Feasibility Study Report

Long-term fencing solution to Human-Wildlife Conflict in Naibunga Conservancy

Prepared by:
Sirimon Thomas
sirimonfbt@gmail.com
+254703757987
P.O. Box 1011
Nanyuki
10400
Kenya

Submitted to:
Northern Rangelands Trust (NRT)
Attn: Ian Craig
Private Bag,
Isiolo
60300
Kenya

Date: January 2020
Executive Summary

Naibunga Conservancy covers 466 km² of Laikipia North sub-county, bordering Isiolo County to the north. It is comprised of nine group ranches which registered as a community conservancy in 2003 with the help of AWF and LWF. Initially, 127 km² were set aside for conservation purposes. The rest of the land was designated as either settlement or grazing areas. The conservancy joined NRT in 2007.

The people of Naibunga are Mukogodo Maasai who are predominantly pastoral, keeping cattle, shoats and a few camels. This livelihood is supplemented by sand harvesting, bee keeping, micro-enterprise and employment. This lifestyle is highly compatible with wildlife and has historically existed alongside wildlife.

However, there are still significant numbers of human-wildlife conflict incidences in Naibunga. The most important of these with regards to human life, injury and livelihood is conflict with elephant. This has been a large problem in Naibunga, prompting the chairmen and community to repeatedly request assistance with this problem. In response, NRT contracted a feasibility study regarding long-term fencing solutions to the human-elephant conflict in Naibunga. This report presents the findings of the study.

The fence was conceptually intended to exclude elephant from the settled areas, while still allowing people and livestock to move freely. The key factors influencing the proposed fence included:

• Land-use designations – Naibunga Conservancy has a land-use plan outlined in their Conservancy Management Plan (CMP), which designates settlement, grazing and conservation areas. However, this CMP is due for review and this fence should be the basis for a larger discussion regarding comprehensive and enforced land-use planning across Naibunga as a whole.
• **Settled areas** – Existing settlements are widely dispersed, often outside designated settlement areas. These were visited during the ground-truthing exercise and efforts were made to encircle formal settlements and trading centers. However, it is hoped that the fence will encourage people to build settlements in a more organized way and develop a better settlement plan, bearing in mind a projected growth in the population.

• **Elephant movement** – Many elephants pass through Naibunga travelling between Laikipia and Isiolo/Samburu to the north. They predominantly follow luggas but also seek out *Opuntia stricta* in dry seasons. These movements were analyzed from GPS collar data and community reports on elephant movements.

• **Water** – Water sources were found to be a common conflict point. Considerations for the fence include protecting key human water sources inside the fence and ensuring sufficient water outside the fence for elephants, so they are not incentivized to break the fence.

• **Schools** – Another point of conflict was found to be children travelling to and from school. Therefore, efforts were made to encircle schools and their access routes to mitigate this conflict.

• **Maintenance** – This was highlighted as a critical part of the project’s success. This should be built in to the conservancy budget and structured in such a way as to ensure community ownership and upkeep the fence.

These factors, and others outlined in detail in the report, all contributed to the recommended alignment and design given in Section 7. These factors were elucidated through extensive stakeholder consultation, as detailed in section 5. Collaboration with the chairmen and managers of Naibunga was constant throughout the study and included a ground-truthing exercise where alignments were discussed and adjusted on site.

This report provides recommended alignments and fence designs that were devised through working with the Naibunga leadership and community, and through other stakeholder consultation. Despite this extensive consultation, further discussion with stakeholders, specifically the local community, is necessary and may result in modifications to the proposed design and alignments provided in this report. This community involvement and ownership of the project will ensure this project results in a more organised, harmonious and prosperous future for Naibunga Conservancy.
# Table of Contents

Executive Summary .................................................................................................................. 1  
1. Introduction .......................................................................................................................... 5  
  1.1. Project introduction ......................................................................................................... 5  
  1.2. Objectives & outputs of this study .................................................................................. 5  
  1.3. Approach ........................................................................................................................ 6  
  1.4. This report ........................................................................................................................ 6  
2. Policy and legal framework .................................................................................................... 8  
  2.2. Environmental Management Coordination Act (EMCA, 1999, amended 2015) .......... 8  
    2.2.1. National Environment Action Plan (NEAP) ........................................................... 9  
  2.3. National Environmental Policy (2013) ............................................................................ 9  
  2.4. Wildlife Conservation and Management Act (2013) .................................................... 9  
    2.5.1. Community Land Act (2016) .................................................................................. 10  
  2.6. Vision 2030 .................................................................................................................... 10  
3. Situation analysis ................................................................................................................... 11  
  3.1. Naibunga physical area ................................................................................................. 11  
  3.2. Naibunga community and livelihoods .......................................................................... 11  
  3.3. Naibunga Conservancy management structures and land ownership ......................... 12  
  3.4. Summary of human-wildlife conflict on Naibunga ....................................................... 13  
    3.4.1. People ....................................................................................................................... 13  
    3.4.2. Elephants .................................................................................................................. 15  
  3.5. Conservancy Management Plan .................................................................................... 16  
4. Project concept ..................................................................................................................... 19  
5. Stakeholders ........................................................................................................................ 21  
6. Key findings .......................................................................................................................... 23  
  6.1. Environmental Feasibility .............................................................................................. 23  
    6.1.1. Elephant movements ................................................................................................. 23  
    6.1.2. Elephant behaviour in response to fences ............................................................... 24  
    6.1.3. Opuntia distribution .................................................................................................. 24  
    6.1.4. Ecological impact of elephant exclusion ................................................................. 25  
    6.1.5. Other wildlife .......................................................................................................... 25  
    6.1.6. Water access for elephants ....................................................................................... 25  
    6.1.7. Fencing out conservation ......................................................................................... 25
1. Introduction

1.1. Project introduction

This study was contracted by the Northern Rangelands Trust, in association with and on behalf of Naibunga Conservancy, in December 2019. Specifically, the study was focused on addressing human-elephant conflict, which has repeatedly been raised by the board and management of Naibunga as a significant challenge, causing death and injury to both people and livestock. This culminated in demonstrations in Nanyuki in 2014, after which a task force was convened comprised of NRT and Space for Giants to look in to the human-elephant conflict in Naibunga and provide recommendations on its mitigation. Since 2014, human-elephant conflict on Naibunga has continued. This project, therefore, is in response to the continued death and injury of people and livestock caused by elephants in Naibunga and the continued death of elephants in that region. This document is the initial stage of this project and details the findings of the feasibility assessment regarding long-term fencing solutions to the human-wildlife conflict in Naibunga Conservancy.

1.2. Objectives & outputs of this study

This work aimed to explore the feasibility of fencing solutions to the human-elephant conflict in and around Naibunga. The feasibility study was to result in a report (this document), a map of proposed alignments and a budgeted project proposal that could be used to source funding for implementation of the fence.
These outputs are in accordance with the Terms of Reference (TOR), provided in Appendix A.

The feasibility study was also to be conducted collaboratively with the chair and board of Naibunga, KWS, Country Government of Laikipia and relevant NGO’s in the area. This was to build understanding and support for the project, especially among the Naibunga community members. This would allow the proposed fence design and alignments to carry a sense of community ownership for the fence. This in turn will be fundamental to long-term maintenance of the fencing infrastructure.

Despite this extensive stakeholder consultation, further and ongoing consultation with stakeholders, especially with the Naibunga community, will be required as this project moves forward. The alignments and design proposed here are preliminary, having been agreed with stakeholders, but may still be subject to review and alteration as needed or requested by the stakeholders.

1.3. **Approach**

This feasibility study was conducted in several phases, as outlined below:

1. Initial stakeholder contact - to introduce the project and understand the project context,
2. Preliminary remote mapping - based on stakeholder consultation and data accumulation and review,
3. Proposed alignment review- return of proposed alignment to stakeholders for comment,
4. Ground truthing- visiting the proposed alignment with the community to verify alignments, including further stakeholder-lead modifications,
5. Report and feedback- draft report,
6. Final recommendations.

The study was approached from five angles:

1. Environmental feasibility
2. Social feasibility
3. Technical feasibility
4. Legal feasibility
5. Financial/Economic feasibility

1.4. **This report**

This document presents the results, findings and recommendations from the feasibility study. It includes a summary of the legal context for a project such as this and the Naibunga Conservancy situation, as it relates to the people, livestock, wildlife and environment. The fencing priorities and methodology for devising the
proposed alignment are discussed. The comments of consulted stakeholders are presented in summary then the study findings, based on the consultations with stakeholders, are laid out in terms of environmental, social, technical, legal and financial feasibility. Finally, recommendations are given regarding the alignment, design and maintenance of the fence. The next steps for the project to move forward are also laid out.
2. Policy and legal framework

This section provides a very brief review of the existing Kenya legislation and policy pertaining to a project of this nature. This includes policy and legislation relating to topics such as land, environment, agriculture, tourism, water, safety, and economic opportunity. The project described and discussed in this document will be achieved within the bounds of the legislation, policies and acts outlined below.


The CoK is the fundamental basis of legislation in Kenya. Of specific relevance to this project are:

- Article 26 (1) – “every person has the right to life.”
- Article 42 – “every person has the right to a clean and healthy environment which includes the right to have the environment protected for the benefit of present and future generations through legislative and other measures.”
- Chapter 5 – all constitutional matters relating to Land (Part 1) and Environment and natural resources (Part 2).
- Fourth Schedule – Distribution of functions between the National Government and the County Governments. Under this Schedule, National Government is responsible for “protection of the environment and natural resources with a view to establishing a durable and sustainable system of development, including … protection of animals and wildlife” (Part 1, Article 22).

County Governments are responsible for:

- Trade development and regulation, including local tourism (Part 2, Article 7 (d)),
- County planning and development including land survey and mapping and, boundaries and fencing (Part 2, Article 8 (b) and (c)),
- Implementation of specific national government policies on natural resources and environmental conservation, including soil and water conservation and forestry (Part 2, Article 10).

2.2. Environmental Management Coordination Act (EMCA, 1999, amended 2015)

EMCA is the framework law on environmental management and conservation. It provides for the integration of environmental concerns into national policies and plans. In this regard, it calls for the establishment of the National Environmental Management Authority (NEMA) which is the principal institution of government charged with the implementation of all policies relating to the environment, as well
as general supervision and coordination over environmental matters. This is the body that manages the Environmental Impact Assessment (EIA) process.

2.2.1. National Environment Action Plan (NEAP)
The NEAP for Kenya was initially formulated in 1994, with the most recent version covering the period 2009-2013. Under EMCA, this is to be written every five years.

The NEAP was an effort to integrate environmental considerations into the country's economic and social development. The integration process was to be achieved through a multi-sectoral approach to develop a comprehensive framework to ensure that environmental management and the conservation of natural resources are an integral part of societal decision-making.

2.3. National Environmental Policy (2013)
The National Environmental Policy aims to integrate environmental concerns and protection into national development plans. The broad policy objectives include:

- Optimal use of natural land and water resources in improving the quality of human environment,
- Sustainable use of natural resources to meet the needs of the present generations while preserving their ability to meet the needs of future generations,
- Integration of environmental conservation and economic activities into the process of sustainable development,
- Meet national goals and international obligations by conserving bio-diversity, arresting desertification, mitigating effects of disasters, protecting the ozone layer and maintaining an ecological balance on earth.

2.4. Wildlife Conservation and Management Act (2013)
This Act is the legal description of the Government of Kenya’s obligations with regards to wildlife conservation and the structures put in place to fulfil those obligations. This includes the relative responsibilities of National and County Governments with regards to wildlife, the creation and operation of the Kenya Wildlife Service, governmental mechanisms for compensation for human-wildlife conflict, and designation of land to conservation and protection of nature (national parks, reserves, conservancies etc.). This Act is highly relevant to the current project.

The aim of the National Land Policy is to promote best land use practices for optimal utilization of the land resources in a productive, equitable and sustainable manner. The Policy lays out the legislative structures for land ownership, designation, administration and management. This covers various areas of relevance to this project:
• Chapter 3.4.1 Land Use Planning Principles - This provides the principles on which Kenya bases land use planning, including an outline of the issues affecting land use planning with regards to the law.

• Chapter 3.4.3 Environmental Management Principles – This outlines the obligations of the Government of Kenya regarding issues of environmental management and provides the principles on which those obligations are built.

• Chapter 3.6.3 Pastoral Land Issues – Recognizes pastoral land issues as a unique situation with specific factors that must be understood and facilitated in law.

2.5.1. Community Land Act (2016)

This Act is “to provide for the recognition, protection and registration of community land rights; management and administration of community land; to provide for the role of county governments in relation to unregistered community land and for connected purposes.”

Essentially this Act defines the official governmental structures for communal land, the ways in which communal land is to be owned, handled and managed and, how communal land authorities are to interact with National and County Governments.

2.6. Vision 2030

Kenya’s Vision2030 is the Government of Kenya’s long-term development blueprint for the country for the period up to 2030. This is structured in three ‘Pillars’: Economic, Social and Political, and was built to incorporate the Millennium Development Goals and push Kenya into a more prosperous future.

In this plan, Tourism and Agriculture are housed under the Economic Pillar, and Environmental Management under the Social Pillar. In accordance with the MDGs, the plan focusses heavily on poverty reduction and sustainable land use, with the aim to be a nation that has a clean, secure and sustainable environment by 2030.
3. Situation analysis

3.1. Naibunga physical area

Naibunga Conservancy covers approximately 466 km$^2$ and is situated in Northern Laikipia, bordering Isiolo and Samburu counties to the North (Figure 1). To the west it is bounded by the Ewaso Nyiro river and to the east by KuriKuri and Makurian group ranches. South of Naibunga are large privately owned ranches, some of which are fenced to exclude elephants. The ecology of Naibunga is mostly categorized as a savannah grassland/woodland mosaic, dominated by *Acacia* spp. The area contains extensive hills in the Upper and Central Units and flattens out through the Lower Unit to the Ewaso Nyiro to the west. The area is semi-arid, ranging from 700 to 500 mm/year along an approximate southeast-northwest axis, with a bimodal rainfall pattern.

3.2. Naibunga community and livelihoods

The people of Naibunga are predominantly Mukogodo Maasai, with smaller ethnic groupings also recognized and loosely associated with the separate group ranches. Agro-pastoralism remains the main livelihood for the majority of the community, although alternative revenue streams include sand harvesting, small-scale
agriculture, micro-businesses and employment through NRT, government, NGO’s and other organizations. Tourism also provides some employment and community income through a few lodges (Ol Gaboli, Koija Starbeds, Lewaso Cottages, and Lentile Sanctuary) and there is a desire to increase the tourism capacity in the conservancy.

3.3. Naibunga Conservancy management structures and land ownership

Naibunga Conservancy is composed of nine group ranches, which are organized into three Units; Lower Unit (Koija, Il Motiok & Tiemamut), Central Unit (Musul, Nkiloriti & Kijabe) and Upper Unit (Morupusi, Il Polei & Munishoi). Each Unit has a chairman and manager, as well as a nine-member board; three from each group ranch (one of whom is the chairman for the group ranch). This makes for a 27-member full board. There is then an umbrella board of nine members, comprised of the chairman, secretary and finance chairman for each Unit.

![Figure 2: Naibunga group ranches.](image)

The land is held under a communal title for each group ranch, with all members holding a title. In accordance with the Community Land Act (2016), these group ranch titles have to be reviewed and changed to Community Land titles. The group ranches are currently in the process of making this transition.
3.4. Summary of human-wildlife conflict on Naibunga

3.4.1. People

In terms of human injury and death, elephants are the greatest danger to the residents of Naibunga. Reported incidences of human-elephant conflict resulting in death, injury or property damage for 2009-2019 are presented in Table 1 and shown in Figure 3.

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Location</th>
<th>Conflict Type</th>
<th>People Killed</th>
<th>People Injured</th>
</tr>
</thead>
<tbody>
<tr>
<td>26/10/2009</td>
<td>15:20</td>
<td>Piriwa</td>
<td>Livestock Death</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>01/12/2009</td>
<td>21:15</td>
<td>Oldupai</td>
<td>Human Death</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>26/05/2010</td>
<td>00:00</td>
<td>Lorubai</td>
<td>Human Death</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>23/07/2011</td>
<td>18:30</td>
<td>Nongamuriak</td>
<td>Human Death/Injury</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>10/03/2014</td>
<td>14:30</td>
<td>Tura</td>
<td>Livestock Death/Injury</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>10/03/2014</td>
<td>08:20</td>
<td>Tura</td>
<td>Livestock Death/Injury</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>03/05/2014</td>
<td>12:30</td>
<td>Nongamuriak</td>
<td>Human Death/Injury</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>09/05/2014</td>
<td>02:00</td>
<td>NA</td>
<td>Crop Raiding</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>14/05/2014</td>
<td>09:00</td>
<td>Lariak Lengai</td>
<td>Human Death/Injury</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>22/11/2015</td>
<td>17:00</td>
<td>Lorubai</td>
<td>Livestock Death/Injury</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>07/01/2017</td>
<td>11:45</td>
<td>Soit Oudo</td>
<td>Human Death/Injury</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>25/03/2017</td>
<td>09:03</td>
<td>Leshashi</td>
<td>Livestock Death/Injury</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>30/03/2017</td>
<td>08:00</td>
<td>Kunanjo</td>
<td>Livestock Death/Injury</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>03/04/2017</td>
<td>19:00</td>
<td>Leshashi</td>
<td>Property Damage</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>28/04/2017</td>
<td>17:30</td>
<td>Mpejot</td>
<td>Human Death/Injury</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>17/05/2017</td>
<td>06:00</td>
<td>Lolaurak</td>
<td>Livestock Death/Injury</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>14/02/2018</td>
<td>11:00</td>
<td>Orbutiany</td>
<td>Human Death/Injury</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>03/04/2018</td>
<td>09:00</td>
<td>Leshashi</td>
<td>Livestock Death/Injury</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>30/09/2018</td>
<td>01:00</td>
<td>Nongamuriak</td>
<td>Human Death/Injury</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>11/04/2019</td>
<td>14:00</td>
<td>Lorubai</td>
<td>Other</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>26/07/2019</td>
<td>06:30</td>
<td>Oldupai</td>
<td>Human Death/Injury</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>27/07/2019</td>
<td>18:30</td>
<td>NA</td>
<td>Human Death/Injury</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>03/09/2019</td>
<td>16:00</td>
<td>NA</td>
<td>Human Death/Injury</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>9</strong></td>
<td><strong>4</strong></td>
</tr>
</tbody>
</table>

*Table 1: Reported human-elephant conflict incidences since 2009 (NRT)*
Through discussion with the Naibunga community and rangers, three societal-groupings were found to be most at risk of conflict with elephants:

- Women collecting water—these incidences often occur in the evening or early morning when women go to dams and pans to collect water and encounter elephants. This poses both a physical risk to the people and also results in lost productivity due to having to spend time negotiating the situation before being able to collect water.

- Children traveling to and from school—again, these incidences generally occur in the early morning or evening. Additionally, the threat of elephants means that children are sometimes kept home from school to help defend the homestead against elephants. This is especially true in areas around Dol Dol, for example, where small scale agriculture is practiced and crop-raiding causes major livelihood loss. Community members report that the elephants have resulted in many people giving up on farming around Dol Dol.

- People traveling home from town in the evening or late at night—these people are often traveling by motorbike or on foot, encounter elephants on the road and are subsequently injured or killed. These conflicts may be exacerbated by people attempting to aggressively chase the elephants out of the road or being inebriated at the time.
A more in-depth discussion of the history of the human-elephant conflict in Naibunga is presented in "A Human-Elephant Conflict Mitigation Strategy for Naibunga Conservancy, Kenya" (2014), the report written by the 2014 task-force that was convened to investigate the issue specifically.

The Kenyan Government does maintain a compensation scheme for wildlife conflict. This scheme provides 5 million shillings for loss of life, 0-3 million shillings for injury (situation dependent) and market-value based compensation for livestock loss. However, community members in Naibunga report that many claims have been filed but it is extremely rare for any compensation to be received.

Other wildlife species also cause problems for the residents of Naibunga, especially (in order of importance) hyena, leopard and lion. These incidences mostly involve livestock killings and rarely involve injury or death of people. These species will not be affected by the proposed fence and will become a more central issue if the elephant conflict is significantly reduced. Mitigating these conflicts may involve access to improved boma infrastructure, improved conservation to increase plains game for the carnivores to predate instead of livestock, and KWS facilitated relocation of problem carnivores. However, mitigation of these conflicts is secondary to the human-elephant conflict as elephants currently pose the greatest risk to human life in Naibunga.

3.4.2. Elephants

There have also been many reported elephant deaths within Naibunga. These result from natural causes, conflict retaliation, poaching and problem animal control. Although incidences reported here are from Naibunga, it should be remembered that elephant injured elsewhere may have travelled into Naibunga before dying.

Figure 4, below, shows incidences where elephants were illegally killed in Naibunga in retaliation for injury or death of people or property damage, since 2009.
Since 2009 there have also been 18 cases of elephant illegally poached for tusks, 4 cases of KWS-approved euthanasia for Problem Animal Control (PAC), 34 natural deaths and 16 deaths of unknown cause.

3.5. Conservancy Management Plan
There have been several attempts to institute land-use planning for Naibunga, with support from various partners. These included:

- An LWF/AWF/USAID supported effort in 2004 (“Natural Resources Management Plan for Naibunga Conservancy” (2004)),
- An International Conservation Caucus Foundation (ICCF) backed effort in 2012 (“Naibunga Conservancy Trust Land Use Strategy” 2012)),
- The NRT supported Conservancy Management Plan (CMP) from 2017.

These have broadly adhered to a similar land-use designation as maintained on the ground by the chairmen and/or elders of the community and presented in the CMP as shown in Figure 5.
This CMP, developed in association with NRT for the period 2017-2021, lays out land use designations for dry and wet season grazing, conservation and settlement across Naibunga\(^1\).

These were discussed and reviewed with the chairmen and managers of Naibunga for two purposes; a) so that the established land-use designations could influence the proposed alignments and b) so that the proposed fence could be incorporated into the longer-term land-use designation and management plan for Naibunga. This integration of the proposed fence with a conservancy-wide management plan will be crucial to the fence’s utility, success and sustainability.

The Naibunga CMP also lays out six goals for the conservancy:

1. Improving Services for Community Development,
2. Building Peace and Security,
3. Conserving Wildlife,
4. Productive Land,
5. Strong Conservancy Institution,

\(^1\) These appear to be semi-fluid in response to climatic and social stressors, such as drought or invasion of non-resident cattle from Isiolo and Samburu counties and as such, were not adhered to rigorously but were still influential in devising the proposed alignments.
These were reviewed and discussed with the chairmen and management of Naibunga and used to define the fencing priorities, as outlined in section 4, which in turn influenced the proposed alignments.

However, the CMP is dated till 2021 and so may be due for review next year. This may be timely in that this fencing project may be used as a foundation for the next phase of conservancy planning and may provide an opportunity to reconsider land-use designations and build a more comprehensive land-use strategy for Naibunga.
4. Project concept

Based on the Terms of Reference, as provided in Appendix A, a basic concept and alignment were devised:

“2/3-strand high-wire fences in 2 zones:

(1) Il Polei, Makurian, Dol Dol,

(2) Kimanjo, Mukogodo ranch, Kaparo’s Farm, Oldonyiro road.”

Considering the various objectives that Naibunga Conservancy maintains, as outlined in the Naibunga Conservancy Management Plan, the overall objective for this fencing project was defined as ‘to mitigate human-elephant conflict by encircling settled areas, leaving space for passage of elephants moving from Samburu to Laikipia, while minimally affecting movement of livestock and people’.

Through discussion with NRT and the chairmen and management of Naibunga, a list of priorities for fence alignment and design were elucidated. These are outlined below, in order of priority.

The fence should:

- Minimize human-elephant and livestock-elephant interaction
• Allow elephants to move between Samburu/Isiolo and Laikipia
• Minimally interfere with movement of livestock
• Minimally interfere with movement of people
• Encourage planned/organized settlement development (as human population grows)
• Avoid lugga crossings & erosion gullies (as elephants can pass under the fence) so utilize ridgelines
• Follow roads for easy maintenance access, where possible

These priorities were applied non-algorithmically, along with extensive Google Earth use, to produce an initial conceptual fence alignment and design, which is presented in Figure 6. This was used as the basis for discussion with stakeholders and was updated as recommendations were built in to the project. This was then ground-truthed in the presence of the Naibunga chairmen and modified accordingly. A final proposed alignment was then produced and reviewed with the chairmen and KWS. This final recommended alignment is provided in section 7.2.
5. Stakeholders

A summary of the consultations with stakeholders is given below.

A full list of stakeholders and details of consultation is provided in Appendix B.

<table>
<thead>
<tr>
<th>Consulted</th>
<th>Date</th>
<th>Comments</th>
</tr>
</thead>
</table>
| Chairmen                      | Throughout            | • As the chairmen represent the Naibunga community, their opinion was solicited on as many aspects of the project as feasibly possible and their comments and concerns were strongly considered and accommodated as much as possible.  
  • The chairmen provided the current land-use plan for Naibunga and articulated their vision for the future of the conservancy, including how this fence would fit in to that vision.  
  • Preliminary alignments were checked with the chairmen and ground-truthed with the chairmen and managers, where modifications to the alignments were made. |
| Scouts                        | 14/1/2020, 15/1/2020, 16/1/2020, 17/1/2020 | • Scouts were involved in ground-truthing exercises.  
  • Water points are a hot-spot of conflict.  
  • Worst human-elephant conflict is in the Lower Unit, in Northern Tiemamut group ranch and Kojia ground ranch (even the Central and Upper Unit scouts reported this).  
  • Community will support the fence and will be willing to take on the responsibility of maintenance. |
| Ministry Land, Environment & Natural Resources | 9/1/2020, 23/1/2020 | • Resettlement may be needed but will have to depend on community support for the project.  
  • Good settlement planning makes for better service provision; reference to the Solio settlement scheme was made as a showcase.  
  • Strong community leadership will be necessary for project success.  
  • Maintenance mechanisms are crucial.  
  • Water provision for wildlife outside the fence needs to be considered. |
| KWS                           | 9/1/2020, 23/1/2020, 28/1/2020 | • KWS has a plan to fence Dol Dol which is stalled in the EIA stage. There are materials for this fence on site in Dol Dol. This KWS project and the proposed project will have to be amalgamated, based on which project reaches implementation first.  
  • KWS is interested to increase capacity in the region, possibly including new KWS post at the Naibunga Lower Unit HQ.  
  • Resettlement of people to inside the fence will be needed and is the responsibility of the chairmen.  
  • Education of people regarding behaviour towards wildlife, specifically elephant, can be very effective for mitigating conflict and has been very successful in other regions.  
  • Maintenance is very important.  
  • Water access for elephants outside the fence is very important—concurrent water projects for wildlife outside and people inside is advisable. Otherwise, alignment has to ensure sufficient water outside. This is particularly important at the Tiemamut Dam, north of Kimanjo. Recommend this be left outside and times be arranged for people and livestock to access it when elephant are not there.  
  • Full EIA must be completed and must involve extensive community consultation. |
<table>
<thead>
<tr>
<th>Location</th>
<th>Date</th>
<th>Information</th>
</tr>
</thead>
</table>
| Rhino Ark         | 24/1/2020        | • Maintenance is the most important element.  
• The Rhino Ark maintenance model; 1 fence attendant for every 7 km (selected as the best builder every 7 km of construction) reporting to a fence supervisor with a motorbike who covers ~50km. Supervisors report to fence committees. Data is collected on fence functioning and maintenance continually with data analysis and review by stakeholders on a monthly basis.  
• Community engagement and ownership is critical. Drawing labour for construction from local community helps with this.  
• Up to 80% of fence outages can be caused by people.  
• At least 8kV required for elephants.  
• EIA community consultation is not sufficient on its own- continual consultation and dissemination of proposed project is important for success. |
| Space for Giants  | 10/1/2020, 22/1/2020 | • Short fences with outriggers are most effective against elephant. This design with gates for people and livestock may be preferable.  
• A few fence-breaking elephants cause the majority of fence breaks, and teach other elephants.  
• Maintenance must be daily or more.  
• Energiser needed every 5-10 km to maintain a minimum effective voltage of 7kV.  
• Community ownership will be key.  
• Consider using school buses and matatus/rangers for water collection to mitigate conflict instead.  
• Approximate costs for proposed fence design. |
| MKT               | 10/1/2020        | • Short fence with outriggers and gates may be most effective. Alternatively, consider using a short fence for sections that are not heavily traversed by people and a high fence where people and livestock need to pass.  
• 3 strands will be needed; LLN (neutral can be buried).  
• Approximate costings for construction and maintenance. |
| Ol Jogi           | 13/1/2020        | • High fence as proposed is a suitable design and is being implemented in some places on Ol Jogi successfully.  
• Post protection is needed with outriggers covering the whole post. This can be achieved with live wire rings around the posts or descending live wires with outriggers.  
• KWS rangers on Ol Jogi could be reposted to Naibunga to aid with human-wildlife conflict response.  
• Weights/joints on danglers for road & lugga crossings will help to avoid tangling and maintenance issues.  
• Minimum 10kV recommended. |
| Mpala             | 13/1/2020        | • Maintenance will be the key issue.  
• Concern regarding the Daraja, Il Motiok and Waso settlements.  
• Cost estimates regarding construction and maintenance. |
| Lewa              | 23/1/2020        | • The lower the fence, the better (5-5.5 ft lower strand recommended).  
• Elephants will pass underneath a high fence as they have been seen doing on Lewa.  
• Buried ground wire 1.5m in front of fence to maximise shock.  
• Outriggers extending horizontally off the bottom strand.  
• Danglers are needed at lugga crossings to make the fence effective.  
• Cost estimates. |
6. Key findings

The key findings presented here are based on stakeholder consultation described in section 5 and extensive research surrounding the proposed project.

6.1. Environmental Feasibility

The fencing of a large area obviously has a significant effect on the environment in that area. The proposed design and alignment try to balance these various factors to attempt to create the most congruent and effective fence possible. These factors are discussed below.

6.1.1. Elephant movements

Elephant collar data shows that elephants predominantly use luggas to move through the Naibunga area. Many elephants pass through Naibunga when moving from Samburu and Isiolo up in to Laikipia, and back. This is especially concentrated in the Koija area with elephants moving in to Loisaba and Mpala or following the Ewaso Nyiro.

Figure 7: Elephant movement through Naibunga Conservancy, from GPS collar data (Save the Elephants, KWS, NRT)
6.1.2. Elephant behaviour in response to fences
Consulted experts say that a short fence (~ 3ft) with outriggers is currently most effective against elephants. However, due to the design priorities outlined in section 4., this type of fence is not feasible. It has also been reiterated that elephants will eventually find a means to break or otherwise pass the fence. For the proposed design of a high fence, this will likely involve crawling underneath the fence. This behavior has been observed in Lewa and other places. Some means to update the fence design when the elephants devise a way to break it is recommended. For the proposed design, it has been suggested that droppers might be used but this is not feasible due to the need for livestock to pass freely beneath the fence.

6.1.3. Opuntia distribution
The community report that the elephant population in Naibunga increases significantly during dry seasons when the elephants accumulate in Naibunga to feed on the Opuntia stricta. As the Opuntia has classically grown in more degraded areas which generally occur closer to settlements, this behavior draws the elephants closer to people and keeps them in the vicinity of the settlements.

Figure 8: Opuntia distribution across Naibunga Conservancy (Opuntia Mapping and Monitoring in Kenya, USFS Technical Mission Report II, 2018)
6.1.4. Ecological impact of elephant exclusion
There has been significant study of this ecological change done by the Kenya Long-term Exclosure Experiment (KLEE) based on Mpala. The main ecological effect of exclusion of megafauna (elephant and giraffe) is significant bush encroachment. There are also changes in feeding behavior of livestock and other wildlife in response to the exclusion of elephant. However, as the area that will be circled is human-dominated and mostly settled, these findings may not be applicable to Naibunga.

6.1.5. Other wildlife
The proposed design of the fence will only affect the movement of elephant and giraffe. This is a function of the desire to maintain free livestock movement but also results in free movement of all other wildlife. This includes predators which often predate livestock and cause livelihood damage for the people of Naibunga. This will become a more critical issue as the relative frequency of elephant conflict is diminished by the proposed fence.

6.1.6. Water access for elephants
Several stakeholders, notably KWS, have raised concerns regarding provision of water for elephants outside the fence. This is a valid concern as insufficient water for elephants outside the fence will incentivize fence-breaking behavior, especially where the fence encircles a dam that is currently heavily visited by elephant. Elephant collar data has shown that this is especially critical in a few areas, including the Dol Dol dam and the dam north of Kimanjo, which are heavily utilized by elephant. Where possible, the alignment should attempt to leave an alternative water source outside the fence when a frequently used dam is encircled within the fence. Otherwise, it may be worth investing in water infrastructure concurrent with this fencing project, both for people inside the fence and elephant outside the fence, to mitigate this conflict. This is contrary to the recently completed Water Management Plan for Naibunga (Rural Focus, 2019) which advocates for efforts to ensure perennial Ewaso Nyiro flow and not implement any new water points specifically for wildlife. However, that document was finalized before this feasibility study was solicited.

6.1.7. Fencing out conservation
Fencing an area for settlement essentially prevents that area from being utilized in a conservation or tourism capacity. This means fence alignment should consider the current designated conservation areas and ensure space is left outside the fence for development of the area’s tourism potential in the future.
6.2. Social Feasibility

The main groups at risk of human-elephant conflict, as discussed in section 3.4, were found to be:

- Women collecting water,
- Children travelling to/from school,
- People travelling home from town in the evening or late at night.

With these in mind, it has been suggested that less capital-intensive solutions to the human-elephant conflict might be considered, including rangers for water collection and school buses. This could be a helpful addition to areas that are not covered by the fence, and may help to pacify political tension caused by the proposed alignments. However, the diversity of times and locations of people within the groups outlined above makes this solution logistically unfeasible, leaving a fence as the best solution.

While the disruption caused by elephants to the community is a significant problem, any proposed fence must ensure that the fence does not prevent the community from carrying out other activities that they are dependent on. There are several areas where this is important.

6.2.1. Access to water

The fence should encircle key water points so that people can freely collect water as needed. This should be considered within the recommendations of the Water Management Plan for Naibunga (Rural Focus, 2019) and should also consider access to water for elephants, as mentioned in section 6.1.6.
6.2.2. Grazing access
As pastoralism and livestock are a mainstay of livelihoods in Naibunga, access to designated grazing areas for livestock is crucial. This should be considered when devising fence design.

Although the majority of livestock in Naibunga are cattle and shoats, there are several families with camels in the Kimanjo area and others in the Koija group ranch. Either, it must be agreed with the camel-keeping families and the chairmen that the camels will be kept outside the fence, or gates must be installed where the fence crosses the major roads (at least two gates per circular fence) to allow camels to pass through. These gates would have to be policed to ensure they are not left open.

6.2.3. Sand harvesting
This represents a significant alternative or supplemental income stream for Naibunga. These trucks often use small tracks to access luggas for harvesting and do not always use main roads. This activity could therefore be easily disrupted by a fence. This should be accounted for and high road crossings with danglers should be built with relative frequency in areas where sand is harvested.

6.2.4. Travel and transport
This includes movement of children to and from school and movement between town centers and out-lying settlements. This should influence the alignments and design of the fence insofar as it allows people to move freely on foot or by vehicle or motorbike.

6.3. Technical Feasibility

6.3.1. Topography
This poses challenges for any fence and there are some parts of Naibunga that would be very difficult to fence. The major topographical problem concerns lugga crossings as luggas (and erosion gullies) create a larger space beneath the fence than otherwise designed. This would provide a space for elephant to pass beneath the fence, undermining its effectiveness. The recommended solution to this is to put danglers at lugga crossings to stop the elephants as other wildlife can pass beneath the fence either side of the lugga.

6.3.2. Elephant behaviour
 Experts with experience in fencing against elephants emphasise the need for outriggers, including down the posts as access to the posts is a common strategy for fence breaking elephant.
It has also been found that elephants will eventually find ways to exploit weaknesses in fence designs to break or otherwise pass them. Novel fence designs usually remain effective for a few years but, as the elephants passing through Naibunga likely have experience with fences in other parts of Laikipia, they will find ways to compromise the fence in a shorter time. A possible solution to this is to increase the ranger and KWS presence in the form of rapid response teams that can deal with fence breaking incidences quickly, before the elephants cause harm inside the fence. KWS has expressed an interest in increasing its presence in Naibunga, especially in the lower area. The possibility of stationing a few KWS rangers at the Lower Unit HQ has been raised and supported but KWS has a current shortage of people and resources for this to be implemented.

6.3.3. Physical fence design

With regards to the height of the fence, the lowest strand should be as low as possible while still allowing people and livestock to pass, as per the objectives of the fence. 5.5-6ft has been recommended.

For the fence to support outriggers, at least two live wires are required and these should be spaced approximately 1ft apart. A neutral wire is also needed and should be buried approximately 1.5m in front of the fence to ensure the elephants are standing on the neutral wire when they touch the live wires. This is to ensure the maximum possible shock is delivered. This 3-
strand (Live, Live, Neutral) design is the simplest and should be used to avoid the cost of extra strands. This also allows for the addition of other strands later, if needed, in response to the elephants figuring out how to compromise the fence.

To support the fence, posts of 5-6 inch diameter are recommended but other designs have used metal bars for straight sections, to reduce cost. 100-120 posts per kilometer has been suggested as sufficient, giving a post spacing of 8-10m.

6.3.4. Power infrastructure
It is recommended that at least must 7 kV be maintained along the full length of the fence for it to be effective against elephant. For the Mount Kenya and Aberdare fences, any voltage less than 5 kV is considered an outage and completely ineffective against elephant. Therefore, energizers and associated power systems must be sufficiently powerful and placed with sufficient regularity to maintain this minimum recommended voltage of 7 kV. The recommended spacing of power stations varies from six to ten kilometers apart.

The other element to maintaining sufficient voltage is fence maintenance. Clearing of vegetation and checking for shorts should be a daily task, although the clearing of vegetation will be a significantly smaller problem than other fences due to the more open savannah ecology and the height of the fence. Maintenance is discussed further below.

The most effective power solution for this fence is solar. However, solar power is a highly-desired technology in Naibunga, so theft of the power equipment is a risk. Other fences house power equipment inside houses/rooms and cement or otherwise fix the panels permanently in place. This makes maintenance or replacement of the panels more difficult. Alternatively, the power equipment can be stored in a locked metal box that is cemented in to the ground and the panel is kept on a tall post that can be lowered but is otherwise locked upright to hold the panel beyond the reach of potential thieves.

The possibility of using beehive fences has been raised, which would do away with the need for power entirely. These fences have been successful in other areas, predominantly to protect smallholder farms from crop-raiding elephant. It is reported that they are quite labor intensive due to the need to look after the bees. This makes beehive fences a less appealing option for a long fence as proposed for this project.

6.3.5. Maintenance
This has been reiterated and emphasized repeatedly as the most important element to the fence's success and effectiveness. The model developed and
used by Rhino Ark on the Mount Kenya and Aberdare fences involves a fence maintainer for every 7km of fence who walks the section daily. This person is selected as the best laborer from the local laborers employed to construct that fence section and offered the job of fence maintainer. The fence maintainers report to a fence supervisor who covers approximately 50km of fence. This person in turn reports to a fencing committee that is created within the local community management. Data on fence breakages and maintenance requirements is collected continually, then analyzed and reviewed by stakeholders (local chairmen, KWS, etc.) on a monthly basis, at least. This ensures maintenance issues can be identified and rectified rapidly and all stakeholders are involved, maintaining ownership of the fence.

This model has also been employed in other NRT conservancies and found to be successful. In Sera conservancy, two fence maintainers are employed for each 7km section of fence. These maintainers cover all daily maintenance tasks and data recording and report to a fence supervisor. The fence supervisor covers approximately 50km of fence (or one supervisor per circular fence in the case of the proposed project), and is provided with a motorbike to effectively cover the entire perimeter. The supervisors report to a fencing committee that is formed within the conservancy governance structures and which reviews the maintenance data monthly with key stakeholders (chairmen, KWS, NRT). This model appears to be the best suited to maintaining fencing projects such as the proposed project.

6.4. Legal Feasibility

6.4.1. Environmental Impact Assessment (EIA)

In accordance with EMCA (1999), Schedule 2, Article 13, a project of this nature will require submission of an EIA study report to NEMA. This EIA study must be conducted by a NEMA registered EIA expert and can take 6-12 months. The process for obtaining an EIA license is as follows:

1. Scoping study from which the Terms of Reference for the EIA study is established by NEMA,
2. NEMA registered EIA expert conducts the EIA study,
3. EIA study report submitted to NEMA,
4. Adverts placed in national gazette,
5. Comments on EIA report (from public or lead agencies including relevant government agencies),
6. NEMA reviews comments & can require further consultations,
7. EIA expert addresses comments,
8. NEMA approves or denies an EIA license, which can be issued with conditions that must be complied with by the project proponent.
6.4.2. Land use
The majority of the land covered by the proposed fence is part of Naibunga Conservancy and under communal ownership of the group ranches. Permission to implement an infrastructural project on this land can be negotiated with the conservancy governance structures i.e. the chairmen and boards. However, extensive local community consultation should be undertaken to ensure full support for the fence. These consultations should be conducted by, or in association with, the chairmen to ensure the project is community lead.

There are also sections of the fence that pass through land that is not within Naibunga. These include KuriKuri group ranch, Makurian group ranch, Dol Dol township and private ranches between Il Polei and Dol Dol. KuriKuri, Makurian and Dol Dol representatives were consulted and all showed support for the project.

Regarding private land, the proposed alignments should minimize private land involvement. A potential way of achieving this is to run the fence close to the roads, which maintain a road reserve as property of the agency in charge of the road (KeNHA, KeRRA or County Government). The width of the road reserve is determined by the class of road. Through discussion with KeRRA, it was established that it would not be possible to build within the road reserve but following the boundary between private property and the road reserve is permitted. However, this must be done with permission of the private land owners. It was decided that negotiation with the affected private land owners should be undertaken by the Naibunga chairmen so as to utilize the established relationships between the chairmen and the private land owners and to help the Naibunga chairmen take ownership of the project from an early stage.

Alternatively, an alignment must be devised that remains within Naibunga conservancy land. This may be needed if private land owners that would be encircled inside the fence wish to maintain elephants on their land. The specifics of these fence sections are discussed in section 7.2.2. but written contractual agreements from any affected private land owners should be obtained before construction begins.

6.4.3. Road crossings
The nature of the project and the area covered require the fence to cross national or county roads. There is a legal requirement to obtain permission from the relevant agencies for every place where the fence crosses these roads. The majority of the main roads in Naibunga fall under the jurisdiction of the Kenya Rural Roads Authority (KeRRA), although permission from County Government is also advisable.
Smaller community built and maintained roads need permission from the community and the chosen infrastructure for crossing these smaller roads should consider sand harvesting and other transport requirements, as discussed in section 6.2.

6.5. Financial Feasibility

6.5.1. Cost-benefit analysis

Given that the objectives of this fencing project involve mitigating loss of life, it is very difficult to conduct a full cost-benefit analysis for the proposed fence. However, to provide rough guidelines, the Government of Kenya’s compensation scheme for human-wildlife conflict can be used. This is outlined in the Wildlife Conservation and Management Act (2013), Part V, Article 25 (3):

(a) in the case of death, five million shillings;
(b) in the case of injury occasioning permanent disability, three million shillings;
(c) in the case of any other injury, a maximum of two million shillings, depending on the extent of injury.

In the case of crops, livestock or other property, under Part V, Article 25 (5), a claimant can receive “compensation valued at the ruling market rates.”
The financial benefits of this fence can therefore be calculated from prevented human-elephant conflict incidences. The available data (presented in Table 1) is summarized in Table 2.

<table>
<thead>
<tr>
<th>Incident</th>
<th>Total Number</th>
<th>Average Incidents per Year</th>
<th>Compensation Rate (Ksh)</th>
<th>Cost per Year (Ksh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Human Death</td>
<td>9</td>
<td>0.9</td>
<td>5,000,000</td>
<td>4,500,000</td>
</tr>
<tr>
<td>Human Injury</td>
<td>4</td>
<td>0.4</td>
<td>3,000,000</td>
<td>1,200,000</td>
</tr>
<tr>
<td>Property Damage</td>
<td>11</td>
<td>1.1</td>
<td>20,000</td>
<td>22,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>33</strong></td>
<td></td>
<td><strong>5,722,000</strong></td>
<td></td>
</tr>
</tbody>
</table>

*Table 2: Summarised available human-elephant conflict data and associated cost (NRT). NB maximum compensation values were used to attempt to balance the incompleteness of the records.*

This approach relies on several assumptions:

- 100% effectiveness of fence in preventing all human-elephant conflict,
- Comprehensive data on all conflict incidences,
- Full compensation for all incidences,

These assumptions are not met in reality and so the numerical estimate provided in Table 2 is a significant under-estimate, even without considering the moral dilemma of valuing human life. These complications mean that this approach to valuing the benefit of the proposed fencing project is unrealistic and should not be relied upon.

There are other factors that a fence will alter that will change productivity and or livelihoods in a beneficial way, that cannot be numerated. These include regained opportunity to farm fertile areas within the fence, productivity increase through not having to spend time dealing with elephants at dams and water points and increased education as children are not kept home to guard against elephant. These factors are very difficult to accurately describe in financial terms, again making a strictly financial benefit analysis for the proposed project unhelpful.

6.5.2. Construction cost

The cost of construction for a fence such as this has been estimated at between 3000 and 7000 USD per kilometre. This is influenced by many factors:

- Distance between posts,
- Number of strands,
- Number of power stations,
- Number of corners,
• Number of road and lugga crossings,
• Materials used for fence (post type etc).

Based on review of similar fencing projects and consultation with stakeholders with expertise in fencing, an estimated total cost of 41,200,338 Ksh (or roughly 412,003 USD) has been calculated. This amounts to a cost of roughly 444,454 Ksh (or 4,445 USD) per kilometre.

The budget breakdown is provided in Appendix C. This budget is built on an approximated total length of 100km of fence. This approximation does not affect the per kilometre cost which was used to calculate the total cost given above and in Table 4.

6.5.3. Maintenance cost

Given the repeated reiteration of the importance of maintenance by consulted experts, this is an area of fence costing that should be emphasised and generously budgeted to ensure it is not limited by lack of funds.

Estimated maintenance costs range from 500 to 1000 USD per kilometre per year.

Again, there are many factors that affect the cost of maintenance:

• Access to the fence – Proximity to roads and tracks.
• Frequency of fence breakages (both by elephant and people) – Rhino Ark estimates 80% of breakages on comprehensive fences around Mount Kenya and Aberdare are caused by people. However, the high design of the proposed fence will hopefully avoid that problem as people will be able to pass freely beneath it.
• Number of people employed as fence maintainers – Dependent of the maintenance model put in place.
• Lifespan of fence and reconstruction - The fence may have to be rebuilt after 20-30 years. Whether this counts as maintenance or a separate fencing project is to be determined.

As with construction cost, a maintenance budget has been estimated based on recommendations from people with experience in maintaining fences. These calculations have come to 77,750 Ksh per kilometre per year. On top of this is a one-time set up cost of 822,857 Ksh for initial equipment and training on Operation and Maintenance (O & M).

Details of this budget are provided in Appendix D.

The budget for fence maintenance should be built in to the budget for Naibunga Conservancy. This will ensure that the community take ownership of fence maintenance and have the power to mobilise resources for fence maintenance, when needed. However, should this system be less effective
than hoped, external pressure and support may be required to ensure maintenance is kept up. This can be done by NRT, through their formal relationship with the conservancy.

6.6. Conclusion

These findings, which were based on discussions with stakeholders and review of existing fencing projects, were considered, consolidated and applied to the proposed fencing project to produce the recommendations given in section 7. Not all advice and comments can be incorporated in to the project so Naibunga chairmen, managers and community input was prioritized, followed by stakeholders with relevant expertise. Despite these consultations, further and ongoing consultation will be needed as this project moves forward and the project proponents should be willing to modify and adapt the project accordingly.
7. Recommendations

7.1. Proposed design
The proposed design involves the following elements:

• 2-strand electrified fence with strands at 6 ft and 7 ft. This height allows for livestock, people and other wildlife to pass under the fence.

• Outriggers initiating from the top strand and extending horizontally from the bottom strand. These are to prevent elephants from accessing the strands and being able to short or break the fence.

• Earth wire buried 1.5m in front of fence posts. This ensures the elephant is standing on the earth wire when they touch the live wires, so that the maximum possible shock is delivered.

• Outriggers rigged down the posts. This is critical to prevent elephants from accessing the posts to push the fence over. These may be live wires running down either side of the post with outriggers extending off them or a series of semi-circular loops mounted to the post by insulators and kept live by a descending live wire, from which outriggers can be rigged.

• Power station every ~ 7 km. This is to attempt to maintain a minimum voltage of 7 kV along the entire fence.

• Solar panels raised on high posts to mitigate theft.

• Power equipment housed in a locked and water-proof container or box to mitigate theft.

• At least two gates in each fence, adjacent to main roads, for the passage of camels.

• Danglers for road crossings on all main roads and smaller roads up to a maximum frequency of one track-crossing per kilometer. This is to allow for sand harvesting trucks to access luggas. These will not be required in all sections of fence.

• Danglers for lugga crossings. This is to prevent elephants from using luggas to enter the fenced areas. Other wildlife can pass either side of the lugga.

• All danglers to have joints/weights. This is used on Ol Jogi and prevents the danglers from tangling and causing maintenance issues.

7.2. Proposed alignment

7.2.1. Alignments requested by chairmen
Based on consultation and site visits with the chairmen and managers of Naibungua, they have requested the alignments presented below, in Figure 9.
These breakdown of lengths and areas for these alignments are provided in Table 3, below.

<table>
<thead>
<tr>
<th>Fence</th>
<th>Perimeter</th>
<th>Area</th>
<th>% of Naibunga Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kimanjo</td>
<td>32.7</td>
<td>56.9</td>
<td>12.2</td>
</tr>
<tr>
<td>II Polei-Dol Dol</td>
<td>42.3</td>
<td>72.1</td>
<td>15.5</td>
</tr>
<tr>
<td>Koija</td>
<td>24.5</td>
<td>34.1</td>
<td>7.3</td>
</tr>
<tr>
<td>Il Motiok</td>
<td>14</td>
<td>8.5</td>
<td>1.8</td>
</tr>
<tr>
<td>Musul</td>
<td>7.9</td>
<td>3.2</td>
<td>0.7</td>
</tr>
<tr>
<td>Nkiloriti</td>
<td>6</td>
<td>2.2</td>
<td>0.5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>127.4</strong></td>
<td><strong>177</strong></td>
<td><strong>38.0</strong></td>
</tr>
</tbody>
</table>

Table 3: Lengths and areas of the requested alignments presented in Figure 7.

7.2.2. Recommended alignments

The requested alignments give a comprehensive encirclement of most settlements and homesteads in Naibunga. However, there are a number of advantages to limiting the fenced area to a single fence per Unit, including:

- Financially, it is easier to build and maintain a shorter fence.
- Fencing a less comprehensive area pushes the community to be more considerate with settlement planning.
- For wildlife conservancy status to be maintained, a sufficient area must be left outside the fence for the wildlife.
• Having one fence per unit may build cohesion at the Unit level and ultimately at the conservancy level.

Considering these issues, the final recommended alignments were drawn. These are presented below, in Figures 10 and 11.

Figure 10: Recommended fence alignments.
Figure 11: Recommended alignments overlaid with waterpoints, watercourses and settlement data.

The length and areas of these recommended alignments are given in Table 4, below, along with the construction cost for each fence, based on the per-kilometer cost calculated in the budget given in Appendix C.

<table>
<thead>
<tr>
<th>Fence</th>
<th>Perimeter</th>
<th>Area</th>
<th>% of Naibunga Area</th>
<th>Cost (Ksh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kimanjo</td>
<td>32.8</td>
<td>56.44</td>
<td>12.1</td>
<td>14,581,043</td>
</tr>
<tr>
<td>Kojia</td>
<td>18.71</td>
<td>20.29</td>
<td>4.4</td>
<td>8,317,418</td>
</tr>
<tr>
<td>Il Polei-Dol Dol</td>
<td>41.17</td>
<td>66.76</td>
<td>14.3</td>
<td>18,301,876</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>92.68</strong></td>
<td><strong>143.49</strong></td>
<td><strong>30.8</strong></td>
<td><strong>41,200,338</strong></td>
</tr>
</tbody>
</table>

Table 4: Lengths and areas of recommended alignments.

This includes a fence in Kojia that was not part of the alignments initially posed in the TOR. This addition is based on reports from the community that the worst human-elephant conflict occurs in the Kojia area. This was supported by the Central and Upper Unit scouts and managers, as well as KWS, and is in alignment with elephant movement data showing many elephants moving through that corner of Naibunga when passing between Loisaba and Isiolo county.
The smaller fences requested by the chairmen and managers were excluded based on a desire to avoid fencing each center separately and instead maintain a more landscape scale, conservancy-wide approach to fencing for settlement planning and elephant exclusion. Additionally, the Il Motiok, Nkilorit and Musul centers are relatively small compared to Kimanjo, Il Polei and Dol Dol, making them a lower priority given the cost limitations of fencing.

However, the lack of a fence for each individual group ranch will likely cause tensions. This is an important consideration and may have to be mitigated through implementing other non-fence-based solutions to the human-elephant conflict in areas that are not fenced. This is especially true of Nkilorit and Il Motiok, although the topography around the Nkiloriti center makes fencing difficult anyway.

There are also unique considerations for some sections of the fence, which must be considered and addressed before the project moves forward. These are outlined below:

**Sunyai lugga** – The concept alignments involved following the south side of the lugga but, at the request of the chairman and manager, the alignment was changed to move south is a semi-circular loop. This moves it closer to a road, making maintenance easier and leaves a large area of un-settled habitat outside the fence for elephant.

**East of Dol Dol township** – Here the fence crosses private land so that it can encircle the Dol Dol dam. This dam is used by elephant and so an alternative water source for wildlife should be considered. Alternatively, the fence could follow the Dol Dol township boundary, which would leave the dam outside the fence, along with many settlements.

**Dol Dol to Il Polei** – This section was drawn to follow the main Dol Dol-II Polei road. It deviates from the road to encircle the main Kiwanja settlement. However, the land adjacent to the road is private land so the fence will need to either follow the road reserve boundary (with permission of the land owners) or take a different alignment that loops north to remain within Morupusi and Munishoi group ranches, as shown in Figure 12, below.
This modification adds 2.61km of fence, representing an additional cost of 1,160,259Ksh based on the budget provided in Appendix C. However, this also reduces the fenced area by 9.13km$^2$.

**Kimanjo-Oldonyiyo Junction to Kimanjo** – The land to the west of the road is owned by Hon. Ole Kaparo. The alignment follows the road reserve boundary until it nears Kimanjo, where it cuts west across the corner of Hon. Ole Kaparo’s land so as to include a church that is being built on land gifted to the church by Hon. Ole Kaparo. Permission will be required for this.

**Rongai Nursery** – This nursery school is located on the main Kimanjo-Waso road, immediately after the road enters Koija group ranch. The Lower Unit chairman requested that it be included in the Kimanjo fence as it is in a main elephant corridor. However, this requires the Kimanjo fence to extend in to Koija for a short section and impinges on this elephant corridor. Alternatively, the fence could remain within Tiemamut at this point and instead cut across to below the Lower Unit HQ, which would leave a larger space for elephants to pass west of the Kimanjo fences.

**Tiemamut Dam** – This dam is extremely heavily used by elephant and is currently closed within the fence, with the hope that the elephants will change to utilizing the Parsampoe Dam, west of the Kimanjo fence. However, there is an argument to be made for bringing the fence around the south side of the Tiemamut Dam and leaving the dam outside as this will reduce the amount of fence breakages in this section. Conflict at the dam could instead be mitigated by setting times for livestock use when elephants are
not present or having rangers available to escort people and livestock to the dam.

**Koija** – The proposed alignment does not cover all the homesteads in Koija, which are very widely dispersed and mostly movable (no permanent/stone structures). This is the area where the fence could most significantly assist with settlement planning and land-use planning. However, it is also an area where fencing between settlement and elephant habitat is hardest, due to the dispersed nature of the human settlements. Therefore, this fence may be of a lower priority than the other fences and could be built subsequent to review of the effectiveness of the other fences and the resultant changes in elephant behavior.

### 7.3. Proposed maintenance structures

Maintenance has been constantly reiterated as the most critical component of this project for long term success. From stakeholder consultation, the following model appears to be the best suited to this project:

- Two fence maintainers for every 7km of fence who cover the section daily. This person is selected as the best laborer from the local laborers employed to construct that fence section and is then offered the job of fence maintainer, including training.

- The fence maintainers report to a fence supervisor who is responsible for one entire circular fence (3 supervisors in total). This person is provided with a motorbike and fuel so they can cover their entire section effectively.

- The fence supervisor reports to a fencing committee that is created within the Naibunga Conservancy management structures.

- Data on fence outages, breakages and maintenance requirements is collected continually, then analyzed and reviewed by stakeholders (Chairmen, KWS, NRT) on a monthly basis. This ensures maintenance issues can be identified and rectified rapidly and all stakeholders are involved, maintaining ownership of the fence.

As outlined in the budget provided in Appendix D, this model amounts to a cost of 77,751Ksh per kilometer per year.

The other consideration for fence maintenance regards fence-breaking elephant. As the majority of fence breaking incidences will be done by a few elephants, there should be emphasis placed on monitoring and management of these key individual elephant. This should be based on a KWS/conservancy ranger team, with support from relevant NGOs for tracking and monitoring purposes, as needed.
7.4. Proposed construction plan

Given the magnitude of the project, and the unitary nature of each fence, a phased approach to construction is recommended. This will allow issues with fence design, alignment, elephant behavior and maintenance to be accounted for in subsequent phases, ultimately producing more effective and sustainable fences.

As such, the recommended approach to construction is:

- **Phase 1** – Kimanjo fence. This is because this fence is the simplest in terms of land tenure as it is almost entirely on Naibunga land. Additionally, as per Figure 5, there is a high density of elephants in very close proximity with people in this region.
- **Phase 2** – Il Polei-Dol Dol. This is the longest fence and is prioritized as it protects the important municipal areas of Il Polei and Dol Dol where human settlement is very dense.
- **Phase 3** – Subject to review of the performance of the Kimanjo and Il Polei-Dol Dol fences, and assessment of modified elephant movement patterns and behavior. This fence is also the most complicated with regards to human re-settlement and so may require a longer period of community engagement and consultation before the community are satisfied and the fence can be built.

7.5. Conservancy land-use planning

As discussed previously, one outcome of a fence as proposed in this report is the encouragement to settle in a more considered, organized and planned fashion. It has been suggested that resettlement schemes will be needed to move people inside the fence to free land for conservation purposes. This will hopefully be community led, even to the extent that people move voluntarily, of their own accord, seeking the security that the fence provides.

This fence therefore presents an opportunity to assess the land-use designations for Naibunga conservancy. Therefore, it is recommended that this fencing project be built into a larger land-use planning and conservancy management effort to ensure the fence is in line with, and supports, the development of the conservancy, as directed by the chairmen and community. This can be done in collaboration with the renewal of the Conservancy Management Plan. Extending the discussion beyond the fence may require more extensive consultation with the community, especially the leadership, and may hold back construction of the fence but is still recommended as it will ensure longer-term success and sustainability of the fence, and of the conservancy as a whole.

This project should also be integrated with the Laikipia county land-use planning agenda. This can be ensured through consultation with the county Spatial Planning office. This project can also inform future county and national land-use planning efforts in northern Laikipia.
7.6. Go ahead
Ultimately, the recommendations from the feasibility study are to move the project ahead to the next phase, subject to several factors, including:

- Pursuit of the steps laid out in section 7.6.
- Further and continual stakeholder consultation, especially local community. This of particular importance and the consultation process in the EIA should not be relied upon as sufficient. Based on feedback from stakeholders, the project proponent should be willing to adapt and modify alignments, as necessary.

7.7. Next steps
The steps given below provide a rough outline of how the project should proceed from this point.

1. Presentation of feasibility study report.
2. Securing project financing for Phase 1. This should include funding for maintenance.
3. EIA study and license for Phase 1. This can take 6-12 months and be quite costly but will be simplified by the phased construction approach.
4. Final design/alignment sign-off. This should be approved by the community, the Naibunga board and management, KWS and county and national governments.
5. Land owner agreements/legal consents. These should be obtained from private land owners and community land representatives before construction begins.
6. Procurement of contractor. The inclusion of labor from the local communities should be considered here.
7. Construction.
8. Training on Operation & Maintenance and set up of maintenance systems.
9. Repetition of steps 2 - 8 for Phase 2 and Phase 3, subject to the success of Phase 1 and review of the effectiveness of the design and the impact on elephant behavior and movement.
Appendix A: Terms of Reference

TERMS OF REFERENCE

FEASIBILITY ASSESSMENT ON HUMAN WILDLIFE CONFLICT CONSULTANCY

POSITION RESPONSIBLE TO: - DIRECTOR OF CONSERVATION / CHIEF EXECUTIVE OFFICER

PURPOSE OF THE CONSULTANCY: BLINDS
Overall objective is to undertake an in-depth feasibility assessment for long-term fencing solution to address Human-Wildlife Conflict in Naibunga Conservancy.

THE FOCUS OF THIS CONSULTANCY WILL BE:

- Undertake an in-depth feasibility assessment for long-term fencing solution to address Human-Wildlife Conflict in Naibunga Conservancy.
- Work with NRT, Naibunga Board and Management, and KWS to undertake a feasibility assessment of the use of large-scale elephant exclusion fences around settlements in Naibunga Conservancy.
- Use data from Save the Elephant (STE) and Space for Giant (SFG) elephant collars as well as local knowledge to identify key elephant corridors.
- Work with land owners and conservancy to determine appropriate alignment of 2/3-strand high-wire fences in 2 zones: (1) Il Polei, Makurian, Dol Dol, (2) Kimanjo, Mukogodo ranch, Kaparo's Farm, Oldonyiro road.
- Work with NRT and Naibunga Conservancy teams to conduct stakeholder and community meetings to ensure support for the proposed project from communities, KWS, Laikipia County Government and relevant NGOs in the region.
- Develop a detailed and budgeted proposal for fencing plan that can be used to fundraise for this project

QUALIFICATIONS: EDUCATION /KNOWLEDGE/ SKILLS AND EXPERIENCE:

- A passion for community-led conservation and development in wilderness areas
- Pilot License is an added advantage
- A strong technical background in areas related to community-conservation
- Ability to operate with sensitivity and diplomacy in a remote and multi-ethnic environment
- A personal style that inspires trust, team work, professionalism, cooperation and passion for NRT’s mission.
- Excellent writing and communication skills, and ability to develop effective relationships
Appendix B: Stakeholders

Naibunga Conservancy Chairmen & Management

- Wilson Sintaroi – Naibunga Upper Unit Chairman
- Solomon Kaparo – Naibunga Central Unit Chairman
- Lerempen Naiputari - Naibunga Lower Unit Chairman
- Paul – Upper Unit Manager
- Dominic – Central Unit Manager
- Piranto – Lower Unit Manager

Other affected land owners

- Chairmen of KuriKuri
- Chairmen of Makurian
- Mukogodo West Senior Chief covering management of Dol Dol municipality
- Sub-county Administrator covering Dol Dol area

County Government of Laikipia

- Njenga Kahiro – CEC Water, Environment & Natural Resources
- David King’ori – Director Environment, Forest, Wildlife & Natural Resources

KWS

- Jacob Orhale – Senior Warden, Laikipia
- Simon Gitau Ngugi – Assistant Director, Mountain Conservation Area

NGOs

- Brendan Buzzard – Laikipia Conservancies Association
- Redempta Njeri – Space for Giants
- Maurice Shutgens – Space for Giants
- Lauren Evans – Space for Giants
- Humphrey Munene – Mount Kenya Trust
- Christian Lambrechts – Rhino Ark
- Adrian Paul - Lewa

Adjacent land managers

- David Hewett – Mpala Ranch
- Jamie Gaymer – Ol Jogi
- Tom Sylvester – Loisaba
Many thanks are extended to all stakeholders who were willing to take time to meet with the consultant and share information, data and ideas.
### Appendix C: Construction Budget

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Quantity</th>
<th>Units</th>
<th>Unit Cost</th>
<th>Total Cost (Ksh)</th>
<th>Total Cost (USD)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Power supply</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Energizer</td>
<td>Gallager B1600/ Stafix i18x, 1 per 7km</td>
<td>14</td>
<td>pcs</td>
<td>165,000</td>
<td>2,310,000</td>
<td>23,100</td>
</tr>
<tr>
<td>Solar panel</td>
<td>120W, 1 per 7kms</td>
<td>28</td>
<td>pcs</td>
<td>20,000</td>
<td>560,000</td>
<td>5,600</td>
</tr>
<tr>
<td>Battery</td>
<td>200Ah, 1 per 7kms</td>
<td>14</td>
<td>pcs</td>
<td>35,000</td>
<td>490,000</td>
<td>4,900</td>
</tr>
<tr>
<td>Solar charge regulator</td>
<td>30A, 1 per 7kms</td>
<td>14</td>
<td>pcs</td>
<td>18,000</td>
<td>252,000</td>
<td>2,520</td>
</tr>
<tr>
<td>Housing</td>
<td>Pole for panel and box for equipment</td>
<td>14</td>
<td>pcs</td>
<td>50,000</td>
<td>700,000</td>
<td>7,000</td>
</tr>
<tr>
<td><strong>Sub-total</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4,312,000</td>
<td>43,120</td>
</tr>
<tr>
<td><strong>Fence</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fencing post</td>
<td>Treated gum 10’ x 6” with 2 holes, 1 per 10m</td>
<td>10,000</td>
<td>pcs</td>
<td>1,200</td>
<td>12,000,000</td>
<td>120,000</td>
</tr>
<tr>
<td>Corner post</td>
<td>Treated gum 10’ x 7” with 2 holes</td>
<td>125</td>
<td>pcs</td>
<td>1,500</td>
<td>187,500</td>
<td>1,875</td>
</tr>
<tr>
<td>Road crossing post</td>
<td>Treated gum 16’ x 6”</td>
<td>60</td>
<td>pcs</td>
<td>4,000</td>
<td>240,000</td>
<td>2,400</td>
</tr>
<tr>
<td>High tensile fencing wire</td>
<td>1 roll per strand per km</td>
<td>200</td>
<td>roll</td>
<td>14,500</td>
<td>2,900,000</td>
<td>29,000</td>
</tr>
<tr>
<td>Outriggers</td>
<td>2 rolls per km</td>
<td>200</td>
<td>roll</td>
<td>14,500</td>
<td>2,900,000</td>
<td>29,000</td>
</tr>
<tr>
<td>Chain strainer</td>
<td>2 needed</td>
<td>2</td>
<td>pcs</td>
<td>34,000</td>
<td>68,000</td>
<td>680</td>
</tr>
<tr>
<td>Earth rods</td>
<td>Copper</td>
<td>500</td>
<td>pcs</td>
<td>1,500</td>
<td>750,000</td>
<td>7,500</td>
</tr>
<tr>
<td>Pipe insulators</td>
<td>2 per post</td>
<td>20,250</td>
<td>pcs</td>
<td>80</td>
<td>1,620,000</td>
<td>16,200</td>
</tr>
<tr>
<td>Straining insulators</td>
<td>4 per corner post plus contingency</td>
<td>800</td>
<td>pcs</td>
<td>200</td>
<td>160,000</td>
<td>1,600</td>
</tr>
<tr>
<td>Gates</td>
<td>2 per circular fence</td>
<td>6</td>
<td>pcs</td>
<td>50,000</td>
<td>300,000</td>
<td>3,000</td>
</tr>
<tr>
<td><strong>Sub-total</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>20,825,500</td>
<td>208,255</td>
</tr>
<tr>
<td><strong>Labour</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Labour</td>
<td>25,000 man-days @ 500 Ksh per day</td>
<td>25,000</td>
<td>man-days</td>
<td>500</td>
<td>12,500,000</td>
<td>125,000</td>
</tr>
<tr>
<td><strong>Sub-total</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>12,500,000</td>
<td>125,000</td>
</tr>
<tr>
<td><strong>Certification</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EIA Consultant</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2,000,000</td>
<td>20,000</td>
</tr>
</tbody>
</table>

This budget is based on an approximate total length of 100km. The per km cost is unchanged by this approximation.
<table>
<thead>
<tr>
<th>Service</th>
<th>Description</th>
<th>NEMA Fees</th>
<th>Advertising fees</th>
<th>Legal consent</th>
<th>Sub-total</th>
</tr>
</thead>
<tbody>
<tr>
<td>NEMA Fees</td>
<td></td>
<td>200,000</td>
<td>2,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Advertising fees</td>
<td>2 x 1/4 pages for 2 weeks</td>
<td>500,000</td>
<td>5,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Legal consent</td>
<td>Legal fees for land consent</td>
<td>2,000,000</td>
<td>20,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sub-total</td>
<td></td>
<td>4,700,000</td>
<td>47,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td>42,337,500</td>
<td>423,375</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contingency</td>
<td>5%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contingency</td>
<td></td>
<td></td>
<td></td>
<td>2,116,875</td>
<td>21,169</td>
</tr>
<tr>
<td>GRAND TOTAL</td>
<td></td>
<td>44,454,375</td>
<td>444,544</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GRAND TOTAL PER KM</td>
<td></td>
<td>444,544</td>
<td>4,445</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

This budget is based on an approximate total length of 100km. The per km cost is unchanged by this approximation.
## Appendix D: Maintenance Budget

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Quantity</th>
<th>Units</th>
<th>Unit Cost Units</th>
<th>Cost per km per year (Ksh)</th>
<th>Cost per year (Ksh)</th>
<th>Cost per year (USD)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Labour</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fence Maintainer</td>
<td>15,000Ksh per pax per month, 2 pax per 7 km</td>
<td>29</td>
<td>pax</td>
<td>15,000 Ksh/ month</td>
<td>51,429</td>
<td>5,142,857</td>
<td>51,429</td>
</tr>
<tr>
<td>Fence Supervisor</td>
<td>18,000Ksh per pax per month, 1 pax per circular fence</td>
<td>3</td>
<td>pax</td>
<td>18,000 Ksh/ month</td>
<td>6,480</td>
<td>648,000</td>
<td>6,480</td>
</tr>
<tr>
<td>Motorcycle</td>
<td>Fuel @ 5000Ksh per month</td>
<td>3</td>
<td>pax</td>
<td>5,000 Ksh/ month</td>
<td>1,800</td>
<td>180,000</td>
<td>1,800</td>
</tr>
<tr>
<td></td>
<td>Maintenance @ 2000Ksh per month</td>
<td>3</td>
<td>pax</td>
<td>2,000 Ksh/ month</td>
<td>720</td>
<td>72,000</td>
<td>720</td>
</tr>
<tr>
<td><strong>Sub-total</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>60,429</td>
<td>6,042,857</td>
</tr>
<tr>
<td><strong>Materials</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wire</td>
<td>1 roll per 25 km per month</td>
<td>4</td>
<td>rolls/month</td>
<td>14,000 Ksh</td>
<td>6,720</td>
<td>672,000</td>
<td>6,720</td>
</tr>
<tr>
<td>Insulators</td>
<td>2 pieces per km per month</td>
<td>200</td>
<td>pcs/month</td>
<td>150 Ksh</td>
<td>3,600</td>
<td>360,000</td>
<td>3,600</td>
</tr>
<tr>
<td>Posts</td>
<td>1 post per 20 km per month</td>
<td>5</td>
<td>pcs/month</td>
<td>1,500 Ksh</td>
<td>900</td>
<td>90,000</td>
<td>900</td>
</tr>
<tr>
<td>Misc materials</td>
<td>@20,000 Ksh per month</td>
<td>1</td>
<td>unit</td>
<td>20,000 Ksh</td>
<td>2,400</td>
<td>240,000</td>
<td>2,400</td>
</tr>
<tr>
<td><strong>Sub-total</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>13,620</td>
<td>1,362,000</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>74,049</td>
<td>7,404,857</td>
</tr>
<tr>
<td>Contingency</td>
<td>5%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3,702</td>
<td>370,243</td>
</tr>
<tr>
<td><strong>GRAND TOTAL</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>77,751</td>
<td>7,775,100</td>
</tr>
<tr>
<td><strong>Initial Set Up</strong></td>
<td>One-time costs</td>
<td></td>
<td></td>
<td></td>
<td>Total Cost (Ksh)</td>
<td></td>
<td>Total Cost (USD)</td>
</tr>
</tbody>
</table>

This budget is based on an approximate total length of 100km. The per km cost is unchanged by this approximation.
<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Quantity</th>
<th>Unit</th>
<th>Cost</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Training</td>
<td>Training on fence O&amp;M for each maintainer</td>
<td>29</td>
<td>pax</td>
<td>6,000</td>
<td>171,429</td>
</tr>
<tr>
<td>Motorbike</td>
<td>Motorbike provided to fence supervisors</td>
<td>3</td>
<td>pcs</td>
<td>110,000</td>
<td>330,000</td>
</tr>
<tr>
<td>Voltmeter</td>
<td>1 per 7km</td>
<td>14</td>
<td>pcs</td>
<td>19,500</td>
<td>278,571</td>
</tr>
<tr>
<td>Pliers</td>
<td>1 per 7km</td>
<td>14</td>
<td>pcs</td>
<td>3,000</td>
<td>42,857</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>822,857</strong></td>
</tr>
</tbody>
</table>

This budget is based on an approximate total length of 100km. The per km cost is unchanged by this approximation.