ENVIRONMENTAL MANAGEMENT PLAN (EMP)

PROJECT TITLE

Environmental Impact Assessment for the Proposed Pig Abattoir Development at Okonjima Farm No. 3, Otjozondjupa Region, Republic of Namibia

Prepared in accordance with:

- Environmental Management Act, 2007 (Act No. 7 of 2007)
- Environmental Impact Assessment Regulations, 2012

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Final Environmental Management Plan (EMP)

Submitted to the **Environmental Commissioner**, Ministry of Environment, Forestry and Tourism, as part of the application for an **Environmental Clearance Certificate** in terms of the Environmental Management Act, 2007.

This report incorporates the outcomes of:

- The Environmental Impact Assessment process
- Public participation and stakeholder consultation
- Specialist inputs where applicable

DISCLAIMER

This Environmental Management Plan has been prepared by KPM Environmental Consulting as an independent Environmental Assessment Practitioner on behalf of the Project Proponent. The information contained in this report is based on data, documentation, site observations, and stakeholder inputs available at the time of preparation.

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DOCUMENT CONTROL

Item	Description
Report Title	Environmental Management Plan
Project Name	Proposed Pig Abattoir Development at Okonjima Farm No. 3
Region	Otjozondjupa Region
Country	Republic of Namibia
Prepared by	KPM Environmental Consulting
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ACRONYMS, ABBREVIATIONS AND DEFINITIONS

Acronym	Full Term	Description
AU	African Union	Continental body promoting economic development, agricultural transformation, and environmental sustainability across Africa, including frameworks such as CAADP relevant to agro-processing and food security.
BID	Background Information Document	A non-technical document prepared for public participation, summarising the proposed project, potential impacts, and opportunities for stakeholder engagement during the EIA process.
BOD	Biological Oxygen Demand	A measure of the amount of oxygen required by microorganisms to decompose organic matter in water; a key indicator of wastewater pollution, particularly relevant to abattoir effluent.
CAADP	Comprehensive Africa Agriculture Development Programme	African Union initiative aimed at improving agricultural productivity, food security, and value addition across member states.
DVS	Directorate of Veterinary Services	Regulatory authority under MAWLR responsible for animal health, disease control, meat inspection, and approval of abattoir operations and waste disposal practices.
ECC	Environmental Clearance Certificate	A legally binding authorisation issued by the Environmental Commissioner (MEFT) permitting a listed activity to proceed, subject to conditions and implementation of the EMP.
EAP	Environmental Assessment Practitioner	An independent professional responsible for conducting the Environmental Impact Assessment, facilitating public participation, and preparing the EIA Report and EMP.
EAR	Environmental Assessment Report	A formal report presenting the findings of the Environmental Impact Assessment, including baseline conditions, impact assessment, and recommended mitigation measures.
EHS	Environmental, Health and Safety	An integrated management approach addressing environmental protection, occupational health, and safety risks associated with project activities.
EIA	Environmental Impact Assessment	A systematic process required under the Environmental Management Act to identify, assess, and manage potential environmental and socio-economic impacts of a proposed development prior to approval.
EMP	Environmental Management Plan	A detailed, enforceable document that translates EIA findings into operational mitigation, monitoring, and compliance measures across all project phases.
EMA	Environmental Management Act, 2007 (Act No. 7 of 2007)	Namibia's principal environmental legislation governing environmental protection, sustainable development, and the requirement for environmental clearance for listed activities.
FAO	Food and Agriculture Organization of the United Nations	International body providing technical guidance on food safety, meat processing, hygiene, and sustainable agricultural practices.
FOG	Fats, Oils and Grease	Components commonly present in abattoir wastewater that contribute to blockages, odour, and high organic loading, requiring removal through grease traps and treatment systems.

IFC	International Finance Corporation	Member of the World Bank Group that provides Environmental, Health and Safety (EHS) Guidelines used as international best practice benchmarks for projects such as abattoirs.
I&AP	Interested and Affected Party	Any individual, group, or institution with an interest in or potentially affected by the proposed development, including regulators, local stakeholders, and the public.
IPM	Integrated Pest Management	A systematic approach to controlling pests through prevention, monitoring, and targeted intervention, reducing reliance on chemicals and minimising environmental risk.
ISO	International Organization for Standardization	International body that develops standards for quality, environmental management, and safety systems, often used as benchmarks for operational best practice.
MAWLR	Ministry of Agriculture, Water and Land Reform	Government ministry responsible for agricultural development, veterinary services, and water resource management, including groundwater protection.
MEFT	Ministry of Environment, Forestry and Tourism	The competent authority responsible for environmental governance in Namibia, including issuing Environmental Clearance Certificates and enforcing compliance.
MoHSS	Ministry of Health and Social Services	Government authority responsible for public and environmental health, including sanitation, hygiene, and food safety oversight.
MSDS	Material Safety Data Sheet	A document providing information on the properties, hazards, handling, and safe use of chemicals used in cleaning and sanitation processes.
OHS	Occupational Health and Safety	Measures and systems implemented to protect workers from hazards associated with workplace activities, including biological, mechanical, and chemical risks.
OIE	World Organisation for Animal Health	International organisation setting standards for animal health, welfare, and disease control, relevant to abattoir operations and biosecurity.
SADC	Southern African Development Community	Regional organisation promoting economic integration, food security, and harmonised standards in agriculture and environmental management.
SOP	Standard Operating Procedure	Documented procedures outlining standard methods for performing tasks safely and consistently, including hygiene, waste handling, and emergency response.
UNDP	United Nations Development Programme	United Nations agency supporting sustainable development, governance, and environmental management aligned with the Sustainable Development Goals.
UNEP	United Nations Environment Programme	Global authority providing guidance on environmental assessment, impact management, and sustainability frameworks.

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1 ENVIRONMENTAL MANAGEMENT PLAN (EMP)

1.1 Introduction and Legal Status of the EMP

The Environmental Management Plan (EMP) constitutes the primary compliance and operational control instrument for the Proposed Pig Abattoir Development at Okonjima Farm No. 3, Otjozondjupa Region, Republic of Namibia. The EMP translates the findings of the Environmental Impact Assessment (EIA), particularly the impact pathways identified in the ESIA Report, into binding, enforceable management requirements applicable throughout the full project life cycle.

The EMP establishes a risk-based, life-cycle framework for the prevention, control, monitoring, verification, and correction of environmental, public health, occupational health and safety, and socio-economic impacts associated with the proposed development. It is intentionally designed to move beyond descriptive mitigation by defining:

- Engineering and design controls;
- Institutional responsibilities and authority;
- Monitoring indicators and performance thresholds;
- Corrective-action triggers and response timelines; and
- Escalation and reporting mechanisms.

Once approved, this EMP forms an integral and legally binding component of the Environmental Clearance Certificate (ECC) issued under the Environmental Management Act, 2007 (Act No. 7 of 2007). Failure to implement the EMP constitutes non-compliance with the ECC and may result in enforcement action by the Environmental Commissioner or other competent authorities.

1.2 EMP Conceptual Framework and Environmental Risk Context

Pig abattoirs are internationally recognised as high-risk agro-processing facilities due to the convergence of biological, chemical, physical, and occupational hazards. Environmental risk does not arise from a single activity, but from the interaction between waste streams, water use, hygiene processes, infrastructure performance, and human exposure pathways.

The principal inherent risks associated with pig abattoir operations include:

- Generation of **high-strength organic effluent**, particularly blood-contaminated wastewater;
- Presence of **zoonotic pathogens**, posing risks to workers, consumers, and surrounding livestock;
- **Intensive water use**, increasing pressure on groundwater resources;
- **Occupational hazards**, including sharp tools, heavy equipment, and biological exposure; and
- **Long-term groundwater contamination** in the event of effluent system failure.

Within the Otjozondjupa Region, these risks are magnified by the strategic dependence on groundwater as the primary water source for domestic, agricultural, and economic activities. In

semi-arid environments, aquifer contamination is typically slow to detect, extremely costly, and often irreversible.

Accordingly, this EMP adopts a precautionary, systems-engineering approach, founded on the following principles:

- Prevention of contamination **at source**;
- Physical separation of incompatible waste streams;
- Redundancy within containment and treatment systems;
- Continuous monitoring using **measurable indicators**; and
- **Early intervention** before environmental thresholds are exceeded.

2 INSTITUTIONAL GOVERNANCE, ROLES, AUTHORITY, AND ACCOUNTABILITY

Effective environmental management depends on clear authority, defined responsibility, and enforceable accountability. Technical infrastructure alone cannot ensure compliance in the absence of institutional control.

2.1 Governance Structure

Effective environmental management requires more than technical controls; it depends on a clear governance structure that assigns authority, responsibility, and accountability at all levels of project implementation. This EMP therefore establishes a governance framework that ensures environmental protection is embedded within operational decision-making, rather than treated as an external or advisory function.

The Project Proponent retains ultimate legal responsibility for compliance with the Environmental Management Act, 2007, all conditions attached to the Environmental Clearance Certificate (ECC), and the full implementation of this Environmental Management Plan. This responsibility includes ensuring that adequate financial, human, and technical resources are available to support environmental compliance throughout the project life cycle.

Day-to-day responsibility for EMP implementation is delegated to the Site Manager, who also serves as the Designated Environmental Officer (EO). The EO role is functional, authoritative, and operational, rather than symbolic. The EO is positioned within the operational hierarchy to ensure that environmental considerations directly inform daily management decisions and are not subordinated to production pressures.

In this capacity, the EO is vested with direct decision-making authority to:

- Enforce compliance with all EMP requirements and Standard Operating Procedures (SOPs);
- Issue instructions to suspend or modify activities that present an immediate or foreseeable environmental, public health, or occupational risk;
- Initiate corrective actions without prior approval where environmental thresholds or performance standards are exceeded; and
- Escalate significant non-compliance to senior management and regulatory authorities where required.

This governance structure ensures that environmental compliance is achieved internally and proactively, with external regulatory oversight functioning as a verification and enforcement backstop rather than the primary compliance mechanism.

The allocation of clear authority and responsibility under this governance framework is intended to:

- Prevent ambiguity in environmental decision-making;

- Ensure rapid response to emerging risks;
- Avoid normalisation of non-compliance; and
- Maintain regulatory confidence through transparency and accountability.

2.2 Responsibilities and Authority

Effective implementation of the Environmental Management Plan depends on the clear allocation of responsibilities and decision-making authority across all levels of the project and among relevant external stakeholders. This EMP therefore establishes a structured responsibility framework that ensures environmental compliance is operationally embedded, enforceable, and auditable.

2.2.1 Authority of the Environmental Officer (EO)

The Environmental Officer (EO), who also serves as the Site Manager, is the central operational authority responsible for day-to-day environmental compliance. The EO is empowered to act independently of production pressures where environmental, public health, or occupational risks are identified.

The EO has the authority to:

- **Enforce full compliance** with all provisions of the EMP, ECC conditions, and Standard Operating Procedures (SOPs);
- **Stop, suspend, or modify any activity** that presents an immediate or foreseeable risk to the environment, public health, animal health, or worker safety;
- **Initiate corrective actions without prior approval** where monitoring results, inspections, or incidents indicate that performance thresholds or legal requirements have been exceeded;
- **Record, investigate, and report** all environmental incidents, complaints, and instances of non-compliance in designated registers;
- **Direct supervisors and contractors** to implement remedial measures within defined timelines;
- **Coordinate environmental training and inductions** for all employees and contractors; and
- **Liaise directly with regulatory authorities**, including the Environmental Commissioner, veterinary authorities, and public health officials, on matters relating to compliance, reporting, and inspections.

The EO is accountable to the Project Proponent for implementation performance, but retains operational autonomy to ensure that environmental protection is not compromised by production or scheduling considerations.

2.2.2 Roles of Internal Project Stakeholders

- **Project Proponent**

Retains ultimate legal responsibility for compliance with all applicable environmental, veterinary, water, labour, and public health legislation. The Proponent is responsible for ensuring that adequate financial, human, and technical resources are made available to implement the EMP effectively.

- **Supervisors / Line Managers**

Are responsible for day-to-day supervision of activities under their control to ensure compliance with SOPs and EMP requirements. Supervisors act as the first line of compliance enforcement and must report any deviations or incidents to the EO immediately.

- **Employees and Contractors**

Are responsible for complying with all SOPs, training requirements, and instructions issued under the EMP. Failure to comply constitutes a disciplinary matter and may result in removal from site.

2.2.3 Roles of External Stakeholders and Authorities

While the EMP is designed to achieve compliance primarily through internal controls, several external stakeholders retain statutory oversight and regulatory authority, including:

- **Ministry of Environment, Forestry and Tourism (MEFT)**
  Through the Environmental Commissioner, responsible for issuing the ECC, reviewing compliance reports, conducting inspections, and enforcing the Environmental Management Act.
- **Directorate of Veterinary Services (DVS) – Ministry of Agriculture, Water and Land Reform (MAWLR)**
  Responsible for animal health, disease control, meat inspection requirements, and approval of abattoir operations, including oversight of offal and condemned material disposal.
- **Ministry of Health and Social Services (MoHSS)**
  Through Environmental Health Practitioners, responsible for public health oversight, hygiene standards, sanitation, and protection of human health.
- **Water Resource Management Authorities (MAWLR)**
  Responsible for regulating groundwater abstraction, protecting water quality, and ensuring compliance with the Water Resources Management Act.
- **Local and Regional Authorities**
  Responsible for local development coordination, infrastructure oversight, and community interface where applicable.

These authorities function as external oversight and enforcement bodies, complementing the internal compliance mechanisms established under this EMP.

Table 1: Governance and Accountability Framework

Role / Stakeholder	Core Responsibilities	Authority Level
Project Proponent	Legal compliance; provision of resources; accountability to regulators	Strategic
Environmental Officer / Site Manager	EMP implementation; enforcement; monitoring; reporting; corrective action	Operational
Supervisors / Line Managers	Daily compliance supervision; incident reporting	Tactical
Employees and Contractors	Compliance with SOPs and training requirements	Task-level
MEFT (Environmental Commissioner)	ECC oversight; environmental compliance enforcement	External – Regulatory
Directorate of Veterinary Services (DVS)	Animal health; meat inspection; biosecurity oversight	External – Regulatory
Ministry of Health and Social Services (MoHSS)	Public and environmental health oversight	External – Regulatory
Water Resource Management Authorities (MAWLR)	Groundwater abstraction and quality protection	External – Regulatory
Local / Regional Authorities	Development coordination; local compliance interface	External – Advisory / Regulatory

3 PRE-CONSTRUCTION PHASE MANAGEMENT

3.1 Purpose and Risk Context

The pre-construction phase represents the single most decisive stage in determining the long-term environmental performance of the proposed pig abattoir. For agro-processing facilities, particularly abattoirs, empirical experience and regulatory precedent demonstrate that the majority of serious environmental failures originate before construction begins, at the stage where design assumptions, infrastructure sizing, and institutional systems are established.

Unlike operational failures, which can often be corrected through procedural changes, training, or enforcement, design-stage failures are structural. Once infrastructure is built, deficiencies such as undersized effluent systems, poorly segregated drainage, or inadequate waste handling areas are extremely difficult - and in some cases impossible-to correct without major reconstruction. These failures therefore represent latent environmental risks that may only manifest after commissioning, when the consequences are already entrenched.

Accordingly, this EMP treats the pre-construction phase as a risk-lock-in phase, during which environmental harm must be designed out of the project, rather than mitigated later through reactive management.

3.2 Key Pre-Construction Environmental Risks

This table identifies the principal environmental risks that typically arise during the pre-construction phase and summarises their potential long-term consequences if not addressed adequately at source.

Table 2: Key Pre-Construction Environmental Risks

Risk Category	Typical Failure	Long-Term Consequence
Wastewater system design	Undersized or poorly configured treatment capacity	Chronic effluent overflow and groundwater contamination
Facility layout planning	Inadequate segregation of clean and contaminated areas	Persistent hygiene failures and biosecurity breaches
Water management assumptions	Underestimation of water demand	Hydraulic overloading of treatment systems
Institutional readiness	Absence of SOPs and training frameworks	Normalisation of non-compliance during operation
Legal compliance	Premature commencement of works	Regulatory enforcement and loss of institutional trust

Interpretation:
These risks illustrate why the pre-construction phase cannot be treated as merely preparatory. Each risk category has the potential to generate long-term or irreversible impacts if not eliminated through design and institutional planning.

3.3 Mandatory Legal and Institutional Requirements

Environmental management during the pre-construction phase is governed by the principle of no authorisation, no activity. The Environmental Management Act, 2007, and associated regulations require that all necessary approvals be obtained before any physical works commence.

This requirement is not procedural formality; it ensures that:

- Environmental risks have been assessed and approved;
- Sectoral authorities have reviewed specialised aspects (veterinary, public health, water); and
- The project is institutionally and technically ready to proceed.

3.4 Mandatory Pre-Construction Authorisations

This table lists the minimum authorisations required prior to any site disturbance or construction activity.

Table 3: Mandatory Pre-Construction Authorisations

Requirement	Description	Responsible Authority
Environmental Clearance Certificate (ECC)	Legal authorisation under the EMA	MEFT / Environmental Commissioner
Veterinary approval	Approval for abattoir operations and disposal of animal by-products	Directorate of Veterinary Services
Public health clearance	Verification of hygiene and sanitation systems	MoHSS / Environmental Health
Water use authorisation	Regulation of groundwater abstraction and protection	MAWLR
Local authority approvals	Development consent and access approvals (where applicable)	Regional / Local Authority

Compliance rule:
Any site clearing, earthworks, infrastructure installation, or equipment placement undertaken prior to receipt of these approvals constitutes non-compliance with this EMP and the Environmental Management Act, and may trigger enforcement action.

3.5 Pre-Construction Environmental and Design Controls

Environmental protection during operation is achieved primarily through engineering and system design, not through behavioural controls alone. The pre-construction phase therefore focuses on ensuring that physical infrastructure, layouts, and institutional systems are capable of supporting compliant operation under realistic conditions.

3.6 Effluent and Water Management Design

Abattoir wastewater represents the highest environmental risk pathway associated with the proposed development. Effluent systems must therefore be designed conservatively, using peak-load assumptions rather than average operational conditions.

3.7 Effluent Design Performance Requirements

This table sets out the minimum performance parameters that must be incorporated into the design of wastewater treatment systems.

Table 4: Effluent Design Performance Requirements

Design Parameter	Minimum Requirement	Verification Method
Slaughter throughput	Capacity based on peak operational load	Engineering design drawings
Cleaning cycles	Inclusion of full hygiene wash-down volumes	SOP review
Water intensity	Litres per animal benchmark applied	Design calculations
Expansion allowance	Built-in capacity margin	Engineer sign-off
Treatment redundancy	Multi-stage treatment train	System schematic

Interpretation:
Designing systems based on average or theoretical minimum throughput is expressly discouraged, as it creates latent failure conditions that typically emerge under peak operating scenarios.

3.8 Facility Layout and Waste Segregation

The physical layout of the facility plays a critical role in preventing contamination, disease transmission, and operational inefficiencies. Effective layout design must ensure that incompatible activities and waste streams are physically separated, rather than relying on procedural controls alone.

3.9 Layout and Segregation Controls

Table 5: Facility Layout and Waste Segregation

Control Element	Design Requirement	Risk Addressed
Clean / dirty zoning	Physical separation of processing areas	Cross-contamination
Waste pathways	Dedicated routes for waste movement	Hygiene failure
Drainage systems	Segregated clean and effluent drainage	Groundwater contamination
Waste storage	Secure, sealed containment	Odour and pest attraction

Interpretation:
Failure to implement physical segregation at this stage typically results in chronic hygiene and biosecurity problems that cannot be resolved through operational discipline alone.

3.10 Procedural and Institutional Controls

In parallel with physical design, institutional readiness must be established before commissioning. Environmental compliance is heavily influenced by organisational culture, which is set before operations begin.

Table 6: Procedural and Institutional Readiness

Control Area	Requirement	Responsible Authority
SOP development	SOPs for hygiene, waste, spills, emergencies	Environmental Officer
Training materials	Induction and refresher modules prepared	Environmental Officer
Staff induction	All staff inducted prior to operation	Environmental Officer
Record systems	Environmental logs and registers established	Environmental Officer
Budget allocation	Monitoring and maintenance funding secured	Project Proponent

Interpretation:
Where SOPs and training systems are introduced after commissioning, non-compliance tends to become entrenched and resistant to correction.

3.10.1 Summary of Pre-Construction Compliance Controls

The table below consolidates all pre-construction requirements into a single compliance reference, allowing rapid verification by management and regulators.

Table 7: Pre-Construction Compliance Matrix

Control Area	Performance Threshold	Action if Not Met
Legal approvals	All permits issued	Construction prohibited
Infrastructure design	Capacity ≥ peak demand	Design revision required
SOP approval	SOPs finalised	Commissioning delayed
Training completion	100% staff inducted	Operation prohibited
Institutional readiness	EO formally appointed	Non-compliance recorded

Overall interpretation:
This matrix ensures that **no transition to construction or operation** occurs unless environmental risk elimination has been demonstrably achieved.

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4 CONSTRUCTION PHASE MANAGEMENT

4.1 Purpose and Risk Context

The construction phase represents a transitional but high-leverage risk period within the project life cycle. Although construction-related impacts are typically short-term in duration, they can result in long-term or permanent environmental consequences if not actively managed.

In rural and semi-arid environments such as Okonjima Farm No. 3, soils are particularly vulnerable to:

- **Compaction**, which reduces infiltration and alters surface hydrology;
- **Erosion**, which may persist long after construction activities cease; and
- **Disturbance of natural drainage patterns**, creating preferential pathways for runoff.

Unlike operational impacts, which are managed through permanent systems, construction impacts occur in a period where environmental controls are still being established. The EMP therefore treats construction as a controlled disturbance phase, where the objective is not to eliminate disturbance entirely, but to ensure that:

- Disturbance is necessary, minimal, and temporary; and
- No construction activity results in a legacy environmental impact.

4.2 Construction Risk Pathways

The principal environmental risks associated with construction activities include:

- **Soil compaction** caused by unrestricted movement of vehicles and machinery, reducing infiltration capacity and increasing surface runoff;
- **Soil erosion**, particularly following rainfall events on disturbed or exposed surfaces;
- **Dust generation**, affecting worker health and causing nuisance conditions; and
- **Improper waste handling**, leading to contamination, visual intrusion, or attraction of pests.

Although the scale of construction associated with the proposed pig abattoir is limited, unmanaged construction in rural settings often produces impacts disproportionate to its footprint, due to slow natural recovery rates.

4.3 Construction Phase Environmental Controls

Construction activities shall be governed by spatial discipline, temporal control, and rapid response mechanisms. All construction works are confined to clearly demarcated areas, and disturbed surfaces must be stabilised as soon as their functional purpose has been fulfilled.

Construction waste is treated as a potential contaminant, irrespective of its perceived inertness. No waste may be buried, burned, or abandoned on site. All waste must be removed to licensed disposal facilities.

Environmental performance during construction is verified through measurable indicators and defined triggers for corrective action, as set out below.

Table 8: Construction Phase Controls and Triggers

Risk	Control Measure	Performance Indicator	Trigger for Action
Soil compaction	Restrict machinery to demarcated areas	No disturbance outside approved footprint	Immediate remediation and access restriction
Erosion	Stabilise disturbed surfaces promptly	No visible rilling or gullying	Repair within 24 hours
Dust	Apply water suppression during dry conditions	No dust-related complaints	Increase suppression frequency
Waste	Remove waste to licensed facilities	Clean site condition maintained	Immediate removal

Interpretation of Controls and Triggers

Each control measure is designed to address a specific risk pathway and is linked to a clear performance indicator that can be verified through routine site inspections.

- **Soil Compaction**
  Restricting machinery movement prevents widespread compaction and preserves soil structure. Any disturbance beyond approved areas constitutes non-compliance and must be remediated immediately through soil loosening and stabilisation.
- **Erosion Control**
  Visible rilling or gullying is treated as an early indicator of erosion risk. Immediate repair following rainfall prevents small failures from developing into persistent erosion channels.
- **Dust Management**
  Dust generation is managed proactively through water application. The absence of complaints serves as a practical indicator of effective control, recognising the rural context of the site.
- **Waste Management**
  A clean construction site is both an environmental and operational indicator. Any accumulation of waste is treated as a compliance failure requiring immediate corrective action.

4.4 Monitoring, Compliance, and Corrective Action

Monitoring during the construction phase is conducted through:

- Routine visual inspections by the Environmental Officer or Site Manager;
- Post-rainfall inspections to identify erosion or runoff pathways;
- Review of waste removal records; and
- Documentation of any incidents, complaints, or corrective actions.

Where performance indicators are not met, corrective action must be implemented immediately. Delayed response increases the likelihood of secondary impacts and undermines the preventative intent of this EMP.

Repeated or unresolved non-compliance during construction shall be escalated in accordance with the EMP's non-compliance and accountability framework.

4.5 Construction Phase Closure

Upon completion of construction activities:

- All temporary disturbance areas must be stabilised;
- Surplus materials and waste must be removed from site; and
- The site must be left in a clean, stable condition suitable for transition to operational use.

The construction phase is not considered complete until environmental controls have been verified and any temporary impacts have been fully addressed.

5 OPERATIONAL PHASE MANAGEMENT (CRITICAL RISK PHASE)

5.1 Purpose and Risk Context

The operational phase represents the highest-risk and longest-duration phase of the proposed pig abattoir development. Unlike pre-construction and construction impacts, which are finite and largely reversible, operational impacts - if inadequately managed - can become chronic, cumulative, and irreversible, particularly in relation to groundwater contamination, public health risks, and occupational exposure.

Pig abattoirs are internationally recognised as high-risk agro-processing facilities due to the continuous generation of high-strength organic effluent, biological waste, and pathogen exposure. In the Otjozondjupa Region, where groundwater is the primary and often sole source of water for domestic and agricultural use, operational failure would have far-reaching environmental, economic, and social consequences.

Accordingly, this EMP treats the operational phase as a systems-controlled phase, where environmental protection is achieved primarily through:

- Engineered containment and treatment systems;
- Clear institutional authority and accountability;
- Continuous monitoring using measurable indicators; and
- Defined triggers for intervention, escalation, and corrective action.

Reliance on informal practice or behavioural compliance alone is explicitly avoided.

5.2 Operational Risk Pathways

The principal environmental, health, and safety risk pathways during operation include:

- Generation of high-strength wastewater containing blood, fats, oils, grease (FOG), and pathogens;
- Handling and disposal of biological waste and condemned material;
- Intensive abstraction and use of groundwater;
- Occupational exposure to biological, mechanical, and chemical hazards; and
- Odour and nuisance emissions associated with waste handling and cleaning processes.

Each risk pathway is managed through layered and redundant controls, ensuring that failure of a single control does not result in immediate environmental harm.

5.3 Water Use and Wastewater Management

Risk Description

Abattoir wastewater is characterised by elevated Biological Oxygen Demand (BOD), suspended solids, blood residues, and pathogenic organisms. If inadequately treated, such effluent poses a high-consequence contamination risk to soil and groundwater. Once groundwater contamination occurs in semi-arid environments, remediation is technically complex, costly, and often ineffective.

Groundwater protection is therefore treated as a critical, non-negotiable operational priority under this EMP.

Table 9: Operational Water and Wastewater Controls and Triggers

Control Element	Performance Indicator	Monitoring Frequency	Trigger for Action
Grease trap / solids interceptor	No overflow or blockage	Weekly inspection	Immediate cleaning and inspection
Anaerobic treatment pond	No overtopping or uncontrolled discharge	Monthly inspection	Operational adjustment
Aerobic polishing stage	No odour or visible failure	Monthly inspection	Maintenance intervention
Water-use intensity	Within benchmark (ℓ/animal)	Monthly analysis	Leak investigation
Groundwater monitoring borehole	No exceedance of parameters	Bi-annual testing	Regulatory notification

Interpretation: Operational Water and Wastewater Controls

The table above translates the wastewater risk pathway into specific, enforceable operational controls. Each control element is linked to a measurable performance indicator and a defined trigger for action, ensuring early detection of system stress and intervention before environmental thresholds are exceeded.

The table is intended to function as a routine operational management tool, rather than a static reporting requirement. Any trigger event constitutes non-compliance and requires immediate corrective action.

5.4 Operational Implication

This control framework ensures that wastewater risks are addressed at source, that treatment systems operate within design limits, and that groundwater protection claims are supported by verifiable data rather than assumption.

5.4.1 Biological Waste and Biosecurity Management

Risk Description

Biological waste generated during abattoir operations presents dual and interconnected risks:

1. Environmental contamination through decomposition and leachate generation; and
2. Disease transmission affecting workers, livestock, wildlife, and downstream consumers.

Blood represents a particularly high-risk waste stream due to its extreme organic loading and rapid decomposition. Mixing blood with general wash-water significantly increases treatment system stress and odour generation.

Table 10: Biological Waste and Biosecurity Controls

Waste Stream	Control Measure	Performance Indicator	Trigger for Action
Blood	Separate sealed collection	No blood in wastewater	Immediate segregation
Condemned material	Lined, fenced disposal pit	Secure, covered, limed	Veterinary intervention
General offal	Controlled storage/removal	No odour or pests	Increased removal
Pests	Integrated Pest Management	No infestation observed	Pest control escalation

Interpretation: Biological Waste and Biosecurity Controls
Table sets out mandatory biological waste controls designed to prevent waste accumulation, odour generation, pest attraction, and disease transmission. Performance indicators are based on physical conditions that are easily verifiable during inspections, while triggers require immediate intervention where containment integrity is compromised.

5.4.2 Operational Implication

These controls ensure that biological waste does not become a chronic environmental or biosecurity risk and that veterinary oversight is integrated into daily operations rather than applied retrospectively.

5.4.3 Occupational Health and Safety (OHS)

Risk Context

Abattoir operations expose workers to a complex hazard environment, including:

- Biological exposure to blood and tissues;
- Sharp tools and cutting equipment;
- Mechanical systems such as stunning and rail equipment; and
- Chemical exposure from cleaning and sanitising agents.

OHS failure poses risks not only to worker welfare but also to operational continuity, regulatory compliance, and public confidence.

Table 11: Operational OHS Controls

Hazard	Control Measure	Monitoring Method	Trigger for Action
Biological exposure	PPE and hygiene SOPs	Routine inspection	Retraining
Mechanical injury	Preventative maintenance	Maintenance logs	Equipment shutdown
Chemical exposure	Bunded storage & MSDS	Site inspection	Spill response
Health surveillance	Annual medical screening	Medical records	Restricted duties

Interpretation: Operational OHS Controls
Table 38 establishes a preventative OHS framework, linking identified hazards to specific controls, monitoring mechanisms, and enforcement triggers. The emphasis is on prevention and early intervention, rather than incident response.

5.4.4 Odour and Nuisance Management

Risk Context and Management Philosophy

Odour generation is a recognised secondary impact associated with abattoir operations and is closely linked to the effectiveness of biological waste handling, cleaning regimes, wastewater treatment performance, and ventilation systems. While odour is often perceived as a nuisance issue, under this EMP it is treated as a proxy indicator of operational stress and control failure, rather than a standalone impact.

Persistent or recurring odour typically indicates one or more of the following underlying issues:

- Delayed removal or inadequate containment of biological waste or offal;
- Insufficient cleaning and sanitation frequency;
- Organic or hydraulic overloading of wastewater treatment systems; or
- Failure or inadequacy of ventilation and airflow management.

In the rural context of Okonjima Farm No. 3, the absence of complaints cannot be relied upon as evidence of acceptable performance. Odour management under this EMP is therefore proactive, requiring investigation and corrective action even in the absence of external complaints.

Table 12: Odour and Nuisance Management Controls

Odour Source	Control Measure	Performance Indicator	Trigger for Action
Biological waste and offal	Prompt removal and secure, sealed containment	No persistent odour detectable on site	Immediate waste handling review
Wastewater treatment systems	Proper operation of grease traps and treatment ponds	No strong or continuous odour	Inspection and system adjustment

Cleaning and sanitation	Adequate cleaning frequency and hygiene practices	Clean working areas	Increase cleaning frequency
Ventilation systems	Adequate airflow and exhaust management	No odour accumulation indoors	Ventilation maintenance
Waste storage areas	Limited storage duration and secure containment	No pest attraction or odour	Immediate waste removal

Interpretation: Odour and Nuisance Control Framework

The table above establishes operationally enforceable controls for odour and nuisance management. Each control is linked to observable performance indicators and defined triggers for intervention, ensuring that odour is addressed at its source rather than managed reactively.

The table is intended to function as a diagnostic and early-warning tool, prompting corrective action before odour escalates into a public health concern, regulatory issue, or reputational risk. Odour persistence, rather than intensity alone, is treated as the primary trigger for action.

Complaints Handling and Verification

All odour-related complaints, whether received from neighbouring land users, workers, or regulators, shall be:

- Recorded in the **Complaints Register**;
- Investigated by the Environmental Officer within 24 hours; and
- Linked to a documented corrective action, where required.

Complaints investigation shall focus not only on the reported odour event, but also on identifying systemic operational causes, such as waste handling delays or treatment inefficiencies.

Enforcement and Escalation

Where odour persists despite corrective action, the Environmental Officer is authorised to:

- Require immediate operational adjustments;
- Suspend specific activities contributing to odour generation; and
- Escalate the issue in accordance with the EMP's non-compliance and escalation framework (Section 9.7).

Repeated odour incidents are treated as indicators of systemic management failure and may trigger additional monitoring, audit review, or regulatory notification.

Operational Implication

By treating odour as an early warning signal rather than a nuisance afterthought, this EMP ensures that underlying environmental and public health risks are identified and addressed before they escalate into regulatory non-compliance or community conflict.

5.4.5 Operational Monitoring, Compliance, and Escalation

Purpose and Compliance Philosophy

Operational monitoring under this EMP is designed to ensure that environmental protection is verified through evidence, not assumed through procedural compliance. Monitoring therefore focuses on measurable indicators, routine verification, and defined escalation triggers, enabling early detection of system stress and timely intervention.

Operational compliance is not assessed episodically, but continuously, recognising that small deviations - if uncorrected - can evolve into significant environmental or public health risks.

Interpretation: Operational Compliance Verification

Operational compliance is verified through multiple, overlapping mechanisms to ensure redundancy and transparency. These mechanisms function collectively to detect deviations early, confirm corrective action, and provide an auditable record of environmental performance.

Compliance verification includes:

- **Routine site inspections** conducted by the Environmental Officer (EO);
- **Systematic review of monitoring data and operational records**, including water use, wastewater performance, waste handling logs, and maintenance records;
- **Internal inspections and annual independent environmental audits**; and
- **Review of complaints, incident, and non-compliance registers**.

Any exceedance of defined performance thresholds constitutes non-compliance and triggers immediate corrective action. Where an exceedance presents an immediate or foreseeable environmental or public health risk, the EO is authorised to modify or suspend operations until the risk is controlled.

Escalation procedures are implemented in accordance with Section 9.7.

5.4.6 Water Use and Wastewater Management

Risk Pathway

Abattoir effluent contains high Biological Oxygen Demand (BOD), blood residues, fats, oils, grease (FOG), and pathogenic organisms. In groundwater-dependent regions such as Otjozondjupa, untreated or inadequately treated effluent poses an unacceptable and high-consequence risk to groundwater quality.

Groundwater contamination is typically persistent and difficult to remediate; accordingly, wastewater management is treated as a critical control point under this EMP.

Mandatory Engineering Controls

Wastewater management is achieved through a mandatory multi-stage effluent treatment train, designed to provide progressive risk reduction and redundancy:

1. **Grease Trap / Solids Interceptor** – removal of FOG and coarse solids at source;
2. **Anaerobic Treatment Pond** – reduction of organic loading and stabilisation;
3. **Aerobic Polishing Stage** – reduction of residual nutrients and pathogens prior to final management.

Water use is managed through a quantified water-intensity benchmark (litres per animal slaughtered), enabling early detection of leaks, inefficiencies, or declining operational discipline.

Table 13: Water Use and Wastewater Performance Thresholds and Triggers

Control	Indicator	Threshold	Triggered Action
Water use	ℓ per animal slaughtered	Deviation >20% from baseline	Leak investigation and corrective action
Treatment ponds	Structural integrity	Any failure or overtopping	Immediate halt to discharge and repair
Groundwater quality	Nitrates / E. coli	Above established baseline	Immediate investigation and regulatory notification

Interpretation: Performance Thresholds and Triggers

The table defines quantitative thresholds and non-negotiable triggers for wastewater and groundwater protection. The table converts wastewater management from a descriptive requirement into an enforceable operational control system.

Any threshold exceedance requires immediate investigation and corrective action. Groundwater exceedances are treated as major non-compliance events, irrespective of magnitude.

5.4.7 Biological Waste and Biosecurity Management

Risk Context

Biological waste generated during abattoir operations presents dual risks:

1. Environmental contamination through decomposition and leachate; and
2. Disease transmission affecting workers, livestock, wildlife, and consumers.

Blood represents a particularly high-risk waste stream due to its extreme organic loading and rapid decomposition.

Interpretation: Mandatory Biosecurity Controls

Biological waste management under this EMP is based on source separation, secure containment, and regulated disposal, supported by veterinary oversight. Failure to comply with biosecurity controls is treated as a serious operational breach, given the associated public and animal health risks.

Mandatory requirements include:

- **Source separation of blood** from general wastewater;
- Disposal of condemned material in **lined, fenced, veterinary-approved condemnation pits**, treated with lime;
- Implementation of a formal **Integrated Pest Management (IPM)** programme.

Failure to comply triggers immediate corrective action and may result in partial or full operational suspension, depending on severity.

5.4.8 Occupational Health and Safety (OHS)

Risk Context and Management Philosophy

Abattoir operations expose workers to a complex hazard environment, including biological exposure, sharp tools, mechanical systems, and chemical agents. OHS failure poses risks not only to workers but also to operational continuity, regulatory compliance, and public confidence.

OHS under this EMP is managed as risk prevention, not incident response.

Interpretation: Preventative OHS Controls

Preventative OHS management includes:

- **Preventative maintenance** of equipment and mechanical systems;
- **Annual medical surveillance** for zoonotic diseases;
- **Bunded chemical storage** with accessible Material Safety Data Sheets (MSDS); and
- Mandatory PPE and training.

Any condition presenting an immediate safety risk authorises the EO to halt affected activities until corrective measures are implemented.

6 ADAPTIVE MANAGEMENT, MONITORING, AND ENFORCEMENT

6.1 Environmental Auditing

Interpretation

Independent auditing provides third-party verification that the EMP and ECC conditions are being implemented effectively.

- An independent environmental audit shall be conducted annually;
- Audit findings shall be submitted to the Environmental Commissioner; and
- Findings shall be used to refine management controls where required.

6.2 Non-Compliance Protocol

Interpretation: Escalation Logic

Non-compliance is categorised and managed as follows:

- **Minor non-compliance**:
  Corrective action implemented within **48 hours**.
- **Major non-compliance**:
  Immediate suspension of the affected activity until risk is controlled.
- **Repeated non-compliance**:
  Escalation to **MEFT** and potential regulatory enforcement.

Early reporting of non-compliance is treated as a positive management action, not a disciplinary failure.

6.3 Complaints Register

All complaints - whether from workers, neighbouring land users, or regulators - shall be:

- Recorded in a **Complaints Register**;
- Investigated by the EO within **24 hours**; and
- Resolved with **documented corrective action**.

Complaints are treated as verification tools, not the sole detection mechanism for impacts.

7 DECOMMISSIONING AND CLOSURE (LEGACY RISK MANAGEMENT)

7.1 Purpose and Legacy Risk Context

Decommissioning represents a critical phase for preventing the transfer of environmental liability to future land users or the State. For abattoirs, legacy risks include residual contamination in wastewater systems, accumulated sludges, and degraded infrastructure acting as pollution pathways.

Interpretation: Closure Requirements

Key closure requirements include:

- Decommissioning and cleaning of all wastewater treatment systems;
- Removal and lawful disposal of residual sludges;
- Assessment of soil and groundwater contamination in high-risk areas;
- Implementation of remediation where thresholds are exceeded; and
- Rehabilitation of the site to functional environmental stability.

Responsibility for closure and remediation remains with the Project Proponent, regardless of changes in ownership or operational control.

8 CONCLUSION

This Environmental Management Plan (EMP) for the Proposed Pig Abattoir Development at Okonjima Farm No. 3 establishes a comprehensive, risk-based, and enforceable environmental management framework, aligned with the Environmental Management Act, 2007 and the Environmental Impact Assessment Regulations, 2012.

The assessment and management approach adopted in this EMP confirms that the environmental, public health, occupational, and socio-economic risks associated with the proposed development are:

- **Clearly identified**, with specific risk pathways defined across the project life cycle;
- **Engineered against**, through the integration of physical design controls, waste segregation systems, and multi-stage effluent treatment infrastructure;
- **Operationally controlled**, through defined Standard Operating Procedures (SOPs), institutional roles, and performance thresholds; and
- **Continuously monitored and verified**, through measurable indicators, inspection protocols, and compliance auditing mechanisms.

The EMP demonstrates a deliberate shift from reactive mitigation to proactive systems-based environmental management, where:

- Groundwater protection is treated as a non-negotiable priority;
- Biological waste and biosecurity risks are controlled at source;
- Occupational health and safety is managed preventatively; and
- Odour and nuisance impacts are treated as early-warning indicators of system stress, rather than secondary concerns.

Importantly, the EMP establishes a clear governance and accountability framework, ensuring that environmental compliance is embedded within operational decision-making, supported by defined authority, escalation mechanisms, and regulatory oversight.

Residual environmental risks, particularly those associated with wastewater management and groundwater protection, have been reduced to acceptable and manageable levels, provided that all mitigation, monitoring, and control measures are implemented in full.

Based on the findings of the Environmental Impact Assessment and the provisions of this EMP, it is concluded that:

The proposed pig abattoir development at Okonjima Farm No. 3 can proceed without resulting in unacceptable long-term environmental, public health, or socio-economic impacts, provided that the Environmental Management Plan is fully implemented and enforced.

The EMP therefore provides a technically defensible and regulator-ready compliance framework, supporting the granting of an Environmental Clearance Certificate (ECC) subject to appropriate conditions.

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