
INDEPENDENT ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT STUDY REPORT

PROPOSED BOUNDARY VARIATION OF THE ABERDARE
[NDARAGWA BLOCK] FOREST LN. NO.48/194, TO ALLOW
FOR EXPANSION OF NDARAGWA TOWNSHIP IN
NDARAGWA SUBCOUNTY, NYANDARUA COUNTY



FINAL REPORT

2020

CERTIFICATION

The Environmental and Social Impact Assessment (ESIA) Consultants on behalf of the proponent, submit this independent ESIA study report for the proposed variation of boundary of Aberdare [Ndaragwa block] Forest LN. No.48/194, to allow for expansion of Ndaragwa Township from 38.47 acres to 162.52 acres in Ndaragwa Sub County, Nyandarua County. The report has been prepared with reasonable skills, care and diligence based on data collected from primary and secondary sources in accordance with the Constitution of Kenya of 2010, Environmental Management and Co-ordination Act, CAP 387, Environmental (Impact Assessment and Audit) Regulations, 2003 and requirements of the Forest Conservation and Management Act, 2016.

We certify that the particulars given in this report are correct to the best of our knowledge.

ESIA LEAD EXPERT

Signed: _____ Date: _____ Official Stamp: _____

Dr. Fridah Wilumila Mugo (NEMA Registration Certificate No. 0084),

Email: fridahmugo@yahoo.com Mobile No.: 254 - 0710806139

PROJECT PROPONENT

Signed: _____ Date: _____ Official Stamp: _____

For the Petitioners

CONTACT PERSON:

Name Position

Mobile No Email

Disclaimer:

This ESIA Report is strictly confidential to Ndaragwa Residents/community (Petitioners) and any use of the materials thereof should be strictly in accordance with the agreement between the Petitioners and the consultants. It is, however, subject to conditions of the Environmental (Impact Assessment and Audit) Regulation 2003 and Environmental Management and Co-ordination Act, CAP 387.

ACKNOWLEDGMENT

The ESIA team under UDELIC Consultants are grateful to the project proponent, Ndaragwa community through the MP Hon. Jeremiah Kioni, for commissioning us to conduct this independent ESIA report in respect to the proposed variation of boundary of Aberdare Forest to allow for expansion of Ndaragwa Township in Nyandarua County.

We would like to further acknowledge with great appreciation the Ndaragwa Community for their participation in the public consultation process throughout the exercise.

We acknowledge the support either direct or indirect from the various parties who assisted the ESIA experts' towards the successful completion of this report.

Further, we extend our sincere appreciation to all our able colleagues and associates who worked hard throughout the entire process of preparing this ESIA report and sacrificing a lot of time in ensuring that it is completed professionally.

Not to be forgotten are the other members of our fieldwork team led by Mr. Francis Mwangi who played a critical backup role for their unreserved commitment and dedication throughout the entire ESIA process.

Thank you and May God abundantly bless you all.

PROJECT TEAM

This Independent Environmental & Social Impact Assessment (ESIA) report for the proposed variation of boundary of Aberdare Forest to allow expansion of Ndaragwa Township in Nyandarua County has been prepared by UDELIC Consultants under a joint consortium of practicing independent professionals listed below:

Name	Positions Held	Academic Qualifications	Roles/Responsibilities
1. Dr. Fridah Mugo	<ol style="list-style-type: none"> 1. Lead ESIA Expert 2. Natural Resource Policy and Management Expert 3. Agriculturalist 	<ul style="list-style-type: none"> ▪ PhD in Natural Resource Policy and Management ▪ MSc. Natural Resource Policy and Management ▪ Master of Arts in Urban and Regional Planning ▪ BSc. Agriculture ▪ Certificate in Environmental and Social Impact Assessment and Audit 	<ul style="list-style-type: none"> ▪ She will be the Lead Expert/Project team leader in the ESIA study ▪ Carry out the ESIA study as per EMCA Cap 387. ▪ Responsible for quality assurance and control for all deliverables ▪ Will develop the detailed project plan for discussion and agreement with the proponent ▪ Officiates all the meetings and delegates the same to the Associate Expert if need be. ▪ Leads/Conduct all stakeholder meetings or engagements ▪ Preparing the draft and final reports
4. Mr. Peter Naibei	<ol style="list-style-type: none"> 1. ESIA Associate Expert 2. Environmental Policy Expert 3. Project Coordinator 	<ul style="list-style-type: none"> ▪ Master of Arts in Environmental Policy ▪ Postgraduate Certificate in Environmental and Social Impact Assessment and Audit ▪ Bachelor of Arts in Planning 	<ul style="list-style-type: none"> ▪ ESIA Associate Expert ▪ Preparing detailed work plan, survey tools and draft reports to be approved by the lead expert ▪ Coordination of field work and stakeholder engagements ▪ Preparation of draft reports
4. Plan. Philip Olale	<ol style="list-style-type: none"> 1. Physical Planner 2. Environmental Law Expert 	<ul style="list-style-type: none"> ▪ PhD Environmental Law (Candidate) ▪ Postgraduate Certificate in Integrated 	<ul style="list-style-type: none"> ▪ Preparation and advisory on the study environmental law and policy ▪ Interpretation of the proposed Ndaragwa town expansion development plan

Name	Positions Held	Academic Qualifications	Roles/Responsibilities
		<ul style="list-style-type: none"> Environmental and Social Impact Assessment and Audit ▪ Master of Arts in Environmental Law ▪ Bachelor of Arts in Planning 	<ul style="list-style-type: none"> ▪ Advise on urban planning and sustainability issues ▪ Preparation of draft reports
<p>5. Ms. Mildred Ambani</p>	<p>1. GIS Mapping Expert &</p>	<ul style="list-style-type: none"> ▪ MSc. Geographic Information System-GIS ▪ Bachelor of Arts in Planning ▪ Diploma in Cartography ▪ Certificate in GIS and Digital Video Plotting 	<ul style="list-style-type: none"> ▪ Conduct field survey on the site location points ▪ Preparation of site base and topographical maps ▪ Conduct site location and context analysis ▪ Digitize current/proposed site land use activities ▪ Preparation of draft reports
<p>6. Ms. Margaret Ngina Njoroge</p>	<p>1. Sociologist 2. Community Development Specialist</p>	<ul style="list-style-type: none"> ▪ Master of Arts Degree in Planning (Spatial). ▪ Master of Arts Degree in Sociology. ▪ Bachelor of Arts Degree in Sociology and Kiswahili ▪ Certificates in Grants Management, Project Management 	<ul style="list-style-type: none"> ▪ Participate in identification of key stakeholders; participating in/ assisting to inform and guide public opinion during stakeholder engagement sessions ▪ stakeholder meetings and engagements on socio-cultural issues ▪ Conduct social impacts (SIA) of the proposed project. ▪ Field survey and data collection ▪ Inform public on the SIA of the proposed project. ▪ Preparing the draft and final reports

EXECUTIVE SUMMARY

Consistent with section 34 of the Forest Conservation and Management Act, 2016, this independent Environmental and Social Impact Assessment (ESIA) report was occasioned by a public petition signed by 88 No. Ndaragwa Constituency residents through their Member of Parliament, Hon. Jeremiah Kioni to vary 300 acres of forest land for economic development in Ndaragwa Township (See **appendix 2**).

Based on the same Act, section 34, subsection 4 (a), Petitioners who may wish to revoke or vary public forest land must submit an independent Environmental and Social Impact Assessment (ESIA) report that should demonstrate that the variation of boundary or revocation of the registration of a public forest or a portion of a public forest does not:

- a) Endanger any rare, threatened or endangered species; or
- b) Adversely affect its value as a water catchment area; and
- c) Prejudice biodiversity conservation, cultural site, protection of the forest or its use for educational, recreational, health or research purposes.

The key deliverables of the ESIA process will be a set of mechanisms for reducing the project's adverse effects and enhancing its positive effects on people and the environment. Despite the petitioners request to vary 300 acres (121.41ha) of the said forest land, the ESIA team was guided by the last Survey Plan, FR 341/63 of 2007 by the Survey of Kenya (See **appendix 5**) as the only authoritative plan with definite boundaries for Ndaragwa township expansion from the current 38.47 acres (15.569 ha) to 162.52 acres (65.77 ha).

As such, the last Survey Plan of 2007 is presumed to have amended the previous ones and hence recognized as the authentic and applicable survey plan. Further the 162.52 acres variation of the Aberdare [Ndaragwa Block] Forest has been supported by various key informants, and most importantly by the public as affirmed during stakeholders' consultation and public participation fora.

The proposed variation of forest boundary is to support the socio-economic expansion of Ndaragwa Township in a sustainable manner which currently occupy about 38.47 acres /15.569 hectares and is fully developed. The proposed variation will thus allow an additional 65.77 ha/162.52 acres to support the provision of adequate land for essential

public utilities infrastructure (sewerage treatment works facilities, sludge disposal facility, public toilets, refuse disposal), and social amenities such as housing, schools (public primary and early child development education), vocational institutions (polytechnic), recreational parks (public gardens and proposed stadium), health centres and hospitals, religious institutions (churches and mosques), public purposes land use (administration and regular police line, ministry of works yard, Kenya Power yard, post office, fire station, County/National government offices, department of fisheries offices, department of water offices), land for commercial use (open air market and commercial stalls), transport support facilities (bus parks, parking areas, motel and petrol stations), abattoirs and cemeteries among others.

In conducting the assessment, a combination of methods was employed including, site inspection, and public consultation with community members affected by the proposed project and other relevant stakeholders, household survey using a semi-structured questionnaire Existing literature on the statutory requirements both at international and national scales was also reviewed. In addition, reference was made from documents relating to the proposed project including survey plans, records of past consultation meetings and the proposed study area development plan among others. The assessment identified specific areas of concern likely to be affected by the establishment and operation of the proposed project. This report also proposes mitigation measures for the same as detailed out in the Environmental Management Plan (EMP).

The ESIA team visited the site, mapped and identified the key stakeholders. Key informants were identified including representatives of various institutions, county departments and state ministries, community forest association groups and Ndaragwa town residents. . Semi-structure interview guides (See Appendix 11) were used for the Key Informant Interviews (KIIs). Further, questionnaires were administered to households and business groups within the project site, mainly to get primary data on anticipated social, economic and environmental effects of the development (See **appendix 9 and 10**). Lastly, on Friday 18th October 2019 at PCEA Ndaragwa Hall, the ESIA team held a one day validation workshop to present draft 1 of the ESIA report to the public. A total of 47 stakeholders including women, youth, area local leaders, farmers, CFA representatives, members of various business groups among others attended the workshop (See the appended record of attendance and plate 16-19).

The Project Impacts (as required by the Forest Conservation & Management Act, 2016) included among others:

- a) On Rare, Endangered, Threatened Species (RETS): The proposed expansion of Ndaragwa Township from 38.47 acres (15.57 ha) to 300 acres (121.41 ha) FR 216/75 of 1991 will significantly affect the RETS negatively. However, if the variation is limited to 162.52 acres (65.77 Ha.) FR 341/63 of 2007 Survey Plan, the negative impact will be minimal. This is because, 80.23% of the 2007 Survey Plan is already developed/occupied as indicated in Plate Nos. 1, 2, 3,4,5,6,7 on page 26,27, 28,29 section 2.6 of chapter 2 of this report. The undeveloped 19.77% (13 ha.) should be left intact for education, research and recreation purposes and linked with the proposed riverine Recreational Park network. In addition, greening of all the streets, parking areas and other infrastructure of the town should be done using dominantly indigenous species found in the Aberdare Forest (Ndaragwa Block) in such a way that indigenous vegetation will be the dominant vegetation and will attract the birds and some of the wildlife such as monkeys back to the town.
- b) On Water catchments Areas: If the boundary is varied as proposed, all the three rivers (Mbombo, Pesi and the seasonal stream) will be significantly negatively affected. The main impact will be low stability of river flows since there will be increased flow during the rainy season as a result of increased run-off and extremely low volume during the dry season. This will be because of the reduced water percolation for recharging the underground water storage. If the variation is limited to the 2007 Survey Plan, the seasonal stream is likely to be negatively affected by the Ndaragwa town expansion with possible effects including: encroachment on riverine reserve or riparian area, water pollution from both solid and liquid waste, increased water use and abstraction). Pollution from urban agriculture is also likely to occur. Due to the current forest buffer zone, River Pesi and River Mbombo are less likely to be affected by the Ndaragwa town expansion if the Survey Plan of 2007 is adopted.
- c) On Biodiversity Conservation: If the boundary variation is implemented as proposed, there will be additional and significant loss of bio-diversity. This situation should not be allowed to deteriorate further. If variation is implemented according to the 2007 Survey Plan, there will be limited and insignificant loss of biodiversity. This is because, the site is already occupied, the main vegetation identified is the Kikuyu grass in about 80% of the land area and Leleshwa shrub in 20% of the land. There are also scattered exotic and few indigenous trees spread across the landscape (see Plates 1 - 7 page 26-29) of the proposed site. The site is also a habitat for various

invertebrates such as insects. No large wild animals were observed within the project area but antelopes and zebras were reported to occasionally graze in the nearby forest. The expansion of Ndaragwa Township will adversely affect biodiversity conservation if implemented as proposed. However, if the 2007 Survey Plan is adopted the negative impacts will be minimal and can be mitigated sufficiently. Under this plan, during the operation phase, implementation of the mitigation measures will enhance biodiversity conservation significantly in the project site as compared to the current state.

- d) On forest use for educational, cultural, recreational or research purposes: Currently no educational, health or research activities are situated or are being conducted within both the 121.41 hectares and 65.77 hectares of land. However, the Twin Falls of Pesi River and the surrounding forest offer recreational services to the local community members especially the youth. There are also caves along the river that are historically important as they were used as hiding sites during the Mau Mau war. The falls and the caves are within Area C and need to be protected and preserved. Some of the elderly community members extract herbs to treat various health conditions from a number of the indigenous plants in the forest. The study notes that with the involvement of the local community, a lot of indigenous knowledge can be documented with regard to the history, plant and wildlife species, trends, and use of the forest for educational, cultural, recreational, health and research purposes that will eventually contribute to both their welfare and that of the forest reserve. The proposed variation of the boundary to allow for expansion of Ndaragwa Township will reduce the current Ndaragwa Forest Block area by 68.64 Hectares. This will adversely affect the forest function for educational, cultural, recreational, health and research purposes. However, if the 2007 Survey Plan is adopted, the negative impact will be minimal because the mitigation plan recommends preservation of the remaining forested 13 hectares to be improved and used for the same functions.

On the other hand, the proposed project cycle impacts is as summarized below:

- a) Environmental Impacts of the Proposed Project:

POSITIVE	NEGATIVE
1. Soil scooped can be used to improve agricultural land elsewhere.	1. There will be vegetation cover loss thus reduced biodiversity. 2. Water catchment function of the forest will be reduced to a minimum.

POSITIVE	NEGATIVE
<ol style="list-style-type: none"> 2. Vegetation cleared if combined with the soils can also be used to improve the organic matter level of the soil. 3. Seeds in the scooped soils and cleared vegetation could also improve biodiversity of the receiving landscape. 4. Some downstream communities capitalize on flood waters/excess surface run-off for irrigated agriculture. 5. Roof catchment of the new buildings that can be used to meet the ever increasing demand for water, augment the ground water storage and control decline of water levels and to reduce ground water pollution. 6. At decommissioning phase, land scape restoration with forest cover and resumption of the ecosystem functions of the forest will prevail. Further, there will be increased rainwater percolation, ground water recharge and storage, increased clean air and reduced pollution. There will also be an increase in biodiversity for both flora and fauna. 	<ol style="list-style-type: none"> 3. Compaction of the land will interfere with the soil structure leading to commencement of land degradation. 4. The carbon sink function of the forest will cease hence increasing CO₂ in the atmosphere and reducing oxygen (O₂) with a net effective of contributing to an increase of the greenhouse gases in the atmosphere hence climate/micro climate change. 5. Loss of aesthetic value of the forest. 6. As buildings emerge, there will be more concrete surfaces that are impervious to water percolation. This will contribute to an increase in water run-off and a decrease to underground water recharge. 7. Other impacts will include increased noise and vibration, solid waste generation, soil disturbance, air pollution, health risks as a result of fuel emissions and enormous generation of dust especially at construction phase.

b) Socio-Economic Impacts of the Proposed Project:

POSITIVE	NEGATIVE
<ol style="list-style-type: none"> 1. Employment creation. 2. Increased economic activities as a result of having an increased population who require food and other services. 3. Use of locally available materials/labour thus increased revenue to the local people/government 4. Accumulation of capital goods and security services. 5. The value of land will increase as a result of the developments. 	<ol style="list-style-type: none"> 1. Increased insecurity and social crimes 2. Enormous pressure on the existing physical infrastructure such as roads, water and electricity supply. 3. The social amenities will also experience strain as more people will require health and educational services. 4. Because of clearing the forest, cultural, educational, and research use of the forest will cease. 5. Due to the influx of people into urban areas, it is anticipated that water abstraction will be very high.

POSITIVE	NEGATIVE
<ol style="list-style-type: none"> 6. No money will be used to purchase land, to survey and plan for expansion of the township. 7. There will be no demolition of buildings and other structures, relocation of people and compensation for property loss. 8. Physical infrastructure such as improved roads, designated bus park, parking areas and waste management facilities. 9. The demand for money to implement the project is low and hence makes the proposed project economically attractive. 10. Increased access to County/National government's services: 11. With the proposed establishment of a police station and other government security structures, security is likely to improve. 12. Enhanced border trade especially with Laikipia and Nyeri counties on exchange of goods and services. 13. Availability of recreational facilities and youth offering opportunities for talents development, sports events keeping youth away from anti-social behavior 14. The proposed establishment of the town will see tourists of all cadres visit the Aberdares region including Ndaragwa due to availability of tourism support services. 15. Increased incomes to CFA members and government from increased tourist activities - nature walks, attractions at Ndaragwa Twin Falls and the Mau Mau Caves, better services at the CFA Hotel, and from cultural tourism products/services, 	<ol style="list-style-type: none"> 6. Pollution from urban agriculture especially agricultural chemicals finding their way downstream. 7. Resource use conflicts: Competition for resources such as land is likely to arise. 8. A lot of both solid and liquid waste will be generated in the town. Proper disposal facilities will be required to avoid the deterioration of the urban environment. 9. Pollution of water resources: River Pesi , Mboobo and other seasonal streams within and adjacent to the proposed town are likely to be polluted.

Based on the above, the main areas of environmental impacts include, water resources, air quality and bio-diversity. The analysis assessed the significance (importance) of the environmental and socio-economic effects/risks of the proposed project. Considering the three categories of impacts, the water resource will have the highest negative ERF of 345 followed by air quality at ERF of 270 and bio-diversity with an ERF of 165. This implies that the highest negative environmental consequences of the proposed project will be on the water resource function of the forest, hence the need to give its mitigation measures sufficient attention at both the formulation and implementation stage.

The project considered the following Alternatives:

- a) ALTERNATIVE 1: COMPLETE RELOCATION OPTION (CRO): There are significant environmental and socio-economic impacts expected from implementation of the proposed project that would require its complete relocation from the current proposed site. The proponent could therefore consider alternative sites. This requires acquisition of 65.77 hectares of land near/next to the old town from a willing seller. The land should be in the direction away from the forest land. This will leave the forest land intact so that it can continue offering the ecological and socio-economic functions indicated in Chapter six.
- b) ALTERNATIVE 2: - ADOPTION OF THE SURVEY PLAN OPTION (SPO): This option proposes varying of the boundary to accommodate only the already developed and surveyed area of the forest land of 65.77 hectares of land for expansion of Ndaragwa Township. The idea here is to ensure minimum or no additional loss of forest land.
- c) ALTERNATIVE 3 - NIL-INTERVENTION OPTION (NIO): No project option in respect to the proposed project implies that the status quo is maintained. For this option, the town will develop in all directions un-planned. Investment will remain insecure hence not vibrant. Other possible effects are that there will be:
 - Investment flight to other towns with investors looking for more secure locations,
 - The economic status of people will remain very low,
 - Local skills will remain under-utilized,
 - There will be no employment opportunities for those who would work in the development projects,
 - There will be increased urban poverty, crime and hopelessness,
 - Development of infrastructural facilities such as - roads, water and power supply will not be undertaken.

To mitigate the adverse effects of the proposed project, the study proposed the following mitigation measures and environmental management plan:

- » The riparian reserve of the seasonal stream Kabuko) near the government offices shall be protected and developed into a recreational park. Activity nodes will be created at intervals along the stream to attract users for activities such as picnics, hiking, jogging, walking, cycling and bird watching.
- » The circulation paths through the town will be designed to take the users through a series of spaces with different characters to enrich the experience in the recreational site.
- » The nodes will be designed to enhance aesthetics through use of appropriate plant and other landscape elements such as paved pedestrian walkways, seats, waste bins, shade structures, public toilets and nature trail.
- » All the recreational spaces in the town shall be linked to the riparian reserve to create a large network of interconnected green spaces.
- » Design the drainage system to allow for slower flow of run-off to allow for maximum percolation.
- » Carry out deliberate enrichment planting of the rare, endangered and threatened species along infrastructural corridors such as roads, foot paths, at landscaping and recreational sites and within social amenity institutions such as health, education and religious facilities.
- » Domesticate the wild fruit trees and growing of herbs within plots and as live fences.
- » Ensure compliance with the EMCA regulations for the same.
- » Establish a botanical garden for educational, research and recreational purposes targeting all the indigenous species found in Aberdare Forest Block.
- » Increase vegetation cover and diversity of plants in all possible locations using mainly indigenous vegetation.
- » Leave and fence at least 15% (10 ha.) of the total land that is most forested with the highest diversity of flora and fauna as a conservation, educational and research site within the township (Botanical garden/Arboretum).
- » Mitigation hierarchy recommends avoiding, minimizing, reuse and recycle. What can be avoided should be avoided. All organic waste should be composted and re-used.
- » Plant as many shade trees as practically possible and other trees and shrubs as possible in all un-used spaces including infrastructure corridors to allow for sufficient transpiration of the vegetation.

- » Plant over 110 hectares of trees (about 162,500 trees and shrubs in an alternative but adjacent site to provide for the same function of transpiration.
- » Promote apiculture to supply honey
- » Promotion of massive tree planting by the neighboring communities
- » Provide PPEs (e.g. dust masks) to workers at all times
- » Noise restriction signs should be displayed where necessary to warn potential noise generators (e.g. at bus parks, night clubs and churches)
- » Ensure noise generators comply with noise regulations/enforce compliance to noise regulations.
- » Open up compacted sites before landscaping and greening to improve on the soil structure.
- » Re-use excavated soil for landscaping along the pedestrian walkways, road reserves and parking areas.
- » Provide for porous pavements during construction to allow for maximum water percolation.
- » Strategic citing of water retention trenches to enhance water percolation for underground water recharge and river flow regulation
- » Establishment of a water and sewerage company to take primary responsibility for efficient management and provide Provision of water in the town
- » Promote roof catchment/rain water harvesting and use at plot level to reduce the quantity of water run-off, and to reduce water demand/costs.
- » Vegetate all embankments to avoid soil erosion and replant with indigenous species
- » Enforce the law on routine maintenance of vehicles and other machinery to ensure minimized emission of pollutants (e.g. nitrogen and sulphur oxides from vehicles and machinery exhaust systems).

In conclusion the ESIA team notes that from the results of this independent ES Forest LN. No.48/194, to allow for expansion of Ndaragwa Township from in Ndaragwa Sub County, Nyandarua County, the ESIA concludes that:

- a) **Rare, endangered, threatened species (RETS):** The proposed variation will not majorly affect any RETS since there were no RETS documented and/or found within the 162.52 acres Ndaragwa Block of the Aberdare Forest. However we note that in the long run, RETS (if any) will significantly be affected negatively as more of their habitat (the forest) is cleared. Further all the wild animals will move further away as the town moves closer to their habitat.

- b) **Water catchment areas** will also be affected negatively as follows:
- Two (2) of the rivers are not within the project site Mbobo and Pesi, as well as Pesi river is closer to the proposed site boundaries, will be affected significantly with an overall reduction in stream flow since there will be little percolation of rain water.
 - Over 851,136 cubic metres of available water/year will be lost estimated at 12,400 cubic metres per/ha/year of forest lost.
 - The water catchment ecosystem functions such as: flood mitigation, water storage, re-charge of ground water, reduced soil erosion and siltation, water purification, micro-climate regulation, nutrient cycling will cease.
 - There will be increased atmospheric carbon-dioxide that may cause climate change in the long term, leading to either increased, erratic or reduced rainfall. Increased atmospheric temperature will also lead to increased evapotranspiration hence increased water demand.
- c) **Biodiversity conservation:** since the proposed site is already occupied and some areas developed, the main biodiversity identified were the *Kikuyu grass*, *Leleshwa shrub* and scattered exotic and few indigenous trees that are spread across the site. The site is also a habitat for various invertebrates such as insects. There were no wild animals within the project area. Thus the proposed variation will not have adverse impact on the local biodiversity. Nonetheless, the broader biodiversity ecosystem functions of the larger Aberdare Forest will be greatly impacted in the long run. In summary, as the vegetation will be cleared and the above and below ground fauna that depends on the vegetation will also cease.
- d) **Educational, cultural, recreational, health or research:** Currently no educational, cultural, recreational, health or research are being conducted/situated within the area proposed for variation.
- e) **Cumulative positive impacts:** The positive impacts of the proposed boundary variation include: addition of more land for provision of vital social and community facilities, availability of additional land for infrastructure and amenity development, increase of land available for housing, increased investment, employment and economic activities in general. Others include temporary increase in wood fuel supply in the short to medium term.
- f) **Cumulative negative impacts:** The key negative impacts include loss of biodiversity, reduced water volume (at 12,400 cubic metres/ha/year), loss of water quality and regulation function of the forest, land degradation, reduction of air quality and air regulation function of the forest, reduction in contribution to

rainfall formation and increase in temperature. Others are poor landscape appearance, increase in concrete surface, increase in noise and vibrations and, loss of non-timber forest products such as honey, medicinal herbs and wild fruits.

- g) **Best alternative:** Alternative 2 has the highest combined positive environmental and socio-economic impacts. This option proposes varying of the boundary to accommodate only the already developed and surveyed area of the forest land of 162.52 acres (65.77 ha) of land for expansion of the town. This will ensure minimum/no additional loss of forest land.

The overall conclusion therefore is that the proposed variation of the boundary of Aberdare Forest (Ndaragwa Block) to allow for expansion of Ndaragwa Township from 38.47 acres (15.56 ha) to 300 acres (121.41 ha) as per survey plan FR 341/63 of 1991 is harmful to the environment in both the short term, medium term and long term. The boundary should therefore not be varied as proposed. However, variation of the boundary as per the 2007 Survey Plan whereby the land is varied from 38.47 acres (15.56 ha) to 162.52 acres (65.77 ha) can be implemented since:

- (i) The impacts on all the four areas as per section 34 of the Forest Conservation and Management Act, 2016 covered above shall be minimal and insignificant particularly during the operation phase.
- (ii) Already 80% of the land has been developed/is occupied as urban land use. As established during the assessment, the area has not had any indigenous forest for the last 40 years.
- (iii) The mitigation measure for the 20% that has not been converted to urban land use - i.e. the southern side of the Catholic Parish land among other undeveloped land within the project site, to be used for recreation sufficiently mitigates against all possible negative effects (
- (iv) The Director of Survey, surveyed the land in 2006 and the survey plan was approved in 2007 (See appendix 5).

Based on the above conclusion and the overall study, the ESIA team recommends:

- a) **Boundary Variation:** The proposed variation of the boundary of Aberdare Forest (Ndaragwa Block) to allow for expansion of Ndaragwa Township should be supported and approved as per the 2007 Survey Plan to change from 38.47 acres (15.57 ha) to 162.52 acres (65.77ha) and NOT 300 acres (121.41 ha) as proposed by the petitioners.

- b) **Mitigation plan:** Mitigation measures that include best environmental management practices, recommended in this report, should be diligently implemented to help protect the physical, ecological and socio-economic environment of the affected forest area. Key players will need to undertake all necessary measures to ensure adverse impacts are mitigated to the extent practically possible during the different project phases.
- c) **Physical and land use planning:** With the approval of this proposal, Nyandarua County Government should prepare a comprehensive Local Physical and Land Use Development Plan as per section 45 of the Physical and Land Use Planning Act 2019.
- d) **Waste management:** Nyandarua County Government in collaboration with other partners in waste management to formulate policies, by laws and economic instruments to reduce waste quantities and manage it well
- e) **Water catchments, biodiversity mainstreaming and climate change resilience:** Nyandarua County Government in collaboration with relevant agencies to embed biodiversity considerations into County/town policies, strategies and practices of key public and private actors that impact or rely on biodiversity, so that it is conserved and sustainably used both locally and globally.
- f) **Affordable and clean energy:** such as cooking gas (LPGs) and eco *jikos* should be promoted to Ndaragwa residents' at subsidized rate to curb on charcoal production and wood fuel use in the area. This will save hectares of forest each year. Further, switching from wood to LPG can reduce cooking carbon emissions significantly.
- g) **Riparian reserve areas conservation and management:** Nyandarua County Government should prepare a riparian reserve conservation plan for the affected areas as a way to ensure environmental services of riparian areas are maintained.
- h) **Sustainable Tourism Development:** Ndaragwa CFA has an established partnership with the KFS office for reforestation of open spaces within the gazetted forest area, and to protect and co-manage the Twin Falls on Pesi River. The County Government (Department of Tourism) should support this partnership by providing facilities to improve the waterfall as a tourism asset (latrine, water point, benches, clearing of the nature trail, establishment of a camping site etc.). The department should also support them in marketing the site and establishing linkage between the CFA and tour companies so that local and international tourists from Nyeri and other areas can stop by for viewing or camping as they head to Aberdares National Park through the nearby gates or to Nyahururu and Nakuru.

TABLE OF CONTENTS

CERTIFICATION	II
ACKNOWLEDGMENT	III
PROJECT TEAM	IV
EXECUTIVE SUMMARY	VI
TABLE OF CONTENTS.....	XVIII
LIST OF MAPS	XXI
LIST OF TABLES	XXI
LIST OF FIGURES.....	XXII
LIST OF PLATES	XXIII
LIST OF CHARTS.....	XXIV
LIST OF ABBREVIATIONS	XXV
CHAPTER ONE.....	1
INTRODUCTION	1
1.1: PREAMBLE.....	1
1.2: PROJECT BACKGROUND	2
1.3: PROJECT OBJECTIVES.....	3
1.4: TERMS OF REFERENCE [ToR]	4
1.5: STUDY GUIDING PRINCIPLES.....	5
1.6: SCOPE OF THE ESIA STUDY.....	6
1.7: STUDY METHODOLOGY	7
CHAPTER TWO:.....	13
PROJECT DESCRIPTION	13
2.1: OVERVIEW	13
2.2: LOCATION OF THE PROJECT SITE.....	13
2.3: HISTORY OF PROPOSED BOUNDARY VARIATION	16
2.4: PROJECT JUSTIFICATION.....	21
2.5: PROPOSED ESIA SITE.....	24
2.6: EXISTING LAND USE OF PROPOSED ESIA SITE	24

CHAPTER THREE	30
POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK.....	30
3.1: OVERVIEW	30
3.2: INTERNATIONAL POLICY FRAMEWORK.....	30
3.3: NATIONAL POLICY FRAMEWORK	35
3.4: NATIONAL LEGAL FRAMEWORK.....	39
3.5: INSTITUTIONAL FRAMEWORKS	50
CHAPTER FOUR	54
BASELINE ENVIRONMENTAL CONDITIONS.....	54
4.1: OVERVIEW	54
4.2: SITE DESCRIPTION	54
4.3: PHYSICAL ENVIRONMENT	55
4.4: BIOLOGICAL ENVIRONMENT	60
4.5: SOCIO-ECONOMIC ENVIRONMENT	62
4.6: PHYSICAL INFRASTRUCTURE	71
CHAPTER FIVE	74
STAKEHOLDERS AND PUBLIC PARTICIPATION	74
5.1: OVERVIEW	74
5.2: BASIS FOR STAKEHOLDERS AND PUBLIC ENGAGEMENT	74
5.3: METHODOLOGY & DATA COLLECTION	75
5.4: KEY INFORMANT PARTICIPATION.....	77
5.5: HOUSEHOLD INTERVIEWS	94
5.6: BUSINESS COMMUNITY INTERVIEWS	97
5.7: MATTERS ARISING FROM TOWN PLANNING FORUMS.....	100
5.8: ESIA VALIDATION WORKSHOP.....	104
CHAPTER SIX.....	111
IMPACT IDENTIFICATION, ASSESSMENT AND ANALYSIS	111
6.1: OVERVIEW	111
6.2: FOREST ECOSYSTEMS PROFILING	111
6.3: DESCRIPTION OF ACTIVITIES AT PROJECT CYCLES	113

6.4:	IMPACTS AS PER FOREST CONSERVATION & MANAGEMENT ACT ...	114
6.5:	PROJECT CYCLE ENVIRONMENTAL IMPACTS	119
6.6:	SOCIO-CULTURAL AND ECONOMIC IMPACTS	121
6.7:	IMPACTS ANALYSIS.....	127
6.8:	ENVIRONMENTAL RISK ANALYSIS	133
CHAPTER SEVEN.....		137
ANALYSIS OF PROJECT ALTERNATIVES		137
7.1:	OVERVIEW	137
7.2:	ALTERNATIVE 1: COMPLETE RELOCATION OPTION (CRO).....	137
7.3:	ALTERNATIVE 2: - ADOPTION OF THE SURVEY PLAN OPTION (SPO).	140
7.4:	ALTERNATIVE 3 - NIL-INTERVENTION OPTION (NIO)	142
7.5:	ALTERNATIVES COMPARISON	145
CHAPTER EIGHT.....		146
MITIGATION MEASURES AND ENVIRONMENTAL & SOCIAL MANAGEMENT PLAN (ESMP)		146
8.1:	OVERVIEW	146
8.2:	ENVIRONMENTAL MITIGATION MEASURES	146
8.3:	ENVIRONMENTAL MANAGEMENT AND SOCIAL IMPACT MANAGEMENT PLAN (ESIMP).....	150
CHAPTER NINE		158
SUMMARY, CONCLUSION AND RECOMMENDATIONS		158
9.1:	OVERVIEW	158
9.2:	SUMMARY	158
9.3:	CONCLUSION	160
9.4:	RECOMMENDATIONS.....	163
REFERENCES.....		168
APPENDICES.....		170

LIST OF MAPS

Map 1: Location Map of the Proposed Site	14
Map 2: Local Context of the Proposed Site	15
Map 3: The old Ndaragwa town 15.569 ha (A), proposed 65.77 ha (B) and 44.530 ha (C) Extensions.....	20
Map 4: Location Map of the Proposed Site from Nyahururu-Nyeri Road	55
Map 5: Topographic Map of the Proposed Site	57

LIST OF TABLES

Table 1: Proposed Land Use and Land Activities for Ndaragwa Town Expansion	22
Table 2: Rainfall in Selected Centres in Nyandarua County	56
Table 3: Population Distribution and Density by Sub-County	63
Table 4: Sports Facilities in Nyandarua.....	70
Table 5: Duration of Impacts	127
Table 6: Rating criteria.....	127
Table 7: Weighted potential environmental impacts of implementing the Aberdare Forest Boundary Variation Plan	128
Table 8: Weighted potential socio-economic impacts of implementing the Aberdare Forest Boundary Variation Plan	129
Table 9: Summary of impacts for selected environmental and socio-economic parameters	131
Table 10: Criteria for Environmental Risk Factor Analysis	133
Table 11: Water Resources Impacts without Mitigation	135
Table 12: Impacts on air quality regulation without mitigation	135

Table 13: Impacts on bio-diversity without mitigation	136
Table 14: Weighted potential environmental impacts at the current proposed site of implementing alternative 1 which is the Complete Relocation Option.....	138
Table 15: Weighted potential socio-economic impacts of implementing Alternative 1	139
Table 16: Weighted potential environmental impacts on Aberdare forest of implementing Alternative 2 which is a Survey Plan of 2007 Option.....	140
Table 17: Weighted potential socio-economic impacts on Aberdare Forest of Implementing Alternative 2 – Survey Plan of 2007 Option	141
Table 18: Weighted potential environmental impacts on Aberdare forest of implementing Alternative 3 which is a No Intervention Option (NIO).....	143
Table 19: Weighted potential socio-economic impacts of implementing Alternative 3	144
Table 20: Summary of environmental and social impacts for the four project options	145
Table 21: Environmental Management and Social Impact Management Plan for the Proposed Project.....	151

LIST OF FIGURES

Figure 1: Global Forest Trend “The Mitigation Hierarchy”	6
Figure 2: Survey Plan FR. 79/140 showing the Ndaragwa old town Boundaries	16
Figure 3: Survey Plan FR. 216/75 showing the proposed Ndaragwa town expansion by 110.3ha	18
Figure 4: Survey Plan FR. 341/63 showing the proposed Ndaragwa town expansion by 65.77ha.	19
Figure 5: The spatial distribution of the land uses and land activities within the site area	23

Figure 6: Existing Land Use of the Proposed Site	29
Figure 7: Global Forest	112
Figure 8: Water catchment areas within and adjacent to the project site.....	116
Figure 9: Mill River Park & Greenway in Stamford	117
Figure 10: Cultuurpark in Amsterdam, the Netherlands.	117

LIST OF PLATES

Plate 1: ESIA team conducting field survey of the Study Area.....	9
Plate 2: Administration Police Housing.....	25
Plate 3: Operation Government Offices within the Proposed Site.....	25
Plate 4: Nyala Dairies and Cooperative Society	26
Plate 5: Residential Areas.....	26
Plate 6: Catholic Mission Complex.....	27
Plate 7: Commercial Shops/Centres	27
Plate 8: Upcoming Developments within the Project Area.....	28
Plate 9: Main Access road to the proposed site from Nyahururu-Nyeri Road.....	54
Plate 10: The Pesi River on the Easterly section adjacent to the project Site	58
Plate 11: The Mbobo River on the Westerly end (outside) the project Site	59
Plate 12: Seasonal Stream passing Adjacent to the Catholic Mission complex	59
Plate 13: Biodiversity Species within the proposed site	60
Plate 14: A section of Aberdare forest to the west of the proposed site.....	61
Plate 15: A section of the site affected by loss of vegetation cover and soil erosion.....	62
Plate 16: The Ndaragwa Falls that can be harnessed as a tourist attraction site	64

Plate 17: A section of mountain climbing and nature trails easterly of the project Site	65
Plate 18: Nyala dairy multipurpose cooperative society located within the project area	66
Plate 19: Crop and Animal farming practiced within the project area	66
Plate 20: A section of the project area with semi-permanent housing	67
Plate 21: A section of the project area with a permanent residential house	67
Plate 22A: Interview with the Chief Kahutha sub location, Ndaragwa	76
Plate 22B: Interview with the Assistant Chief Kahutha sub location, Ndaragwa	76
Plate 23: ESIA Lead Expert, Dr. Fridah Mugo Presenting during the ESIA Validation Workshop	108
Plate 24: Stakeholders during the ESIA Validation Workshop	109
Plate 25: A Stakeholder expressing his view/opinion during the ESIA Validation Workshop	110

LIST OF CHARTS

Chart 1: Respondent’s positive environmental or socio-economic impacts of the Proposed Project.....	95
Chart 2: Respondent’s Negative environmental or socio-economic impacts of the Proposed Project.....	95
Chart 3: Respondent’s Mitigation measures of the negative environmental or socio-economic impacts of the Proposed Project	96
Chart 4: Respondent’s positive environmental or socio-economic impacts of the Proposed Project.....	97
Chart 5: Respondent’s Negative environmental or socio-economic impacts of the Proposed Project.....	98
Chart 6: Respondent’s Mitigation measures of the negative environmental or socio-economic impacts of the Proposed Project	99

LIST OF ABBREVIATIONS

CBD	Convention on Biological Diversity, 1992
CBOs	Community Based Organizations
CDF	Constituencies Development Fund
CESI	Combined Environmental and Socio-Economic Impacts
CFA	Community Forestry Associations
CGN	County Government of Nyandarua
CIDP	County Integrated Development Plan
CoK	Constitution of Kenya, 2010
CPP	Consultation and Public Participation
CRO	Complete Relocation Option
DDC	District Development Committee
ESIA	Environmental and Social Impact Assessment
EMCA	Environmental Management and Coordination Act CAP 387
EPIC	Free, Prior and Informed Consent
ERF	Environmental Risk Factor
ESMP	Environmental and Social Management Plan
ESS	Environmental and Social Safeguards (or Standards)
FCMA	Forest Conservation and Management Act, 2016
FGD	Focus Group Discussions
GoK	Government of Kenya
GOK	Government of Kenya

IPCC	Intergovernmental Panel on Climate Change
IUCN	International Union for Conservation of Nature
KEFRI	Kenya Forestry Research Institute
KFS	Kenya Forest Service
KWS	Kenya Wildlife Service
LPLUDP	Local Physical and Land Use Development Plan
NEMA	National Environment Management Authority
NGO	Non-Governmental Organization
NIO	Nil-Intervention Option
NLUP	National Land Use Policy, 2017
OSHA	Occupational Health and Safety Act, 2007
PES	Payment for Ecosystem Services
PFM	Participatory Forest Management
RDED	Rio Declaration on Environment and Development, 1992
RETS	Rare, Endangered, Threatened Species
SDGs	Sustainable Development Goals
SoK	Surveys of Kenya
SPO	Survey Plan Option
ToR	Terms of Reference
UNFCCC	UN Framework Convention on Climate Change, 1992
WB	World Bank

CHAPTER ONE

INTRODUCTION

1.1: PREAMBLE

This independent environmental and social impact assessment (ESIA) report has been occasioned by a public petition that was signed by 88 No. Ndaragwa constituency residents through their Member of Parliament, Hon. Jeremiah Kioni to vary 300 acres of forest land for economic development in Ndaragwa Township as appended in this report.

Based on the Forest Conservation and Management Act No. 34 of 2016, section 34, subsection 4 (a), Petitioners who may wish to revoke or vary public forest land must submit an independent Environmental and Social Impact Assessment (ESIA) study report that should demonstrate that the variation of boundary or revocation of the registration of a public forest or a portion of a public forest does not: a) Endanger any rare, threatened or endangered species; or b) Adversely affect its value as a water catchment area; and prejudice biodiversity conservation, cultural site protection of the forest or its use for educational, recreational, health or research purposes.

Social Impact Assessment (SIA) is a research and analytical process of identifying and managing the social issues of project development, and includes the effective engagement of affected communities and stakeholders in participatory processes of identification, assessment and management of social impacts throughout the whole project development cycle, from conception to post-closure. SIA is also used as an impact prediction mechanism and decision-making tool in regulatory processes to consider the social impacts in advance of permitting or licensing decision. This also entails statutory public participation to inform the public and allow them to have a say about a planned intervention.

Despite the petitioners request to vary 300 acres (121.41ha) of the said forest land, the ESIA team was guided by the last Survey Plan, FR 341/63 of 2007 by the Survey of Kenya (See appendix 5) as the only authoritative plan with definite boundaries for Ndaragwa township expansion from the current 38.47 acres (15.569 ha) to 162.52 acres (65.77 ha). As such, the last Survey Plan of 2007 is presumed to have amended the previous ones and hence recognized as the authentic and applicable survey plan. Further the 162.52 acres variation of the Aberdare [Ndaragwa Block] Forest has been supported by various key informants, and most importantly by the public as affirmed during stakeholders' consultation and public participation fora.

1.2: PROJECT BACKGROUND

One of the Principles of land policy under the Constitution of Kenya 2010, is that Land in Kenya shall be held, used and managed in a manner that is equitable, efficient, productive and sustainable, and in Principles of land accordance with the principles of security of land rights; sustainable and productive management of land resources and sound conservation and protection of ecologically sensitive areas.

Indeed in line with this provision, section 34 of the Forest Conservation and Management Act No. 34 of 2016, confers powers to any person may petition the National Assembly or the Senate, for the variation of boundaries of a public forest or the revocation of the registration of a public forest or a portion of a public forest. The proposal to expand Ndaragwa Township (See **appendix 4**) was reached based on that the current Ndaragwa Old town which is about 38.47 acres (See plot LR No. 9524 of 1957, **appendix 5**) gazetted in 1955 (See **appendix 3**) is fully developed and thus essential public purpose and utilities could not be allocated within this land which is within this limited space. Therefore, the expansion of Ndaragwa Township from 38.47 acres to 162.52 acres based on survey plan FR 341/63 of 2007 will see provision of adequate land for essential public utilities infrastructure (sewerage treatment works facilities, sludge disposal facility, public toilets, refuse disposal), and social amenities such as housing, schools (public primary and nursery), vocational institutions (polytechnic), recreational parks (public gardens and proposed stadium), health centres and hospitals, religious institutions (churches and Mosques), public purposes land use (administration and regular police line, ministry of works yard, Kenya Power yard, post office, County/national government offices, department of fisheries offices, department of water offices), Commercial land use (open air market and commercial stalls), transport support facilities (bus parks, motel and petrol stations) abattoirs, cemeteries among others.

In compliance with the Forest Conservation and Management Act No. 34 of 2016, section 34, subsection 4 (a), the approval of this proposal to expand Ndaragwa town is subject to the Petitioners submitting an independent Environmental and Social Impact Assessment (ESIA) study report that should demonstrate that the variation of boundary or revocation of the registration of a public forest or a portion of a public forest does not:

1. Endanger any rare, threatened or endangered species; or
2. Adversely affect its value as a water catchment area; and
3. Prejudice biodiversity conservation, cultural site protection of the forest or its use for educational, recreational, health or research purposes.

Further, section 75 of the same Act notes that in preparation of the independent EIA, Environmental Management and Co-ordination (EMCA) CAP 387 provisions shall apply where it requires a person to conserve or protect the environment as well as with respect to the manner in which the conservation or protection shall proceed.

According to the International Principles of SIA, SIA requires meaningful engagement of the affected peoples and other stakeholders in the analysis of impacts and in the planning of mitigation and benefit strategies. The process demonstrates respect to local communities and key stakeholders, provides co-learning opportunities that arrive at useful outcomes and deliver shared value. It instils a sense of ownership and a greater likelihood of attaining more sustainable project results. According to the World Bank Social Safeguards policies, the SIA should demonstrate that the variation of the boundary will not harm or adversely affect the indigenous peoples (if any), other persons and stakeholders affected by the project, and that they have been consulted and engaged for a “license to operate” or approval to proceed. That the rights of marginalized or vulnerable groups will be respected; that they will contribute towards the decision making process and the physical cultural assets will not be destroyed.

Thus UDELIC Consultants were contracted to prepare this independent Environmental and Social Impact Assessment (ESIA) report on behalf of the Ndaragwa residents/community (Petitioners) in order for the relevant Parliamentary Committee to consider approval of the proposed variation of boundary of Aberdare [Ndaragwa block] forest LN. No.48/194, to allow for expansion of Ndaragwa Township from 38.47 acres to 162.52 acres in Ndaragwa sub county, Nyandarua County.

1.3: PROJECT OBJECTIVES

The objective of the ESIA study were to:

- a) Generate baseline data that will be used to monitor and evaluate the mitigation measures implemented during the project cycle;
- b) Conduct and present Public and stakeholders Consultations findings.
- c) Identify and assess all potential positive environmental and social impacts of the proposed project;
- d) Identify potential significant negative environmental and social impacts of the project and recommend measures for mitigation;
- e) Verify compliance with the environmental regulations and relevant standards;
- f) Identify problems (non-conformity) and recommend measures to improve the environmental management system;

- g) Recommend cost effective measures to be used to mitigate against the anticipated negative impacts.
- h) Prepare an ESIA report compliant to the EMCA CAP 387 and the Environmental (Impact Assessment and Audit) Regulations (2003).

1.4: TERMS OF REFERENCE [ToR]

The TOR for this assessment was based on the Environmental (Impact Assessment and Audit) Regulations dated June 2003 and section 34, subsection 2 of the Forest Conservation and Management Act, 2016. The report contains:

- a) Discloses the ground for the variation of the boundaries of a public forest or the revocation of the registration of a public forest or a portion of a public forest.
- b) Location of the proposed project including the physical area that may be affected by the project's activities
- c) A description of the Environmental policy, institutional and legal framework, baseline information, and any other relevant information related to the project.
- d) The objectives of the proposed project.
- e) The materials to be used in the construction and implementation of the project.
- f) A description of the potentially affected environment including among others: Endanger any rare, threatened or endangered species; water catchment area; and biodiversity conservation, cultural site protection of the forest or its use for educational, recreational, health or research purposes.
- g) The environmental effects of the project including the social and cultural effects and the direct, indirect, cumulative, irreversible, short-term and long-term anticipated effects.
- h) Analysis of project alternatives including project site, design and technologies.
- i) An environmental management plan (EMP) proposing the measures for eliminating, minimizing or mitigating adverse impacts on the environment, including the cost, timeframe and responsibility to implement the measures.
- j) The social risks and effects of the project including loss of livelihoods, loss of land/other assets, increased land value, insecurity, crime and anti-social behaviour among others.

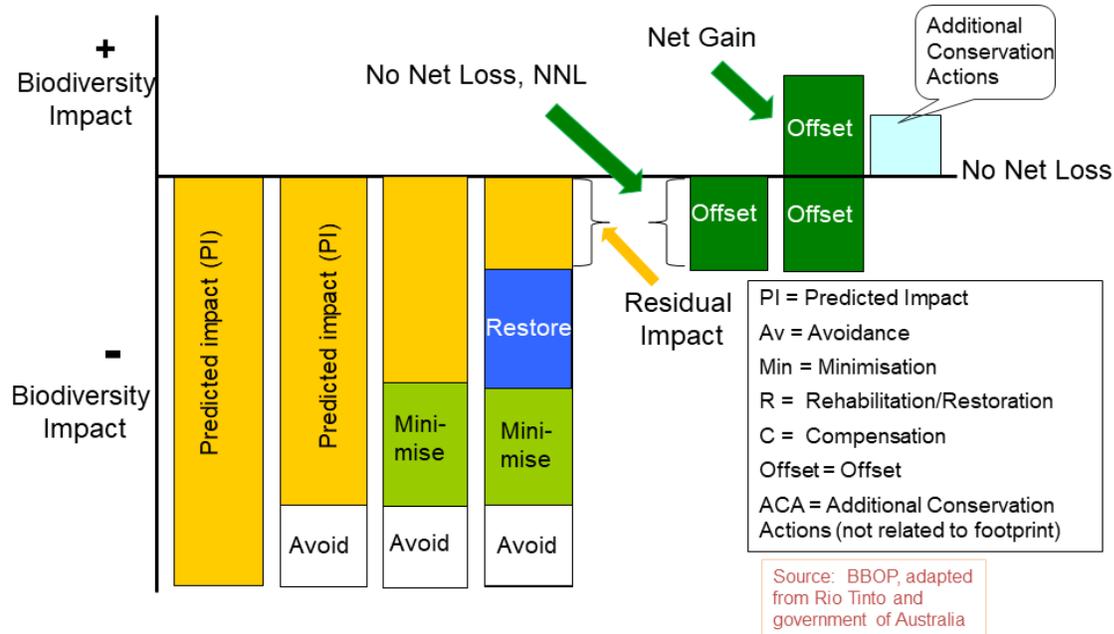
1.5: STUDY GUIDING PRINCIPLES

Pursuant to the ESIA guidelines and the global sustainable development agenda, our specific guiding principles of this independent ESIA study included among others:

- a) Environmental concerns must be accounted for in all development activities.
- b) Public participation in the development of projects, policies, plans and programmes important.
- c) Recognition of social and cultural principles traditionally used in the management of the environment and natural resources
- d) International cooperation in the use and wise management of shared resources
- e) Intra-generational and inter-generational equity
- f) Polluter-pays principle
- g) The precautionary principle.
- h) Mitigation hierarchy principle: As a principle it enabled the Consultants to work towards 'No Net Loss' of biodiversity (NNL), and preferably, a 'Net Gain' (NG) especially in coming up with alternatives as demonstrated in *figure 1*. Essentially, the mitigation hierarchy is defined as:
 1. Avoidance: measures taken to avoid creating impacts from the outset (including direct, indirect and cumulative impacts) in order to completely avoid impacts on certain components of biodiversity.
 2. Minimization: measures taken to reduce the duration, intensity and/or extent of impacts (including direct, indirect and cumulative impacts) that cannot be completely avoided, as far as is practically feasible.
 3. Rehabilitation/restoration: measures taken to rehabilitate degraded ecosystems or restore cleared ecosystems following exposure to impacts that cannot be completely avoided and/or minimized.
 4. Offset: measures taken to compensate for any significant residual, adverse impacts that cannot be avoided, minimized and/or rehabilitated or restored, in order to achieve no net loss or preferably a net gain of biodiversity. Offsets can take the form of positive management interventions such as restoration of degraded habitat, arrested degradation or averted risk, protecting areas where there is imminent or projected loss of biodiversity.
 5. Need for the proponent to seek Free, Prior and Informed Consent (FPIC) and must secure the social license to operate
 6. Recognition of the human rights of and engagement of indigenous peoples, minority groups and persons with special needs to ensure inclusion of all key stakeholders

7. Assessment of social risks and impacts of the proposed project on people's livelihoods, health, cultural heritage or other social assets.

Figure 1: Global Forest Trend “The Mitigation Hierarchy”



1.6: SCOPE OF THE ESIA STUDY

As guided by EMCA CAP 387 and the Environmental (Impact Assessment and Audit) Regulations (2003), the scope of this Environmental and Social Impact Assessment covered but was not limited to:

(1) Baseline Conditions:

- Site location
- Environmental setting (climate, topography, geology, hydrology, ecology, water resources, sensitive areas etc.),
- Socio-economic activities in the project site and in surrounding areas (land use, human settlements, economic activities, institutional aspects, water demand and use, health and safety, public amenities, etc.).
- Social amenities such as schools, health facilities, recreational facilities
- Any cultural heritage sites (i.e. physical cultural assets) or norms, values and practices
- Infrastructural issues (roads, water supplies, drainage systems, power supplies, bus parks, parking areas etc.).

(2) Local legal and policy framework: Focusing on the relevant national environmental laws, regulations and bylaws and other laws and policies focusing on allied activities relative to the project.

(3) International social safeguards policies and principles that seeks to prevent and mitigate undue harm to people in the development process.

(4) Interactive approach was adopted for the community members in discussing relevant issues including among others: Land-use aspects, Neighborhood issues, Project acceptability, Social, cultural and economic aspects,

(5) Project impacts: Environmental, Social Impacts, Physical Impacts, Biological impacts as well as Legal Compliance (the direct, indirect, cumulative, irreversible, short-term and long-term anticipated effects) and adherence to recognized international social impact assessment standards.

(6) Mitigation measures for to adverse impacts, and

(7) An Environmental Management and Monitoring Plan and a Social Impact Management Plan for the proposed project proposing the measures for preventing, eliminating, minimizing or mitigating adverse impacts on the environment, including the cost, human resources, timeframe and responsibility required to implement the measures.

The output of this work was a comprehensive Environmental and Social Impact Assessment Report to ensure that appropriate measures to mitigate any adverse impacts to the environment and the people are taken into consideration and for licensing of the project

1.7: STUDY METHODOLOGY

The preparation of an Environmental and Social Impact Assessment report is a multi-disciplinary process that requires use of various approaches and data collection methods. In this particular survey, public participation and consultation (with members of the community in the project areas, local leaders, persons with special needs, county and national government personnel and parastatals), administration of questionnaires, field survey, observations, photography and discussions with the Petitioners representatives including the area MP, MCA, Chief among others) was widely used and the bottom-top approach of participation applied. Both scientific and social data collection methods were used and they included the following:

1.7.1: Environmental Screening

Screening of the project was undertaken to evaluate the need of conducting an ESIA study and the level of study. Through a Terms of Reference Report (ToR No. 30) submitted by the lead Expert to NEMA, the project was identified as among those requiring Environmental and Social Impact Assessment Study under schedule 2 of EMCA, CAP 387.

1.7.2: Environmental Scoping

The project scoping stage phase involved issuing a notice of intent to conduct the ESIA, and distribution of notices through announcements in churches and on the County District Commissioner's office, the chief's notice board and in other strategic places for public information. Thereafter, the ESIA team conducted preliminary discussions with the project proponent and community leaders on project issues and for mapping and selecting the key stakeholders to be consulted during the detailed field survey was applied to narrow down the project issues to that requiring detailed analysis. The process also involved site visits and observation to ascertain boundaries, land uses, available social amenities among others conducting discussions with the proponent on the project issues. These activities helped to narrow down the project issues to those requiring detailed analysis and to refine the study methodology and data collection tools.

1.7.3: Data Collection

Primary data was collected through qualitative and quantitative methods including public participation, key informant interviews and administration of business and household questionnaires.

Secondary data was collected through review of documents such as related policies, legal and institutional frameworks that govern the proposed project. The documents included the Environmental Management and Coordination Act CAP 387, the Forest Conservation and Management Act, 2016, the Land Act, the Nyandarua County Integrated Development Plan 2018-2022 and the project area survey plans. The Consultant also reviewed the Aberdare Forest Reserve Management Plan, the Aberdare Ecosystem Management Final_Plan_2010-2020, the Ndung'u Report, the Environmental (Impact Assessment and Audit) Regulations (2003), Occupational Health and Safety Act, 2007, the Forest Conservation and Management Act, 2016, the World Bank Social Safeguards Policies, and the international SIA principles among others,.

1.7.4: Desktop Case Studies

Desktop studies were conducted through review of secondary data to establish the legal policies, legislative and institutional framework governing the proposed project. This included a thorough review of case studies of forest boundaries variation for other land uses case studies both in Kenya and globally, to establish the project area baseline information including documented sensitive environmental receptors. Types and volumes of waste to be generated, potential positive and negative impacts and proposed management and disposal methods;

1.7.5: Field Assessment

Detailed field surveys for this study were undertaken within the proposed project area and it involved conducting field visits to appreciate conditions of the project area, conduct preliminary analysis of potential key direct and indirect impacts of the Project, environmental and social conditions in the potentially affected areas, identify and map the stakeholders to be consulted during the detail field visits and data collection as well as collect available information from the Kenya Forest Service Ndaragwa station and other line county departments such as the department of lands and physical planning, environment among others. *See plate 1.*

Plate 1: ESIA team conducting field survey of the Study Area



Source: Field Survey, 2019

1.7.6: Stakeholders and Public Consultations

The ESIA team visited the site, mapped and identified the key stakeholders. Key informants were identified including representatives of various institutions, county departments and state ministries, community forest association groups and Ndaragwa town residents. The ESIA team ensured involvement and consultation of persons with special needs including women, youth, the elderly and Persons with Disabilities. Semi-structured interview guides (See Appendix 11) were used for the Key Informant Interviews (KIIs). Further, questionnaires were administered to households and business groups within the project site, mainly to get primary data on anticipated social, economic and environmental effects of the development (See appendix 9 and 10). Consultation with the project Petitioners. The key stakeholders included the general public, the elderly, leaders of various community groups, special needs groups, the local CFA, county and state government representatives and other government institutions, including:

- County Government of Nyandarua (County Physical Planner and the County Surveyor)
- Ndaragwa Constituency MP
- Ndaragwa National Constituency Development Fund (NNCDF) officials
- Kenya Forest Service Station Manager and Officer, Ndaragwa
- Social Services Department, Ndaragwa
- Director, Tourism Department, Ol Kalou
- Local administration of Ndaragwa -Kahutha sub location Chief/ Assistant Chief
- County NEMA Director
- Ndaragwa Health Centre Officer in charge
- Nyandarua sub county offices
- Ndaragwa primary school head office
- Ndaragwa police station
- Holy family catholic church
- Nyala dairy multipurpose cooperative society.
- Vice Chairperson, Ndaragwa Constituency PWD CBO
- Maendeleo ya Wanawake Chairlady
- Youth Chairperson with 3 other youth members
- Business community representatives - matatu operators, motor cycle operators, food market traders, and clothes market representatives and mechanics
- A group of elders for historical information

Box 1 gives shows some of the stakeholders/ public consultations sessions:

Box 1: Stakeholders and Public Consultations Sessions.

KII Social Services during Stakeholders and Public Consultations



KII Vice Chair PWDs Interview with Sociologist, Ms. Margaret Ngina in Ndaragwa



KFS Station Manager with Sociologist, Ms. Margaret Ngina in Ndaragwa



Chief, women leader and CFA Rep. during Stakeholders and Public Consultations



Source: Field Survey 2019/20

1.7.7: Household and Business Group Interviews



Household and business groups' questionnaires as well as oral interviews were administered mainly to get primary data from households within the project site with regards to social, economic and environmental effects the development (See appendix 9 and 10). The aim of the survey was to establish acceptability of the project to the public and especially the area residents who are likely to suffer or benefit most from the impacts of the proposed project. See box 2.

Source: Field Survey 2019/20

1.7.8: Preparation of the Independent ESIA Report

The ESIA team synthesized and harmonized the study findings in a report-writing workshop. This was to ensure that key environmental and socio-economic aspects have been captured and documented clearly and logically. The compilation of this report has been done pursuant to section 34 of the Forest Conservation and Management Act, 2016, EMCA CAP 387, the Environmental (Impact Assessment and Audit) Regulations, 2003, the Environmental (Impact Assessment and Audit) Regulations 2002 and the Environment Impact Assessment guidelines and administrative procedures of 2002.

CHAPTER TWO:

PROJECT DESCRIPTION

2.1: OVERVIEW

This section details out the description of the location, history, justification, proposed use, and existing use of the proposed site for variation of boundary in Aberdare forest for expansion of Ndaragwa Township in Nyandarua County.

2.2: LOCATION OF THE PROJECT SITE

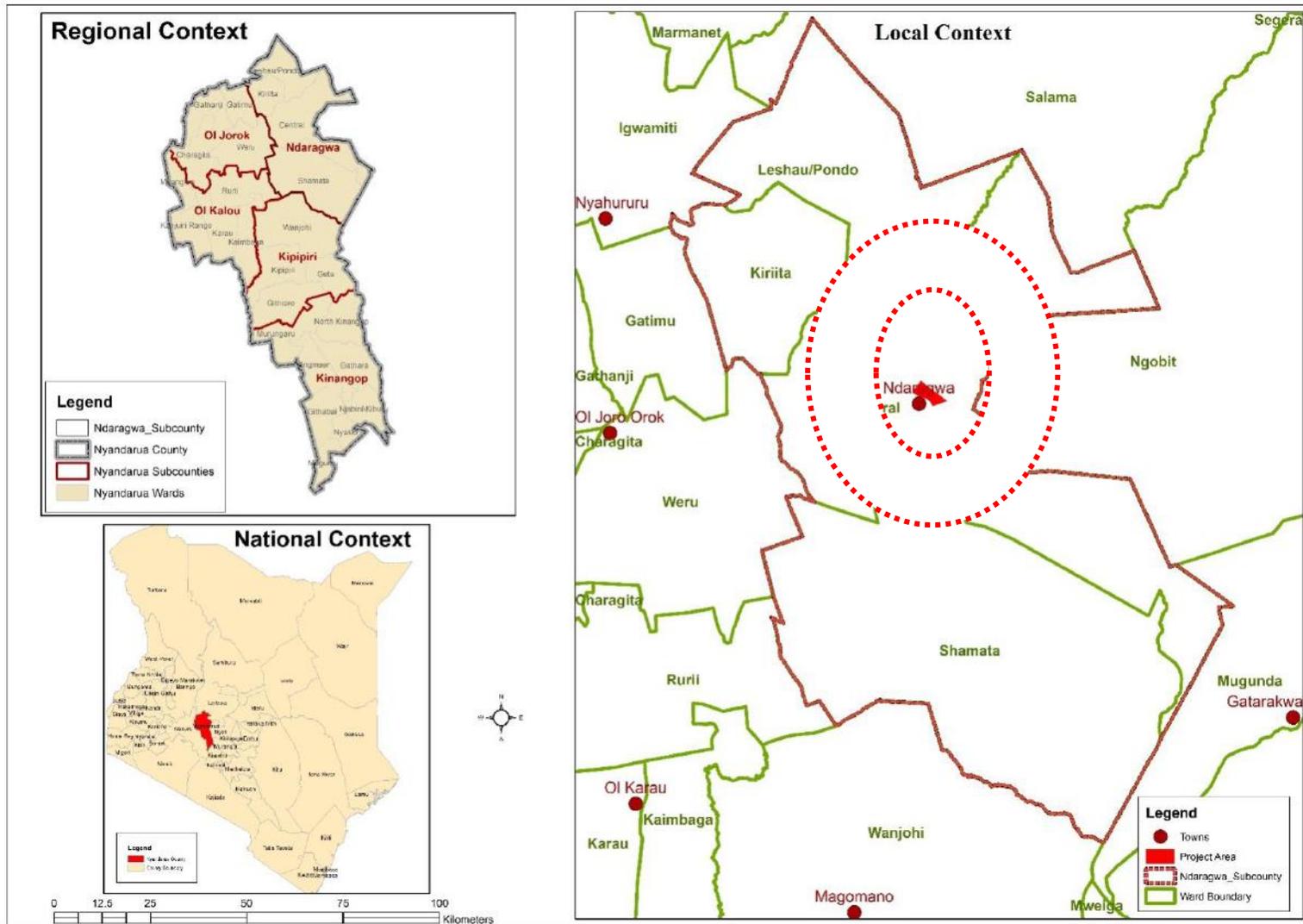
The proposed site covering 38.47 acres (15.569 ha), is located at 0.0581° S, 36.5311° E. The site is approximately 26.9 km from Nyahururu town on Nyahururu - Nyeri Road. The site is bound by the Aberdares Forest to the North and easterly, Aberdare Forest to the west and Nyahururu-Nyeri road to the south - see *map 1 & 2*.

Regionally, the proposed site is located in Ndaragwa Constituency Nyandarua County. Nyandarua County lies in the central part of Kenya between latitude 0°8' North and 0°50' South and between Longitude 35° 13' East and 36°42' West. It is linked to the other counties through the major trunk roads. To Nairobi, it is connected via (A8) to Mombasa, and to Kisumu via (A12) - see *map 1*.

The County is connected to Uganda and Tanzania by primary roads: Ol'Kalou-Miharati-Engineer Road (B20) and Ol'Kalou-Gilgil Road (A4) that join the Nairobi-Nakuru Transnational Highway (A8) at Nakuru and Gilgil respectively. The highway then connects the County to Uganda via Eldoret, Webuye and Malaba and to Tanzania via Road (A12) through Kisumu, Migori and Isebania.

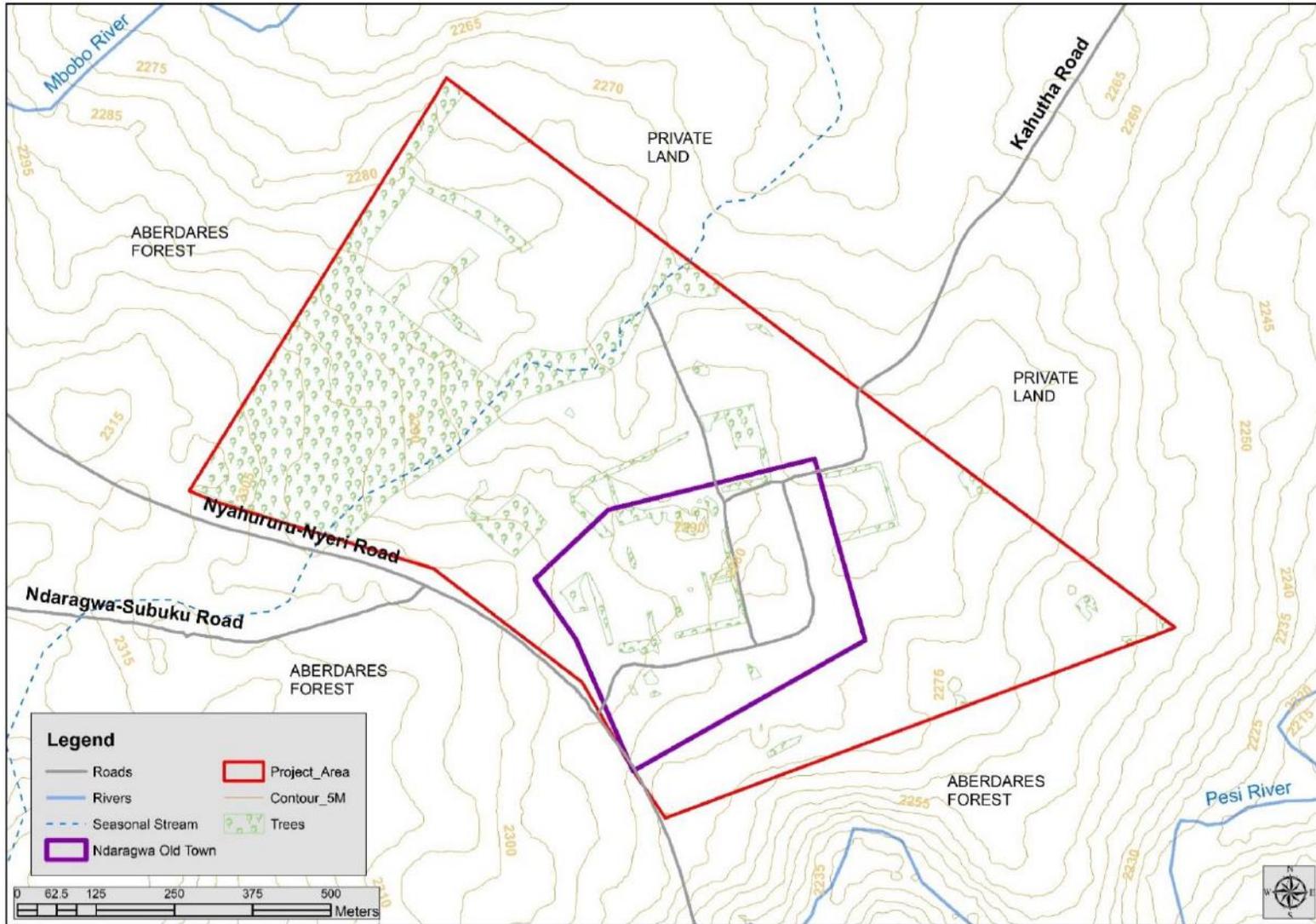
The locational advantage opens up both the proposed site and the County at large to vast trading and investment opportunities within East Africa due to an enlarged market and the expected ease of transporting raw materials and finished products.

Map 1: Location Map of the Proposed Site



Source: Google Earth and modified by Author, 2019

Map 2: Local Context of the Proposed Site



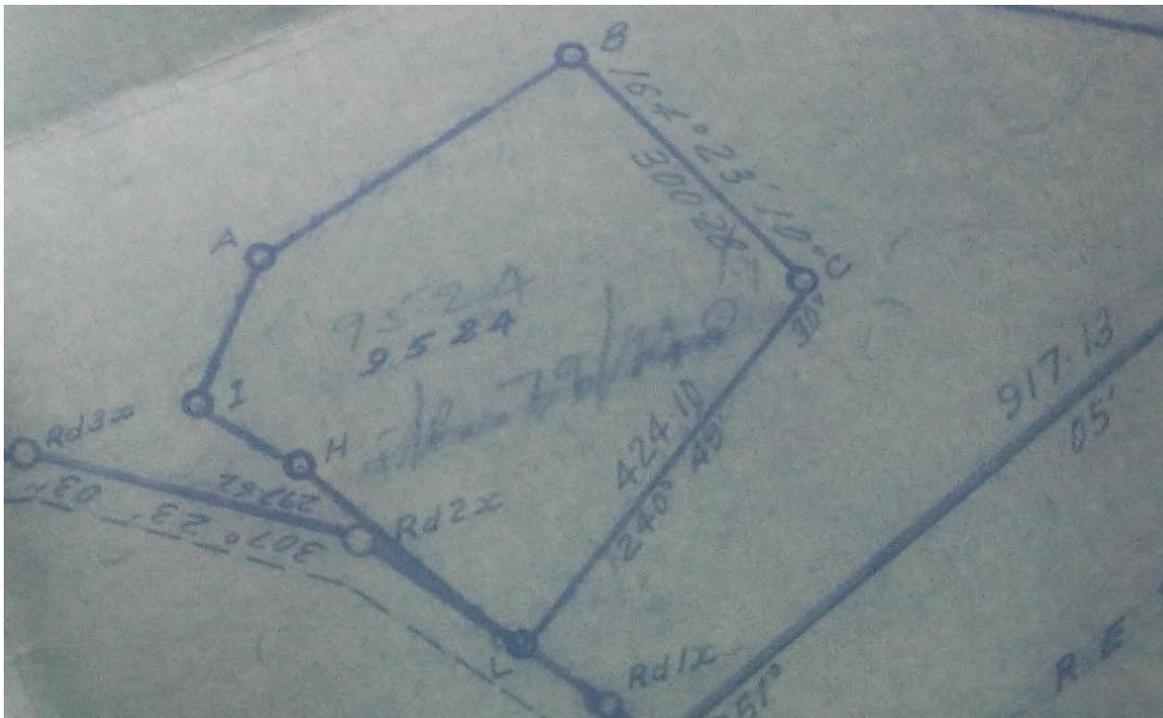
Source: Survey of Kenya and modified by Author, 2019

2.3: HISTORY OF PROPOSED BOUNDARY VARIATION

Ndaragwa old town measuring approximately 15.569 ha (38.47 acres), registered as Plot LR No. 9524 (See Figure 2) was curved out of the Aberdares Forest Reserve (1957) as an African Trading Centre by the colonialists, following degazettement of that portion of the Forest Reserve as per proclamation no. 18 of 1955 (Appendix 4).

The first development plan was prepared in 1983. Hitherto, allocation of plots was based mainly on temporary occupational licenses from the now repealed local authority. The need for expansion of the town in the 1980s necessitated the revision of the town development plan. Therefore, a series of plans were prepared which included the 1988, 1996 and finally 1999 draft plans. None of these development plans were approved due to the unresolved issue of forest land degazettement. Planning and even land allocation was done pending formal degazettement. In terms of development activities, Ndaragwa town is the largest and the most active designated urban centre in Ndaragwa Sub-county (in spite of Mairo Inya urban centre, being more active commercially, it is undesignated, unplanned and is located at the boundary of Laikipia and Nyandarua counties in the outskirts of Nyahururu town.

Figure 2: Survey Plan FR. 79/140 showing the Ndaragwa old town Boundaries



Source: Survey of Kenya, 2007

In 1988 a proposal was made to elevate the trading center into an urban council. On 25th January 1988, the President, who was on a tour of the area, consented to the proposed expansion of the town into the forest by 113.3 ha (280 acres).

On 22nd Oct 1991, the Department of Survey carried out and completed survey works for the proposed 113.3 ha (280 acres). Survey F/R No. 216/75 and later boundary plan no. 175/325 for the parcel LR No. 15411 were generated.

In March 1992, the Forest Department forwarded the approved survey plan to the PS, Ministry of Environment and Natural Resources.

On 29th July 1992, the PS wrote to the AG seeking approval of the gazette notices. On Aug. 31st 1992, the AG approved the gazette notices. However, notice of the degazettement was not done.

Later on 5th Dec 2003, the DDC sanctioned the excision of the 280 acres from the forest for the purpose of expanding the town. To date, nothing has been done as regards to the degazettement of the 280 acres. Later, the Ndungu report of 2003 recommended that the forest land should go back to the forest excluding the 15.569 ha citing illegal/irregular allocation of public land.

In 2006, the County Forest Department acknowledged the fact that the town had outgrown the 15.569 ha (A) and that there was need to accommodate the developed area. They carried out a survey and adjusted the proposed 110.3 ha (B) to 55.3ha [50ha for the town +5.3 ha for the Catholic mission]. This in effect left out about 44.530 ha (C) of the proposed area, which is still under forest. (See *figure 4* Survey Plan FR. 341/63 showing the proposed Ndaragwa town expansion by approximately 65.77ha) and *figure 5* of the same as modified by the survey of Kenya (SOK).

The old town is fully developed. Essential public purpose facilities and utilities cannot be allocated to this land due to the limited space. In this regard, local leaders, through the County Council of Nyandarua and the District Development Committee (DDC) recommended the excision of 110.3 ha of the forest land (Survey Plan FR. 216/75) for the purpose of expansion of the town - see *Figure 3*.

Figure 3: Survey Plan FR. 216/75 showing the proposed Ndaragwa town expansion by 110.3ha



Source: Survey of Kenya, 2007

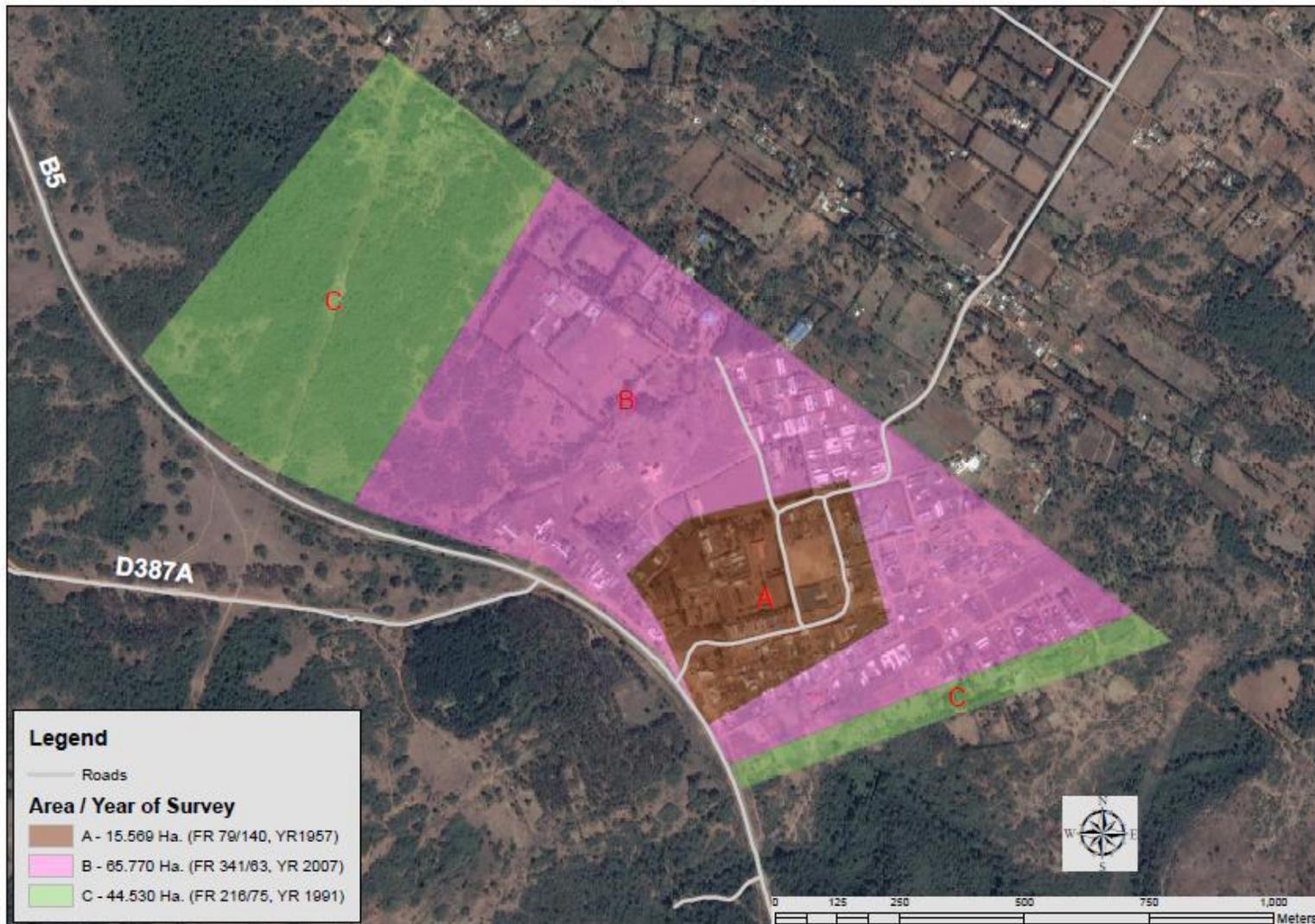
Over the years, the town indeed has grown both in size and function. Its administrative function has seen it get elevated from a location, division and currently district headquarters for Nyandarua North. This has not only necessitated the need for more land but also the need for planning. It is in this regard that the excision of part of Aberdares forest is a priority given that the official 15.569 ha of 1955 is sandwiched fully by Ndaragwa.

Figure 4: Survey Plan FR. 341/63 showing the proposed Ndaragwa town expansion by 65.77ha.



Source: Survey of Kenya, 1991

Map 3: The old Ndaragwa town 15.569 ha (A), proposed 65.77 ha (B) and 44.530 ha (C) Extensions



Source: Google Earth, Modified by Author, 2019

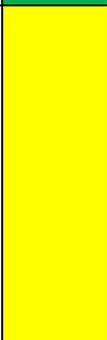
2.4: PROJECT JUSTIFICATION

Over the years, Ndaragwa town has grown both in size and function. Its administrative function has seen it get elevated from a location, division and currently district headquarters for Nyandarua North. This has not only necessitated the need for more land but also the need for planning. The old Ndaragwa town, which was about 15ha, is fully developed. Essential public purpose and utilities could not be allocated to this land which is within a limited space. Thus the need for the proposed variation of boundaries of the Aberdare forest, to allow expansion of Ndaragwa Township to not only cater for the increasing town population needs but also to ensure the town status for Ndaragwa is fully achieved as prescribed in Urban Areas and Cities (Amendment) Act, 2019. The latter prescribes the facilities and services that a town is supposed to have/provide, that Ndaragwa is not able to.

Based on the proposed development plan done by the Nyandarua County Physical Planning Department, the expansion of Ndaragwa Township into a social-economic hub will see provision of adequate land for essential public utilities infrastructure (sewerage treatment works facilities, sludge disposal facility, public toilets, refuse disposal), and social amenities such as housing, schools (public primary and nursery), vocational institutions (polytechnic), recreational parks (public gardens and proposed stadium), health centres and hospitals, religious institutions (churches and Mosques), Public purposes land use (administration and regular police line, ministry of works yard, Kenya Power yard, post office, County/national government offices, department of fisheries offices, department of water offices), Commercial land use (open air market and commercial stalls), transport support facilities (bus parks, motel and petrol stations) recreational facilities, abattoirs, cemeteries among others.

Table 1 below summarizes the land and land use activities proposed for inclusion in the extended Town boundary.

Table 1: Proposed Land Use and Land Activities for Ndaragwa Town Expansion

Code	Color	Land Use	Proposed Land Activities
0		Residential	Low and high density residential, D.O residence
1		Industrial	Timber yard, Slaughter house and cattle ring
2		Educational	Public primary school and Polytechnic
3		Recreational	Public garden, stadium, playgrounds
4		Public Purpose	Special purpose, Private hospital, Administration and regular police lines, Ministry of works yard, Kenya Power yard, Churches, Mosque, Post office, County/national government offices, Department of fisheries offices, Department of water offices, Fire station.
5		Commercial	Commercial Stalls, Open air market, completion and operationalization of the economic empowerment market.
6		Public Utilities	Sludge disposal, Public VIP toilets, Sewerage treatment works, Refuse disposal and Cemetery
7		Transportation	Petrol stations, Motel, Bus park, designated parking areas

The spatial distribution of the land uses and land activities within the site area is presented on *Figure 5*.

2.5: PROPOSED ESIA SITE

As noted earlier, this independent Environmental and Social Impact Assessment (ESIA) study report has been occasioned by a public petition that was signed by 88 no. Ndaragwa constituency residents/signatories through their Member of Parliament, Hon. Jeremiah Kioni to vary 300 acres of forest land for economic development in Ndaragwa Township.

Despite the petitioners request to vary 300 acres (121.41ha) of the said forest land, the ESIA team was guided by the last Survey Plan, FR 341/63 of 2007 by the Survey of Kenya (See appendix 5) as the only authoritative plan with definite boundaries for Ndaragwa township expansion from the current 38.47 acres (15.569 ha) to 162.52 acres (65.77 ha).

As such, the last Survey Plan of 2007 is presumed to have amended the previous ones and hence recognized as the authentic and applicable survey plan. Further the 162.52 acres variation of the Aberdare [Ndaragwa Block] Forest has been supported by various key informants, and most importantly by the public as affirmed during stakeholders' consultation and public participation fora.

2.6: EXISTING LAND USE OF PROPOSED ESIA SITE

Land-use planning is the process of regulating the use of land in an effort to promote more desirable social and environmental outcomes as well as a more efficient use of resources. By and large, the uses of land determine the diverse socioeconomic activities that occur in a specific area, the patterns of human behavior they produce, and their impact on the environment. The current land use of the proposed site is predominantly mixed residential and commercial land use with also huge chunk of land remaining undeveloped in the study area especially on the westerly side of the site as shown in *figure 6*.

Some of the major land uses set up on site includes: residential land uses, the Catholic Mission complex, new local county offices, County council offices, health centre, Nyala dairy multipurpose cooperative society, administration police residence, and various churches among others as presented in plate 2-8.

Plate 2: Administration Police Housing



Plate 3: Operation Government Offices within the Proposed Site



Plate 4: Nyala Dairies and Cooperative Society



Plate 5: Residential Areas



Plate 6: Catholic Mission Complex



Plate 7: Commercial Shops/Centres

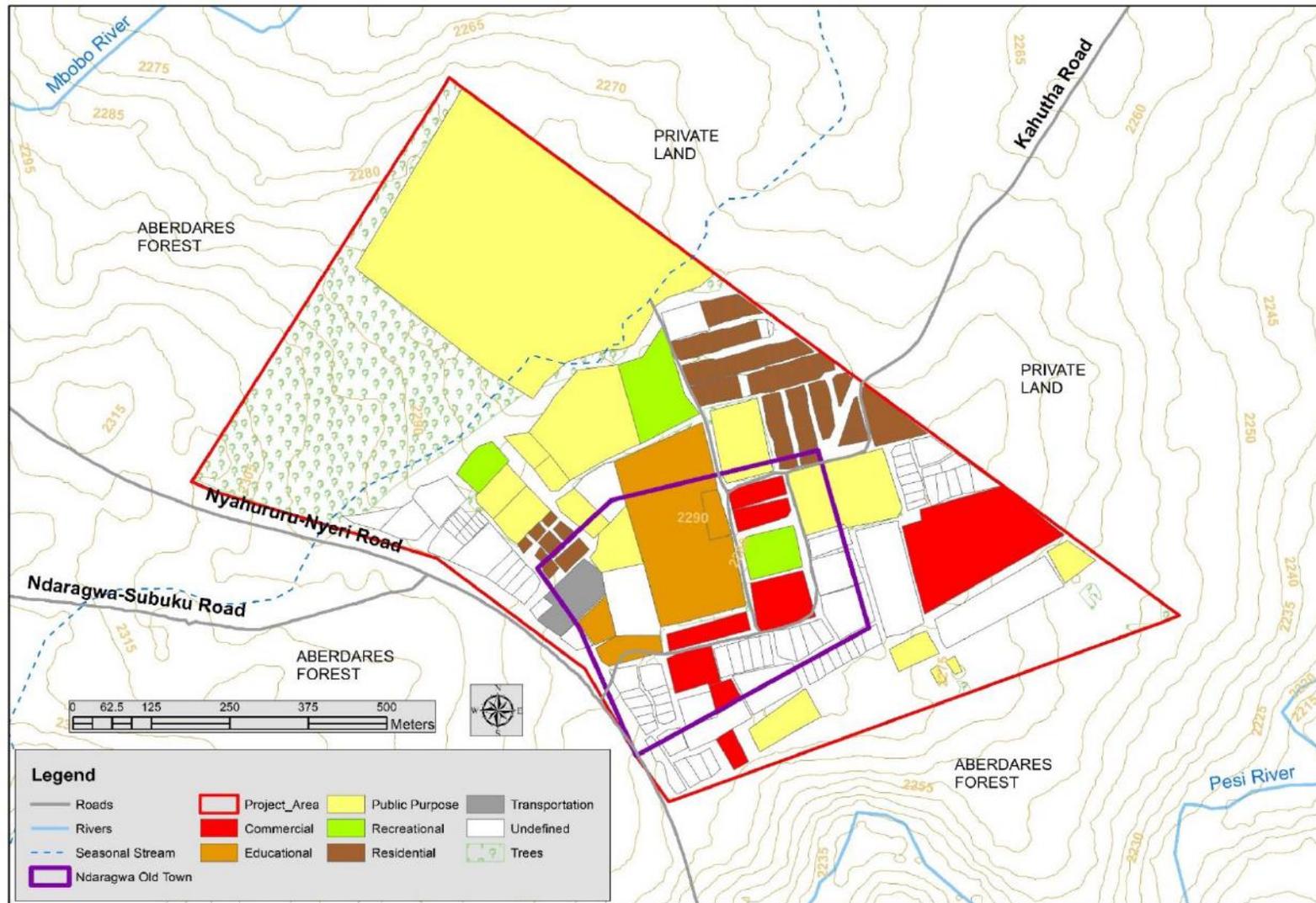


Plate 8: Upcoming Developments within the Project Area



Source: Field Survey, 2019

Figure 6: Existing Land Use of the Proposed Site



Source: Google Earth and Modified by Author, 2019

CHAPTER THREE

POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK

3.1: OVERVIEW

This chapter presents a detailed review of policy, legal, regulatory and institutional frameworks that have informed the proposed variation of boundary of Aberdare [Ndaragwa block] Forest LN. No.48/194, to allow for expansion of Ndaragwa Township from 38.47 acres to 162.52 acres in Ndaragwa sub county, Nyandarua County. Specifically, the review integrates the international, national and sectoral policies and principles into the study and compliance with the existing policies and laws.

3.2: INTERNATIONAL POLICY FRAMEWORK

3.2.1: Sustainable development Goals (SDGs), 2015-2030

In 2016, the 17 SDGs of the 2030 Agenda for Sustainable Development, adopted by world leaders in September 2015 officially came into force. While the SDGs are not legally binding, governments party to it such as Kenya, are expected to take ownership and establish national frameworks for the achievement of the 17 Goals. The proposed development contributes towards achieving various goals of SDG such as:

- a) **SDG 1 No Poverty:** Eradicating poverty in all its forms remains one of the greatest challenges facing humanity. This proposed project would see creation of employment opportunities for the local residents during the project implementation phases, which will generate income that will support various households thus eradicating poverty
- b) **SDG 8 Decent Work and Economic Growth:** Ndaragwa town's development and expansion is handicapped by inadequate land. In that regard, of the proposed town expansion is to enhance the economic activities and service delivery by providing them with all the auxiliary facilities. This has not only necessitated the need for more land but also the need for planning bid to support SDG 8.

On the other hand, the proposed project with rising greenhouse gas emissions, climate change as echoed in **SDG 13** is occurring at rates much faster than anticipated and its

effects are clearly felt worldwide. The proposed project may lead to increased greenhouse gas emissions due to urban development activities. Thus proper mitigation mechanisms has to be explored such as promoting green buildings in order to combat climate change and its impacts.

3.2.2: Rio Declaration on Environment and Development (RDED), 1992

The United Nations Conference on Environment and Development having met at Rio de Janeiro from 3 to 14 June 1992, adopted 27 Principles referred to as the Rio declaration on environment and development (RDED). The study has complied and taken into considerations with a number of principles of the Rio declarations. In this ESIA study:

- a) The Ndaragwa residents/locals have been put at the centre of concern for the sustainable development of their township. Hence they are entitled to a healthy and productive life in harmony with nature - RDED 1.
- b) The right to Ndaragwa township expansion has been fulfilled so as to equitably meet developmental and environmental needs of present and future generations- RDED 3.
- c) The ESIA experts have identified potential environmental impacts resulting from the Ndaragwa town expansion and propose the mitigation measures against these negative effects. This is in compliance with PRD 4: “In order to achieve sustainable development, environmental protection shall constitute an integral part of the development process and cannot be considered in isolation from it.
- d) In compliance with RDED 10, environmental issues with respect to the proposed variation of boundaries of Aberdare forest to allow expansion of Ndaragwa Township in Nyandarua County, have been best handled with the participation of all concerned citizens/stakeholders at the relevant levels. All the key stakeholders have had appropriate access to information concerning the proposed development, and the opportunity to participate in decision-making processes. Further, Ndaragwa National Constituency Development Fund and Nyandarua County government have encouraged public awareness and participation by making the project information widely available.
- e) Has involved full participation of women, youth, elderly, PWDs, local communities among other stakeholders within Ndaragwa town pursuant to RDED 20 which recognizes that participation of such stakeholders especially

women, have a vital role in environmental management and development and their full participation is therefore essential to achieve sustainable development.

3.2.3: Convention on Biological Diversity (CBD), 1992

The UN Convention on Biological Diversity (CBD) of 1992 recognizes the intrinsic value of biological diversity and of the ecological, genetic, social, economic, scientific, educational, cultural, recreational and aesthetic values of biological diversity and its components. Hence the CBD advocated for conservation of biological diversity for evolution and for maintaining life sustaining systems of the biosphere.

Ndaragwa town expansion seeks variation of boundaries of Aberdare forest which is an important but yet delicate ecosystem which has been recognized by CBD as a biosphere reserve. As such any proposed alteration of its very existence should be thoroughly scrutinized for purposes of identifying beforehand, the possible negative impacts followed by suggesting practical mitigation measures for the identified impacts.

Hence in compliance with the legal provisions of CBD, the ESIA study itself is aimed at identifying the potential environmental impacts resulting from the proposed development and proposing prevention and mitigation measures against these anticipated negative effects before this project is implemented. At decision making level all parties involved will comply with CBD provision especially where there will be lack of information and knowledge regarding this biological diversity and of the urgent need to develop scientific, technical and institutional capacities to provide the basic understanding upon which to plan and implement appropriate measures and environmental management plan.

3.2.4: UN Framework Convention on Climate Change (UNFCCC), 1992

The UNFCCC acknowledges that change in the Earth's climate and its adverse effects are a common concern of humankind. Thus it identifies forests as key in building climate change resilience especially in urban areas. Ndaragwa town expansion seeks variation of boundary of Aberdare forest which is key in building climate change resilience. Based on UNFCCC, the forest land conversion will pave way for town expansion that see human activities substantially increasing the atmospheric concentrations of greenhouse gases that will result to global warming and may adversely affect natural ecosystems and humankind. In compliance with the UNFCCC, this project implementation will be done

in a manner that will allow adequate vegetation cover (within open spaces) that will provide carbon sinks. The project proponent will also endeavor to encourage the use of clean energy within the proposed town. Further, the proponent will take precautionary measures to prevent or minimize the causes of climate change and mitigate its adverse effects as echoed in article 3, principle 3 of the UNFCCC.

3.2.5: New Urban Agenda - Habitat III, 2016

The New Urban Agenda (NUA), 2016 is new framework that lays out how cities should be planned and managed to best promote sustainable urbanization. The Ndaragwa town expansion has been triggered with the rapid urbanization and the need to provide essential services to its residents. In compliance with NUA, this ESIA study is aimed at supporting sustainable and inclusive urban prosperity and opportunities for all through advocating for environmental protection, and sustainable growth in the urban economy (article 44). Fundamentally, the ESIA study undertakes the process of identifying, predicting, evaluating and mitigating the biophysical, social, and other relevant effects of the proposed development prior to major decisions being taken and commitments made. This is in a bid to foster resilience and protecting the environment as echoed under article 5 of NUA.

3.2.6: World Bank Environmental and Social Safeguards-ESS (Revised 2008)

The ESS below are policies, standards and operational procedures designed to first identify and then try to avoid, mitigate and minimize adverse environmental and social impacts that may arise in the implementation of development projects. ESS also have a pro-active dimension to try to increase chances that development projects deliver better outcomes for people and the environment. Some of the World Bank ESS adopted in the study include the following:

1. ESS 1. Assessment and Management of Environmental and Social Risks and Impacts: this formed the core of the ESIA looking at potential risks and effects of the boundary variation, and identifying prevention and mitigation measures in close consultation with the communities and other stakeholders.
2. ESS 2. Labor and Working Conditions: this standard informed the proposal of ensuring absorption of labor and specialists from the local community and ensuring protective gear for workers during the construction phase.

3. ESS 3. Resource Efficiency and Pollution Prevention and Management: used to gauge the cost of the various project alternatives where acquisition of alternative land for town expansion was found to be prohibitive. Air pollution mitigation measures during the construction phase such as watering the construction sites were proposed.
4. ESS 4. Community Health and Safety guided identification of measures to prevent accidents, provide safety for workers such as gas masks were identified
5. ESS 5. Land Acquisition, Restrictions on Land Use and Involuntary Resettlement; the project site is already 90% developed and settled on so no resettlement will be necessary.
6. ESS 8. Cultural Heritage: there are no cultural heritage sites within the project site but those in the neighboring forest will be protected within the context of sustainable tourism operations.
7. ESS 10. Stakeholder Engagement and Information Disclosure: representatives of the local communities and key stakeholders were notified prior to commencement of the study, consulted and engaged during the ESIA.

3.2.7: Africa Agenda 2063 - *The Africa We Want*, 2015

Africa Agenda 2063 is a framework formulated for the purpose of guiding Africa's development in the next fifty years. The Agenda with 7 key aspirations notes that Africa has the capability to realize her full potential in development, culture and peace and to establish flourishing, inclusive and prosperous societies.

The proposed ESIA study report articulates Africa Agenda 2063 aspirations by seeking to expand and develop Ndaragwa Township so as to promote inclusive growth and sustainable development, eradicate poverty in one generation and build shared prosperity through social and economic transformation of the County (Aspiration 1).

Legal compliance of EMCA CAP 387, involvement of key stakeholders such as county government of Nyandarua, NEMA, KFS and local communities and other stakeholder are aimed at promoting good governance, democracy, respect for human rights, justice and the rule of law(Aspiration 3). Finally, this ESIA study methodologically has been public/people-driven to inform stakeholders/locals about the project and its likely effects, which has in turn would incorporated their inputs, views and concerns to influence decision-making in compliance with Aspiration 6 of Africa Agenda 2063.

3.3: NATIONAL POLICY FRAMEWORK

3.3.1: Kenya Vision 2030

As the country's development blueprint covering the period 2008-2030, Vision 2030 aims to achieve a “globally competitive and prosperous country with a high quality of life by 2030” (GOK, 2007). It aims to transform Kenya into “a newly-industrializing, middle-income country providing a high quality of life to all its citizens in a clean and secure environment”. Ndaragwa town expansion is geared towards supporting Kenya Vision 2030 pillars in the following ways:

- a) **Economic Pillar** - Moving both the national and Nyandarua county economy up the value chain by supporting commercial and other support land use activities within Ndaragwa town such as market centres, hotels etc.
- b) **Social Pillar** – The Ndaragwa township expansion will see Ndaragwa people access social services among them: housing, health facilities, sports and cultural centers or facilities, religious institution, solid waste management, community centres, vocational institution among others.
- c) **Political governance Pillar:** In the spirit of devolution, with Ndaragwa town expansion, this will require a proper management structure that is people-centered, result-oriented and accountable democratic system in order to facilitate public service delivery.

3.3.2: Forest Policy, 2014

The overall goal of Forest Policy is sustainable development, management, utilization and conservation of forest resources and equitable sharing of accrued benefits for the present and future generations of the people of Kenya. Ndaragwa town expansion calls variation of boundaries of Aberdare [Ndaragwa block] forest which is a valuable natural endowment that must be sustainably managed for present and future generations.

Hence in compliance with this Policy, this ESIA study as a planning and decision making tool has promoted public, private and community participation in a bid to seek approval for the Ndaragwa town expansion. Further it has been done taking into consideration, the rule of law, relevant institutions, access to information, transparency and accountability, professional ethics, respect for human rights, non-discrimination and the meaningful participation of citizens as echoed in section 3.3 of the Forest policy.

Lastly, in an effort to compensate the developed forest section, the town expansion plan has provided for green/open spaces/public gardens, all roads, pedestrian walkways and parking spaces will be lined with trees. Unutilized spaces in individual plots will also be greened.

3.3.3: National Environment Policy, 2013

The National Environment Policy upholds the tenets of environment management and planning in Kenya by tracing the same to the Rio Earth Summit of 1992, which helped a great deal in raising the understanding of the link between environment and development (GOK, 2013). Overall, the government recognizes the need to integrate environmental concerns in all policy, planning and development processes.

It states that, "Integration of environmental considerations in all national, county and relevant sectoral policies, planning and development processes is critical if this policy is to achieve its goal and objectives' (GOK, 2013). This ESIA report is geared towards showing how the proposed Ndaragwa town expansion fulfills and complies with the provisions of the environmental policy concerns. The proposed environmental management plan (EMP) in this reports details all the possible impacts of the implementation of the plan and shows how the negative impacts will be mitigated.

3.3.4: National Land Policy, 2009

The National Land Policy was formulated to provide an overall framework and define the key measures required to address among others, the critical issues on land, land use planning, environmental degradation, conflicts and unplanned proliferation of informal urban settlements, outdated legal framework, institutional framework and information management. The policy further encourages a multi-sectoral approach to land use, provision of social, economic and other incentives and put in place an enabling environment for investment, agriculture, livestock development and the exploitation of natural resources. The main objective of expanding Ndaragwa Township is enhanced economic development. However specific and detailed impacts, mitigation and strategies to enhance acceptability and appropriateness of the township activities are contained in chapter 7-9 of this report.

3.3.5: National Land Use Policy, 2017

The National Land Use Policy (NLUP), seeks to provide legal, administrative, institutional and technological framework for optimal utilization and productivity of land and land related resources in a sustainable and desirable manner at National, County and local level. Over the years, Ndaragwa town indeed has grown both in size and function. Its administrative function has seen it get elevated from a location, division and currently district headquarters for Nyandarua North. This has not only necessitated the need for more land but also the need for a land use development Plan in tandem with NLUP provisions among others:

- a) Section 1.1.2: The land use development plan will give Ndaragwa town a growth framework as a basis for resource allocation and resource management for public good and general welfare. Both the Land use plan and this ESIA study report will help to prevent problems of rapid urbanization, inadequate land use planning, un-sustainable agricultural and industrial production methods, poor environmental management, poor cultural practices, inappropriate ecosystem protection and management are commonplace and require appropriate policy responses.
- b) Section 1.5: In compliance with the NLUP, Ndaragwa town expansion land use plan, has:
 - o Recognized the central place of land in the production chain and addresses issues that relate directly to the use of land, its resources, and the perceptions held towards land.
 - o Incorporated measures and principles to guide all activities, whether proposed or on-going that may have direct or indirect impact on the use of land and its resources.
 - o Take cognizance too, of the benefits of planned use of land and its resources; and builds in measures for integrated, equitable and sustainable utilization for optimal production.
 - o Upholds the values of social-economic productivity, environmental sustainability and the conservation of culture; and seeks to facilitate their protection and optimal use.

NLUP under section 2.5 further notes that, the forests have been deliberately and illegally reduced due to encroachment and deforestation, conversion of forest land into other land uses such as urban land, and climate change among others.

This has seen Kenya's forest cover standing at 6.3% forest against the 10% land cover as per UNEP. Hence it calls for priority to management of the environment and natural resources as articulated in the Constitution and other developmental policies and strategies including the Vision 2030.

We note in compliance with NLUP, the project proponent has undertaken the legal process of seeking the proposed variation of boundaries of Aberdare (Ndaragwa block) forest to allow expansion of Ndaragwa Township in Nyandarua County as laid down in the Forest Conservation and Management Act, 2016.

3.3.6: National Water Policy, 2012

The National Water Policy is informed by the gains made during the past decade on implementation of reforms in the water sector as anchored on the National Water Policy of 1999 (NWP 1999) also referred to as Sessional Paper No. 1 on National Policy on Water Resources Management and Development, the Water Act 2002, existing related policy documents, and the globally recognized Integrated Water Resources Management (IWRM) approach (GOK, 2012).

The key principle of the policy is to ensure a comprehensive framework for promoting optimal, sustainable, and equitable development and use of water resources for livelihoods of Kenyans' (GOK 2012). In regard to the Ndaragwa township expansion, provisions are incorporated to ensure protection of the affected water resources such as River Pesi and Mboobo, supply and efficient utilization of water resources as well as the safe disposal of wastewater.

3.3.7: Public Health Policy, 1994

The Kenya Health Policy Framework set out the policy agenda for the health sector up to the year 2010. According to the Policy, the major players in the health sector include the government represented by the Ministry of health and the local government, private sector, and non-governmental (NGOs). The implementation of the devolved system of government has led to the active involvement of the lower levels of government albeit

with major challenges. The role of the county governments includes implementation of the health policies, maintaining quality standards, and coordinating and controlling all county public health activities. Public health challenges in urban areas revolve around poor sanitation, unhygienic environment, and non-adherence to planning and building regulations. Ndaragwa town expansion will see for enhanced physical environment including guidelines for management of solid and liquid waste, ensuring building standards are adhered to as well as controlling all public health activities.

3.4: NATIONAL LEGAL FRAMEWORK

3.4.1: Constitution of Kenya, 2010

The Constitution is the supreme law of the land. It lays the foundation on which the wellbeing of Kenya is founded. The constitution's provisions are specific to ensuring sustainable and productive management of land resources; transparent and cost effective administration of land; and sound conservation and protection of ecologically sensitive areas. Specifically, Chapter 2 Part 4, on the Bill of Rights, section 42 provides that every person has the right to a clean and healthy environment, which includes the right: (a) to have the environment protected for the benefit of present and future generations through legislative and other measures. *Article 69* outlines specific provisions on the environment; subsections (d) encourage public participation in the management, protection and conservation of the environment, and g) provides for elimination of processes and activities that are likely to endanger the environment.

The development Plan and this independent ESIA report for Ndaragwa town expansion has made provisions to ensure a clean and healthy environment through the environmental and social management plan. Provisions for optimal utilization of natural resources particularly water and energy through promotion of efficient utilization and regular water and energy use audit are contained in the Plan. The document further provides for the management of solid and liquid wastes, reduced pollution that will emanate as a result of the town expansion including annual air quality audits etc.

In addition, this proposed ESIA study report seeks to ensure that every person has the right to a clean and healthy environment (see article 43), which includes the right to – (a) have the environment protected for the benefits of present, future generations through legislative and other measures, particularly those contemplated in Article 69 to have obligations relating to the environment fulfilled under Article 70.

Further, in compliance with *article 60 (1)*, the proposed Ndaragwa township expansion plan has proposed equitable, efficient, productive and suitable use of the 65.77ha based on (a) equitable access to land, (b) security of land rights, (c) sustainable and productive management of land resources and (d) sound conservation and protection of ecological sensitive areas. Last but not least, in exercising article 66 of the CoK, the Nyandarua County has exercised their mandate to regulate the use of land or any interest in or right over any land in the interest of defense, public safety, public order, public morality, public health or land use planning through developing the proposed Ndaragwa township expansion Plan.

We note that if a person alleges that a right to a clean and healthy environment recognized and protected under Article 42 has been, is being or is likely to be denied, violated, infringed or threatened, the person may apply to court for redress in addition to any other legal remedies that are available in respect to the same matter based on article 70 of CoK 2010.2. On application under clause (1) the court may take any order or give any directions it considers appropriate: to prevent, stop or discontinue any act or omission that is harmful to the environment; to compel any public officer to take measures to prevent or discontinue any act or omission that is harmful to the environment or to provide compensation for any victim of a violation of the right to a clean and healthy environment.

3.4.2: Forest Conservation and Management Act (FCMA), 2016

The Act give effect to Article 69 of the Constitution of Kenya 2010 with regard to forest resources; to provide for the development and sustainable management, including conservation and rational utilization of all forest resources for the socio-economic development of the country and for connected purposes. Fundamentally the proposed variation of boundaries of Aberdare Ndaragwa- forest process to allow expansion of Ndaragwa Township in Nyandarua County is clearly laid under section 34 of FCMA as follows:

- a) Any person may petition the National Assembly or the Senate, for the variation of boundaries of a public forest or the revocation of the registration of a public forest or a portion of a public forest.
- b) A petition under subsection (1) shall demonstrate that the variation of boundaries or revocation of the registration of a public forest or a portion of a public forest does not:

- Endanger any rare, threatened or endangered species; or
 - Adversely affect its value as a water catchment area; and prejudice biodiversity conservation, cultural site protection of the forest or its use for educational, recreational, health or research purposes.
- c) A petition made under subsection (1) shall be considered in accordance with the provisions of the Petitions to Parliament (Procedure) Act and the Standing Orders of the relevant House.
- d) The Cabinet Secretary shall, within thirty days of the petition being committed to the relevant Committee, submit a recommendation on whether the petition should be approved subject to:
- The petition being subjected to an independent Environmental and Social Impact Assessment; and
 - Public consultation being undertaken in accordance with the Second Schedule.
- e) If the relevant Committee, reports that it finds that the petition:
- Does not disclose a ground for the variation of the boundaries of a public forest or the revocation of the registration of a public forest or a portion of a public forest, no further proceedings shall be taken; or
 - Discloses a ground for the variation of the boundaries of a public forest or the revocation of the registration of a public forest or a portion of a public forest, the National Assembly or the Senate shall vote on whether to approve the recommendation.
- f) If the resolution under subsection (5) (b) is supported by a majority of the members of the National Assembly or the Senate, present and voting, the Cabinet Secretary shall publish a notice in the Gazette.

Indeed, the preparation of this independent ESIA study report to support the proposed variation of boundaries of Aberdare forest to allow expansion of Ndaragwa Township in Nyandarua County is as per section 34 subsection 10 (a) of the Act which the project proponent has complied with. In addition, based on section 34 subsection 8, both the ESIA study and the proposed Ndaragwa development plan has ensured that the variation of boundaries does not: Endanger any rare, threatened or endangered species such as wildlife; or Adversely affect its value as a water catchment area such as River Pesi; and prejudice biodiversity conservation, cultural site protection of the forest or its use for educational, recreational, health or research purposes.

3.4.3: Environment Management & Coordination (Amendment) Act (EMCA), 2015

EMCA, 2015 amends the Environmental Management and Co-ordination Act, 1999 that describes the legal and institutional framework for environmental management in Kenya. The study has been carried out by ESIA experts in compliance with the Legal requirement stipulated in the EMCA CAP 387, Second Schedule. Further, based on the Act, this report will be submitted to the National Environment Management Authority (NEMA) for review and eventual licensing. There are a number of regulations that stem from EMCA which have significance to this ESIA as discussed below:

- a) Environmental (Impact Assessment and Audit) Regulations, 2003: The Environmental (Impact Assessment and Audit) Regulations, state in Regulation 3 that “the Regulations shall apply to all policies, plans, programmes, projects and activities specified in Part IV, Part V and the Second Schedule of the Act”. (ER-ESIA, 2003). Section 42 and 43 address ESIA’s; section 42(1) requires lead agencies in consultation with NEMA to subject all proposed projects for implementation to an ESIA. This ESIA study and report has been done in accordance with the environmental (Impact Assessment and Audit) Regulations, 2003.
- b) Environmental Management and Coordination (Wetlands, Riverbanks, Lake Shores and Sea Shore Management) Regulations 2009: These regulations are described in Legal Notice No. 19 of the Kenya Gazette Supplement no. 9, February 2009. These regulations include management of wetlands, wetland resources, river banks, lake shores and sea shores. Specific sections have requirements that apply to sources of water supply to the community. The regulations will empower the County Environment Committee in the project area to co-ordinate, monitor and advise on all aspects of wetland and water resource management within the county. They will also guide protection of riparian areas in the project site and its environs.
- c) Environmental Management and Coordination (Fossil Fuel Emission Control) Regulations 2006: These regulations are described Legal Notice No. 131 of the Kenya Gazette Supplement no. 74, October 2006, and will apply to all internal combustion engine emission standards, emission inspections, the power of emission inspectors, fuel catalyts, licensing to treat fuel, cost of clearing pollution and partnerships to control fossil fuel emissions used by the Contractor. The fossil fuels considered are petrol, diesel, fuel oils and kerosene.

- d) Air Quality Regulations, 2013 (Legal Notice No. 34): These regulations spell out levels of ambient air quality standards that should not to be exceeded. Part II prohibits an individual from causing immediate or subsequent air pollution. Section 6 states that “no person shall cause or allow emission of the priority air pollutants prescribed in the Second Schedule of the regulations to cause the ambient air quality limits prescribed in the First Schedule to be exceeded” (AQR, 2013).
- e) Waste Management Regulations, 2006 (Legal Notice 121): These regulations provide for the management of waste. Part II regulation 4 (1) provides that no person shall dispose of any waste on a public highway, street, road, recreational area or in any public place except in a designated receptacle; regulation 4 (2) further states that a waste generator shall collect, segregate and dispose such waste in the manner provided for under these regulations and finally; and regulation 5 (1) provides for cleaner production methods. It states that a waste generator shall minimize the waste generated by adopting the following cleaner production methods (1)Improvement of production process through: Conserving raw materials and energy; Eliminating the use of toxic raw materials; and Reducing toxic emissions and wastes; and (2) Monitoring the product cycle from beginning to end by: Identifying and eliminating potential negative impacts of the product; Enabling the recovery and re-use of the product where possible; and Incorporating environmental concerns in the design and disposal of a product.
- f) Water Quality Regulations, 2006 (Legal Notice No. 120): This regulation has provisions for ensuring water quality standards by actors and players in the water sector. Regulation 8 provides for all operators and suppliers of treated water, containerized water and all water vendors to comply with the relevant quality standards in force Regulation 9 provides for water quality monitoring and states that the Authority in consultation with the relevant lead agency, shall maintain water quality monitoring for sources of domestic water at least twice every calendar year.
- g) Noise and Excessive Vibration Pollution (Control) Regulations, 2009 (Legal Notice No. 25): These rules provide for the noise regulations that apply to every factory, premises, place, process and operations to which the provisions of the Factories and Other Places of Work Act (Cap 514) apply. Section 1.4 of the legislation details the permissible levels of noise in a work place; section 5 and 6 elaborate on the recommended noise prevention programme as well as

measurement and records to be undertaken by the contracted company during construction and operational phases of the project.

A great amount of noise and vibrations are expected in the activities proposed during implementation phase and these regulations will serve as guidelines to the investors. Specifically, the ESIA has incorporated the Environmental and Social Management Plan that will ensure all EMCA regulations are adhered to.

3.4.4: County Government Act, 2012

The County Government Act aims at giving effect to chapter 11 (devolution) of the constitution of Kenya, 2010 and provides for the county government powers, functions and responsibilities in the delivery of services and for connected purposes. The Act emphasizes the need for a consultative and participatory approach where the principles of planning and development facilitation in a county serve as a basis for engagement between the county government and the citizenry, other stakeholders and interest groups (Article 102 (i)).

An important feature of this ESIA is that it is a participatory process whose hallmarks are public participation and stakeholder consultations to ensure that individuals and institutions directly or indirectly affected by implementation of the Ndaragwa town expansion Plan are entitled to express their interests and have them respectively taken into consideration in the decision-making process.

3.4.5: Physical and Land Use Planning Act, 2019

The Act make provision for the planning, use, regulation and development of land and for connected purposes. The Ndaragwa town expansion development plan was prepared pursuant to section 56 of the Act. Approval of the proposed variation of boundaries of Aberdare forest to allow expansion of Ndaragwa Township in Nyandarua County will gives Nyandarua county government powers, pursuant to section 56 of the , powers to:

- a) Prohibit or control the use and development of land and buildings in the interests of proper and orderly development of its area;
- b) Control or prohibit the subdivision of land;
- c) Consider and approve all development applications and grant all development permissions;

- d) Ensure the proper execution and implementation of approved physical and land use development plans;
- e) Formulate by-laws to regulate zoning in respect of use and density of development;
- f) Reserve and maintain all the land planned for open spaces, parks, urban forests and green belts
- g) In accordance with the approved physical and land use development plans; and
- h) Consider and determine development planning applications made in respect of land adjoining or within reasonable vicinity of safeguarding areas.

3.4.6: Urban Areas and Cities (*Amendment*) Act 2019

The Act give effect to Article 184 of the Constitution; to provide for the, classification, governance and management of urban areas and cities; to provide for the criteria of establishing urban areas, to provide for the principle of governance and participation of residents and for connected purposes. Looking at the proposed Ndaragwa township development Plan, approval of the proposed variation of boundaries of Aberdare forest to allow expansion of Ndaragwa Township in Nyandarua County will see a supply of services and facilities/amenities as stipulated in the Act first schedule for it to achieve the full status as a town.

Based on the Act, the proposed town expansion development plan done by the Nyandarua County Physical Planning Department, has provided adequate land for essential public utilities infrastructure (sewerage treatment works facilities, sludge disposal facility, public toilets, refuse disposal), and social amenities such as housing, , schools (public primary and nursery), vocational institutions (polytechnic), recreational parks (public gardens and proposed stadium), health centres and hospitals, religious institutions (churches and Mosques), Public purposes land use (administration and regular police line, ministry of works yard, Kenya Power yard, post office, County/national government offices, department of fisheries offices, department of water offices), Commercial land use, transport support facilities (bus parks, motel and petrol stations) abattoirs, cemeteries among others. Lastly, to facilitate proper management service delivery, Ndaragwa town management shall be vested in a town committee pursuant to section 31 of the Act.

3.4.7: Employment Act, 2007

This Act declares and defines the fundamental rights of employees; minimum terms and conditions of employment; to provide basic conditions of employment of employees; and to regulate the employment of children, among other rights. Key sections of the Act elaborate on the employment relationship; protection of wages; rights and duties in employment; termination and dismissal and protection of children, among others. *This Act will guide the management of workers, especially during the construction period. The Act ensures that majority of unskilled labourers are from local community.*

3.4.8: Occupational Health and Safety Act (OSHA), 2007

This is an Act of Parliament, which provides for the safety, health and welfare of all workers and all persons lawfully present at workplaces. The act further provides for the establishment of the National Council for Occupational Safety and Health and for connected purposes. The act repealed the Factories and Other Places of Work Act. It applies to all workplaces where any person is at work, whether temporarily or permanently and therefore will apply to the project both during construction and operation phases.

The scope of OSHA 2007 has been expanded to cover all workplaces including offices, schools, academic institutions and plantations. It establishes codes of practices to be approved and issued by the Director, Directorate of Occupational Health and Safety (DOHS) for practical guidance of the various provisions of the Act.

In compliance to OSHA, this ESIA study notes that the department in Nyandarua County mandated with the development and enforcement of a health and safety shall promote health and safety as well as community health and safety mechanisms during the three phases of development during the expansion of the Ndaragwa township. This mandate should be accompanied with the requisite capacity building interventions, which may include specialized training for staff as well as targeted recruitment to enhance the existing expertise.

3.4.9: Public Health Act (Cap 242) of 2002

This Act concerns the protection of public health in Kenya and lays down rules relative to, among other things, food hygiene and protection of foodstuffs, the keeping of animals, protection of public water supplies, the prevention and destruction of mosquitos and the abatement of nuisances including nuisances arising from sewerage.

In relation to the proposed ESIA, section 15 (ix) protects the public from any nuisance that may arise with the implementation of the proposed project. It states that any noxious matter, or wastewater discharged from any premise, such as a building constitutes nuisance. Any premise not kept in a clean and free from offensive smell such as gases which are injurious to health such as those from commercial establishments shall therefore generate nuisance. The Act therefore stresses that no person shall cause a nuisance to exist on any land or premise occupied by him.

The Act acknowledge that it shall be the duty of all local authorities to take all lawful measures for maintaining its district at all times in a clean and sanitary condition for remedy of any nuisance or condition liable to be injurious to health.

3.4.10: National Land Commission Act, 2012

The Act provides for the functions and powers of the National Land Commission-NLC, which among others gives effect to the Constitution, the objects and principles of devolved government in land management and administration, and for connected purposes. In relation to this ESIA study and more important implementation of the Ndaragwa town expansion plan, section 19 (1) provides that NLC shall, subject to the physical planning and survey requirements, process applications for allocation of land, change and extension of user, subdivision of public land and renewal of leases. In addition, NLC will be expected to monitor and have oversight responsibilities over land use planning if the Ndaragwa town expansion application will be approved by the relevant authorities.

3.4.11: Land Act, 2012

The Act give effect to Article 68 of the Constitution of Kenya 2010, to revise, consolidate and rationalize land laws; to provide for the sustainable administration and management of land and land based resources, and for connected purposes. Regarding the proposed project which falls on public land, the Land Act, 2012:

- a) Under section 4 (2) mandates NLC and any State officer or public officer to ensure(a) equitable access to land; (b) security of land rights; (c) sustainable and productive management of land(e) conservation and protection of ecologically sensitive areas such as River Pesi; (m) democracy, inclusiveness and participation of the people. These provisions have been observed both during the Ndaragwa town expansion Plan preparation and carrying out this ESIA study.
- b) Under section 6 mandates the Cabinet Secretary shall, in relation to the management and administration of land to (e) regulate service providers and professionals, including physical planners, surveyors, valuers, estate agents, and other land related professionals, to ensure quality control; and (f) monitor and evaluate land sector performance.
- c) Under section 7 gives ways the proponent may acquire title to land regarding the proposed variation of boundaries of Aberdare forest to allow expansion of Ndaragwa Township. Applicable ones include (a) allocation; (b) land adjudication process; (c) compulsory acquisition; (d) prescription; (g) transfers; or (i) any other manner prescribed in an Act of Parliament.
- d) Under section 9 the Act permits the conversion of land from one category to another. For this proposed project the Act notes under section 9 (2):(b) subject to public needs or in the interest of defence, public safety, public order, public morality, public health, or land use planning, public land may be converted to community land. NLC shall be the custodian of all records of such transactions.
- e) The proposed variation of boundaries of Aberdare forest to allow expansion of Ndaragwa Township requires NLC approval since the Act under section 11 mandates NLC to take appropriate action to maintain public land that has endangered or endemic species of flora and fauna, critical habitats or protected areas. The ESIA study and the proposed Ndaragwa development plan has ensured that the variation of boundaries or revocation of the registration of a public forest or a portion of a public forest does not: endanger any rare, threatened or endangered species such as wildlife; or adversely affect its value as a water

catchment area such as River Pesi and Mboobo; and prejudice biodiversity conservation, cultural site protection of the forest or its use for educational, recreational, health or research purposes.

- f) On allocation of public land under section 12 of the Act, NLC is mandated on behalf of the National or county governments, allocate public land by way of: (a) public auction to the highest bidder at prevailing market value subject to and not less than the reserved price; (b) application confined to a targeted group of persons or groups in order to ameliorate their disadvantaged position; (c) public notice of tenders as it may prescribe; (d) public drawing of lots as may be prescribed; (e) public request for proposals as may be prescribed; or (f) public exchanges of equal value as may be prescribed.
- g) In addition, NLC shall ensure that any public land that has been identified for allocation does not fall within any of the following categories—
 - (a) Public land that is subject to erosion, floods, earth slips or water logging;
 - (b) Public land that falls within forest and wild life reserves, mangroves, and wetlands or fall within the buffer zones of such reserves or within environmentally sensitive areas;
 - (c) Public land that is along watersheds, river and stream catchments, public water reservoirs, lakes, beaches, fish landing areas riparian and the territorial sea as may be prescribed; and
 - (d) Natural, cultural, and historical features of exceptional national value falling within public lands;
 - (e) Reserved land; or
 - (f) Any other land categorized as such, by the Commission, by an order published in the Gazette.

3.4.12: Traffic Act, Cap 403 (Revised 2013)

The Act This Act specifies that motor vehicles use proper fuel. The Traffic Regulations promulgated under the Act specifies that every vehicle is required to be well constructed, maintained and used so as not to emit any smoke or visible vapour. *The machineries to be used during the construction process should be serviced to ensure that they are in good condition in order to prevent the emission of any hazardous element. The contractor should therefore ensure that during the construction phase, all trucks used for transportation and other vehicles involved comply with this Act.*

3.5: INSTITUTIONAL FRAMEWORKS

3.5.1: National Assembly

In line with section 34 of the Forest Conservation and Management Act No. 34 of 2016, Ndaragwa residents/community (Petitioners) launched a petition to the National Assembly through their Member of Parliament, to vary the boundary of Aberdare forest (Ndaragwa block) to allow expansion of Ndaragwa Township. The National assembly derives its responsibility on this subject from section 34 of the Forest Conservation and Management Act No. 34 of 2016, which *inta alia*, requires it to consider the variation of the boundaries or the revocation of the registration of or a portion of a public forest, by voting on whether to approve the recommendation. If the resolution is supported by a majority of the members of the National Assembly present and voting, the Cabinet Secretary is advised to publish a notice in the Gazette.

3.5.2: Nyandarua County Government

Nyandarua County Government (NCG), the host of the proposed project will be required to implement the expansion of Ndaragwa Township if the proposed project is given approval. Approval of the proposed project will see NCG under section 56 of the Physical and Land Use Planning Act, 2019 implement the development plan in the following ways:

1. Prohibit or control the use and development of land and buildings in the interests of proper and orderly development of the area;
2. Control or prohibit the subdivision of land;
3. Consider and approve all development applications and grant all development permissions;
4. Ensure the proper execution and implementation of approved physical and land use development plans;
5. Formulate by-laws to regulate zoning in respect of use and density of development;
6. Reserve and maintain all the land planned for open spaces, parks, urban forests and green belts in accordance with the approved physical and land use development plans; and;
7. Consider and determine development planning applications made in respect of land adjoining or within reasonable vicinity of safeguarding areas.

Further subject to Part 2 (Fourth Schedule, Article 185 (2), 186 (1) and 187 (2) of the constitution of Kenya, 2010 if the proposed project is given approval, NCG will be expected to ensure participation of communities and locations in governance at the local level and assisting communities and locations to develop the administrative capacity for the effective exercise of the functions and powers and participation in governance at the local level.

3.5.3: National Environment Management Authority (NEMA)

NEMA is the key agency in charge of coordination of environment management activities, ensure compliance environmental guidelines and advise government on legislative and measures concerning environment management. For approval and licensing of this proposed project, the project proponent has to submit 5 copies of the reports to NEMA for licensing as required by EMCA CAP 387. For purposes of the Ndaragwa town expansion development Plan and ESIA study, NEMA has to ensure proper management and rational utilization of environmental resources, on sustainable yield basis, for the improvement of the quality of human life in the project area. Further, NEMA a key player in all environmental matters in the country, and is the approving authority ESIA studies/reports, all subsequent proposed development shall be subjected to an ESIA study and eventual approval by NEMA.

3.5.4: National Environment Council (NEC)

Under this project, the National Environment Council (NEC) established under Section 4(1) of the Environmental Management and Coordination Act CAP 387 shall be expected to promote cooperation among public departments, local authorities, private sector, non-governmental organizations and such other organizations engaged in environmental protection programs.

3.5.5: Kenya Forest Service (KFS)

Kenya Forest Service (KFS) was established in February 2007, as a state corporation mandated to implement the Forest Policy objectives. It's vital to note that the proposed variation of boundaries of Aberdare forest to allow expansion of Ndaragwa Township will see the reduction of almost 110.3ha of Aberdare forest that is currently managed by KFS. In that regard the aim of this independent ESIA is to identify, predict and evaluate

the environmental effects of proposed actions and projects. This process is applied prior to major decisions and commitments being made.

Our engagement with KFS during stakeholder consultation have revealed that they have no objection with the expansion of the town if the proposed development does not: endanger any rare, threatened or endangered species; or adversely affect its value as a water catchment area; and prejudice biodiversity conservation, cultural site protection of the forest or its use for educational, recreational, health or research purposes.

The ESIA team has ensured the above conditions are met by ensuring the water catchment areas of the forest are protected such river Pesi, and seasonal streams river passing adjacent to the Catholic Mission Complex. Further the town expansion plan developed has compensate some percentage of the lost forest cover through creating green/open spaces, all roads, pedestrian walkways and parking spaces will also be lined with trees. Unutilized spaces in individual plots will also be greened.

3.5.6: National Environmental Complaints Committee (NECC)

Under this project, NECC established under Section 4(1) of EMCA CAP 387 shall be expected to investigate any allegations or complaints against any person or against NEMA in relation to condition of the environment within the proposed project area and to make a report of its findings together with its recommendations thereon to the NEC and prepare and submit to the NEC, periodic reports of its activities, which report shall form part of the annual report on the state of the environment under section 9(3) of EMCA.

3.5.7: County Environmental Tribunal (CNET)

The CNET is established under Section 125 of EMCA for the purpose of hearing appeals from administrative decisions by organs responsible for enforcement of environmental standards. An appeal may be lodged by a project proponent upon denial of an ESIA license or by a local community upon the grant of an ESIA license to a project proponent. NEMA may also refer any matter that involves a point of law or is of unusual importance or complexity to CNET for direction. EMCA provides that any person aggrieved by a decision or award of CNET may within 30 days appeal to the High Court.

3.5.8: County Environment Committee (CEC)

Under section 29 (1) of EMCA, the Cabinet Secretary shall by notice in the gazette appoint County Environment Committees-CECs of NEMA in respect of every County. These committees assist NEMA in effectively carrying out its function of proper management of the environment at this level. As a result, the Nyandarua CEC within this project shall be expected to ensure proper management of the environment within the county and developing a county strategic environmental action plan every five years. Further as apart from being a key stakeholder, Nyandarua CEC shall provide an oversight role on issue of the environment during all the stages of the proposed project.

3.5.9: National Land Commission (NLC)

The NLC established under article 67 of the CoK, 2010 is mandated to perform the following duties as far as the proposed project on public land is concerned. Allocation of the public land as provided under section 12 of the Land act 2012; ensure that any public land that has been identified for allocation does not fall within any of the categories provided under section 12 of the Land act 2012; prescribe rules and measures to conservation of land based natural resources as provided under section 19 of the Land act 2012; approve the proposed variation of boundaries of Aberdare forest to allow expansion of Ndaragwa Township; manage public land on behalf of the national and county governments; monitor and have oversight responsibilities over land use planning; and encourage the application of traditional dispute resolution mechanisms in land conflicts.

3.5.10: Water Resources Authority (WRA)

Water Resources Authority (WRA) is a state corporation established under the Water Act 2002 and charged with being the lead agency in water resources management in the country. Based on the proposed project, WRA will be responsible to manage water resources adjacent to the site such as *River Pesi and Mbobo* through ensuring pollution control and its sustainable management. Further, WRA will issue permits to residents who may wish to extract water from drilling of boreholes among other water resources within the proposed town.

CHAPTER FOUR

BASELINE ENVIRONMENTAL CONDITIONS

4.1: OVERVIEW

Baseline conditions describe the state of the environment before the onset of the proposed development. This section provides the state of the existing environmental conditions of the proposed site broadly categorized into the physical environment, biological environment and socio-economic environment.

4.2: SITE DESCRIPTION

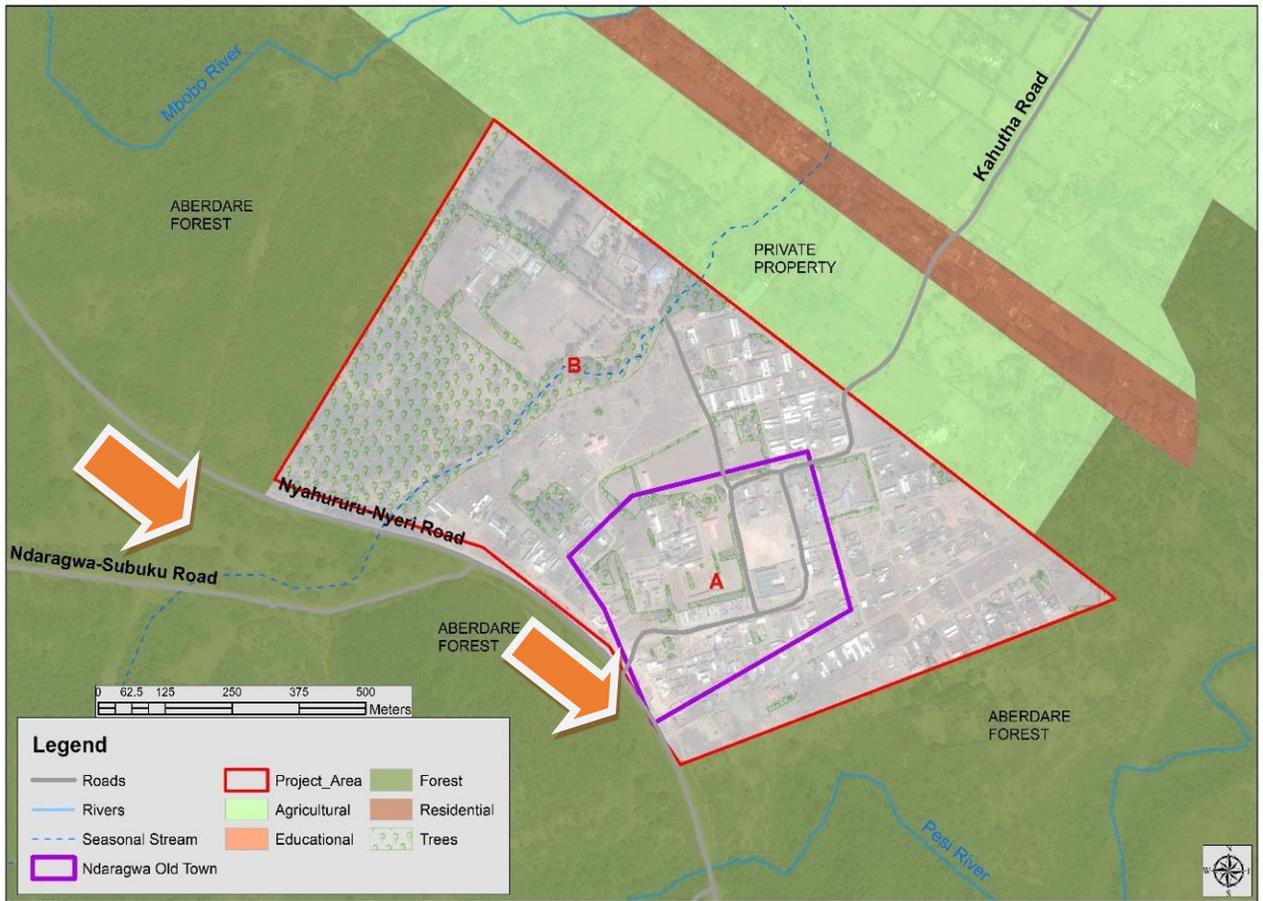
The project site, app. 65.77ha/162.52 acres is situated about 26.3 km from Nyahururu town, Nyandarua County. The Site is situated off the main Nyahururu-Nyeri Road (B65) and is accessed by an all-weather road running from the main road. *See plate 9.*

Plate 9: Main Access road to the proposed site from Nyahururu-Nyeri Road



Source: Field Survey, 2019

Map 4: Location Map of the Proposed Site from Nyahururu-Nyeri Road



Source: Google Earth ad Modified by Author, 2019

4.3: PHYSICAL ENVIRONMENT

4.3.1: Temperature

The project site has a moderate temperature. High temperatures, which are low by national average, are experienced between December and March with the lowest temperatures occurring in July. The highest temperature in December has a mean average of 21.5 degrees centigrade while the lowest in July have a mean average of 7.1 degrees centigrade.

4.3.2: Rainfall

Nyandarua County has a cool and temperate climate with reliable rainfall which is generally well distributed throughout the year. In a typical year, the County experiences two rainy seasons: long rains from March to May with a maximum rainfall of 1,600 mm and short rains from September to December with a maximum rainfall of 700 mm. The average annual rainfall of the County is 1,500 mm. The average monthly rainfall in selected centres within Nyandarua County is shown in the *table 2*.

Table 2: Rainfall in Selected Centres in Nyandarua County

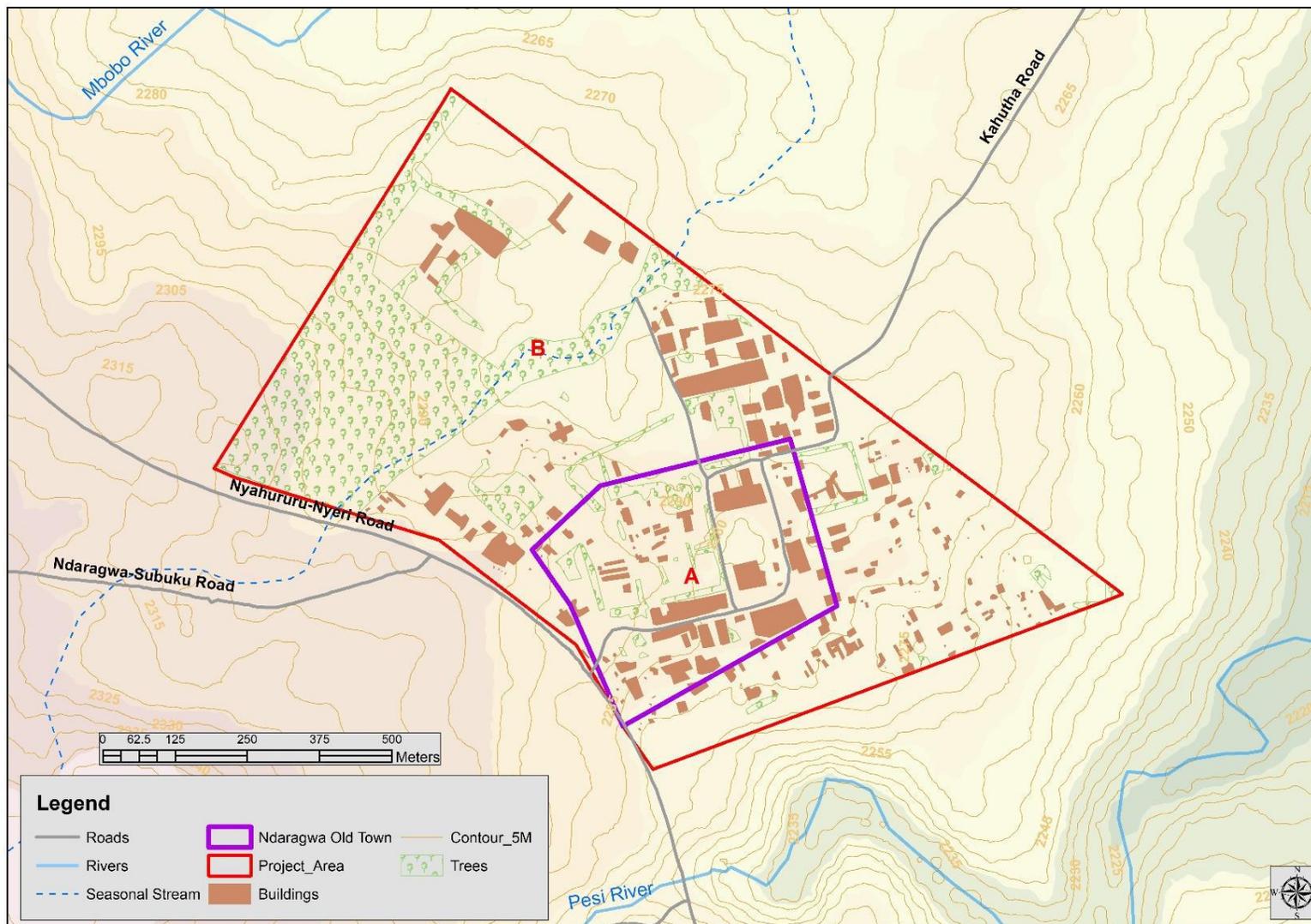
Station	Average Rainfall (mm)											
	Jan	Feb	Mar	Apr.	May	June	July	Aug	Sept	Oct	Nov	Dec
Ol'Kalou	26	23	46	108	103	83	100	116	68	68	83	35
Ol'Joro Orok	29	30	52	121	11	90	130	148	74	59	87	57
Engineer	53	64	108	221	184	73	59	75	67	117	143	84
Njabini	66	84	146	309	257	83	60	70	67	141	194	96
Miharati	35	39	70	156	125	68	73	91	62	89	109	61
Ndaragwa	33	35	59	115	81	66	101	111	53	57	95	69

Source: Nyandarua County CIDP, 2018-2022

4.3.3: Topography

The topography of the proposed site is similar to the wider Nyandarua County which is a mixture of plateaus and hilly areas. The proposed project site slopes towards River Pesi to the western boundary and to the easterly it slopes towards the Catholic Mission complex where a seasonal stream is also located - **see map 5**.

Map 5: Topographic Map of the Proposed Site



Source: Google Earth ad Modified by Author, 2019

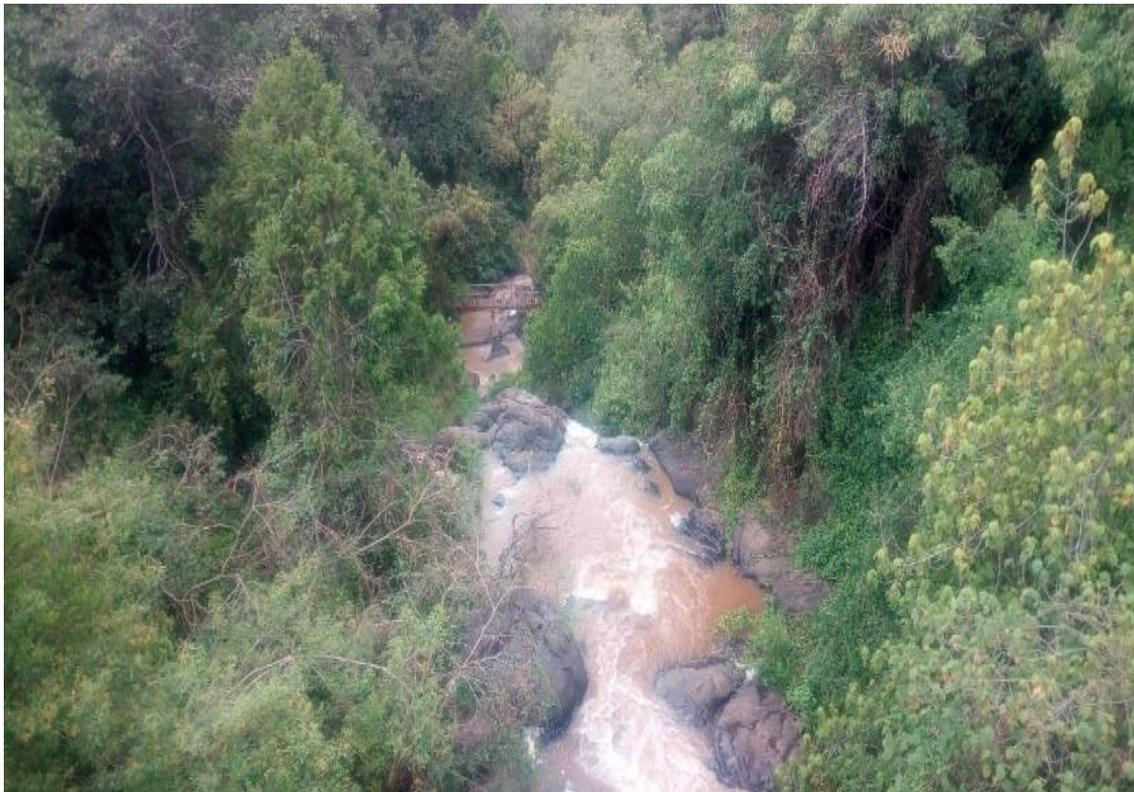
4.3.4: Geology and Altitude

Ndaragwa located in Nyandarua North district is at an altitude of 2405m above mean sea level. The rock occurrence in the area is dominated by natural stone for quarrying as well as clay loamy soils that supports agriculture. Over time, rock weathering has transformed the Aberdare ranges, which dissected the slopes into shallow valleys and the gorges with deep and well-drained soils.

4.3.5: Ground and Surface Water Characteristics

The site generally drains eastwards into River Pesi (*see plate 10*) while westerly into River Mbobo (*see plate 11*) and at the centre it drains towards a seasonal river passing adjacent to the Catholic Mission complex (*see plate 12*). Drainage of storm water into the site is minimal except from central sides that are higher than the site.

Plate 10: The Pesi River on the Easterly section adjacent to the project Site



Source: Field Survey, 2019

Plate 11: The Mbobo River on the Westerly end (outside) the project Site



Source: Field Survey, 2019

Plate 12: Seasonal stream passing adjacent to the catholic mission complex boundaries



Source: Field Survey, 2019

4.4: BIOLOGICAL ENVIRONMENT

4.4.1: Biodiversity

The site is generally predominant with vegetation, mainly grass and scattered exotic and indigenous trees that is spread across the site. The predominant grass type is Kikuyu grass. The site is also a habitat for various invertebrates such as insects. There is no wildlife in the project area. The biodiversity of the site requires significant enhancement, especially tree and shrub planting. It is anticipated that this can attract mainly birds to the area and increase the fauna diversity. The site is currently being temporarily used as grazing field and pathway for community members. Human activities and clearing of the catchments areas for settlement has affected its natural refilling system and its existence is threatened. See Plate 13.

Plate 13: Biodiversity Species within the proposed site



Source: Field Survey, 2019

4.4.2: Forestry

Based on the Nyandarua County CIDP, 2018-2022, the total gazetted forest area in the County is 49,916.2 km² which is concentrated in the western side of the Aberdares Ranges. The main forest areas include four (five??) forests, namely Ndaragwa (13,233.5 ha), Lake Ol’Bolosat (3,326.9 ha), Geta (19,884.3 ha), North Kinangop (6,811.5 ha) and South Kinangop (6,660 ha). The proposed site is bound by the Aberdares forest to the North and easterly, Aberdare forest, Ndaragwa block to the west. See *plate 14*.

The main forest products are livestock fodder (grass), timber, poles and fuel wood. These are both from the forests adjacent to the site. As many households in the County use firewood and charcoal as cooking fuel, there is a need to explore more sustainable sources of energy in order to sustain and increase the County’s forest cover.

Plate 14: A section of Aberdare forest (Ndaragwa Block) to the west of the proposed site



Source: Field Survey, 2019

4.4.3: Environmental Degradation

There are several contributors to environment degradation in the proposed study area. These include: degradation of a section Aberdare forest due to human encroachment and pollution from human settlements and agricultural activities; which have caused loss of vegetation cover and topsoil making topsoil vulnerable to erosion. See *plate 15*.

Plate 15: A section of the site affected by loss of vegetation cover and soil erosion



Source: Field Survey, 2019

4.5: SOCIO-ECONOMIC ENVIRONMENT

4.5.1: Population

The 2009 Kenya population and housing census estimated the population of Ndaragwa Constituency to be at 92,626. 18.5% of the total population was found to be living in urban areas while the rest of the population resides in the rural areas. A major urban center close to the project site is the Ndaragwa old town which is heavily populated. The project site falls largely within Kahutha location which has three sub locations, Kianjogu, Uruku and Murichu which have of a population size of 2,903, 2668 and 7,090 respectively according to the 2009 population census, volume 1.

4.5.2: Population Density and Distribution

The population density of the County has been steadily increasing over the years from 184 persons per square kilometre to persons per km² in 2018. The population density varies from one Sub-County to the other ranging from 261 persons per km² in Ol’Joro Orok which is the most densely populated Sub-County to 170 persons per km² in Ndaragwa as the least densely populated Sub-County as shown in table 3 below. The proposed town expansion proposal is likely to contribute to an even high population growth rate since it will provide housing and social amenities, commercial areas, create jobs to people as well as entrepreneurs coming to set up their own commercial and logistics businesses.

Table 3: Population Distribution and Density by Sub-County

Sub-Counties	Area Km ²	2009 Census		2018 Projections		2020 Projections		2022 Projection	
		population	density	population	density	population	density	population	density
Ol’ Kalou	670	120,282	180	143,748	215	149,556	224	155,598	233
Ol’ Joro Orok	439	95,643	218	114,302	261	118,920	271	123,724	282
Ndaragwa	654	92,626	142	110,697	170	115,169	177	119,822	184
Kinangop	939	192,379	205	229,911	245	239,199	255	248,863	265
Kipipiri	544	95,338	175	113,938	209	118,541	218	123,330	226

Source: Kenya National Bureau of Statistics, 2013

4.5.3: Local Employment

Most of Nyandarua’s and Ndaragwa town population, according to Nyandarua County CIDP, 2018-2022 about 46.2%, are self-employed, 13.0% are in full time employment, 9.4% are casual labourers, 20.1% are students and 11.4% are unemployed. About 24.5% of the households earn between 5,000 and 10,000 Kenya shillings a month, about 22.5% earn from 10,000 to 20,000 shillings monthly and a minority of about 3.3% earn above 50,000 per month. Food crops, livestock and to a large extent horticulture production comprise the major economic activities in the agricultural sector. Cottage and small-scale industries are minor economic activities carried out in the market centres. Sawmills as a major source of employment has declined with the fall in available trees for lumber in the County. Commercial tree production is now the only source of timber for the few saw mills that are still operational.

The Jua Kali sector remains the most important economic activity in the urban and trading centres. These sectors are the major sources of employment opportunities in the County. Agriculture employs about 50% of the population with most people employed in the family agricultural holding (Exploring Kenya's Inequality, 2013).

Arable/Crop farming is the main agricultural activity in Nyandarua with a total arable land of 184,900 ha; in 2016, nearly 46% of this land was under crop farming. About 76.9% of households practice crop farming. Livestock farming is the second major employment sector under agriculture with approximately 65.1% of households rearing livestock: cattle, sheep, goats, poultry, pigs and rabbits. Cattle and sheep account for the largest percentage.

Although the County is within the Mt Kenya and Aberdares Ranges tourist circuits, tourism remains undeveloped. The County is richly endowed with abundant game and beautiful scenery for tourist attraction such the Ndaragwa falls along *River Pesi* bordering the project area on the south-eastern end, the cool temperatures, the hilly terrain and beautiful scenery that can be harnessed for recreational activities including mountain climbing and nature trails. There are also *Mau Mau* caves along the same river that can be mapped and linked to cultural tourism products. See *plate 16 and 17*.

Plate 16: The Ndaragwa Falls that can be harnessed as a tourist attraction site



Plate 17: A section of mountain climbing and nature trails easterly of the project Site



Source: Field Survey, 2019

Ndaragwa Sub County at large, apart from being predominantly agricultural, has other resources, which include: forest, water, tourist attractions and natural stone for quarrying. Specifically, within the project site, there is potential for secondary utilization of these resources. Potential for agro-industrial processing exists in the dairy sector with Nyala dairy multipurpose cooperative society located within the project area. Potential for m processing and hides and skins tanning also exist owing to its proximity to the drier Laikipia County. *See plate 18.*

Plate 18: Nyala dairy multipurpose cooperative society located within the project area



Source: Field Survey, 2019

Other economic activities include: horticulture and food crop production, commerce and small-scale Jua Kali cottage industries and enterprises also abound as shown in *plate 19*.

Plate 19: Crop and Animal farming practiced within the project area



Source: Field Survey, 2019

4.5.4: Housing

Housing typologies within the project site are predominantly semi-permanent with timber walling and iron sheet roofs. This is attributed to mainly insecure land tenure. However, some residents have built permanent structures within the proposed site. See *plate 20 and 21*.

Plate 20: A section of the project area with semi-permanent housing



Plate 21: A section of the project area with a permanent residential house



Source: Field Survey, 2019

4.5.5: Socio-cultural setup

Understanding of a project area's socio-cultural composition is important as it provides insights into the best way to develop rapport with the local community, helps create an understanding of acceptable norms, locational distribution that may be ethnic based and "taboo" subjects to enhance inclusivity in identification and engagement of the stakeholders and general project acceptance. The population in Ndaragwa town largely constitutes the Kikuyu community although there are a few people from other communities. The socio-cultural study revealed that there are two caves along the Peri River that were being used by the Mau Mau freedom fighters during the fight for independence. These caves are linked to other caves along the routes used by the Mau Mau fighters across the area now covering the Aberdares Forest and the Aberdares National Park, as they moved from Nyeri to Nyandarua and other areas of Central Province. These caves fall about 1km away from the eastern border of the project site and have been classified by the ESIA as cultural physical assets. Ndaragwa is largely a Christian town.

4.5.6: Health Amenities and Access

The proposed project site (for de-gazettement) has no health facilities. It is served by one public facility within the gazetted old Ndaragwa town namely Ndaragwa health centre and private clinics. This facility is being upgraded to Level 4. However, at the county level, based on the Nyandarua County CIDP, 2018-2022, there are currently 207 health facilities of which 73 of these are public health facilities.

4.5.7: Education

The project site lacks any developed education facilities except the ones within the gazetted old town such as the Ndaragwa primary school and the school for persons with disability. However, at the county level, based on the Nyandarua County CIDP, 2018-2022, the education facilities statistics within the county stands as follows:

- a) Pre-School Education (Early Childhood Development Education): The County currently has 929 Early Childhood Development and Education (ECDE) centres of which 496 are public and 433 are private. The enrolment stands at 33,953 where 20,216 are in public centres and 13,737 are in private centres. In

this enrolment, 17,270 are boys while 16,683 are girls. There is one ECDE in the old town, within the Ndaragwa Primary School.

- b) Primary Education: The County has 507 primary schools of which 349 are public while 158 are private. The total enrolment is 151,165, where 128,298 are in public primary schools and 22,427 are in private schools. In this enrolment, 76,165 are boys while 75,000 are girls.
- c) Secondary Education: There are 221 secondary schools; 167 public and 54 private. The average distance travelled to access a public secondary school facility within the County is 2.5 km. This is longest in Ndaragwa, 3.3 km and shortest in Kipipiri, 2 km. Current total enrolment is 57,646, of which 51,599 are in public and 6,047 are private.
- d) Youth polytechnics: The Youth polytechnics are basic technical education institutions intended to offer school leavers both from primary and secondary schools opportunities to acquire education and training, knowledge and technical skills for gainful employment. Besides, they equip the youth with entrepreneurial skills based on appropriate technology enabling them to utilize locally available resources for further job creation. The County has twenty-four (24) public youth polytechnics (YP) distributed as follows: 9 in Ndaragwa Sub-County, 2 in Ol'Joro Orok, 4 in Ol'Kalou, 4 in Kipipiri and 4 in Kinangop. Out of this, 15 polytechnics are operational with total enrolment of 1540 trainees, while 4 are non-functional, 3 are under construction and two 2 needs to be renovated. There is no polytechnic in Ndaragwa town.
- e) Tertiary Education: The County has four technical training institutes, namely Nyandarua Institute of Science and Technology (NIST), Leshau, Kinangop, and Kipipiri Technical Training Institutes. In addition, there is the Aberdare Teacher Training College. The County also has Animal Health Industry Training Institute (AHITI) at Ol'Joro Orok. Lack of adequate tertiary institutions has negatively affected the transition to higher learning for skills development and also upgrading from traditional to market driven courses. The sector needs close attention since the level of education is always proportional to the rate of development. There are no tertiary institutions in the project site.
- f) Adult and Continuing Education: There are 36 special needs schools. There were 130 ACE centres by 2015. Total enrolment in ACE in 2014 was 4,326. Most students in ACE facilities are female. Kipipiri Constituency has the highest enrolment while Mirangine has the least.

The County literacy rate stands at 84% being County population that can read. The population aged 15 and above that can read and write in the County is about 83.8%, better than the National average of 78%. This implies that about 16% of the population cannot read and this will be the target group for adult education basic literacy programs.

4.5.8: Sports and Sporting Facilities

The project site lacks any sports and sporting facilities. However, at the county level, based on the Nyandarua County CIDP, 2018-2022, despite the County being a home to renowned national athletes due to its high altitude climate, the sports facilities are not well developed. The Ol’Kalou stadium is in the process of being upgraded to international standards. *Table 4* below shows the county stadiums distribution throughout its Sub Counties that require upgrading and maintenance.

Table 4: Sports Facilities in Nyandarua

Stadium/Field Location (Sub-County)	No. with Soccer pitch Only	No. with Soccer pitch and Running Tracks
Ol’Kalou	-	1
Ol’Joro Orok	-	1
Ndaragwa	1	-
Kipipiri	2	1
Kinangop	2	1

Source: Nyandarua County CIDP, 2018-2022

4.5.9: Other Social Facilities

The project site lacks other essential social facilities including a bus park and designated parking areas especially for market areas, recreational park, rehabilitation centre, a public orphanage and fire station.

4.6: PHYSICAL INFRASTRUCTURE

4.6.1: Water Sources and Supply

According to Nyandarua County CIDP, 2018-2022, the County is categorized as water scarce. The situation has been aggravated by degradation of water catchments leading to reduced ground water recharge. As a result, boreholes have medium to low yields. The main source of water in the County is rainwater which ends up in dams and rivers. A total of 22 rivers flow through Nyandarua County, of which eight are permanent, namely Malewa, Ewaso Narok, Pesi, Turasha, Chania, Kiburu, Mkungi and Kitiri. Lake Ol'Bolosat, which is the only lake and the largest water mass in the County, is fed by streams and groundwater seepage from the Aberdare and Dundori hills. The major rivers within the County originate in the Aberdare forest and drain to the Ewaso Ng'iro, Rift Valley, Tana and Athi catchments.

Rainfall intensity varies according to the location. Areas near the Aberdare slopes receive sufficient rainfall, whereas rainfall in the lower parts of Ndaragwa and the plateau is scanty and erratic. The County has one lake, about 222 small dams, 280 boreholes, 6,244 shallow wells and 96 springs. Main source of water for domestic use is small dams and shallow wells. Most of the water used is untreated which poses a health risk to the population.

There are two registered water companies in the County, namely Nyandarua Water and Sanitation Company and the Ol'kalou Water and Sanitation Company, in addition there are several community managed water supply schemes. However, some areas in the County are not covered by these schemes and therefore remain unserved. The water supply schemes are unreliable requiring augmentation and rehabilitation to increase the number of households with access to piped water. About 46,400 households have access to piped water. Most of the households depend on water from shallow wells, dams, springs, roof catchment and rivers.

In the project site, there are three community based gravity flow water projects that provide piped water to communities namely Ndaragwa Water Project, Haki Water Project and Kinga Fallow Irrigation Project. Majority of residents however rely on water from shallow wells, Pesi River and the streams.

4.6.2: Sanitation

According to Nyandarua County CIDP, 2018-2022, the County sanitation encompasses maintenance of personal hygiene, safe disposal of liquid and solid waste, control of disease vectors, provision of safe drinking water and provision of hygienic shelter. The main form of disposal of human waste is pit latrines, 92 % of the households have latrines, 3% have flush toilets and there is no sewerage system in the County. On the other hand, 32.8% of Nyandarua's households dispose of their solid waste at garbage pits while 28% of households burn their waste and 25% dispose it in their gardens. The County Government collects garbage for only 2% of the households.

4.6.3: Energy Access Infrastructure

According to Nyandarua County CIDP, 2018-2022, only 1% of residents in the County use liquefied petroleum gas (LPG), while 1% use paraffin, 78% use firewood and 19% use charcoal. A total of 11% of Nyandarua residents use electricity as their main source of lighting. A further 56% use lanterns and 26% use tin lamps. Less than 1% use fuel wood. The most common lighting source among male headed households is lanterns at 56% and the same holds for female headed households at 55%.

Hydro power is the biggest source of electricity in Nyandarua County. However, the County has no hydro generating plant, but is connected to the National grid. There are four power sub-stations in the County, namely: Ol'Kalou, Matundura, Magumu and Wanjohi. There is an energy centre just completed in Mirangine area which will serve as a key learning centre and enhance energy throughout the County. Moreover, it will promote research and uptake of new technologies and devices in the County.

The Kenya Power and Lighting Company is the main electricity supplier. A total of 65,399 households are connected, accounting for approximately 40% of the total households.

4.6.4: Information, Communications Technology Infrastructure

According to Nyandarua County CIDP, 2018-2022, the County is well served by a postal system network with Post Offices located in the various townships. However, with advancement in technology, other means of communication including private courier and transport service providers who offer delivery services for mail and parcels, mobile

telephone, and data communication which offer electronic mail and information transfer platforms, the use of post offices has diminished.

Nyandarua County has embraced ICT in public service delivery, and in learning institutions. The County has poor signal network apart from the centres with Base Transmission Stations (BTS). ICT infrastructure in the County remains weak as demonstrated by weak Grams per Square Metre (GSM) signal in certain areas, and lack of 4G network. The main mobile phone and telephone service providers are Safaricom, Airtel and Orange. The County is also not fully connected to the National Optical Fibre forcing residents to rely on a weak Local Area Network (LAN).

4.6.5: Solid Waste Management Facilities

According to Nyandarua County CIDP, 2018-2022, the main waste include: domestic, industrial and medical waste. To comply with national solid waste management strategy standards, the County will need to zone off waste collection areas; ensure timely and regular collection of all wastes and provide waste collection facilities; ensure that collected waste is transported to designated sites for waste disposal; gazette a County dumpsite and accelerate the process of purchasing land for dumpsites in Ndunyu Njeru and Engineer Market and increase the number of garbage collection trucks. Urban areas are the largest generators of liquid waste. However, all the urban areas in the County lack sewerage networks posing a risk of contamination and ill-health. The major sources of liquid waste are households, institutions, commercial establishments and light industries. The wastes mainly include blackwater, silage and waste from industrial processes. Most of the households, 84.1%, rely on pit latrines for sewage disposal. A majority of the households, close to 74.2%, pour waste water in their compounds.

CHAPTER FIVE

STAKEHOLDERS AND PUBLIC PARTICIPATION

5.1: OVERVIEW

Public and stakeholders' involvement in project development in ESIA studies has been set out in the EMCA CAP 387 and section 17 of the Environmental (Impact and Audit) Regulations, 2003, and in most international financing institutions such as the World Bank. This exercise aims to ensure that all stakeholders interested in a proposed project (including project beneficiaries and the general public in the vicinity of the proposed project) are identified and their buy-in sought and opinions considered during project planning, design, construction, operational and decommissioning phase. The proposed project has incorporated stakeholders' consultations in order to understand the local impacts, needs and thoughts and eventually incorporate them into the final designs and operations of the project as detailed out in the subsequent sections.

5.2: BASIS FOR STAKEHOLDERS AND PUBLIC ENGAGEMENT

Public participation in the implementation of government projects is not only a constitutional right but also a requirement under Environmental Management and Coordination (Revised Edition, 2018) Act. However, the essence of stakeholder consultation is not just for compliance with legal requirements, but also because it establishes a strong foundation for developing a common understanding and rapport between project impact assessors and local communities as well as offering a platform for resolving emergent conflicts and remedying and misinformation and misunderstanding regarding a proposed project.

The key benefits of stakeholder consultation include:

- a) Ensures involvement of the affected persons in decision making and planning. This fosters impartiality, justice and cooperation.
- b) Helps create a sense of ownership of the project among them
- c) It is useful in the education of stakeholders (proponent and public) as well as enlightening them on the details concerning the entire project.
- d) Draws insights on the fears and concerns of project stakeholders regarding the project

- e) It is an effective tool for acquiring public opinion on the planned intervention and helps draw proper mitigation measures.
- f) Contributes to better analysis of proposals leading to more creative development, more sustainable interventions and consequently greater public acceptance and support than would otherwise be the case.
- g) It is a source of data and information collection from the public about their human (including cultural, social, economic and political dimensions) and biophysical environment, as well as about the relations (including those related to traditional and local knowledge) they have with their environment.

The proposed project is intended to benefit businesses and residents of Ndaragwa and its hinterland, and improve the town's standing as an investment generation. However, the intended benefits of project may not be fully realized if the views and concerns of its intended beneficiaries are not addressed. In addition, the project's probable adverse effects may not be properly mitigated if stakeholder consultation is not adequately done.

5.3: METHODOLOGY & DATA COLLECTION

Stakeholder mapping was our main methodological approach in the public and stakeholders' involvement. The criteria adopted in the stakeholder mapping included interest, influence, financial stake, emotional stake, those on the periphery who are still important enough to keep in the loop, special and vulnerable groups, persons with disabilities etc. The stakeholders were identified in consultation with the project petitioners and local community leaders. Stakeholders' consultations were conducted in the form of key informant interviews and semi-structured questionnaires. The public consultations for the proposed project was conducted simultaneously with the field survey targeting the various groups of stakeholders.

In summary, identification of the specific issues from the stakeholders' responses and analysis of the questionnaire data provided the basis upon which the aspects of the ESIA were analysed. The purpose for such interviews was to identify impacts and subsequently promote proposals on the best practices to be adopted and mitigate the negative impacts respectively. It also helped in identifying any other miscellaneous issues, which may bring conflicts in case project implementation proceeds as planned. The stakeholder consultations findings are detailed below and samples of questionnaires administered are annexed in this report.

Plate 22A: An interview with the Chief Kahutha sub location, Ndaragwa



Plate 23B: An interview with the Assistant Chief Kahutha sub location, Ndaragwa



Source: Field Survey, 2019

5.4: KEY INFORMANT PARTICIPATION

5.4.1: Nyandarua County Director of Physical Planning Comments

Key Informant 1: Nyandarua County Director of Physical Planning	
Institution	Nyandarua County Government
NOTES: <ul style="list-style-type: none">▪ Ndaragwa town was carved out of the Aberdares Forest Reserve. The first development plan was prepared in 1983. Hitherto, allocation of plots was based mainly on temporary occupational licenses from the local authority. The need for expansion of the town in the 1980s necessitated the revision of the town development plan. Hence series of plans were prepared which includes the 1988, 1996 and finally 1999 draft plans.▪ None of these developments plans were endorsed as approved due to the unresolved issue of forest land degazettement. Planning and even land allocation was done pending formal degazettement.▪ In terms of development activities, Ndaragawa town is the biggest and the most active designated town centre in Ndaragwa division (Mairo Inya town, albeit more active commercially is undesignated, unplanned and is located at the boundary at the outskirts of Nyahururu town.▪ The old town which was about 15ha is fully developed. Essential public purpose and utilities could not be allocated within this land which is within a limited space. In this regard, local leaders, through the county Council of Nyandarua and the District Development Committee (DDC) recommended the excision of 110.3 ha of the forest land (survey Plan FR. 216/75) for the purpose of expansion of the town.▪ From a physical planning point of view the town is dead and needs to be expanded.▪ In spite of the above, it's imperative to look into ways of utilizing the available land optimally. Hence the town should be planned.	

5.4.2: Assistant County Commissioner Comments

Key Informant 2: Assistant County Commissioner	
Institution	National Government
Date	8 th May 2014
<p>NOTES:</p> <ul style="list-style-type: none"> ▪ Various county and national fora had been addressing the issue of Ndaragwa town expansion. ▪ He was aware of the town expansion debate and urges that the degazettement should be carried out according to the laid down law and eventually if successful, it has to be passed by 2/3 majority vote by the parliamentarians ▪ He urged the public to cooperate with KFS on the degazettement issue and continue to help the department in conservation of forests and planting of trees. ▪ He expressed optimism that concerns of Ndaragwa residents will be quickly addressed. 	

5.4.3: Director of Surveys Comments

Key Informant 3: Director of Surveys	
(Letter File Ref. CF/55/C/VOL II/69, 18th July 2006)	
Institution	National Government
<p>NOTES:</p> <ul style="list-style-type: none"> ▪ The perimeter survey of 110.3 ha, survey plan FR 216/75 had been carried out from the Aberdare forest and the boundary plan 175/325 prepared for the purpose of Ndaragwa township expansion. ▪ When we sought for the de-gazettment, it was decided to excise only 50ha. As per the PS, Ministry of Environment And Natural Resources letter MENR/B14.04/VOL. (168) of 12th July 2006 and the chief conservator of forest letter CONF/FD/267.VOLXXX/104 of 17th July 2006. 	

5.4.3: Director of Forests Comments

Key Informant 4: Director of Forests (Letter File Ref. CONF/FD/Z67/VOL XXX/58, 20 th April 2007)	
Institution	Forest Department, National Government
<p>NOTES:</p> <ul style="list-style-type: none"> ▪ The old Ndaragwa town occupying 25.3 acres was degazetted as per proclamation no. 18 of 1955. ▪ The authorized additional 50 ha. covers the current developed area falling outside of the old Ndaragwa Township. However, the authorized area leaves out the developed portion of the Catholic mission Church measuring approximately 5.3 ha. Thus bringing the total currently developed area to 55.3 ha. ▪ However with the commencement of the Forest Act, which was operationalized on 1st Feb 2007. The Act stipulates that any conversion of any part of the forest into any other use has to be in accordance with section 28 of the Act. The conditions as follows: <ul style="list-style-type: none"> ▪ Must be approved by the forest conservation committee for the area. ▪ Be subject to an independent Environmental and Social Impact Assessment (ESIA) as per EMCA, 1999. ▪ Be subjected to public consultation in accordance with Third schedule of the Act. ▪ Be recommended for excision by the Kenya Forest Board (KFB) ▪ Be approved by a resolution of Parliament ▪ The Minister has to publish a legal notice in the Kenya Gazette for degazettement. ▪ Its only when the above conditions have been met that the Minister for Environment and Natural Resources can then publish a legal notice in the Kenya gazette for degazettement. 	

5.4.4: Nyandarua North District Physical Planning Committee Comments

Key Informant 5: Nyandarua North District Physical Planning Committee
(Subcommittee report of 20th March 2009)

Institution	Nyandarua North District
--------------------	--------------------------

NOTES:

- Ndaragwa Township is located inside a forest and has an area of 29ha which was excised through proclamation no. 18 of 1955.
- That the town is the headquarters of Ndaragwa Division of Nyandarua North District and relatively the seat of the district.
- The current township occupied area covers an area of about 55ha although the physical development plan covers approximately 110ha. Half of which is still forested. This was reached following a recommendation by *Ndungu land report* that the whole area of the township excluding the original 29ha reverts back to forest.
- The first and second proposals for Ndaragwa township expansion vide forest excision had not been approved.
- That the town was quite vibrant with banking facilities and a milk cooling plant in addition to other facilities for commercial, residential among other activities.
- For the purpose of social amenities and expansion of Ndaragwa town, there is need to pursue the excision of the land to the north and west of the Catholic Mission Complex and bound by the Nyahururu-Nyeri road (as per the development plan). However, advice on the process has to be sought for from the Board in accordance with section 28 of the Forest Act 2005. Key to this excision is the preparation of an independent Environmental and Social Impact Assessment (ESIA).

5.4.5: Nyandarua County Community Forest Association Comments

Key Informant 6: Chairperson/Association Members (Field Interview 2019/20)	
Institution	Nyandarua County Community Forest Association
NOTES: <ul style="list-style-type: none">▪ The The Nyandarua County Community Forest Association representing its 48 user groups is registered in accordance to the societies Act CAP 108.▪ The Association having consulted all the stakeholders and in full cognizance of the Forest Act wish to note that the Local Forest Committee of Ndaragwa committee:<ul style="list-style-type: none">▪ Does not object the Ndaragwa town expansion.▪ Does not object the variation of Aberdare forest whatsoever to pave way for Ndaragwa town expansion.▪ Notes that a lot of concern has been raised regarding the degazettement of Aberdare forest and expansion of Ndaragwa town. This is absolutely necessary since the town population has grown rapidly increasing the demand for various social amenities.▪ The requested land does not have an indigenous tree forest and generally consists of already developed area with some grassland and scattered shrubs.▪ A lot of public participation has been done on this matter and that the County and town residents including the business community were eager to see the degazettement of Aberdare forest and expansion of Ndaragwa town.	

5.4.6: NEMA Nyandarua County Director Comments

Key Informant 7: NEMA (Field Interview 2019)	
Institution	National Environment Management Authority (NEMA), Nyandarua
<p>NOTES:</p> <ul style="list-style-type: none"> ▪ Confirmed of no baseline studies such as air quality/sound/noise/water quality etc. done in the county. However such studies can be done if required. ▪ Indicated that the approval process for the ESIA will have to be done from both the National and County Environment Committee through NEMA. ▪ The office has never received such type of ESIA report. ▪ Expressed the concern that the office has a toll order to conserve the water tower. ▪ He was aware of the Ndaragwa Town expansion project through the area MP but further consultations at the NEMA office had not been done. ▪ He is of the do nothing option for now citing the importance of the forest to the environment. Other alternatives should be explored. ▪ As a way forward, he proposed the independent ESIA requested should provide information for decision-making on the environmental consequences of the proposed actions; and promote environmentally sound and sustainable development through the identification of appropriate enhancement and mitigation measures. 	

5.4.7: KFS Officer, Ndaragwa Town Comments

Key Informant 8: KFS Officer, Ndaragwa Town (Field Interview 2019)	
Institution	National Government
<p>NOTES:</p> <ul style="list-style-type: none"> ▪ Confirmed his awareness on the proposed variation of boundaries of Aberdare forest to allow expansion of Ndaragwa Township. ▪ Indicated the potential environmental negative effects of the proposed project: <ul style="list-style-type: none"> ▪ Potential pollution of river Pesi - this calls for relocation of the proposed sewer plant away from the river. ▪ Potential destruction of the water catchment areas. ▪ Potential further encroachments into the forest in future. ▪ Poor sanitation associated with urban areas ▪ To mitigate the above effects he suggested the need to put up a buffer zone between the proposed town boundary and the water catchment areas. ▪ In his opinion there will be no positive environmental value as regards the proposed project. ▪ The benefits of the forest to the residents before and to date were identified as: <ul style="list-style-type: none"> ○ Water catchment area ○ Rich indigenous forest ○ Medicinal herbs/value ▪ The proposed variation of boundaries of Aberdare forest to allow expansion of Ndaragwa Township should be free from political interference as well as personal/individual interests. ▪ If given approval, the implementers of this project should consider issuing afresh plot allotment letters to evade any disputes. ▪ He has no objection with the implementation of the project if his concerns are considered and the established KFS beacons/boundaries are adhered to. ▪ Other comments raised included the need: <ul style="list-style-type: none"> ○ For the town to be given enough space to grow and supply essential facilities to the people. ○ KFS involvement in this project is critical. ○ The community can consider getting a land lease from KFS. ○ The demarcated area should be buffered to avoid further encroachment into forest land. 	

5.4.8: Assistant Chief, Kahutha Sub location, Ndaragwa Town Comments

Key Informant 9: Assistant Chief, Kahutha Sub location, Ndaragwa Town (Field Interview 2019)	
Institution	National Government
<p>NOTES:</p> <ul style="list-style-type: none"> ▪ Confirmed his awareness of the proposed variation of boundaries of Aberdare forest to allow expansion of Ndaragwa Township. ▪ The proposed project area historically had a Cypress plantations before KFS harvested leaving the land bare. This paved way for people to encroach into the forest land. ▪ Basic social facilities provision and expansion of business opportunities will be the major benefit of the proposed project. ▪ In his opinion there will be no environmental value as regards the proposed variation of boundaries of Aberdare forest to allow expansion of Ndaragwa Township. Although Parks and public open spaces/gardens can be provided. ▪ There will be need to preserve the indigenous tree species that may be found within the expansion area. ▪ The project should not endanger wildlife habitat found within Ndaragwa forest. ▪ Potential environmental negative effects of the proposed project include: <ul style="list-style-type: none"> ○ Pollution of river Pesi this calls for relocation of the proposed sewer plant to be away from the river and section C on the development plan respectively. ○ Destruction of the water catchment areas. ○ Further encroachments to the forest in future. ○ Poor sanitation normally associated with urban areas ▪ To mitigate the above effects he suggested the need to <ul style="list-style-type: none"> ○ Provide an elaborate waste management plan citing the case of Singapore. ○ Promote rain and storm water harvesting e.g. water pans and retention trenches ○ Promote eco-tourism on River Pesi falls to enhance its management. ○ Establish a rehabilitation centre to handle social crimes and drug abuse in the area ▪ 	

- Other comments he raised include the need:
 - KFS to grant Ndaragwa people land unconditionally.
 - For the town to be given enough space to grow and supply essential facilities to the people.
 - The town is dead and needs to be expanded.
 - For legalizing the land tenure of the proposed variation of boundaries of Aberdare forest to allow expansion of Ndaragwa Township.
 - Increased public awareness on the proposed project.
 - Considering other alternatives such as getting a lease from KFS, preserving or relocation of section C on the development plan to avoid destruction of the water catchment areas.
 - Actively engage the local administration in the implementation of the project.
 - Using the community to enhance public awareness on the proposed project.

5.4.9: Chairperson and other members of the Ndaragwa Youth Association

Key Informant 10: Chairperson and other members, Ndaragwa Youth Association	
(Field Interview 2019)	
Marginalized Groups	Youth
<p>NOTES:</p> <ul style="list-style-type: none"> ▪ Confirmed their awareness of the proposed variation of boundaries of Aberdare forest to allow expansion of Ndaragwa Township. ▪ The main benefits of expanding the town area is to provide space for additional social facilities, create employment and opportunities for income generation including: <ul style="list-style-type: none"> ○ Bus parks and parking areas, current bus park is on a road reserve ○ Recreational facilities, no stadium or sports facilities and play grounds for children. This will help offer sports facilities for recreation, enable talent development among the youth for better livelihoods while keeping them away from crime and illicit habits such as alcoholism and drug abuse. The land initially set aside for a bus park has been taken up by the IEBC offices, while 	

the new County administration offices have taken up part of the land set aside for a stadium and a polytechnic.

- Space for establishment of industries such as milk, beef and vegetable processing, and hides and skins tanning based on the prevalent economic activities. To service the industries, the service industry will expand. These activities will provide employment opportunities, while value addition will make the agricultural commodities more competitive and generate better returns to farmers and revenue to the County Government.
- Create opportunities for business expansion for many youth and other members of the community who are either semi-literate or non-literate, and hence improve livelihoods.
- Provide bus and motor cycle parks and other parking areas, which are currently non-existent. Matatu operators use a road reserve as a bus park which is in deplorable state during the rains and cannot be maintained because KeNHA always seeks to evacuate them. Efforts to get the County Government allocate them suitable land have been unsuccessful.
- Need for a public rehabilitation centre for persons involved in substance abuse and more classes and equipment for the existing public school for children with disabilities.
- There is an urgent need for establishment of a mixed secondary school as there is none to reduce the distance children walk to the nearest school 3km away. The ECDE facility at Ndaragwa Primary School is also quite congested.
- Anticipated Environmental Impacts and mitigation measures
 - No negative environmental impacts are foreseen if the landowners can plant trees along fences and boundaries and County Government to plant trees and other vegetation along the streets.
- Other Comments
 - Government to introduce the youth fund or other financing mechanisms for the youth to enable initiate or expand their businesses.

5.4.10: Chairperson, Maendeleo ya Wanawake

Key Informant 10: Chairperson, Maendeleo ya Wanawake and Member of the Ndaragwa CFA (Field Interview 2020)	
Marginalized Groups	Women
<p>NOTES:</p> <ul style="list-style-type: none"> ▪ Confirmed she is aware and participated in public participation meeting on the proposed variation of boundaries of Aberdare forest to allow expansion of Ndaragwa Township. ▪ Explained that residents of the project site were initially settled in Gaturia Maru, an informal settlement in Ndaragwa that dates back pre-colonial times. That these people were informally awarded the land, by the former late President Daniel Moi and were issued with land allocation letters. ▪ Variation of the boundary is important because: <ul style="list-style-type: none"> ○ The current residents of the project area have lived on this land for more than 55 years and evicting them would destroy their lives. ○ It will pave way for acquisition of title deeds as they currently have no security of tenure and hence lack the confidence to invest in good housing, residential buildings for rental and commercial buildings in fear of eviction. ○ Provision of titles will enable them access credit for meaningful investment, which has not been possible with land allocation letters. ○ Increase space for markets and other commercial activities, which are the main livelihood activities of women and youth in Ndaragwa town. ○ Provide a skills training facility for women and girls on tailoring, baking, beadwork and basket making among others i.e. a section set aside and equipped within the Polytechnic. 	

Negative environmental Impacts

- Degradation of the riparian area of the stream running adjacent to the Eastern boundary of the Catholic Mission property for agriculture, livestock watering and grazing and for domestic water
- Potential pollution of this stream and Pesi River by waste from the town.. As it is, waste from shops and bars had littered the bushes up to a few metres to the stream on the South West corner of the project site.

Mitigation Measures

- Create a recreational park adjacent to the stream neighboring the Catholic Mission and plant indigenous trees and other vegetation to attract monkeys from the nearby forest area in C.
- Protect the riparian area of the stream and Mbombo stream with fencing to avoid encroachment and destruction
- Provide a waste disposal site.

Other Comments

- There is need for the County Government to complete the bigger national government funded market to accommodate all traders. The current food market is small so most foodstuff traders operate from the open air, which is unhygienic, exposes them to harsh weather conditions, has inadequate sanitation facilities, lacks loading and offloading parking area and is unhygienic.
- The CFA has been allocated 10acres of land with a waterfall and a hotel established through a partnership agreement with KFS. The hotel is leased and managed by a private sector player but for years was not generating significant returns to the CFA. Requests the County Tourism Department and KFS to support development of tourism linked to the Twin Falls, the Mau Mau caves, the nature trails and the hotel.

5.4.11: Representatives of the Elderly

Key Informant 11: Representatives of the Elderly, Ndaragwa Town (Field Interview 2020)	
Vulnerable Groups	The Elderly
<p>NOTES:</p> <ul style="list-style-type: none"> ▪ The elders were aware of and participated in a public participation meeting on the proposed variation of boundaries of Aberdare forest to allow expansion of Ndaragwa Township. ▪ Offered that the project site initially had bushes that were slashed by the whites and exotic namely “pine radiata” and Cypress thereafter (one came to Ndaragwa as a Forest Officer in 1972). ▪ The old Ndaragwa town was designated as an African Trading centre by the colonialists with a few shops and a police post. Retired forest workers were allocated small plots of about 50x100 ft² at a section called “Kwa Retire” while casual workers settled at Gaturia Maru (informally). ▪ After Moi announced he is giving Ndaragwa people forest land, people in these areas invaded the forest and began to settle. ▪ Variation of the boundary and degazettement of Area B is important because: <ul style="list-style-type: none"> ○ The population and has increased and there is need to meet the increased demand for services ○ There is no space for expansion of the health centre being upgraded to a Level 4 facility ○ Legalize land ownership by 70% of the population resident on the land through provision of title deeds and enable them invest in permanent structures ○ Pave way for acquisition of land for expansion on Nyala Milk Cooling Plant to a milk processing plant and establishment of other industries. ○ Avail land for a secondary school, training colleges and a polytechnic ○ The Children with disability school needs to be expanded and a secondary school/skills training school established 	

- Space for a stadium and other play grounds to engage the youth and safeguard them from bad social habits

Demerits of Degazettement

- Potential pollution of the river and streams
- Possible encroachment into Area C (neighboring forest) for firewood and grazing
- Over the years, water level in the neighboring rivers has substantially reduced, rainfall levels have diminished and seasons have changed. It is possible that continued reduction in forest cover will worsen the climatic conditions.

Mitigation Measures

- Provide waste disposal and waste management facilities
- Reforestation efforts be intensified and regulations enacted by the county to enforce tree planting in every homestead and protection of the rivers.

Other Comments

- Complete the bigger market that has been under construction for 14 years
- Wondered where cemetery and sewerage system will be set up as all the land is already allocated.

5.4.12: County Social Services Department – hosts the women, youth and persons with disabilities programs

Key Informant 12: Secretary, Social Services Department (Field Interview 2020)	
Marginalized Groups	Women enterprise, Youth and Persons with Disabilities programs
<p>NOTES:</p> <ul style="list-style-type: none"> • Most women are involved in micro-enterprises within the old town and in the project area. • Majority of them belong groups that engage in savings and internal lending and Merry-Go-Round. While group savings serve as security for loans, merry go round funds help pool funds for education, health and other household welfare needs • Therefore, most groups are able to borrow business loans of between Kshs. 50,000 to Kshs. 100,000. The Women Fund is therefore very active. <p>Apart from the monthly cash transfers, the national fund for PWDs gives them equipment such as knitting machines, wheel chairs, brail machines etc. It also supports skills training for them at various institutions. Variation of the boundary and degazettement of the forest land will:</p> <ul style="list-style-type: none"> • Avail land for establishment of government offices and institutions, and hence increase access to government services by residents • Development of commercial facilities, residential houses and industries for employment creation • Improved infrastructure and services will increase economic activities and open access to markets for the neighboring areas. The will improve the economy of the area and raise revenues. • Provide land for PWDs public school and training institution, • Land for recreational facilities for the youth 	

Demerits of Degazettement

- Conversion of the land into urban form will erase the current rural-like beauty of green vegetation and trees
- Potential pollution of the rivers and streams
- Noise and air pollution will destroy the serene clean environment

Mitigation Measures

- Create green spaces along streets, establish recreational sites with trees and flowers for beauty
- Plant trees along rivers and streams for protection and control encroachment for agriculture
- Provide waste disposal and waste management facilities, and enforce proper waste management by any upcoming industries
- Enforce the noise pollution controls

Other Comments

- Complete the bigger market that has been under construction for 14 years to enable more women and youth do business
- Youth are the future, reinstate the youth fund and provide basic business training to enable the youth invest sustainably in SMEs.

5.4.13: Vice Chairperson, Ndaragwa Constituency CBO for Persons with Disabilities

Key Informant 13: Vice Chairperson, Ndaragwa Constituency CBO for Persons with Disabilities (Field Interview 2020)	
Vulnerable Groups	Persons with Disabilities
<p>NOTES:</p> <p>The CBO has 15 active groups with approximately 1,000 members from Ndaragwa Constituency. Apart from the monthly cash transfers, the CBO has received a pig from the area Women Representative through which they have established a pig farming project on leased land about 50kms away from Ndaragwa town. They also got equipment from the County Government but have had no land or building to initiate a bakery and soap making businesses in Ndaragwa town.</p> <p>Variation of the boundary and degazettement of the forest land will:</p> <ul style="list-style-type: none"> • Avail land for establishment of businesses and they will hopefully be allocated land for establishment of their businesses and an office for the CBO (have none). Having their business in a central place will ease access and reduce transport cost to most of the members. • The road infrastructure in Ndaragwa town is poor and makes movement on a wheelchair a daunting task for PWDs. De-gazettement of the land will allow for infrastructure improvement and therefore easier movement for them. • Will allow completion of the main market and allocation of a designated area for use by PWDs. • Availability of space for additional government offices. He recommends PWD user-friendly facilities during the design and construction phase and maintenance during the operational phase including access roads, even roads, wide pavements and ramps for use of wheel chairs, provision of lifts and utilities friendly to PWDs (i.e. customized washrooms and water points). The new county government offices are not usable by PWDs. During construction and operational phases of the proposed project, provision of office space for the National Council of PWDs Help Desk and designate an office for PWDs separate from women and youth, to reduce the waiting time for services in consideration of their physical and other challenges. <p>Demerits of Degazettement</p> <ul style="list-style-type: none"> • All land in the project site is occupied so this is only formalizing ownership and use of land. 	

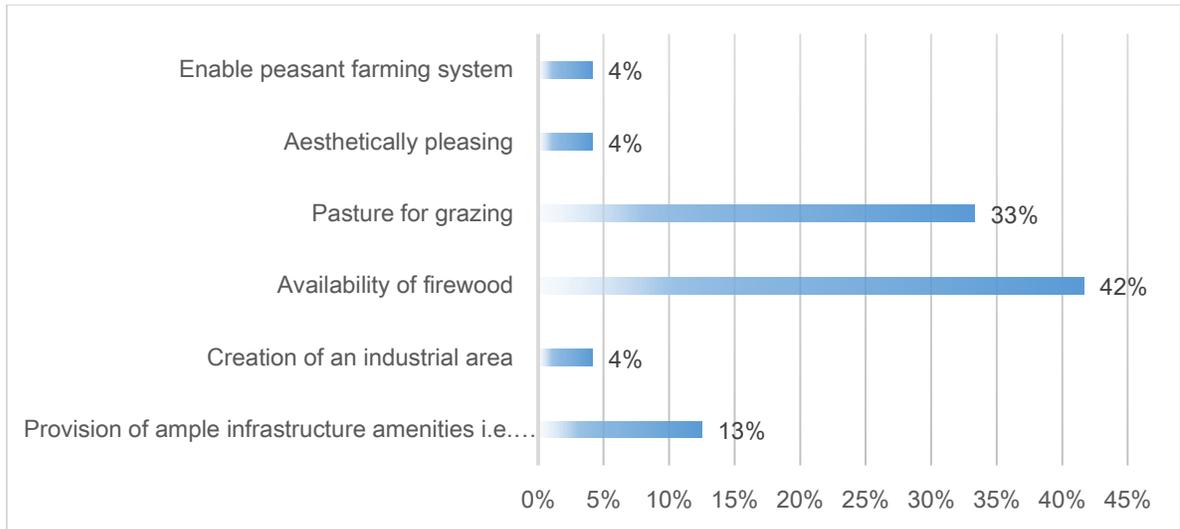
5.5: HOUSEHOLD INTERVIEWS

The household interviews were done on Wednesday 4/9/2019 in order to get primary data from households on their perceptions on social, economic and environmental effects of the proposed land boundary variation. The interviews were also aimed at three key aspects. One was to establish acceptability of the project especially the area residents who are likely to suffer or benefit most from its impacts. The second was to, identify the possible impacts that may arise from implementing the boundary variation and subsequent developments. The third was to identify the possible mitigation measures as proposed by the households. From the household interviews, 48% of the respondents were male while 52% were female. All of the respondents were aware of the proposal to expand Ndaragwa Township.

Majority (50%) of the respondents were farmers, 44% were engaged in business while the rest 6% were Jua kali artisans. Up to 79% of the respondents believe that the community already directly benefits from the section of the Aberdare forest proposed for variation since the forest land, over years, has been a place where they have built their homes as well as engage in crop and livestock farming. On the other hand 21% of the respondents indicated that the community does not directly benefit from the section of the Aberdare forest proposed for variation since the land is still under the KFS, hence they can't engage much in harnessing the full potential of the land they are currently occupying.

Majority of the respondents at 65% indicated that implementation of the proposed project will have positive environmental and socio-economic impacts such as provision of ample infrastructural amenities i.e. sports ground, creation of an industrial area, availability of firewood, pasture for grazing, aesthetically pleasing and enable peasant farming system as presented in *chart 1* below.

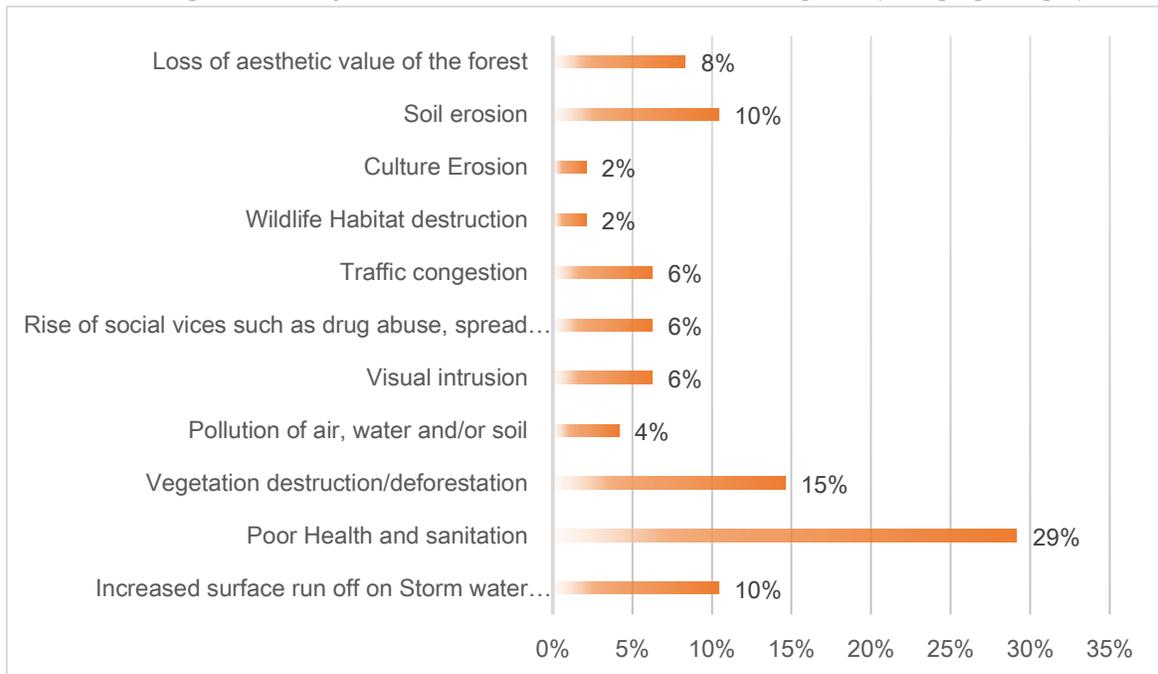
Chart 1: Respondent's positive environmental or socio-economic impacts of the Proposed Project



Source: Field Survey, 2019

While on the other hand 35% of the respondents indicated that the implementation of the proposed project will have negative environmental and social impacts as presented in chart 2.

Chart 2: Respondent's negative environmental or socio-economic impacts of the proposed project

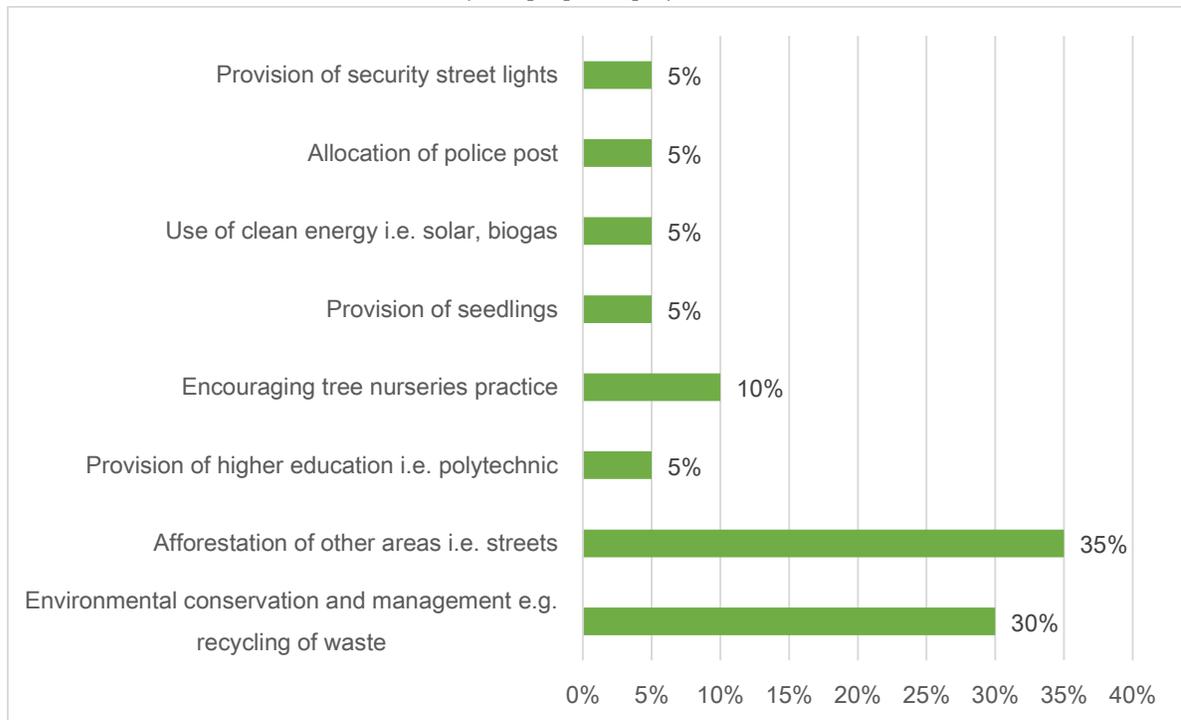


Source: Field Survey, 2019

Respondent's negative environmental or socio-economic impacts included among others increased surface run off, poor health and sanitation, vegetation destruction/deforestation, pollution of air, water and/or soil, visual intrusion, culture erosion, rise of social vices such as insecurity, drug abuse, spread of HIV/AIDS and prostitution among others, traffic congestion, wildlife habitat destruction, soil erosion as well as loss of aesthetic value of the forest.

The mitigation measures proposed by the respondents on the said impacts included the need for environmental conservation and management such as recycling of waste, afforestation of other areas i.e. streets, farms, provision of higher education i.e. polytechnic to teach on the basic skills, encouraging tree nurseries establishment and management, use of clean energy such as i.e. solar, biogas; allocation of police post, as well as provision of security street lights as presented in *chart 3*.

Chart 3: Respondent's mitigation measures of the negative environmental or socio-economic impacts of the proposed project



Source: Field Survey, 2019

Overall, 93% of the household respondents interviewed did not have any objection(s) to the proposed project while 7% objected to the proposed project. *The filled copies of the household questionnaires are annexed in this report.*

5.6: BUSINESS COMMUNITY INTERVIEWS

The views/concerns of the business group stakeholders present were noted on Wednesday 4/9/2019 and their identification and contact details taken during the fieldwork period in order to get primary data on the social, economic and environmental effects of the proposed boundary variation and sub-sequent development. From the business group stakeholder's interviews, 50% of both male and female respondents interviewed were aware of the proposal to expand Ndaragwa Township. The major type of business practiced included operating general shops (40%), medical laboratories (10%), fruit and pudding shops (8%), small retail shops (12%) hotel business (10%), hardware shops (10%) and butcheries (10%).

Over 89% of the respondents believe that the community already directly benefit from the section of the Aberdare forest proposed for variation since the forest land, over years, has been a place residents have been operating their business, getting animal pastures, sourcing firewood as well as engaging in other economic activities such as crop farming. On the other hand, 11% of the respondents believe that the community does not directly benefit from the section of the Aberdare forest proposed for variation since the land has already been deforested.

Majority of the respondents, 60% indicated that implementation of the proposed project will have positive environmental or socio-economic impacts such as improved facilities/businesses for service provision, allocation of higher education i.e. training colleges, improved living standards as well ownership of title deeds for securing loans and business as presented in *chart 4* below.

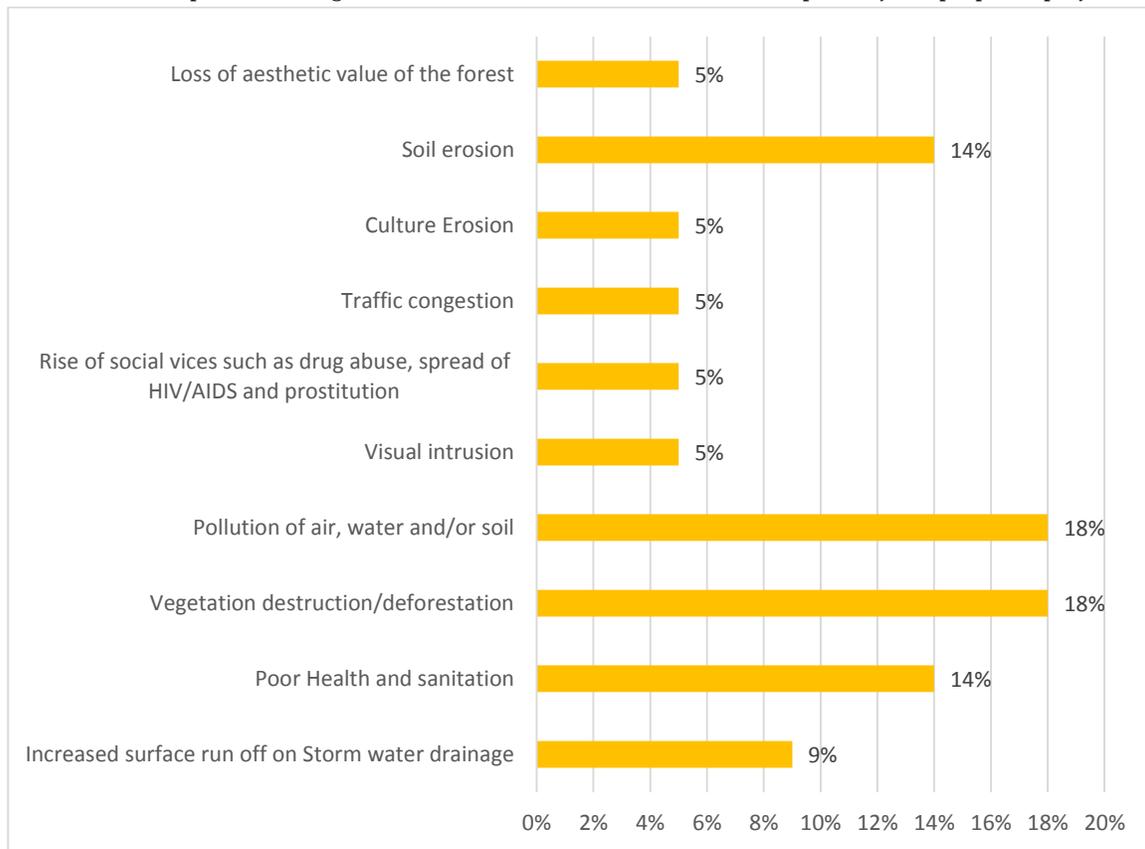
Chart 4: Respondent's positive environmental or socio-economic impacts of the Proposed Project



Source: Field Survey, 2019

While on the other hand 40% of the respondent reported that the implementation of the proposed project will have negative environmental and social impacts among others increased surface run off, poor health and sanitation, vegetation destruction/deforestation, pollution of air, water and/or soil, visual intrusion, culture erosion, rise of social vices such as insecurity, drug abuse, spread of HIV/AIDS and prostitution among others, traffic congestion, wildlife habitat destruction, soil erosion as well as loss of aesthetic value of the forest as presented in *chart 5*.

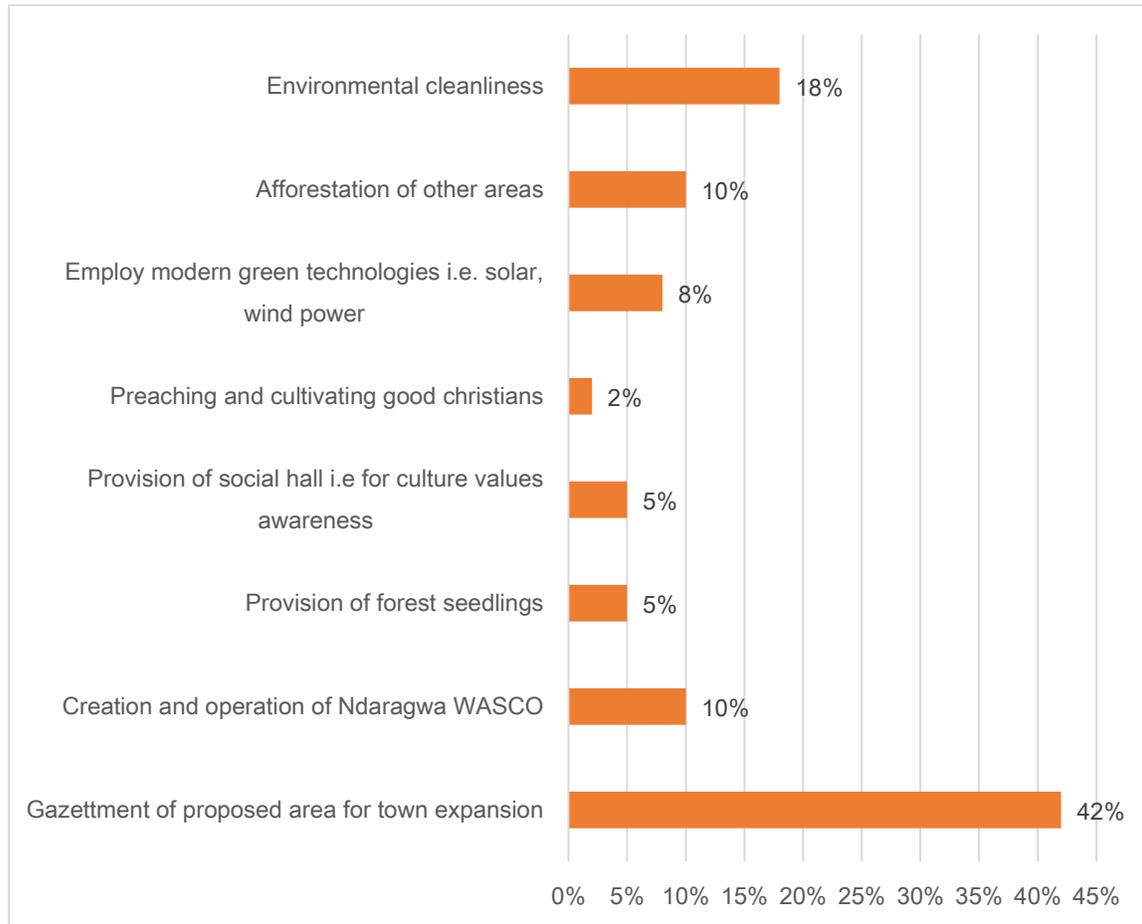
Chart 5: Respondent’s negative environmental or socio-economic impacts of the proposed project



Source: Field Survey, 2019

The mitigation measures proposed by the respondents included among others: the “gazettement” of proposed area for town expansion, creation and operation of Ndaragwa WASCO (Water and Sanitation Company), provision of forest seedlings, provision of a social hall i.e. for culture values awareness, preaching and cultivating good christians, adopting modern green technologies e.g. solar, wind power, afforestation of other areas as well as environmental cleanliness as presented in *chart 6*.

Chart 6: Respondent's mitigation measures of the negative environmental or socio-economic impacts of the proposed project



Source: Field Survey, 2019

Overall, the entire business group respondents interviewed did not have any objection(s) to the proposed project. *The filled copies of the business group questionnaires are annexed in this report.*

5.7: MATTERS ARISING FROM TOWN PLANNING FORUMS

5.7.1: First Ndaragwa Township Stakeholders Forum Comments

Forum	1st Ndaragwa Township Stakeholder Forum with the Assistant County Commissioner (13/02/2013).
Institution	Ndaragwa Sub-County
<p>NOTES:</p> <ul style="list-style-type: none"> ▪ Stated that part of Ndaragwa town centre is located within Aberdare forest and remained un-degazetted making investors shy away from investing in the town. ▪ Concurred with members present that there's an urgent need to compile a document that will enable commencement of the degazettement of the already occupied and developed town area as demarcated by Kenya Forest Service in 2005. ▪ Notified by the committee members as to why, when and how the town was established during the colonial period. ▪ That Ndaragwa market started as a meeting centre in 1946 for colonial settlers' and their African workers who occupied surrounding farms. The colonial land council members were allocated an area to provide social amenities i.e. barter shops upon request from the then Forest Department. ▪ Ndaragwa market was officially opened in 1947. As a result, the Aberdare area council built 3 houses for hotel and 2 shops within the area. ▪ Construction of police station was in 1948 near the present bridge along the Nyeri-Nyahururu road which later relocated to its present location within the town. ▪ Ndaragwa primary and the intermediate schools were constructed in 1948. ▪ Ndaragwa dispensary was opened by Sir Evelyn Baring, the then Governor of Colonial Kenya. ▪ Aberdare county council were given Ksh 27,000 for construction of a hall for meetings and entertainment by colonialists before they left which is presently utilized as a milk collection center of Nyandarua and Laikipia counties. ▪ The established center was changed to Ndaragwa trading center by the leaving settlers. ▪ The first town plan was made on 25th May 1967 and approved by the then Commissioner of lands. ▪ The town hosted independence celebrations for the entire Ndaragwa area and surrounding Laikipia region. In consequence, the D.O operating from Oljororok relocated to Ndaragwa town where an office was constructed for him by the area residents. That is the present office of Assistant County Commissioner. 	

- Expansion of Ndaragwa town by an extra 300 acres was done by President Daniel T. Arap Moi in 1997 and legalization of the process through the degazettment by the Nyandarua County Council in liaison with the Director of Forests started.
- In 1998, Nyandarua had allocated land to squatters and forest retirees who previously resided in Gaturia Maru and Huruma villages within the town.
- Approval of 125 acres of the 300 proposed land degazettment and placement of beacons in the year was foreseen by Director of the Kenya Forest Service. The beacons are still in place.
- Consequently, the Ndaragwa town residents requested for fast tracking of the degazettment of the 125 acres already occupied, developed and demarcated.
- Currently, Ndaragwa has been promoted and made Nyandarua North District Headquarters. Moreover, several National Government and County Government installations have been established on un-degazetted land in the town.
- Amenities provided in the plan to cater for the increasing town population include a cemetery; sewerage facilities; district headquarters extension offices; the children’s home; secondary school; stadium/sports ground; civil servants quarters; playing fields; matatu stage; parking lot; recreation park; water treatment works; slaughter house; a university college; a technical college/polytechnic; judiciary offices-magistrate’s court; magistrate’s residence; industrial site/jua kali; security lights (masts); modern social hall; extension of residential plots, area about (50) hectares; opening and guiding of town roads; resource center; extension of hospital area; extension of hospital area; show ground for agricultural displays; cultural and eco-tourism sites and refuse disposal sites.

5.7.2: Second Ndaragwa Township Stakeholders Forum Comments

Forum	
Ndaragwa Township Stakeholder Forum	
Institution	Ndaragwa Sub-County (8 th May 2014)
<p>NOTES:</p> <ul style="list-style-type: none"> ▪ A strong case for the degazettment of the town and if possible, expansion was needed to be put forward to the relevant authorities. ▪ Debate of the town’s degazettment would have to be carried all the way to parliament and passed by a 2/3 majority vote by the parliamentarians. ▪ Stakeholders were urged to cooperate with Kenya Forest Service Department in the area during pursue and delivery of the planning process. 	

- No residential buildings within the initial 125 acres KFS had curved and earmarked for occupation by residents and installation of government facilities would be demolished.
- Stakeholders requested that the issue of Ndaragwa Town be treated the same way as other areas that had been occupied by people before independence.
- The Assistant County Commissioner was requested to play a leading role in ensuring that the plight of the people of Ndaragwa was fully addressed and work closely with the officials of the resident's group.
- It was agreed that the town needed more space for expansion for accommodation of amenities inclusive of national library, petrol station and dump site and previous minute's amenities in catering for the increasing population.
- The Nyandarua County Government was commended for showing willingness to buy land from the town's neighbours.
- Advertisements are to be put in the facilitation of procuring such land.

5.7.3: Ndaragwa Town Planning Team and Stakeholders Comments

Forum	
Ndaragwa Town Planning Team and Stakeholders	
Institution	Ndaragwa Town (28 th June 2016)
<p>NOTES:</p> <ul style="list-style-type: none"> ▪ Allocation of space on land for training youths in the making of jikos and related works from an essential stone mineral available in Ndaragwa. ▪ Importance of public participation was explained and insisted upon the planning process for rational decision making. ▪ Emphasis of sewerage, drainage systems, road access and public facilities ought to be incorporated in the planning. Nairobi and Narok were used as case studies to illustrate the town planning importance. ▪ Most plots were allocated in the Aberdare forest area that hindered the development. Stakeholders wanted to know what could be done for such plots. ▪ There were drainage issues arising in Huruma phase two as it is always flooded. ▪ Stakeholders requested for the degazettment of the town to allow proper planning. ▪ A reclamation of the town committee that they had come with recommendations which early states on plot ownership was relayed. The C.E.C Ministry of Lands was handed on the report. 	

- Proposed planning of the satellite area which has been subdivided and possessed large tracts of land to be the main resource of the town.
- One of the major challenges addressed was that the town has many plans while the plan with a title deed measures only 22 ha.
- There's encroachment of public utilities and facilities such as Bus Park, the health centers and the public schools. Public land encroachment was thus condemned.
- There's dispute that has ensued among the 300 people allocated a 12 acres land with other interested parties. The disputes inhibit development and growth of the town.
- Only 297 acres of land has been allocated as public land.
- Collection of secondary data was highly advised because some land ownership documents are illegal.
- Some of the proposed facilities include; cemetery services and dumpsites to eradicate water borne diseases in the area.
- Stakeholders' cooperation with relevant authorities was highly encouraged during the planning exercise through a preview of former plans.
- Planning and survey offices are to be responsible and play as the main actors before allocation of plots on public lands.
- Confirmation was noted of the possession of only two plans whereas the rest are not genuine.
- Repossession process of the 120ha from the forest reserve has to be speeded up through proper and suitable planning.
- Squatters are to be considered in the town planning budget.
- The planning should be done on an updated base map.
- Hindrance of development and decision-making process was blamed by poor politics among leaders.
- Agriculture was not allowed on implementation of land uses in the town.

5.7.4: Nyandarua North District Physical Planning Liaison Committee Comments

Forum	Nyandarua North District Physical Planning Liaison Committee
Institution	County and National Government (20 th March 2009)
<p>NOTES:</p> <p>a) That, the township is located inside the forest and has an area of about 29ha which was excised through a proclamation.</p> <p>b) That, the town is the headquarters for Ndaragwa Division of Nyandarua North District and relatively the seat of the District.</p> <p>c) That, the town occupied a much bigger area than gazetted.</p>	

- d) That, the current township area under occupation covers an area of about 55ha though the physical development plan covers approximately 110ha half of which is still forested. This was reached following a recommendation by Ndungu Report on Land that the whole land for the township excluding the 29ha reverts back to the forest.
- e) That, the first and second proposals for township expansion vide forest excision had not been approved.
- f) That, a Full Gospel Church was within the forest area in accordance to the proposed 55ha township boundary.
- g) That, the town was quite vibrant with a banking facility and a milk cooling plant in addition to other facilities such as commercial, residential among other activities.
- h) That, Mairo Inya Town had grown organically with no social amenities such as disposal sites, cemetery public gardens and recreational facilities among others.
- i) That, the solid waste disposal site had not been put to use.
- j) That, an electric fence had been erected along the boundaries of Mairo Inya Settlement Scheme boundary and the forest.
- k) That, there was no alternative dumping site for the fast-growing town.
- l) That, sewage treatment works site fell within the riparian reserve.
- m) That, adequate space exist between the river and the settlement area enough to permit the putting up of sewage treatment works.
- n) That, the site is ideal for the citing of sewage works as it is next to a water body.
- o) That, the site has a gradual gradient to the river.
- p) It was recommended that there was need to pursue the excision of the land to the north and west of the Catholic Mission Complex and bound by the Nyahururu-Nyeri road for the purposes of social amenities and town expansion.
- q) It was recommendation that dumping site for Mairo Inya Township to be provided, however, technicalities of provincial boundaries and provision of Forest Act Section 28 have to be addressed.
- r) It was recommended that an Environmental and Social Impact Assessment be done by an expert with a bias to urban development with respect to the proposed sewage treatment works for Mairo Inya Township.

5.8: ESIA VALIDATION WORKSHOP

On Friday, 18th October 2019 from 9 am- 1 pm at PCEA Hall Ndaragwa, the ESIA team held a 1 day validation workshop to present draft 1 of the ESIA report to the public. A total of 47 stakeholders including women, youth, local leaders, farmers, business group members among others attended the workshop (See the appended record of attendance and plate 16-19). The key issues raised during the forum area as follows:

- a) As far as the proposed project to vary the boundaries of the Aberdares forest (Ndaragwa block), residents are willing and ready to plant trees within the town (urban greening) noting a case of Rwanda and Singapore. They noted that by greening the town with street trees, urban parks, will help to:
- Improve the town microclimates. There is heat generated by traffic and industrial activity, as well as the spread of heat-trapping concrete buildings that have steadily replaced plant life, urban air temperature is often higher than in rural environments. Hotter cities compel urban citizens to opt for air conditioners in order to stay cool, which further strains energy demands and worsens the urban heat island effect.
 - Cool the town through the water that evaporates from their leaves when exposed to the sun's rays, and by shading surfaces that otherwise might have absorbed heat. Research has found that on a sunny day, a single healthy tree can have the cooling power of more than ten air-conditioning units.
 - Keep harmful pollutants such as microscopic particulate matter at bay through a complex process known as dry deposition, whereby particles penetrate and become trapped in the wax or cuticles of leaves.
 - Lessen the impacts of climate change and improve air quality. Evidence from a range of disciplines has uncovered numerous social, psychological, and health benefits of human exposure to green spaces. These include stress and anxiety reduction, improved cognitive functioning, lowered risks of depression, and overall greater mental and physical wellbeing.
- b) Residents to be fully involved in community greening by KFS supplying tree seedlings to them. This will not only improve the environment but also increase social cohesion and social bonds among participants and the wider community.
- c) Community nature initiative to be set up to help the public learn about, respect, and appreciate town and household greening.
- d) Urban/County planning development control (DC) to introduce at least some percentage at plot level for planting of trees at both town and household levels.
- e) The proposed variation will only affect the Ndaragwa block of the Aberdare forest that is already developed which originally had a cyprus tree plantation that was harvested. This will not touch on the natural forest section of the Aberdare forest.
- f) KFS should consider supplying seedling to the community and other groups such as Community Forest Associations (CFAs), Water Resources Users Associations (WRUAs) schools religious institutions with an aim of promoting afforestation

forest protection, monitoring and management as well as instill Participatory Forest Management (PFM) on the proposed site.

- g) The community is seeking gazettelement of the proposed site that stands at 162.52 acres based on the 2007, survey plan FR 341/63.
- h) Since the proposed area only accommodates the already developed area, KFS should consider leasing of section C area that is approximately 44.530 Ha. based on the 1991 survey plan FR 216/75 (for a period of 99 years) to enable the community set up essential public utilities infrastructure (sewerage treatment works facilities, sludge disposal facility, public toilets, refuse disposal).
- i) Insecure land tenure in the area is risky to the community since it makes developer and the community shy away from developing the area with proper permanent structures. Hence the need for the relevant authorities to consider and approve the proposed variation of boundary of Aberdare forest (Ndaragwa block) LN. No.48/194, to allow expansion of Ndaragwa Township from 15.569 ha (38.47 acres) to 65.77 ha (162.52 acres).
- j) Ndaragwa residents are ready to conserve and protect the environment once the proposed variation of boundary of Aberdare forest (Ndaragwa block) LN. No.48/194, to allow expansion of Ndaragwa Township from 15.569 ha. (38.47 acres) to 65.77 ha (162.52 acres) is approved. To ensure this is implemented the community suggested Ndaragwa CFA and KFS to be the lead oversight authorities.
- k) Alternative clean energy to Ndaragwa residents' such as cooking gas (LPGs) should be supplied at subsidized rate to curb on charcoal production and wood fuel use in the area especially at household level. Residents noted that substituting LPG for wood fuel will save many hectares of forest each year. Further, switching from wood to LPG can reduce cooking's carbon emissions significantly.
- l) Rural electrification coverage should be completed in the area in order to serve as a key catalyst for economic development and social progress.
- m) By the fact that residents have already occupied and developed part of the proposed (65.77 ha (162.52 acres) of land for many years, the community urged the relevant authorities to have special consideration and approve the gazettelement of this land. They noted forceful eviction of the community out of the KFS land may intensify inequality, social conflict, emotional pain/social stress, loss of property and invariably affect the poorest, socially and economically vulnerable and marginalized sectors of society, especially women, children, minorities and indigenous people.

- n) CFA official noted that there was need to undertake the situational analysis of the current state of the environment within the gazetted old town. This will enable the community to learn the dos and don'ts even as they seek for another variation of boundary of Aberdare forest (Ndaragwa block) LN. No.48/194, to allow expansion of Ndaragwa Township.
- o) CFA to be involved in governance of the forest resources as well as implementation of the proposed expansion of Ndaragwa Township if approval is granted. This will help achieve sustainability and biodiversity conservation with socioeconomic objectives such as equity, conflict resolution, awareness, forest production, poverty reduction, and sustainable utilization.
- p) The proposed variation of boundary of Aberdare forest (Ndaragwa block), to allow expansion of Ndaragwa Township should not affect the water catchment area such as River Pesi and Mbobo if proper mechanisms are put in place.
- q) Historical development and expansion of Ndaragwa town should be weighed vis a vis the proposal to vary the boundary to allow expansion of Ndaragwa Township. The town needs to grow and be vibrant to attract investors hence the proposal should be approved.
- r) Reference to be made on the proposed variation of boundary area (162.52 acres) which is currently occupied and thus the larger Aberdare forest ecosystem will not be affected.
- s) With the approval of the proposed variation of boundary of Aberdare forest (Ndaragwa block) LN. No.48/194, to allow expansion of Ndaragwa Township from 38.47 acres to 162.52 acres, the County physical regulations should encourage densification in order to discourage urban sprawl as a strategy to obtain a more sustainable town development.
- t) Possibility of resource use conflict should be mitigated through public consultation and participation as well as involving relevant institutions such as NLC, Nyandarua County Government, NEMA etc.

Overall the stakeholders who participated in the ESIA validation approved and supported the proposed variation of boundary of Aberdare Forest (Ndaragwa block) LN. No.48/194, to allow expansion of Ndaragwa Township from 15.569 ha (38.47 acres) to 65.77 ha (162.52 acres) in Ndaragwa sub county, Nyandarua County.

Plate 24: ESIA Lead Expert, Dr. Fridah Mugo Presenting during the ESIA Validation Workshop at PCEA Hall Ndaragwa



Source: Field Survey, 2019

Plate 25: Stakeholders during the ESIA Validation Workshop at PCEA Hall Ndaragwa



Source: Field Survey, 2019

Plate 26: A Stakeholder expressing his view/opinion during the ESIA Validation Workshop at PCEA Hall Ndaragwa



Source: Field Survey, 2019

CHAPTER SIX

IMPACT IDENTIFICATION, ASSESSMENT AND ANALYSIS

6.1: OVERVIEW

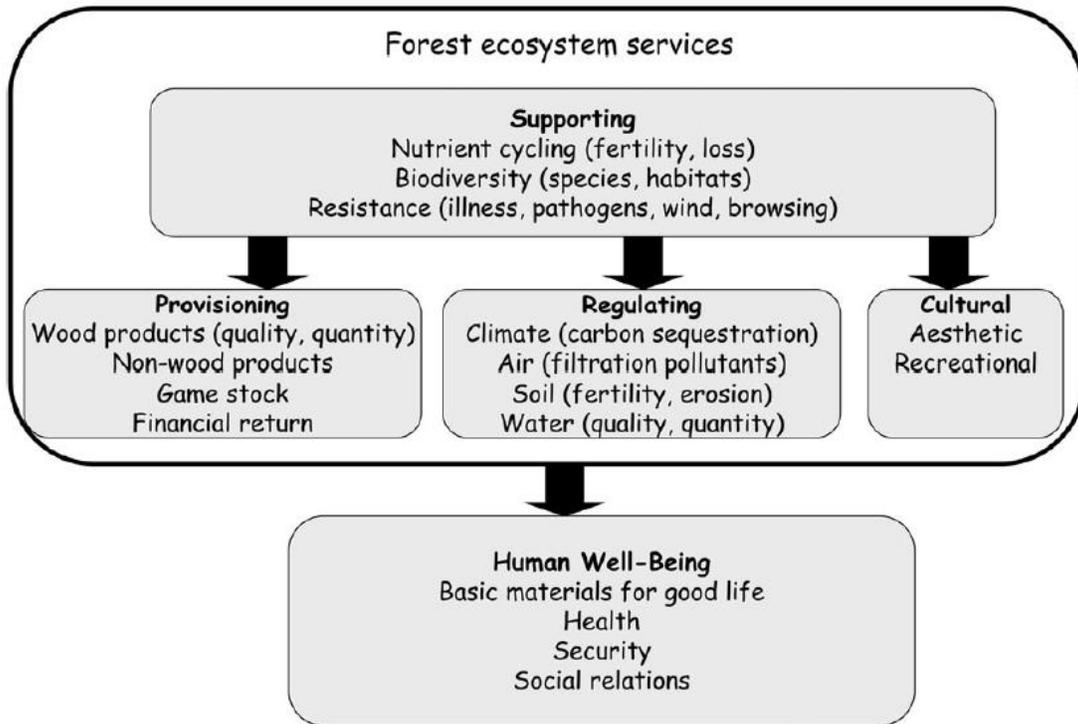
This chapter profiles the value of the forest ecosystems, identifies and discusses anticipated environmental (ecological) & social-economic impacts of the variation of the forest boundary from 38.47 acres to 162.52 acres. The impacts may be positive or negative, direct or indirect and reversible or irreversible. It reports on the assessment and analysis associated with the proposed project in the three main project phases of construction, operation and decommissioning as detailed out below.

6.2: FOREST ECOSYSTEMS PROFILING

Kenya is endowed with a wide range of forest ecosystems ranging from montane rainforests, savannah woodlands; dry forests, coastal forests and mangroves. The current forest cover of 6.99% of the land area of the country is still below the constitutional requirement of 10%. These forests have high species richness and endemism, which has made the country to be classified as mega diverse. They rank high as the country's natural asset, due to their environmental, life supporting functions, and the provision of diverse goods and services. The functions include river flow regulation, flood mitigation, water storage, re-charge of ground water, reduction of soil erosion and siltation, water purification, promoting bio-diversity (flora & fauna), micro-climate regulation, nutrient cycling and soil formation. They also act as carbon sinks absorbing carbon-dioxide from the atmosphere. The carbon is stored in wood biomass as a reservoir, a process described as carbon sequestration. The forest releases oxygen, thus purifying the air and supporting the survival of human kind. See the illustration in *figure 7*.

Further, based on the National Forest Policy, 2014 it is estimated that forests contribute about 3.6% of Kenya's GDP, excluding charcoal and direct subsistence uses. Forests also support most of the productive and service sectors in the country, particularly agriculture, fisheries, livestock, energy, wildlife, water, tourism, trade and industry that contributes between 33% - 39 % of the country's GDP. Biomass comprises about 80% of all energy used in the country, while they also provide a variety of goods and services, which support subsistence livelihoods of many communities.

Figure 7: Global Forest



Source: Millennium Ecosystem Assessment, 2005

Forests comprise the country's water towers and catchments, where over 75% of the country's renewable surface water originate, and therefore serve critical water regulation roles which are important for human livelihoods, irrigated agriculture, and production of hydroelectric power. At the same time, deforestation in Kenya is estimated at 50,000 hectares annually, with a consequent yearly loss to the economy of over USD 19 million.

The constitution of Kenya (CoK), 2010 and the economic blueprint Vision 2030 requires the country to work towards achieving a forest cover of at least 10% of the land area to ensure sustainable resource supply, growth and employment creation. Due to population pressure in the high potential areas, realizing these targets will require mobilizing communities and the private sector to invest in commercial forestry, expansion of forestry development to arid and semi-arid areas, investment in the forestry industry for enhanced processing efficiency and value addition, strengthening of forest governance policies and institutions, and greater consideration of forestry in development programmes such as in agriculture, energy, tourism, and water. Further, the constitution requires that international environmental agreements, protocols and conventions to which Kenya is a signatory be domesticated and implemented within sectoral policies and laws.

6.3: DESCRIPTION OF ACTIVITIES AT PROJECT CYCLES

a) Description of activities at Pre-construction phase:

This will involve land demarcation, setting out of the proposed new town boundaries, riparian zone and siting of various utilities and zones and plots for different land use activities on the ground.

b) Description of activities during the construction phase

Construction phase activities will involve the following:

- Site preparation (including buffering of the water catchment areas/riparian areas).
- Excavations, filling and foundation laying.
- Building works and removal of construction wastes.
- Procurement of construction materials and delivery of the same to the site.
- Storage and utilization of materials.
- Civil, mechanical, and electrical works.
- Completion of the proposed land uses buildings.

The above works/activities shall be done using local and common construction materials and construction procedures that are not expected to compromise the safety of the neighboring residents as well as the general environment.

c) Operational phase

Completion of construction activities will be followed by commissioning of the new town. The contractor is expected to hand over all the facilities and support infrastructure to the proponent. The proponent will there after organize for occupation and operation of the town such as availing litter bins for temporary storage. In addition, solid waste handlers will collect and distribute wastes to appropriate sites for further handling.

d) Decommissioning phase

During decommissioning, the town with all other associated infrastructure will be demolished in order to restore the parcel of land to its original state. Different kinds of works and equipment will be deployed to carry out these tasks. This will produce a lot of solid waste that may be re-used for other construction works or if not reusable, disposed

of appropriately by a licensed waste disposal company. Decommissioning will also entail restoring the project area to its original state. Activities during restoration include landscaping and planting of Aberdare (Ndaragwa block) indigenous tree species in designated urban areas and riparian reserves and beautification of the recreational areas and streets. It will be upon the proponent and the contractor to ensure restoration is done appropriately.

6.4: IMPACTS AS PER FOREST CONSERVATION & MANAGEMENT ACT

6.4.1: Rare, Endangered, Threatened Species (RETS)

A rare species is a group of organisms that are very uncommon, scarce, or infrequently encountered. This designation may be applied to either a plant or animal taxon, and is distinct from the term endangered or threatened. According to the Aberdare Forest Reserve Management Plan (2010-2019), the Aberdare National Park Ecosystem hosts five rare and threatened species of mammals of international conservation interest which include the rhinos, elephants, bongos, giant forest hogs and the leopards. The forest reserve is also home to many other animals' such as antelopes and carnivores including the lion, cerval cat, golden cat, civet cat and genet hyena. Aberdare Forest Reserve is recognized as an Important Bird Area (IBA) by Nature Kenya recording about 290 bird species. Three hundred and three (303) species of moths belonging to 19 families have also been identified in the eastern side of the forest.

Based on the International Union for Conservation of Nature (IUCN) Red List <https://www.iucnredlist.org/>, the proposed variation of boundary of Aberdare Forest (Ndaragwa Block) LN. No.48/194, to allow for expansion of Ndaragwa Township from 38.47 acres (15.57 ha) to 300 acres (121.41 ha) FR 216/75 of 1991 will significantly affect the RETS. However, if the variation is limited to 162.52 acres (65.77 Ha.) FR 341/63 of 2007 Survey Plan, the negative impact will be minimal. This is because, 80.23% of the 2007 Survey Plan is already developed/occupied as indicated in Plate Nos. 1, 2, 3,4,5,6,7 on page 26,27, 28,29 section 2.6 of chapter 2 of this report. The undeveloped 19.77% (13 ha.) should be left intact for education, research and recreation purposes and linked with the proposed riverine Recreational Park network. In addition, all the streets, parking areas and green infrastructure of the town should be done using dominantly indigenous species found in the Aberdare Forest (Ndaragwa Block) in such a way that indigenous vegetation will be the dominant vegetation and will attract the birds back to the town.

6.4.2: Water Catchment Areas

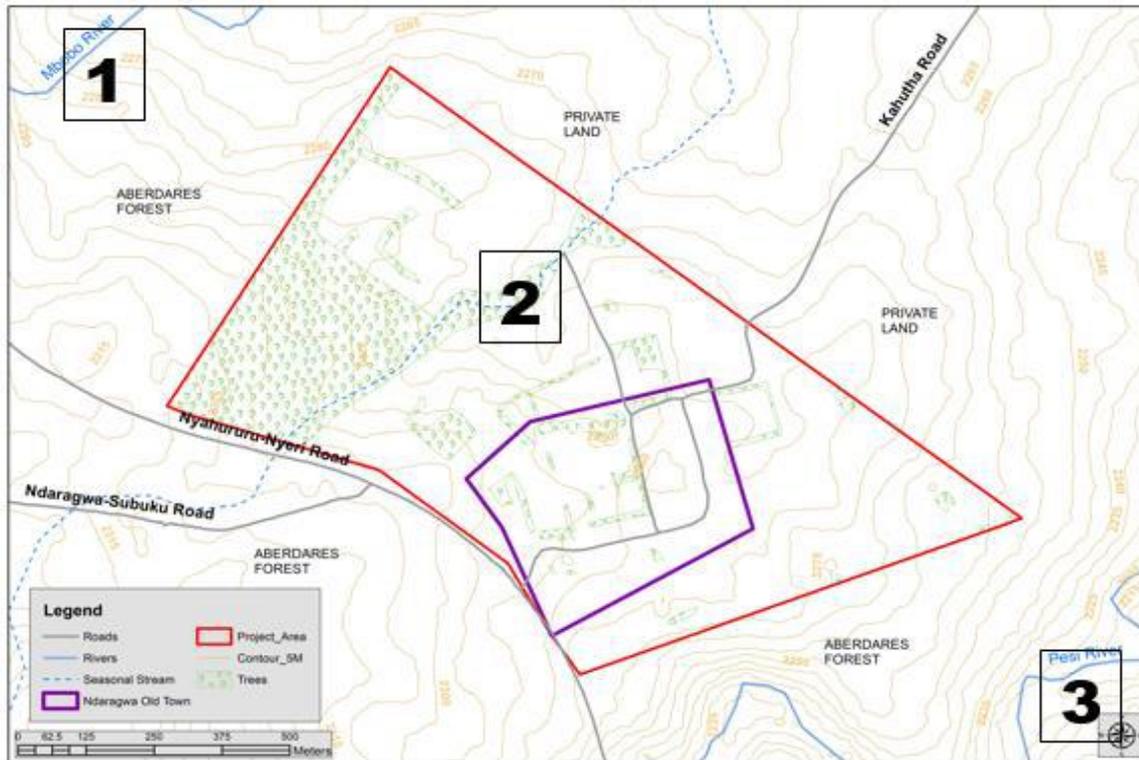
Water catchments are widely recognized as the most effective management unit for the protection of water resources, both water quality and supply. A water catchment (commonly referred to as a “watershed”) is an area of land where all water flows to a single stream, river, lake or even ocean. A water catchment area is home to a complete water-cycle system. Research has shown that healthy water catchments provide among others: a source of clean drinking water, unspoiled natural areas for recreation, habitat for plants and animals, healthy vegetation and waterways, a system of recharging underground water, reliable and clean water for livestock and irrigation as well as opportunities for sustainable agriculture and industry.

The proposed variation of boundary of Aberdare forest (Ndaragwa block) LN. No.48/194, to allow for expansion of Ndaragwa Township site falls within one water catchment area – denoted 2 in *Figure 8* and two water catchment areas that are adjacent to the study area, river Mbobo (denoted 1) and Pesi River (denoted 3) as illustrated in **figure 8** below.

If the boundary is varied as proposed, all the three rivers will be affected significantly and negatively. The main impact will be low stability of river flows since there will be increased flow during the rainy season as a result of increased run-off and extremely low flow during the dry season. This will be a consequence of the reduced water percolation for recharging the underground water storage.

If the variation is limited to the 2007 Survey Plan, the seasonal stream denoted 2 below is likely to be negatively affected by the Ndaragwa town expansion with possible effects including: encroachment on riparian reserve, water pollution (both solid and liquid waste), over-abstraction and depletion. Pollution from urban agriculture is also likely to occur. If a forest buffer zone is created, River Pesi and River Mbombo are less likely to be affected with the Ndaragwa town expansion if the Survey Plan of 2007 is adopted.

Figure 8: Water catchment areas within and adjacent to the project site



Source: Google earth and Modified by Author, 2019

A study by UNEP (2012) reported that deforestation reduces the available water by an average of 12,400 cubic metres/ha/year. If the variation is carried out as proposed, there will be a loss of over 851,136 cubic metres of available water per year. This is because 68.64 additional forest land will be deforested. In addition, if the variation is implemented as proposed, the expansion of Ndaragwa Township will affect the landscape ecosystem functions such as: flood mitigation, water storage, re-charge of ground water, reducing of soil erosion and siltation, water purification, micro-climate regulation, nutrient cycling, soil formation and increased atmospheric carbon-dioxide that may likely cause climate change in the long term. As a mitigation strategy to protect the seasonal stream 2, in case of implementing the 2007 Plan, the ESIA team proposes creation of a riparian recreational park or a nature trail along the stream like the case of Mill River Park & Greenway in Stamford and Cultuurpark in Amsterdam in the Netherlands as shown in **Figure 9 and 10** below. This will serve a recreational function for the urban population and also contribute to protecting the river. The stability of the flow of the seasonal river can also be enhanced by having water retention trenches up stream to reduce run-off and promote percolation.

Figure 9: Mill River Park & Greenway in Stamford



Figure 10: Cultuurpark in Amsterdam, the Netherlands.



Source: American Society of Landscape Architects

6.4.3: Impact on Biodiversity Conservation

Vegetation zones and species distribution are distinguished according to the different climatic zones and altitudes, mostly through variation in vegetation structure, cover and composition. A transect walk and observation of the type of flora and fauna in Aberdare Forest (Ndaragwa Block) displayed an already degraded forest zone as far as bio-diversity is concerned. The forest has a significant number of plant diversity but is dominated by *Leleshwa* shrub. Comparing with the bio-diversity level of the neighbouring Aberdares Core Forest which has about 778 species, sub-species and varieties of vascular plants belonging to 421 genera and 128 families, gives an impression that the Ndaragwa Block of Aberdare Forest has lost heavily in terms of biodiversity.

If the boundary variation is implemented as proposed, there will be additional and significant loss of biodiversity. This situation should not be allowed to deteriorate further. If variation is implemented to vary the forest boundaries from 38.47 acres to 162.52 acres, there will be limited and insignificant loss of biodiversity. This is because, the site is already occupied, the main vegetation identified is the Kikuyu grass in about 80% of the land area and *Leleshwa* shrub in 20% of the land. There are also scattered exotic and very few indigenous trees spread across the land scape (see Plates 1 – 7 page 26-29) of the proposed site. The site is also a habitat for various invertebrates such as insects. No large wild animals were observed within the project area. But antelopes were reported to occasionally graze in the forest. The proposed expansion of Ndaragwa Township from 38.47 acres to 162.52 acres if adopted, the negative impact will be minimal and can be mitigated sufficiently. Under this plan, during the operation phase, implementation of the mitigation measures will enhance the biodiversity of the project site to a level better than the current one.

6.4.4: Impact on forest use for educational, cultural, recreational, health or research purposes

There are numerous research sites that generate valuable information on forest development, conservation and management issues within the larger Aberdare Forest. Some of these sites within the project site were established by the Kenya Forestry Research Institute (KEFRI) and KWS (Mweiga Station). Research is also being carried out by National Museums of Kenya and Nature Kenya within the Important Bird Areas (IBA). There have been other research and monitoring activities, which include ethno-

botany, vegetation, animal and social economic surveys. Universities also take students periodically on education tours and field attachments to the Aberdare Forest Reserve.

Currently no educational, cultural, recreational, health or research activities are situated or are being conducted within both the 162.52 acres to be varied. The study notes that with the involvement of the local community, a lot of indigenous knowledge can be documented with regard to the history, trends and use of the forest for educational, cultural, recreational, health and research purposes that will eventually contribute to both their welfare and that of the forest reserve. The proposed variation of the boundary to allow for expansion of Ndaragwa Township from 38.47 acres to 162.52 acres will reduce the current Ndaragwa Forest Block area by 68.64 Hectares will adversely affect the forest function for educational, cultural, recreational, health and research purposes. However, if the 2007 Survey Plan is adopted, the negative impact will be minimal because the mitigation plan recommends preservation of the remaining forested 13 hectares to be improved and used for the same functions.

6.5: PROJECT CYCLE ENVIRONMENTAL IMPACTS

6.5.1: Construction (Urban development) Phase

a) Positive Effects

During construction, a lot of soil will be scooped from the sites being constructed. The soil can be used to improve agricultural land elsewhere. The vegetation cleared if combined with the soils can also be used to improve the organic matter level of the soil for the neighboring farming communities. The seeds in the scooped soils and cleared vegetation could also improve bio-diversity of the receiving landscape.

b) Negative Effects

The ESIA assumes that upon variation of the boundary, the land will be used for urban development. During the development phase, almost all vegetation cover will be cleared to pave way for construction of buildings and infrastructural facilities. This will destroy wildlife habitat, destroy biodiversity and vegetation cover and reduce biodiversity to a minimum. The water catchment function of the forest will be reduced to a minimum, compaction of the land will interfere with the soil structure leading to commencement of land degradation. The compacted soil will be less receptive to percolation of rainfall through the soil structure. The carbon sink function of the forest will cease hence

increasing CO₂ in the atmosphere and reducing oxygen (O₂) with a net effective of contributing to an increase of the greenhouse gases in the atmosphere hence climate change. Clearance of the forest during the construction phase will also leave behind a very unattractive landscape considering the natural attributes of forests. As buildings emerge, there will be more concrete surfaces that are impervious to water percolation. This will contribute to an increase in water run-off and a decreased underground water recharge.

Alteration of existing drainage design specifications to allow acceptable geometrics of the road could effectively change micro-topographical conditions thereby altering access to homes and premises, and local storm water regime. Disruptions of settlements and land use features during development of drainage outfalls. Obstruction, diversion of roads and drainage channels and culverts.

Air pollution and therefore decreased air quality due to dust emissions from various construction activities will affect the health condition of residents, particularly eye infections and upper respiratory diseases. Noise pollution and vibrations by heavy machinery causing disturbance to residential, commercial and institutional premises and damaging adjacent structures such as premises and water tanks). Non-compliance with the Noise and Excessive Vibrations Regulations is a likely health risk to the immediate residents and business communities i.e. Use of explosives must be licensed.

Other impacts will include increased excessive solid waste generation, soil pollution and land degradation, health risks as a result of fuel, dust and gas emissions causing health problems such as eye infections and upper respiratory system diseases.

6.5.2: Operation Phase

a) Positive Effects

Some downstream communities capitalize on flood waters/excess surface run-off for irrigated agriculture. During the operation phase, the water run-off will be high and could be used downstream for agriculture. More water can also be harvested from roof catchment of the new buildings that can be used:

- To meet the ever increasing demand for water
- To augment the ground water storage and control decline of water levels
- To reduce ground water pollution and soil erosion.

b) Negative Effects

During the operation phase, all the negative impacts identified in the construction phase will be experienced except construction based air pollution. There will be micro-climate change with an increase in the temperature of the site as a result of the concrete surfaces created during the construction phase.

6.5.3: Decommissioning Phase

a) Positive Effects

The positive effects will include land scape restoration with forest cover and resumption of the ecosystem functions of the forest. There will be increased rainwater percolation, ground water recharge and storage, increased clean air and reduced pollution. There will also be an increase in biodiversity for both flora and fauna.

b) Negative Effects

During this phase, new negative effects like increased air and water pollution, solid and liquid waste generation will emerge from the demolitions.

6.6: SOCIO-CULTURAL AND ECONOMIC IMPACTS

Forests provide cultural services such as spiritual, recreational, educational and research facilities among others. They also provide the same to urban centres for domestic and commercial use. Forests also provide wood fuel which is used for energy and also as a source of income for vendors. They also provide medicinal herbs, honey, wild fruits and livestock forage among others.

6.6.1: Potential Impacts during the Construction Phase

a) Positive Effects

Creation of and Support to Local Economy

Improvement in physical infrastructure such as roads, drainage and sewerage system, bus parks and parking areas allow easier traffic flow and efficiency of services, create order and reduce perennial flooding. This will create a conducive environment for business. Availability of construction labor opportunities, commercial facilities and better support

infrastructure will attract more people to the town, who will require food and other services. This will enhance trade between the town and its hinterland and with neighboring counties, create employment and business opportunities, raise incomes and generate other livelihood benefits for those involved, and the economy of the area will start to thrive.

Employment

Construction activities will require skilled and unskilled labor that will be largely drawn from the project site. Materials used for construction will be sourced from the neighbourhood further providing jobs and direct income to the town residents and the neighboring areas.

Skills and Technology Transfer

The locals and other labourers who will be involved in the project construction activities will gain skills and technology which they can apply to similar projects in the future. Unemployment is a challenge in the project area.

Increased Land Value and Other Capital Assets

As a result of enormous investments at the site, there will be accumulation of capital goods and security services. The value of land will also increase as a result of the developments. Other livelihood benefits will include wood in the short-term from the cleared trees and shrubs to supply energy for restaurants, educational institutions and communities, and construction materials.

Some of the land will be set aside for sports and recreational purposes as there is limited provision currently. Community members graze their livestock in the current forested area especially during the dry season. They will continue doing so but in a reducing intensity as more land is converted to buildings and concrete surfaces.

Under the planned boundary variation project, no money will be used to purchase land, to survey and plan for expansion of the township. There will also be no demolition of buildings and other structures, relocating of people and compensation for property loss. The demand for money to implement the project is low and this makes the proposed project economically attractive.

b) Negative Effects

There will be increased insecurity and social crimes due to population influx.

- Enormous pressure on the existing physical infrastructure such as roads, water supply. There will also be increased pressure on housing, water and sanitation facilities.
- Occupational hazards such as injuries, deformities or death of workers and community members from fire outbreaks, machines, vehicles and other accidents in construction sites or on roads due to blockages, diversions or altered terrain.
- Conflict risks to pedestrians and other road users moving within the town during the construction works (pedestrian/traffic conflicts, slips and falls into drains and embankments in construction sites and diversion routes.
- Temporary but limited disruption of public amenities and services i.e. water and electricity
- Likely conflicts on employment opportunities may arise between the contractor and the local community
- Potential water user conflicts between community and contractor, and contamination
- Destruction of structures resulting in displacement of businesses as well as eviction of stall operators leading to disruption of livelihoods, loss of jobs and therefore reduced incomes.
- Increased crime and anti-social behavior such as alcoholism, drug abuse and commercial sex owing to an influx of people from other areas and limited economic opportunities and social amenities.
- Potential health risks from anti-social behavior, sanitation and hygiene challenges in workers camps and construction sites, HIV/AIDs, TB, STIs and other communicable diseases.

6.6.2: Operational Phase

The operational phase will be when most of the construction phase activities are over and the town is in full scale operation. During this period, there will still be positive and negative impacts as described below.

a) Positive Effects

During this operational phase, all the impacts indicated in section 6.3.1 a will be experienced, however, the need for unskilled labor will reduce as more skilled, more formal and more regular type of employment opportunities will increase. Other positive socio-economic effects will include:

- **Access to County/National government's services:** With the proposed town establishment, the existing County/National governments' services will be upgraded. It is expected that other services such as improved medical services, will be introduced.
- **Improved infrastructure:** The proposed development establishment will come with improved roads leading into and out of this urban center. Roads will be improved into all-weather roads. The town will be supplied with reliable source of energy that will serve various players.
- **Increased security:** Participants noted of insecurity as an anticipated effect due to the anticipated rapid influx of population. With the proposed establishment of a police station and other government security structures, security measures are likely to be improved.
- Increased trade and commercial activities within the town and with its hinterland, creating employment opportunities and other income generating activities. There will also be industrial development that will be an employer and the associated support industries (backward and forward linkages) and services. Demand for raw materials for industries, food and other products from the hinterland will have multiple benefits for the communities.
- **Enhanced County cross-border economic activities:** The proposed town will enhance border trade with especially Laikipia and Nyeri counties on exchange of goods and services that will see:
 - More jobs created in the construction industry;
 - There will be existence of a ready market for construction materials;

- It will contribute to the realization of vision 2030 of providing business space and a conducive business environment;
 - It will result in further development and improvement of local infrastructure and
 - Increased revenue in form of taxes to the governments.
- Safety and security improved to safeguard the increasing population, more government facilities and services, and the increased commercial activities. With creation of employment and diverse business opportunities, availability of training institutions as well as presence of sports and sporting facilities, crime and anti-social behavior cases will also reduce leading to increased productivity of the youth and hence a vibrant economy
- **Increased tourism in the Aberdares forest ecosystem region:** The Aberdares forest ecosystem has very attractive scenery that is highly appreciated by tourists. It attracts both domestic and international visitors, including mountain hikers, walkers, birdwatchers, game viewers and sport fishermen. The tourist attractions include animals like the elephant, buffalo, waterbuck, black rhino, giant forest hog and the endangered bongo. Among the primates are black and white columbus monkeys, sykes monkey and baboon. The carnivores include leopard, spotted hyena, lions, civet and genet cats. Other attractions include waterfalls, caves, mountain hiking and cultural tourism.
- Most residents will have secure land tenure and hence the confidence to aggressively invest on their land, housing and businesses.

b) Negative Effects

Under the operational phase, the insecurity reported in the construction phase will reduce as there will be more of the skilled than non-skilled workers as well as greater security enforcement. The social crimes will also be there but at a reduced level. The enormous pressure on the existing physical infrastructure such as roads, water and electricity supply and sanitation facilities will ease as they will have been provided for during the construction phase. The pressure on social amenities will reduce as there will be newer developments of social amenities such as private health clinics and educational

facilities. Cultural, educational, and research use of the forest will have ceased. Other socio-economic effects will include:

- **Water use and depletion:** There will be the exploitation of both surface and underground water resources. Due to the influx of people into urban areas, it is anticipated that water abstraction will be higher.
- **Pollution from urban agriculture:** It is common to find people practicing agriculture in its various forms in most urban centers. Being an agricultural area, residents might opt to carry out some agricultural activities within the proposed urban area and as a result pollution may occur.
- **Resource use conflicts:** Competition for resources such as land is likely to arise. This might spark out serious conflicts if no proper measures are put in place.
- **Deterioration of sanitary conditions:** Higher volumes of both solid and liquid waste will be generated in the town. Proper disposal facilities will be required to avoid the deterioration of the urban environment.
- **Pollution of water resources:** River Pesi , Mbombo and other seasonal streams within and adjacent to the proposed town are likely to be polluted.

6.6.3: Impacts of the Decommissioning Phase

In urban development, decommissioning may therefore take an extended period of time leading to the following positive and negative effects are likely to happen:

a) Positive Effects

During this phase, it is assumed that the developments will have stabilized and the main changes will be maintenance and improvement of the developed physical and social infrastructure/facilities. Employment, provision of modern services and a vibrant economy will remain the leading effects of the project.

b) Negative Effects

At decommissioning, the main negative effects will be the lost forest and its biodiversity, cultural assets, educational, and research values. However, there will be new challenges arising like a rapid influx of population to benefit from the services of the expanded urban developments.

6.7: IMPACTS ANALYSIS

6.7.1: Impact Analysis Approach and Methodology

Impacts were analyzed based on the relative time they occur. This included short-term, medium term and long-term as classified in **Table 5** below.

Table 5: *Duration of Impacts*

Duration	Time Range
Short-Term (S)	0-5 years
Medium-Term (M)	5.1-10 years
Long-Term (L)	>10 years

The impacts were further assessed on whether they are neutral, minor positive or negative and significant positive or negative using the criteria explained in Table 6. The findings are as reported in Table 7, 8 and 9.

Table 6: *Rating criteria*

Category/Type	Rating	Rating
Neutral	0	0
Type of Impact	Negative	Positive
Minor	-1	+1
Significant	-2	+2

6.7.2: Environmental / Ecological Impacts Analyses

As indicated in **Table 7**, almost all the environmental impacts except two are negative and significant both in the short, medium and long-term with a rating of -2 for all the three time frames considered. It is only emerging of the town that is positive and significant. Complementarity with the existing land uses is positive but minor. These findings suggest that the planned variation of Aberdare forest Boundaries has significant negative environmental consequences and should be considered carefully.

Table 7: Weighted potential environmental impacts of implementing the Aberdare Forest Boundary Variation Plan

Duration/ Components	Short-term (0-5 Years)	Medium 5.1-10 Years)	Long-term (>10 Years)
Rare, endangered, threatened species	-2	-2	-2
Water catchment area	-2	-2	-2
Bio-diversity (flora and fauna)	-2	-2	-2
Land degradation	-2	-2	-2
Air quality and regulation	-2	-2	-2
Climatic factors	-2	-2	-2
Landscape appearance	-2	-2	-2
Increase in concrete surface	-2	-2	-2
Noise and vibrations	-2	-2	-2
Conservation of green spaces	-2	-2	-2
Townscape	+2	+2	+2
Complementarity with existing land uses	+1	+1	+1
Total	-17	-17	-17

6.7.3: Socio-Cultural and Economic Impacts Analyses

Unlike the environmental impacts, socio-economic impacts of varying the Aberdare Forest Boundary are both positive and negative in almost equal measures as detailed in **Table 8**. In the short-term, use of the forest as a cultural site, for educational, recreational and research purpose, are negative and significant. All the others are positive as indicated and have an overall positive rating of +6. For the medium term, the overall rating is -2 and for the long term, it is -1. In summary, despite there being many positive socio-economic impacts, the negatives are also significant especially in the Medium-Term and Long-term and should be weighed appropriately.

Table 8: Weighted potential socio-economic impacts of implementing the Aberdare Forest Boundary Variation Plan

Duration/ Components	Short-Term (0-5 Years)	Medium-Term 5.1-10 Years)	Long-Term (>10 Years)
Use as cultural site	-2	-2	-2
Use for educational purpose	-2	-2	-2
Use for recreational purpose	+1	-2	-2
Human health	-2	-1	+1
Research purpose	-2	-2	-2
Employment	+2	+2	+2
Social amenities	+2	+2	+2
Population increase	+2	+2	+2
Improved security	+2	+2	+2
Investment in capital goods	+2	+2	+2
Increase value chain benefits	+2	+2	+2

Duration/ Components	Short-Term (0-5 Years)	Medium-Term 5.1-10 Years)	Long-Term (>10 Years)
Non-timber forest products (honey, herbal medicine, wild fruits)	-2	-2	-2
Livestock grazing/forage	+1	-2	-2
Wood fuel supply	+2	-2	-2
Purchase of land, survey, plan formulation	0	0	0
Demolition of buildings and structures	0	0	0
Relocation of people/ emotional pain	0	0	0
Weakening of social family networks	0	0	0
Compensation for deserving cases	0	0	0
Demolition of buildings and structures	0	0	0
Total	+6	-2	-1

6.7.4: Summary of Impacts

Combining environmental and socio-economic impacts gives an overall negative and significant impact both during the short, medium and long-term time period as indicated in **Table 9** again suggesting that the decision to implement the proposed project should be weighed carefully.

Table 9: Summary of impacts for selected environmental and socio-economic parameters

Duration/Components	Short-term (0-5 Years)	Medium 5.1-10 Years)	Long-term (>10 Years)
Environmental impacts			
Rare, endangered, threatened species	-2	-2	-2
Water Catchment Area	-2	-2	-2
Bio-diversity (flora and fauna)	-2	-2	-2
Land degradation	-2	-2	-2
Air quality and regulation	-2	-2	-2
Climatic factors-rainfall and temperature	-2	-2	-2
Landscape appearance	-2	-2	-2
Increase in concrete surface	-2	-2	-2
Noise and vibrations	-2	-2	-2
Conservation of green spaces	-2	-2	-2
Townscape	+2	+2	+2
Complementarity with existing land uses	+1	+1	+1
Sub-total environmental impacts	-17	-17	-17
Socio-economic impacts			
Use as cultural site	-2	-2	-2
Use for educational purpose	-2	-2	-2
Use for recreational purpose	-2	-2	-2
Employment	+2	+2	+2

Duration/Components	Short-term	Medium	Long-term
	(0-5 Years)	5.1-10 Years)	(>10 Years)
Human health	-2	+2	+2
Social amenities	-2	+2	+2
Population increase	+2	+2	+2
Improved security	+1	+2	+2
Investment	+2	+2	+2
Increase value chain benefits	+2	+2	+2
Non-timber forest products (Honey, Herbal medicine, wild fruits)	-2	-2	-2
Wood fuel supply	+2	-2	-2
Demolition of buildings and structures	0	0	0
Relocation of people and emotional pain	0	0	0
Weakening of social family networks	0	0	0
Compensation for deserving cases	0	0	0
Purchase of land, survey, plan formulation	0	0	0
Sub-total socio-economic	-1	+4	+4
Overall total	-18	-13	-13

6.8: ENVIRONMENTAL RISK ANALYSIS

As reported above, analysis of the proposed project has both positive and negative environmental and social-economic impacts at the project site and the wider bio-region. The main areas of environmental impacts include, water resources, air quality and biodiversity. The analysis assessed the significance (importance) of the environmental and socio-economic effects/risks of the proposed project. The assessment criteria identified the likely changes to the baseline conditions as a result of implementing the Boundary Variation Project. The changes are described as much as possible in terms of their: geographical scale; magnitude of the impacts; time scale over which the impacts could occur; probability of the impacts occurring; frequency/rarity of occurrence of the impacts; temporary or permanent nature of the impacts (reversible or irreversible); and the overall positive or negative attributes of the impacts.

Based on these parameters, an environmental risk factor has been calculated for each potential impact by assigning each parameter a score – see **Table 10**. The Environmental Risk Factor (ERF) is a function of: [Extent + Duration + Magnitude + Frequency + Reversibility] multiplied by Probability factor. The formula can be summarised as: {ERF = (GC + M + D + F + R) x (P)}.

Table 10: Criteria for Environmental Risk Factor Analysis

No.	Parameter	Element	Score
1.	Coverage (Extent or Geographical Scale)	Site Level	1
		Site and its immediate Environs	2
		County Level	3
		Regional Level (Central)	4
		National Level (Country)	5
		International (Beyond Kenya)	6
2.	Magnitude	Small and will have no effect on the environment	1
		Minor and will not result in a significant impact on the environment	2
		Low and will cause a slight impact on the environment	3

No.	Parameter	Element	Score
		Moderate and will cause a moderate impact on the environment	4
		High and will cause a major impact on the environment	5
		Very high and will result in a complete destruction of the environment	6
3.	Duration	Very Short (<1 year)	1
		Short (>1<5 Years)	2
		Medium *(>5<10 years)	3
		Long (>10<15 years)	4
		Very Long (>15 years)	5
4.	Frequency	Rare	1
		Less frequent	2
		Frequent	3
		Highly frequent	4
		Continuous	5
5.	Reversibility	Highly Reversible	1
		Moderately Reversible	2
		Reversible	3
		Partially Irreversible	4
		Completely Irreversible	5
6.	Probability	Highly improbable (<20% chance of occurring)	1
		Improbable (20<40% chance of occurring)	2
		Probable (40<60% chance of occurring)	3
		Highly probable (60<80%)	4
		Definite (>80% chance of occurring)	5

NOTES:

- a. Secondary impact (indirect) – occurs at a distant from the direct result or as a result of the complex
- b. Cumulative impacts – these are small effects from different sources
- c. Synergistic impacts – effects that could interact to produce a new total effect that could be greater than the sum of the individual effects

6.8.1: Risk Analysis on Water Resources

The boundary variation plan impacts water resources include increased water run-off, reduced underground water recharge and no evapo-transpiration leading to reduced cloud formation hence low rainfall. The Environmental Risk Factor of the project on the water resource is as indicated in **Table 11**.

Table 11: Water Resources Impacts without Mitigation

Impacts	Geographic Coverage (GC)	Magnitude (M)	Duration (D)	Frequency (F)	Reversibility (R)	Probability (P)	ERF (% of maximum)
Increased Water Run-off	4	5	5	5	5	5	120 (89%)
Reduced Under ground Water Recharge	4	5	5	5	5	5	120 (89%)
Reduced Rainfall	2	4	5	5	5	5	105 (78%)
Total for water	10	14	15	15	15	5	345 (85%)

Lowest ERF = 5 Median = 65 Highest ERF = 135 Total 405

6.8.2: Risk Analysis on Air Quality

Table 12: Impacts on air quality regulation without mitigation

Impacts	Geographic Coverage (GC)	Magnitude (M)	Duration (D)	Frequency (F)	Reversibility (R)	Probability (P)	ERF (% of maximum)
Reduced CO ₂ absorption	6	4	5	5	5	5	125 (93%)
Reduced air quality regulation	2	4	5	5	5	5	105 (78%)
Total	8	8	10	10	10	5	230 (85%)

Lowest ERF = 5 Median = 65 Highest ERF = 135 Total 27

6.8.3: Risk Analysis on Bio-diversity

Table 13: Impacts on bio-diversity without mitigation

Impacts	Geographic Coverage (GC)	Magnitude (M)	Duration (D)	Frequency (F)	Reversibility (R)	Probability (P)	ERF (% of Maximum)
Reduction in flora	1	4	3	3	3	5	70 (52%)
Reduction in fauna	2	3	5	5	4	5	95 (70%)
Total	3	7	8	8	7	5	165 (61%)

Lowest ERF = 5 Median = 65 Highest ERF = 135 Total 270

6.8.4: Summary of Risk Analysis

Considering the three categories of impacts, the water resource will have the highest negative ERF of 345 followed by air quality at ERF of 270 and bio-diversity with an ERF of 165. This implies that the highest negative environmental consequences of the proposed project will be on the water resource function of the forest, hence the need to give its mitigation measures sufficient attention at both the formulation and implementation stage.

CHAPTER SEVEN

ANALYSIS OF PROJECT ALTERNATIVES

7.1: OVERVIEW

This chapter presents the alternatives to the proposed project of varying Aberdare Forest (Ndaragwa block) boundary. The alternatives include (i) Complete Relocation of the project to an alternative site, (ii) Adoption of the 2007 variation of the forest boundary and (iii) Nil – Intervention. The options are as described below.

7.2: ALTERNATIVE 1: COMPLETE RELOCATION OPTION (CRO)

There are significant environmental and socio-economic impacts of the proposed project that would require complete relocation of the project from the current proposed site. The proponent could therefore consider alternative sites. This requires acquisition of 65.77ha of land near/next to the old town from a willing seller. The land should be in the direction away from the forest land. This will leave the forest land intact so that it can continue offering the ecological and socio-economic functions indicated in chapter six.

There are high possibilities that the land will be found since the Sub-County still has some areas with reasonably large land sizes. Given that land is currently being sold at Ksh. 1,000,000. per acre, or Ksh. 2.5 million per hectare, the total amount required to purchase an equivalent piece of land is Ksh. 275.75 million. This money has to be budgeted for through the normal government budget process. If allocated, it will take approximately one year to be released. It could also be budgeted for in the supplementary budget, which could take slightly shorter than one year.

The new site has to be surveyed and the survey plan approved. This may cost approximately Ksh. 2 Million. After approval of the survey plan, the new site has to be designed and re-planned for township expansion according to site conditions. Project design and planning and approvals will cost a reasonable amount of money approximately Ksh. 5 million. So far, whatever work that has been done and paid for to date will be counted as a loss to the Proponent. Implementation of the plan will be delayed by about 1-2 years. This is a delay that can be accommodated given the grave impacts of implementing the project as proposed.

The Complete Relocation Option has a net positive impact of +20 on the environment in the short, medium and long-term time frames. The net socio-economic impact, however is negative in the short, medium and long-term at -9, -5 and -5 respectively. The combined environmental and socio-economic impact is estimated at +11, +15 and +15 respectively for the short medium and long-term. This suggests that from the environmental point of view, it is a potential alternative that can be implemented instead of the proposed project- See **table 14 and 15**.

Table 14: Weighted potential environmental impacts at the current proposed site of implementing alternative 1 which is the Complete Relocation Option

Duration/Components	Short-term	Medium	Long-term
	(0-5 Years)	5.1-10 Years)	(>10 Years)
Rare, threatened and endangered species	+2	+2	+2
Water Catchment	+2	+2	+2
Bio-diversity (flora and fauna)	+2	+2	+2
Land degradation	+2	+2	+2
Air quality and regulation	+2	+2	+2
Climatic factors	+2	+2	+2
Landscape appearance	+2	+2	+2
Increase in concrete surface	+2	+2	+2
Noise and vibrations	+2	+2	+2
Conservation of green spaces	+2	+2	+2
Townscape	-2	-2	-2
Complementarity with existing land uses	+2	+2	+2
Total	+20	+20	+20

Table 15: Weighted potential socio-economic impacts of implementing Alternative 1

Duration/Components	Short-Term (0-5 Years)	Medium-Term 5.1-10 Years)	Long-Term (>10 Years)
Use of forest for culture	+2	+2	+2
Use for education purpose	+2	+2	+2
Use for research purpose	+2	+2	+2
Use for recreation purpose	+2	+2	+2
Employment	-2	-2	-2
Human health	+2	-2	-2
Social amenities	-2	-2	-2
Population increase	-2	-2	-2
Improved security	-2	-2	-2
Investment	-2	-2	-2
Increase value chain benefits	-2	-2	-2
Non-timber forest products	+2	+2	+2
Wood fuel supply	+1	+1	+1
Demolition of buildings and structures	-2	0	0
Relocation of people	-2	0	0
Weakening of social family networks	-2	-2	-2
Compensation for deserving cases	-2	0	0
Purchase of land, survey, plan formulation	-2	0	0
Total socio-economic	-9	-5	-5

7.3: ALTERNATIVE 2: – ADOPTION OF THE SURVEY PLAN OPTION (SPO)

This option proposes varying of the boundary to accommodate only the already developed and surveyed area of the forest land of 65.7 hectares of land for expansion of Ndaragwa Township. The idea here is to ensure minimum or no additional loss of forest land. The Survey Plan of 2007 Option has a negative environmental impact of -5 for both the short and medium terms and a +23 for the long-term. On the socio-economic front, it has an overall positive impact of +12, +15 and +17 respectively for the short, medium and long-term. The combined environmental and socio-economic impact of implementing alternative 2 is +7, +10 and +40. This suggests that Alternative 2 is a potential option that can be implemented-See **table 16 and 17**.

Table 16: Weighted potential environmental impacts on Aberdare forest of implementing Alternative 2 which is a Survey Plan of 2007 Option

Duration/Components	Short-term (0-5 Years)	Medium 5.1-10 Years)	Long-term (>10 Years)
Rare, threatened and endangered species	-1	-1	+2
Water Catchment Area	-1	-1	+2
Bio-diversity (flora and fauna)	-1	-1	+2
Land degradation	-1	-1	+2
Air quality and regulation	-1	-1	+2
Climatic factors	-1	-1	+2
Landscape appearance	-1	-1	+2
Increase in concrete surface	-1	-1	+2
Noise and vibrations	+1	+1	+2
Conservation of green spaces	-1	-1	+2
Townscape	+1	+1	+1
Complementarity with existing land uses	+2	+2	+2
Total	-5	-5	+23

Table 17: Weighted potential socio-economic impacts on Aberdare Forest of Implementing Alternative 2 – Survey Plan of 2007 Option

Duration/Components	Short-Term (0-5 Years)	Medium-Term 5.1-10 Years)	Long-Term (>10 Years)
Use of forest as cultural site	+1	+1	+2
Use for education purpose	+1	+1	+2
Use for research purpose	+1	+1	+2
Use for recreation purpose	+1	+1	+2
Employment	+2	+2	+1
Human health	+1	+2	+2
Social amenities	+2	+2	+2
Population increase	+2	+2	+2
Improved security	+1	+2	+2
Investment	+1	+2	+2
Increased value chain benefits	+2	+2	+2
Food production	+1	-2	-2
Wood fuel supply	-1	-1	-2
Demolition of buildings and structures	0	0	0
Relocation of people and emotional pain	0	0	0
Weakening of social family networks	0	0	0
Compensation for deserving cases	-2 (KFS)	0	0
Purchase of land, survey, landuse plan formulation	-1	0	0
Total	+12	+15	+17

7.4: ALTERNATIVE 3 - NIL-INTERVENTION OPTION (NIO)

No project option in respect to the proposed project implies that the status quo is maintained. For this option, the town will develop in all directions un-planned. Investment will remain insecure hence not vibrant. Other possible effects are that there will be:

- a) Investment flight to other towns with investors looking for more secure locations,
- b) The economic status of people will remain very low,
- c) Local skills will remain under-utilized,
- d) There will be no employment opportunities for those who would work in the development projects,
- e) There will be increased urban poverty, crime and hopelessness,
- f) Development of infrastructural facilities such as – roads, water and power supply will not be undertaken.

The NIO has a net negative environmental impact of -11, -14, -17 for the short, medium and long-term time frame respectively. The socio-economic impact on the other hand is +11, 0 and -3 for the short, medium and long-term respectively. The combined environmental and socio-economic impact is 0, -14 and -21 for the short, medium and long-term frame work respectively. This suggests a net negative impact. This suggests that the NIO is not an attractive alternative to the planned project- See **table 18 and 19**.

Table 18: Weighted potential environmental impacts on Aberdare forest of implementing Alternative 3 which is a No Intervention Option (NIO)

Duration/Components	Short-term	Medium	Long-term
	(0-5 Years)	5.1-10 Years)	(>10 Years)
Rare, Threatened, Endangered Species	-2	-2	-2
Water Catchment Area	-2	-2	-2
Bio-diversity (flora and fauna)	0	-1	-2
Land degradation	-1	-2	-2
Air quality and regulation	-1	-1	-2
Climatic factors	-1	-1	-2
Landscape appearance	-1	-2	-2
Increase in concrete surface	-1	-1	-2
Noise and vibrations	-1	-1	-1
Conservation of green spaces	-1	-1	+1
Townscape	-1	-1	-2
Complementarity with existing land uses	+1	+1	+1
Total	-11	-14	-17

Table 19: Weighted potential socio-economic impacts of implementing Alternative 3

Duration/Components	Short-Term (0-5 Years)	Medium-Term 5.1-10 Years)	Long-Term (>10 Years)
Use of forest as cultural site	+1	-1	-2
Use for education purpose	+1	-1	-2
Use for research purpose	+1	-1	-2
Use for recreation purpose	+1	-1	-2
Employment	+1	+1	+1
Human health	+1	+1	+1
Social amenities	+1	+1	+1
Population increase	+1	+1	+1
Improved security	+1	+1	+1
Investment	+1	+1	+1
Increased value chain benefits	+1	+1	+1
Food production	+1	-1	-1
Wood fuel supply	-1	-2	-2
Purchase of land, survey, landuse plan formulation	0	0	0
Total	+11	0	-3

7.5: ALTERNATIVES COMPARISON

Short-term: Comparison of the four alternatives show that considering Environmental Impacts (EI) in the short term period, the Planned Project has the worst impacts rated at an overall score of -17 while alternative 1 which is complete relocation has the best score of +20. Within the same time frame, alternative 2 has the overall best score of social economic impacts rated at +12 while alternative 1 has the worst rated at -9. Overall, for the short-term, the combined Environmental and Social Impacts rate Alternative 1 as the most positive with a rating of +11 and the planned project has the worst rating with -11.

Medium-Term: As indicated in Table 20, in the medium term, Alternative 1 has the highest positive rating followed by Alternative 2. The planned project has the lowest with a rating of -19.

Long-term: Overall, for the combined environmental and socio-economic impacts (CESI) for the long-term time frame however, alternative 2 has the highest positive rating of +40. As indicated in Table 7.5, the planned project has the lowest with a rating of -19. For the long-term time frame however, alternative 2 has the highest positive rating of +40 while the planned project has the worst rating with -18.

From the analysis, considering that the desire is to have long term combined positive impact, option 2 appears to be the better option for expansion of Ndaragwa Township.

Table 20: Summary of environmental and social impacts for the four project options

ALTERNATIVES	Short-Term			Medium -Term			Long-Term		
	EI	SI	CESI	EI	SI	CESI	EI	SI	CESI
Planned Project	-17	+6	-11	-17	-2	-19	-17	-1	-18
Alternative 1	+20	-9	+11	+20	-5	+15	+20	-5	+15
Alternative 2	-5	+12	+7	-5	+15	+10	+23	+17	+40
Alternative 3	-11	+11	0	-14	0	-14	-17	-3	-20

* EI = Environmental Impacts; SI = Social Impacts; CESI = Combined Environmental and Social Impacts

CHAPTER EIGHT

MITIGATION MEASURES AND ENVIRONMENTAL & SOCIAL MANAGEMENT PLAN (ESMP)

8.1: OVERVIEW

This chapter presents the environmental mitigation measures for the identified projects negative effects as well as environmental management plan (EMP) for the entire project cycle. Environmental Management Plan (EMP) for developing projects is usually to provide a logical framework within which identified negative environmental impacts can be mitigated and monitored. Additionally, EMP assigns responsibilities of actions to various actors and provides a timeframe within which mitigation measures and monitoring can be done. The EMP is a vital output of an ESIA study as it provides a checklist for project monitoring and evaluation. The EMP outlined below will address the identified negative impacts of the proposed variation of boundary of Aberdare [Ndaragwa block] forest LN. No.48/194, to allow for expansion of Ndaragwa Township from 38.47 acres to 162.52 acres in Ndaragwa sub county, Nyandarua County.

8.2: ENVIRONMENTAL MITIGATION MEASURES

8.2.1: Mitigation of Construction Phase Related Effects

a) Clearance of forest and other vegetation

Almost all vegetation cover will be cleared to pave way for construction of buildings and infrastructural facilities. This will reduce bio-diversity to a minimum. In addition, the water catchment function of the forest will be reduced to a minimum, compaction of the land will interfere with the soil structure leading to commencement of land degradation. The compacted soil will be less receptive to percolation of rainfall through the soil profile. The carbon sink function of the forest will cease hence increasing CO₂ in the atmosphere and reducing oxygen (O₂) with a net effective of contributing to an increase of the greenhouse gases hence climate change. This will generate many secondary impacts.

Clearance of the forest during the construction phase will also destroy the aesthetic value of the forest and buildings will block the beautiful scenery and the Aberdares ranges.

Buildings will also create concrete surfaces that are impervious to water percolation. This will contribute to an increase in water run-off and a decrease in underground water recharge. Other impacts will include increased noise and vibration, higher volumes of solid waste generation, soil disturbance and pollution, air pollution, health risks as a result of fuel emissions and enormous generation of dust. Rainfall will also be affected as the cloud formation function of the forest will cease. To mitigate against the listed negative impacts, the following measures will be implemented.

Construction sites with cuts and fills be landscaped/back sloped appropriately; rehabilitate affected areas through grassing and planting trees; integrate drainage system in the overall road planning and construction such as to discharge run-off into the nearest natural water courses; ensure protection of soil adjacent to the side drains and the constructed drainage by grassing, scour checks, mitre drains, culverts, stone pitching, gabions, terraces etc.; avoid leaving heaps of soil and gravel on sites in cases where there is no intended immediate use to avoid erosion by runoff and periodic de-silting and unclogging of drainage channels.

b) Bio-diversity loss

To mitigate against loss of bio-diversity, intensive greening using indigenous tree and shrub species with other vegetation found in Aberdare Forest shall be undertaken. This can be done through landscaping of road reserves, foot paths, parking, and all green spaces. The excavated soil shall be used for landscaping within the plots, along road reserves and pedestrian walkways. Where the soil is in excess quantities, it should be used in neighboring farms to improve production. This will ensure that none is lost.

c) Increased water run-off and reduced water percolation

To reduce water run-off and increase water percolation, the following will be promoted: roof water harvesting and use of rain water at plot level, use of porous paving in the open spaces to reduce surface run-off and promote percolation, use of retention trenches for recharging of the underground water table, creating of green roofs which slow surface run-off hence increasing chances of percolation and evaporation of storm water.

d) Air quality and regulation

Air quality will be maintained through optimal planting of trees and shrubs within the land and promotion of massive tree planting by the neighbouring communities of the forest. Air pollution from dust emissions will be minimized through regular watering of construction sites to keep dust low; covering delivery trucks transporting dust-emitting materials and driving haulage trucks at moderate speeds to reduce dust emission.

e) Land degradation and poor landscape appearance

To mitigate against land degradation, the following will be done. All embankments will be vegetated to avoid soil erosion and replant with indigenous species. Open up compacted sites before landscaping and greening to improve on the soil structure. Re-use excavated soil for landscaping along the pedestrian walkways, road reserve and parking areas.

f) Noise pollution and vibrations from construction sites

To reduce noise pollution and vibrations, contractors should inform the neighbouring residents of any unusual construction activities with excessive noise levels planned (include timing, expected duration and any safety precautions required). Undertake structural integrity assessment of existing structures around the construction sites as a control measure for damages from vibrations during construction (i.e. markets and government offices) and utilize low noise machinery for the construction to the extent possible. Normally, noise levels should be below 35dBA to the nearest receptors by day. Community members to inform contractors of any cracks in building accrued to vibrations. Provide construction workers with relevant safety gear including ear muffs at all times while at work and enforce use of appropriate PPEs. Working at night within settled and built-up areas will be upon issuance of necessary permits from the National Environment Management Authority (NEMA) and contractor to apply for a noise and excess vibration permit from NEMA

g) Accidents, injuries and deformity of workers and communities

To ensure safety and wellbeing of construction workers and the community in the project area contractors will be required to ensure driving discipline among drivers and other construction workers with respect to public safety; observe all Occupational Health and Safety (OHS) requirements including equipping workers with PPEs; awareness creation

and regular information sharing; use of appropriate signage near road diversions, barriers and work areas ,to avoid pedestrian/traffic conflicts, visibly mark pedestrian and livestock crossing points slips and falls in to drains, trenches and embankments. Training of staff on and provision of fire extinguishers to camps areas especially in fuel storage areas.

- h) Moral decadence will require community sex education and awareness creation on HIV/Aids and STIs awareness programs; provision of skills training, sports and talent development facilities and access to fiancé and credit for youth.
- i) Potential water user conflicts and contamination should be prevented by ensuring abstraction of construction from any surface water source is licensed by WRA and is strictly adhered, and appropriate waste handling facilities provided at work sites and worker camp sites.
- j) Other socio-economic impacts

Potential conflicts with local communities over employment opportunities can be mitigated by ensuring inclusion of local community members where skill sets meet work requirements; Temporary but limited disruption of public amenities and services, will require issuance of timely notices as to when and where key public amenities are to be affected (e.g. water pipes).

8.2.3: Mitigation of Operational Phase Related Effects

During the operation phase, there will be increased demand for utilities/ infrastructure services such as water, electricity, storm water drains, sewer services, ICT and telephone facilities. Water, drainage and sewerage services will be provided by the water company serving Ndaragwa Township. Power will be supplied by KPLC. Telephone and ICT services will be provided by various providers depending on the consumer's interest. With availability of employment opportunities and sports/talent development facilities, youth will be fully committed in productive activities leading to lower crime rate and other anti-social behavior.

8.2.3: Mitigation of Decommissioning Phase Related Effects

The key impacts of decommissioning phase will include noise and vibrations, air pollution and waste generation from the activities of the expanded town. The mitigation

hierarchy recommends avoiding, minimizing, reuse and recycle. What can be avoided should be avoided. The matching mitigation measures are as indicated below.

a) Noise and vibrations mitigation

To mitigate against noise, noise restriction signs should be displayed where necessary to warn potential noise generators e.g. at bus parks and new constructions or building maintenance sites. Equipment and machinery should be serviced appropriately and used in accordance with manufacturers recommendations. There is also likely to be noise from night clubs and other entertainment centres. This should be regulated to ensure compliance with noise regulations.

b) Air pollution mitigation

Carry out routine maintenance of vehicles and other machinery to ensure minimized emission of pollutants (e.g. sulphur oxides from vehicles and machinery exhaust systems. Provide dust masks to workers at all times – e.g. those cleaning roads. Avoid spillage of loose soil on the roads where it will be disturbed and blown away by traffic.

c) Solid waste mitigation

All waste should be sorted at generation point. Over 70% of urban solid waste tends to be organic. All organic waste should be composted and used by urban tree and vegetable nursery producers. Use of polythene should be banned completely. Metallic waste should be recycled. The town should have an E-waste drop off point where all electronic waste shall be collected for specialized handling.

8.3: ENVIRONMENTAL MANAGEMENT AND SOCIAL IMPACT MANAGEMENT PLAN (ESIMP)

The scope of this ESIMP is to give guidelines to all parties involved in the designing, implementing and day to day running of the proposed town expansion project in fulfillment of environmental and social-economic requirements. The management plan has a long-term objective to ensure that environmental management conditions and requirements are implemented throughout the town's existence management cycle, and Precautions against damage to the environment and property and claims arising from damages are compensated expeditiously. **Table 21** below therefore summaries the project ESIMP.

Table 21: Environmental Management and Social Impact Management Plan for the Proposed Project

Impacts	Recommended mitigation measures	Responsibility	Monitoring Indicators	Monitoring Time frame	Cost in(Kshs) (Ksh. Million)
Construction Phase					
1. Bio-diversity loss	<ul style="list-style-type: none"> ▪ Leave and fence at least 15% (10 ha.) of the total land that is most forested with the highest diversity of flora and fauna as a conservation, educational and research site within the township (Botanical garden/Arboretum). ▪ Carry out deliberate enrichment planting of the rare, endangered and threatened species along infrastructural corridors such as roads, foot paths, landscaping sites and within social amenity institutions such as health, educational and religious facilities. ▪ Establish a botanical garden for educational and research purposes targeting all the indigenous species found in Aberdare Forest Block. 	National Museum of Kenya (NMK), Kenya Forest Service (KFS), Kenya Wildlife Service, Community Forest Association.	Number of plant and animal species and total population per unit area compared to baseline level.	Annual	<ul style="list-style-type: none"> ▪ 5 M fencing ▪ 0.5M annual maintenance and monitoring
2. Increased water run-off and reduced underground water recharge	<ul style="list-style-type: none"> ▪ Strategic citing of water retention trenches to enhance water percolation for underground water recharge and river flow regulation ▪ Provide for porous pavements during construction to allow for maximum water percolation. 	WTA, WRA, The Company Responsible for Water Supply for Ndaragwa Town, KFS. Contractors, County Department of	Quantity of Run-off water Underground water yield levels	Seasonal (Long and Short Rains measurements) for all seasons Monthly data collection from all private and public	2M - Permanent water measuring equipment at strategic points on the drainage system for initial installation. 2.5 M - Monthly water yield data

	<ul style="list-style-type: none"> Design the drainage system to allow for slower flow of run-off to allow for maximum percolation. Roof/rainfall water harvesting and use at plot level to reduce the quantity of water run-off. 	Social Services and relevant Self help groups		boreholes to measure the production pattern	collection and analysis.
3. Reduced rainfall	<ul style="list-style-type: none"> Plant over 110 hectares of trees (about 162,500 trees and shrubs in an alternative but adjacent site to provide for the same function of transpiration. Plant as many trees and shrubs as possible in all un-used spaces including infrastructure corridors to allow for sufficient transpiration of the vegetation. 	<ul style="list-style-type: none"> KFS All institutions Property owners Contractors 	<ul style="list-style-type: none"> Number of trees and shrubs planted and surviving Total area of vegetation cover planted and surviving. 	Annual	<ul style="list-style-type: none"> KFS Individual institutions at their own cost Property owners
4. Reduced CO ₂ sequestration as a result of vegetation clearance	<ul style="list-style-type: none"> Optimal planting of trees and shrubs within the land. Promotion of massive tree planting by the neighbouring communities 	<ul style="list-style-type: none"> All institutions and property owners. Individual land owners 	<ul style="list-style-type: none"> Number of trees and shrubs planted and surviving 	Annual	<ul style="list-style-type: none"> Individual institutions Property owners at their own cost.
5. Reduced air quality and regulation function as a result of vegetation clearance and dust generation from construction	As in 4 above Use water to minimize dust particles in the air.	All institutions	<ul style="list-style-type: none"> Number of trees and shrubs planted and surviving 	Annual	Individual institutions at their own cost

<p>6. Land degradation through disturbance of soil, compaction of soil due to the use of heavy machines and generation of waste soil from excavation of buildings and road works</p>	<ul style="list-style-type: none"> ▪ Vegetate all embankments to avoid soil erosion and replant with indigenous species ▪ Open up compacted sites before landscaping and greening to improve on the soil structure. ▪ Re-use excavated soil for landscaping along the pedestrian walkways, road reserve and parking areas. 	<p>All implementing institutions</p>	<p>Area restored</p>	<p>Annual</p>	<p>Individual institutions and property owners at their own cost.</p>
<p>7. Reduced aesthetic appeal</p>	<ul style="list-style-type: none"> ▪ The riparian reserve of the seasonal stream near the government offices shall be developed into a recreational park. Activity nodes will be created at intervals along the stream to attract users for activities such as picnics, hiking, jogging, walking, cycling and bird watching. ▪ The nodes will be designed to enhance aesthetics through use of appropriate plant and other landscape elements such as paved pedestrian walkways, seats, waste bins, shade structures, public toilets and nature trail. ▪ The circulation paths through the town will be designed to take the users through a series of spaces with 	<p>County government</p>	<p>Area of land developed and maintained for recreation</p> <p>Number of activity nodes created and functioning.</p>	<p>Annual</p>	<p>10 M for development</p> <p>1 M for annual maintenance</p>

	<p>different characters to enrich the experience in the recreational site.</p> <ul style="list-style-type: none"> All the recreational spaces in the town shall be linked to the riparian reserve to create a large network of interconnected green spaces. 				
8. Increased noise and vibrations	<ul style="list-style-type: none"> Noise restriction signs should be displayed where necessary to warn potential noise generators e.g. at bus parks. Service and use equipment/machinery in accordance with manufacturers' recommendations. Regulate noise generation from (e.g. night clubs) and ensure their compliance with noise regulations. 	NEMA	Noise levels	Continuous	0.2 M
9. Reduced supply of non-timber forest products such as honey, medicinal herbs, wild fruits	<ul style="list-style-type: none"> Domesticate the wild fruit trees Domesticate growing of herbs Promote api-culture to supply honey 	Ministry of Agriculture and Livestock Individual farmers	-Number of wild fruit species domesticated -Number of medicinal herbs domesticated -Number of bee-hives installed	Continuous	0.5 M Individual farmers at their own cost.
Occupational injuries on construction workers	<ul style="list-style-type: none"> Regular maintenance of machines Use of skilled personnel to operate machines Adequate training of workers on OSHA. Provision of PPEs 	Contractor NCA National Council for Safety, Health and Welfare for workers.	Number of cases reported	Continuous	Paid by Contractor

	<ul style="list-style-type: none"> Monitoring to enforce use of PPEs and sobriety of workers 				
Conflicts with community over jobs	<ul style="list-style-type: none"> Transparency in the recruitment process Fairness in allocating jobs to locals Payment of standard wages 	Contractor County Government	Number of locals employed Number of cases reported	Continuous	Paid by Contractor
Temporary or permanent disruption of businesses and access to utilities	<ul style="list-style-type: none"> Adequate prior notice to relocate or suspend operations Awareness creation among stakeholders 	Contractor Local administration		Continuous	Relocation by Trader Awareness raising by Contractor and
Operational Phase					
Increased demand for water	<ul style="list-style-type: none"> Water will be provided by the appropriate water company 	Ndaragwa Water Company	-Per capita consumption -Total consumption	Continuous	Paid by consumer
Increased demand for electricity	<ul style="list-style-type: none"> Will be supplied by KPLC 	KPLC	-Per capita consumption -Total consumption	Continuous	Paid by consumer
Increased demand for sanitation facilities	<ul style="list-style-type: none"> Will be provided by the company in charge of sanitation in the Town. 	Sanitation Company	No. of people served.	Continuous	Paid by consumer
Increased temperature as a result of the increase in the built up area	<ul style="list-style-type: none"> Increase vegetation cover and diversity of plants in all possible locations using mainly indigenous vegetation. Plant as many shade trees as practically possible. 	County government	Area greened	Continuous	0.2 M
Noise and vibrations	<ul style="list-style-type: none"> Noise restriction signs should be displayed where necessary to warn 	NEMA	Noise levels	Continuous	0.1 M

	<p>potential noise generators e.g. at bus parks.</p> <ul style="list-style-type: none"> ▪ Service and use equipment/machinery in accordance with manufacturers' recommendations. ▪ Regulate noise generation from night clubs and ensure compliance with noise regulations. 				
Air pollution	<ul style="list-style-type: none"> ▪ Carry out routine maintenance of vehicles and other machinery to ensure minimized emission of pollutants from vehicles and machinery exhaust systems. ▪ Ensure compliance with the regulations for the same. 	NEMA Ministry of Transport	Pollution levels	Continuous	0.1 M
Decommissioning Phase					
Air pollution	<ul style="list-style-type: none"> ▪ Carry out routine maintenance of vehicles and other machinery to ensure minimized emission of pollutants (e.g. nitrogen and sulphur oxides from vehicles and machinery exhaust systems.) ▪ Provide dust masks to workers at all times – e.g. those cleaning roads. ▪ Avoid spillage of loose soil on the roads where it will be disturbed and blown away by traffic and wind 	NEMA All agencies and individual property owners	Air quality levels	Continuous	0.2 M Individual property owners at their own cost.
Noise pollution	<ul style="list-style-type: none"> ▪ Noise restriction signs should be displayed where necessary to warn potential noise generators e.g. at bus parks. 	NEMA	Noise levels	Continuous	0.2 M

	<ul style="list-style-type: none"> ▪ Service and use equipment/machinery in accordance with manufacturers' recommendations. ▪ Regulate noise generation from night clubs and ensure their compliance with noise regulations. 				
Increase in solid waste that include metals, plastic, rags, paper, timber, agricultural materials etc.	<ul style="list-style-type: none"> ▪ Mitigation hierarchy recommends avoiding, minimizing, reuse and recycle. What can be avoided should be avoided. All organic waste should be composted and re-used. 	NEMA	Tons avoided, re-used and re-cycled.	Continuous	0.2 M

CHAPTER NINE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

9.1: OVERVIEW

This independent ESIA report has precisely demonstrated the various elements likely to be effected and affected by implementation of the proposed variation of boundaries of Aberdare forest to allow for expansion of Ndaragwa Township in Nyandarua County. The project cycle and its various components have been articulated with the potential impacts, both positive and negative, ecological and socio-economic identified and addressed. This chapter summarizes the key ecological and socio-economic contributions of forests and highlights the key ESIA findings. It also provides the study conclusion and recommendations as indicated below.

9.2: SUMMARY

9.2.1: Water Regulation Functions of Forests

Indigenous closed canopy forests play an important regulatory role in trapping, storing, and slowly releasing water. Forests trap radiation in their multi-layered canopies, resulting in a net warming of the local ecosystem. The warming increases thermal turbulence above the forest, favoring the formation of clouds and rainfall over forest areas. During the day, transpiration of water through plants into the atmosphere cools the forest environment and increases air humidity in the near surface atmospheric layer. Evapo-transpiration determines the availability of water vapor for the formation of clouds. Large trees gain access to soil water through their roots all year round, thus maintaining evapo-transpiration and hence favoring cloud formation through the dry season. Large areas of forests thus regulate the total and redistribution of surface and below ground run-off. Forests reduce the rate of run-off after rainfall, thereby protecting against soil erosion and landslides as well as effectively storing the water. The stored water is released slowly into the rivers, therefore regulating the flow of rivers.

A study by UNEP (2012) reported that deforestation at the rate of 5,000 hectares per year 2000-2010 reduced the available water by 62 million cubic metres (equivalent to 12,400 cubic metres/ha/year). This reduced agricultural production by Ksh. 2.6 Billion

(Ksh. 520,000/ha/year) in irrigation agriculture output (UNEP, 2012). Deforestation therefore has a significant negative effect on agriculture and overall economic development. Forests therefore prevent and mitigate against the consequences of floods and droughts and through prevention of soil erosion, trapping of sediments and uptake of nutrients, improve water quality and prevent the siltation of water reservoirs and hydropower stations downstream. Analysis of deforestation shows that for every 1% loss in forest cover, the water yield in the catchment system would reduce by more than 1%. 100% loss of forest cover the water yield in the ecosystem will reduce by over 100%. This calls for conservation of forests at all costs.

9.2.2: Air Quality functions of Forests

Forests remove about 25% of the CO₂ emissions from the atmosphere. According to the Intergovernmental Panel on Climate Change (IPCC), the world is headed for painful problems sooner than expected as emissions keep rising (Leahy, 2018). The past decade has seen an astonishing run of record-breaking storms, forest fires, droughts, heat waves, coral bleaching and floods around the world with just 1.8 degrees Fahrenheit (1.0 degrees Celsius) of global warming. Much of this will get substantially worse with the expected 2.7 degrees Fahrenheit of warming, and far worse with 3.6 degrees Fahrenheit (2 degrees Celsius) according to the IPCC's Special Report on Global Warming of 1.5°C after examining 6000 studies.

The IPCC also reported that the 2.7°F global warming could be reached in as little as 11 years from 2018 and almost certainly within 20 years if there are no major cuts in CO₂ emissions. Even if such cuts were to begin immediately, the report warns that it would only delay, not prevent the 2.7°F of global warming. Limiting global warming to 1.5°C compared with 2°C would reduce challenging impacts on ecosystems, human health and wellbeing (Shukla, 2018). Such impacts include more erratic weather, stronger storms, dangerous heat waves, rising seas, large scale disruption of infrastructure and migration patterns. One of the solutions is to expand forest cover by 10 million square kilometres (1 billion hectares) globally by 2050. Even this will not be enough. This implies that all existing forests must be protected at all costs to avoid the predicted dangerous climate change. The earth's future is therefore inextricably tied to the future of its forests.

9.2.3: Bio-diversity

Vegetation zones and species distribution are distinguished according to the different climatic zones and altitudes, mostly through variation in vegetation structure, cover and composition. A trans-sect walk and observation of the type of the flora and fauna in Aberdare forest displays an already degraded forest zone as far as bio-diversity is concerned. The forest has a significant number of plant diversity but is dominated by *Leleshwa* shrub. Comparing with the bio-diversity level of the neighbouring Aberdares Forest which has about 778 species, sub-species and varieties of vascular plants belonging to 421 genera and 128 families, gives an impression that Aberdare forest has lost a lot in terms of bio-diversity. This is a situation that should not be allowed to deteriorate further.

9.2.4: Socio-economic functions of Forests

Forests provide cultural services such as spiritual worship. They are used as recreational, educational and research facilities. Forests provide water to rural communities for domestic use and irrigated agriculture. They also provide the same to urban centres for domestic and commercial use hence support livelihoods and economic development. Forests provide wood for fuel, construction, furniture and carvings. They are also used as a source of income for vendors. Forests also provide livestock forage. Forests provide medicinal herbs and food such as honey, wild fruits and game meat. Forests provide natural beauty.

9.3: CONCLUSION

From the results of this independent ESIA study for the proposed variation of boundary of Aberdare [Ndaragwa block] forest LN. No.48/194, to allow for expansion of Ndaragwa Township from 38.47 acres to 162.52 acres in Ndaragwa sub county, Nyandarua County, the ESIA concludes that:

- a) **Rare, endangered, threatened species (RETS):** The proposed variation will not majorly affect any RETS since there were no RETS documented and/or found within the 162.52 acres (65.77 ha) of Ndaragwa block of the Aberdare forest. However the ESIA study notes that in the long run, RETS (if) any will significantly be affected negatively as more of their habitat (the forest) is cleared. Further all the wild animals will move further away as the town moves closer to their habitat.

- b) **Water catchment areas** will also be affected negatively as follows:
- All the three rivers will be affected significantly and negatively with an overall reduction in stream flow since there will be little percolation of rain water.
 - Over 851,136 cubic metres of available water/year will be lost estimated at 12,400 cubic metres per/ha/year of forest cover lost.
 - In addition the water catchment ecosystem functions such as: flood mitigation, water storage, re-charge of ground water, reduced soil erosion and siltation, water purification, micro-climate regulation, nutrient cycling will cease.
 - There will also be increased atmospheric carbon-dioxide that may eventually cause climate change in the long term, leading to either increased, erratic or reduced rainfall. Increased atmospheric temperature will also lead to increased evapotranspiration hence increased water demand.
- c) **Biodiversity conservation:** since the proposed site is already occupied and some areas developed, the main biodiversity identified were the *Kikuyu grass*, *Leleshwa shrub* and scattered exotic and very few indigenous trees that is spread across the site. The site is also a habitat for various invertebrates such as insects. There were no wild animals within the project area. Thus the proposed variation will not have adverse impact on the local biodiversity. Nonetheless, the broader biodiversity ecosystem functions of the larger Aberdare Forest will be greatly impacted in the long run. In summary, as the vegetation will be cleared and the above and below ground fauna that depends on the vegetation will also cease.
- d) **Educational, cultural, recreational, health or research:** Currently no educational, cultural, recreational, health or research are being conducted/situated within the area proposed for variation.
- e) **Cumulative positive impacts:** The positive impacts of the proposed boundary variation include: addition of more land for provision of vital social and community facilities, availability of additional land for infrastructure and amenity development, increase of land available for housing, secure land tenure and related social and economic benefits, increased investment, employment and economic activities in general. Others include temporary increase in wood fuel supply.
- f) **Cumulative negative impacts:** The key negative impacts include loss of biodiversity, loss of water availability (at 12,400 cubic metres/ha/year), water quality

and regulation function of the forest, land degradation, reduction of air quality and regulation function of the forest, reduction in contribution to rainfall formation and increase in temperature. Others are poor landscape appearance, increase in concrete surface, increase in noise and vibrations and, loss of non-timber forest products such as honey, medicinal herbs and wild fruits.

- g) **Best alternative:** Alternative 2 has the highest combined environmental and socio-economic positive impacts. This option proposes varying of the boundary to accommodate only the already developed and surveyed area of the forest land of 162.52 acres (65.77 ha) of land for expansion of the town. This will ensure minimum or no additional loss of forest land.

The overall conclusion therefore is that the proposed variation of boundaries of Aberdare Forest (Ndaragwa Block) to allow for expansion of Ndaragwa Township from 38.47 acres (15.56 ha) to 300 acres (121.41 ha) as per survey plan FR 341/63 of 1991 is harmful to the environment in both the short term, medium term and long term. The boundary should therefore not be varied as proposed.

However, variation of the boundary as proposed in the 2007 Survey Plan whereby the land is varied from 38.47 acres (15.56ha) to 162.52 acres (65.77 ha) can be implemented since:

- (i) The impacts on all the four areas as per section 34 of the section 34 of the forest conservation and management act, 2016 covered above shall be minimal and insignificant during particularly the operation phase.
- (ii) Already 80% of the land has been developed/is occupied as urban land use. It has not been having an indigenous forest for the last 40 years as reported by the community during one of the stakeholders meeting.
- (iii) The mitigation measure for the 20% that has not been converted to urban land use - i.e. to be used for recreation sufficiently mitigates against all possible negative effects.
- (iv) The Ministry of Environment and Natural Resources and Kenya Forest Service approved variation of the boundary for 50 hectares for the town and 5.3 hectares for the Catholic Church through the letter of 12th July 2006 from the Permanent Secretary (**See Appendix 8**).
- (v) The Director of Survey, surveyed the land in 2006 and the survey plan was approved in 2007 (**See appendix 5**).

9.4: RECOMMENDATIONS

9.4.1: Boundary Variation

The proposed variation of the boundary of Aberdare Forest (Ndaragwa Block) to allow for expansion of Ndaragwa Township should be supported and approved as per the 2007 Survey Plan to change from 38. 47 acres (15.57 ha) to 162.52 acres (65.77ha) and NOT 300 acres (121.41 ha) as proposed by the petitioners.

9.4.2: Mitigation Plan

Mitigation measures that include best environmental management practices, recommended in this report, should be diligently implemented to help protect the physical, ecological and socio-economic environment of the affected forest area. Key players will need to undertake all necessary measures to ensure adverse impacts are mitigated to the extent practically possible during the different project phases.

9.4.3: Sustainable Policy Measures

The following policy measures should be adhered to:

- a) **Physical and land use planning**
 - Nyandarua County government should prepare a comprehensive Ndaragwa Town Local Physical and Land Use Development Plan (LPLUDP) as per section 45 of the Physical and Land Use Planning Act 2019 for:
 - a) Zoning (the process of dividing land into zones in which certain land uses are permitted or prohibited) of Ndaragwa Town;
 - b) Guiding and coordinating the development of infrastructure;
 - c) Regulating the land use and land development;
 - d) Providing a framework and guidelines on building and works development in the town.
 - Nyandarua County government should formulate Zoning guidelines/ordinance to guide densification of the urban commercial and residential developments to achieve a compact Ndaragwa Town. This will minimize expansion of urban areas into forest and agricultural land.

- Nyandarua County Government while preparing the Ndaragwa Town LPLUDP should mainstream sustainable land use planning principles.
 - Nyandarua County Government while undertaking the spatial and land-use planning of the town, should ensure that land and resource use is appropriately situated to maximize production without undermining or degrading biodiversity.
- b) **Waste Management**
- Nyandarua County Government in collaboration with NEMA and CSOs, NGOs and other informal groups in waste management through the PPP and consultative approach should:
 - a) Formulate policies, legislations and economic instruments to reduce waste quantities.
 - b) Inculcate responsible public behaviour on waste management through public awareness campaigns and education;
 - c) Promote waste segregation at source.
 - d) Promote resource recovery for materials and energy generation.
 - e) Establish environmentally sound infrastructure and systems for waste management.
 - f) Encourage where waste cannot be avoided, recovery of materials and energy from waste as well as remanufacturing and recycling waste into usable products should be the second option. Recycling leads to substantial resource savings.
 - g) Encourage eco-friendly production methods and proper treatment of special wastes (electronics, agricultural biomass, plastics).
 - h) Upscale the activities of the informal sector to link up with the existing formal recycling industries.
 - i) Establishment of infrastructure and systems for residual waste through a stepwise phasing out of illegal dumpsites to establishment of sanitary landfills.
 - j) Adopt the 7R (Reuse, Recycle, Reduce, Rethink, Refuse, Refill, Repairing) and/or an integrated solid waste management approach in the management of all waste streams.
 - k) Expand supply or /reticulate biogas generated at Ndaragwa Primary School for use in neighboring homes and businesses; create incentives for promotion of renewable energy sources for cooking, heating and lighting to save on electricity and serve areas that have no electricity connections.

c) **Water Catchments Biodiversity Mainstreaming and Climate Change Resilience**

- Nyandarua County government in collaboration with relevant agencies to:
 - a) Embed biodiversity considerations into County/town policies, strategies and practices of key public and private actors that impact or rely on biodiversity, so that it is conserved and sustainably used both locally and globally.
 - b) Consult and involve the public on the need for payment for ecosystem services (PES) as a revenue mechanism to support biodiversity conservation and to compensate resource managers for off-site ecological benefits associated with land-use practices that are compatible with biodiversity conservation such as recreational parks preservations, 10% plot tree cover etc.
 - c) Encourage afforestation and discourage forest degradation through partner agencies such as KFS and CFAs.
 - d) Encourage ecosystem-based adaptation through maintenance and restoration of indigenous forests and conserving and restoring of forests to stabilize slopes and regulate water flows to prevent floods.
 - e) Encourage green infrastructure provision and maintenance such as green roofs, rain water harvesting, rain gardens, bioswales, green streets, green parking, land conservation and increasing tree cover in Ndaragwa town.
 - f) Provide universal access to safe, inclusive and accessible, green and public spaces, in particular for women and children, older persons and persons with disabilities.
 - g) Encourage improving and changing production practices to be more biodiversity friendly, with a focus on sectors that have significant biodiversity impacts (e.g. agriculture, forestry, fisheries and tourism).
 - h) Carry out deliberate enrichment planting of the rare, endangered and threatened species along infrastructural corridors such as roads, foot paths, landscaping sites and within social amenity institutions such as health, educational and religious facilities.
 - i) Establish a botanical garden for educational and research purposes targeting all the indigenous species found in Aberdare Forest.
 - j) Promote massive tree planting by the neighbouring communities spearheaded by the Ndaragwa CFA.

d) Affordable and Clean Energy

- Nyandarua County Government in collaboration with relevant agencies to:
 - a) Ensure access to affordable, reliable and modern clean energy services such as LPGs, electricity, bio gas, solar energy, energy saving cook stoves and fuels etc. at subsidized rates.
 - b) Enhance cooperation through PPPs to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and to promote investment in energy infrastructure and clean energy technology.
 - c) Expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in Ndaragwa Town.
 - d) Initiate a youth focused clean energy support program to provide technical support and employment opportunities
 - e) Initiate women focused clean energy programs to promote adoption to alleviate health problems associated with firewood and charcoal and enable women and girls save time spent looking for firewood for investment in more productive activities.

e) Riparian Reserve Areas Conservation and Management

- Nyandarua County government should prepare a riparian reserve conservation plan for the affected areas such as the seasonal stream as a way to:
 - a) Ensure environmental services of riparian areas among others (1) hydrology and sediment dynamics, (2) biogeochemistry and nutrient cycling, and (3) habitat and food web maintenance are maintained sustainably.
 - b) Promote local eco-tourism.
 - c) Promote public recognition and awareness of the importance of riparian reserve areas conservation and management.
- The riparian reserve of the seasonal stream near the government offices to be developed into a recreational park. Activity nodes will also be created at intervals along the stream to attract users for activities such as picnics, hiking, jogging, walking, cycling and bird watching.
- Strategic citing of water retention trenches to enhance water percolation for underground water recharge and river flow regulation.

e) Tourism development and other recreational facilities

- Nyandarua County Government should support the CFA strengthen the existing partnership agreement with KFS to develop nature trails for walking safaris, map and secure the Mau Mau caves and provide the necessary utilities (such as latrine, water taps etc.) for use by tourists at the Ndaragwa Twin Falls. To also develop other tourism products such as a cultural manayatta with Kikuyu cultural artifacts, Mau Mau war story-telling and traditional Kikuyu dances,
- Provide sports facilities for children and the youth including play grounds and s a stadium. This will help control alcoholism, drug abuse, crime and other social vices.

REFERENCES

1. Africa Agenda 2063 (2015) - The Africa We Want.
2. Air Quality Regulations, 2013 (Legal Notice No. 34). Nairobi: Government Printer.
3. Convention on Biological Diversity (CBD), 1992
4. County Government Act, 2012. Nairobi: Government Printer.
5. Environment Impact Assessment Guidelines and Administrative Procedures of 2012 by NEMA
6. Environment Management and Coordination (Amendment) Act, 2015. Nairobi: Government Printer.
7. Environmental (Impact Assessment and Audit) Regulations (2003).Nairobi: Government Printer.
8. Environmental Management and Co-ordination (EMCA) CAP 387. Nairobi: Government Printer.
9. Forest Conservation and Management Act No. 34 of 2016. Nairobi: Government Printer.
10. National Environment Policy, 2013. Nairobi: Government Printer.
11. National Land Commission Act, 2012. Nairobi: Government Printer.
12. National Land Policy, 2009. Nairobi: Government Printer.
13. National Water Policy, 2012. Nairobi: Government Printer.
14. Noise and Excessive Vibration Pollution (Control) Regulations, 2009 (Legal Notice No. 25). Nairobi: Government Printer.
15. Occupational Health and Safety Act (OSHA), 2007. Nairobi: Government Printer.
16. Physical and Land Use Planning Act, 2019. Nairobi: Government Printer.
17. Public Health Policy, 1994. Nairobi: Government Printer.

18. Rio Declaration on Environment and Development (RDED), 1992
19. Sustainable development Goals (SDGs), 2015-2030. Nairobi: Government Printer.
20. The Constitution of Kenya, 2010. Nairobi: Government Printer.
21. The Forest Policy, 2014. Nairobi: Government Printer.
22. The Kenya Vision 2030. Nairobi: Government Printer.
23. The Land Act, 2012. Nairobi: Government Printer.
24. The National Land Use Policy, 2017. Nairobi: Government Printer.
25. The New Urban Agenda - Habitat III, 2016
26. The Public Health Act (Cap 242) of 2002. Nairobi: Government Printer.
27. UN Framework Convention on Climate Change (UNFCCC), 1992
28. Urban Areas and Cities (Amendment) Act, 2019. Nairobi: Government Printer.
29. Waste Management Regulations, 2006 (Legal Notice 121). Nairobi: Government Printer.
30. Water Quality Regulations, 2006 (Legal Notice No. 120). Nairobi: Government Printer.

APPENDICES