

Part III Annex C

Biodiversity Management Plan

Version 2.0

January 2015

Yara Dallol Potash Project, Danakil Depression, Ethiopia

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LIST OF ACRONYMS

Abbreviation	Full Definition
BMP	Biodiversity Management Plan
BOMP	Biodiversity Offsets Management Plan
ERM	Environmental Resources Management
AfDB	African Development Bank
ANP	(Proposed) Afar National Park
ANRS	Afar National Regional State
BBOP	Business and Biodiversity Offsets Programme
EEP	Ethiopian Electrical Production
EPE	Environmental Policy of Ethiopia
ESIA	Environmental and Social Impact Assessment
ES-MS	Environmental and Social Management Systems
EWCA	Ethiopian Wildlife Development Authority
GHG	Greenhouse Gas Emissions
IFC	International Finance Corporation
IUCN	International Union for the Conservation of Nature
PS6	Performance Standard 6
SDPASE	Sustainable Development of the Protected Areas System of Ethiopia
SOP	Sulphate of Potash (K_2SO_4)

DEFINITIONS

The following definitions are of relevance within this report:

- **Biodiversity** – the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species (genetic diversity), between species and of ecosystems.
- **Biodiversity Offset** – biodiversity offsets are measurable conservation outcomes resulting from actions designed to compensate for significant residual adverse biodiversity impacts arising from Project development after appropriate prevention and mitigation measures have been taken. The goal of biodiversity offsets is to achieve no net loss and preferably a net gain of biodiversity on the ground with respect to species composition, habitat structure and ecosystem function and people’s use and cultural values associated with biodiversity.
- **Modified Habitat** - according to IFC Performance Standard 6, modified habitats are areas that may contain a large proportion of plant and/or animal species of non-native origin, and/or where human activity has substantially modified an area’s primary ecological functions and species composition (this excludes habitat that has been converted in anticipation of the project). Modified habitats may include areas managed for agriculture, forest plantations, reclaimed coastal zones, and reclaimed wetlands.
- **Natural Habitat** – according to IFC Performance Standard 6, natural habitats are areas composed of viable assemblages of plant and/or animal species of largely native origin, and/or where human activity has not essentially modified an area’s primary ecological functions and species composition.
- **Critical Habitat** – a range of lending institutions have recently defined ‘critical habitat’, accompanied by conditions for clients whose projects may impact upon it. Common themes mentioned by these definitions include threatened species; endemic or geographically restricted species; congregations of migratory and other species; assemblages that support key processes or services; and biodiversity of social, economic or cultural value. Examples of definitions include the following:
 1. Critical habitats are areas with high biodiversity value, including (i) habitat of significant importance to Critically Endangered and/or Endangered species; (ii) habitat of significant importance to endemic and/or restricted-range species; (iii) habitat supporting globally significant concentrations of migratory species and/or congregatory species; (iv) highly threatened and/or unique ecosystems; and/or (v) areas associated with key evolutionary processes. (IFC Performance Standard 6, January

2012.) The determination of critical habitat based on other listings is as follows: (i) If the species is listed nationally / regionally as critically endangered or endangered, in countries that have adhered to IUCN guidance, the critical habitat determination will be made on a project by project basis in consultation with competent professionals; and (ii) in instances where nationally or regionally listed species' categorizations do not correspond well to those of the IUCN (e.g., some countries more generally list species as "protected" or "restricted"), an assessment will be conducted to determine the rationale and purpose of the listing. In this case, the critical habitat determination will be based on such an assessment.

2. Irrespective of whether it is natural or modified, some habitat may be considered to be critical by virtue of (i) its high biodiversity value, (ii) its importance to the survival of endangered or critically endangered species, (iii) its importance to endemic or geographically restricted species and sub-species, (iv) its importance to migratory or congregatory species, (v) its role in supporting assemblages of species associated with key evolutionary processes, (vi) its role in supporting biodiversity of significant social, economic or cultural importance to local communities, or (vii) its importance to species that are vital to the ecosystem as a whole (keystone species).

Yara International is a leading global fertilizer company with sales of fertilizer to about 150 countries globally. As part of Yara International's overall upstream strategy, the company is exploring for suitable raw sources that can be developed and used as a source to Yara International's global fertilizer production and directly as finished product in its product portfolio. To complement these upstream processes, Yara International has recently started a subsidiary company, Yara Dallol BV, which is involved in the exploration and mining development of potash concessions in Ethiopia. These concessions are located in the Danakil Depression, Afar National Regional State (ANRS), Ethiopia. Yara International, through its subsidiary, proposes to develop a potash mine - the Yara Dallol Potash Project (hereafter referred to as the proposed Project) within these concession areas.

As part of the environmental approval process for the Project a suite of environmental and social management plans is needed to address the issues identified in the Environmental and Social Impact Assessment (ESIA). Several management plans have been developed to address impacts identified in the ESIA and are implemented as part of an environmental management system for the proposed Yara Dallol Potash Project.

Key biodiversity features associated with the Project Area include the narrow habitats that fringe the outer edge of the salt pan, the Doum Palms growing in that habitat, Killifish that are restricted to pools supported seepage of groundwater, and diversity of small and medium sized fauna. Several activities associated with the Project will impact upon the local Biodiversity at a local and regional scale. This Biodiversity Management Plan (BMP) has been compiled to address the specific impacts that are anticipated to occur as a result of planned mining developments as identified in the ESIA and associated impact assessment. This plan sets out a formal system by which Yara Dallol BV will manage mitigation measures that will reduce the impacts on the local biodiversity

1.1 POLICY STATEMENT AND OBJECTIVES

1.1.1 Policy Statement

The development of this BMP has been guided by certain aspects of the Yara Dallol BV's Health, Environment, Safety, Quality and Product Stewardship Policy, as set out in *Box 1.1*. This Policy is a high-level corporate statement of intent and establishes the principles to be followed in the management of environmental and health & safety issues.

COMPANY COMMITMENT

Yara Dallol BV's aim is to establish sustainable growth and the creation of shareholder and societal value. Yara Dallol BV affirms to their stakeholders, including employees, customers and the public, their commitment to continuously improve and reach standards of excellence in Health Environment, Safety, Quality and Product Stewardship through their operations.

ENVIRONMENTAL POLICY

Yara Dallol BV will manage their business in a life cycle perspective. In its operations Yara Dallol BV will contribute to eco-efficiency by continuously improving energy consumption and reducing waste, emissions and discharges. Waste that is generated will be handled and disposed if safely and responsibly.

Yara Dallol BV will design their products and develop product applications to have the minimum adverse effect on the environment throughout their lifecycle.

1.1.2 Objectives

The objectives of this BMP are as follows:

1. Minimise the loss of habitats, species and ecosystem services within and around the Project Area;
2. Develop a framework for the protection of biodiversity and raise the Yara Dallol BV staff and contractor awareness of biodiversity issues; and
3. Establish a framework for external collaboration and data dissemination for the benefit of the greater ecosystem.

1.2 PURPOSE AND SCOPE

The purpose of the BMP is to provide a clear set of actions and responsibilities for the control of impacts affecting the Biodiversity within the Project's area of influence.

The scope of this BMP covers the construction, operational and decommissioning/closure phases of the Project. Mitigation measures are presented to ensure that ecological processes are maintained and are not disrupted through the development of potash mining and related activities. Specific measures relate to (i) minimising the unavoidable loss or degradation of Natural Habitats associated with the mining footprint and the influx of people, (ii) to avoid the loss of species as a result of groundwater abstraction, and (iii) to minimise negative cumulative effects to the greater conservation area.

This plan should be considered to be a “living” document that is amended in light of the learning experienced during its implementation.

1.3 LINKAGE TO OTHER ENVIRONMENTAL AND SOCIAL PLANS

This BMP should be read in the context of the ES-MS (discussed in *Chapter 13* of *Part I* of the ESIA), which has been structured to provide a vehicle for the integrated management of the suite of management plans which are described in *Part III*. These management plans have been designed to address a broad range of social and environmental risks.

It is recognised that the ES-MS and associated plans are living tools that will be constantly updated to accommodate changing circumstances.

The BMP links with the Water Management Plan (*Annex H* in *Part III*), Integrated Mine Closure Plan (*Annex E* in *Part III*), Community Health, Safety, Security Management Plan (*Annex J* in *Part III*) and the Worker Management Plan (*Annex M* in *Part III*). Details of this link are described in *Table 1.1* below.

Table 1.1 *Details of Linkages between the BMP and Other Management Plans associated with the Yara Dallol Potash Project*

Management Plan	Overlap of the BMP with Content of Other Plans
ENVIRONMENTAL MANAGEMNT PLANS	
Water Management Plan (WMP)	<ul style="list-style-type: none"> • Management of the Aquifers and Reduced Demand for Freshwater (<i>Mitigation item 19</i>). • Monitoring of Doum Palm survival (<i>Section 5.1</i>). • Monitoring of the health and survival of Killifish populations (<i>Section 5.2</i>).
Integrated Mine Closure Plan (IMCP)	<ul style="list-style-type: none"> • Rehabilitation of disturbed areas (<i>Mitigation item 23</i>).
SOCIAL MANAGEMENT PLANS	
Community Health, Safety and Security Management Plan (CHSSMP)	<ul style="list-style-type: none"> • Allow Continued Movement of Livestock and Wildlife Outside of High Security Zones (<i>Mitigation item 16</i>). • Cultivation of Doum Palms (<i>Mitigation item 22</i>).
Worker Management Plan (WoMP)	<ul style="list-style-type: none"> • Integrate Biodiversity Importance into Induction Programmes (<i>Mitigation item 11</i>). • Implement an Internal Biodiversity Protection Statement (<i>Mitigation item 12</i>). • Develop and Implement Awareness Programmes Focussed on Biodiversity (<i>Mitigation item 15</i>).

A summary of the legal requirements and standards relevant to the BMP are presented below.

2.1 NATIONAL LEGISLATION AND POLICY

The following Ethiopian regulations informed the development of this BMP:

2.1.1 *Constitution of the Federal Democratic Republic of Ethiopia*

The constitution sets out the concept of sustainable development and provides the rights around living in a clean and healthy environment.

2.1.2 *The Environmental Policy of Ethiopia, 1997*

The Environmental Policy of Ethiopia (EPE), 1997 was issued by the Government of Ethiopia and is to be implemented by the former Environmental Protection Authority (EPA) and now ministry of Environment and Forestry. Key elements of this policy that are of relevance to this BMP include the following:

- **Section 3.6** - the policy acknowledges that mineral resources are not renewable resources. The policy promotes environmental protection, environmental education and awareness for the public and safe mining methodologies. Terms and conditions of a contract should be utilised to ensure that all pre-development environmental impact studies, appropriate mitigation and reclamation measures are taken during and after the operations.
- **Section 4.9** - requires an EIA to consider the physical, biological, social, socio-economic, political and cultural impacts and conditions of a development. For private sector developments, the developer has the ultimate responsibility to ensure that a preliminary and a full EIA are performed. Mitigation and contingency plans are compulsory elements in an EIA. The policy also requires that the EIA process involves independent review and public comments.

2.1.3 *The Ethiopian Water Sector Policy, 2001*

The overall goal of the policy is to enhance and promote all national efforts towards the efficient, equitable utilisation of water resources of Ethiopia. Furthermore, the policy aims for optimised utilisation that allows for sustainable socio-economic development.

2.1.4 *Environmental Impact Assessment Proclamation (299/2002)*

The EIA Proclamation (299/ 2002) came into force on 3rd December 2002. Any project listed in any directive issued pursuant to this Proclamation is to be subjected to an EIA. Project impacts must be assessed based on the size, location, nature, cumulative effect with other concurrent impacts or phenomena, trans-regional effects, duration, reversibility or irreversibility or other related effects of the project.

2.2 *NATIONAL GUIDELINES AND STANDARDS*

Within Ethiopia, the following document sets out the key considerations pertaining to the conservation of Biodiversity:

2.2.1 *Gap Analysis of the Protected Areas System of Ethiopia (Vreugdenhil et al. 2012) ⁽¹⁾*

The project for Sustainable Development of the Protected Areas System of Ethiopia (SDPASE), on behalf of the Ethiopian Wildlife Development Authority (EWCA) has contracted the study "Gap Analysis of the Protected Areas System of Ethiopia" (Vreugdenhil *et al.* 2012). The study systematically fills the gaps in knowledge about biodiversity. The study is based on scientific criteria and identifies areas needed to complete the Ethiopian Protected Areas System, with a realistic representation of the country's still surviving biodiversity. The existing protected areas have been analysed on compliance with the international criteria on "Ecoregions" and "Hot Spot". Additionally, the study produced the "Ecosystems Map of Ethiopia" and updated the known knowledge on the distribution of "Species of Special Concern". The study also takes into consideration geomorphological highlights of international significance, important socio-economic criteria, such as water-based ecosystem services and tourism, each of which can contribute to employment and strengthen the economy. On the basis of various criteria, more than 20 locations were identified that need to be added to the Protected Areas System of Ethiopia for it to be reasonably representative of the nation's biodiversity, one of these sites is the Proposed Afar National Park.

2.3 *IFC PERFORMANCE STANDARDS*

The following IFC Performance Standards are applicable to this BMP:

2.3.1 *Performance Standard 1 (Assessment and Management of Environmental and Social Risk and Impacts)*

IFC Performance Standard (PS) 1 aims to identify and assess environmental (including biodiversity) and social risks and impacts of any given project. The project must adopt a mitigation hierarchy to anticipate and avoid, or where

⁽¹⁾ Available at: www.birdlist.org/downloads/parks/gap_analysis_protected_areas_system_of_ethiopia.pdf

avoidance is not possible, minimise, and where residual impacts remain, compensate/offset for risks and impacts to workers, Affected Communities, and the environment. PS1 promotes improved environmental and social performance of clients through the effective use of management systems. Furthermore, the standard promotes and provides a means for adequate engagement with Affected Communities throughout the project cycle on issues that could potentially affect them and to ensure that relevant environmental and social information is disclosed and disseminated.

2.3.2 *Performance Standard 6 (Biodiversity Conservation and Sustainable Management of Living Natural Resources)*

IFC PS6 has the greatest relevance to this BMP. PS6 recognises that protecting and conserving biodiversity, maintaining ecosystem services, and sustainably managing living and natural resources are fundamental to sustainable development. This standard covers the following aspects that are relevant to this BMP:

- To protect and conserve biodiversity;
- To maintain the benefits from ecosystem services; and
- To sustainably manage living natural resources.

2.4 *BUSINESS AND BIODIVERSITY OFFSETS PROGRAMME (BBOP) GUIDELINES*

The IFC Performance Standard 6 (PS6) states that in many cases, biodiversity offsets would be required for projects implemented in natural or critical habitats. The PS6 does not provide guidance on the development of offsets, but references the Business and Biodiversity Offset Programme (BBOP) in that regard.

BBOP is collaboration between some 75 companies, government agencies, conservation organisations and financial institutions from around the world. Its aim is to develop shared views and experience of best practice on the application of the mitigation hierarchy, including biodiversity offsets. Drawing on experience of BBOP members and non-members from around the world, and from pilot projects with companies, BBOP has developed Principles and the Standard on Biodiversity Offsets, handbooks on offset design and implementation, a number of resource papers and case studies, which are described in this Glossary under BBOP outputs. The IFC Performance Standard 6 Further information on BBOP's vision and outputs is detailed in *Annex A*.

With respect to the BMP, Yara Dallol BV has the responsibility to provide Biodiversity management and to structure and coordinate Biodiversity management procedures for the Yara Dallol Potash Project.

Furthermore, Yara Dallol BV has the responsibility for ensuring that specific Ecological responsibilities allocated to them are organised and implemented. Yara Dallol BV has the responsibility to ensure that their employees and contracted third parties are trained and aware of all required Ecological procedures.

The roles and responsibilities within Yara Dallol BV for the implementation of the BMP are presented in *Table 3.1*.

Table 3.1 *Responsible Parties and Roles and Responsibilities*

Responsible Parties	Roles and Responsibilities
Dallol General Manager	<ul style="list-style-type: none"> Review monthly biodiversity reporting Work with Environmental and Social Manager to identify necessary improvements
Environmental and Social Manager	<ul style="list-style-type: none"> Provide biodiversity information at local level Support Health and Safety Manager in development of training and management plans to ensure environmental concerns are addressed
Community Liaison Officer and Biodiversity Specialist	<ul style="list-style-type: none"> Provide biodiversity information at local level and liaise with potentially affected communities Keep detailed records of stakeholder communication and actions Perform inspections after major events (i.e. heavy rains, excavations, etc.)
Project Manager	<ul style="list-style-type: none"> Together with the Environmental and Social Manager is responsible for staffing, planning and day-to-day execution of the management measures described under this BMP during the construction phase of this Project. As needed, this individual will develop and propose staff plans and contractual language to ensure that these measures are implemented by Yara Dallol BV staff and contractors throughout the construction phase of the Project.
Operations Manager	<ul style="list-style-type: none"> Together with the Environmental and Social Manager is responsible for staffing, planning and day-to-day execution of the management measures described under this BMP during the operational phase of this Project. As needed, this individual will develop and propose staff plans and contractual language to ensure that these measures are implemented by Yara Dallol BV staff and contractors throughout the operational phase of the Project.
Contractors (Construction and Operations)	<ul style="list-style-type: none"> Responsible for following the procedures and requirements indicated in construction and operational sections of this BMP.
Academic Institutions	<ul style="list-style-type: none"> To develop a collaboration between specialists and mining operators to enhance the knowledge and protection of unique species.

4.1 SUMMARY OF IMPACT MANAGEMENT

As with any project of this scale and nature, there are certain impacts that cannot be entirely eliminated, i.e. residual impacts after implementing mitigation measures. With respect to impact mitigation, the Project subscribes to the philosophy of impact avoidance (by changes to Project planning and/or design) and impact reduction (to reduce impacts that cannot be avoided to acceptable levels). What follows, is a description of the potential residual impacts and the mitigation measures to reduce them to acceptable levels. These mitigation measures essentially comprise the “management plan” to address Biodiversity related impacts.

The following sections will:

- Identify impacts associated with each phase of the proposed Project;
- Identify the objectives and targets related to the impacts;
- Describe the management measure(s) to minimise the impact; and
- Assign responsibilities for the management measures.

The predicted biodiversity-related impacts resulting from the Yara Dallol Potash Project that were identified in the ESIA are presented in *Table 4.1*, with a breakdown of their occurrence during the various phases of the Project.

Table 4.1 *Predicted Biodiversity-related Impacts and their Expected Occurrence during the Construction, Operation and Closure Phases of the Project*

Predicted Impact Group	Mine Phase		
	Construction	Operation	Closure
Direct loss and degradation of habitat through development of infrastructure and possible increased human influx during the construction and operational phases of the Project.	•	•	
Indirect loss of habitats and associated species resulting from groundwater abstraction during the operational phase of the Project.		•	•
Loss of threatened faunal species through inappropriate development of infrastructure and cultural alterations resulting from improved infrastructure and access to external markets.	•	•	•
Cumulative impacts to proposed conservation areas (Proposed Afar National Park) through development of modern mining activities.	•	•	
Cumulative impacts associated with the loss of habitats and faunal species associated with the Project and other potash mining operations in the greater Project Area.	•	•	

4.2 MANAGEMENT DURING CONSTRUCTION

4.2.1 *Potential Impacts*

The key impacts during the construction phase are associated with:

- **Direct Loss and Degradation of Habitat** – through development of infrastructure and possible increased human influx.
- **Loss of Threatened Faunal Species** – through inappropriate development of infrastructure and cultural alterations resulting from improved infrastructure and access to external markets.
- **Cumulative Impacts to Proposed Conservation Areas (Proposed Afar National Park)** – through development of modern mining activities.
- **Cumulative Impacts associated with the Loss of Habitats and Faunal Species** – associated with the Project and other potash mining operations in the greater Project Area.

4.2.2 *Objectives and Targets for the Construction Phase*

The following four objectives encompass the mitigation requirements for the construction phase of the Project:

1. Promote Ecologically Friendly Approaches to Project Construction;
2. Establish Personnel Management and General Due Diligence for improved biodiversity conservation;
3. Encourage External Collaboration and Data Dissemination; and
4. Introduce Consideration and Requirements for Biodiversity Offsets.

4.2.3 *Management Actions for the Construction Phase*

Promote Ecologically Friendly Approaches to Project Construction

1. Avoidance of the Killifish Habitat

Maintenance of the Killifish habitat needs to be compatible with the nearby solution mining activities.

- The proposed layout of solution wells within the North Musley concession will largely avoid the small areas of surface water on the western edge of the salt pan that support Killifish populations.
- Possibilities may be investigated to excavate additional pools of similar size along the salt pan edge that will retain seepage water away from the solution wells, as may be required for future experimental artificial

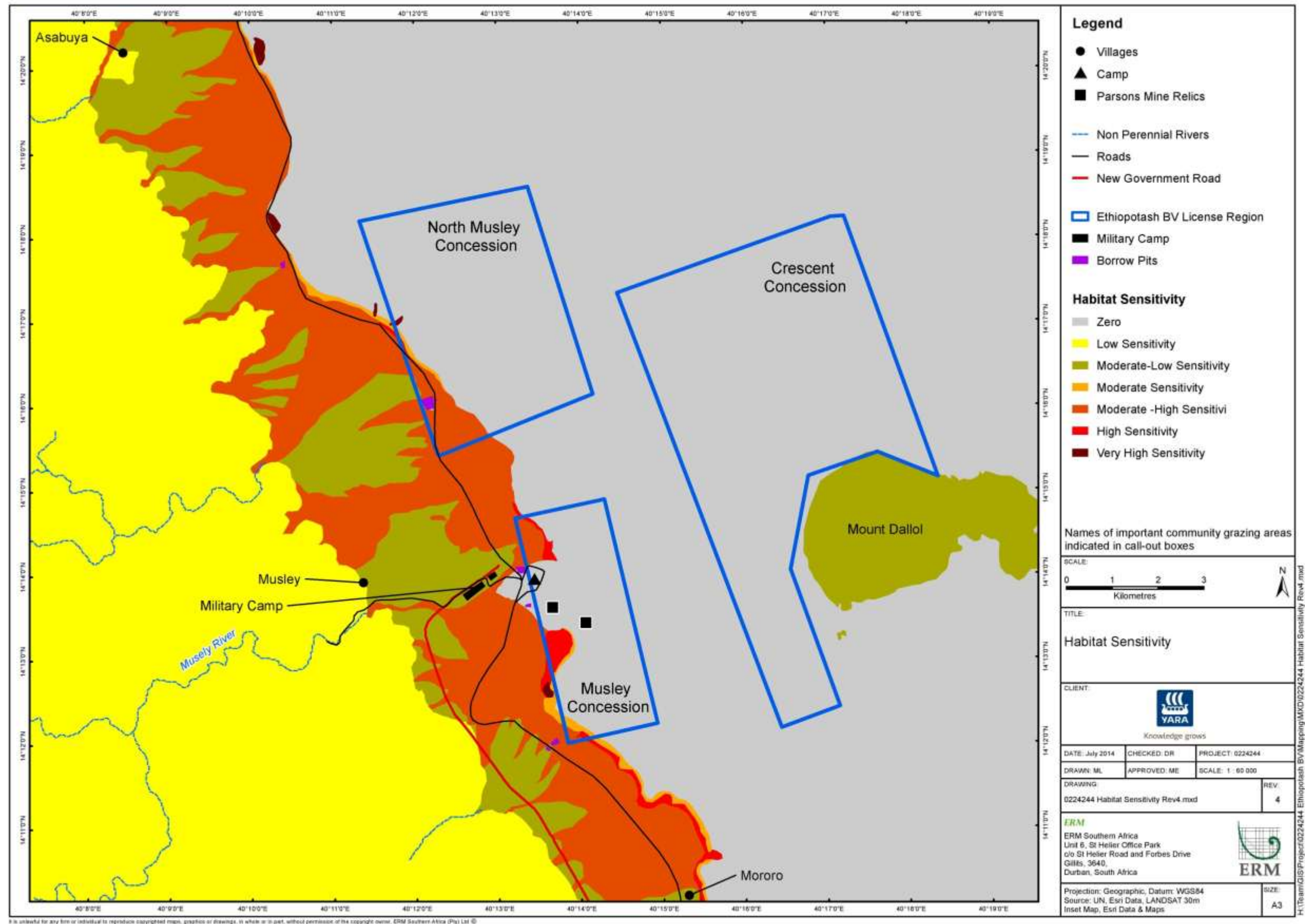
maintenance of ponds. Further considerations for the development and maintenance of additional killifish habitat are presented in *Mitigation item 21*, with monitoring measures presented in *Section 5.2*.

2. *Avoid the Loss of Sensitive Habitats*

The layout of the infrastructure footprint has successfully avoided sensitive habitats, however, additional disturbances resulting from activities are expected (*viz.* excavation of borrow pits, equipment laydown areas, temporary storage, parking for trucks, importing heavy equipment and may also include other activities). In this regard, the following will be undertaken:

- A habitat sensitivity assessment has been conducted with the results presented in *Figure 4.1*. Any developments in excess of the planned infrastructure footprint will be minimised (see *Mitigation item 3*) and located within modified or low sensitivity habitats.
- A minimum of a 50 meter buffer around sensitive habitats will not be disturbed.
- Natural drainage lines will not be disrupted significantly and development of borrow pits will be located as far away from any of the fringe habitats as possible to avoid drainage disturbances to the palm vegetation there. (See also *Mitigation item 6*)

Figure 4.1 Spatial Sensitivity Patterns for Ecological Habitats associated with the Project Area



3. Containment of Construction Activities and Avoiding Footprint Creep

Construction activities will be contained within a reasonable minimum area through a planning and disciplined approach that accounts for the following considerations to avoid undesirable “footprint creep”:

- The reasonable minimum area required for the construction activity will be determined in advance and clearly demarcated on the ground. These areas will consider equipment laydown areas, vehicle parking and turning space.
- Construction teams will be made aware of the demarcations prior to initiating construction works, and follow-up checks are to be done to ensure that the construction areas are not being exceeded.
- Toilet facilities and rest areas will be provided for construction teams to avoid the need for them to venture beyond the demarcated area in search of such necessities.

4. Grouping of Linear Infrastructure

Linear infrastructure (*viz.* roads, powerlines, pipelines and any near underground cables) will be grouped to follow the same route adjacent to one another wherever possible and appropriate to minimise the footprint of these disturbances.

Development plans do currently reflect a grouping of linear infrastructure.

5. Installation of Culverts

Pipelines, roads and other linear infrastructure will include facilities that allow the underpass or overpass of fauna, such as culverts, so as to prevent unnecessary fragmentation of habitats. These are particularly important where linear infrastructure crosses over the fringe habitats along the edge of the salt pan.

Terrestrial faunal species needing to move include Dorcas Gazelle, various Hyaenas, Jackal and fox species. All of the species are able to hop over low structures and will readily creep beneath pipelines and fences. All except the gazelles live in burrows and will readily enter enclosed culverts.

6. Avoid Disruption of Natural Drainage Systems

The Doum Palms depend on small drainage lines that transport surface water during flash flood events. Many small culverts will be installed to allow the lesser drainage lines to continue operating, and appropriate culverts or bridges installed on larger drainage lines.

7. Limit the Use of Lighting

The baseline assessment revealed that bats are present. The use of lights at night will be necessary for security purposes around infrastructure, but can be disruptive for the movement of bats and nocturnally flying birds. The use of lights will be restricted to essential requirements and will be inward and downward facing in a manner that reduces the effect on the surrounding areas.

8. Promote the use of Raptor-friendly Transmission Line Designs

Ethiopian Electric Power (EEP) has committed to supplying electrical power to the Project site once the Project is approved. A transmission line with a 230kv capacity will be constructed by EEP from Mekele, which will require a minimum transmission line length of approximately 170 km. This transmission line could have a negative impact on the Endangered Egyptian Vulture and a diversity of other large raptors which are common in the area. Electrocutions of raptors and other large birds can cause power disruptions and alter reliability. Design and construction will be the responsibility of EEP, but Yara Dallol BV will convey to EEP for raptor-friendly approaches to be considered. The following design aspects and illustrations (*Figure 4.2*) have been shown to reduce raptor mortality elsewhere in Africa:

- Perches can be fitted to the top of the poles to provide additional perching space for large raptors and to lure them away from the cross-arms (*Figure 4.2a*).
- Insulating switches, jumpers, circuit breakers and cross-arms with PVC insulation (*Figure 4.2 b. to f.*)
- Bird Flight Diverters for increased visibility (*Figure 4.2g*)
- Jumper cables on strain structures should be insulated (if possible) to prevent the birds from bridging the air gap between the phases and between phase and earth.
- Bird protection safeguards that have collapsed must be properly secured and moved to the end of the cross-arms.
- Minimum space of 152cm of separation between energized parts to protect large raptors from electrocution (Wells Hydroelectric Project, 2009)
- The steel monopole design (*Figure 4.3*) protects against raptor electrocution, and outages caused by bird pollution (excrement) and streamers. The key aspect of this design is in the adequate clearance of at least 2 meters between elements, which prevents the wingspan of large birds from connecting active wires and becoming electrocuted.

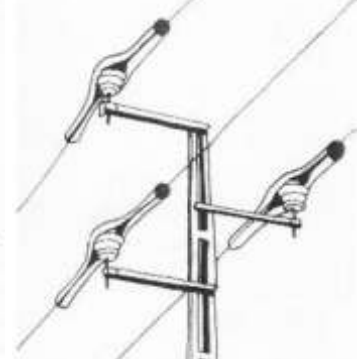
Figure 4.2 *Simple Visibility, Insulation and Perch Dissuasive Designs that Reduce Large Avian Mortalities associated with Transmission Lines*



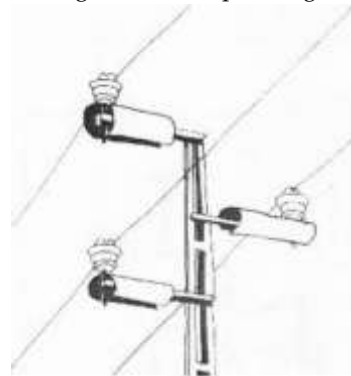
a. Elevated post & dissuasive triangles so divert perching



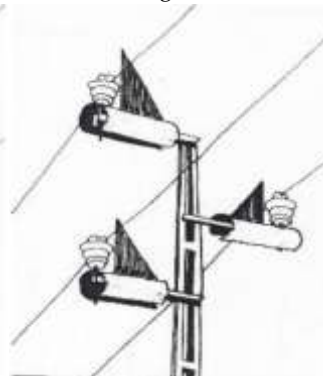
b. PVC strips in comb shaped arrangement



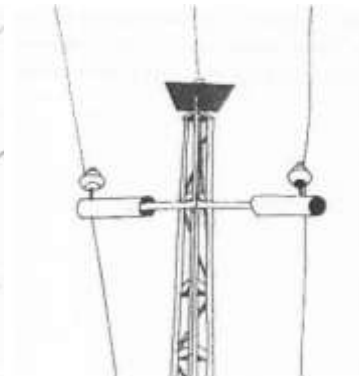
c. PVC tubing for insulator and cables



d. PVC tube to insulate the cross-arm



e. Tube and dissuasive perch guard combination



f. PVC tubes on cross-arm and plate under the central phase

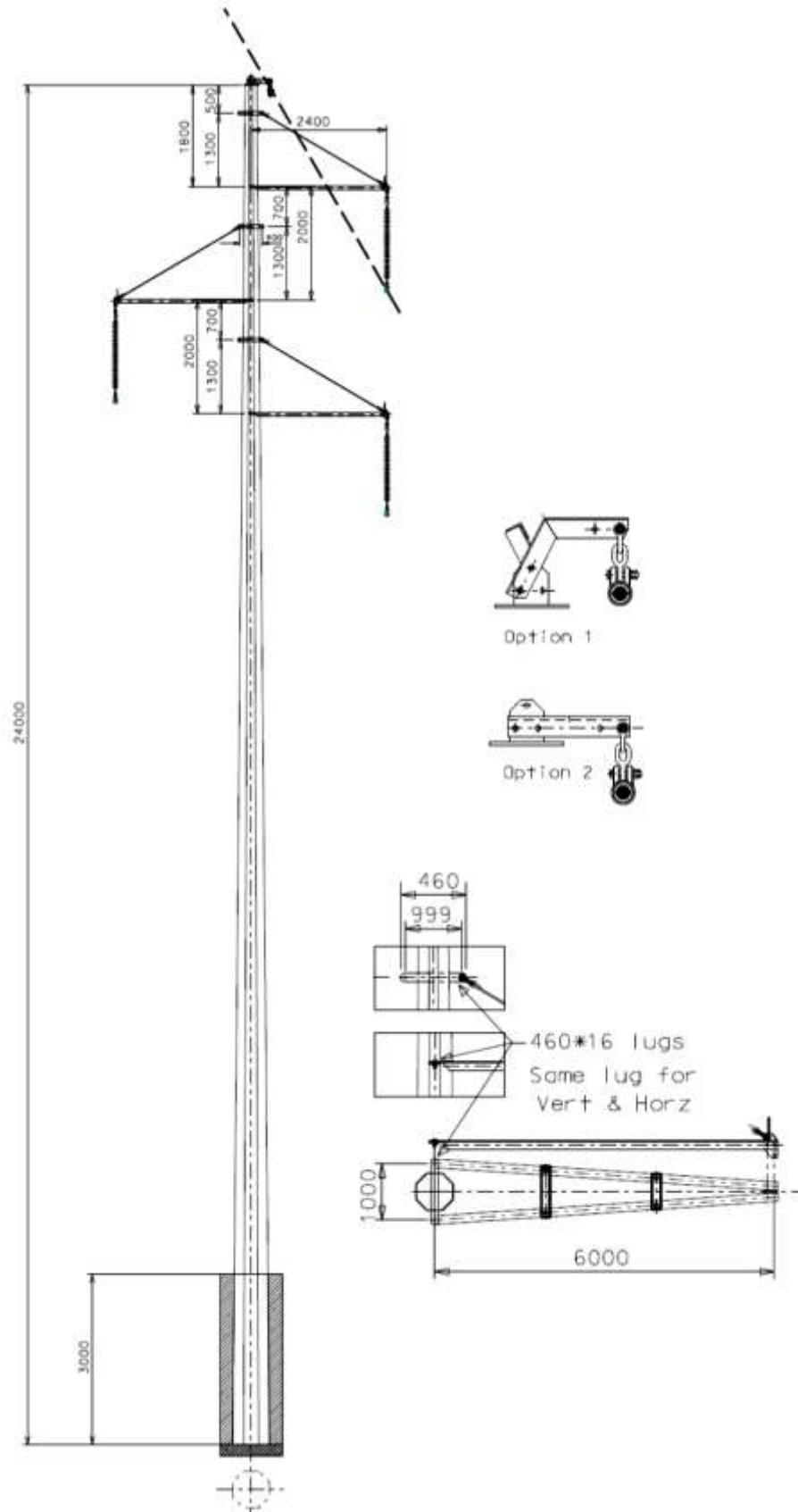


g. Bird flight diverters

The habitat setting determines the abundance and diversity of raptors and is an important parameter influencing the risk of raptor electrocution or collisions. A comprehensive raptor assessment should be undertaken by EEP to accurately quantify the large avifauna risk and determine the optimum designs and locations for their installation to minimise electrocutions and improve the reliability of power delivery.

Regular monitoring and maintenance of the line has proven to significantly increase the effectiveness once many of the above measures have been implemented.

Figure 4.3 *Steel Monopole Promoted as a Raptor-friendly Design by the Endangered Wildlife Trust (van Rooyen, 2004)*



Additional literature on raptor-friendly designs and strategies is available from the following sources:

- EnviroDynamics CC. 2014. Specific Environmental Management Plan for the 330kV transmission line from the Zambezi Substation to Wenela/Sesheke, Zambezi Region, Namibia. *Scoping Report*.
- Ferrer, M. 2012. Birds and power lines – From conflict to solution. *Endesa S. A and Fundación MIGRES*, 1st Edition.
- Mañosa, S. 2001. Strategies to identify dangerous electricity pylons for birds. *Biodiversity and Conservation*, **10**: 1997-2012.
- Public Utility District No.1 of Douglas County. 2009. Wells Hydroelectric Project. *East Wenatchee, Washington*
- Van Rooyen, C. 2004. EWT: Report on vulture interactions with powerlines in southern Africa: 1996 to 2003. In Monadjem *et al.*, *The Vultures of Southern Africa – Quo Vadis? Proceedings of a workshop on vulture research and conservation in southern Africa*.

9. Management of Birds associated with the Evaporation Ponds

There is a small risk that contamination of potash resources could occur due to the presence of waterbirds at the evaporation ponds, but this risk is considered to be unlikely. If contamination problems do occur, a small freshwater pond could be constructed in a secluded location close to the edges of the salt pan to attract waterbirds away from the evaporation ponds. Such a pond should have muddy shores (not plastic lined) or possibly a mud-lined island to increase its attractiveness to birds. Non-lethal bird scare tactics can also be used at the evaporation ponds.

The edges of the evaporation ponds will be inspected on a weekly basis to remove any carcasses resulting from exhausted migrating birds, particularly during the migration periods of March-April and August to October each year.

10. Be Sensitive to Visual Disturbances

Severe visual disturbances of the landscape may lead to adverse reactions from tourists, conservation lobbies and other stakeholders that are opposed to the presence of mining activities within a proposed Afar National Park, and thus present a risk to the Project. As such, all activities will be kept clean and tidy and mitigations proposed within the visual impact assessment (*Chapter 11 of Part I of the ESIA*) will be carefully considered.

11. Integrate Biodiversity Importance into Induction Programmes

The importance of the natural environment and the local biodiversity will be incorporated into Induction Programmes for all Yara Dallol BV staff and contractors working in the Project Area. These components of the induction programme will be regularly updated and improved, and will include the following topics:

- Awareness of the biodiversity that exists in the Project Area and surrounds and the impacts caused during the construction and operational phases of the Project.
- Contents of a Biodiversity Protection Statement as outlined below (*Mitigation item 12*).
- Outline the individual responsibilities to reduce impacts to the environment.
- Present the company procedures on land clearance and waste disposal.
- Vehicle speed limits and the reasons for them.
- Highlight who are the 'go to' (responsible) people on any biodiversity related issues that may arise, for example in the event of a problem animal needing to be rescued or removed (*Mitigation item 14*).

12. Implement an Internal Biodiversity Protection Statement

A Biodiversity Protection Statement to conserve plants and animals will be developed, and made applicable to all staff, contractors and other personnel associated with the Project. The following activities will be prohibited by Yara Dallol BV staff and contractors within and surrounding the Project Area, both during and outside of work hours:

- Any forms of hunting of wildlife or fishing or blank firing of guns.
- The intentional killing of any animals including snakes, lizards, birds or other animals. Awareness of the Animal Rescue Plan (*Mitigation item 14*) will be promoted as a means of addressing the presence of animals at risk or presenting a risk to the implementation of activities.
- Purchase, sale or transport of any live animals, bush meat or other local wild animal products from local communities or passing traders.
- Collection of any animals or animal products for consumption, medicinal or other use.

- Sellers of wildlife are not to be allowed on mine site premises. Such people must be reported to local authorities or appropriate wildlife agencies.
- Camp residents keeping pets, either introduced species such as cats or dogs, or native wildlife.
- Camp residents purchasing local wildlife or wildlife products for any reason.
- Purchase or transport of fuel wood from or for surrounding communities.
- Contamination or disposal of waste into aquatic environments.

The above information will be included within the site induction processes so that all workers are aware of these prohibitions. It will also be included in environmentally related information campaigns such as a quarterly newsletter.

13. Maintain an Inventory of Floral and Faunal Species

The IFC standards require that developments demonstrate there is no net loss of biodiversity values as a result of their activities. This can in part be achieved through maintaining a structured register of species that demonstrates the continued presence of a diversity of species in the area associated with the mine and vicinity.

A detailed inventory and photo library of plant and animal species present within and around the Yara Dallol BV concessions will be kept by the Environmental Department. The species within this inventory will be classified into taxonomic groups and families, Red Data status using the IUCN Red List of Threatened Species and their perceived threat status within the Danakil Depression and the potash mining operations. *Table 4.2* presents a proposed set of categories for classifying the species risk on the mine concession.

Table 4.2 *Proposed Categories for Classifying the Levels of Species Risk in the Project Area*

Risk Category	Description
No Risk	Species observed regularly or migrant species observed regularly during appropriate seasons
Moderate Risk	Species observed occasionally in habitats that are not at risk of loss Species seldom observed but not restricted to particular habitats
High Risk	Species observed regularly but restricted to habitats that are at risk Only few instances of species occurrence known

Risk Category	Description
Data Deficient	Uncertain if species still occurs within and around the Yara Dallol concessions

A biennial record will be kept of as many species as possible observed within and around the Project Area, with updates to cover all seasons and include migratory species. A record of species known to occur will never be complete, but will gradually become increasingly comprehensive. Such activities can involve a broad spectrum of staff within the Environmental Department and volunteers within the other departments of the mine.

Data will be formerly updated on an annual basis to assess progress, which can be measured by the growth in the number known to occur within and around the concessions, and increases in the proportion of species that in the non-risk categories described in *Table 4.2*.

14. Implement an Animal Rescue Plan

An animal rescue procedure will be developed and implemented for the safe translocation of any faunal species found to be at risk from mining operations or posing a threat to mine operations. These may include medium sized and potentially aggressive mammals (such as hyaenas, jackals or foxes) that become trapped or seek refuge inside infrastructure; venomous snakes present in work and accommodation areas and a remote possibility of crocodiles in the evaporation ponds. The animal rescue procedure will include the following aspects:

- Selected staff will be professionally trained and equipped to handle venomous snakes, with particular emphasis on species likely to be encountered in and around the Project Area, and a schedule maintained whereby a trained snake handler is on call during operational hours.
- Selected staff, preferably with some medical background, will be trained and equipped with sedative drugs to safely subdue and translocate aggressive mammals.
- Safe areas of similar habitat type will be identified where animals rescued from areas of risk can be released without harm to mining operations, surrounding communities, neighbouring mine operators or harm to that animal.
- A register of all relocated species including their confirmed identification and photographs will be used to update the species register (*Mitigation item 13*).

15. Develop and Implement Awareness Programmes Focussed on Biodiversity

Awareness and appreciation of the local ecology among people generates tremendous support for the conservation of biodiversity. Various biodiversity-related activities are highlighted in this document, which include the development of a register of species (*Mitigation item 13*), the need for an animal rescue plan (*Mitigation item 14*), and offsetting and ecological monitoring programmes (*Section 5*). Awareness of these activities will be raised among staff and contractors. The following suggestions are presented, but awareness programmes need not be restricted to these:

- Where possible, opportunities will be explored for involvement of staff, contractors and associated personnel to widen the appreciation and enthusiasm for the conservation of the biodiversity in and around the Project Area.
- The Environmental Department of Yara Dallol BV will produce and circulate a regular newsletter and posters relating to biodiversity conservation and management associated with the Project Area, within the Danakil Depression or as relevant for Ethiopia.
- Staff and contractors will be encouraged to report interesting wildlife sightings and observations, which are to be incorporated into the species register (*Mitigation item 13*), and recognition for worthwhile wildlife observations will be publicised accordingly.
- Lambing season of the local Dorcas Gazelles will be a notable event each year, and internal wildlife and nature photography competitions should be encouraged by the Environmental Department.
- An acceptance of hyenas and vultures will be promoted due to their importance in the local ecosystem.
- Additional means of generating pride will be explored.

16. Allow Continued Movement of Livestock and Wildlife Outside of High Security Zones

Scavengers form an important component of the mammal and bird diversity and rely on the carcasses of livestock. Their survival is dependent on the continued movement of livestock through the Project Area, which could be interrupted by development of mining activities associated with the Project.

- Security will be applied in a planned manner that allows traditional practices and the normal movement of livestock to continue.
- Fencing and erection of barriers that impede movement will be avoided wherever possible (refer also to *Mitigation item 5*).

- Similarly the traditional artisanal salt trade to the south of the Project Area (that relies on thousands of camels) must be allowed to continue. Yara Dallol BV may have indirect influence over these activities.

Encourage External Collaboration and Data Dissemination

17. Proactive Dissemination of Information

Yara Dallol BV will consolidate information that demonstrates the compatibility of their activities with conservation and present the steps taken to avoid ecological impacts and promote cultural harmony. Such information will be proactively released through appropriate channels to avoid the development of negative perceptions against mining activities within a proposed conservation area.

18. Collaborate with Other Mining Operators in a Local Forum

Yara Dallol BV will plan to collaborate with other mining companies (*viz.* Allana Potash Corp. and G&B Central African Resources) within the area of the proposed Afar National Park to address regional issues that affect the conservation of the area. One example of an issue to be considered is the continuation of the traditional harvesting of salt from Lake Assale and its transport into the highlands, and how the presence of mining activities may impact this ancient trade.

Introduce Consideration and Requirements for Biodiversity Offsets

There is currently uncertainty regarding the significance of the residual impact to the Doum Palms and the Killifish habitats due to unknown variables associated with the dependence of the Doum Palms on the groundwater, the groundwater conceptual and numerical model and the extent to which the groundwater aquifers can be adequately managed to reduce the abstraction of freshwater to the recharge levels. The independent consultant hydrogeological study (MWH study) has addressed issues of uncertainty and proper management of the groundwater to reduce impacts on the biodiversity through design of water well fields; however, monitoring of these ecological receptors will form an important part of understanding the impacts. Detailed monitoring requirements of the Doum Palms and Killifish habitats are elaborated in *Section 5.1* and *Section 5.2*, together with collaboration with independent academic institutions. The outcomes of these monitoring measures will decide whether the impact to the key biodiversity values of the Doum Palms and the Killifish are sufficiently negative to warrant the requirement for a biodiversity offset.

If required, a biodiversity offset contribute to biodiversity conservation priorities identified at the landscape, eco-regional and national levels, as stipulated in the BBOP guidelines. The Gap Analysis commissioned by the EWCA (Vreugdenhil *et al.* 2012) provides a detailed overview of conservation priorities for Ethiopia, and proposes formation of the Afar National Park.

4.3 *MANAGEMENT DURING THE OPERATIONAL PHASE*

4.3.1 *Potential Impacts*

During operations the key impacts are associated with:

- **Direct Loss and Degradation of Habitat** – through development of infrastructure and possible increased human influx.
- **Loss of Threatened Faunal Species** – through inappropriate development of infrastructure and cultural alterations resulting from improved infrastructure and access to external markets.
- **Cumulative Impacts to Proposed Afar National Park** – through development of modern mining activities.
- **Cumulative Impacts associated with the Loss of Habitats and Faunal Species** – associated with the Project and other potash mining operations in the greater Project Area.

4.3.2 *Objectives and Targets*

The following five objectives encompass the mitigation requirements for the Operational phase, within which management actions are grouped (note that some of these objectives and associated management actions are also described for the previous construction and operations phases):

1. Establish Personnel Management and General Due Diligence for improved biodiversity conservation;
2. Sustain Ecosystem Services and Species Diversity;
3. Initiate Ecologically responsible Rehabilitation of Disturbed Areas;
4. Encourage External Collaboration and Data Dissemination; and
5. Introduce Consideration and Requirements for Biodiversity Offsets.

4.3.3 *Management Actions*

Sustain Ecosystem Services and Species Diversity

19. *Ensure Appropriate Management of Groundwater Aquifers and Optimal Use of Freshwater*

Water is a limited resource and will be in high demand to meet Yara Dallol BV's requirements as well as those of any neighbouring mine operators. A high level of professional management of the groundwater will be required to ensure the resource is not extracted beyond the safe levels of replenishment

and resources are retained to meet the needs of the natural environments dependent on that water. The following actions will be implemented:

- Groundwater models will be updated regularly based on the latest monitoring data and specialist input. Abstraction rates will not exceed the latest estimates of aquifer recharge rates.
- Abstraction levels of freshwater can be reduced through desalination of brackish and brine groundwater, which occurs in abundance in the subterranean aquifers. Options for the use of brine and brackish water for mine activities will be explored, in accordance with the Water Management Plan.
- Appropriate water utilization and administration authorities will be kept informed of the latest developments of the groundwater conceptual models, estimated extent of groundwater resources and recharge rates.
- The above water utilization and administration authorities will be supported in their efforts to manage the water resource in a fair and equitable manner.
- The Ministry of Water shall be consulted for the sustainable use of ground water in the vicinity of Dallol and need to be encourage neighbouring mining companies, namely Allana Potash Corp. and G&B Central African Resources, to investigate potential alternative sources of water other than the alluvial fans associated with the project concessions and spread the abstraction levels over a wider geographical extent.

20. Collaborate with Academic Institutions and Support Studies into Killifish Ecology

The current taxonomy of the Arabian Killifish (*Aphanius dispar*) is expected to be revised and could yield many new species that may become classified as highly threatened due to their limited range and the extent of mining activities there. Yara Dallol will strive to be at the forefront of species taxonomy changes and be aware of the potential uniqueness of these fish. Collaboration with appropriate academic institutions will be sought and genetic samples from local populations will be submitted for analysis.

The University of Addis Ababa is considered the most appropriate local academic institution as the university maintains an active aquatic ecology department and includes specialist ichthyologists with experience in this Killifish species. Support for research studies into the taxonomy and ecology of this killifish is also encouraged and will require collaboration with international ichthyology institutions but should nevertheless be channelled through a local university, such as the University of Addis Ababa.

21. Artificial Maintenance of Existing Killifish Ponds

The MWH (2014) report states: *“that it is possible that 1 or 2 of the Arabian Killifish springs, located 1 to 2 km north of the Gehertu Fan, could be impacted by significantly reduced flows.”* The MWH (2014) report noted that under a 36 ML/d scenario (to meet the Yara Dallol BV demand) , the simulated drawdown at the springs is 0.3 to 0.5 m, which would *“probably not cause the springs to dry out but would result in the springs rising further down the line of ponds in each case”*. An indicative water quality deterioration of 4,500 to 5,500 µS/cm was simulated under this scenario which is an increase of 2.5 to 5%. Under greater abstractions rates (in exceedance of the safe yield of the alluvial fan aquifers), the MWH (2014) report states that the *“simulated drawdown at the springs is 0.9 to 1.85 m which would probably result in the springs drying out and a substantial impact”*.

PLEASE NOTE

There remains a relatively low level of certainty around the biological impacts associated with the potential loss of Killifish ponds as a result of groundwater abstraction. The ESIA has identified that over abstraction of groundwater for solution mining Projects in the Danakil could potentially have detrimental impacts to this system; however, there is still a low confidence level with respect to recharge into the aquifers targeted for groundwater abstraction. In this respect the ESIA has taken a precautionary approach to these impacts and residual impacts therefore remain high.

Although MWH (2014) indicate that there is a high probability that there are sufficient water reserves for solution mining by Yara Dallol BV and other mining companies in the Danakil, and that recharge into the aquifers targeted for groundwater abstraction is thought to be sufficient, long term monitoring of groundwater levels and water quality in production boreholes and observation wells is required, both to confirm recharge parameters and to better refine a groundwater model. The groundwater model will be continually refined and updated as further data becomes available.

Moreover, it is crucial that the health and survival of Killifish populations in response to groundwater abstraction are monitored (as per *Section 5.2 on Page 5-3*). Monitoring systems will be established prior to the commencement of the operational phase and maintained through the life of mine into the decommissioning and closure phase and will only cease once positive and predictable environmental trends are established. In the event that monitoring does identify significant impacts to Killifish populations (i.e. drying up of ponds), then Yara Dallol BV have committed to the compensatory measures included in this *Section*. Such compensatory measures include artificial maintenance of existing Killifish ponds.

There is a possibility that the Killifish ponds will be impacted. In such case Yara Dallol BV will need to investigate possibilities for artificial maintenance. Water may need to be artificially supplied to the existing pools as a last resort, if it appears that the pools will be lost, and based on a detailed understanding of the Killifish species' tolerance to change. These quantities of water would be minimal compared to the quantities extracted for mining operations. Quality of the water provided will be within the range of salinity and temperature fluctuations assessed in the baseline determination of their habitat as described above.

Development of artificial ponds for sustaining killifish will be experimented if there are indications that the ponds will be impacted, with small populations taken from the existing ponds. The following approaches will be considered:

- Results of the water quality monitoring as advised in *Section 5.2* will be used to determine the required salinity levels and other parameters such as pH, Total Dissolved Solids and Electrical Conductivity will be matched for the water to be supplied.
- Small numbers, approximately mature 20 fish, will be translocated from the natural Killifish pools to artificially created water bodies that support a water quality suitable for these fish to survive.

Such actions may not jeopardise the current populations of these fish, but potentially increase their numbers considerably and provide a buffer against loss of the species. It must be noted that such actions do not replace *in situ* conservation efforts of the species.

There are no records of these ponds drying out. If ponds are at risk of drying out due to a shortage of natural groundwater seepage (although considered by MWH (2014) to be unlikely), water will need to be provided artificially. Results of the water quality monitoring implemented during the construction phase will be used to determine the required salinity levels and other parameters such as pH, Total Dissolved Solids (TDS) and Electrical Conductivity (EC) will be matched for the water to be supplied.

Translocation of fish to other naturally occurring water bodies where fish already occur will **not** take place. For example, fish will not be moved from the Musley Concession to ponds within the northern Alluvial Fan or to Lake Assale. These fish populations are naturally isolated by different drainage systems or pools, and Killifish in particular have evolved considerable genetic differences. It is not currently known if genetic differences do occur between different drainage systems, but if differences do occur, these would be disrupted by deliberate translocation of individuals.

22. Cultivation of Doum Palms

PLEASE NOTE:

As with Killifish, there remains a relatively low level of certainty around the biological impacts associated with the potential loss of Doum Palms as a result of groundwater abstraction, and as such, the ESIA has taken a precautionary approach to these impacts and residual impacts remain high.

Similarly, it is crucial that the health and survival of Doum Palms in response to groundwater abstraction are monitored (as per *Section 5.1.1* on *Page 5-1*). In the event that monitoring does identify significant impacts to Doum Palms (i.e. mass mortality rates), then Yara Dallol BV have committed to the compensatory measures included in this Section. Such compensatory measures include artificial cultivation of Doum Palms.

In the event that a die-off of palm trees occurs, Yara Dallol BV will investigate the cultivation of Doum Palms (*Hyphaene thebaica*) under artificial conditions to compensate the potential lost harvest to communities. This activity would compensate the ecosystem service but will not substitute the loss of the fringe habitat and the diversity of species that depend on the palm trees in their natural environment. The following actions will be considered for the cultivation of palms:

- A horticulturalist with experience in palm propagation will be sourced by Yara Dallol BV. The horticulturalist will advise and lead the most cost efficient approach of propagating large numbers of young Doum Palm plants either through seed germination or tissue culture techniques. A combination of techniques may be best to ensure success and genetic diversity is maintained. Kew Gardens in the United Kingdom employ palm specialists that could advise on cultivation practices of this species.
- Genetic material for propagating palms will be sourced from within the Project Area or within the northern Danakil Depression to preserve the genetic purity of the palm species that are present there.
- Yara Dallol BV will replace palms that have been determined by an appointed ecologist (see *Section 5.1*) to have been lost within the Salt Pan Fringe as a result of mining activities. Lost palms will be replaced with young plants at a ratio in excess of 10:1. This high ration accounts for a potential loss of seedlings between transplanting and maturity.
- If there is a dramatic loss of Doum Palm plants and/or decline in their state of health determined through monitoring programmes (*Section 5.1*), then the artificial cultivation of Doum Palms will be considered, within suitably large containers and/or irrigated conditions within the former habitat, under the advice of a qualified horticulturalist.

Mitigation Measures Applicable to the Operational Phase but Described for the Construction Phase

The following mitigation measures are applicable to the Operational Phase, but are described in *Section 4.2* for the Construction Phase:

- *Mitigation item 10* (Be Sensitive to Visual Disturbances)
- *Mitigation item 11* (Integrate Biodiversity Importance into Induction Programmes)
- *Mitigation item 12* (Implement an Internal Biodiversity Protection Statement)
- *Mitigation item 13* (Maintain a Floral and Faunal Registry)
- *Mitigation item 14* (Implement an Animal Rescue Plan)
- *Mitigation item 15* (Awareness Programmes)
- *Mitigation item 16* (Allow the Movement of Livestock and Wildlife)
- *Mitigation item 17* (Proactive Dissemination of Information)

- *Mitigation item 18* (Collaborate with Other Mining Operators in a Local Forum)

4.4 *MANAGEMENT FOR DECOMMISSIONING AND CLOSURE*

4.4.1 *Potential Impacts*

The closure and decommissioning phase of the Project has the potential to result in the following potential impacts:

- **Direct Loss and Degradation of Habitat** – through development of infrastructure and possible increased human influx; and
- **Cumulative Impacts associated with the Loss of Habitats and Faunal Species** – associated with the Project and other potash mining operations in the greater Project Area.

4.4.2 *Objectives and Targets*

The following five objectives encompass the mitigation requirements for the decommissioning and closure phase, within which management actions are grouped (note that some of these objectives and associated management actions are also described for the previous construction and operational phases):

1. Establish Personnel Management and General Due Diligence for improved biodiversity conservation;
2. Sustain Ecosystem Services and Species Diversity;
3. Initiate Ecologically responsible Rehabilitation of Disturbed Areas;
4. Encourage External Collaboration and Data Dissemination; and
5. Introduce Consideration and Requirements for Biodiversity Offsets.

4.4.3 *Management Actions*

Initiate Ecologically Responsible Rehabilitation of Disturbed Areas

23. *Rehabilitation Programmes*

Rehabilitation programmes in arid environments can be challenging due to the slow growth of vegetation, but disturbed habitats must still be rehabilitated. The Alluvial Fan habitat is a naturally disturbed habitat due to irregular flood events and can be expected to have an inherent capacity for self-restoration provided soil conditions can be adequately replaced. The following issues will be considered:

- Hybridized or alien species to the local environment will not be introduced for rehabilitation programmes. Although introduced species are unlikely to survive the harsh climate, no species will be brought in to the site.
- Control of the Sodom's Apple shrubs (*Calotropis procera* see Figure 4.4) must be implemented; this species currently appears to present a low level of invasive threat; however, is widespread within the Danakil. Any soil or vegetation disturbances can be expected to result in an increase of this unwanted alien species.

Figure 4.4 *Identification of the Invasive Sodom's Apple (Calotropis procera)*



A number of Doum Palm clusters are present within the modified habitats that are earmarked for development of the processing plant and staff living quarters. These palms will be transplanted to areas where future access by local communities is possible, as this is a key resource for local inhabitants. Small specimens will be easier to transplant, and efforts should focus initially on smaller plants to assess the capacity required and build experience for moving larger specimens.

Mitigation Measures Applicable to the Decommissioning and Closure Phase but Described for the Construction or Operation Phases

The following mitigation measures are applicable to the Decommissioning and Closure Phase, but are described above for the Construction or Operational Phases:

- *Mitigation item 10* (Be Sensitive to Visual Disturbances)
- *Mitigation item 11* (Integrate Biodiversity Importance into Induction Programmes)
- *Mitigation item 12* (Implement an Internal Biodiversity Protection Statement)
- *Mitigation item 13* (Maintain a Floral and Faunal Registry)
- *Mitigation item 14* (Implement an Animal Rescue Plan)
- *Mitigation item 15* (Biodiversity Awareness Programmes)
- *Mitigation item 16* (Allow the Movement of Livestock and Wildlife)

- *Mitigation item 17* (Proactive Dissemination of Information)
- *Mitigation item 18* (Collaborate with Other Mining Operators in a Local Forum)
- *Mitigation item 22* (Cultivation of Doum Palms)

Verification and monitoring the effectiveness of actions taken to alleviate impacts is important. A Biodiversity monitoring programme is presented here to assist in the decision-making process around the implementation of mitigation, verification the efficiency of mitigation measures and to ensure that unacceptable impacts are not arising at nearby sensitive receptors. The monitoring programme includes the following two elements which are discussed in detail below:

- Monitoring of Doum Palm survival rates in response to groundwater abstraction; and
- Monitoring the health and survival of Killifish Populations.

5.1 *MONITORING OF DOUM PALM SURVIVAL RATES IN RESPONSE TO GROUNDWATER ABSTRACTION*

A detailed monitoring of the survival of Doum Palms in response to groundwater abstraction for mining purposes will be conducted. Two approaches are proposed for the monitoring of palms on site, as detailed below.

5.1.1 *Overall Mapping and Census of Palms throughout the Project Area*

A baseline mapping, census and assessment of the health of Doum Palm clusters present in the Fringe habitats within the Project Area is required prior to the operational phase and associated abstraction of large quantities of groundwater. These large palm clusters can be easily identified on a detailed satellite image, which can be used to map and count plants in different zones of the Fringe habitats. A balanced proportion of young, mature, old and dying plants can be expected within a natural system, but this balance may be altered as a result of groundwater abstraction and needs to be monitored. This desktop-based exercise will be followed by a ground-truthing exercise to allocate plants into size categories and state of health categories, with a proposed categorisation presented in *Table 5.1*.

Table 5.1 *Proposed Size-health Categories to be used as a Basis for Monitoring the Survival of Doum Palms*

	Small	Medium	Large	Very large
Healthy	Cat01	Cat02	Cat03	Cat04
Unhealthy	Cat05	Cat06	Cat07	Cat08
Dead	Cat09	Cat10	Cat11	Cat12

A detailed mapping and assessment of palms throughout the Project Area will be done prior to any significant increase in groundwater abstraction.

Monitoring of Fixed Sample Plots

Three fixed plots will be selected within the Fringe habitat covering approximately 1 ha each and not within the proposed footprint of the mine operations. These plots will be selected on the basis of supporting a number of palm clusters of different sizes and for being representative of the surrounding Fringe habitat.

The locations of all palm plants within the fixed plots will be mapped and numbered with permanent markers on stakes knocked firmly into the ground. Onsite photos of each palm cluster will be taken recording palm number and direction of photographing. The photographer will consider facing towards the Salt Pan for the sake of consistency and future comparison of photographs. Each palm cluster is to be allocated to a size/health category, with a proposed categorisation presented above in *Table 5.1*.

The Fixed Sample Plots will be established following mapping of the palms throughout the Project Area, to ensure that suitable representative sites are chosen based on the generated data.

Frequency of Monitoring

The assessment of palm health based on fixed plots will be conducted every four months (three times per year). Results obtained will be consolidated and submitted to a qualified botanist for assessment.

A repeat mapping and reassessment of palm health throughout the Project Area will be scheduled every two years; however, if the successive results obtained from assessment of the Fixed Sample Plots show a declining trend, then an overall assessment may be required at a closer interval.

Capacity Requirements

An independent and competent senior botanist associated with an Ethiopian University will be appointed to initiate and oversee the Palm monitoring programme. Environmental Support Staff appointed by Yara Dallol BV will conduct the regular monitoring of Fixed Sample Plots and the extensive field work, under supervision of the appointed botanist. Results obtained from the field will be submitted to the appointed botanist for analysis and decision on the appropriate way forward.

Assessment of Results

The botanist will assess the numbers of palm plants that have died or are in a reduced state of health within the Fixed Sample Plots, and will determine the necessity and timing for a repeat of the overall mapping and health assessment of the palm population. If a die-off of palms is detected, the extent

to which these losses are attributed to mining operations will be determined by the botanist, based on the layout of palm die-offs and comparison to detailed groundwater abstraction rates. Restructuring of the monitoring programme may be required at the discretion of the appointed botanist.

The appointed botanist will routinely liaise with a Hydro-geologist appointed by Yara Dallol BV to monitor and increase the accuracy of the current groundwater conceptual model.

If a die-off of palms is detected and appears to be associated with mining operations, the situation will be discussed between the appointed botanist and hydro-geologist. The artificial cultivation of palms for community support (*Mitigation item 22*) will be up-scaled accordingly based on the confidence of attributing the palm loss to groundwater abstraction, and the future prediction of palm losses.

Threshold Levels of Response

If a 50% die-off of Doum palms is confidently predicted by the appointed botanist and hydro-geologist team within a three to five year period based on observed trends, then the fringe habitat is to be considered severely impacted and a Biodiversity Offset for the offsite protection of a like-for-like habitat is to be initiated in collaboration with the EWCA.

5.2 MONITORING THE HEALTH AND SURVIVAL OF KILLIFISH POPULATIONS

Baseline monitoring of the surface water habitat is required to develop a better understanding of their physical and biological characteristics prior to large-scale abstraction of groundwater resources during the operational phase. A quantifiable baseline state of the habitats and populations will be established in advance, covering physical attributes such as extent of surface water pools, depth, daily temperature and salinity fluctuations, water quality variables and fluctuations. Biological (morphological and genetic) attributes of the Killifish populations are also required. It is important to understand the detailed baseline conditions, as it may be necessary to artificially replicate these systems at a later stage.

5.2.1 *Monitoring of Abstraction Rates and Changes in Groundwater Levels*

Water extracted from the underground resources will need to be monitored and the results used to improve the groundwater conceptual and numerical model and understanding of aquifer recharge rates and acceptable abstraction levels. This BMP assumes that this detailed groundwater monitoring will be outsourced by Yara Dallol BV to a hydro-geologist team of repute.

5.2.2 *Abiotic Monitoring of the Killifish Habitat*

Extent of the Killifish habitat, i.e. the actual groundwater fed pools will be monitored. This includes the water depth and the surface area. An accurate

baseline estimate of the extent of the pools will be determined using a high resolution aerial image and GIS tools. The water edge will be physically marked at a few key points (minimum of three points per pond) at the time of this baseline measurement. These points will be selected on gently sloping banks where alteration in water levels will reveal prominent horizontal shrinkage or expansion. Changes in the extent of the habitat will in future be monitored based on these few points around each pond.

Monitoring of water quality within these Killifish pools will be conducted on a regular basis. Increased temperature, increased salinity and reduced dissolved oxygen are expected to correspond to reduced water outflow levels. These three variables are key parameters to be monitored and can be measured *in situ* quickly and easily with hand-held meters. Additional parameters such as pH, dissolved oxygen, electrical conductivity and total dissolved solids will also be measured concurrently using a simple hand-held meter.

5.2.3 *Biotic Monitoring of the Killifish Populations*

The health of the Killifish populations will be estimated to detect declining trends so that measures can be implemented before the populations disappear. Any methods used to estimate the numbers of fish will be non-destructive and will not involve the physical catching of any fish.

The pools are small, the water is clear and the fish are easily observed from the edge of the pools. Fish shoals will be photographed with a camera fitted with a polarizing filter to avoid glare off the water surface. Numbers of fish can be counted in selected photos. A precise estimate of the population size is not necessary but it will be a simple exercise to estimate if the population exceeds one of the following threshold levels:

- Greater than 10 fish;
- Greater than 50 fish;
- Greater than 100 fish;
- Greater than 500 fish; or
- Greater than 1,000 fish.

Evidence of any dead fish or deformed fish will be noted. If such observations occur frequently or are affecting more than 1% of the population, affected specimens will be taken and submitted to an ichthyological laboratory for further investigation of possible causes.

5.2.4 *Creation of Artificial Habitats*

Mitigation item 21 recommends the creation of artificial habitats through landscaping alterations or independent creation of Killifish pools. Implementation of these operations (and an evaluation of their success) will be included within the Killifish monitoring programme.

5.2.5 *Frequency of Monitoring*

The surface area, depth and water quality monitoring will be conducted every two weeks.

Biotic monitoring of the fish populations will be conducted on a monthly basis.

5.2.6 *Capacity Requirements*

Yara Dallol BV will collaborate with senior Aquatic Ecologists within the Zoology Department of the University of Addis Ababa. A senior aquatic ecologist that is independent of the mining operations will be required to initiate and supervise the implementation of the Killifish monitoring programme. Dialogue will be required between the aquatic ecologist and a geohydrologist appointed to monitor groundwater abstraction and recharge.

Regular field tasks may be conducted by the Biodiversity Specialist employed by the mine, but under the supervision of an appointed aquatic ecologist.

5.2.7 *Assessment of Results*

Requirements for assessing the state of health of the Killifish populations are non-specific and will be at the discretion of the monitoring teams. Alterations in the water quality and flow rates from subterranean aquifers, and the implications of these changes for the survival of the Killifish populations will be determined through communication between the appointed Geohydrologists and Aquatic Ecologists.

5.2.8 *Threshold Levels for Response*

Thresholds for response based on the outcomes of monitoring the health of Killifish populations cannot be set, but responses will be determined by the confidence of the capacity of groundwater aquifers to sustain killifish populations and the success achieved in creation of artificial habitats. If there is confidence that groundwater sources will not continue to sustain the Killifish populations, regardless of artificial habitat maintenance, then a biodiversity offset will need to be considered in collaboration with the EWCA and international lender(s).

5.3 *VISUAL INSPECTION FOR BIODIVERSITY*

During the construction, operation and decommissioning/closure phases commitment is made to undertake visual inspections of activities resulting in negative impacts to the biodiversity values (fauna, flora and habitats) associated with the Project and adjacent activities. In the event that activities on site are observed to be generating loss of fauna, risks to the Project, or observations of interest as highlighted in the following examples, these are to

be reported to the Environmental Department of the Federal Ministry of Mines and prompt action requested:

- Road kills of wildlife;
- Harvesting of fuel wood;
- Contamination of aquatic ecosystems;
- Aggressive animals, snakes or crocodiles hindering activities;
- Significant numbers of birds attracted to the evaporation ponds; or
- Any interesting wildlife sightings.

The visual inspections will be opportunistically undertaken but on a continuous basis, and will reflect the ethos of 'see it, own it', in terms of identifying and addressing significant Biodiversity impacts. Where significant impacts are observed, these will be recorded. On the basis of the reports, where there are activities that repeatedly result in significant impacts, further investigations will be undertaken to reduce these impacts.

6 *REPORTING AND DOCUMENTATION*

6.1 *GOVERNMENT/AUTHORITY REPORTING*

Yara Dallol BV will comply with any Ethiopian Government reporting requirements relating to biodiversity management.

6.2 *INTERNAL REPORTING*

On the basis of the daily and monthly monitoring undertaken during construction and decommissioning phases, monthly reports will be generated and lodged with the Yara Dallol BV board of directors as part of Yara Dallol BV's Environmental and Social Monitoring. During the operational phase, the monthly monitoring will be reported on a six monthly basis.

The reports will summarise the data collected through the monitoring programme, identifying any occasions when the action levels were triggered and the remedial action that was taken. The reports will also include the findings of the visual observations, and will include a record of the activities resulting in impacts and any remedial actions taken, and the likelihood of a repetition of impact. The reports will also summarise any complaints received from the local communities, setting out the complaint, whether it was substantiated and any actions taken to alleviate the impact.

6.3 *COMMUNITY REPORTING*

On the basis of the monthly and bi-annual reporting undertaken during the construction, operational and decommissioning/closure phases, a summary report suitable for digestion by a non-technical community audience will be developed and disclosed on a bi-annual basis. This report will focus where possible upon graphical representation of information, and in particular outcomes of any community complaints or grievances and those actions taken to remedy significant impacts.

Table 7.1 Construction Phase

Impact	Objective	Mitigation/Management Measures	Monitoring Plan/ Verification	Responsibility
Direct loss and degradation of habitat	Promote Ecologically Friendly Approaches to Project Construction	1. Avoidance of the Killifish Habitat	Mine development plans to reflect Killifish habitat	<ul style="list-style-type: none"> Environmental and Social Manager
Direct loss and degradation of habitat		2. Avoid the Loss of Sensitive Habitats	Mine development to be implemented in accordance with agreed layout plans.	<ul style="list-style-type: none"> Environmental and Social Manager
Direct loss and degradation of habitat		3. Containment of Construction Activities and Avoiding Footprint Creep	Mine development plans must reflect minimum infrastructure development within this habitat	<ul style="list-style-type: none"> Project Manager Environmental and Social Manager
Direct loss and degradation of habitat		3. Grouping of Linear Infrastructure	Grouping of infrastructure to be shown on mine development plans and constructed accordingly	<ul style="list-style-type: none"> Project Manager Environmental and Social Manager
Direct loss and degradation of habitat		5. Installation of Culverts	Mine development plans must reflect culvert locations	<ul style="list-style-type: none"> Project Manager
Direct loss and degradation of habitat		6. Avoid Disruption of Natural Drainage Systems	Mine development plans must reflect culvert locations and constructed accordingly	<ul style="list-style-type: none"> Project Manager Environmental and Social Manager
Cumulative impacts to proposed conservation areas		7. Limit the Use of Lighting	Mine development plans reflect lighting requirements and implemented accordingly	<ul style="list-style-type: none"> Project Manager
Loss of threatened faunal species		8. Promote the use of Raptor-friendly Transmission Line Designs		<ul style="list-style-type: none"> EEP
Loss of threatened faunal species		9. Management Birds Associated with the Evaporation Ponds	Quality of product is not compromised as a result of bird presence around the evaporation ponds	<ul style="list-style-type: none"> Project Manager Environmental and Social Manager

Impact	Objective	Mitigation/Management Measures	Monitoring Plan / Verification	Responsibility
Cumulative impacts to proposed conservation areas		10. Be Sensitive to Visual Disturbances	A complaints register does not reflect any landscape disturbance complaints raised by stakeholders	<ul style="list-style-type: none"> Project Manager Environmental and Social Manager
Loss of threatened faunal species	Establish Personnel Management and General Due Diligence for improved biodiversity conservation	11. Integrate Biodiversity Importance into Induction Programmes	Induction programmes include biodiversity-related issues	<ul style="list-style-type: none"> Project Manager Environmental and Social Manager
Loss of threatened faunal species		12. Implement an Internal Biodiversity Protection Statement	Policies, statements and posters available for protection of biodiversity	<ul style="list-style-type: none"> Environmental and Social Manager
Loss of threatened faunal species		13. Maintain an Inventory of Floral and Faunal Species	Inventory of species exists and reflects same or greater diversity than the Baseline assessment	<ul style="list-style-type: none"> Environmental and Social Manager
Loss of threatened faunal species		14. Implement an Animal Rescue Plan	Records are available for the safe translocation of problem animals	<ul style="list-style-type: none"> Environmental and Social Manager Health and Safety Manager
Loss of threatened faunal species		15. Develop and Implement Awareness Programmes Focussed on Biodiversity	Evidence of awareness programmes in the form of posters, newsletters etc.	<ul style="list-style-type: none"> Environmental and Social Manager
Loss of threatened faunal species		16. Allow Continued Movement of Livestock and Wildlife Outside of High Security Zones	No grievances lodged by local communities, local authorities or NGOs relating to restricted livestock movements	<ul style="list-style-type: none"> Environmental and Social Manager
Cumulative impacts to proposed conservation areas	Encourage External Collaboration and Data Dissemination	17. Proactive Dissemination of Information	Evidence of dissemination of intelligent and up-to-date information	<ul style="list-style-type: none"> Environmental and Social Manager Dallol General Manager
Cumulative impacts to proposed conservation areas		18. Collaborate with Other Mining Operators in a Local Forum	Forum established and evidence of meetings and decisions taken	<ul style="list-style-type: none"> Environmental and Social Manager Dallol General Manager

Impact	Objective	Mitigation/Management Measures	Monitoring Plan / Verification	Responsibility
Indirect loss of habitats and associated species	Introduce Consideration and Requirements for Biodiversity Offsets			<ul style="list-style-type: none"> Environmental and Social Manager Dallol General Manager

Table 7.2 Operational Phase

Impact	Objective	Mitigation/Management Measures	Monitoring Plan / Verification	Responsibility
Indirect loss of habitats and associated species	Sustain Ecosystem Services and Species Diversity	19. Ensure Appropriate Management of Groundwater Aquifers	Evidence of communication with relevant authorities and other water users	<ul style="list-style-type: none"> Environmental and Social Manager Dallol General Manager Project Manager
Indirect loss of habitats and associated species		20. Collaborate with Academic Institutions and Support Studies into Killifish Ecology	Collaboration established between Yara Dallol, Geohydrologists and Aquatic Ecologists in Academia	<ul style="list-style-type: none"> Environmental and Social Manager
Indirect loss of habitats and associated species		21. Artificial Maintenance of Existing Killifish Ponds	Evidence of healthy Killifish populations	<ul style="list-style-type: none"> Environmental and Social Manager Biodiversity Specialist
Indirect loss of habitats and associated species		22. Cultivation of Doum Palms	Evidence of abundant palms on site and accessible to local communities	<ul style="list-style-type: none"> Environmental and Social Manager Biodiversity Specialist Operations Manager
Cumulative impacts to proposed conservation areas		10. Be Sensitive to Visual Disturbances	A complaints register does not reflect any landscape disturbance complaints raised by stakeholders	<ul style="list-style-type: none"> Environmental and Social Manager Community Liaison Officer

Impact	Objective	Mitigation/Management Measures	Monitoring Plan / Verification	Responsibility
Loss of threatened faunal species		16. Allow Continued Movement of Livestock and Wildlife Outside of High Security Zones	No grievances lodged by local communities, local authorities or NGOs relating to restricted livestock movements	<ul style="list-style-type: none"> Environmental and Social Manager Community Liaison Officer
Loss of threatened faunal species	Establish Personnel Management and General Due Diligence for improved biodiversity conservation	11. Integrate Biodiversity Importance into Induction Programmes	Induction programmes include biodiversity-related issues	<ul style="list-style-type: none"> Environmental and Social Manager Biodiversity Specialist
Loss of threatened faunal species		12. Implement an Internal Biodiversity Protection Statement	Policies, statements and posters available for protection of biodiversity	<ul style="list-style-type: none"> Environmental and Social Manager
Loss of threatened faunal species		13. Maintain an Inventory of Floral and Faunal Species	Inventory of species exists and reflects same or greater diversity than the Baseline assessment	<ul style="list-style-type: none"> Environmental and Social Manager Biodiversity Specialist
Loss of threatened faunal species		14. Implement an Animal Rescue Plan	Records are available for the safe translocation of problem animals	<ul style="list-style-type: none"> Environmental and Social Manager Health and Safety Manager
Loss of threatened faunal species		15. Develop and Implement Awareness Programmes Focussed on Biodiversity	Evidence of awareness programmes in the form of posters, newsletters etc.	<ul style="list-style-type: none"> Environmental and Social Manager Community Liaison Officer
Cumulative impacts to proposed conservation areas	Encourage External Collaboration and Data Dissemination	17. Proactive Dissemination of Information	No grievances lodged by local communities, local authorities or NGOs relating to restricted livestock movements	<ul style="list-style-type: none"> Environmental and Social Manager Community Liaison Officer
Cumulative impacts to proposed conservation areas		18. Collaborate with Other Mining Operators in a Local Forum	Evidence of dissemination of intelligent and up-to-date information	<ul style="list-style-type: none"> Environmental and Social Manager Dallol General Manager

Table 7.3 *Decommissioning/Closure Phase*

Impact	Objective	Mitigation/Management Measures	Monitoring Plan / Verification	Responsibility
Direct loss and degradation of habitat	Initiate Ecologically responsible Rehabilitation of Disturbed Areas	23. Rehabilitation Programmes		<ul style="list-style-type: none"> • Environmental and Social Manager
Cumulative impacts to proposed conservation areas		10. Be Sensitive to Visual Disturbances	A complaints register does not reflect any landscape disturbance complaints raised by stakeholders	<ul style="list-style-type: none"> • Environmental and Social Manager • Community Liaison Officer
Loss of threatened faunal species	Establish Personnel Management and General Due Diligence for improved biodiversity conservation	11. Integrate Biodiversity Importance into Induction Programmes	Induction programmes include biodiversity-related issues	<ul style="list-style-type: none"> • Environmental and Social Manager • Biodiversity Specialist
Loss of threatened faunal species		12. Implement an Internal Biodiversity Protection Statement	Policies, statements and posters available for protection of biodiversity	<ul style="list-style-type: none"> • Environmental and Social Manager
Loss of threatened faunal species		14. Implement an Animal Rescue Plan	Records are available for the safe translocation of problem animals	<ul style="list-style-type: none"> • Environmental and Social Manager • Health and Safety Manager
Loss of threatened faunal species		15. Develop and Implement Awareness Programmes Focussed on Biodiversity	Evidence of awareness programmes in the form of posters, newsletters etc.	<ul style="list-style-type: none"> • Environmental and Social Manager • Community Liaison Officer
Loss of threatened faunal species		16. Allow Continued Movement of Livestock and Wildlife Outside of High Security Zones	No grievances lodged by local communities, local authorities or NGOs relating to restricted livestock movements	<ul style="list-style-type: none"> • Environmental and Social Manager • Community Liaison Officer

Impact	Objective	Mitigation/Management Measures	Monitoring Plan / Verification	Responsibility
Cumulative impacts to proposed conservation areas	Encourage External Collaboration and Data Dissemination	17. Proactive Dissemination of Information	No grievances lodged by local communities, local authorities or NGOs relating to restricted livestock movements	<ul style="list-style-type: none"> Environmental and Social Manager Community Liaison Officer
Cumulative impacts to proposed conservation areas		18. Collaborate with Other Mining Operators in a Local Forum	Evidence of dissemination of intelligent and up-to-date information	<ul style="list-style-type: none"> Environmental and Social Manager Dallol General Manager
Indirect loss of habitats and associated species		22. Cultivation of Doum Palms	Evidence of abundant palms on site and accessible to local communities	<ul style="list-style-type: none"> Environmental and Social Manager

Annex A

Business and
Biodiversity
Offsets Programme
(BBOP) Website
and Programme
Outputs

The Business and Biodiversity Offsets Programme (BBOP) website can be accessed at: <http://bbop.forest-trends.org>.

The results of the first phase of BBOP's work, from 2004 to 2009, include:

- The BBOP Principles on Biodiversity Offsets, included in the BBOP document *Business, Biodiversity Offsets and BBOP: An Overview*, available at www.forest-trends.org/biodiversityoffsetprogram/guidelines/overview.pdf.
- Interim guidance comprising: the Biodiversity Offsets Design Handbook (available at www.forest-trends.org/biodiversityoffsetprogram/guidelines/odh.pdf); the Cost-Benefit Handbook (available at www.forest-trends.org/biodiversityoffsetprogram/guidelines/cbh.pdf); and the Offset Implementation Handbook (available at www.forest-trends.org/biodiversityoffsetprogram/guidelines/oih.pdf).
- Resource papers on biodiversity offsets and stakeholder participation (available at – www.forest-trends.org/biodiversityoffsetprogram/guidelines/participation.pdf); and the relationship between biodiversity offsets and impact assessment (available at www.forest-trends.org/biodiversityoffsetprogram/guidelines/eia.pdf).
- Case studies of the BBOP pilot projects (available at www.forest-trends.org/biodiversityoffsetprogram/guidelines/).
- Summary case studies of some other examples of compensatory conservation (available at www.forest-trends.org/biodiversityoffsetprogram/guidelines/non-bbop-case-studies.pdf).

The results of the second phase of BBOP's work (2009 to 2012) include:

- The Standard on Biodiversity Offsets, available at <http://bbop.forest-trends.org/guidelines/Standard.pdf>
- Guidance Notes to the Standard on Biodiversity Offsets, available at http://bbop.forest-trends.org/guidelines/Standard_Guidance_Notes.pdf.
- Resource Paper: Limits to What Can Be Offset, available at http://bbop.forest-trends.org/guidelines/Resource_Paper_Limits.pdf.
- Resource Paper: No Net Loss and Loss-Gain Calculations in Biodiversity Offsets, available at: http://bbop.forest-trends.org/guidelines/Resource_Paper_NNL.pdf
- This updated Glossary, available at http://bbop.forest-trends.org/guidelines/Updated_Glossary