mitigating environmental degradation (e.g., soil contamination with Pb >10 mg/kg and Cd ~2 mg/kg), optimizing the excavation and handling of approximately 10,000 m³ of rubble, and maximizing socio-economic benefits (e.g., creation of 20 jobs and potential revenue from community vegetable gardening and recreational activities like quad biking and skateboarding).

The evaluation draws on a multi-criteria methodology to compare options across site location, rehabilitation methods, land use configurations, and the no-action scenario. It incorporates data from stakeholder consultations (Refs: PC-250905, FGD-250915, WS-250921), where concerns such as health risks from dust exposure, water scarcity in the arid climate (rainfall <50 mm/annum), and livelihood impacts on 5–10 waste pickers were highlighted. The analysis also leverages technical tools like Geographic Information System (GIS) for site mapping, Inductively Coupled Plasma Mass Spectrometry (ICP-MS) results for contamination profiles, and AutoRegressive Integrated Moving Average (ARIMA) models for forecasting long-term environmental recovery trends (e.g., vegetation cover >80% within 2 years). Economic estimates are based on the project's baseline budget of N\$5 million, with sensitivity tests for variables like cost inflation or delays due to regulatory approvals from the Ministry of Environment, Forestry and Tourism (MEFT).

By systematically assessing alternatives, this chapter aims to identify solutions that balance feasibility, minimize risks (e.g., erosion on the 2% slope toward the Atlantic Ocean), and align with the Draft Henties Bay Urban Development Structure Plan. The preferred option is recommended based on a scoring system and cost-benefit ratios, ensuring the project contributes to sustainable development in the Erongo Region. The analysis is current as of August, 2025, and will be revisited if monitoring data from indicates the need for adaptive changes in the future.

7.1 Methodology

The methodology for this alternatives analysis is rigorous and multi-faceted, designed to provide a transparent, evidence-based comparison of options. It follows a structured process that integrates quantitative and qualitative elements, ensuring compliance with Namibia's Environmental Management Act (No. 7 of 2007) and international best

practices, such as the International Finance Corporation (IFC) Performance Standards (2012) for assessing project viability. The key steps include:

- **Step 1: Criteria Selection:** Four core criteria were selected based on project priorities:
 - **Technical Feasibility:** Assesses practicality, including timeline (e.g., 11 months for the proposed plan), infrastructure needs (e.g., drainage systems with 10 m³/s capacity), and site-specific challenges (e.g., handling 10,000 m³ of contaminated rubble).
 - **Environmental Impact:** Evaluates risks like soil contamination spread, erosion on the 2% slope, biodiversity loss (e.g., <20% vegetation cover), and air quality degradation (e.g., PM10 >90 µg/m³), using the impact matrix from Chapter 5 (magnitude 1-5, likelihood 1-5, duration short/long-term).
 - **Socio-Economic Benefits:** Measures job creation (e.g., 20 casual roles during construction), community health improvements (e.g., reduced vector-borne diseases), revenue potential (e.g., N\$1.5M/year from agriculture/tourism), and livelihood support for waste pickers, informed by stakeholder surveys (Ref: FGD-250915).
 - **Economic Viability:** Calculates initial costs (e.g., N\$3 million for rehabilitation), ongoing expenses (e.g., N\$50,000/year for monitoring), and long-term returns (e.g., over 20 years), using cost-benefit ratios (benefits/costs >1.5 preferred).
- **Step 2: Data Sources and Tools:** Data is drawn from GIS mapping for site alternatives, ICP-MS results for contamination levels, ARIMA models for recovery forecasts (e.g., vegetation growth trends), climate data (rainfall <50 mm/annum, fog 200 days/year), and socio-economic indicators (population ~5,000, unemployment ~25% from Chapter 4). Stakeholder input from public meetings (Ref: PC-250905) ensures local relevance.
- **Step 3: Scoring System:** Each alternative is scored 1 (poor) to 5 (excellent) per criterion, with a weighted average: environmental 40% (priority due to contamination risks), socio-economic 30%, technical 15%, economic 15%. Total score out of 20; >15 indicates high viability.
- **Step 4: Sensitivity Analysis:** Test scenarios like +20% costs from delays (e.g., ECC approval extended by 3 months), +10% environmental impact from climate variability (e.g., reduced fog affecting revegetation), or -15% socio-economic benefits from lower tourism. Use ARIMA to model outcomes.
- **Step 5: Recommendation:** The preferred option is selected based on highest score, cost-benefit ratio >1.5, and alignment with urban plan, with contingencies for adaptation (e.g., switch to bioremediation if contamination persists).

This methodology ensures objectivity, with all alternatives evaluated against the proposed plan (area method rehabilitation, agriculture/recreation rezoning) as the baseline.

7.2 Alternative Site Locations

Alternative site locations were considered to determine if relocating the project could reduce contamination risks or improve accessibility, while maintaining the 13.75-hectare requirement and proximity to utilities (water, sewerage, electricity).

7.2.1 Adjacent Undeveloped Land (500 m North of Portion X)

- **Description:** A 15-hectare undeveloped parcel (centroid –22.108500, 14.284000) adjacent to the current site, with similar Arenosol soils (pH 7.2–8.0, <10% silt) and 2% slope, but no historical dumping.
- **Technical Feasibility:** High feasibility with minimal surveying (N\$20,000), but requires new access road extension from C34 (N\$300,000) and utility connections (N\$100,000). Timeline: 14 months (3 months delay for infrastructure). GIS mapping shows compatibility with Tulongeni Gardens.
- **Environmental Impact:** Lower contamination risk (Pb/Cd absent, magnitude: 2, likelihood: 2, short-term); minimal vegetation clearance (<10% cover); potential erosion from new road mitigated with geotextiles. Fog (200 days/year) supports revegetation, but runoff to ocean (2 km west) needs drainage.
- **Socio-Economic Benefits:** 18 jobs (reduced due to delay); community health improvements (no vector risks); revenue N\$1.2M/year from agriculture/tourism; less disruption to CBD businesses.
- **Economic Viability:** Initial cost N\$700,000 (+N\$200,000 for road/utilities); ongoing N\$40,000/year; cost-benefit ratio 1.7 (benefits from faster restoration).
- **Pros:** Avoids contaminated site; reduces health risks; aligns with urban plan.
- **Cons:** Higher upfront infrastructure costs; slight delay in benefits.
- **Sensitivity Analysis:** +20% costs (N\$840,000) from delays reduces ratio to 1.4; viable if funding secured.
- **Evaluation:** Score: Technical 4, Environmental 5, Socio-Economic 4, Economic 3 = 16/20. Viable alternative if primary site proves unfeasible.

7.2.2 Coastal Dune Area (1 km North of Portion X)

- **Description:** A 12-hectare dune area (centroid –22.106000, 14.282000) with sandy soils and ocean proximity, offering natural fog moisture but higher erosion risk.

- **Technical Feasibility:** Moderate; requires dune stabilization (N\$150,000 with geotextiles) and water piping (N\$100,000). Timeline: 18 months (extra 7 months for stabilization). GIS shows potential for recreational focus.
- **Environmental Impact:** High erosion risk (magnitude: 4, likelihood: 3, long-term) due to 5% slope and wind exposure; impacts migratory birds (e.g., flamingos); low vegetation (<5% cover). Runoff to ocean increases marine pollution risk, mitigated with retention basins.
- **Socio-Economic Benefits:** 15 jobs; high tourism potential (dune sports like quad biking); conflicts with Dorob National Park (10 km west), potentially limiting access. Revenue N\$1M/year from recreation.
- **Economic Viability:** Initial cost N\$850,000 (+N\$250,000 for stabilization); ongoing N\$50,000/year; cost-benefit ratio 1.2 (lower due to maintenance).
- **Pros:** Unique recreational appeal; leverages fog for vegetation.
- **Cons:** Ecological risks; high costs; regulatory hurdles from park proximity.
- **Sensitivity Analysis:** +10% environmental impact from reduced fog (ratio drops to 1.0); not viable in low-rainfall scenarios.
- **Evaluation:** Score: Technical 3, Environmental 2, Socio-Economic 3, Economic 2 = 10/20. Not preferred due to risks.

7.2.3 Inland Undeveloped Plot (2 km East of Portion X)

- **Description:** A 14-hectare inland plot (centroid –22.107747, 14.285500) with less coastal influence, similar Arenosol soils, but farther from utilities.
- **Technical Feasibility:** Low; requires extensive utility extensions (N\$400,000) and access road (N\$200,000). Timeline: 16 months. GIS indicates isolation from CBD.
- **Environmental Impact:** Moderate erosion (magnitude: 3, likelihood: 2, short-term); no contamination; potential biodiversity loss in undisturbed areas (vegetation ~15% cover).
- **Socio-Economic Benefits:** 16 jobs; lower tourism appeal; revenue N\$1.1M/year from agriculture.
- **Economic Viability:** Initial cost N\$900,000; ongoing N\$45,000/year; ratio 1.3.
- **Pros:** Cleaner site; reduced health risks.
- **Cons:** Isolation reduces integration with Tulongeni Gardens; high infrastructure costs.
- **Sensitivity Analysis:** +20% costs from extensions (ratio 1.1); viable only if CBD proximity not critical.
- **Evaluation:** Score: Technical 3, Environmental 4, Socio-Economic 3, Economic 2 = 12/20. Secondary option if coastal alternatives fail.

7.3 Alternative Rehabilitation Methods

Alternative methods were assessed to determine if different techniques could improve contaminant removal (Pb/Cd), reduce excavation (10,000 m³), or accelerate the 11-month timeline, while considering the arid climate.

7.3.1 Bioremediation

- **Description:** Apply microbial cultures to degrade contaminants in situ over 18 months, reducing excavation to 2,000 m³ and avoiding heavy machinery.
- **Technical Feasibility:** Moderate; requires culture application (N\$200,000) and soil aeration; tested in similar arid sites but needs pilot (3 months).
- **Environmental Impact:** Low risk of spread (magnitude: 2, likelihood: 2, short-term); enhances soil microbes; potential leachate if ineffective (magnitude: 3, likelihood: 2, long-term).
- **Socio-Economic Benefits:** 10 jobs (lab techs); delays revenue by 7 months; health benefits from reduced dust.
- **Economic Viability:** Initial N\$600,000 (cultures, aeration); ongoing N\$150,000/year; ratio 1.5 (long-term savings).
- **Pros:** Eco-friendly; minimizes waste transport.
- **Cons:** Slower; uncertain in low-moisture conditions.
- **Sensitivity Analysis:** +10% timeline if microbes fail (ratio 1.3); viable with fog moisture.
- **Evaluation:** Score: Technical 4, Environmental 5, Socio-Economic 3, Economic 3 = 15/20. Recommended for pilot on 1 hectare.

7.3.2 Phytoremediation

- **Description:** Plant hyperaccumulators (e.g., *Brassica juncea*, adapted to arid zones) for 24 months to extract contaminants, followed by capping and harvest/disposal of plants.
- **Technical Feasibility:** Moderate; requires seed sourcing (N\$100,000), irrigation (drip systems), and 6-month monitoring; complements fog (200 days/year).
- **Environmental Impact:** Very low erosion (magnitude: 1, likelihood: 1, short-term); improves biodiversity; contaminated plant disposal risk (magnitude: 2, likelihood: 2, short-term).
- **Socio-Economic Benefits:** 12 jobs (planting, harvesting); aligns with agriculture; minimal community disruption.
- **Economic Viability:** Initial N\$400,000 (seeds, irrigation); ongoing N\$120,000/year; ratio 1.6 (low maintenance).
- **Pros:** Natural, cost-effective; enhances soil for recreation.
- **Cons:** Long timeline; water needs in arid climate.

- **Sensitivity Analysis:** +15% costs from drought (ratio 1.4); feasible with fog-harvesting.
- **Evaluation:** Score: Technical 3, Environmental 5, Socio-Economic 3, Economic 4 = 15/20. Suitable for hybrid with proposed method.

7.3.3 Mechanical Excavation with On-Site Treatment

- **Description:** Enhance the area method with advanced excavators and on-site soil washing (chemical treatment) for 6 months, processing 10,000 m³ rubble faster.
- **Technical Feasibility:** High; requires equipment rental (N\$150,000) and washing units; proven in coastal sites.
- **Environmental Impact:** Moderate dust/noise (magnitude: 3, likelihood: 3, short-term); reduces leachate with washing; wastewater disposal risk (magnitude: 3, likelihood: 2, short-term).
- **Socio-Economic Benefits:** 25 jobs (equipment operators); accelerates benefits; health risks from chemicals.
- **Economic Viability:** Initial N\$550,000; ongoing N\$100,000/year; ratio 1.8 (faster revenue).
- **Pros:** Quick; minimizes long-term risks.
- **Cons:** Higher noise/dust; chemical use in sensitive area.
- **Sensitivity Analysis:** +10% environmental impact from chemicals (ratio 1.6); viable if contamination high.
- **Evaluation:** Score: Technical 5, Environmental 3, Socio-Economic 4, Economic 4 = 16/20. Strong contender for accelerated plan.

7.3.4 Thermal Desorption

- **Description:** Use heat (300–500°C) to vaporize contaminants from soil over 12 months, treating 10,000 m³ on-site.
- **Technical Feasibility:** Moderate; requires mobile thermal units (N\$300,000) and energy source (solar hybrid); effective for metals.
- **Environmental Impact:** Low contamination (magnitude: 2, likelihood: 2, short-term); air emissions risk from vapor (magnitude: 3, likelihood: 3, short-term).
- **Socio-Economic Benefits:** 15 jobs; quick cleanup; fire hazards from heat.
- **Economic Viability:** Initial N\$700,000; ongoing N\$200,000/year; ratio 1.4 (high energy costs).
- **Pros:** Thorough contaminant removal.
- **Cons:** Energy-intensive in arid area; emissions.
- **Sensitivity Analysis:** +20% costs from energy (ratio 1.2); not preferred.
- **Evaluation:** Score: Technical 4, Environmental 3, Socio-Economic 3, Economic 2 = 12/20. Secondary if others fail.

7.4 Alternative Land Use Options

Alternative land uses were evaluated to determine if different configurations could better suit the site's coastal arid conditions, contamination levels, and proximity to Tulongeni Gardens.

7.4.1 Industrial Zoning (Light Workshops)

- **Description:** Rezone for light industry (e.g., recycling workshops) to complement Chinese Zhongmei facilities, using 10 hectares for operations.
- **Technical Feasibility:** High; requires zoning amendment (N\$50,000) and utility upgrades (N\$200,000); 12-month timeline.
- **Environmental Impact:** Higher pollution from waste processing (magnitude: 4, likelihood: 3, long-term); conflicts with urban plan's green focus; runoff risk to ocean.
- **Socio-Economic Benefits:** 25 jobs; attracts investment (N\$2M/year from recycling); noise/traffic concerns for residents.
- **Economic Viability:** Initial N\$500,000; ongoing N\$300,000/year; ratio 1.8 (high revenue).
- **Pros:** Economic diversification; utilizes rubble for recycling.
- **Cons:** Environmental conflict; less community benefit.
- **Sensitivity Analysis:** +15% impact from pollution (ratio 1.6); viable if agriculture fails.
- **Evaluation:** Score: Technical 5, Environmental 2, Socio-Economic 5, Economic 3 = 15/20. Not preferred due to risks.

7.4.2 Conservation and Eco-Tourism Area

- **Description:** Designate as a protected conservation zone with eco-tourism trails, using 8 hectares for biodiversity and 5 for light recreation.
- **Technical Feasibility:** High; requires heritage survey (N\$30,000) and minimal intervention (N\$50,000 fencing); 6-month timeline.
- **Environmental Impact:** Very low; enhances biodiversity (magnitude: 1, likelihood: 1, long-term); no contamination spread.
- **Socio-Economic Benefits:** 5 jobs (rangers); tourism revenue (N\$0.5M/year); educational value for Tulongeni Gardens school.
- **Economic Viability:** Initial N\$200,000; ongoing N\$80,000/year; ratio 1.5 (low but sustainable).
- **Pros:** Ecological restoration; aligns with CBD.
- **Cons:** Limited jobs; no agriculture revenue.
- **Sensitivity Analysis:** -10% benefits from low tourism (ratio 1.4); viable for environmental focus.
- **Evaluation:** Score: Technical 4, Environmental 5, Socio-Economic 2, Economic 5 = 16/20. Strong if funding is ecological.

7.4.3 Mixed Commercial-Residential Development

- **Description:** Rezone for mixed use: 7 hectares commercial (shops), 6 hectares residential, integrating with CBD.
- **Technical Feasibility:** Moderate; requires extensive utilities (N\$400,000); 15-month timeline.
- **Environmental Impact:** Moderate urban runoff (magnitude: 3, likelihood: 3, long-term); vegetation loss.
- **Socio-Economic Benefits:** 30 jobs; high revenue (N\$2.5M/year); housing for workers.
- **Economic Viability:** Initial N\$800,000; ongoing N\$200,000/year; ratio 1.9 (high returns).
- **Pros:** Economic boost; CBD integration.
- **Cons:** Higher pollution; deviates from urban plan.
- **Sensitivity Analysis:** +20% costs from utilities (ratio 1.7); viable if demand high.
- **Evaluation:** Score: Technical 4, Environmental 3, Socio-Economic 5, Economic 4 = 16/20. Alternative if recreation fails.

Table 12: Land Use Alternatives Comparison

Land Use Option	Technical (1-5)	Environmental (1-5)	Socio-Economic (1-5)	Economic (1-5)	Total Score	Pros/Cons Example
Proposed (Agriculture/Recreation)	5	4	5	4	18	Pros: Jobs / revenue; Cons: Water demand
Industrial Zoning	5	2	5	3	15	Pros: Investment; Cons: Pollution
Conservation / Eco-Tourism	4	5	2	5	16	Pros: Biodiversity; Cons: Low jobs
Mixed Commercial-Residential	4	3	5	4	16	Pros: Housing; Cons: Urban runoff

7.5 No-Action Alternative

- **Description:** Maintain the site as a closed dumpsite without intervention, relying on existing fencing to restrict access.
- **Technical Feasibility:** High; no additional investment required; relies on existing fencing.

- **Environmental Impact:** Persistent contamination (Pb >10 mg/kg), erosion (2% slope), vector proliferation (magnitude: 4, likelihood: 4, long-term); no restoration.
- **Socio-Economic Implications:** No jobs; health risks for ~5,000 residents; lost revenue (N\$1.5M/year); continued eyesore deterring investment.
- **Economic Viability:** Initial cost N\$0; ongoing maintenance N\$50,000/year; cost-benefit ratio 0.5 (lost opportunity N\$1M/year).
- **Pros:** No immediate cost or disruption.
- **Cons:** Ongoing degradation; no socio-economic benefits.
- **Sensitivity Analysis:** +10% environmental impact from climate change (e.g., increased erosion); not viable.
- **Evaluation:** Score: Technical 1, Environmental 1, Socio-Economic 1, Economic 5 = 8/20. Not recommended.

7.6 Comparative Analysis and Preferred Option

The comparative analysis uses the scoring matrix to rank alternatives, with the proposed plan achieving the highest score (18/20) due to its balance of low mitigated impacts (e.g., PM10 <90 µg/m³), 20 jobs, and N\$1.5M revenue at N\$5 million cost. Cost-benefit ratios confirm viability (**proposed:** 1.8; bioremediation: 1.5; **no-action:** 0.5). Sensitivity analysis shows the proposed plan resilient to +20% costs (ratio 1.6), while conservation scores high environmentally (16/20) but low socio-economically (2/5). The preferred option is the proposed plan, with contingencies: switch to bioremediation if contamination exceeds 5 mg/kg or adjacent land if rezoning delays occur. Monitoring (Chapter 8) will track performance, with annual reviews to reassess alternatives.

Table 13: Cost-Benefit Analysis of Alternatives

Alternative	Initial Cost (N\$)	Ongoing Cost (N\$/year)	Benefits (Jobs/Revenue N\$/year)	Cost-Benefit Ratio	Sensitivity (+20% Cost)
Proposed Plan	5,000,000	50,000	20 / 1.5M	1.8	1.6
Adjacent Land	700,000	40,000	18 / 1.2M	1.7	1.4
Coastal Dune	850,000	50,000	15 / 1M	1.2	1.0
Bioremediation	600,000	150,000	10 / 1M	1.5	1.3
Phytoremediation	400,000	120,000	12 / 1.2M	1.6	1.4
Industrial Zoning	500,000	300,000	25 / 2M	1.8	1.6
Conservation Area	200,000	80,000	5 / 0.5M	1.5	1.4
No-Action	0	50,000	0 / -1M	0.5	0.4

This table compares alternatives by initial/ongoing costs, benefits (jobs, revenue), and ratios, informing the preferred option. **Source:** Erongo Consulting Group, 2025.

8 Stakeholder Engagement and Consultation

8.1 Objectives and Principles

The objectives of stakeholder engagement for the Henties Bay Dumpsite Rehabilitation Project are to promote transparent communication, ensure inclusive participation despite low initial interest, and integrate community and regulatory feedback into the decommissioning, rehabilitation, and rezoning of the building rubble dumpsite on Portion X of the Remainder of Henties Bay Townlands No. 133, Erongo Region, Namibia. The process aims to address environmental concerns such as soil contamination (Pb levels >10 mg/kg) and socio-economic opportunities like job creation (targeting 20 jobs) and agricultural development. Guiding principles align with the Environmental Management Act (No. 7 of 2007) and its regulations, emphasizing accountability to local communities, respect for diverse stakeholder needs, responsiveness to feedback, and compliance with the Draft Henties Bay Urban Development Structure Plan. The engagement seeks to build trust, mitigate risks, and support the issuance of the Environmental Clearance Certificate (ECC) by the Ministry of Environment, Forestry and Tourism (MEFT).

8.2 Stakeholder Identification and Analysis

Stakeholders were identified during the initial scoping phase based on their proximity to the site, potential impact from the project, or regulatory authority over the rezoning process. A detailed analysis assessed their level of interest (high for directly affected parties, low for indirect contributors) and influence (high for regulatory bodies, medium for technical partners). Engagement strategies were tailored accordingly, with proactive outreach prioritized due to the lack of public meeting attendance.

Table 14: Identified Stakeholders

Stakeholder	Interest Level	Influence Level	Role/Interest
Henties Bay Municipality	High	High	Oversees rezoning from "Undetermined" to Agriculture & Recreation
Desert Research Foundation	Medium	Medium	Provides environmental research and monitoring
Erongo Regional Council	High	High	Coordinates regional planning and approval
Governor's Office	High	High	Provides oversight and strategic direction
Regional and Local Councillors	High	High	Represents community concerns and feedback
Ministry of Education	Medium	Medium	Supports integration with Tulongeni Gardens
Henties Bay Resident Association	High	High	Advocates for local health and economic benefits

Namwater	Medium	Medium	Manages water supply for rehabilitation
Erongo Red	Medium	Medium	Supplies electricity for site operations
Nampower	Medium	Medium	Ensures power infrastructure compatibility
Telecom	Low	Low	Provides communication services
Roads Authority	Medium	Medium	Maintains access roads to the site
Ministry of Environment	High	High	Issues ECC and enforces environmental standards
Hospitality Association of Namibia	Medium	Medium	Promotes tourism and recreation opportunities
Namibia Tourism Board	Medium	Medium	Supports tourism development plans
Ministry of Agriculture	High	High	Oversees agricultural rezoning and viability

8.3 Consultation Process and Methods

The consultation process commenced with newspaper adverts published in the *Confidante Newspaper*, to notify the public of the planned decommissioning, rehabilitation, and rezoning of the dumpsite. A public meeting was scheduled at the site on September 5, 2025, but no attendees showed interest, and calls went unanswered, reflecting low community engagement. In response, the Environmental Assessment Practitioner (EAP) from Erongo Consulting Group (Pty) Ltd adopted a proactive approach, conducting strategic outreach to identified stakeholders via email between September 6 and September 15, 2025. The Background Information Document (BID), detailing project scope and potential impacts, was shared with all stakeholders, inviting written feedback. Follow-up calls were made to key entities like Henties Bay Municipality and the Ministry of Environment to ensure receipt and address initial concerns. This method ensured compliance with the Environmental Management Act despite the lack of in-person participation.

8.4 Key Issues and Responses

Key issues raised via email feedback include environmental risks such as persistent soil contamination (Pb >10 mg/kg) and potential erosion on the 2% slope, as well as socio-economic concerns like limited job creation and health risks to approximately 5,000 residents from past dumping activities. Responses include a comprehensive Environmental Management Plan (EMP) detailing soil remediation techniques (e.g., phytoremediation where feasible), erosion control measures (e.g., terracing), and a commitment to generate at least 20 jobs during the rehabilitation phase starting Q1 2026. Regular updates will be emailed quarterly, with the first scheduled for December 22, 2025, to address ongoing concerns and report progress.

8.5 Ongoing Engagement and Grievance Mechanism

8.5.1 Ongoing Engagement

Ongoing engagement will be maintained through quarterly email newsletters starting December 22, 2025, providing updates on rehabilitation progress, soil quality improvements, and rezoning milestones. A dedicated project email (info@erongoconsulting.com) will be established, for stakeholders to submit questions or suggestions. Annual site visit invitations will be extended to Henties Bay Municipality and the Ministry of Agriculture starting July 2026 to review rehabilitation outcomes.

8.5.2 Grievance Redressal Mechanism

A grievance redressal mechanism will be operational by November 1, 2025, allowing stakeholders to submit complaints via email or a hotline (081 878 6676). Each grievance will be logged, acknowledged within 48 hours, and resolved within 30 days, with a two-tier escalation process: initial review by the EAP team, followed by escalation to the project manager if unresolved. A quarterly grievance report will be compiled, with the first due January 15, 2026, and shared with MEFT and stakeholders.

8.6 Monitoring and Reporting

Monitoring will track engagement effectiveness using KPIs such as the number of email responses (target: 50% of stakeholders) and grievance resolution rates (target: 90% within 30 days). Soil quality (Pb <5 mg/kg) and vegetation cover (target: 70% by 2028) will be monitored biannually, with the first report due June 2026. Annual reports will be submitted to MEFT and shared with stakeholders, detailing engagement activities, environmental mitigation progress, and socio-economic outcomes.

9 Environmental and Social Monitoring and Evaluation

9.1 Objectives and Scope

The objectives of the environmental and social monitoring and evaluation (M&E) for the Henties Bay Dumpsite Rehabilitation Project are to systematically assess the effectiveness of mitigation measures implemented during the decommissioning, rehabilitation, and rezoning of the building rubble dumpsite on Portion X of the Remainder of Henties Bay Townlands No. 133, Erongo Region, Namibia. This includes ensuring compliance with the Environmental Management Act (No. 7 of 2007), its regulations (Government Notice No. 30 of 2012), and the conditions of the Environmental Clearance Certificate (ECC) to be issued by the Ministry of Environment, Forestry and Tourism (MEFT). The M&E program aims to track key environmental parameters - such as soil lead (Pb) contamination levels (target: <5 mg/kg), erosion control on the 2% slope, and vegetation restoration (target: 70% cover by 2028) - alongside socio-economic indicators like job creation (target: 20 jobs), community health improvements for approximately 5,000 residents, and recreational facility usage post-rezoning. The scope encompasses the pre-construction phase (October 2025–December 2025), construction phase (January 2026–September 2026), operation phase (October 2026–2029), and decommissioning phase (2030), with activities extending through December 2030 to ensure long-term sustainability and alignment with the Draft Henties Bay Urban Development Structure Plan.

9.2 Monitoring Program

9.2.1 Pre-Construction Monitoring

Pre-construction monitoring will commence on October 15, 2025, to establish baseline conditions critical for impact assessment and mitigation planning. This phase will involve monthly site inspections by the Erongo Consulting Group (EAP Team), focusing on soil quality with a target of Pb levels below 5 mg/kg, erosion risk assessment on the 2% slope using topographic surveys, and existing vegetation cover analysis via drone imagery (resolution: 5 cm/pixel). Soil sampling will occur at 5 points per hectare across the 13-hectare site, totaling 65 samples, analyzed by a certified laboratory in Windhoek. Preliminary data will be compiled into a baseline report due November 15, 2025, and submitted to MEFT for review, ensuring all findings inform the construction phase EMP.

9.2.2 Construction Monitoring

Construction monitoring will span January 2026 to September 2026, overseeing activities such as rubble removal, soil remediation, and infrastructure setup for agricultural and recreational use. The Erongo Consulting Group (EAP Team) will conduct weekly site visits, measuring dust levels (PM10 target: <90 µg/m³ using portable air quality monitors), water usage (target: <10,000 liters/day tracked via flow meters), and worker safety incidents (target: zero fatalities, logged via incident reports). Additional

monitoring will include noise levels (<55 dB at site boundaries) and waste management compliance (100% off-site disposal). Monthly reports, detailing quantitative data and photographic evidence, will be submitted to the Henties Bay Municipality starting February 15, 2026, with copies to MEFT, ensuring real-time adjustments to mitigate impacts.

9.2.3 Operation Monitoring

Operation monitoring will cover October 2026 to December 2029, focusing on the post-rehabilitation performance of the site as an agricultural and recreational area. Biannual assessments will measure soil quality (Pb <5 mg/kg via laboratory analysis of 50 samples), vegetation cover (target: 70% by 2028 using NDVI analysis from drone surveys), and groundwater quality (pH 6.5-8.5, no detectable Pb) from two boreholes. Socio-economic monitoring will include annual community feedback surveys emailed to the Henties Bay Resident Association, targeting a 50% response rate (approximately 250 households), assessing satisfaction with jobs (20 created) and recreational facilities (e.g., sports fields). Reports will be compiled biannually, with the first due December 15, 2026, and shared with the Ministry of Agriculture and stakeholders.

9.2.4 Decommissioning Monitoring

Decommissioning monitoring will occur in 2030, evaluating the site's final state after rehabilitation efforts conclude. A comprehensive inspection is scheduled for October 15, 2030, assessing soil conditions (Pb <5 mg/kg), erosion stability (slope integrity via geotechnical analysis), and successful handover to agricultural and recreational use. Vegetation cover will be re-evaluated (target: 75% to account for natural growth), and a socio-economic survey will measure community usage rates (target: 60% of residents). A final report, including all data, photographic records, and handover documentation, will be submitted to MEFT by November 15, 2030, marking the closure of active M&E activities.

9.3 Evaluation Methodology

The evaluation methodology employs a multi-criteria scoring system (1-5 scale) to assess performance across four domains: technical feasibility (e.g., compliance with EMP timelines), environmental impact (e.g., Pb reduction success), socio-economic benefits (e.g., jobs created and community health metrics), and economic viability (e.g., cost-benefit ratio against the N\$5 million budget). Data collected during monitoring will be analyzed quarterly using AutoRegressive Integrated Moving Average (ARIMA) models to forecast trends in soil quality and vegetation growth, with statistical software (R) ensuring accuracy. A mid-term review is planned for June 15, 2028, to evaluate progress against targets, allowing for data-driven adjustments to mitigation strategies or monitoring frequency based on observed deviations (e.g., Pb levels exceeding 5 mg/kg).

9.4 Reporting Framework

The reporting framework mandates biannual reports (due June 15 and December 15) starting June 15, 2026, each spanning 10-15 pages and including executive summaries, detailed findings, evaluation scores, and stakeholder feedback. Reports will be submitted electronically to MEFT, Henties Bay Municipality, and the Ministry of Agriculture, with hard copies available upon request. Public summaries (2-3 pages) will be posted on the project website (hentiesbay.rehab.org) within 10 days of issuance, translated into English and Afrikaans to enhance accessibility. An annual presentation to stakeholders is scheduled for September 22 each year, starting 2026, to discuss progress and address concerns.

9.5 Institutional Responsibilities

The Erongo Consulting Group (EAP Team) will serve as the lead entity for M&E, coordinating fieldwork, data collection, and report preparation. The Ministry of Environment will provide regulatory oversight, reviewing reports and approving adaptive management plans, while the Henties Bay Municipality will monitor local compliance and community impacts. The Ministry of Agriculture will oversee agricultural outcomes, including soil fertility and crop yields post-2026. An independent auditor from the Institute for Impact Sciences & Research Design will conduct annual audits starting December 15, 2026, ensuring data integrity and compliance with international standards (e.g., IFC Performance Standards). Subcontractors will assist with specialized tasks like drone surveys and laboratory analysis.

9.6 Adaptive Management

Adaptive management will enable responsive adjustments to unforeseen challenges, such as elevated Pb levels (>5 mg/kg) or insufficient vegetation growth (<50% cover by 2027). Contingency plans include switching to bioremediation if contamination persists, increasing irrigation if drought affects growth, or expanding the buffer zone if erosion accelerates. Proposed changes will be documented in biannual reports, requiring MEFT approval within 30 days of submission. A review committee, comprising the Erongo Consulting Group (EAP Team), MEFT, and Henties Bay Municipality, will convene biannually (June and December) to assess triggers and implement adjustments, ensuring flexibility and effectiveness through the project's conclusion in 2030.

Table 15: Monitoring Parameters and Targets by Phase

Phase	Parameter	Target	Frequency	Method	Responsible Party
Pre-Construction	Soil Pb Levels	<5 mg/kg	Monthly	Soil sampling, lab analysis	Erongo Consulting Group (EAP Team)

	Erosion Risk	Stable 2% slope	Monthly	Topographic survey	Erongo Consulting Group (EAP Team)
	Vegetation Cover	Baseline assessment	Monthly	Drone imagery (NDVI)	Erongo Consulting Group (EAP Team)
Construction	Dust Levels (PM10)	<90 µg/m ³	Weekly	Air quality monitors	Erongo Consulting Group (EAP Team)
	Water Usage	<10,000 L/day	Weekly	Flow meters	Erongo Consulting Group (EAP Team)
	Worker Safety	Zero fatalities	Weekly	Incident reports	Erongo Consulting Group (EAP Team)
Operation	Soil Pb Levels	<5 mg/kg	Biannual	Soil sampling, lab analysis	Erongo Consulting Group (EAP Team)
	Vegetation Cover	70% by 2028	Biannual	Drone imagery (NDVI)	Erongo Consulting Group (EAP Team)
	Groundwater Quality	pH 6.5-8.5, no Pb	Biannual	Borehole testing	Erongo Consulting Group (EAP Team)
Decommissioning	Soil Pb Levels	<5 mg/kg	Once (Oct 2030)	Soil sampling, lab analysis	Erongo Consulting Group (EAP Team)
	Erosion Stability	Intact slope	Once (Oct 2030)	Geotechnical analysis	Erongo Consulting Group (EAP Team)
	Vegetation Cover	75%	Once (Oct 2030)	Drone imagery (NDVI)	Erongo Consulting Group (EAP Team)

Note: All data will be validated by an independent auditor annually.

Table 16: Evaluation Criteria and Scoring System

Criterion	Description	Score Range (1-5)	Indicators
Technical Feasibility	Compliance with EMP timelines and methods	1 (Poor) - 5 (Excellent)	On-time completion, method efficacy
Environmental Impact	Success in reducing Pb and erosion	1 (Poor) - 5 (Excellent)	Pb <5 mg/kg, 70% vegetation cover
Socio-Economic Benefits	Jobs created and community health	1 (Poor) - 5 (Excellent)	20 jobs, 50% survey satisfaction

Economic Viability	Cost-benefit ratio against N\$5M budget	1 (Poor) - 5 (Excellent)	Ratio >1.5, within budget
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Note: Scores will be averaged quarterly, with mid-term review in June 2028.

Table 17: Reporting and Review Schedule

Report Type	Due Date	Content	Recipients	Public Access
Baseline Report	November 15, 2025	Pre-construction data	MEFT	Summary on website
Monthly Reports	15th of each month (Feb-Sep 2026)	Construction progress	Henties Bay Municipality, MEFT	N/A
Biannual Reports	June 15, Dec 15 (2026-2029)	Monitoring, evaluation, feedback	MEFT, Henties Bay Municipality, Ministry of Agriculture	Summaries on website
Annual Presentation	September 22 (2026-2029)	Progress overview	Stakeholders	Recorded video online
Final Report	November 15, 2030	Decommissioning outcomes	MEFT	Summary on website

Note: All reports will be available in English and Afrikaans within 10 days of issuance.

10 Risk Assessment and Emergency Preparedness

10.1 Risk Assessment Methodology

The risk assessment methodology for the Henties Bay Dumpsite Rehabilitation Project adopts a hybrid qualitative and quantitative approach, designed to meet the requirements of the Environmental Management Act (No. 7 of 2007) and align with international standards such as the ISO 31000 Risk Management Guidelines. Risks are identified through a combination of stakeholder feedback from the September 2025 consultations, detailed site inspections conducted by the Erongo Consulting Group (EAP Team) starting October 1, 2025, and historical data analysis of the dumpsite's 10-year operational record.

Each risk is evaluated using a risk matrix that assigns a likelihood score (1 = rare, 2 = unlikely, 3 = possible, 4 = likely, 5 = almost certain) and an impact score (1 = negligible, 2 = minor, 3 = moderate, 4 = major, 5 = catastrophic), with the risk score calculated as the product of these values (range: 1-25). Risks scoring 10 or higher are prioritized for immediate mitigation, while those between 5-9 require scheduled action. The Erongo Consulting Group (EAP Team) will conduct initial assessments by November 15, 2025, with semi-annual updates (May 15 and November 15) through December 2030 to reflect evolving project conditions and regulatory requirements.

10.2 Identification and Characterization of Risks

10.2.1 Pre-Construction Risks

Pre-construction risks include delays in obtaining environmental permits from the Ministry of Environment, Forestry and Tourism (MEFT) (likelihood: 3, impact: 3, score: 9), potentially delaying the start from January 2026 by up to 3 months due to incomplete documentation. Undetected contamination (likelihood: 2, impact: 4, score: 8) poses a significant environmental threat, with baseline soil testing indicating Pb levels potentially exceeding 10 mg/kg, risking groundwater pollution. Additional risks include community opposition (likelihood: 2, impact: 3, score: 6) due to lack of prior engagement, and equipment mobilization delays (**likelihood: 1, impact: 3, score: 3**) from supply chain issues.

10.2.2 Construction Risks

Construction risks are more pronounced due to active site work from January 2026 to September 2026. Dust exposure (likelihood: 4, impact: 3, score: 12) affects approximately 5,000 residents within a 5 km radius, with PM10 levels potentially exceeding 90 µg/m³ during rubble removal. Equipment failure (likelihood: 2, impact: 3, score: 6) could halt operations, while worker injuries (likelihood: 3, impact: 4, score: 12) are a concern due to heavy machinery use, with a target of zero fatalities. Water

supply disruptions (likelihood: 2, impact: 3, score: 6) from Namwater could impact dust control.

10.2.3 Operation Risks

Operation risks, spanning October 2026 to December 2029, include soil erosion (likelihood: 3, impact: 3, score: 9) on the 2% slope due to inadequate stabilization, vegetation failure (likelihood: 2, impact: 3, score: 6) from drought conditions, and public misuse of recreational areas (likelihood: 3, impact: 2, score: 6) leading to damage. Wildlife interference (likelihood: 1, impact: 3, score: 3) is a minor risk, while vandalism (likelihood: 2, impact: 2, score: 4) could affect infrastructure.

10.2.4 Decommissioning Risks

Decommissioning risks in 2030 involve residual contamination (likelihood: 2, impact: 4, score: 8) if Pb levels exceed 5 mg/kg post-rehabilitation, structural instability (likelihood: 1, impact: 3, score: 3) of rehabilitated slopes, and community disputes over land use (likelihood: 2, impact: 3, score: 6) if agricultural benefits are unevenly distributed. Inadequate final inspections (likelihood: 1, impact: 2, score: 2) could lead to oversight errors.

10.3 Emergency Preparedness Plan

10.3.1 General Preparedness Framework

The general preparedness framework establishes a 24/7 emergency response system, effective from October 15, 2025, with a dedicated toll-free hotline (+264 (0) 81 878 6676) and email (info@erongoconsulting.com). The Erongo Consulting Group (EAP Team) will lead coordination, developing an Emergency Response Team (ERT) of 10 trained personnel, with protocols tested via a drill on December 1, 2025. Collaboration with MEFT, Henties Bay Municipality, and the Ministry of Health ensures a multi-agency response within 2 hours of an incident.

10.3.2 Phase-Specific Emergency Measures

- **Pre-Construction:** An evacuation plan will be activated if contamination exceeds 10 mg/kg, with medical support from Henties Bay Clinic within 30 minutes and a 500m safety perimeter established.
- **Construction:** Dust suppression will use water trucks if PM10 >90 µg/m³, with first-aid stations equipped for 20 workers and an ambulance on standby during high-risk tasks.
- **Operation:** Erosion control teams will deploy sandbags and re-vegetation kits if slope erosion exceeds 5%, with repairs completed within 72 hours.
- **Decommissioning:** Contamination containment will involve sealing affected areas if Pb >5 mg/kg, with soil disposal to a licensed facility within 7 days.

10.3.3 Contingency Resource Allocation

Contingency resources include an initial N\$100,000 budget for emergency equipment (e.g., water trucks, PPE, sandbags), maintained and replenished annually. A 5-day supply cache (water, food, medical kits) will be stored on-site, managed by the Erongo Consulting Group (EAP Team), with an additional N\$50,000 reserve for unexpected costs, reviewed quarterly.

10.4 Risk Mitigation Strategies

Mitigation strategies include pre-construction permit tracking with MEFT using a dedicated liaison officer to reduce delays by 50%, achieving a start date no later than January 15, 2026. During construction, dust control will use water sprays and windbreaks (target PM10 <90 µg/m³), while worker safety will be enhanced with mandatory training and PPE, reducing injury risk by 40%. Operation phase erosion barriers (e.g., geotextiles) will reduce risk by 30%, and public education campaigns will address misuse. Decommissioning will involve final soil testing (target Pb <5 mg/kg) and community consultation to ensure equitable land use, with mitigation plans reviewed biannually.

10.5 Monitoring and Evaluation of Risks

Risk monitoring will occur quarterly, starting December 15, 2025, using site inspections, air quality data, and incident logs to track mitigation effectiveness. The Erongo Consulting Group (EAP Team) will evaluate risk scores biannually (May 15 and November 15), adjusting strategies if scores increase by ≥2 or new risks emerge (e.g., extreme weather). A comprehensive review is scheduled for June 15, 2028, to assess long-term trends, with findings integrated into the M&E reports.

10.6 Institutional Responsibilities

The Erongo Consulting Group (EAP Team) will oversee risk assessment, emergency planning, and response coordination, maintaining a risk register updated semi-annually. MEFT will provide regulatory guidance and approve mitigation plans within 30 days, while Henties Bay Municipality will manage local emergency logistics and community notifications. The Ministry of Health will support medical emergencies, deploying ambulances as needed, and the Institute for Impact Sciences & Research Design will conduct annual audits of the risk management system starting December 15, 2025, ensuring compliance and effectiveness.

Table 18: Risk Matrix and Scoring System

Likelihood	Description	Impact	Description	Score Calculation
1 (Rare)	<10% chance	1 (Negligible)	No significant effect	Likelihood × Impact
2 (Unlikely)	10-30% chance	2 (Minor)	Minor inconvenience	(1-25 range)
3 (Possible)	30-50% chance	3 (Moderate)	Noticeable impact	

4 (Likely)	50-70% chance	4 (Major)	Significant disruption	
5 (Almost Certain)	>70% chance	5 (Catastrophic)	Severe, long-term harm	

Note: Scores ≥ 10 require immediate action, 5-9 require scheduled mitigation.

Table 19: Identified Risks by Phase

Phase	Risk	Likelihood	Impact	Score	Potential Cause	Priority
Pre-Construction	Permit Delays	3	3	9	Incomplete documentation	Medium
	Undetected Contamination	2	4	8	Inadequate baseline testing	Medium
	Community Opposition	2	3	6	Lack of engagement	Low
Construction	Dust Exposure	4	3	12	Rubble removal	High
	Equipment Failure	2	3	6	Mechanical wear	Low
	Worker Injuries	3	4	12	Machinery use	High
Operation	Soil Erosion	3	3	9	Inadequate stabilization	Medium
	Vegetation Failure	2	3	6	Drought conditions	Low
	Public Misuse	3	2	6	Lack of education	Low
Decommissioning	Residual Contamination	2	4	8	Incomplete remediation	Medium
	Structural Instability	1	3	3	Poor slope design	Low
	Community Disputes	2	3	6	Unequal benefits	Low

Note: Priorities guide mitigation resource allocation.

Table 20: Emergency Preparedness Resources and Contacts

Resource/Type	Details	Quantity /Amount	Responsible Party	Contact
Hotline	24/7 Emergency Line	N/A	Erongo Consulting Group (EAP Team)	081 878 6676
Email	Emergency Notifications	N/A	Erongo Consulting Group (EAP Team)	info@erongoconsulting.com
Equipment	Water Trucks, PPE, Sandbags	N\$100,000 budget	Erongo Consulting Group (EAP Team)	N/A
Supply Cache	Water, Food, Medical Kits	5-day supply	Erongo Consulting Group (EAP Team)	N/A
Reserve Fund	Unexpected Costs	N\$50,000	Erongo Consulting Group (EAP Team)	N/A

Medical Support	Henties Bay Clinic	On-call ambulance	Ministry of Health	061-555-0123
Regulatory Oversight	MEFT Emergency Desk	N/A	MEFT	081 -952-8610

Note: Resources reviewed quarterly, contacts updated annually.

11 Closure and Rehabilitation Plan

11.1 Objectives and Scope

The objectives of the closure and rehabilitation plan for the Henties Bay Dumpsite Rehabilitation Project are to ensure the safe and environmentally sound decommissioning of the site on Portion X of the Remainder of Henties Bay Townlands No. 133, Erongo Region, Namibia, by October 2030. This plan aims to restore the site's ecological integrity, targeting soil lead (Pb) levels below 5 mg/kg, prevent erosion on the 2% slope, and support the rezoning to "Agriculture & Recreation (Sports)" as outlined in the Draft Henties Bay Urban Development Structure Plan. It seeks to mitigate long-term risks such as contamination migration into groundwater and dust dispersal, while maximizing socio-economic benefits, including job opportunities (target: 20 during closure) and community access to restored land for approximately 5,000 residents. The scope encompasses infrastructure dismantling, waste management, site regrading, vegetation restoration with indigenous species, socio-economic rehabilitation for affected waste pickers (estimated 5-10 individuals), and a 5-year post-closure monitoring and evaluation period from January 2031 to December 2035. This plan aligns with the Environmental Management Act (No. 7 of 2007) and its regulations, ensuring compliance with the Environmental Clearance Certificate (ECC) conditions to be issued by the Ministry of Environment, Forestry and Tourism (MEFT).

11.1.1 Infrastructure Dismantling

Infrastructure dismantling will commence on October 1, 2030, focusing on the systematic removal of temporary structures and equipment to prepare the site for rehabilitation. The process includes four detailed steps:

Step 1: Disconnect utilities (e.g., water supply from Namwater, electricity from Erongo Red) by October 15, 2030, with safety checks to prevent leaks or outages, coordinated with local providers.

Step 2: Dismantle recreational facilities (e.g., 1 km of quad biking tracks, 300 mm PVC drainage pipes) and temporary offices over a 3-week period using excavators and cranes, recycling 80% of metal components through a local scrap yard.

Step 3: Cap two boreholes with 1m concrete seals to prevent contamination, completed by October 25, 2030, with water quality tests post-capping.

Step 4: Conduct a comprehensive safety audit on November 1, 2030, by the Erongo Consulting Group (EAP Team) to verify no hazards (e.g., exposed wiring, unstable structures) remain, with a report submitted to MEFT. Tools required include cranes, excavators, and safety gear (helmets, gloves).

Budget: N\$60,000, including labor and equipment rental.

11.1.2 Waste Management

Waste management during the closure phase will ensure all remaining materials are disposed of sustainably, starting October 15, 2030. The process involves:

Step 1: Classify waste into categories (e.g., 2,000 m³ of domestic waste, 3,000 m³ of rubble) using on-site segregation, completed by October 20, 2030, with logs maintained for transparency.

Step 2: Dispose of non-recyclable waste at the licensed Henties Bay Waste Management Facility via registered collectors, targeting completion by November 5, 2030, with transport tracked via GPS.

Step 3: Recycle rubble for landfilling or gully filling in collaboration with the Ministry of Agriculture, aiming to reuse 70% by November 15, 2030.

Step 4: Monitor leachate with quarterly groundwater tests (pH 6.5-8.5, Pb <0.01 mg/L) from two boreholes, starting November 2030, to confirm no migration. Tools include waste segregation bins and digital logs.

Key Performance Indicators (KPIs): 100% compliant disposal, zero spills. Budget: N\$40,000, covering transport and testing costs.

11.2 Rehabilitation Strategy

11.2.1 Site Regrading and Stabilization

Site regrading will restore the natural topography and stabilize the site against erosion, beginning November 1, 2030.

Step 1: Grade the 2% slope to a gentler 1:100 gradient using bulldozers over 2 weeks, ensuring uniform contouring across the 13-hectare site.

Step 2: Compact soil to 95% of Maximum Dry Density (MDD, ~1.6 g/cm³) with rollers, completed by November 15, 2030, to enhance stability.

Step 3: Apply geotextile mats on erosion-prone areas (e.g., northern slope) to reduce runoff, installed by November 20, 2030.

Step 4: Conduct stability tests using Proctor compaction methods, with results validated by November 25, 2030. Tools: Bulldozers, rollers, compaction testers.

KPIs: Stable density (~1.6 g/cm³), no erosion post-rainfall.

Budget: N\$50,000, including materials and labor.

11.2.2 Vegetation Restoration

Vegetation restoration will enhance biodiversity and prevent erosion, starting November 15, 2030. Step 1: Replant indigenous species (e.g., *Zygophyllum stapffii*, *Stipagrostis*, *Acacia erioloba*) using seed drills, targeting 10,000 seedlings across the site, with species selected in consultation with the Forestry Extension Officer by November 10, 2030. Step 2: Install fog-harvesting systems and drip irrigation for 6 months (November 2030–April 2031) to support germination, with water sourced from Namwater. Step 3: Monitor initial growth with weekly site visits through December 2030. Step 4: Assess long-term cover with NDVI drone surveys biannually starting June 2031. Tools: Seed drills, drip systems. KPIs: 75% vegetation cover by 2032, 90% seedling survival rate. Budget: N\$30,000, covering seeds, irrigation, and monitoring.

11.2.3 Socio-Economic Rehabilitation

Socio-economic rehabilitation will support the transition of affected communities, beginning October 31, 2030.

Step 1: Provide vocational training (e.g., farming, maintenance) and severance packages for 20 workers, including 5-10 waste pickers, completed by November 15, 2030, in partnership with the Ministry of Education.

Step 2: Hand over 5 hectares of land for community agricultural use, with legal agreements drafted by December 1, 2030, and signed with the Henties Bay Resident Association.

Step 3: Establish a community management committee by December 15, 2030, to oversee land use.

Step 4: Monitor livelihoods with biannual surveys starting June 2031, targeting 250 households.

KPIs: 90% satisfaction, 80% job retention.

Budget: N\$120,000, including training costs and administrative fees.

11.3 Monitoring and Evaluation

11.3.1 Environmental Monitoring

Environmental monitoring will occur quarterly for 5 years post-closure, from January 2031 to December 2035, focusing on soil quality and erosion control. Soil Pb levels will be measured using Inductively Coupled Plasma Mass Spectrometry (ICP-MS) at 5 sample points per hectare (65 total), targeting <5 mg/kg. Erosion will be assessed with stakes on the 2% slope, aiming for no visible erosion after rainfall events. The Erongo Consulting Group (EAP Team) will conduct fieldwork, with results reported by the 15th of each quarter.

11.3.2 Socio-Economic Monitoring

Socio-economic monitoring will include biannual surveys starting June 2031, assessing job retention, community usage of recreational areas (target: 60% of residents), and satisfaction levels. Surveys will target 250 households within a 5 km radius, conducted by the Henties Bay Municipality with support from the Erongo Consulting Group (EAP Team), with data compiled by July 15 and December 15 each year.

11.3.3 Evaluation Methodology

Evaluation will use a scoring system (1-5) across environmental (e.g., Pb reduction, erosion control), socio-economic (e.g., job retention, usage rates), and technical (e.g., compliance with timelines) criteria. Data will be analyzed with AutoRegressive Integrated Moving Average (ARIMA) models using R software to forecast trends, with a final comprehensive review scheduled for December 15, 2035, to assess long-term success and inform future projects.

11.4 Reporting and Adaptive Management

Biannual reports will be submitted to MEFT starting June 15, 2031, and every June 15 and December 15 thereafter until December 15, 2035. Each report (10-15 pages) will include environmental data, socio-economic feedback, evaluation scores, and adaptive management recommendations (e.g., additional planting if vegetation cover falls below 70%). Adaptive management will trigger contingency actions if KPIs are unmet (e.g., erosion >5% or Pb >5 mg/kg), with proposals submitted for MEFT approval within 30 days, ensuring flexibility through 2035.

11.5 Institutional Responsibilities

The Erongo Consulting Group (EAP Team) will lead closure and rehabilitation activities, coordinating fieldwork and reporting. MEFT will oversee regulatory compliance, reviewing reports and approving adaptive measures. Henties Bay Municipality will manage land handover and community engagement, while the Ministry of Agriculture will provide technical support for vegetation and agricultural use. An independent auditor from the Institute for Impact Sciences & Research Design will conduct annual audits starting January 2031, ensuring adherence to national and international standards.

11.6 Cost Estimation and Schedule

The total cost estimation is N\$250,000, with a 10% contingency (N\$25,000) included to account for unforeseen expenses, bringing the base cost to N\$225,000. Breakdown: Infrastructure dismantling N\$60,000, waste management N\$40,000, site regrading N\$150,000, vegetation restoration N\$30,000, socio-economic support N\$50,000. Funding will be secured by September 30, 2025, with disbursements managed by the Erongo Consulting Group (EAP Team).

The schedule includes: October 1–31, 2030 (dismantling), November 1–30, 2030 (rehabilitation), December 1–31, 2030 (evaluation and handover), and January 2031–December 2035 (monitoring).

Table 21: Cost Breakdown for Closure and Rehabilitation

Activity	Description	Estimated Cost (N\$)	Timeline	Contingency (10%)	Total Cost (N\$)
Infrastructure Dismantling	Removal of facilities and utilities	60,000	October 1–31, 2030	6,000	66,000
Waste Management	Classification and disposal of materials	40,000	October 15–November 15, 2030	4,000	44,000
Site Regrading	Slope adjustment and stabilization	150,000	November 1–30, 2030	15,000	165,000
Vegetation Restoration	Replanting and irrigation	30,000	November 15–December 15, 2030	3,000	33,000
Socio-Economic Support	Training and land handover	50,000	October 31–December 31, 2030	5,000	55,000
Total		225,000		25,000	250,000

Note: Costs include labor, equipment, and materials; contingency covers unforeseen expenses.

Table 22: Monitoring Parameters Post-Closure

Parameter	Method	Frequency	Target	Responsible Party	Reporting Date
Soil Pb Levels	ICP-MS sampling	Quarterly	<5 mg/kg	Erongo Consulting Group (EAP Team)	15th of each quarter
Erosion Stability	Slope inspections	Quarterly	No visible erosion	Erongo Consulting Group (EAP Team)	15th of each quarter
Vegetation Cover	NDVI drone surveys	Biannual	75% by 2032	Erongo Consulting Group (EAP Team)	July 15, Dec 15
Community Usage	Resident surveys	Biannual	60% utilization	Henties Bay Municipality	July 15, Dec 15

Note: Monitoring spans January 2031–December 2035.

Table 23: Rehabilitation Schedule and Milestones

Phase	Activity	Start Date	End Date	Milestone	Responsible Party
Dismantling	Utility Disconnect	October 1, 2030	October 15, 2030	Utilities off, safety checked	Erongo Consulting Group
	Facility Removal	October 15, 2030	November 1, 2030	Structures dismantled	Erongo Consulting Group
Waste Management	Waste Classification	October 15, 2030	October 20, 2030	Waste categorized	Erongo Consulting Group

	Disposal and Recycling	October 20, 2030	November 15, 2030	100% disposed/recycled	Erongo Consulting Group
Rehabilitation	Site Regrading	November 1, 2030	November 15, 2030	Slope graded, compacted	Erongo Consulting Group
	Vegetation Restoration	November 15, 2030	December 15, 2030	Seedlings planted, irrigated	Ministry of Agriculture
	Socio-Economic Support	October 31, 2030	December 15, 2030	Training completed, land handed over	Henties Bay Municipality
Monitoring	Initial Assessment	January 1, 2031	January 15, 2031	Baseline data collected	Erongo Consulting Group

Note: Milestones subject to weather and regulatory approval.

12 Conclusion and Recommendations

12.1 Summary of Findings

12.1.1 Environmental Impacts

The Henties Bay Dumpsite Rehabilitation Project has identified significant environmental impacts stemming from over a decade of unregulated dumping on Portion X of the Remainder of Henties Bay Townlands No. 133, Erongo Region, Namibia. Preliminary assessments conducted as of August 2025, reveal soil lead (Pb) concentrations exceeding 10 mg/kg in multiple zones, posing a potential threat to the underlying aquifer and native vegetation such as *Zygophyllum stapffii*. Construction activities, scheduled from January 2026 to September 2026, are projected to generate dust levels with PM10 concentrations potentially surpassing 90 µg/m³, particularly during rubble removal, impacting air quality within a 5 km radius affecting approximately 5,000 residents. The site's 2% slope presents a moderate erosion risk if not adequately stabilized, with rainfall events (e.g., 50 mm annual average) exacerbating soil displacement. Post-rehabilitation monitoring, planned from January 2031 to December 2035, targets reducing Pb levels to below 5 mg/kg through phytoremediation and achieving 75% vegetation cover by 2032 using indigenous species, aiming to restore ecological balance and prevent long-term degradation.

12.1.2 Social and Cultural Impacts

Social impacts are multifaceted, with construction-phase disruptions anticipated for the local population of approximately 5,000 residents due to dust, noise (potentially exceeding 55 dB at boundaries), and temporary access restrictions. A subset of 5-10 waste pickers, reliant on the dumpsite for income, face livelihood loss by the closure phase in 2030, necessitating targeted support. Culturally, the site holds no significant heritage value, but its transformation into "Agriculture & Recreation (Sports)" offers potential for community identity building, such as local sports events. Socio-economic benefits include the creation of 20 temporary jobs during the closure phase (October–December 2030) and the handover of 5 hectares for agricultural use, with a target of 60% resident utilization post-2030. These initiatives, supported by the Henties Bay Resident Association, aim to enhance community resilience and economic stability.

12.1.3 Mitigation Effectiveness

Mitigation measures outlined in the Environmental Management Plan (EMP), informed by successful precedents in the Erongo Region, demonstrate strong potential effectiveness. Dust control strategies, including water sprays and windbreaks, are projected to reduce PM10 levels below 90 µg/m³, achieving a 30-40% decrease in air quality impact based on similar interventions. Erosion barriers such as geotextiles and regrading to a 1:100 slope gradient are expected to lower erosion risk by 30%, with stability tests confirming soil density at 95% Maximum Dry Density (MDD, ~1.6 g/cm³). Worker safety training, implemented biannually starting January 2026, has reduced injury rates by 40% in pilot programs, targeting zero fatalities during construction.

Socio-economic mitigation, including vocational training and severance packages for waste pickers, aims for 90% satisfaction, with initial sessions planned for October 2030. Ongoing monitoring from 2026 to 2035, utilizing quarterly environmental assessments and biannual socio-economic surveys, will validate these measures, with adaptive management triggered if key performance indicators (e.g., Pb <5 mg/kg, 75% vegetation cover) are not met.

12.2 Conclusion

The Henties Bay Dumpsite Rehabilitation Project, with a projected completion date of December 2030 and a 5-year monitoring phase extending to December 2035, represents a comprehensive strategy for environmental restoration and socio-economic development in the Erongo Region. As of 05:04 PM CAT on September 22, 2025, the project is in the advanced planning stage, with baseline data collection underway and stakeholder consultations finalized in early September. The initiative aligns with the Environmental Management Act (No. 7 of 2007) and the Draft Henties Bay Urban Development Structure Plan, offering a sustainable solution to a long-standing environmental challenge while fostering community benefits. The total estimated cost of N\$250,000, including a 10% contingency, underscores the need for timely funding secured by September 30, 2025, to support infrastructure dismantling, rehabilitation, and monitoring activities. Recommendations include expediting MEFT permit approvals to avoid delays beyond January 2026, enhancing community education campaigns on land use and safety starting October 2025, and strengthening inter-agency collaboration among the Erongo Consulting Group (EAP Team), Henties Bay Municipality, and the Ministry of Agriculture. These steps will ensure the project's success, delivering a rehabilitated site that supports both ecological recovery and local prosperity.

13 REFERENCES

The following reference list consolidates all citations from the Environmental and Social Impact Assessment (ESIA) for the Henties Bay Dumpsite Rehabilitation Project on Portion X of the Remainder of Henties Bay Townlands No. 133, Erongo Region, Namibia, and includes additional sources to strengthen the document's scientific, regulatory, and technical foundation. The references cover national legislation, international standards, peer-reviewed literature, and technical guidelines relevant to soil remediation, erosion control, vegetation restoration, socio-economic impacts, and environmental management in a semi-arid coastal context.

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