

**BOTSWANA EMERGENCY WATER SECURITY AND
EFFICIENCY PROJECTS**

**UPDATED ENVIRONMENTAL AND SOCIAL IMPACT
ASSESSMENT**

FOR THE

**NORTH EAST DISTRICT AND TUTUME SUB DISTRICT
WATER SUPPLY UPGRADING PROJECT**

March 2019

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ABBREVIATIONS

AIA	Archaeological Impact Assessment
BH	Borehole
BOS	Botswana Standards
BP	Bank Procedure
BSAP	Botswana Biodiversity Strategy Action Plan
BWNMP	Botswana Water National Master Plan
DEA	Department of Environmental Affairs
DFRR	Department of Forestry and Range Resources
DNMM	Department of National Museums and Monuments
DWMPC	Department of Waste Management and Pollution Control
DWNP	Department of Wildlife and National Parks
EA	Environmental Assessment
ECC	Environmental Compliance Certificate
ECOP	Environmental Codes of Practice
EIA	Environmental Impact Assessment
ESC	Enviro Solve Consultancy
ESMP	Environmental and Social Management Plan
ESIA	Environmental and Social Impact Assessment
ESS	Environmental and Social Standard
GRM	Grievance Redress Mechanism
GRS	Grievance Redress System
HAC	Human Animal Conflict
I&AP	Interested and Affected Party
IEC	Information and Education Campaign
IWRM	Integrated Water Resources Management
NACA	National Aids Coordinating Agency
NDP	National Development Plan
NGO	Non-Government Organization
OP	Operational Policy

PAP	Project Affected Person
PMU	Project Management Unit
PVC	Polyvinyl Chloride
RADP	Remote Area Development Programme
RAP	Resettlement Action Plan
RPF	Resettlement Policy Framework
RPM	RPM (Pty) Ltd
SADC	Southern African Development Community
SB	Statistics Botswana
SIA	Social Impact Assessment
TOR	Terms of Reference
VCP	Vulnerable Community Plan
WB	World Bank
WUC	Water Utilities Corporation

EXECUTIVE SUMMARY

Water Utilities Corporation (WUC) intends to upgrade the North East District and Tutume Sub-District Water Supply Project (hereafter referred to as the project) through the World Bank funding for Botswana Emergency Security and Efficiency Project (EWSEP). To actualize this infrastructure upgrade, WUC engaged Enviro Solve Consultants (Pty) Ltd (ESC) to review and update the current Environmental and Social Impact Assessment (ESIA) for the same scheme which was prepared by RPM (Pty) Ltd (RPM) in 2014.

1. Project Description and Rationale

The project entails the following;

- (i) Upgrading of Masingwaneng water treatment plant to bring it to its original design capacity;
- (ii) Construction of a 1,000cu.m break pressure tank and booster station at the Kalakamati village;
- (iii) Construction of pipeline from Kalakamati to Masunga village;
- (iv) Construction of 5000 cu.m. Mbalambi reservoir and pump station;
- (v) Construction of pipeline from Jackalas 1 to Siviya;
- (vi) Upgrading of the 800m Goshwe pipeline with 250mm diameter pipes; and,
- (vii) Upgrading the capacities and elevation of 12 village tanks.

The sub-project's development objective is to improve availability of water supply in drought vulnerable areas, increase the efficiency of WUC, and strengthen wastewater management in selected systems in the North East District and Tutume Sub-District respectively.

2. Location

The proposed project area covers a number of villages in the Tutume Sub-District (Matobo, Goshwe, Sebina Dagwi, Nkange, Nswazi and Tutume) and the most of the villages in the North East District (Siviya, Mabudzane, Jakalas No. 2, Ramokgwebana, Jakalas No. 1, Nlakhwane, Mbalambi, Masunga, Vukwi, Kalakamati, Makaleng and Masingwaneng).

3. Study Objectives

The overall objective of the ESIA is to align the proposed project with the requirements of the World Banks Operational Policies on Environmental Assessment (OP 4.01) and also to further identify environmental impacts likely to result from the proposed upgrade activities and to determine their significant impacts on the receiving environment and recommend measures to mitigate the impacts.

4. Approach to the Study

The study approach included desktop studies (review of the ESIA Report prepared by RPM in 2014, reconnaissance survey, public and stakeholder consultations involving technical departments, the general public and affected parties), analysis of alternatives, evaluation of impacts and development of mitigation measures and monitoring plan, Code of Conduct and Public Disclosure Plans.

5. Key Potential Impacts Identified

Ecological Aspects

The ecological assessment undertaken as part of the ESIA for the Project has identified a number of possible ecological impacts associated with the proposed development. All identified impacts were rated as being of moderate and low ecological significance. This derives from the fact that the current natural environment of the project area has realised long-term anthropogenic influences that have over time diminished the biodiversity value. This includes a drastic reduction in wildlife populations, save in private holdings, and high human density that is often inversely related to biodiversity value. The potential negative impacts on biodiversity is of low significance and could be further reduced through proper implementation of the suggested mitigation measures/ management actions.

Hydrological Aspects

Ground/surface water pollution may occur during the construction phase as a result of hydrocarbon (fuel, oil, grease) spillages. In addition, poor waste management practices such as improper disposal of used oils and lubricants and other potentially toxic effluents pose a risk to groundwater pollution.

Socioeconomic Aspects

Economy

The proposed project will result in improvements to the local economy from increased employment, during all the phases of development, and from the improved supply of water to the target villages. Therefore, the local economy, lifestyle and community wellbeing, amongst others, would be improved. This also includes most importantly the improvement in service delivery and infrastructure as health facilities and schools among others will have adequate water supply.

However, for the community to fully benefit from the scheme, deliberate measures must be put in place to empower the local population. The benefits in the form of both the income and employment multiplier could have far reaching benefits to the local population.

Health and Safety

The envisaged benefits notwithstanding could be offset by social ills that may result from an influx of job seekers. An increase in the numbers of people in the project area could lead to more spread of HIV/AIDS. The public health and safety could be compromised during construction due to open trenches and generation of dust. Unmarked open trenches are a potential hazard in densely populated areas. Dust generation could compromise air quality resulting in contraction of respiratory ailments by both the general public and construction crew.

Archaeological Aspects

Significant archaeological materials were recovered during field exercise. The findings recorded were scattered ceramics possibly belonging to the Iron Age communities as detailed in the archaeology report appended. The findings were sporadic and were recorded as ‘occurrences’. Due to the fact that most cultural/heritage remains may occur below surface, the possibility exists that some features or artefacts may not have been discovered/ recorded during the survey. There is a high possibility that during both the construction and operational phases, more archaeological materials will be encountered. The more excavation that is done, the more likely that important materials possibly belonging to the early stages of human development will be encountered. It is therefore incumbent upon the developer to stop operations and inform the relevant heritage agency should further cultural remains, such as stone tool

scatters, artefacts, bones or fossils, be exposed during the process of development. Any changes or deviations of the water supply line will have to be assessed separately.

The whole development route is ranked No. 4 on the Department of National Museums and Monuments (DNMM) Grading Scale which reads; systematic preventative sampling sufficient. Ranking No. 4 means that the site is medium with high chance discovery therefore an Archaeological Watching Brief (monitoring) and Archaeological Awareness Program (AAP) during all earthworks is recommended. The programs should be implemented and monitored by an accredited Archaeologist with the DNMM, on periodic basis, during the implementation of the project. An Archaeological Awareness Program should also be undertaken prior to the commencement of the project to cater for chance discoveries in the absence of an Archaeologist.

Table 1: Summary of Potential Impacts

Phase	Environmental Aspect	Potential Environmental Impact	Impact Significance Rating (e.g. Low, Moderate, high)		Impact Significance (Negative, Neutral, Positive)
			Before Mitigation	After Mitigation	
Construction					
	Biophysical				
	Soil	Soil contamination	Moderate	Low	Negative
	Water Resources	Groundwater contamination	Moderate	Low	Negative
	Biological Resources				
	Flora	Loss of vegetation cover	Low	Low	Negative
		Increased risk of wild fires	Low	Low	Negative
	Fauna	Increased risk of wildlife mortality due to pitfalls	Low	Low	Negative
		Changes in wildlife behaviour & wildlife habituation	Low	Low	Negative
		Increased incidents of negative human-wildlife interactions	Moderate	Low	Negative
		Increased risk of illegal harvesting of biodiversity resources	Low	Low	Negative
	Socio-economic				
		Employment creation	High	High	Positive
		Boost to local economy	Moderate	Moderate	Positive
		Potential encroachment onto existing properties	Moderate	Low	Negative
		Shortage of amenities	Moderate	Low	Negative

Phase	Environmental Aspect	Potential Environmental Impact	Impact Significance Rating (e.g. Low, Moderate, high)		Impact Significance (Negative, Neutral, Positive)
			Before Mitigation	After Mitigation	
		Compromised safety due to excavation works	Moderate	Low	Negative
		Compromised safety from working at heights	Moderate	Low	Negative
		Compromised air quality due to generation of dust	Moderate	Low	Negative
		Land pollution (from improper waste management)	Moderate	Low	Negative
Operation/Maintenance					
	Biophysical				
	Soil	Soil contamination	Low	Low	Negative
	Water Resources	Groundwater contamination	Low	Low	Negative
	Socio-economic				
		Improved livelihoods due to water availability	High	High	Positive
Decommissioning					
	Biophysical				
	Soil	Soil contamination	Moderate	Low	Negative
	Water Resources	Groundwater contamination	Moderate	Low	Negative
	Socio-economic				
		Employment creation	Moderate	Moderate	Positive
		Compromised safety due to decommissioning works	Moderate	Low	Negative
	Land pollution (from improper waste management)	Moderate	Low	Negative	

6. Environmental and Social Management Plan

An Environmental and Social Management and Monitoring Plan has been developed to facilitate implementation of mitigation and enhancement measures. The Plan is accompanied by a Public Participation and Disclosure Plan whose key objective is to build a rapport with the project community through provision of continuously updates on the project throughout all the development phases. Environmentally and socially acceptable implementation of the proposed project can only be achieved if WUC, and the other parties involved, faithfully implement recommendations of this ESMP.

7. Conclusion

The detailed studies undertaken for the proposed upgrade for the North East District and Tutume Sub District Water Supply Project have established that the natural and socio-economic environment is capable of receiving the proposed project without detrimental impacts of a high significance. The envisaged impacts can successfully be mitigated/ managed to attain sustainable development.

8. Overall Study Recommendation

Most of the identified potential negative impacts of the proposed project can successfully be mitigated and the positive impacts enhanced. Therefore, the study recommends that the proposed project proceed providing that the recommended mitigation and monitoring measures are implemented.

1 INTRODUCTION

This document presents the report for the updated Environmental and Social Impact Assessment (ESIA) for the upgrade of the North East District and Tutume Sub-District Water Supply Upgrading Project (hereafter referred to as the project) through the World Bank Funding for Botswana Emergency Security and Efficiency Projects (EWSEP). The updated ESIA Report aims to align the proposed project with the requirements of the World Bank's Operational Policies.

1.1 Background to the Project

The Project supplies water to 52 villages, spanning across the Central and North East Districts, comprising of 16 and 36 affected villages, respectively. The population of all the villages in the scheme stood at 88,478 people as per 2011 official population census report. This population is projected to grow at a rate of 1.9% to around 107,000 in 2021. The most densely populated village in the scheme is Tutume, which had a population of 17,528 people as at 2011. The village's population is projected to increase to about 21,300 people in 2021. These projected population sizes are followed by Maitengwe having a population of 5,890 people as at 2011, and projected to increase to a population of 7,100 people in 2021. Masunga village's population was at 5,666 people in 2011 and is projected to grow to around 6,900 people in 2021. All other villages have populations below 5,000, with the least populated village being Botlaote at 173 people in 2011.

All the project demand villages are located in the north-eastern part of Botswana, and can be accessed by roads turning off the Francistown-Nata Road, along the Sebina-Tutume-Maitengwe Road and from the Francistown-Ramokgwebana Highway (A1 Road). Access to these villages is either via bitumen-surfaced or well-maintained gravel roads. This scheme falls under the Masunga Management Centre, with its headquarters being located at Masunga village. The Centre has satellite offices located at various villages in the management area for ease of operational activities and closeness to customers. Masunga is the location of the headquarters of the Management Centre as well as the headquarters of the North East District Council.

For several years, villages in the water scheme have been experiencing acute water shortage mainly due to inefficiency of the water infrastructure that supplies the area. The two sources of water that supply the area are Ntimbale Dam, through Masingwaneng Water Works, which is supposed to produce 14,000 m³/day of water per day but only managing 7,200 m³/day currently. Conjunctive to the Ntimbale Dam is the Maitengwe Wellfield, a borehole system that supplies most villages in the Tutume Sub-District. The boreholes have a recommended extraction rate of 3,290 m³/day but currently being extracted at a rate of 8,640 m³/day which depicts over extraction. The two components of the scheme are interconnected by the Mbalambi-Goshwe pipeline, a 17km 300mm diameter ductile iron pipeline which can transfer water from either side of the scheme components. The water schemes were designed with a notion that, the entire demand area would be supplied from Ntimbale Water Works, with the Maitengwe Wellfield being a back-up.

In June 2013, WUC engaged a consultant to thoroughly investigate the water supply scheme and come up with solutions that can ensure that the scheme is utilised effectively so that water can reach out to the consumers..Due to passage of time WUC engaged another consultant in June 2018 to review the 2014 designs which advised preparation of this report.Recommendation for improvements to the water supply scheme are detailed in final design reports. Implementation of the consultant’s recommendation would require specialists with technical knowledge and experience in pump stations, reservoirs structures, water pipelines, mechanical and electrical works, and having worked in live water structures previously.

1.2 Project Rationale / Objective

The project’s development objective is to improve the availability of water supply in drought vulnerable areas, increase the efficiency of WUC, and strengthen wastewater management in selected systems in the North East District and Tutume Sub-District respectively.

1.3 Location

The proposed project covers some villages in the Tutume Sub-District (namely Matobo, Goshwe, Sebina Dagwi, Nkange, Nswazi and Tutume) and the most of the villages in the North East District (namely Siviya, Mabudzane, Jakalas No. 2, Ramokgwebana, Jakalas No. 1, Nlakhwane, Mbalambi, Masunga, Vukwi, Kalakamati, Makaleng and Masingwaneng).

1.4 Study Objectives

Apart from aligning the proposed project with the requirements of the World Bank’s Operational Policies on Environmental Assessment (OP 4.01), the current study also seeks to:

- Assess the current environmental and social conditions;
- Identify key environmental and social issues;
- Assess the magnitude of predicted impacts of the proposed project;
- Develop mitigation measures through an Environmental and Social Management Plan (ESMP) and Environmental Codes of Practice (ECOP) that address the potential impacts and risks of the sub-projects; and
- Determine the environmental monitoring and reporting requirements, emergency response procedures, institutional or organization arrangements, and capacity development measures to ensure the implementation of the ESMP.

1.5 Approach to the Study

Desktop studies

Desktop studies were undertaken to address information gaps identified as part of the development of the study specific Terms of Reference (ToRs). The review of the previous study by RPM and other studies conducted in the study area was pivotal at this stage.

Reconnaissance Surveys

A field survey was undertaken by the consulting team; the surveys were mainly to close the information gap from the desktop studies. The surveys entailed traversing the pipeline corridor route by foot and visiting the sites proposed for the placement of elevated tanks and other associated infrastructure.

Public and Stakeholder Consultations

There was a need for further stakeholder consultations with various technical departments as part of the update of the ESIA. These were due to the need to close up gaps identified during the previous study. In addition, consultations aimed to establish if there were any alterations required in the institutional processes, and if any, to get a better understanding of their bearing on the study. The consultation also assisted in reminding local communities about the objectives of the proposed project.

Analysis of Alternatives

This entailed identification and assessment of alternatives sites for the proposed components (placement alternatives) such as the new pipeline and elevated water storage tanks.

Identification, Evaluation of Impacts

The key issues identified during the review formed the basis for identification of impacts and categorisation based on their nature (negative, neutral or positive). These impacts were then subjected to environmental impact evaluation criteria to add objectivity to the assessment process. Mitigation measures/ management actions were then proposed to reduce negative impacts of a high significance and enhance positive impacts.

Development of Implementation Tools

The following implementation tools have been developed to facilitate environmentally sound implementation of the proposed works.

- Mitigation/ Environmental and Social Management Plan
- Environmental Monitoring Plan
- Decommissioning Plan
- Public Disclosure Plan

- Contractors Code of Conduct
- Stakeholder Engagement Plan

1.6 Structure of the Report

The report has been structured as follows:

Chapter 1: Introduction

This chapter introduces the Project and provides background including major components of the proposed project including the purpose, objectives and the location. Page 1.

Chapter 2: Policy, Legal and Administrative Framework

This chapter highlights the policy, legal and administrative framework that governs the implementation of the proposed project. Page 6.

Chapter 3: Project Description

This chapter provides a detailed description of the proposed project and the information in the report derives from a desktop study mainly as provided by the Client/ Project Proponent (WUC) and the Funder (The World Bank) and the environmental consultants from field survey. Page 27.

Chapter 4: Outcomes of Environmental Audit

This chapter serves to identify gaps from the previous EIA study undertaken by RPM Consultants. Page 40.

Chapter 5: Baseline Environment

In order for an ESMP to achieve its overall aim of protecting the environment, appreciation of the baseline setting is paramount. Thus chapter 4 purports to present the key aspects of the project receiving environment to enable among others, identified impacts from interface of project activities and the receiving environment. Page 47.

Chapter 6: Stakeholder Consultations

This chapter serves to capture all consultations undertaken during the study. This is a fundamental aspect of any environmental and social assessment process. Page 70.

Chapter 7: Analysis of Alternatives

This chapter analyses different alternatives and then recommends the best option (i.e. alternative) for implementation (and assessment). This is particularly relevant in relation to siting of infrastructure and technology adopted where applicable. Page 73.

Chapter 8: Identification and Assessment of Environmental Impacts

This chapter provides a detailed account and analysis of impacts by all specialists. Identified impacts were evaluated, and mitigation and enhancement measures outlined. The key outcomes of which will be the implementation tools that include the impact management and monitoring plans. Page 79.

Chapter 9: Archaeological Impact Assessment

This chapter provides a summary of the Archaeological Impact Assessment study which is appended to this report. Page 92.

Chapter 10: Environmental Management Plan

This chapter comprises of the impact mitigation and monitoring plans that are central to implementation and auditing of the suggested mitigation measures. An action plan or system which addresses the how, when, who, where and what of integrating environmental mitigation and monitoring measures throughout an existing or proposed operation or activity. Page 95.

Chapter 11: Conclusions and Recommendations

This chapter summarizes the report as a whole, drawing inferences from the entire process about what has been found, or decided, and the impact of those findings or decisions. It also contains recommendations to the project which are concise and clear. Page 123.

Chapter 12: References

This include all sources used in the study and they have been listed in alphabetical order. Page 126.

Chapter 13: Appendices

Appendices contain information that supports the content in the report and are needed for reference or detailed review by technical experts. Page 127

2 POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

2.1 World Bank Standards (Environmental and Social Policies)

1.1.1 OP 4.10 - Indigenous Peoples Policies

1. This policy contributes to the Bank's mission of poverty reduction and sustainable development by ensuring that the development process fully respects the dignity, human rights, economies, and cultures of Indigenous Peoples. For all projects that are proposed for Bank financing and affect Indigenous Peoples, the Bank requires the borrower to engage in a process of free, prior, and informed consultation. The Bank provides project financing only where free, prior, and informed consultation results in broad community support to the project by the affected Indigenous Peoples. Such Bank-financed projects include measures to (a) avoid potentially adverse effects on the Indigenous Peoples' communities; or (b) when avoidance is not feasible, minimize, mitigate, or compensate for such effects. Bank-financed projects are also designed to ensure that the Indigenous Peoples receive social and economic benefits that are culturally appropriate and gender and intergenerational inclusive.
2. The Bank recognizes that the identities and cultures of Indigenous Peoples are inextricably linked to the lands on which they live and the natural resources on which they depend. These distinct circumstances expose Indigenous Peoples to different types of risks and levels of impacts from development projects, including loss of identity, culture, and customary livelihoods, as well as exposure to disease. Gender and intergenerational issues among Indigenous Peoples also are complex. As social groups with identities that are often distinct from dominant groups in their national societies, Indigenous Peoples are frequently among the most marginalized and vulnerable segments of the population. As a result, their economic, social, and legal status often limits their capacity to defend their interests in and rights to lands, territories, and other productive resources, and/or restricts their ability to participate in and benefit from development. At the same time, the Bank recognizes that Indigenous Peoples play a vital role in sustainable development and that their rights are increasingly being addressed under both domestic and international law.

1.1.2 Applicability to the updated Environmental and Social Impact Assessment (ESIA) for the upgrade of the North East and Tutume Sub-District Water Supply Upgrading Project

North East and Tutume Sub-District does not have Indigenous People and the areas are predominantly Bakalanga. Nonetheless this does not mean social assessment should not be carried out. Proposed project will affect people's social life in terms of potential positive and

adverse effects. Most of the expected impacts are positive. Most of positive impacts are related to issues of unemployment and poverty.

1.1.3 Involuntary Resettlement OP 4.12

The World Bank's Policy on Involuntary Resettlement (OP 4.12) applies to all project components that have only direct economic and social impacts due to expropriation of land or restriction of access to natural resources irrespective of number of affected people, severity of loss and ownership rights. Key principles and policy objectives of OP 4.12 can be summarised as:

- To minimise or avoid involuntary resettlement where feasible and to explore all viable alternative project designs.
- To conceive and implement resettlement activities as sustainable development programs where affected people are provided with sufficient investment resources and opportunities to share in project benefits.

1.1.4 Applicability to updated ESIA for the upgrade of the North East and Tutume Sub-District Water Supply Upgrading Project.

In-case of the updated ESIA for the upgrade of the North East and Tutume Sub-District Water Supply Upgrading Project the design, survey and consultations carried showed that no resettlement is anticipated therefore OP .12 will not be triggered.

2.2 Botswana Regulatory, Administrative and Legislative Framework

Legislature

2.2.1.1 Environmental Assessment Act No. 10 of 2011

The Environmental Assessment (EA) Act 2011 requires that all the developmental interventions be subjected to an environmental impact assessment. Such interventions include both existing and proposed developments. The assessment must identify, evaluate and mitigate impacts throughout the development life cycle, namely Pre-construction, Construction and Decommission. The Environmental Impact Statement (EIS) developed from the EIA study must include an Environmental Management Plan (ESMP) and is subject to review and approval by the Department of Environmental Affairs (DEA). The ESMP must follow the life cycle categories so that impacts unique to specific stages are clearly addressed.

The Act in Part V Section 20 clearly indicates the need for monitoring the implementation of mitigation measures to ensure compliance to agreed mitigation measures during and after project implementation. The Act imposes a fine not exceeding P100 000 or a term of imprisonment not exceeding five years or both to any person who contravenes the provisions of the Act.

The Environmental Assessment Act No. 10 of 2011 is read together with the Environmental Assessment Regulations of 2012, which outline the requirements for environmental assessment reports in terms of content as well as the qualifications of the persons expected to undertake environmental assessment work. Schedule 3 of the regulations highlights fees that DEA charges for services rendered based on the cost of the overall project.

The key components of the EA Act, applicable to the proposed development are:

- Requirement for a project brief
- Requirement for public participation during Scoping;
- Preparation of terms of reference for the environmental statement;
- Review process including informing the public of the review process (at the developers expense);
- Conduct of public hearings in the event of public concern over the development activity;
- Approval process by the competent authority;
- Authorization of the statement and possibility of validity period attached to an authorization granted by the competent authority;
- Requirements for monitoring during the post EIA period;
- Submission of evaluation reports to relevant technical departments or local authorities;
- Environmental audits to be carried out by the competent authority;
- Failure of developer to comply with the provisions of the audit, may result in a revoked or modified authorization; and
- The terms of reference, statements, reports and decisions prepared under the Act shall be public documents.

WUC must recognize the EIA and ESMP as legal documents that must be followed to ensure proper mitigation and monitoring of potential impacts arising from the development and operation of the sub-project.

2.2.1.1.1 Environmental Assessment Regulations of 2012

The purpose of the EA Regulations is to aid implementation of the EIA process as per the EA Act, 2011. The regulations provide direction in achieving the implementation of the Act. They are also designed to integrate the EIA process into planning process to ensure timely consideration of environmental factors and to avoid delays. The regulations provide guidance on how exercises such as EIA should be presented (Form D & E, Regulation 7 and 8), including the content of the report. This ESIA report therefore follows the outline as required by the regulations.

2.2.1.2 Water Act of 1968 (Part V)

The Act defines rights of use and ownership of water and provides for the granting of water rights and servitudes. Water in rivers, streams, lakes, pans, swamps, or beneath watercourses, or underground water, as well as in works such as canals, reservoirs and dams is public water. Such water can only be used with permission granted by the Water Apportionment Board. The Act states that there will be no right of property in public water including groundwater and water in any natural streams, rivers, lakes and dams. It covers all aspects of water abstraction and disposal of effluent into natural streams in the North East District and Tutume Sub-District.

2.2.1.3 Water Utilities Corporation Act Cap 74:02

The Act provides for the establishment of the water utilities Corporation (WUC) with the legal duty to supply and distribute water to various waterworks areas. By the declaration of Waterworks Areas Order of 1970, this legislation also outlines the role of the WUC and its responsibilities towards the Botswana people. The Act confers the following powers to WUC to acquire rights to take water, construct, make, order or purchase, expropriate or take over and manage the works for supply of water in the North East and Tutume District. The Act supports the principles of co-operative governance and integrated decision making.

2.2.1.4 The Mines, Quarries, Works and Machinery Act of 1978 amended as in No. 54 of 2005.

The Act provides for the safety, health and welfare of persons engaged in prospecting, mining and quarrying operations including any works which part of are and supplementary to mining and quarrying operations. It also makes provision with respect to the inspection and regulation of mines, quarries, works, and of associated machinery, as well as for matters accompanying the aforementioned. This Act provides regulations as to among others, the conduct required from the contractor, supervisor and employees at a project location.

The obligations of these Acts respectively should be observed by WUC to ensure preservation of the natural environment and maintenance and restoration of land suitability to a condition in which it was prior to commencement of the project, and to ensure the required working conditions for individuals operating at waterworks.

2.2.1.5 Mines and Minerals Act No. 17 of 1999

The Act has a provision for regulations which relate to, among others, the protection of the environment. It specifies the developer's environmental obligations so that environmental damage is minimized, and that rehabilitation of the site is undertaken within a reasonable time. These obligations include:

- As far as possible, the preservation of the natural environment, minimization of waste, and prevention and treatment of pollution and contamination;
- Rehabilitation from time to time and ultimately reclamation in so far as is practicable in a manner acceptable to the Director of Mines;
- For any operations (such as excavation, waste dumps, and ponds), the undertaking of appropriate measures from time to time to maintain and restore the top soil of affected areas and otherwise restore land substantially to a condition in which it was prior to the commencement of the operations; and
- In the event of an emergency, which, among others, affects natural or biological resources, taking immediate actions as directed by the Director of Mines.

This Act shall be used to guide most of the excavation activities conducted by WUC in terms of construction of access roads, trenching, and any land clearance for refurbishment.

2.2.1.6 Atmospheric Pollution (Prevention) Act No. 33 of 1971

This Act is intended for the prevention of the pollution of the atmosphere from industrial processes. The Act requires that Air Pollution Control Officers are satisfied that proposed industrial activities do not conflict with local land uses within the project environs. The flexibility or dynamism of the Act in terms of regulations is provided in Section 15. In view of this, the Department of Waste Management and Pollution Control (DWPMC) and Botswana Bureau of standards (BOBS) have developed standards for air quality indicating allowable maximum measurement of major indicators of pollution such as carbon-monoxide, and Nitrogen dioxide among others. The Act is relevant to the sub-project provided that there would be emissions from the equipment (e.g. excavators, diesel fuelled backup generator), vehicles and other combustion processes that may produce smoke or other emissions resulting in air pollution.

2.2.1.7 Herbage Preservation Act No. 37 of 1978

The Herbage Act aims to prevent and control bush and other fires. In order to preserve existing vegetation on land, the Act defines as growing or standing vegetation, any tree or part thereof and any bush, shrub, brushwood, undergrowth, grass, crops or stubble. Section 4(1) of the Act prohibits, without permission any person from setting fire to any vegetation on land, which he is not the owner or in lawful occupation.

2.2.1.8 The Tribal Land Act of 1970 (Chapter 32:02)

The Act provides for the administration of tribal land by Land Boards. This Act (CAP 32:02) describes the responsibility of tribal Land Boards relating to tribal land and explains their authority in relation to subsequent land issues. It explains the procedure and actions to be taken in the allocation and

compensation for lost tribal land. The Act articulates, under Section 33(2), that it is essential that direct payment of compensation be made to the claimants.

The Act is an important reference guide to the compensation procedures if uptake of parts of property is considered an option.

2.2.1.9 The Acquisition of Property Act No. 42 of 1971

The Acquisition of property, provides for “authorising the acquisition of property for public and other purposes, and for settling the amount of any compensation to be paid, or any matter in difference”. This Act will come in effect as and when land is expropriated for the proposed water supply scheme. Reference should therefore be made to this Act during compensations that may be conducted by WUC and the Land Board in line with The World Bank safeguards policies OP 4.10.

The Act regulates the transactions, which involves the sale and purchase of agricultural land, provides for the control of transactions in agricultural land. In section 3(1) of the Act, no dealings in agricultural land are to occur without the consent of the Minister and section 3(1) (a) states that the sale, transfer, exchange, partition or other disposal or dealing with any agricultural land and if the party acquiring any interest in such land or in such shares is a person who is not a citizen of Botswana, be void for all purposes unless the Minister has given his consent in respect of that transaction in accordance with this Act. The proposed water supply scheme in North East District and associated refurbishments will have to conform The World Bank Safeguards Policies OP 4.10, 412 and Resettlement Policy Framework if WUC wishes to acquire any land from farmers located within the project area.

2.2.1.10 Monuments and Relics Act No. 12 of 2001

Preserves and ensures sustainable use of historical as well as archaeological resources. Section 18 (1) of the Act makes it an offence for anyone to make an alteration to, destroy or damage any archaeological remains without the written consent of the relevant authorities. The Act, in section 19 (2), makes it a pre-requisite for anyone wishing to undertake any major development to conduct an Archaeological Impact Assessment (AIA). The Act further allows for mitigation by a person of approved credentials in cases where archaeological remains occur within the proposed area where developments are to take place. One other important and relevant aspect of the Act that needs to be emphasised is Section 10 subsections 2 and 3. Here the Act outlines that; ‘Land on which a national monument is situated shall not be used for purposes other than the protection and preservation of the national monuments, unless approval has been given by the relevant authorities.

Subsection 3 on the other hand stresses that ‘no development within 1 kilometre of any national monument shall take place without the minister’s prior written approval, which approval shall not be granted unless the Minister is satisfied that-

- Such development will not be incompatible with the preservation of the national monument; or
- It is in the national interest for such development to be undertaken’.

It is in this regard that the importance of a detailed archaeological impact assessment undertaken by the professional archaeologist is emphasised for this WUC project so as to establish the presence and/or

absence of archaeological sites within and around the project area. The technical assessment would also need to determine the potential impacts of the proposed infrastructure on the archaeology and heritage resources, and suggest mitigation/ management action to eliminate or reduce any impacts of a negative nature.

2.2.1.11 Conveyance of Dead Bodies Act of 1933 (Chapter 65:01)

The Conveyance of Dead Bodies Act establishes the procedure for conveyance of dead bodies from one district to the other. The Act provides that authority must be sought from the District Administration officer who shall satisfy himself or herself that such conveyance of dead bodies does not present a health risk to the community or places through which it traverses to its internment site. Further, the Act provides that re-internment must be done within 24 hours of the arrival of remains at the reburial site. This act is normally triggered when sites have been identified with human burial remains, which sites may have to be salvaged.

2.2.1.12 Town and Country Planning Act of 2013 (Chapter 32:09)

Provides for the orderly and progressive development of land in both urban and rural areas in order to preserve and improve the amenities thereof. The Act requires that development plans for all areas in the North East District and Tutume Sub-District declared as planning areas be approved (Section 11). Part II of the Second Schedule makes provision for buildings and building plots with regard to size, height, lines, coverage, space, car parking, and other requirements for regulating and controlling such matter.

2.2.1.13 Waste Management Act of 1998 (Chapter 65:06)

This Act provides for the management and control of waste. According to the Act¹, waste is defined as household, industrial, commercial, clinical, or hazardous waste all of which constitute the umbrella term-controlled waste. The Act which establishes a system for the registration and licensing of waste disposal carriers and facilities, also introduces waste management plans and various enforcement powers. WUC must be cognisant of the requirements of this Act as the proposed project will generate various waste types (e.g. construction waste materials) during the different project phases.

2.2.1.14 Waste Management Strategy Act No. 107 of 1998

Waste management will be carried out in a manner that protects human health and the environment, and that ensures prudent use of natural resources. It captures the principles of prevention; the polluter pays principle; and the principle of cooperation. The strategy has adopted an internationally acceptable Waste Management Hierarchy (i.e. Waste reduction → Waste Reuse and Recycling → Treatment → Disposal) to minimise wastes. The Strategy's guidelines and case studies provide a detailed framework for site selection and identification of key issues. Human and other waste generated during the construction of the project will be managed in accordance with the recommendations of the strategy.

¹ Waste Management Act (1998) p.4

2.2.1.15 Public Health Act No. 16 of 1981

The Public Health Act, relates to the well-being of the country's citizens by making provisions for public health. Essentially, it makes notification of certain diseases compulsory and seeks to prevent and control the spread and introduction of communicable diseases within and into the country. It also seeks to regulate sanitation and provides for the protection of water supplies.

Part IX, section 57 of the Act makes it mandatory for public health officers to take all practicable and lawful measures to ensure the purity of any public water supply which has the right to be used for drinking or other domestic purposes and to take action against any persons found polluting any such supply or streams. The Act is relevant in protecting public health from any harmful activity/effluent that might be attributed to the construction works in the project area.

2.2.1.16 Public Health Act of 2013 (Chapter 63:01)

Protects the quality of water used by the public, by controlling the disposal of polluted water and control of mosquito larvae. The following shall be deemed to be a nuisance liable to be dealt with in the manner provided in this Part:

- a) Any well or other source of water supply or any cistern or other receptacle for water, whether public or private, from which the water is used or is likely to be used by human beings for drinking or domestic purposes or in connection with the manufacture or preparation of any article of food intended for human consumption, which is in the opinion of a health officer polluted or otherwise liable to render water injurious or dangerous to health.
- b) Any noxious matter or waste water flowing or discharged from any premises wherever situated, in to any public street, or in to water course, irrigation channel or bed of water course or irrigation channel or any adjoining land not approved for the reception of discharge.

The management of dams and water reservoirs shall be managed in accordance with the Act.

2.2.1.17 Road Traffic Act No. 13 of 2001

An Act to provide for the registration and licensing of motor vehicles; for the issue of driving licences; for the creation of offences relating to the use of vehicles and for the regulation of traffic; and for matters incidental thereto. Subsidiary legislation enhances some of the aspects in the road Traffic Act. This Act applies to the development which is along the road. Adherence to the Act is essential to prevent accidents especially during construction. According to the Act, a road authority may cause or permit traffic signs to be placed on or near a road. Traffic signs shall be of the prescribed size, colour and type except where the Minister authorizes the erection or retention of a sign of another character. The Act goes on to prohibit the encroachment and/or damage to roads without written permission from the appropriate road authority.

The Act requires that if a vehicle is involved in or contributes to any accident whereby the death of or injury or damage to any person, property, cattle or other domestic animal is caused, the driver of the vehicle shall give his name and address, the name and address of the owner of the vehicle and of the

company with whom the vehicle is insured and the registration number of the vehicle. In the case of such an accident, the driver of the vehicle shall report the accident at a Police station or to a Police officer as soon as it is reasonably practicable to do so and in any event within 48 hours immediately after the accident. This Act should be used by WUC when applying for the use of road traffic warning signs for the proposed project.

2.2.1.18 Agricultural Resources Conservation Act of 1973 (Chapter 35:06)

The Act makes provision for the conservation and improvement of the agricultural resources of Botswana. The Act defines agricultural resources in Section 2 as soils, water, animal life and fauna (animals, birds, reptiles, fish and insects) and other things to be declared as agriculture resources by regulations. By this definition, the Act covers a wide range of environmental issues, which are relevant to the project provision. Sections 16 and 18 of the Act explicitly provide for the protection of the physical environment including the protection of slopes, protection of land against erosion, preservation of vegetation, prevention of silting of water resources, preservation of the soil and its fertility and the drainage of land (construction, maintenance, or repair of artificial or natural drains, gullies, contour banks). All construction and operations activities in all project sites in the North East and Tutume District must be in line with this Act such that environmental degradation of the area is minimized if not avoided.

2.2.1.19 Wildlife Conservation and National Parks Act No. 28 of 1992

The Wildlife Conservation and National Parks, provides for the protection of game animals in Botswana. In Part IV, section 17 of the Act, it is specified that “No person shall, except only under and in accordance with the terms and conditions of a permit issued by the Director of the Department of Wildlife and National Parks under section 39 or section 40 hunt or capture any protected game animal”. Part V, section 18 of the Act also makes reference to partially protected game animals throughout Botswana, and that no person shall, except under and in accordance with the terms and conditions of a licence or permit issued under the Act, hunt or capture any partially protected game animal.

The proposed project in Tutume and North East is in an environment characterised by the presence of wildlife including hares, baboons and veld products (foods, medicines, craft materials, tannins, gums, resins, dyes, essential oils, florist materials, ornamental plants, insects, horns, hides, skins and many other renewable natural resources). In accordance with this Act, personnel engaged to work on the project should not hunt or harvest veld products without permission from the wildlife authority.

Policies and Guidelines

2.2.1.20 Waste Water and Sanitation Policy of 2001

This provides a framework for the development of affordable and sustainable wastewater/sanitation infrastructure and management. It calls for the protection and improvement to public health. It calls for the prevention of pollution of natural resources, water resources in particular and for water conservation.

The overall aims of the policy are to:

- a. Provide the framework for the development of affordable and sustainable wastewater / sanitation infrastructure and management
- b. Protect and improve public health
- c. Prevent pollution of natural resources; water resources in particular
- d. Conserve water resources

Few of the key objectives of the policy are to create institutional and organizational facility, legislative and regulatory framework, development of proper planning concept and human resource, develop appropriate – affordable – sustainable system, pollution control, and cost recovery and private sector participation. The proposed facility has to commit to fulfilment of the aims and objectives of the policy.

2.2.1.21 Botswana National Master Plan for Waste Water and 2003

The plan provides the long term strategy for sanitation and treatment of wastewater (until 2030). Possible study implications include:

- a) Encouraging re-use and recycling and compliance with the 2030 target of 98% re-use and recycling.
- b) The effluent from treated waste water should meet the BS 93 standard should there be a plan to release the same into the environment as effluent.

2.2.1.22 National Policy on Natural Resources Conservation and Development of 1990

The National Policy on Natural Resources Conservation and Development was approved by the National Assembly of Botswana on the 17th December 1990. The policy is aimed at the integration of environmental issues in the national development planning process. To ensure that the development does not result in environmental issues such as pressure on water resources in the area; degradation of rangeland pasture resources; depletion of wood resources, exploitation of veldt products; depletion of wildlife resources and pollution, the proposed project should be designed so as to limit the environmental costs and to enhance the environment in line with this policy.

2.2.1.23 National Health Policy of 2011

The first National Health Policy for Botswana, formulated in 1995 and revised in 2011, guided the development of the health sector. Since the policy was adopted, many changes occurred in epidemiological, socioeconomic and demographic situations as well as health technology development. The most important epidemiological change affecting Botswana is the advent of the HIV/AIDS epidemic and related opportunistic diseases. In order to improve access to quality health care, the Government of Botswana invested substantially in building health facilities all over the country.

The overall development of Botswana can be judged by the quality of its population's health, how fairly health is distributed across the social spectrum, and the degree of protection provided to the disadvantaged as a result of ill-health. The policy thus encompasses all the social determinants which impact the health of the nation. This National Health Policy bears the slogan 'Towards a Healthier

Botswana', implying that the provision of health services is not just merely curing the sick but also promoting healthy lifestyles in order to prevent diseases/ill-conditions for all people living in Botswana.

The implementation of the Policy on the proposed projects aims at ensuring harmony, improving efficiency, clarifying the roles of relevant stakeholders and the effective involvement of communities, non-governmental organizations and development partners through the proposed structures.

2.2.1.24 Compensation Guideline for Tribal Areas of 2010

These are a set of guidelines which work in accordance with the Tribal Land Act (1970) as amended. The guidelines are therefore provided to handle all customary rights and common law grants as given in the Act. The Compensation Guidelines document provides ways in which the people affected by any project of national significance can be compensated for their land and assets. This document will become valuable in instances where people and their productive assets are physically relocated, and will therefore be used to assist in procedures to be followed in the compensation for disturbances caused by the activities related to the proposed project such as the construction of the water tanks, treatment plant and installation of pipes.

2.2.1.25 National Policy on HIV/AIDS of 2012

This policy arises from and reflects the current socio-economic and legal situation in which the national response to HIV and AIDS is being undertaken. It takes cognizance of the fact that due to age, gender, socio-economic status, sexual orientation or disability, some Batswana are more vulnerable to the devastating effects of HIV and AIDS than others.

Government of Botswana partners must cooperate with the national coordinating body, NACA, for the national response to HIV and AIDS by sharing relevant information that may be requested which will assist with reviewing their contribution to response achievements as well as ensuring that a comprehensive overview of the national response is maintained. To promote the necessary coordination and management of the multi-sectoral national response to HIV and AIDS at all levels, formal coordination structures with the appropriate human resources should exist in the public and private sectors and civil society.

Botswana's National Strategic Framework for HIV/AIDS recognizes that highly mobile, mostly male contracted labourers that spend long periods away from home are not only susceptible to HIV and AIDS but that they also fuel the epidemic. Contractors are highly mobile and therefore their chance of contracting and spreading the HIV/AIDS virus becomes high. The proposed project is envisaged to attract job seekers to the project area; therefore, it is very imperative to come up with measures to prevent the spread of HIV/AIDS.

2.2.1.26 The Wildlife Conservation Policy of 1986

This policy calls for the preservation of wildlife as a way of economic diversification. It also points out that wildlife areas are not restricted to Game Reserves and National Parks, but can also be found in communal areas. The over-riding philosophy of the policy is that utilization of wildlife should not be

conducted in a way that is detrimental to the continued existence of the resource base. Therefore, WUC has to ensure that wildlife in the area is not adversely affected by this development.

Plans

2.2.1.27 Botswana Water National Master Plan (BWNMP)

The 2006 Review of the 1991 recommends a strategic switch from supply oriented water management to Integrated Water Resources Management (IWRM). The latter approach requires that demand and supply measures are balanced, and that water resources are managed as finite, economic and social resources. It further implies that countries allocate and use water resources efficiently.

2.2.1.28 National Master Plan for Wastewater and Sanitation

The plan provides the long term strategy for sanitation and treatment of wastewater (until 2030). Possible study implications include:

- Encouraging re-use and recycling and compliance with the 2030 target of 98% re-use and recycling.
- The effluent from treated waste water should meet the BS 93 standard should there be a plan to release the same into the environment as effluent.

2.2.1.29 National Development Plan 11

A number of policy initiatives are required in order to make sustainable development the core cross-cutting issue of NDP 11. In this context, major programmes and projects in key sectors such as mining, agriculture, energy, water, manufacturing and tourism will be subjected to sustainability appraisal, planning and implementation during NDP 11 to ensure that social, economic and environmental objectives are maximized and harmonized.

Prudent management of natural resources is desirable to ensure the derivation of maximum benefits through conservation and equitable distribution of benefits to the majority of the country's population through economic growth and employment creation. During NDP 11, focus will be on the strengthening and/or development of policies and legislation to address threats, as well as measures to enhance the state of the environment. Specific areas will include land, water, minerals, energy, biodiversity and cultural resources, which are key to economic development.

Local knowledge that is unique to a given culture or society, which facilitates communication and local-level decision making in agriculture, health care, food preparation, education, natural-resource management, will be harnessed for economic growth and employment creation. The value of such resources and their implication to economic development should be measured through natural capital accounting to assess the physical stocks of such natural resources and their utilization.

2.2.1.30 Tutume Development Plan (2000-2024)

The Tutume Development Plan (2000 – 2024) is intended to serve as a physical land use plan, the purpose of which is to identify, by means of zoning and written policies, those parts of Tutume Planning

Area where changes from the existing land use are anticipated. It indicated how all the land within the planning area may be used. The main functions of development plan are to:

- Apply the policies of the National plan (NDP 9) in a physical form at the local level;
- Review and analyze existing land uses and make projections for future development and changes where necessary;
- Allocate appropriate land for specific purposes to meet the spatial needs for Tutume for the 24 years (2000 – 2024); and
- Identify the phasing of the proposed development. This will comprise 6 year periods, which will be subject to monitoring and review.

From an environmental responsibility perspective, the plan highlights one of its goals as being to protect and conserve both the natural and man-made environment.

This is to be achieved through the:

- Identification and protection of environmentally sensitive areas;
- Reclamation of damaged land; and
- Identification of buildings, structures and sites with architectural and historical significance for preservation.

2.2.1.31 North East District Development Plan (2000-2024)

The North East Development Plan (2000 – 2024) is intended to serve as a physical land use plan, the purpose of which is to identify, by means of zoning and written policies, those parts of North East Planning Area where changes from the existing land use are anticipated. It indicated how all the land within the planning area may be used.

The main functions of development plan are to:

- Apply the policies of the National plan (NDP 9) in a physical form at the local level;
- Review and analyze existing land uses and make projections for future development and changes where necessary;
- Allocate appropriate land for specific purposes to meet the spatial needs for North East for the 24 years (2000 – 2024); and
- Identify the phasing of the proposed development. This will comprise 6 year periods, which will be subject to monitoring and review.

From an environmental responsibility perspective, the plan highlights one of its goals as being to protect and conserve both the natural and man-made environment.

This is to be achieved through the:

- Identification and protection of environmentally sensitive areas; and the
- Reclamation of damaged land

2.2.1.32 The Botswana Biodiversity Strategy and Action Plan (BSAP-2004)

The policy was compiled in compliance with the Convention on Biological Diversity (1993), to which Botswana is a signatory. The goal of the BSAP is to contribute to the long term health of Botswana's ecosystems and related species as well as to encourage sustainable and wise use of resources through provision of a framework of specific activities designed to improve the way biodiversity is perceived, utilized and conserved. WUC should ensure that Rare and Endangered Species as well as unique habitats occurring in the area are protected.

Standards

2.2.1.33 Waste Water Discharge Standard, BOS 93: 2012

This Botswana Standard specifies requirements for physical, microbiological and chemical limits for waste water discharged into sewer, a watercourse and open environment. BOS 93 standard is to ensure that all discharge from all industries into the sewage system was at a level which would assist the proposed project to comply with the required standard. The standard simply gives a company or entity consent to discharge wastewater into a public sewer system, because if a person discharge a small amount of liquid waste, as it could cause serious damage to the sewage system and create a risk of danger to public health. Threshold values for total dissolved solids (TDS) are presented in this standard as 2000mg/l for ephemeral watercourses such as transboundary watercourses. This standard applies in the event that WUC conducts activities that involve disposal of water/waste water into ponds and open environments. The proposed project will by default comply with this standard as it will depend on WUC for disposal of effluent generated thereof.

2.2.1.34 Botswana Standard for Drinking Water: BOS 32:2015

This standard provides microbiological safety determinants' requirements for drinking water. According to this standard two classes of water are suitable as drinking water and are defined in terms of physical, organoleptic, chemical and microbiological constituents. The standard recognises Class I water as also defined in the World Health Organization (WHO) guidelines as water acceptable for whole lifetime consumption and Class II as allowable for short term consumption. Water is deemed to be non-compliant when it fails to meet requirements set out in Class I in more than 5% of the samples analysed. Water that fails to meet the Class I requirement but meet Class II requirements may be supplied to consumers for short-term consumption only while measures are being taken to improve the water quality. Both classes of water shall comply with microbiological requirements specified in **Table 2-1** below;

Table 2-1: Microbial Safety Determinants' Requirements for Drinking Water

Determinants	Units	Acceptable limit ^{a)}
Total coliform	Count/100ml	Not detected
E. coli ^{b)}	Count/100ml	Not detected
Thermotolerant (faecal) coliform bacteria ^{c)}	Count/100ml	Not detected
Faecal streptococci	Count/100ml	Not detected

Clostridium perfringens ^{d)}	Count/100ml	Not detected
Cryptosporidium ^{e)}	Count/volume sampled ^{f)}	Not detected
Giardia ^{e)}	Count/volume sampled ^{f)}	Not detected

^{a)} The allowable annual compliance contribution shall be at least 95% to the limits indicated in column 3
^{b)} Definitive, preferred indicator of faecal pollution
^{c)} Indicator of unacceptable microbial water quality, could be tested instead of *E. coli* but is not the preferred indicator of faecal pollution. Also provides information on treatment efficiency and after growth in distribution networks.
^{d)} Analyses for *Clostridium perfringens* should be done biannually. However, during the rainy season or outbreak of water borne diseases, analysis should be carried more often.
^{e)} If *Clostridium perfringens* is detected, then *Cryptosporidium* and *Giardia* should be analysed for.
^{f)} Standard volume usually used in 10l or 1000l

E. coli is the preferred indicator of faecal pollution as it is not usually able to multiply in aquatic environments. Therefore, the presence of *E. coli* in water indicates recent faecal pollution. Water drawn from Water Treatment Works must meet this standard if it is to be reused.

2.2.1.35 Ambient Air Quality-Limits for Common Pollutants: BOS 498:2012

This Botswana standard specifies limit values for common air pollutants to ensure that the negative effects of such pollutants on human health and the environment are prevented or reduced. The project will comply with the requirements of the Standard to ensure that all air pollutants management measures are in place to prevent the onset of air pollution.

2.2.1.36 Maximum Permissible Limits for Environmental Noise; BOS 575:2013

In 1999, the World Health Organisation (WHO) produced Guidelines for Community Noise, prescribing health-based levels of acceptable noise under different scenarios. Main sources of community noise include road, rail, construction and public works. According to the WHO guidelines (1999), hearing impairment is not expected to occur at LAeq 8h levels of 75 decibels or lower, even for prolonged occupational noise exposure. **Table 2-2** highlights WHO guideline values for noise.

Table 2-2: Guideline values for community noise in specific environments

Specific environment	Critical health effect(s)	LAeq [dB(A)]	Time base [hours]	LAmx [dB]
Outdoor living area	Serious annoyance, daytime and evening	55	16	-
Industrial, commercial shopping and traffic areas, indoors and outdoors	Hearing impairment	70	24	110
Impulse sounds from toys, fireworks and firearms	Hearing impairment	-	-	140 (adults) 120 (children)

Source: WHO, 1999; where LAeq [dB (A)] is the energy average equivalent level of the A-weighted sound over a period of time and LAmx [dB] is the maximum noise level.

2.2.1.37 National Occupational Safety Association Standards (NOSA)

2.2.1.37.1 Ladders, Elevated Platforms, Stairs and Scaffolding (2.14)

The intent of the Standard is to ensure that ladders, scaffolding, stairs and elevated platforms are safe for use. It ensures the following;

Ladders

Responsibility assigned for the regular inspection of all ladders

All ladders should be marked in a clear and legible manner

Register should be kept up-to-date and correctly completed

All deviations must be reported and actioned against

Scaffolding

Scaffolding should be erected, altered and dismantled according to standards

Erection and inspection should be carried out by a competent person

Register should be maintained according to standards

Stairways

All stairways (including access steps to loading docks, etc.) should be fitted with at least one handrail (as per applicable building requirements)

Access to each landing should be unobstructed

Physical conditions of all ladders, stairs and ramps to be used in the project should comply with this standard.

2.2.1.37.2 Pollution and Environmental Degradation Control (1.15)

The standard is aimed at ensuring that Impacts associated with pollution and degradation of the environment are effectively and proactively managed. This is done through;

Pollution Reduction Programme

Opportunities for prevention, reduction or proactive control of pollution should be identified, taking into consideration interested and affected parties.

Degradation of the Environment

Due consideration is given to the potential degradation of the environment, including those relating to loss or adverse alteration of habitat, loss of species, loss or adverse alteration of biodiversity, loss of amenity to a community, contribution to global warming and climate change, depletion of non-renewable resources, and so forth

Rehabilitation

All areas requiring rehabilitation identified and all polluted areas adequately rehabilitated with Environmental due diligence.

2.2.1.37.3 Aisles, Storage and Keep Accessible Areas Demarcated/Signposted (1.21)

The intent of the standard is to create order, maintain accessibility and restrict access to hazardous areas. It ensures that floors and areas are demarcated or signposted and the demarcations are adhered to. Barricading should also be provided to restrict access to hazardous areas. The project should adhere to the Standard to ensure safety for all.

2.2.1.37.4 Colour Coding: Plant Equipment and Pipelines (1.25)

This Standard is aimed at effective hazard communication. The project should comply with this standard by ensuring that uniform color code is applied throughout and that appropriate color code key boards are provided and displayed.

2.2.1.37.5 Lifting Machines and Lifting Tackle (2.15)

The standard advocates for safe lifting machinery and tackle. It ensures that the lifting machinery and tackle are operated by suitably competent operators. All operators and assistants of lifting machines should be specifically trained to operate a particular type of machine. All lifting machines/tackle should be inspected and tested by a designated competent person in accordance with standards.

2.2.1.37.6 Waste Management (1.24)

The intent of the standard is to ensure that risks associated with waste are well managed. All waste should be identified and quantified in inventory. Due consideration should be given to waste as preventable, recyclable, non-recyclable and inherently hazardous. There should be clear indication that waste to landfill is only undertaken as an absolute last option, where no reasonable opportunities exist to rather prevent, reduce, reuse, recondition or recycle (including composting) waste.

2.2.1.37.7 Personal Protective Equipment (PPE) (2.40)

The aim of the standard is to ensure personal protective equipment is provided, maintained and effectively applied as part of an overall risk management strategy and safely disposed of to prevent possible adverse Health, Safety and Environment risks/impacts. The contractor for the project should comply with this standard by making sure all people accessing the site/s have proper personal protective equipment.

2.3 Institutional Framework

Policies

2.3.1.1 WUC Occupational Health and Safety

WUC strives to implement Occupational Health and Safety programmes in order to ensure that, as far as is reasonably practicable, the workplaces, machinery, equipment, the chemical, physical and biological substances and agents and processes are safe and without risk to the health and safety of the employees. Furthermore, the purpose of this policy is to ensure that WUC provides a conducive work place which preserves life, good health, equipment and infrastructure in order to improve service delivery. This policy is relevant to the proposed project because it applies to all Corporation staff,

contractors who are doing works on behalf of the corporation, facilities, premises and other stakeholders.

2.3.1.2 Personal Protective Equipment Policy

WUC's mandate is to manage and operate water and wastewater resources, treatment and supply infrastructure, including boreholes and other associated works hence ensuring environmentally prudent manner to safeguard social equity, economic efficiency and ecological sustainability. In carrying out its mandate, WUC has to ensure that the employees work safely in their environments by identifying and assessing workplace hazards, eliminating or reducing the hazards where feasible through engineering and administrative controls, then providing appropriate personal protective equipment (PPE) to further reduce the potential for exposure to workplace hazards.

Most importantly the purpose of this policy is to protect all people whose job requires them to work in an environment where there is potential for exposure to physical, chemical, radiological, or mechanical irritants capable of causing injury through absorption, inhalation or physical contact. It applies to the use of PPE for eyes, faces, head, extremities, protective clothing, respiratory equipment, and hearing protection, therefore it is relevant to the project as the WUC contractors and other stakeholders will be working and visiting construction and work places areas.

2.3.1.3 Environmental Management Policy

This policy is to manage and guide the corporation in executing their mandate in an environmentally prudent manner to ensure social equity, economic efficiency and ecological sustainability, therefore its purpose is to ensure that WUC provides water and wastewater services within the framework of acceptable environmental principles and standards and give guidance for improving environmental performance and consciousness. The policy will help the employees and stakeholders of Water Utilities Corporation to better understand how its operations impact on the environment and to reduce or eliminate the impacts. The policy will be applicable to all the works to be carried on the proposed project to ensure environmental management and sustainability.

2.4 International Obligations and Agreements

Botswana is signatory to a number of international obligations and agreements below which some with a bearing on the proposed development are discussed.

Convention on International Trade in Endangered Species (CITES)

Botswana is signatory to the *Convention on International Trade in Endangered Species (CITES)*, which entered into force in 1975. Its aim is to ensure that international trade in specimens of wild animals and plants does not threaten their survival and it accords varying degrees of protection to species of animals and plants. There are some wild animals in the project area and therefore WUC must make certain that those involved in the project do not engage in activities that run counter to the convention.

The United Nations Framework Convention on Climate Change (UNFCCC, 1994)

The *United Nations Framework Convention on Climate Change* (UNFCCC, 1994) is an international environmental treaty aimed at stabilizing greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. The Convention therefore provides the basis for global action “to protect the climate system for present and future generations”.

Parties to the UNFCCC have a number of commitments under the convention, which include:

- a) Submitting a national inventory of emissions and removals of greenhouse gases;
- b) Implementing national programmes to mitigate climate change and adapt to its impacts;
- c) Strengthening scientific and technical research and systematic observation related to the climate system, and promoting the development and diffusion of relevant technologies;
- d) Promoting education programmes and public awareness about climate change and its likely effects; and
- e) Periodically submitting comprehensive reports on activities to implement commitments under the Convention.

WUC has to regularly maintain the equipment used for the project and operation such that the amount of carbon emissions is minimized. Further, the developer must also endeavour to monitor the levels of carbon emissions (e.g. consumption of electricity/ energy) from the WWTP.

The Kyoto Protocol of 1997

The Kyoto Protocol, which was adopted in 1997, is linked to the UNFCCC to prevent anthropogenic interference with the climate. The Protocol establishes legally binding commitments for the reduction of greenhouse gases and fluorocarbons. As of December 2006, a total of 169 countries and other governmental entities had ratified the agreement including Botswana, hence adopting the common responsibility that other countries have in reducing the greenhouse gas emissions. Examples of carbon emitting equipment likely to be used on the sub-project include trucks, frontend loaders and bulldozers.

The Basel Convention of 1989

The Basel Convention (concluded in 1989) controls trans-boundary movement of hazardous waste and its disposal. Botswana is a party of this convention, of which the requirements are regulated by the Department of Waste Management and Pollution Control (DWMPC) through the Waste Management Act (Act No 15 of 1998). Currently, Botswana does not have a disposal site for hazardous waste; therefore, hazardous waste is transported outside Botswana through DWMPC.

World Heritage Convention

Botswana is signatory to the United Nations Educational, Scientific and Cultural Organization (UNESCO) World heritage Convention of 1972, which strongly affirms that it is our shared moral and financial responsibility to protect what is referred to as our common cultural and natural heritage, through international co-operation. There are some archaeological sites occurring in the general area of the proposed project. Any artefacts and other archaeologically significant finds along the proposed water pipeline alignment corridor revealed by this Archaeological Impact Assessment (AIA) will have to be managed in a way that sites are maintained, and any moveable archaeological finds or heritage features are not negatively impacted.

Convention for the Safeguarding of the Intangible Cultural Heritage

The Convention for the Safeguarding of the Intangible Cultural Heritage of 2003 takes into consideration the importance of intangible cultural heritage as a mainspring of cultural diversity and a guarantee of sustainable development. The purposes of this convention are safeguarding the intangible cultural heritage, ensuring respect for the intangible cultural heritage of the communities, groups and individuals concerned. As a result, state parties to this convention are tasked with making sure that these aims are fulfilled especially that there is provision for funding assistance towards promotion of intangible heritage. It is in this regard that interviews with the affected parties were undertaken during this archaeological survey to establish any areas associated with intangible heritage so as to put in place mitigation to preserve and safeguard where possible.

3 PROJECT DESCRIPTION

3.1 Project Area General Description

The North East District is one of the administrative districts of Botswana, with its capital being Francistown. In 2013, the North East District had a population of 167,500 people. The District is predominantly occupied by Kalanga speaking people (the BaKalanga). In the north and east, the North East District borders the Matabeleland South Province of Zimbabwe. It borders in the east predominantly with the Ramokgwebana River. In the south and west, the North-East District borders Central District with the border being the Shashe River. The Tutume Sub-District has a population of about 25,000. The combined district's project area has a total of fifty two (52) villages that will potentially benefit from this project. However, the following Table 3 below details the project villages where the majority of the works will be carried out:

Table 3-1: Project Villages

Number	Project Village	District	Population Size (Persons)
1	Masingwaneng	North East	677
2	Makaleng	North East	1,256
3	Vukwi	North East	369
4	Kalakamati	North East	858
5	Masunga	North East	5,666
6	Mbalambi	North East	1,037
7	Zwenshambe	North East	1,943
8	Nlapkwane	North East	1,583
9	Ramokwebana	North East	1,548
10	Jackalass No.1	North East	1,281
11	Siviya	North East	1,289
12	Mabudzane	North East	563
13	Jackalass No.2	North East	1,222
14	Sebina	Tutume	3,276
15	Nshakashogwe	Tutume	1,700
16	Dagwi	Tutume	454
17	Nkange	Tutume	3,651
18	Goshwe	Tutume	1,766
19	Matobo	Tutume	1,471
			31,610

3.2 Existing Water Supply Schemes

North East District and Tutume Sub-District share two sources of potable water supply. Groundwater is sourced from the Maitengwe Wellfield and is located about 54 km northeast of Maitengwe Village, a Tutume Sub-District border village located near the Zimbabwean border. The wellfield has a total of twelve (12) boreholes with an average of 33 m³/hr discharge rate.

In addition to the wellfield boreholes, the Maitengwe Water Supply Scheme has three (3) booster pumping stations on its 53km long water main. The Pump Station No.1 is located about 12km from the wellfield. The second booster station, the Pump Station No. 2, is located about 25km from the wellfield towards the village. The third pump station (Pump Station No.3) is located in Maitengwe Village near the main road to Tutume Village.

The Maitengwe Wellfield water supply scheme was designed to supply 3.29ML/day. However, due to inefficiency of Ntimbale Dam to supply potable water to the Tutume Sub-District and North East District villages, the scheme's output has been increased to supply 8.64 ML/day, which exceeds its capacity. This scenario has put too much stress on the Wellfield and is likely to over extract the boreholes. Water from Maitengwe Village is pumped through a 400mm Ductile Iron (D.I). Pipeline to Tutume Village where it is also pumped to Goshwe Village Pump Station where again it is further pumped to Mbalambi Village reservoir before gravitating it to the rest of villages supplied by the project (52 villages in total).

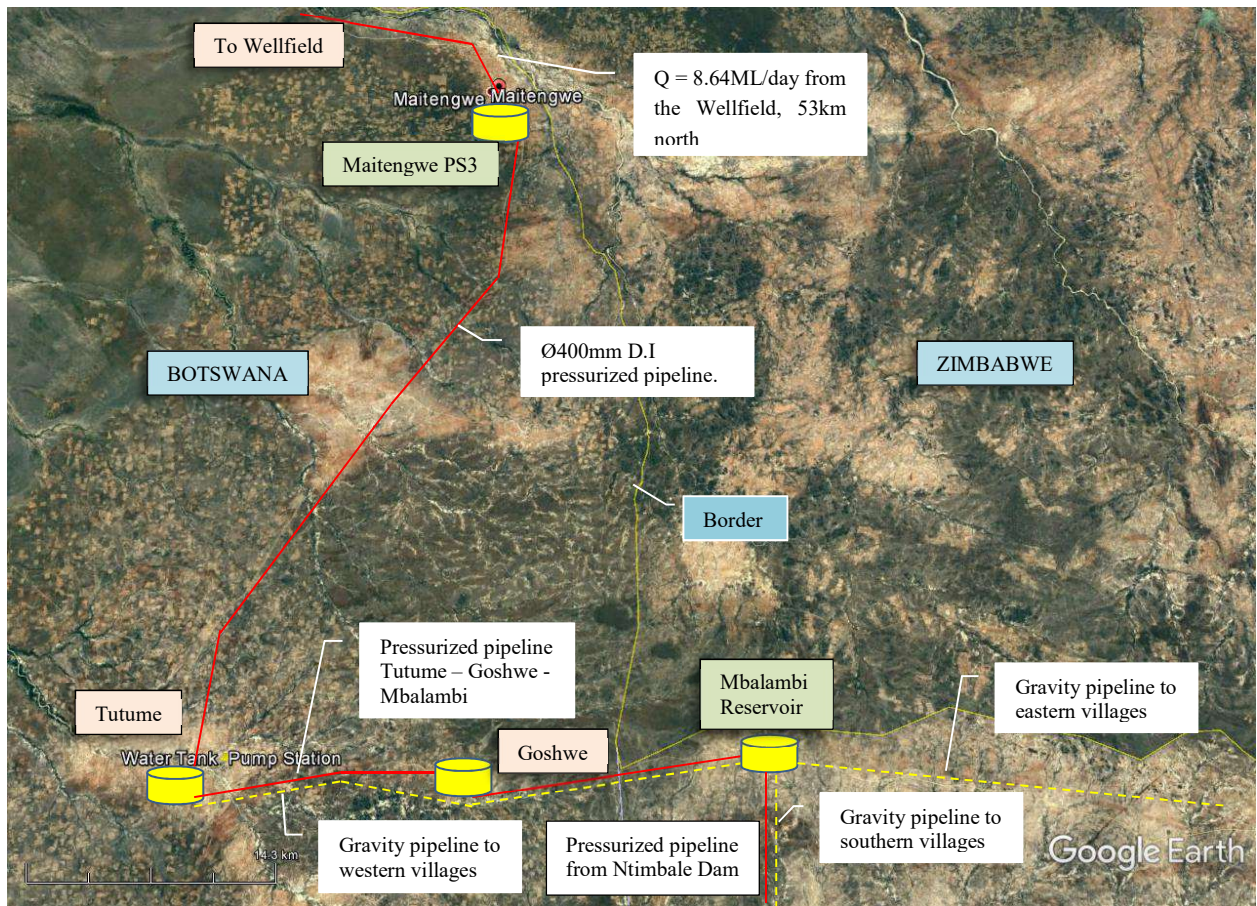


Figure 3-1: Existing North East and Tutume Water Supply Scheme (Northern)

The other source of water supply to the region is surface water from Ntimbale Dam. The Dam is located south east of Masingwaneng village with the water treatment plant located within Masingwaneng village.

Ntimbale Dam has a capacity of 26Mm³ and its raw water is pumped to the Masingwaneng Waterworks for treatment. Its treatment plant has a capacity of 14ML/day pumping water from the Dam to the reservoir located within the treatment plant with a 270m x 260m footprint. The Masingwaneng Water Treatment Plant was designed to pump 14ML/day treated potable water to Mbalambi Reservoir before distributing it to the rest of the region villages by gravity, however, the treatment plant pumps only 7ML/day about 50% of the design pumping rate. According to WUC, one of the reasons why the treatment plant pumps only 50% of the initial capacity was due to low duty pumps installed. The Mbalambi Reservoir that receives water from Maitengwe Wellfield and Ntimbale Dam, and then supplies water back to Tutume Sub-District villages and down to Masingwaneng and other surrounding villages by gravity, and into individual village tanks.

3.3 Project Justification

Botswana relies on both groundwater and surface water sources to meet the growing demand and it faces serious challenges with regards to fresh water resources, which could curb future welfare and economic growth if they are not addressed in time. The challenges are:

- a. A growing spatial mismatch between water resources and water demand, requiring costly transfer schemes or relocation of activities;
- b. High variability of annual run-off related to highly variable rainfall patterns, limiting the safe yields of dams;
- c. Lack of suitable high-yielding dam sites, especially near demand centres, leading to high evaporation rates from dams;
- d. Most surface water resources are subject to the SADC Protocol on Shared Water Courses, and need to be shared in a fair, equitable and sustainable way with other countries;
- e. Limited groundwater resources, especially in the west, and high variations in recharge rates and saline groundwater in large parts of western and northern Botswana; and
- f. Escalating domestic, urban and peri-urban water demand

With the abovementioned challenges, the Government of Botswana has been putting in place measures to address and mitigate most of these challenges and as a result in order to improve water supply to Tutume Sub-District and North East District as a region, Maitengwe Wellfield and Water Transfer Scheme were developed. Maitengwe Wellfield was developed between 2005 and 2007. Construction of Ntimbale Dam and its associated infrastructure also commenced in 2005 and was completed in 2010. The two water supply sources have been supplementing each other (50% - 50%) in supplying potable water to the region. The two water supply schemes have been unable to adequately and efficiently operate due to the following reasons:

- a. The Ntimbale Waterworks is unable to operate at its design capacity of 14ML/day due to the fact that the treated water pumps have a total output of 7ML/day. This then means that the shortfall has to be made up for by abstracting 8.6 ML/day from the Maitengwe Wellfield which has a sustainable yield of 3.2ML/day.
- b. Frequent pipe failures occur on the Masingwaneng – Mbalambi rising main, which interrupts supply to the Mbalambi Reservoir resulting in intermittent supply to the area;
- c. The Moroka Village Reservoir cannot supply higher-lying areas, including Ramokgwebana, in its supply area as it was not constructed at the highest point in the area;
- d. It is not possible to fill the Moroka Reservoir under normal pumping conditions due to a combination of demand, availability of water from Mbalambi and a constriction placed in the pipe to allow water to reach Ramokgwebana and

- e. Low water supply tank capacities in some project area villages.

Because of the above reasons, some of the villages in the region have unreliable water supply regardless of having capable water supply schemes in the area. This project will help alleviate most of water supply challenges the region is currently facing. According to WUC, an improved Masingwaneng Water Works (from Ntimbale Dam) is capable of supplying potable water to the whole region while relieving the Maitengwe Wellfield and giving it time to recharge, the wellfield can then be used as a reserve.

3.4 Project Components Details and their Alternatives.

2.1.1 Upgrading of Masingwaneng Water Treatment Plant

In order to improve the efficiency and effectiveness of the Masingwaneng Treatment Works, a number of upgrades will be carried out at the Treatment Works. The following works are proposed to be carried out:

- a) Change of the disinfection system from Chlorine gas to the use of Chlorine dioxide
- b) Upgrade of the sludge handling system including return water pumps and sludge ponds
- c) Upgrade of the treated water pumps to improve capacity from 7Ml/ day to 14 Ml/day
- d) Construction of a 1.76Ml reservoir to increase storage at the treatment works
- e) Refurbishment of some treatment plant components

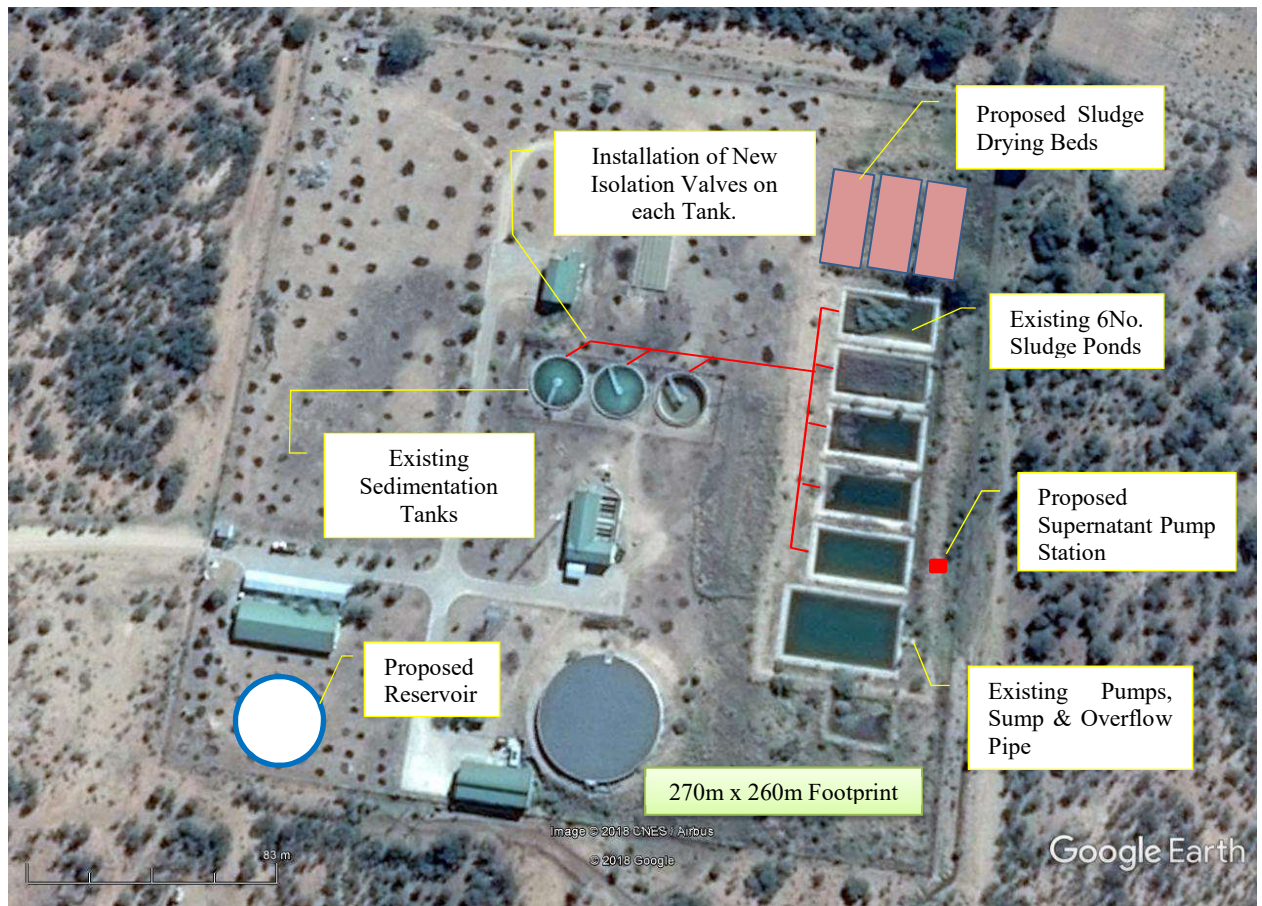


Figure 3-2: Masingwaneng Water Treatment Plant

2.1.2 Kalakamati Break Pressure Tank and Booster Station

The pressurised water supply pipeline between Masingwaneng Village and Mbalambi Village (Main Reservoir Site) has been experiencing frequent of pipe bursts due to the high pumping pressures in the system. It was then proposed that a break pressure tank and a booster station be constructed at Kalakamati Village (almost midway between the two villages) so that the pressures in the pipeline could be reduced. A 1,000m³ Break Pressure Tank and a Pump Station will therefore be constructed around Kalakamati Village.

Alternative sites for the Break Pressure Tank and Pump Station were proposed as detailed below:

Alternative Site 1

The first option (i.e. alternative) for the Break Pressure Tank and Pump Station site (Alternative 1) is located 3.5km from the Masunga junction on the Kalakamati – Makaleng Road. The site is 30 km from Masingwaneng to Mbalambi Villages. From a hydraulic perspective, this is the preferred site as it is closer to the 50% pressure reduction in the pipeline.

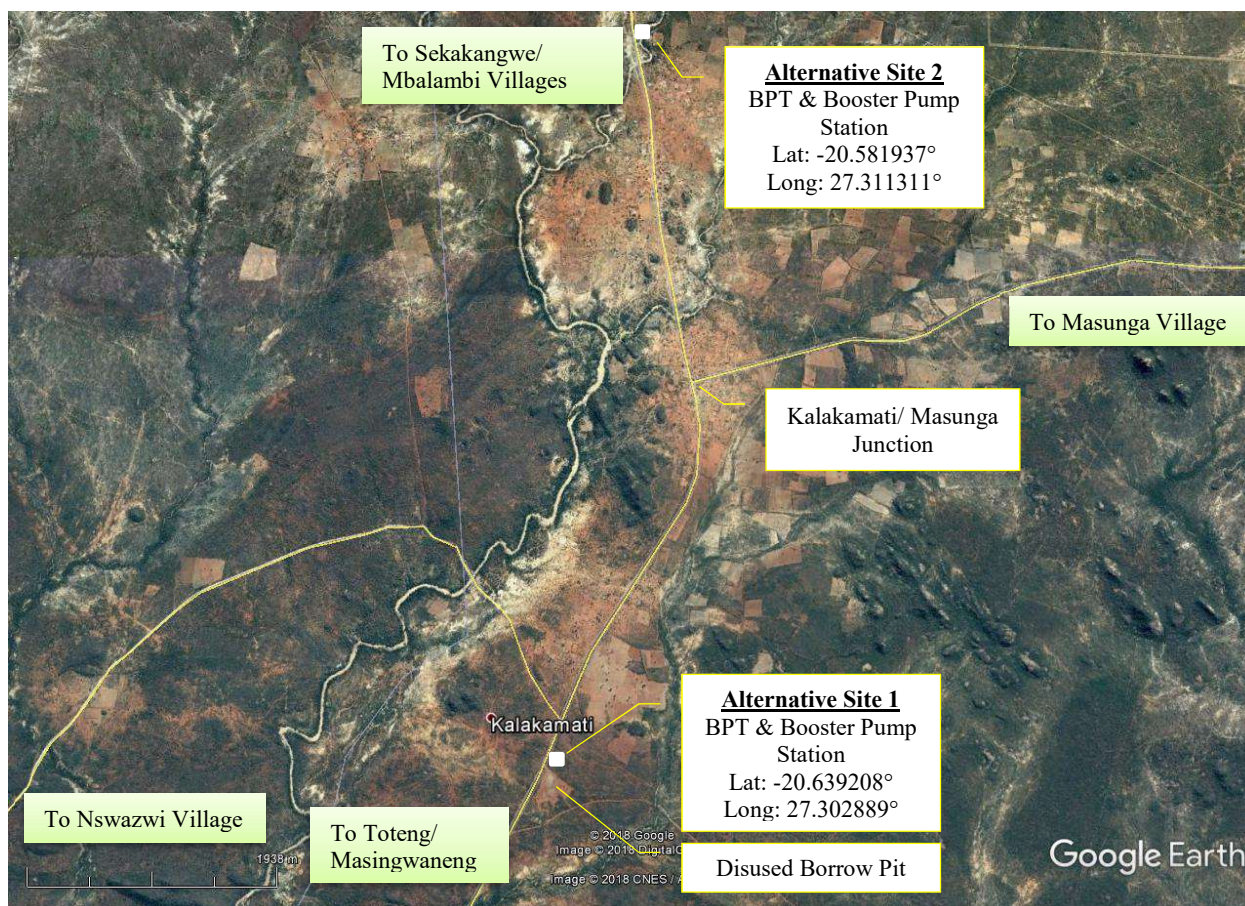


Figure 3-3: Proposed Break Pressure Tank (BPT) and Booster Pump Station Site at Kalakamati

There is an existing 11kV power line nearby supplying Kalakamati Village (1.0km from the site). However, subsequent to consultations with BPC, the power lines closer to the proposed Alternative Site 1 were found not to have enough capacity to supply power to the proposed development due to already existing power demands in the area. In terms of the proposed site land ownership, it was discovered that the land has not been allocated to anyone, therefore, it is available to be used for the establishment of the Booster Pump Station and the proposed Break Pressure Tank.

Alternative Site 2

The second option for the Break Pressure Tank and Pump Station site is 3.1km from the Masunga junction on the Kalakamate Village – Sekakangwe Village Road. The site is 36km from Masingwaneng to Mbalambi. From a hydraulic perspective, this site is less favourable as the pressure reduction achieved is not as much as Alternative Site 1. Alternative Site 2 if selected would also be tapping power from the same source as Alternative Site 1, which according to BPC is already being used to its capacity. Similar to the Alternative Site 1, the land has not been allocated and is, therefore available to the project. Upon detailed investigations, proposed Alternative Site 1 has been identified by the engineers and WUC as the preferred location for the proposed Break Pressure Tank and Booster Station.

2.1.3 Pipeline Alternatives

In order to improve the energy efficiency of the scheme, a pipeline was proposed to connect the Masingwaneng – Kalakamati BPT pipeline to the Sebina/Nshakashokwe elevated tanks. The advantage of having this pipeline is that water will now be transferred directly from the treatment works to these two villages instead of the water being pumped all the way to Mbalambi and then back to these two villages through the Goshwe Reservoir.

Alternative Pipeline Route 1

Alternative Pipeline Route 1 was considered to be constructed on a straight line from the Makaleng connection point to the Sebina/Nshakashogwe elevated tanks. This resulted in a shorter length of the pipeline being 7.8 km. However, this route traverses twenty-seven (27) ploughing fields it is likely to have a lot of land ownership issues.

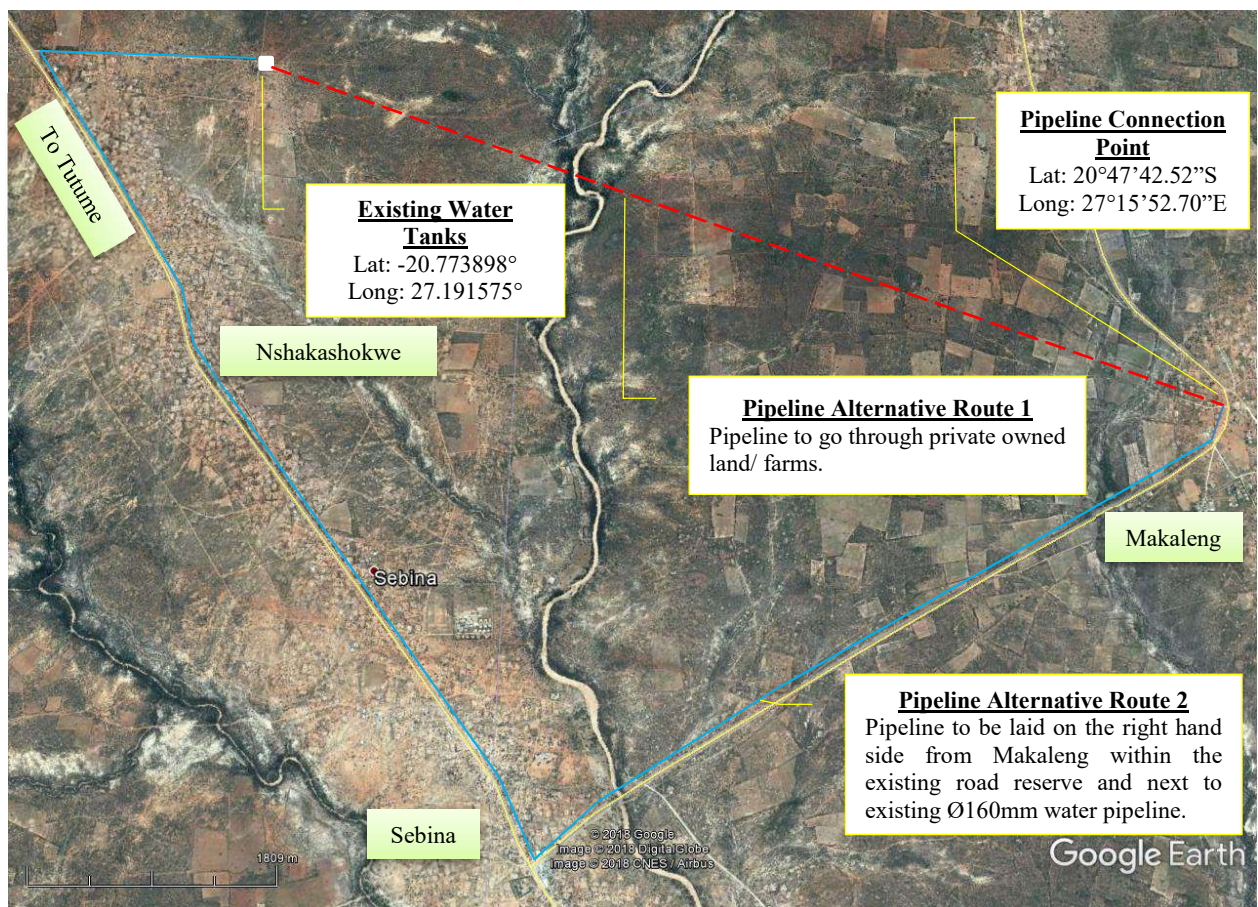


Figure 3-4: Makeleng - Sebina/ Nshakashogwe Pipeline

Alternative Pipeline Route 2

Alternative Pipeline Route 2 was considered to be constructed within the road reserve from Makaleng to the Sebina/Nshakashogwe Elevated Tanks. This route is longer (15.8km), however it does not traverse private property and as such there would be no compensation issues for land acquisition.

2.1.4 Kalakamati to Masunga Pipeline

According to the initial design of the water supply scheme, it was proposed that Masunga Village be supplied by tapping off from the proposed Kalakamati Booster Station – Mbalambi Reservoir pipeline. Water supply to Masunga is currently being supplied via Zwenshambe village north of Masunga, which is a longer route. Two alternative pipeline corridor routes were considered with Alternative 1 pipeline route going along the road reserve all the way to the Masunga Reservoir site from Kalakamati and Alternative 2 pipeline route leaving the road reserve and taking a more direct route to the Masunga elevated tank site as shown in Figure 5 below.

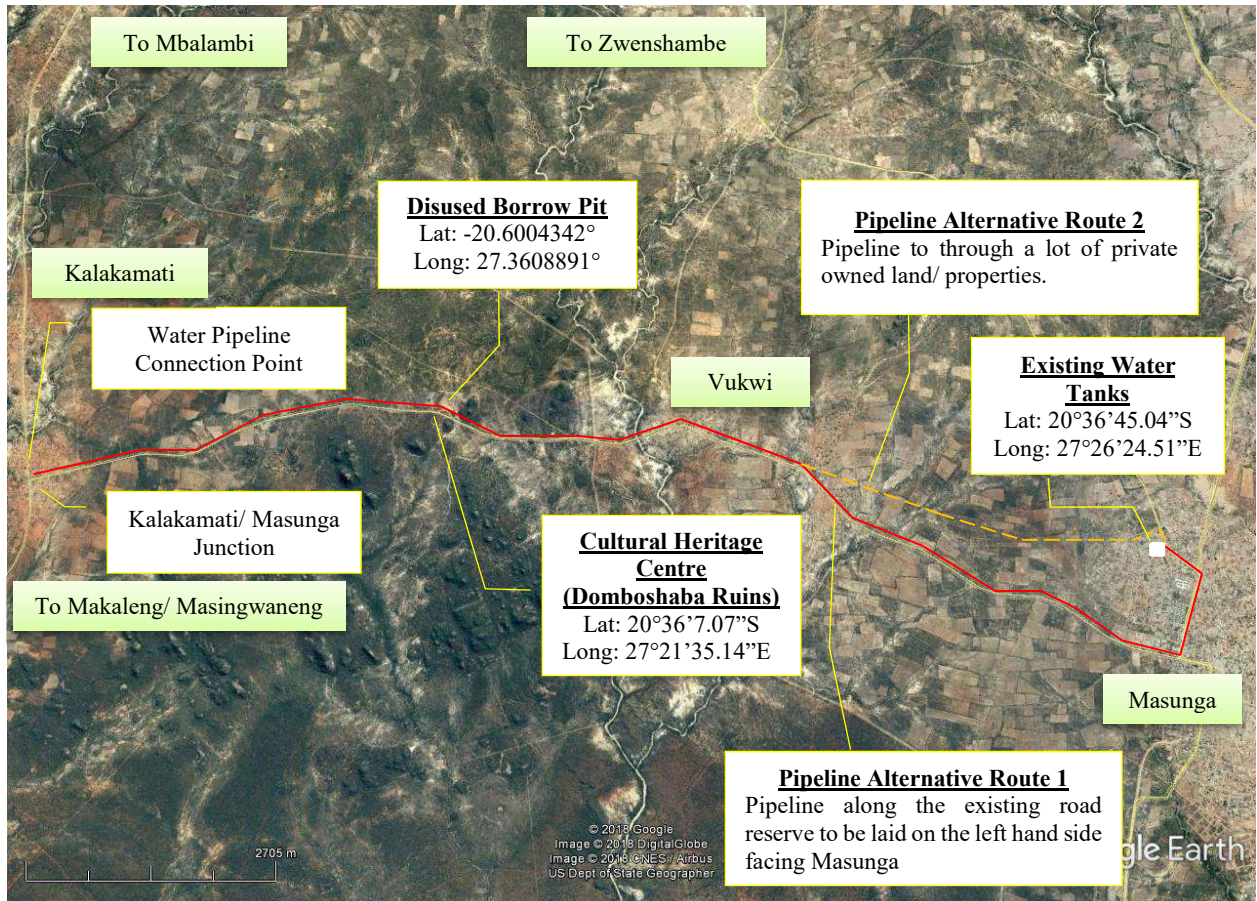


Figure 3-5: Proposed Water Pipeline from Kalamati to Masunga Tanks.

It is also worth noting that the preliminary design of the proposed water supply scheme had Vukwi Village tank that lies between Kalakamati and Masunga Village, however, at the detailed design stage it has been decided that Vukwi village will only tap off its water from the proposed Kalakamati – Masunga pipeline and maintain its current water tank. Therefore, there is no new tank to be installed at Vukwi Village as previously envisaged.

2.1.5 Mbalambi Reservoir/Pump Station

Mbalambi reservoir has been playing a major role in the entire water supply system in the region, the reservoir receives groundwater supply from Maitengwe Wellfield in the north and surface water from Ntimbale Dam down south before distributing it to the rest of the region. However, due to the increased water demand and future water supply security in the region, the existing reservoir capacity will be upgraded. A 5000m³ concrete reservoir will be constructed at Mbalambi.

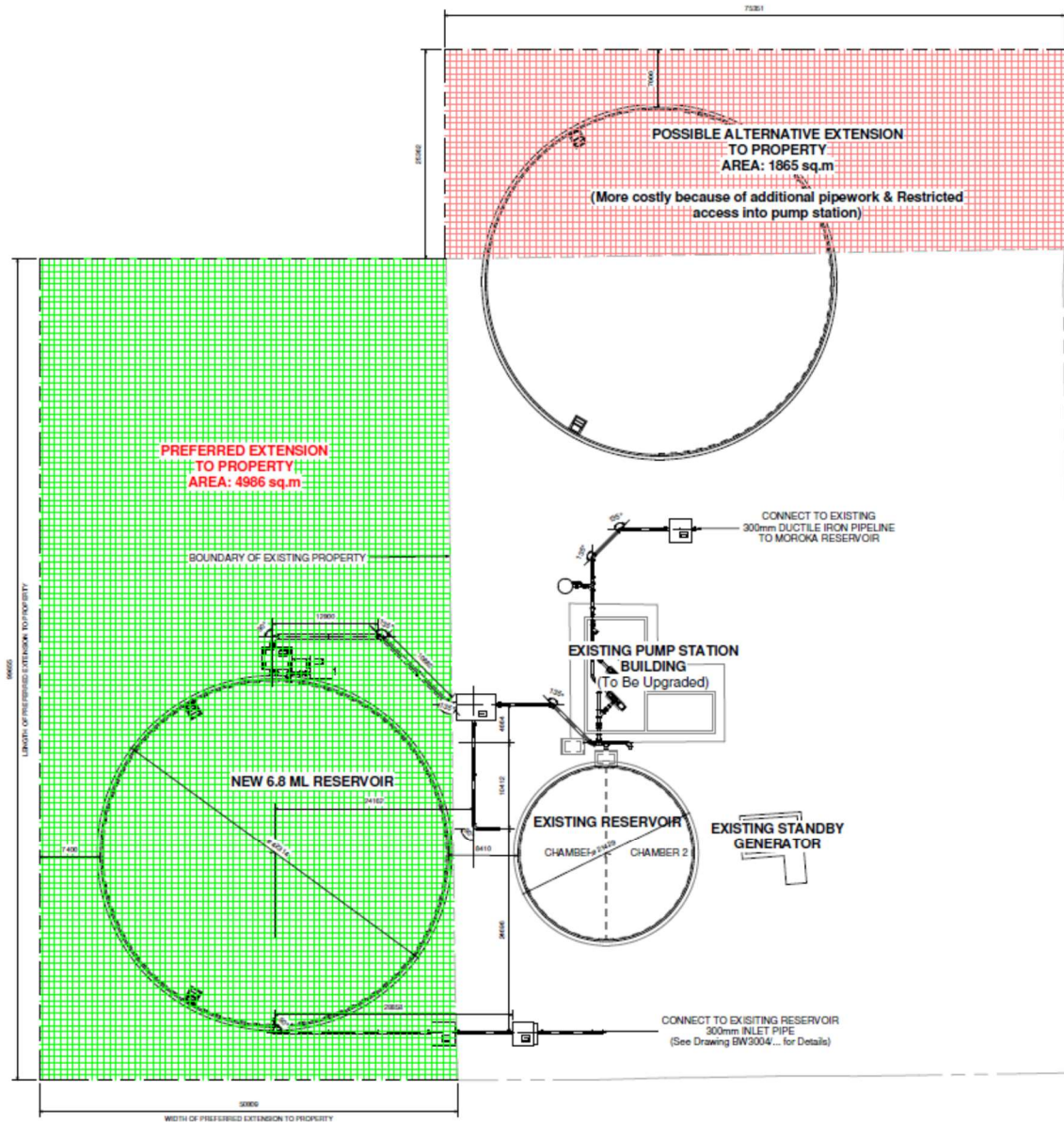


Figure 3-6: Proposed New Reservoir at Mbalambi

The two shaded areas in the above Figure 6 above indicate the suitable positions for the proposed reservoir; one north of the existing reservoir shaded red and one east of the existing reservoir shaded

green. However, due to easiness of pipework on the left of the existing reservoir compared to the north alternative site, the ‘green site’ has been chosen for the additional reservoir at Mbalambi Pump Station.

2.1.6 Jackalas 1 – Siviya Pipeline

Currently the villages of Butale and Senyawe are supplied with potable water from Moroka reservoir which is at a lower elevation and as such there is not enough head to supply the villages especially when Moroka reservoir levels are low. It has been proposed that the two villages be supplied from Jackalas 1 Village elevated tank which is at a higher elevation than the Moroka Reservoir. A pipeline from Jackalas 1 will therefore be constructed that will supply Butale and Senyawe Villages. The only two alternatives that were considered on this route was to have the pipeline constructed on the northern side of the road reserve or alternatively on the southern side of the road reserve. A decision was taken to locate the proposed pipeline on the same side of the existing road reserve of the A1 Road (Southern side of the Gaborone - Zimbabwean Border road) so as to avoid the properties on the northern side.

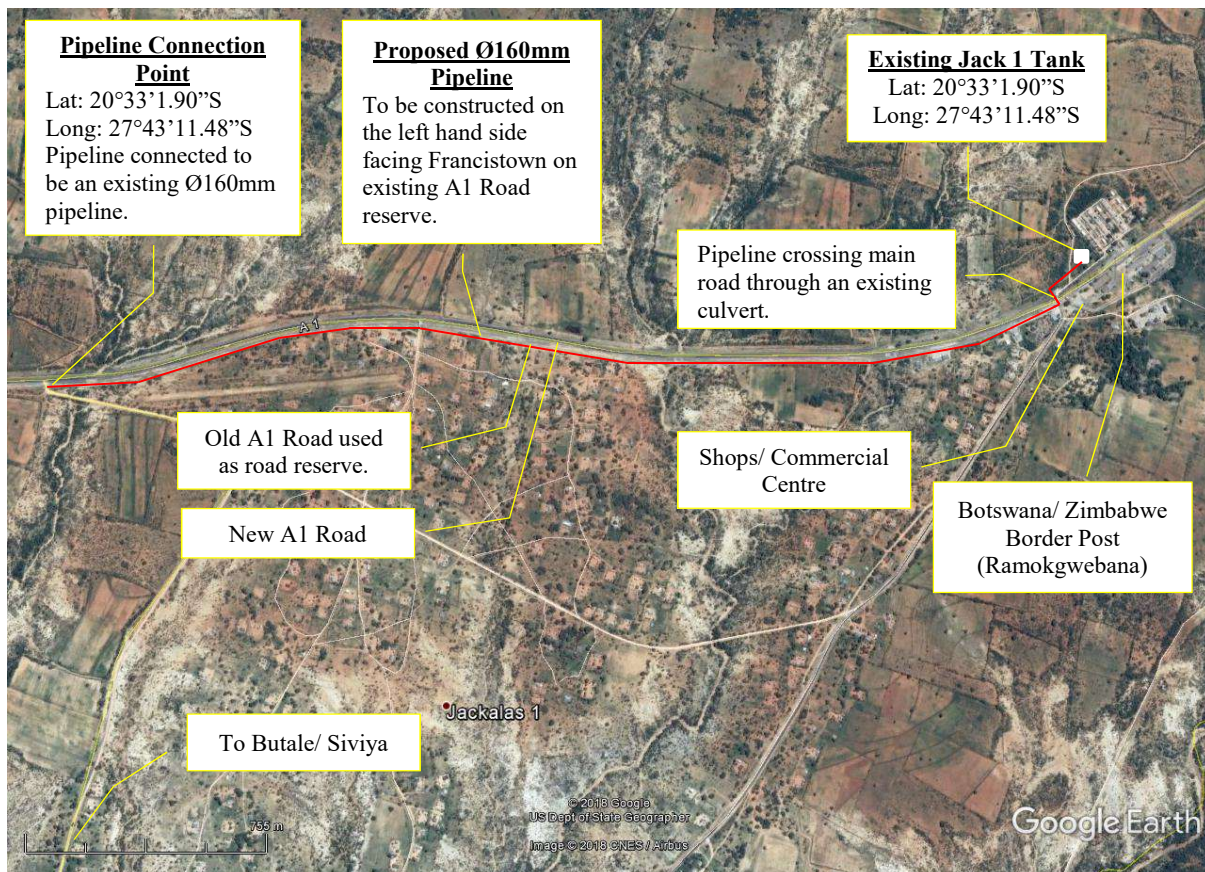


Figure 3-7: Jackalas 1 - Siviya Pipeline Connection

2.1.7 Goshwe Pipeline

The current 800m long pipeline connecting Goshwe Village Reservoir to the Tutume/Mbalambi pipeline has a diameter of Ø160mm, it has been discovered that the current Ø160mm pipeline is too

small and pressure losses are high. It has been therefore decided that the pipeline capacity be increased from Ø160mm to Ø250mm while maintaining the same pipeline length.

2.1.8 Project Villages Tank Capacities and their Footprints

As a way of securing future water demands, WUC has embarked on increasing the village water tank capacities in the project region. On average, most of these elevated tanks have been increased by 1.0m³ and the new tanks in most cases will be erected on existing WUC premises or tanks footprints. On the other hand, there are proposed tanks whose sites have not been verified or acquired from local authorities and still in the process of acquiring the land. Table 3-2 below shows existing village tanks capacities, their footprints and coordinates.

Table 3-2: Existing Project Villages Water Tanks Capacities

Village	Existing Storage (m ³)	Existing Footprint (m)	Coordinates	
Masingwaneng	46	14 x 17 x 14 x 18	20°50'31.76"S	27°19'16.59"E
Makaleng	102	27 x 18 x 21 x 26	20°47'50.35"S	27°16'13.00"E
Nlapkhwane	77	To be verified	20°30'37.00"S	27°30'47.29"E
Ramokgwebana	77	32 x 29 x 28 x 29	20°34'13.80"S	27°39'15.61"E
Jakalas 1	102	24 x 31 x 26 x 32	20°33'1.86"S	27°43'11.56"E
Dagwi	46	25.551x30.15x28.7x28.7	22 36656, -27 262 (LO27)	
Nkange	184	49.8 x 48.4 x 49.8 x 48.4	22 45941, -17611 (LO27)	

Table 3-3: Works Footprint Information

Project Component	Footprint	Area	Coordinates	
Masingwaneng Treatment Works	Current plot size: 27.0m x 26.0m	0.07ha	S20°50'23.53"	E27°19'25.63"
Kalakamati Booster Station	Required Plot Size: 40m x 75m	0.3ha	S20°38'9.37"	E27°18'17.39"
Mbalambi Reservoir Site	Current plot size: 100m x 74m Required extension: 55m x 100m	0.74ha 0.55ha	S20°29'25.05"	E27°21'7.12"
Pipeline	Pipeline Diameter (mm)	Pipeline Corridor Width (m)	Start – End Coordinates	
Makaleng – Sebina/Nshakashogwe Pipeline	200 (New)	5 (within existing road reserve)	S20°29'25.05" E27°21'7.12"	S20°47'14.014" E27°14'8.549"
Kalakamati Masunga Pipeline	160 (New)	5 (within existing road reserve)	S20°47'42.52" E27°15'52.70"	S20°46'26.67" E27°11'29.74"
Jackalass 1 – Siviya Connection Point Pipeline	160 (New)	5 (within existing road reserve)	S20°33'1.90" E27°43'11.48"	S20°33'30.08" E27°41'30.11"
Goshwe Pipeline (800m)	250 (New)	5 (within existing road reserve)	S20°47'42.52" E27°15'52.70"	S20°33'30.08" E27°11'29.74"

Table 3-4: Proposed Project Villages Works and their respective areas and lengths

<i>Village (s)</i>	<i>Works</i>	<i>Areas/ Lengths</i>
Kalakamati/ Masunga	250mm Dia. Water Pipeline	16km
Makaleng/Nshakashokwe	250mm Dia. Water Pipeline	15km
Kalakamati	Pump Station	0.3ha
Mbalambi	Extension to current Reservoir	0.55ha
Goshwe	250mm Dia. Water Pipeline	800m

3.5 Rationale for Infrastructure Upgrade

The overall aim of the infrastructure upgrade is to improve availability of water supply in the target villages and ultimately improve the efficiency of WUC in fulfilling its mandate.

3.6 Scope of Infrastructure Upgrade

The scope of the infrastructure upgrade entails upgrading and remedial works on the North East and Tutume Sub-District Water Supply Scheme. The remedial works will include:

- Upgrading of the Ntimbale Dam treatment works at the Masingwaneng to bring it to full capacity,
- Upgrading of some pump stations to increase pumping rates and efficiencies,
- Construction of a booster pump station,
- Upgrading of some collector reservoirs,
- Upgrading of village tanks at most of the target villages, and
- Improvement to some pipelines to enhance flow to other sections of the scheme.

3.7 Project Status in the Project Cycle

The Scheme is currently operational but needs to be improved through upgrading of some of its components. This will entail increasing the capacities for most of the tanks and installing new lines to improve supply to some of the target villages.

4 OUTCOMES OF ENVIRONMENTAL AUDIT

4.1 Gaps Identified from Review and Site Surveys

General Data Review

This Chapter outlines the outcomes of the review of studies undertaken within the study area. The review entailed perusal of the Environmental Impact Assessment (EIA) Report for the Proposed North East and Tutume Sub District Villages Water Supply Scheme compiled by RPM (Pty) Ltd (RPM) in 2014, as well as other studies undertaken in the area. The data was augmented through reconnaissance surveys which were mainly a ground-truthing exercise. The latter was pivotal in acquiring current information on the status of the study area as presented in **Chapter 5**.

The reviews were conducted according to the specific specialist studies carried out in the project area with particular emphasis on the existing water supply in the Tutume Sub-District and the North East District. Information gaps are for specialist areas and are detailed below:

Table 4-1: Findings of the Data Review

Report/ Source	Summary of Key Contents	Adequacy of Detailed Primary Data
Water Resources		
Environmental Impact Assessment (EIA) Report for the Proposed North East and Tutume Sub-District Villages Water Supply Scheme 2014, (RPM (Pty) Ltd).	Detailed Baseline Information <ul style="list-style-type: none"> • Geology • Topography • Surface Hydrology 	Yes, but the EIA Report does not inform on water quality in the project villages nor in the districts concerned. The Report further omits information on groundwater resources and water table depth.
North East and Tutume Sub-District Villages Water Supply Scheme. Final Design Report, 2014. ACE GIBB (Pty) Ltd (Engineering Consultants) and WUC approved Design Auditor.	Construction Sites: <ul style="list-style-type: none"> • Proposed Makaleng – Sebina pipeline. • New Vukwi Tank. • Proposed Kalakamati – Masunga pipeline. • New Nlapkwane Pipeline • New Jackalas No.1 tank 	<p>The proposed pipelined to be constructed on the right-hand side of the road facing Tutume.</p> <p>The new tank site will be located at the existing WUC plot.</p> <p>Coordinates: Lat: -20.773898° Long: 27.191575°</p> <p>This information will be necessary in development of Relocation Action Plans (RAPs) through World Bank Resettlement Policy Framework (RPF) and compensation issues.</p>
Terms of Reference for the Design of North East and Tutume Sub-District Villages Water Supply Scheme, 2017. WUC.	Detailed ToR details the following: <ul style="list-style-type: none"> • Project areas background • Existing water supply details in project villages • Scope of Works and detailed tasks 	Yes, the Terms of Reference is adequate.
Biodiversity		
Environmental Impact Assessment Report for the Proposed North East and Tutume Sub-District Villages Water Supply Scheme, 2014, (RPM (Pty) Ltd).	Flora and Fauna	<p>No, the EIA Report does not provide sufficient detail on how sampling of fauna and flora was conducted. The study approach and methodology of sampling needs to be expounded upon.</p> <p>The EIA Report omits detail on the distribution of wildlife species in the project areas, conservation classifications, veldt products, biodiversity conservation</p>

Report/ Source	Summary of Key Contents	Adequacy of Detailed Primary Data
		<p>issues e.g. fires, human animal conflicts, elephant range expansion, illegal offtake (harvesting) of plant and animal species in the area.</p> <p>The EIA Report needed to detail more on standards that recognizes that the protection and conservation of biodiversity, as well as sustainable management of living natural resources is fundamental to sustainable development; and this project is part and parcel of that development.</p>
Socio-Economy		
<p>Environmental Impact Assessment Report for the Proposed North East and Tutume Sub-District Villages Water Supply Scheme 2014, (RPM (Pty) Ltd.)</p>	<p>Employment & Economic Activities</p>	<p>The EIA Report omits details regarding: Local residents Livelihoods (Economic Activities and Sources of employment), HIV and AIDS prevalence, Land Use, Settlement Pattern, current infrastructure (water supply systems, sanitation systems), and solid waste management in each project village and the two affected districts.</p>
		<p>The EIA Report does not provide detail on consultations with local business owners in close proximity to the proposed sites in all Project villages.</p>
		<p>The EIA Report does not provide details of door to door consultations to indicate household source of income, income class, gender of bread winner, age etc.</p>
		<p>The EIA Report does not detail hiring patterns of local communities. Contractor(s) need to be encouraged to hire construction workers from nearby villages. Most villages in the North East District are only separated by ephemeral streams or are within walking distance from each other and the proposed construction site(s)</p>
	<p>Local Communities Consultations: Consultations with local communities and stakeholders</p>	<p>The EIA Report indicates that the consultant sent letters of notice for public consultation to 18 village chiefs/local leaders (page 39), however, the consultations and public meetings were only held in only four (4) villages, namely</p>

Report/ Source	Summary of Key Contents	Adequacy of Detailed Primary Data
		<p>Kalakamati, Masingwaneng, Zwenshambe and Mbalambi Villages, (page 42).</p> <p>The reason provided in the EIA Report is that in other villages WUC is only proposing the construction of elevated tanks on WUC owned land. It is worth noting that despite this, the construction works will potentially generate dust, elevated noise levels, increase the spread of infectious diseases such as HIV/AIDS and other social issues, as the contractor interacts with local people. Impacts that could potentially be significant (positive or negative) include health and safety of the local community, waste generation and management, and job creation.</p> <p>Although the EIA consultant (RPM) indicated that only villages where “minor works” proposed were excluded from the public consultation exercise it was noted that some of the villages excluded were earmarked for major works. Examples are Sebina and Maitengwe Villages and Tutume; where a 1,297m³, 3,526 m³ and 2,689 m³ elevated tanks are proposed, respectively Goshwe Village was also excluded from the public participation exercise and this is the proposed site of a 1km long Ø250mm water pipeline. These are major works which could potentially result in both positive and negative impacts on the receiving environment and people.</p>
	Demography	The EIA Report does not compare data contained within the previous census (2001) to the current one (2011) to determine the population growth rate over time.
		Detailed demographic data (e.g. sex/gender ratios, ethnicity, ages etc.) are omitted from the EIA Report.
	District/ Village Local Administration	The EIA Report does not describe local administration and governance setup in the Districts and at local level and Village Development Committees (VDCs) who

Report/ Source	Summary of Key Contents	Adequacy of Detailed Primary Data
	Land Issues	<p>are in most cases involved in development projects in their respective villages.</p> <p>There is need to develop key land issues of concern e.g. land ownership issues like tribal allocation, permanent, squatters (shanties or shacks), this information comes in handy in the development of Relocation Action Plans (RAPs) through the World Bank Resettlement Policy Framework (RPF) and compensation issues.</p> <p>The EIA Report omits the discussion around issues regarding relocation or compensation, or alternatively these were not raised by Potentially Affected Persons PAPs during the study.</p>
Cultural Heritage		
<p>Environmental Impact Assessment Report for the Proposed North East and Tutume Sub-District Villages Water Supply Scheme, 2014. RPM (PTY) Ltd.</p> <ul style="list-style-type: none"> • Monuments and Relics Act of 2001, Government Printer, Gaborone. • Conveyance of Dead Bodies Act of 1933, Government Printer, Gaborone. • Country and Town Planning Act of 2013, Government Printer, Gaborone. • Cultural Heritage Reports undertaken in the study area • Van Waardern C. 1998. The Late Iron Age. In Lane, P. Reid, A. and Segobye A.K. (eds). Ditswammung-The Archaeology of Botswana. Pula Press. Gaborone. • Walker, N. 1996. The Rock Paintings of north-East Botswana. Pictogram 8(2):1-6. 	<p>Cultural Heritage: Domboshaba Heritage Site</p>	<p>AIA Report indicated stonewalls around Domboshaba Hill, coordinates: (20°36'24"S, 27° 21'23"E) (Page 10). However the Report does not detail much on this National Heritage and government protected site. The proposed water pipeline between Kalakamati and Masunga will pass next to Domboshaba Heritage Site along the main road linking the two villages. In addition, the proposed elevated tank site at Vukwi Village (located between the two villages) is located a few hundred meters from both Domboshaba Heritage Site and Domboshaba Lodge. This necessitates a detailed cultural heritage study. Historical background information needs to be obtained and analysed and the impacts likely to be generated from both pipeline and tank constructions be assessed.</p> <p>Further identified gaps and mitigation options are detailed in Chapter 5.</p>

Report/ Source	Summary of Key Contents	Adequacy of Detailed Primary Data
<ul style="list-style-type: none">Walker, N. 1996. Botswana's Prehistoric Rock Art. In Lane, P. Reid, A. and Segobye A.K. (eds). Ditswammung-The Archaeology of Botswana. Pula Press. Gaborone. Tutume Development Plan 2002-2026.		

5 DESCRIPTION OF RECEIVING ENVIRONMENT

This section provides baseline information on the receiving environment. The information given is a collation of the current and historical data, as informed by field surveys and literature reviews on the study areas.

5.1 Physiography

5.1.1 Climate

The North East District has an annual rainfall which averages between 400 mm (in the south) and 500 mm (in the north). Rainfall falls only during a few months from October to March (summer), usually in thunderstorms. Tutume District and North East Sub District both receive highly variable falls, with November to February generally being the wettest months. Most of the rain falls as thunderstorms, depositing between 15 mm and 90 mm of rain within a few hours. During the winter months (May to August) there is little or no rain, and no surface water to sustain vegetation. The mean annual rainfall is usually between 450 and 500 mm. In the past few years however, rainfall in this area has increased dramatically causing major flooding and widespread devastation.

5.1.2 Temperature

North East District has a pattern of high diurnal and seasonal temperature ranges. Winters are generally mild except for occasional cold winds. The minimum temperature can be as low as 5°C with maximum temperatures of 23°C. Midday summer temperatures average around 35°C and reach a maximum of 41°C at times. Winter is long, and dry with few cloudless days. Winter midday temperatures rise to 17°C and drop to a low of – 8°C at night.

5.1.3 Wind

Generally there is paucity of data on wind properties of the study area. However, for this study data on wind was based on information from Francistown which the nearest synoptic station. Winds in the region are predominantly easterly in direction. They may be strong for short periods during the seasonal storms. Wind direction and wind speed has a direct bearing on determining the significance and severity of impacts such as dust (**Figure 5-1**).

There is a substantial period (37.7 percent of the time) when there is no wind (calm periods). The average annual wind speed at the altitude of 2 to 10m above ground level is low and ranges between 4.4 and 6.9km/hr. During the summer period, the subtropical high pressure belt moves southwards of its winter position. There is a decrease in stability in the region and occasional strong winds and tempests occur (Tutume Village Development Plan 2002-2036).

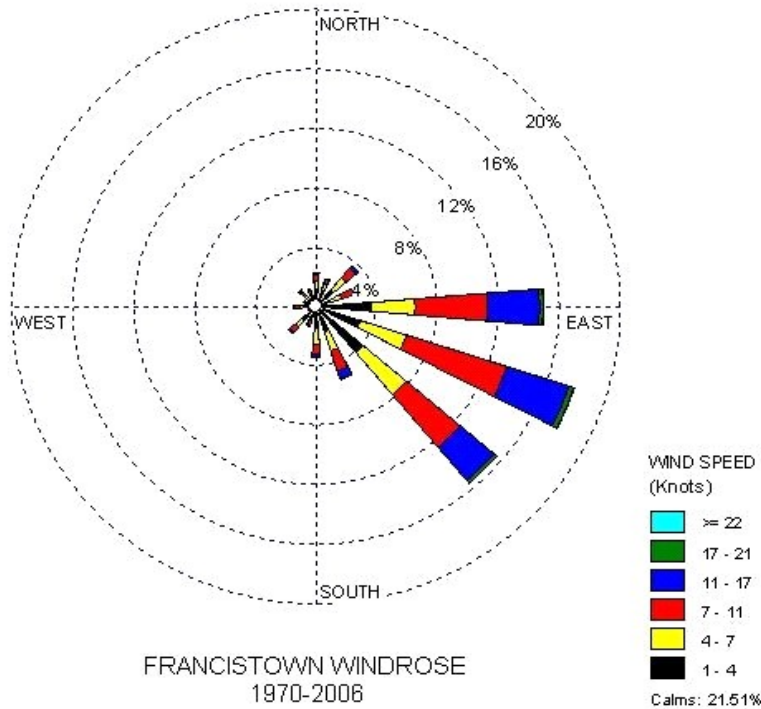


Figure 5-1: Regional Wind Properties as Represented by the Francistown Station

Source: Department of Meteorological Services, 2018

5.1.4 Air Quality

There is generally a lack of data on the air quality of the study area. Nonetheless, given that the area has no major sources of emissions such as industries, the assumption would be that the air quality falls within acceptable standards and threshold limits.

5.2 Biophysical Environment

5.2.1 Geology

A significant portion of the study area consists of rocks of basement complex including meta-volcanic of the so-called Tati Schist Group. Exposure (Gibb and Partners, 1987) generally good most of the granitoid rocks are poorly exposed. The basement complex is divided into various granitic formations and two non-granitic lithostratigraphic units (Gibb and Partners, 1987). The oldest granitoid rocks in the area including Francistown are tonalitic ortho-gneisses, which occur as elliptical plutons with marginal monzonites. A regional metamorphism with hornfels enrichment affected most parts of the study area converting a major part of the Tati Schist Group into high grade gneisses. Minor late granite dykes cut the rocks north of Francistown into North East and striking share the same fractures with Karoo dolerite dyke swarm and may probably be contemporary within them.

The granitic gneisses of the study area are collectively included in the Shashe Gneiss Group. This is subdivided into Mooke Paragneiss Formation, which tends to occur in the zones of varying width sandwiched between the major belts of non-granitic rocks and the Seke Porphyroplastic Gneiss Formation, which occur south of the Project Area. The recent sediments of probably Kalahari age mask the solid geology beneath in some parts of the area. Small floodplains alluvial deposits tend to be confined to the larger water courses of Maitengwe River, Tutume River, Nkange River, Shashe River, Tati River and Ntsho where they cross granitoid rocks. Generally, the dendritic drainage pattern is most probably controlled by the underlying geology of the area. (Gibb and Partners, 1987)

5.2.2 Topography and Drainage

The topography of the study area is relatively flat with kopjes (inselbergs) outcropping within the geologic units less susceptible to weathering. The highest point within the project area is at 1300m above sea level (masl) and the lowest at 930masl. The ground slopes in the study area are divided into three (3) overall slopes; In Tutume area, the ground and surface water flows northwest including Tutume River towards Nata (Nata River), while in Nkange and Maitengwe areas surface water flows northeast. Both Nkange and Maitengwe Rivers named after their villages flow northeast into Zimbabwe thereafter turn back into Botswana and flow towards Nata. Nata area forms part of the general basin of Makgadikgadi Pan including Sowa Pan. The rest of the Project Area in North East District, the ground slopes southwest with Shashe River being the main surface water course.

Other prevailing dendritic drainage pattern consists of systems of irregularly branching tributaries and forms junctions at various acute angles. This also is a manifestation of the complex folded and contorted metamorphosed rocks where lithological variations (in terms of weathering and erosion) are insufficient to modify this pattern. The sporadic rainfall of high intensities in the study area implies high velocities during surface water flow and hence intense water erosion.

5.2.3 Soils

The geology of the project area is fairly uniform consisting of Kalahari sediments of sand, silcrete or calcrete under the major soil group of Arenosols. These soils are sandy-textured soils that lack any significant soil profile development. They exhibit only a partially formed surface horizon (uppermost layer) that is low in humus, and they are bereft of subsurface clay accumulation. Given their excessive permeability and low nutrient content, agricultural use of these soils requires careful management.

Another major soil group found in the project area (North East and Part of Northern part of Botswana) are Luvisols. These soils have formed predominantly in the eastern part of Botswana and have well-developed profiles. They are characterized by increased clay in the subsoil and are deep to very deep and are well drained. Their texture ranges from sandy clay loams, sandy loams, clay loams and even clay. Their profiles range in colour from reddish brown, yellow brown, brown to red and dark grayish brown to pale brown. They have higher retaining holding capacity than other soils.

However, there are some problems associated with these soils, especially soil crusting which impedes water infiltration. This results in widespread sheet erosion in arable fields and rangelands. Because of the steeper slopes in eastern part of Botswana. Luvisols are also subjected to rill and gully erosions.

Specific soils at on each project component site is shown in the Table 5-1 below.

Table 5-1: Project Components with their associated soils.

Project Component	Associated Soil	Soil Description	Coordinates	
Masingwaneng Treatment Works	Dystric Regosols	Moderately deep, moderately well to well drained, dark grayish brown to reddish brown, coarse sand to coarse loamy sands.	S20°50'23.53"	E27°19'25.63"
Kalakamati Booster Station	Dystric Regosols	Moderately deep, moderately well to well drained, dark grayish brown to reddish brown, coarse sand to coarse loamy sands.	S20°38'9.37"	E27°18'17.39"
Mbalambi Reservoir Site	Dystric Regosols	Moderately deep, moderately well to well drained, dark grayish brown to reddish brown, coarse sand to coarse loamy sands.	S20°29'25.05"	E27°21'7.12"
Pipeline	Associated Soil	Soil Description	Start – End Coordinates	
Makaleng – Sebina/Nshakashogwe Pipeline	Chromic Luvisols	Moderately deep, to very deep, moderately well to slight excessively drained, strong brown to dark red sandy loams to clay loams.	S20°29'25.05" E27°21'7.12"	S20°47'14.014" E27°14'8.549"
Kalakamati Masunga Pipeline	Kalakamati – Vukwi: Chromic Luvisols Vukwi – Masunga: Haplic Luvisols	Moderately deep, to very deep, moderately well to slight excessively drained, strong brown to dark red sandy loams to clay loams. Moderately deep to very deep, imperfectly to moderately well drained, very dark gray to brown, loamy soils.	S20°47'42.52" E27°15'52.70"	S20°46'26.67" E27°11'29.74"
Jackalass 1 – Siviya Connection Point Pipeline	Dystric Regosols	Moderately deep, moderately well to well drained, dark grayish brown to reddish brown, coarse sand to coarse loamy sands.	S20°33'1.90" E27°43'11.48"	S20°33'30.08" E27°41'30.11"
Goshwe Pipeline	Dystric Regosols	Moderately deep, moderately well to well drained, dark grayish brown to reddish brown, coarse sand to coarse loamy sands.	S20°47'42.52" E27°15'52.70"	S20°33'30.08" E27°11'29.74"

Table 5-2: Project Area Major Soil Characteristics

Name	Description	Distribution
Arenosols	Sandy soils, developed from weathering of quartz-rich material or rock. Loamy sandy consistency up to approximately 100 cm depth. Less than 35 % rock fragment. Parent material unconsolidated calcareous or sandstone rocks. Code: AR	The Mozambique coast, in a zone adjacent to the Lebombo range, and in the southern half of the Botswana part of the basin.
Luvisols	Soils with a higher clay content in the lower horizons, that the upper horizons. Wide variety of different parent material types, including glacial, aeolian (wind-blown), alluvial (water-borne) or colluvial (gravity) deposits. Code: LV	Zimbabwean and northern Botswana parts of the basin.



Plate 5-1: Kalahari sand with rock outcrops western part of project area and colours changes to red/brown towards eastern parts of the project area.

Soils are generally well-drained and moderately deep. The soils are sandy loam and sandy clay with the gravel about 50cm below the surface. Clay soils occur between Makaleng and Kalakamati and north of Francistown. Some of this area comprises base rock and very shallow soils associated with hills and ridges. Substantial portions of the soil are not suitable for dry-land farming due to their chemical composition and low water holding capacity.

5.3 Water Resources

5.3.1 Hydrogeology

The project area of North East District and Tutume Sub-District and falls in an area underlain by Archean bedrock which is hydrologically divided into two main areas, the Limpopo Mobile Belt and the North Eastern gneisses (**Figure 5-2**). The North East gneisses belongs to Zimbabwean Craton

(Aldiss 1983). The Project Area consists of gneisses, which also include granites, amphibolites together with limited areas of ultramafic rocks, marble and metamorphosed clastic sediments.

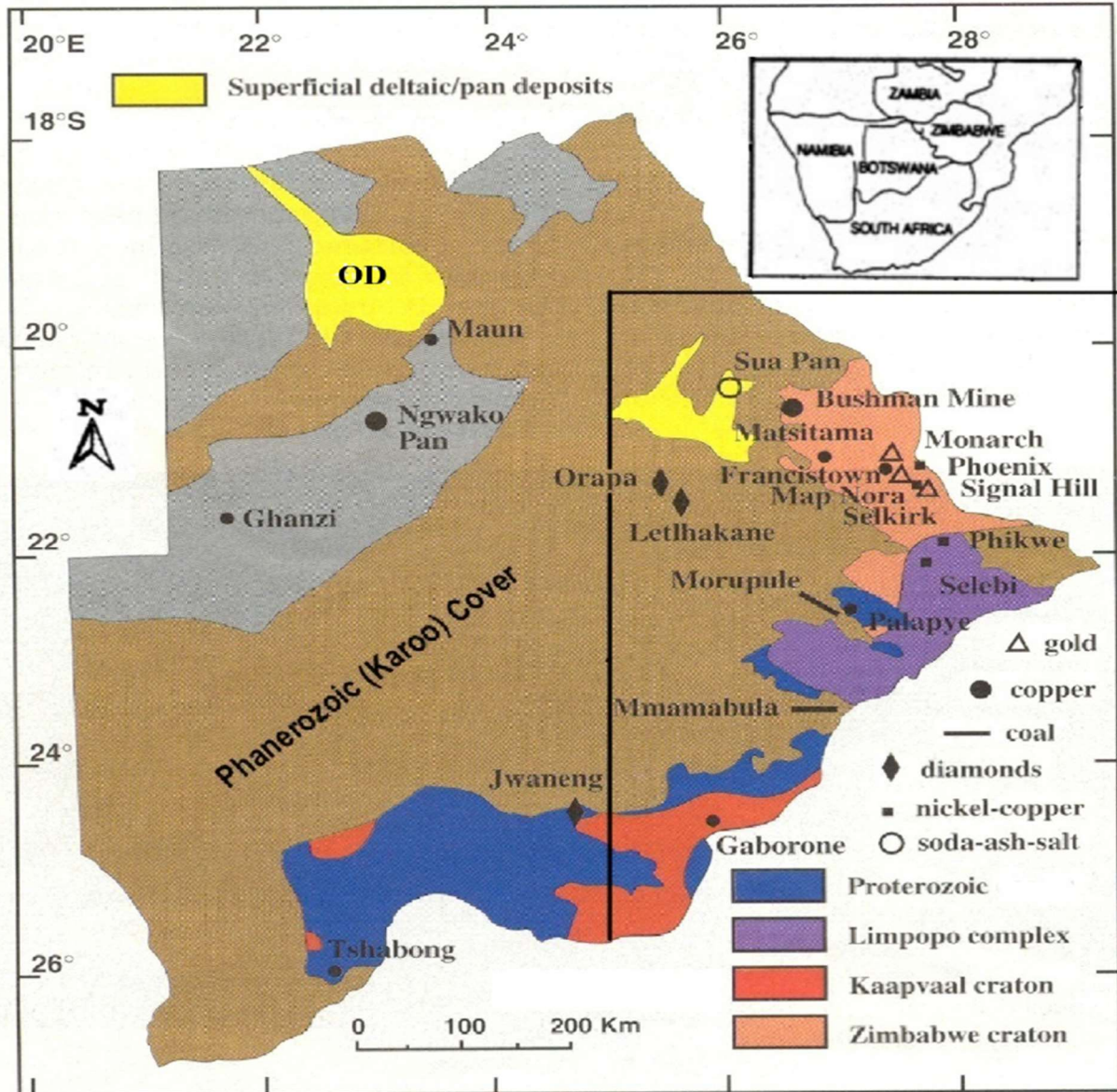


Figure 5-2: Botswana Geology Outline

(Source: Botswana Department of Surveys and Mapping)

Boreholes statistics in the area reveal that the highest median yield is found in the amphibolites, whereas in the granites the median borehole yield is lower than the gneisses. According to Botswana Hydrogeological Reconnaissance Maps, the Archaen bedrock is described as a uniformly poor aquifer with possible borehole yields of 0 to 1 litre per second. (0 to 3.6m³/hr).

Table 5-3: Eastern Archean Region: Borehole Statistics

Area & Rock Type	Area Size (Km ²)	Borehole Success Rate (%)	Median Borehole Yield (m ³ /h)	Median Borehole Depth (m)	Median Depth to Groundwater Level (m)
Limpompo Mobile Belt	21500	83	4.41	94	21
Seleka-Malete	900	64	2.18	93	29
Limpopo Area	-	96	7.34	16	9.1
North Eastern Gneisses	19800	81	3.36	48	13
Amphibolite	1700	91	4.82	80	18
Granites	500	79	2.84	47	14

Source: Botswana National Water Master Plan Study, 1991.

5.3.2 Groundwater Vulnerability

Vulnerability to pollution in the project area is moderate. According to groundwater resources comprehensive protection report, the project area falls within the Moderate Protection Area although it falls within the threshold of High Protection Area of the Shashe River basin. The average groundwater table depth ranges from 13 – 18 m deep thus making the groundwater in the project area vulnerable to pollution. Vulnerability to pollution in the area can be exuberated due the fact that the project area is in part of central Botswana where the land is covered in free draining Kalahari sands.

5.3.3 Project Area Groundwater Hydrochemistry

The northern part of the eastern gneisses the groundwater is of the bicarbonate type. The dominating cation is Calcium. The Total Dissolved Solids (TDS) are generally below 250 mg/l around most parts of the project area although around Francistown as the regional administrative centre the TDS is slightly higher but below 400mg/l. (BNWMPS, 1991). Groundwater Total Dissolved Salts (TDS) falls below 1000mg/ litre in North East regional area (North of Francistown) (**Figure 5-3**).

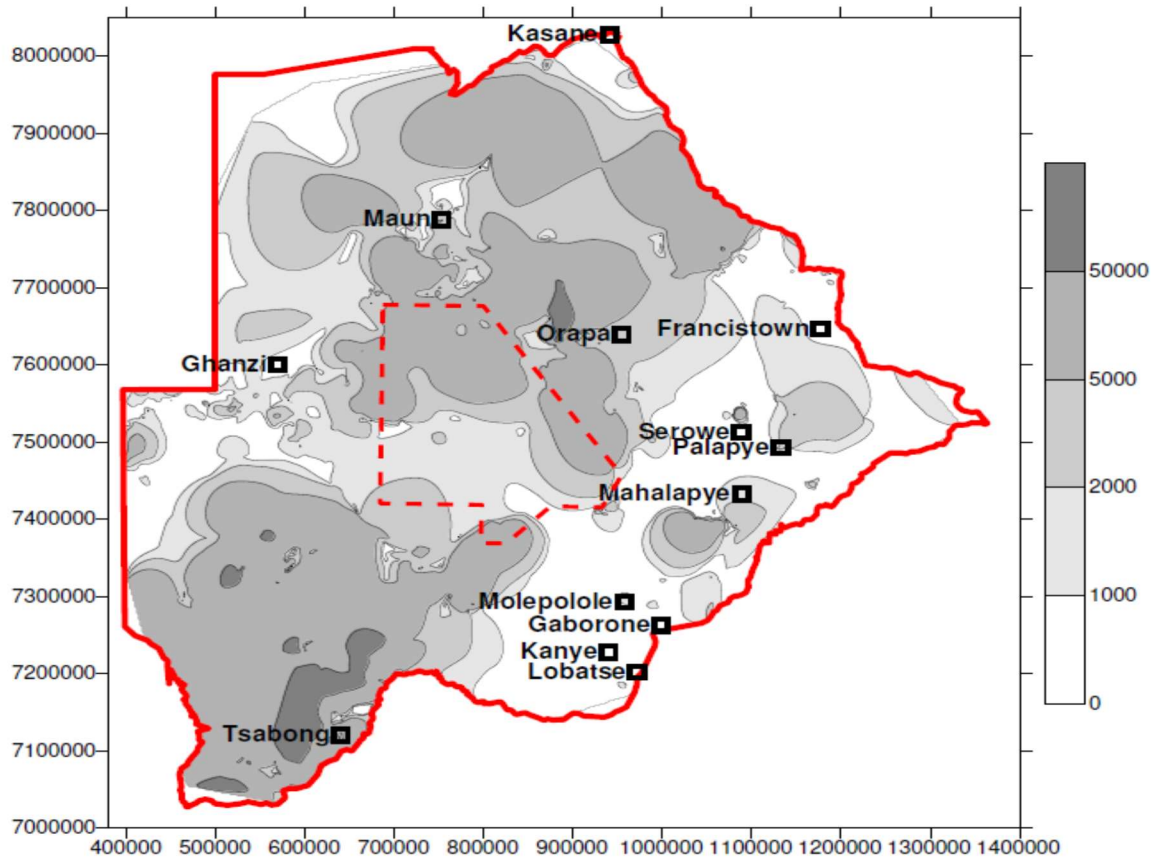


Figure 5-3: TDS Distribution

Source: Botswana Hydrogeology Map

5.3.4 Hydrology

The North East District has several ephemeral rivers and streams. The principal rivers include Shashe, Vukwi, Tati, Ntshe, Sikukwe, and Ramokgwebana. The direction of drainage is towards the south. These rivers are able to store considerable amounts of water in the sub-surface sand layer for most of the year. The rivers and streams carry floodwater after rainstorms during the rainy season, but for the rest of the year they are dry.

The ephemeral Shashe River is one of the major surface water course in the region, with its flows are restricted to a few days of the year. The river contributes 12.2% of the mean annual runoff of the Limpopo Basin.

Major tributaries of the Shashe River include the Simukwe, Shashani, Thuli, Tati and Ramokgwebana rivers. The Lower Shashe River is a sand filled channel, with extensive alluvial aquifers in the river channel and below the alluvial plains. These supply water for a number of irrigation schemes including Sibasa and Shashe Villages.

More than two million years ago, the Upper Zambezi River used to flow south through what is now the Makgadikgadi Pan (presently a vast seasonal wetland) to the Shashe River and thence the Limpopo

River. Shashe River rises on the border between Botswana and Zimbabwe, it flows south past Francistown the regional capital within and then southeast along the border for about 362km to its junction with the Limpopo River. Total catchment area of Shashe River basin (at Lower Shashe, entrance into Limpopo River) is about 7810km² and its discharge is average rate 462 million cubic metres per year (14.6 m³/s; 517 cu ft/s).

5.4 Biological Diversity

The biodiversity and ecological function of any area is primarily determined by its physical environment, i.e. relief, climate, geology, soils and hydrology. In arid and semi-arid African savannas, water is considered the primary limiting factor to biodiversity as it regulates biological species diversity, density or abundance and spatio-temporal distribution. Therefore, in semi-arid African environments, biodiversity (species richness, diversity, abundances and density) in general tend to be directly related to water and moisture gradients. Other effects that are also known to influence biodiversity and ecological function can be grouped as anthropogenic effects, i.e. human related factors.

This ecological impact assessment is for a proposed upgrade the North East District and Tutume Sub-District Water Supply Upgrading Project funded by the World Bank. It aims to assess potential ecological and biodiversity impacts of proposed water supply project. This includes large landscape and local scale impacts, ecological continuity and connectivity, effects on biological diversity and population distribution and lastly interaction at the project-biodiversity interface, i.e. construction and project infrastructure mediated biodiversity mortality. Rapid field assessments reveal that the project area is characterised by high density of anthropogenic activity (settlement and arable agriculture) and high incidence of fences (loss of some ecological connectivity), e.g. disease control fences, commercial agricultural fences and fences along the Botswana-Zimbabwe international boundary.

Satellite imagery (Google Earth, 2018) reveal very high arable agriculture activity, particularly around major settlements (e.g. Mapoko, Zwenshambe, Masunga and Jackalas 1). Subsistence agriculture is the predominant land use across this landscape outside fenced privately held land. The current state of the North East District landscape (i.e. high intensity of subsistence agriculture and fenced properties) offers very little terrestrial landscape ecological function; loss of habitat, displacement of wildlife around settlements, incidents of illegal offtake (poaching), localised habitat degradation due to overgrazing, effects of negative human-animal interactions and loss of connectivity.

5.3.5 Large Landscape Ecological Function

Although in the current state the landscape has been fragmented by intense anthropogenic activity and fences (commercial farms, disease control and international boundary fence), historical large landscape connectivity can be inferred (See **Figure 5-4** – red arrows). Prior to the proliferation of fences and high settlement density, the project area was ecological connected to the Makgadikgadi Salt Pans, Northern Botswana via Nata-Sepako, Motloutse River catchment area, and Western Zimbabwe conservation areas. In addition, an analysis of water gradient suggest a possible linkage to Central District that also likely extended into the current Central Kalahari Game Reserve.

Even though fences are very common in the landscape, the high incidence of hydrological features (rivers and streams) suggest that aquatic connectivity is still extant. An assessment of hydrological flow suggest aquatic connectivity with the Makgadikgadi Salt Pans through the Mosetse, Nata, Tutume and Lepashe rivers and with Shashe-Limpopo River System. In this regard, aquatic and avian species passages across the landscape are facilitated by the multiple linear hydrological features of the landscape. The rivers and streams, through its effect on vegetation communities, also creates ideal habitat for riparian avian species.

Potential Historical Large Landscape Ecological Connectivity

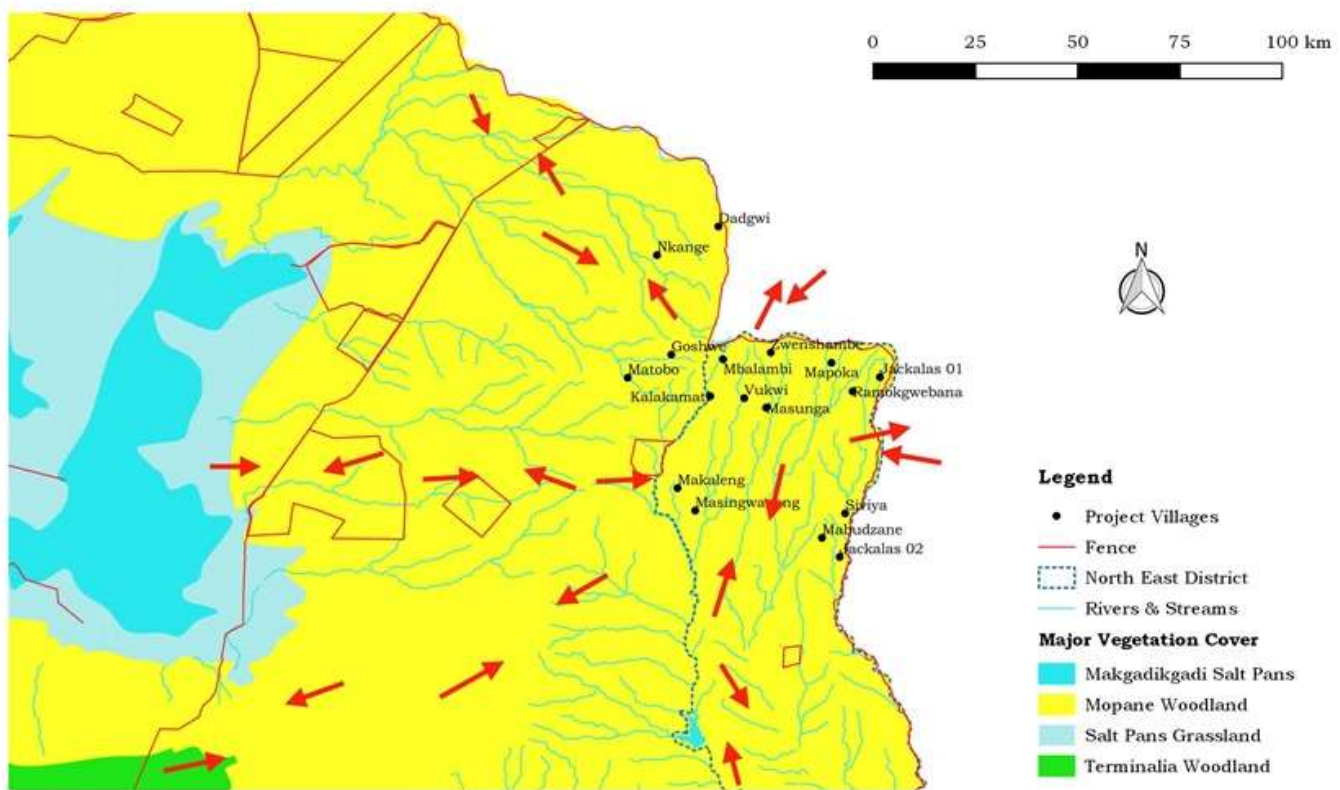


Figure 5-4: Potential Historical Large Landscape Ecological Connectivity

5.3.6 Wild Fires

Wildfires are a significant biodiversity conservation and socio-economic concern. Fires can degrade the quality of habitat, cause wildlife mortality, regulate short to medium term spatio-temporal redistribution wildlife and does destroy some veldt products (e.g. thatch grass, wild fruits, fuel wood and mopane worm) that some local livelihoods are dependent upon.

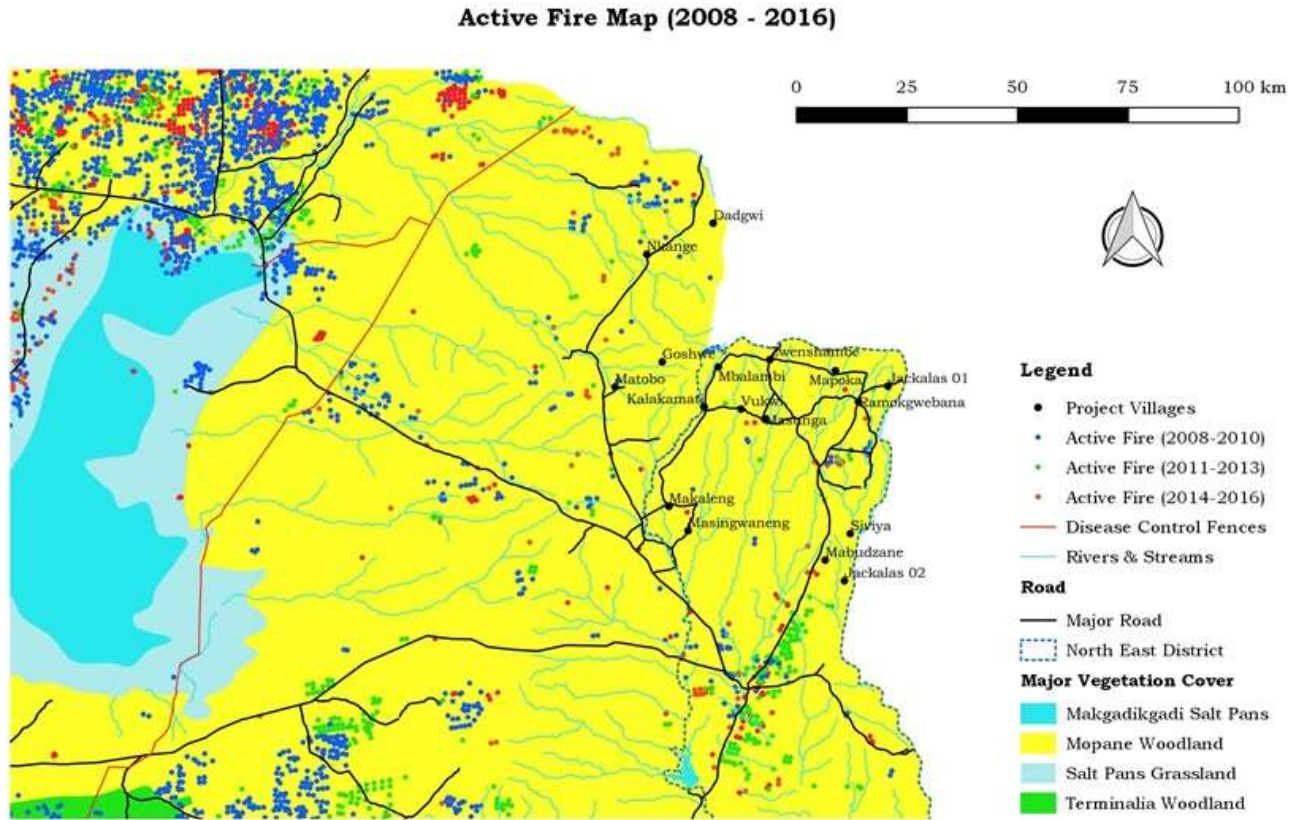


Figure 5-5: Fire Regime in the Project Area

Similar to poaching, an influx of construction teams bring with it increased risk of wildfires, i.e. more domestic fires (cooking, smoking and other sources) and hence increased risk of escape into the wild. Grinding of metal can also cause fire. As fire risk is directly related to number of people, the risk of increase in veld fires is expected to be most pronounced during the construction and decommissioning phase as a result of an influx of construction and decommissioning teams respectively. Of particular importance here is to note that fire frequency in the project area (**Figure 5-5**) has been very low compared to other districts. Increased risk of wild fires in a high human density area like the project can have far reaching consequences; i.e. impact on livelihood and an already overstretched natural environment.

5.5 Biological Species Inventory

The inventory of biological species in the project area was conducted following predetermined stratified sampling. Even though broad scale vegetation classification depict a homogenous Mopane Woodland across the entire project area, fine scale variability in physiognomic and species diversity occurs within the landscape. Such fine scale variability are mainly related to sudden changes in relief and topography (hills) and surface hydrology (rivers and streams). At each predetermined sampling point, all biological species (flora and fauna) were recorded to the lowest taxonomic level. Faunal species inventory was further supplemented by opportunistic observation as driving through the project area. Literature, field guides and other published documents were also used to supplement the inventory.

5.5.1 Flora

Broad scale vegetation defines Mopane Woodland as the only major vegetation class within the project area. However, at a finer scale the vegetation class depict physiognomic and diversity variability. At broad scale the dominant Mopane (*Colophospermum mopane*) is interspaced with various **Mimosoideae** (*Senegalia* spp and *Vachellia* spp), **Combretaceae species** (e.g. *Terminalia sericea*, *T prunioides*, *Combretum imberbe*), and other species including *Commiphora* spp (corkwood, moroka), *Peltophorum africanum* (weeping wattle mosetha) and *Sclerocarya birrea* (morula). Common shrub species include *Grewia* species (e.g. *G. montiola*, *G. flava*, *G. flavescens* and others), *Azanza garckeana* (moroja) and *Dichrostachys cinerea* (moselesele).

At a fine spatial scale, vegetation density depicts variability in both relative species composition, structure and density, however, all depict similar species composition in the exception of the riparian vegetation. This vegetation class is restricted to the margins of hydrological features (i.e. rivers) and is characterised by comparatively tall dense evergreen trees as a result of high moisture content. Common woody plant species include leadwood (motswere), *Senegalia nigrescens* (mokoba), *Philenoptera nelsii*, *Ziziphus mocrunata* (buffalo thorn, mokgalo). Understory shrub species are similar to those described for the large landscape. Grass species in the understory include *Digitaria* spp, *Pogonarthria squarrosa*, *Schmidtia* spp, *Eragrostis* spp, *Aristida* spp and *Heteropogon* spp and *Urochloa* spp.

The riparian vegetation also offers specialised habitat for specific avian species and refugia for most extant wildlife species. This vegetation class is still comparatively intact and continuous across the landscape providing connectivity of the project site with other adjacent landscapes like the Makgadikgadi Salt Pans and Shashe-Limpopo River system.

5.5.2 Fauna

As a result of high anthropogenic activity, habitat conversion to agriculture and fragmentation due to fences, faunal species diversity in the project area is very low. Large mammalian species in particular are uncommon around human dominated areas, except in the fenced private holdings. Extant mammalian species are mainly small mammals in the order insectivore (e.g. shrews, hedgehogs (*Atelerix frontalis*)) and Order RODENTIA (rats, mouse and gerbils), tree squirrels *Paraxerus cepapi*, porcupine

(*Hystrix africae australis*), spring hare (*Pedetes capensis*), scrub hare (*Lepus saxatilis*) mongooses (e.g. slender mongoose *Galerella* spp, banded mongoose *Mungos mungo*). Extant primate species include Chacma baboon (*Papio ursinus*), vervet monkey (*Chlorocebus pygerythrus*) and bush babies. Both primate species tend to be mainly associated with unsettled hilly areas. Large herbivore species are mainly restricted to intact landscapes within the fenced private properties. These include kudu (*Tragelaphus strepsiceros*), impala (*Aepyceros melampus*), steenbok (*Raphicerus campestris*), duiker (*Sylvicapra grimmia*) and warthog (*Phacochoerus aethiopicus*). A very low density of members of the Order CARNIVORA can be extrapolated. Extant carnivore species, albeit at very low densities include brown hyaena (*Parahyaena brunnea*), spotted hyaena (*Crocuta crocuta*) and jackal species (*Canis mesomelas* and *C. adustus*) and leopard (*Panthera pardus*). Lion, the largest African carnivore, occurs very infrequently as transients from northern Botswana or Makgadikgadi Salt Pans area. Extant mesopredators include: caracal (*Felis caracal*), African wild cat (*Felis lybica*), serval (*Felis serval*), bat eared fox (*Otocyon megalotis*), honey badger (*Mellivora capensis*) and genets (*Genetta* spp) and others.

In the recent years, sighting of African elephant (*Loxodonta africana*) have been gradually increasing in the project area. The observed rise in elephant sightings in the North East District has been ascribed to northern Botswana and western Zimbabwe elephant population expansion and the perennial availability of surface water at the recently constructed Ntimbale Dam. Elephants are highly water dependent, and this has a bearing on the proposed water supply scheme, i.e. risk of damage of infrastructure and consequent problem animal control mediated mortality.

Faunal diversity in the project area is dominated by avian species as depicted in **Table 5-4**.

Table 5-4: Faunal Diversity

Family	Species	IUCN Redlist (National Classification)
Accipitridae	vulture (species not determined)	Endangered. Protected
	<i>Terathopius ecaudatus</i> , bateleur, peteke	Near Threatened. Protected
Bucerotidae	<i>Tockus leucomelas</i> , yellow-billed hornbill, koro	Least Concern
	<i>Tockus erythrorhynchus</i> , red-billed hornbill, koro	Least Concern
	<i>Lophoceros nasutus</i> , grey hornbill, koro	Least Concern
	<i>Bucorvus leadbeateri</i> , ground hornbill, lehututu	Vulnerable. Protected
Columbidae	<i>Streptopelia</i> spp, dove, maeba	Least Concern
	<i>Oena capensis</i> , Namaqua dove, ramokudinyane	Least Concern
	<i>Streptopelia semitorquata</i> , red-eyed dove, leeba	Least Concern
	<i>Streptopelia capicola</i> , ring-necked dove, leeba	Least Concern
	<i>Streptopelia senegalensis</i> , laughing dove, leeba	Least Concern
Corvidae	<i>Corvus albus</i> , pied crow, legakabe	Least Concern
	<i>Corvus capensis</i> , black crow, legakabe	Least Concern
Dicruridae	<i>Dicrurus adsimilis</i> , fork-tailed drongo	Least Concern
Estrildidae	<i>Uraeginthus angolensis</i> , blue waxbill, rabiibii	Least Concern
Leiotrichidae	<i>Turdoides</i> spp, babbler	Least Concern

Musophagidae	<i>Corythaixoides concolor</i> , grey lourie, mokowe	Least Concern
Nectariniidae	<i>Chalcomitra amethystina</i> , Amethyst sunbird	Least Concern
Numididae	<i>Numida meleagris</i> , guinea fowl, kgaka	Least Concern
Passeridae	<i>Passer</i> spp, sparrows	Least Concern
	<i>Peliperdix coqui</i> , Coqui francolin, lesogo	Least Concern
	<i>Peliperdix sephaena</i> , crested francolin, lesogo	Least Concern
Ploceidae	<i>Quelea quelea</i> , red-billed quelea, thaga	Least Concern
	<i>Ploceus</i> spp, weavers, thaga (nests)	Least Concern
	<i>Ploceus velatus</i> , masked weaver, thaga	Least Concern
	<i>Ploceus</i> spp, weavers, thaga	Least Concern
Pteroclididae	<i>Pterocles burchelli</i> , sandgrouse, legwaragwara	Least Concern
	<i>Pterocles</i> spp, sandgrouse, legwaragwara	Least Concern
Pycnonotidae	<i>Pycnonotus</i> spp, bulbul,	Least Concern
Sturnidae	<i>Lamprotornis nitens</i> , glossy starlings, legodi/legwedi	Least Concern
Turnicidae	<i>Turnix sylvaticus</i> , button quail, lesogo	Least Concern
Upupidae	<i>Upapa epops</i> , hoopoe, mmadilepe	Least Concern

The observed high species richness (n = 32) of avian species is attributed to the guilds ability to use flight to evade capture/mortality, traverse hostile landscapes and existence of enough refugia offered by unsettled hills and the riparian fringe along the multiple hydrological features. Also, movement of avian species is not affected by fences. However, most of the avian species recorded by this assessment are common birds of Botswana and of no significant national and international concern, in the exception of raptor species and ground hornbill (*Bucorvus leadbeateri*). Recorded avian species were dominated by members of families Ploceidae, Passaridae, Columbidae and Bucerotidae.

5.6 Social Profile

Regional Setting and Administration

Tutume sub-District occupies an area of 43,487 km², the largest sub district in the Central District. Domestically, it borders the following districts: North East District on the south eastern, Boteti sub-District on the South western, Serowe-Palapye sub-District on the south and Chobe District on the north while North east district is the second smallest district in the country. The district fits within the lines of longitude 27°15 and 28 east, and between latitude 20°30 and 21°25 south. The district is bordered by the Central District in the west and south with the Shashe River forming the boundary. In the east and north is Zimbabwe, with the Ramokgwebana River as much of the boundary. The Francistown urban area is surrounded by the North East District, which has a tremendous influence on the delivery of services as well as transfer of technology to the district. On the other hand, Tutume village is the administrative centre for the sub district. It also provides social services such as shopping, banking, health, education, to name a few.

5.7 Demography

5.7.1 Population Change

According to the 2011 Population and Housing Census, Tutume sub-District had a population of 147,377 in 2011 as compared to 123,514 in 2001. The sub-district had a population increase of 19.3% while North East District had a population of 60,264 in 2011 as compared to 49,399 in 2001 with population increase of 22.0% during the period.

Table 5-5: Population size and % increase in Tutume sub-District and North East

Project Location	2001 Population	2011 Population	Population increase from 2001	% increase from 2001
Tutume Sub District	123,514	147,377	23,863	19.3
North East District	49,399	60,264	10,865	22.0

5.7.2 Ethnicity

Within the Tutume Sub-district there are several ethnic groups whose cultural values and beliefs vary significantly. Such groups comprise of Bakalanga and Batalaote. All these groups are under the leadership of the Paramount Chief of Bangwato who is represented at sub-district level by Senior Subordinate Tribal Authorities and Headman of various levels at village level. The North-East District ethnically comprises the Bakalanga, Barolong, Batalaote and Bakhurutse. The Bakalanga traditionally do not settle in a compact form of settlement, but scatter within a big geographical area. In most cases when a village is originally established, it is composed mostly of a family and relatives. However, the villages are dominated by Bakalaka and Bangwato are composed of wards, occupied by different families. They have separated their grazing areas and the fields from their villages. None of the groups however can be considered as historically underserved traditional minority.

Livelihoods

There are no major manufacturing or wholesale establishments in both districts. There are a number of small-scale construction companies carrying out some maintenance work to various institutions in the district. Other than the latter, there are also a number of commercial activities in the Tutume Sub-District and North East District. These include among others, restaurants, general dealers, butcheries, cooperatives, chibuku depots, supermarkets, filling stations and recently lodges and motels. These provide employment and essential goods and services to the community of Tutume and North East District.

Apart from commercial activities in Tutume and North East villages there are also government support programs provided by government to set up income generating undertakings. Some of these programs include; old age pension fund, Ipelegeng Programme (drought relief), Poverty Eradication such as;

poultry production, small stock production, dairy production, backyard garden and to a lesser extent piggery and small scale businesses (hawkers and tuck-shops).

5.7.4 Agriculture

The dominant economic activity in Tutume Sub-District and North East District is agriculture (both arable and pastoral). The districts are predominantly rural so most of its residents are engaged in both arable and livestock. Most operations are at subsistence level with a few commercial endeavors (Central District Development Plan 6; 2003-2009).

Livestock Production

Table 5-6 shows 2013 cattle herd composition in Tutume Sub-District and North East District. Most of these additions were in the communal areas.

Table 5-6: Cattle herd composition in Tutume Sub-District and North East District

District	Bulls	Oxen	Cows	Tollies	Heifers	Male calves	Female calves	Cattle Population
Tutume sub-District	3,528	12,361	74,688	25,965	18, 623	10, 692	13, 265	159,122
North East District	294	2,151	8,239	8,459	4,007	1,996	1,554	26,700

Only a minority of the household's own cattle, but small stock ownership is more widespread (Annual Agricultural Survey Report 2013, 2015). Arable agriculture is mostly practiced in many fields around villages.

Table 5-7: Goats population by type of breed in Tutume Sub-District and North East District

Districts	Tswana	Crosses	Exotic	Total Goats
Tutume Sub District	88,812	18,684	3,711	111,207
North East District	12,756	3,197	1,110	17, 063

Source: Annual Agricultural Survey Report 2013, 2015

Table 5-7 shows that the majority of goats in both Districts are the Tswana type and the districts has a small population of sheep (Table 5-8).

Table 5-8: Sheep population by type of breed in Tutume sub-District and North East District

Districts	Tswana	Crosses	Exotic	Total Sheep
Tutume Sub District	3,778	2,765	315	6,858

North East District	1,506	511	42	2,059
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Source: Annual Agricultural Survey Report 2013, 2015

Crop Farming

Crop production statistics for both North East District and Tutume Sub-District are provided in Table 5-9. On average Tutume Sub-District crop production is higher compared to North East District. It is only for a few crops such as beans, sunflower and water melons that are produced more in North East District than in Tutume Sub-District.

Table 5-9: Total Production (Metric Tons) by type of crop

Districts	Sorghum	Maize	Millet	Beans	Sunflower	Groundnuts	Water melons	Other crops
Tutume Sub-District	3,656	1,105	1,472	82	16	75	3,577	6,603
North East District	1,102	836	104	897	129	34	4,838	6,202

Source; Annual Agricultural Survey Report 2013, 2015

5.7.5 Employment

According to the Population and Housing Census 2011 Selected Indicators (2015), 44 673 and 16 170 people are employed in Tutume Sub-District and North East District respectively. Table 5-10 shows the number of employed residents and unemployed rate in the project area.

Table 5-10: ESMPloyment status by village and sex in the projet area

Districts	Employed			Unemployed			Economically Active			Unemployed Rate %		
	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total
Tutume	23 777	20 896	44 673	2 866	4 462	7 329	26 644	25 358	52 002	10.8	17.6	14.1
North East	8 210	7 961	16 170	903	1 998	2 901	9 113	9 958	19 071	9.9	20.1	15.2

Source: Central Tutume District Population and Housing Census 2011 Selected Indicators, 2015

5.7.6 Tourism

Tourism in both districts is not well developed but promising. The expansion of the hospitality sector, is a positive development as it is likely to encourage and complement the development of the tourism industry in the districts which is as of now contributing marginally or none at all in terms of total output

and/or developments in the districts. This is in line with the broader national/regional objectives of enhancing the country/region's competitiveness in the tourism sector. Although both districts are not rich in game, they have great potential in eco-tourism sites of historical interest in the district such as the Domboshaba ruins, rock paintings, old mines especially near Domboshaba ruins and Vukwi ruins and some in Farm 1-NQ, and old pottery in some caves. As of now the sites remain unknown to the outside world. There is also the Supa–Ngwao museum located in Francistown, which intends educating communities on conservation of natural heritage and historic sites as well as promoting cultural festivals.

This study acknowledges that the potential for tourism activities has not been explored to its maximum potential hence the need to come up with measures to strengthen the possibility of tourism activities as a means to diversify the economy given the sustainable utilization of Ntimbale dam and the Domboshaba ruins. Utilisation of veldt products for commercial purposes like phane-*Gonimbrasia belina* (mophane worm) has potential for income generation. There is need to lay down strategies for exploring the opportunities.

5.8 Health

5.8.1 HIV Prevalence

HIV/AIDS represents one of the biggest challenges confronting Botswana today. The impacts of the epidemic on every sector of the economy are adverse and far-reaching. The number of AIDS related deaths, increase in the number of orphans, an overstretched healthcare system, absenteeism, reduced productivity and the diversion of a significant proportion of the national budget to address the critical areas of HIV/AIDS prevention, treatment, care and support are but a few examples of such impacts. According to BAIS IV Report (2014), the HIV prevalence in Tutume Sub-District district is 18.2% whereas for North East District is 17.7% which are both lower than the national figure of 18.5% (**Figure 5-6**).

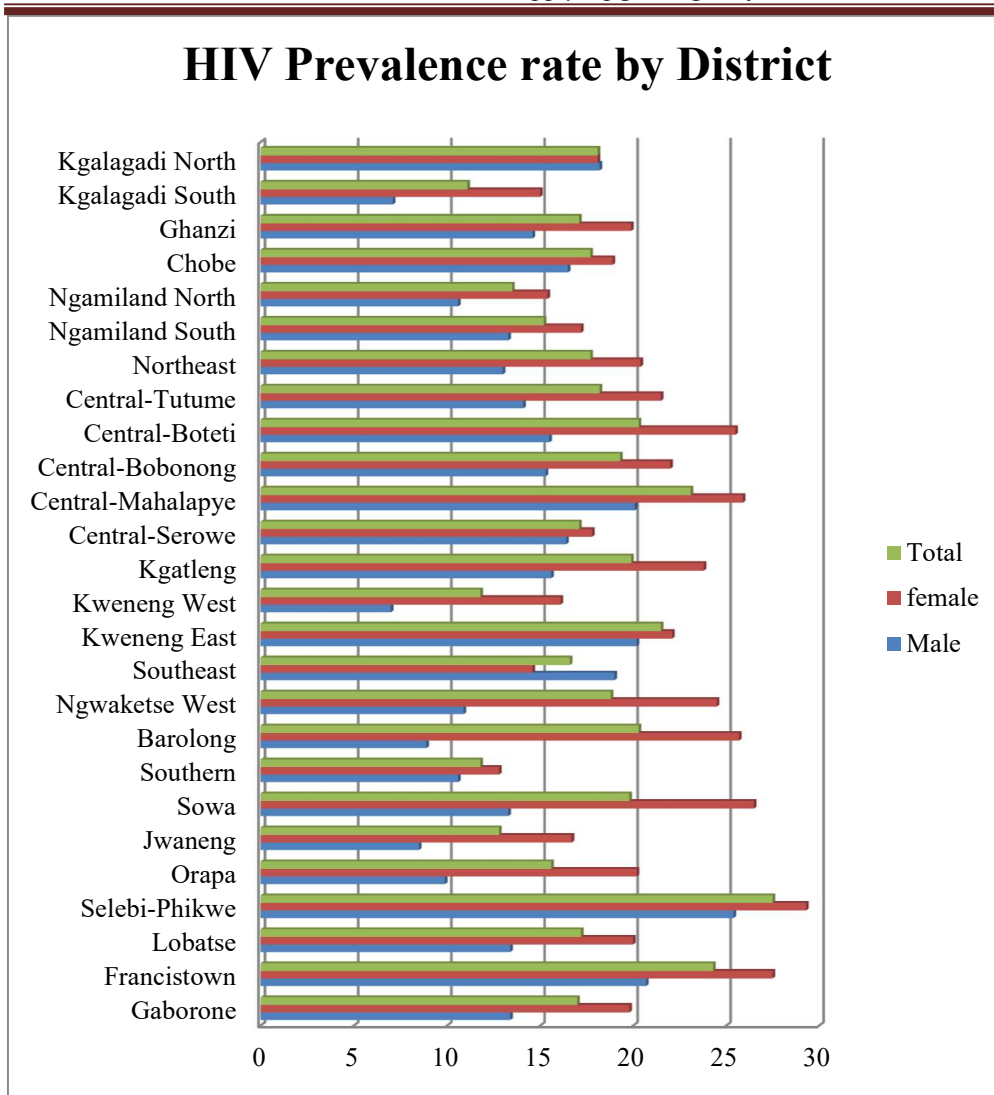


Figure 5-6: HIV/AIDS Prevalence Rate by District

Source: BAIS, 2014

According to BAIS (2014), HIV in Tutume Sub-District and North East District has mostly affected the youth between 25 and 29 at 38.5% and 31.5% respectively. Within this group, females are mostly infected.

5.9 Education

As of 2011, there were a total of 66 schools in the district, with 6.70 per cent private schools. The total number of students in the Council schools was 24,296, while it was 1,277 in private schools. The total number of students enrolled in the district was 25,572: 12,564 girls and 13,008 boys. The total number of qualified teachers was 1,058 of which 841 were females and 217 male. There were around 34 temporary teachers, 19 male and 53 female. There were no untrained teachers in the district while in Tutume Sub-District there are a total of 24 government schools, the Sub-District has a total of 45 primary

schools with an 117,729 total number of enrolled students, one senior secondary school, Tutume McConnell Community College in Tutume Village, admits students from all 12 junior secondary schools in the area making a total of 13,110 enrolled secondary students and the sub district also hosts 7 vocational schools.

5.10 Transportation

Tutume Sub-District is accessible through the Francistown-Maun Road (A3 Road) where it connects to Sebina at the Sebina Junction. Tutume Sub-District is also accessible through Masunga-Sebina and Tutume-Mosetse roads which are tarred. The main road, Sebina-Maitengwe, is tarred and most of the internal roads in the villages are gravel.

Transportation in North East District is by road and rail. The District is mainly connected to Francistown and the rest of the country through the Ramokgwebana-Ramatlabama, Ramokgwebana-Sebina-Francistown and Matsiloje-Francistown tarmacked roads and Tshesebe-Mulambakwena earth surfaced road. The rest of the roads are un-gazetted, with some of them gravel surfaced and others earth roads. The area to the south of Matsiloje is mainly characterized by tracks and is not easily accessible, especially during the rainy season. The main railway line from Ramatlabama to Ramokgwebana passes through the eastern part of the district and this line carries passengers and freight both within Botswana and to and from Zimbabwe.

5.11 Telecommunication

The areas are well covered in by a number of telecommunications services. They both have a good coverage from the Botswana Telecommunication Cooperation and private operators namely; Mascom, Orange and BeMobile. The areas enjoy coverage of signals from a number of local radio stations and the national television (BTV). Botswana Post also has provided the area with a well-developed postal infrastructure. Existence of good communication network in the district presents good opportunities for industrialization. However, it is regrettable that dominance of Francistown over the districts headquarters Masunga and Tutume might mean investors would continue to concentrate or be attracted to Francistown. Francistown provides higher order services for the districts and such a scenario has always led to opportunity seekers migrating to the City of Francistown.

5.12 Water

Sebina and Maitengwe, residents are supplied with borehole water from Maitengwe Wellfield, which is 66km from Maitengwe village. Boreholes that supply residents with portable water include BH 9935, BH 9934, BH 9474, BH 9466, BH 9465, BH 9472, BH 9470, BH 9960 and BH 9961. Borehole depths in the wellfields ranges from 60 – 160m deep. However, on average water level depths on all boreholes have lowered since commissioning in 2006 (about 10 years ago).

Potable water from the wellfield is collected by a network of Ø160mm uPVC pipes from individual boreholes and fed into a Ø400mm collector ductile iron (D.I) pipe. Water collected from the boreholes

is first boosted by the first booster pump station (PS1) to increase the pressure before being pumped to the second booster pump station (PS2) which is closer to Maitengwe village (about 30km). The final pump station (PS3) is located right in Maitengwe village which further boosts the potable water to Tutume Village that lies about 50 km. This potable water together with that water from Chidumela wellfield in Tutume is then pumped south to supply Matobo, Goshwe, Nswazwi, Makuta, Nshakashokwe and Sebina. Borehole water supply in the area is augmented by surface water from Ntimbale Dam.

North East District has several ephemeral streams and rivers. The principal rivers include Shashe, Vukwi, Tati, Ntshe, Sikukwe and Ramokgwebana. The rivers store considerable amount of water which is able to supply the majority of human beings and animals. There are few dams in the area which collect most of the runoff. These are the Shashe and Ntimbale Dams. Other sources of water include boreholes under the jurisdiction of the district council and other small dams constructed under the development section of the Ministry of Agriculture and these are very useful to small farmers.

5.13 Power Supply

Botswana Power Corporation (BPC) is responsible for the provision of electricity in both North East District and Tutume Sub-District through a 132kV line.

5.14 Housing / Accommodation

The recent upgrade in economic status of the residents of the study areas have seen to a gradual improvement in the housing structures from the traditional mud and thatch housing units to mortar and cement brick, and corrugated iron or clay tile roofs. In most cases the houses are electrified and connected to water. That notwithstanding, the housing units are in most cases not connected to any sewerage collection lines except to localized soak-away systems.

5.15 Waste Management

Waste streams generated in both study areas include solid waste (domestic), clinical waste, and sewerage waste. The strategies employed in management of these waste types in both areas are discussed below.

5.15.1 Solid Waste

Solid waste or refuse management is administered by Environmental Health Department of Tutume Sub-District Council and North East District Council respectively. The Environmental Health Department usually engages private companies to collect solid waste in some villages on their behalf. Waste collected from government institutions and residential houses is disposed of at respective dumping sites. The Department of Environmental Health indicates existence of the problem of indiscriminate waste disposal and the department has embarked on annual clean-up campaigns through cleanest school and village competitions.

5.15.2 Clinical Waste

Tutume Sub-District Environmental Health Clinical waste truck collects waste from clinics in the sub-district. Waste is then taken to an incinerator at Tutume Hospital while in North East District all the clinical waste from the all the 39 health facilities, private clinics, home-based care is collected and treated at Masunga Landfill incinerator.

5.15.3 Sewerage Waste

Sewerage waste falls under the mandate of WUC country wide. Residents apply for disposal service. The Utility gives a quote (P400/load for septic tank, domestic rate and P1500 for institutions).

5.16 Land Uses and Land Tenure in Tutume Sub District

All land in the Tutume sub-District, with exception of land owned under freehold title or State land, is owned by the Government of Botswana and vested in the Tutume sub-Land Board and Marapong sub-Land Board established under the Tribal Land Act. The Land Board, through the Tribal Land Act, manages the land. The Tribal Land accommodates a number of land use zones and these are commercial areas, Wildlife management areas, Communal service Centres, Remote Area Development (RAD) ranches, Communal First Development Area (CFDA) ranches and Tribal grazing Land Policy (TGLP) (Armstrong Attorneys, 2012).

Land Use in the North East District

The District covers a total area of 5 993km², making it the second smallest district in the country. The district has different types of land ownership and they are under Tati Land Board administration.

Table 5-11 depicts that out of the 5 993 km² of land in the district Freehold farms covers an area of 2 569km² (42.9 %), State land 33 km² (0.5 %) and Tribal land 3 391 km² (56.6 %). The district set up is that several villages are sparsely populated and scattered all over the district. Unlike the rest of Botswana which is normally characterized by large traditional villages separated from arable lands and cattle posts, the current scenario in North East is that agricultural land use is mixed with residential land use.

Table 5-11: Land Tenure in the North East District

Type of Land Use	Area in Km ²	% of Total Land
Freehold Land	2 569	42.9
State Land	33	0.5
Tribal/Communal Land	3 391	56.6
Total District	5 993	100 %

Source: North East Settlement Strategy, (2000 – 2024)

5.17 Archaeology and Historical Background

Cultural heritage resources include traces of our past and the structures: stone tools, pottery, monuments and stone walls among others. These resources can either be tangible and intangible aspects. They include social value systems (culture) as well as palaeontological (fossil) remains. Cultural resources are important because they are unique and non-renewable. Unlike biodiversity, cultural materials cannot reproduce. Heritage resources also have economic, spiritual, scientific, educational and historic values. It is therefore important to protect cultural heritage both past and present during the development phase.

Recognizing and protecting local heritage from the adverse impact of project development is consistent with many international conventions including the Convention concerning the Protection of World Culture and Natural Heritage and the UNESCO 2004 Yamato Declaration on Integrated Approaches for Safeguarding Tangible & Intangible Cultural Heritage and related statutory tools. In addition, the International Finance Corporation (IFC) Performance Standards are often taken as an international benchmark of good practice. In particular, Performance Standard 8 recognizes both tangible and intangible cultural heritage. These include ‘moveable or immovable objects, property, sites, structures, or groups of structures, having archaeological (prehistoric), paleontological, historical, cultural, artistic, and religious values’, as well as ‘unique natural environmental features or tangible objects that embody cultural values, such as sacred groves, rocks, lakes, and waterfalls’.

Performance Standard 8 applies ‘to cultural heritage regardless of whether or not it has been legally protected or previously disturbed’. Since the ratification of the UNESCO Convention on Intangible Heritage the intangible values are also considered important too. Performance Standard 8 defines intangible cultural heritage to include ‘cultural knowledge, innovations and practices of communities embodying traditional lifestyles’.

Archaeology

The study area seems to fall within a region where evidence suggests that earlier Stone Age (SA) occupations, with Middle Stone Age (MSA), and Late Stone Age (LSA) materials being the most observed. The Department of National Museum and Monuments site register has recorded over 107 archaeological sites in and around the study area. These include all the Stone Age phases and Historic sites. Sites of similar nature were expected to be found while undertaking this study.

Archaeological research in north eastern and central Botswana has identified numerous archaeological sites ranging from the Stone Age to present. Most of the information is derived from heritage impact assessments as well as systematic scientific research in the area. Most of the sites are within the north east District.

All Stone Age phases have been recorded in the study area. There is also evidence of rock art associated with the Late Stone Age (Walker 1998). North East District is particularly known for Zimbabwe types of sites and/or associated stone wall sites including Domboshaba site that has been a subject of scientific interest since the colonial period.

Historical Background

Historically, the North East District has been populated by the Bakalanga, branch of the Shona peoples since 1540AD and possibly longer. The Kalanga settled in the area as part of the gold rich Butwa kingdom. Gold resources in the area have attracted Europeans settlers and illegal looters to settle in the area subsequently establishing Francistown. The Tati Mining Company has been instrumental in the mining of gold using modern techniques. But the company did not make new discoveries as they followed prehistoric mines in their exploration and mining of gold. To date, the gold and now copper mines are significant economic drivers in the area. The Department of National Museum and Monuments site register has recorded over 566 heritage site in the study area and the sites table is appended to the ESIA report.

5.18 Specific Environmental Characterization for New Sites (Greenfield)

Provided below is the specific environmental baseline for new sites to be included as part of the project activities;

Table 5-12: Site Specific Conditions for Greenfield Sites

Facility/Activity	Environmental Conditions (vegetation, land use, ownership status, archaeological status, status of development e.g. presence of structures etc.)				
	Vegetation	Land use	Ownership Status	Archaeological Status	Status of Development
Kalakamati Break Pressure Tank & Booster Station	Mostly <i>Acacia tortilis</i> woodland. No species of special conservation status.	Customary Land	Local Land Board	Cleared	Not developed
Kalakamati - Masunga Pipeline	Mixed <i>Acacia</i> woodland closed to farming lands. No species of special conservation status.	Road reserve	Department of Roads	Close to Domboshaba ruins Occurs next to marked grave site	Kalakamati-Vukwi-Not developed Vukwi-Masunga-Existing pipeline

*Updated Environmental and Social Impact Assessment for the North East District and Tutume Sub District
Water Supply Upgrading Project*

Jackalas 1 - Siviya Connection Point Pipeline	Mixed <i>Acacia</i> woodland closed to farming lands. No species of special conservation status.	Road Reserve	Department of Roads	Cleared	Pipeline to be constructed parallel to existing Ø160mm pipeline along the Botswana/ Zimbabwe main road reserve.
Makaleng – Sebina/Nshakazhogwe Pipeline	Mixed woodland dominated by <i>C.mopane</i> . No species of special conservation status.	Road reserve	Department of Roads	Cleared	Next to existing pipeline

6 STAKEHOLDER CONSULTATIONS

It is worth noting that the ESIA study conducted by RPM (Pty) Ltd had consulted the communities and relevant authorities largely in line with the local legislative requirements for an Environmental Impact Assessment as stipulated in the EA Act No. 10 of 2011. That notwithstanding, the current study also undertook stakeholder consultations mainly to recap on previously raised issues and also to align the study with the World Bank Standards and Social Safeguards which obligates that stakeholders to be consulted during environmental assessment studies such this Environmental Social Impact Assessment (ESIA) study. The consultations undertaken for this study entailed high level meeting with leaders of the communities, one-on-one interactions with local technical authorities and directly affected parties. The public participation process was adopted with the view to achieve the following specific objectives:

- Solicit views and concerns from the interested and affected people and allowing them to suggest mitigations and/or enhancement measures;
- Consult communities and affected parties who were omitted during the initial consultations by RPM (Pty) Ltd especially vulnerable communities who have attachment to land in the project area (if any);
- To establish if there were any alteration in institutional processes and if any to get a better understanding of their bearing on the study;
- To touch base with the communities as a way of reminder on the objectives of the proposed project;

6.1 Stakeholder Identification and Mapping

Stakeholder Analysis

Stakeholder analysis is a methodology often used to incorporate the needs of those who have an interest in proposed developmental interventions such as the Botswana Emergency Water Security and Efficiency Projects-North East District and Tutume Sub District Water Supply Project. This is to ensure that the interventions are accommodative, realistic and sustainable. Consequently, a stakeholder analysis was undertaken to identify the various stakeholders that are likely to be affected by and/or have interest in the proposed development. The stakeholder analysis has identified two broad categories of stakeholders namely:

- i. Affected Parties - These members of the public are affected either positively or negatively by the proposed development. These were further sub-divided into primary stakeholders (first priority group-land owners) and secondary (second priority group-street vendors).
- ii. Authorities - these encompass the various groups that pertain to tribal administration, local government and central government; the latter mainly through control of the licenses and/or permits required.

Table 6-1 contains stakeholders who were identified and engaged during the previous study by RPM (Pty) Ltd.

Table 6-1: Stakeholders Consulted in 2015 from the Previous Study

Group represented	Region	Position	Telephone	Name
National				
Botswana Power Corporation	Masunga	Station Manager	2489339	Mr. Tlhako
Department of Water Affairs	Francistown	Officer In charge	2405056	Mr. G. Kago
Land Board	Tutume Sub Land board	Sub Land board Secretary	2987230	Mr. N. Sebonego
	Tati Main Land board	Land board Secretary	2489267	Mr. Mmolawa
Department of Waste Management and Pollution Control	Francistown	Environmental Engineer	2412885	Mr. Molebatsi
North East District Council				
Environmental Health		Principal Environmental Health Officer	2489616/2489341	Mr. Tapiso
Roads Division		Principal Roads Engineer	2489861	
Tutume Sub District Council		Principal Roads Engineer	2987232	Mr. Magagane
		Environmental Health Superintendent	2987551	Mr. C. Chikunyana
Elected Representative				
Tati West Constituency		MP	2489760	Mr. C. Tibone
Nkange Constituency		MP	2987717	Mr. E. Batshu
Tati East Constituency		MP	2489443	Mr. S. Guma
Zwenshambe councillor		Councillor	2416441	Hon. Khazi Motswakae
Masingwaneng councillor		Councillor	2481032	Hon. Dikitso Mandevu
Kalakamati and Mbalambi		Councillor	71841309	Hon. Madumela Matebu

6.2 Methods of Engagement

Focus Group Discussions

Focus group discussions were held with community representative in the form of Tribal Authorities and the respective Village Development Committees. These were held to help touch base with the communities as a way of reminder on the objectives of the proposed project as well as include communities which were previously left out during the initial stakeholder consultations.

One-on- One Interviews

One-on-one interviews were held with technical department and Interested and Affected Parties (IAPs). The former was consulted to establish if there were any alteration in institutional processes which would require better understanding as they could have bearing on the study. The IAPs were engaged purely through a social survey where a sampled section of the community was involved in the study. They were placed into two distinct groups i.e. those who are likely to directly affected (Directly Affected Community) and the general community (herein referred to as rapid opinion respondents). The latter were randomly selected. Questionnaires comprised of mostly closed ended questions with few open ended questions were used as an instrument for data collection for both groups.

6.3 Summary of Issues²

The following is a summary of issues raised during stakeholder (Interested and Affected Parties) engagement exercises:

- The project is likely to benefit the communities during construction phase through employment opportunities.
- The proposed project will improve water quality and supply in both North East and Tutume Sub District area.
- An improvement in livelihood is anticipated upon completion of the construction of the infrastructure due to constant and reliable water supply.
- The awarded contractor should consider engaging local construction companies and facilitate the procurement of goods and services from the local communities.
- Some of the project activities will result in the generation of dust which lead to respiratory ailments.
- Noise generated during the construction phase of the project is likely to disturb serenity.
- The proposed project may result in loss of land use rights especially for those land uses located within the proposed developments.
- All land uses affected should be compensated accordingly.

² Other issues are as contained in the outcomes of the consultations

7 ANALYSIS OF ALTERNATIVES

7.1 Location Alternatives

Infrastructure Upgrade

Most of the infrastructure in the proposed North East District and Tutume Sub-District Water Supply Scheme upgrade already exists. As such only location alternatives were considered for the proposed new pipelines, booster stations and elevated tanks i.e. Makaleng - Sebina Pipeline, Kalakamati – Masunga Pipeline, Goshwe Pipeline, Jackalass 1 – Siviya Pipeline, Mbalambi Reservoir upgrade, Kalakamati Booster station and Masingwaneng Treatment Works.

Location alternatives were not considered for most of the project villages since for the latter elevated tanks will be placed on land that was previously disturbed during construction of the existing tanks.

Masingwaneng Water Treatment Plant

Water works upgrade of the treatment plant will be done within the existing plant footprint and the works will be done within a “brownfield”. The proposed upgrading of the water works will be at the same location and within the village of Masingwaneng, therefore, no alternative site was considered for its placement. Refer to Figure 2.

Mbalambi Reservoir Upgrade

Similarly, the reservoir upgrade which will be done at Mbalambi will be constructed within a “brownfield” where the existing reservoir is located. However, two alternatives were considered for extension of the existing footprint to accommodate the new reservoir. The two alternatives were assessed based on easiness of construction of internal pipework. The proposed extension of the existing yard will not encroach in any private properties, as such no alternative site was considered for its placement. Refer to Figure 6.

Kalakamati Break Pressure Tank and Booster Station

Two site location alternatives were considered for the proposed Break Pressure Tank and Booster Station. Alternative 1 site is located approximately 3.5km from the Masunga junction on the road from Kalakamate village to Toteng. The location of the Booster Station on this site will reduce more pressure in the pipeline and help avoid frequent pipeline bursts compared to Alternative 2 site located about 6km further north of the pipeline. Therefore, Alternative Site 1 has been chosen to accommodate the proposed Kalakamati Break Pressure Tank and Booster Station. Refer to Figure 3.

Kalakamati and Masunga Pipeline

The proposed pipeline which will connect Kalakamati and Masunga was considered for alternative routing (Figure 5). It is proposed that the pipeline be confined to the road servitude which is already disturbed; the route is also easy to traverse since further from the road occurs quite a number of kopjes (Ancient Rocks) which are culturally rich. The pipeline traverses an archaeologically rich area of the Domboshaba ruins. Therefore, in discussing the route alternative, the archaeological elements of the

receiving environment were used as the weakest link hence needed to be preserved. As the archaeological aspect was central in influencing the preferred routing alternative;

Placement within Road Servitude

Placing the pipeline route within the road servitude will ensure minimum disturbance of the area since the area was previously disturbed during road construction. This will significantly reduce the chances of disturbing archaeological material in the area. However, during the construction of the gate house for Domboshaba Monument, several archaeological materials were unearthed including burials near the road reserve where the proposed pipeline is likely to pass. It is therefore recommended that no further development should be undertaken on the northern side of the road corridor. An alternative option would be to lay the water pipeline on the northern side of the road but within the road reserve. The development should be subject to archaeological monitoring where a full time archaeologist is deployed on full time basis for all earthworks within 500m distance in front of Domboshaba Monument.

Outside the Road Reserve

Placing the pipeline outside the road reserve would require that a new route be eased to create a pathway for the pipe. This comes with higher chances of disturbing the archaeological material in the area. During the construction of the gate house for Domboshaba Monument, several archaeological materials were unearthed including burials near the road reserve where the proposed pipeline is likely to pass. It is therefore highly likely that much more could be disturbed should works be extended beyond the road reserve.

Preferred Option

The pipeline should be confined to the northern side of the road but to be laid within the existing road reserve. Jackalas 1 – Siviya Connection Point Pipeline

The proposed pipeline will link Siviya Village and other surrounding smaller villages' water supply to the proposed tank at Jackalas 1 tank. Currently Siviya is not adequately receiving enough water due to its elevation, therefore, the upgraded Jackalas 1 elevated tank will be able to gravitate potable water to Siviya tank and improve water supply to the area. The pipeline will start from the Jackalas 1 tank and follow an existing Ø90mm pipeline route on the right hand side of A1 road (Botswana – Zimbabwe highway) facing Francistown, it will cross the A1 road through an existing culvert through a 90° bend and exit the culvert again with 90° bend then go on the left side of the main next to an existing WUC Ø160mm pipeline route.

Placement within Road Servitude

Placing the pipeline route within the road servitude will ensure minimum disturbance of the area since the area was previously disturbed during road construction. This will significantly reduce the chances of disturbing other services like power and telecommunication cables, sewer pipelines and passing through private owned plots. The proposed pipeline will be laid next to the existing WUC Ø160mm pipeline all the way to the connection point.

Outside the Road Reserve

Placing the pipeline outside the road reserve would require that a new route be eased to create a pathway for the pipe. This comes with higher chances of disturbing the services in the area. The first option was to run the pipeline on the northern part of the A1 road there after cross the main road, this however would have increased the costs since there are more plots on the northern side than the southern side of the road, besides its very expensive to do a pipe jacking crossing such a wide international highway. On the other hand, the Alternative Route 2 was to pass through an existing culvert and run the new pipeline alongside an existing pipeline.

Preferred Option

The proposed pipeline should be constructed on the southern side of A1 road to avoid passing through people's plots and also avoiding cutting through the main road. In addition, the old A1 which is currently being used by the locals while avoiding to be too close to the busy highway serves as a good route for the proposed pipeline.

It is therefore recommended that the proposed pipeline be constructed alongside the existing pipeline and between the old A1 Road and the road reserve fencing.

Makaleng – Sebina/ Nshakashokwe Pipeline

The proposed pipeline will serve two villages, namely; Sebina and Nshakashokwe. The advantage of having this pipeline is that water will now be transferred directly from the treatment works to these two villages instead of the water being pumped all the way to Mbalambi and then back to these two villages through Goshwe reservoir.

Alternative Pipeline Route 1 was considered to be constructed on a straight line from the Makaleng connection point to the Sebina/Nshakashogwe tanks. However, this route traverses private ploughing fields and as such it would be expensive to acquire the land and a lot of land ownership issues; Alternative Route 2 will be laid using the existing road reserve from Makaleng to Nshakashokwe existing water tanks through Sebina.

Placement within Road Servitude

Placing the pipeline route within the road servitude will ensure minimum disturbance of the area (and consequently natural habitat) since the area was previously disturbed during road construction. This will significantly reduce the chances of disturbing other services like power and telecommunication cables, sewer pipelines and passing through private owned plots. The proposed pipeline will be laid next to the existing WUC Ø160mm pipeline all the way to the elevated water tanks at Nshakashokwe.

Outside the Road Reserve

Placing the pipeline outside the road reserve would require that a new route be eased to create a pathway for the pipe. This comes with higher chances of disturbing the services in the area. If Alternative Site 1 was adopted the proposed pipeline will traverse a lot of private owned ploughing fields and land.

Preferred Option

The proposed pipeline should be constructed on the Makaleng – Sebina/ Nshakashokwe Main Road reserve and to be confined to the right hand side of the road coming from Makaleng to Sebina and on the right hand side of Sebina - Tutume Road reserve, next to the existing water pipeline within the road reserve.

7.2 Process Alternatives

Installation of Surface Pipes

The use of surface installations such as galvanised steel pipes along this route could ensure the least disturbance of the sub terrain structure. However, surface installation come along with the following disadvantages:

- i. They are very expensive
- ii. They are aesthetically unappealing especially in the area of such high tourism importance

7.3 Activity Alternatives

The “No Action Option” Kalakamati – Masunga Pipeline

The “No Action Option” implies that the development is not implemented hence, the proposed road reserve would remain as it currently is and all the impacts which could possibly come with the project to the nearby Domboshaba monument would not materialize hence better protection and limited threat to archaeological resources/archaeological sites. That notwithstanding, this option would imply that the proposed corridor remains undeveloped and water supply to Vukwi and Masunga villages would be thwarted.

The “No Action Option” For other Pipelines

The following would be expected to happen in the event that a “No Action” option was chosen for the rest of the pipelines.

- a. The output at Masingwaneng Treatment Plant will be restricted to 7Ml/day which would result in excessive abstraction of ground water from Maitengwe Wellfield
- b. Excessive pumping would continue at Maitengwe Wellfield thus resulting in depletion of water in the aquifer, which could result in shortage of water in the region

- c. If the Jackalass 1 pipe is not constructed, the villages of Senyawé and Butale would continue having water shortage.

The “Action Option” Kalakamati – Masunga Pipeline

Adoption of the “Action” alternative implies that the proposed development is allowed to proceed and there will be water supply to Vukwi and Masunga Villages. This will result in the possible destruction of archaeological materials. The “Action” alternative may be adopted if the development will be on the southern side of the Kalakamati - Masunga Road and subject to the following;

- i. Avoid archaeological sensitive areas on the northern side
- ii. Full time archaeological monitoring of all earth works in cases of chance discoveries

The Preferred Option

The ‘Action Option’ is preferred although it comes with the potential of disturbing the archaeological material in the area. It is expected that implementation of an Archaeological Watching Brief during construction could minimize unintended destructions.

The “Action Option” For other Pipelines

Masingwaneng Treatment Plant

The output at Masingwaneng treatment plant will be increased to 14Ml/day and it will result relieving the Maitengwe Wellfield which has been running low in recent years. In addition villages like Sebina and Nshakashokwe will be getting potable water directly from Masingwaneng water works than depending on the Masingwaneng – Mbalambi gravity pipeline, this in turn will reduce running costs of the water supply scheme.

An upgraded Masingwaneng Water Works Plant will relief the wellfield and it will be used as a reserve water supply source. This in turn will make the wellfield recover.

The Preferred Option

The ‘Action Option’ is preferred as it will reduce pumping energy costs and also reduce on high pressures the Kalakamati – Mbalambi pipeline experiences.

Makaleng - Sebina/ Nshakashogwe Pipeline

If this pipeline is not constructed, the two beneficiary villages will continue to experience erratic water supply therefore its construction will definitely improve water supply to the villages and have a steady and reliable source of potable water.

The Preferred Option

The ‘Action Option’ is preferred as it will improve water supply to the two villages and add to the improvement of the local people’s lives.

Jackals 1 – Siviya Pipeline

The construction of Jackals 1 – Siviya pipeline will make it possible for the Siviya village tank to be receiving water as pressures will be improved due to the upgraded and higher Jackals 1 tank. Siviya tank also supplies other smaller villages in the area, therefore, stabilizing water supply to other smaller villages and settlements. Refer to Figure 7.

The Preferred Option

The ‘Action Option’ is preferred as it will improve water supply to many villages and add to the improvement of the local people’s lives.

Goshwe Pipeline

The current Goshwe pipeline has system hydraulics problems, that is, the existing water outlet pipeline that leaves the Goshwe reservoir is smaller than the pipeline it is connected to. The outlet pipe diameter is 160mm while the main pipeline it connect to and that serves the village and other nearby villages like Nswazwi is a 200mm diameter pipeline, this creates a lot of pressure losses in the system and affects water supply to other villages. Therefore, an upgraded pipeline (by increasing its size from Ø160mm pipeline to a Ø250mm pipeline) will improve pressure and improve the efficiency of the water supply system.

The Preferred Option

The ‘Action Option’ is preferred as it will improve water supply to Goshwe and nearby villages that gets their water directly from the Goshwe reservoir.

8 IDENTIFICATION AND ASSESSMENT OF ENVIRONMENTAL AND SOCIAL IMPACTS

The efficacy of environmental/social impact assessment studies lies in their ability to determine their potential significance should if they were to go unmitigated. The level of impact of significance is necessary in determination impacts that require monitoring and close supervision by experts during project implementation.

8.1 Impact Assessment and Evaluation Method

The impact/risk identification and assessment method derives from a combination of best practice and the significance evaluation criteria based on EA regulations of 2012³.

The anticipated significance of impacts is therefore assessed as **Significance of Impact = Probability x Consequence** where:

1. The consequence of impacts/risks is described by considering:
 - Severity/magnitude of impact/risk;
 - Spatial extent and
 - Duration

Thus consequence is determined as:

Consequence = severity + duration + spatial scale.

2. Probability refers to an assessed chance of the occurrence of the predicted impact/risk.

The ranking scale for measuring the consequence of impacts/risks and their significance is as tabulated below.

Table 8-1: Consequence and Probability Ranking Scale

Severity/ Magnitude	Duration	Spatial Scale	Cumulative// Non-Cumulative	Probability
10 – Very high / don't know	5 – Permanent	5 – International	4–High (Capacity to withstand change and further stress is close to being exceeded)	5 – Definite / don't know
8 – High	4–Long-term (Ceases after operational life)	4 – National		4 – Highly probable

³ Form E, Regulation 8, Item (h)

Severity/ Magnitude	Duration	Spatial Scale	Cumulative// Non-Cumulative	Probability
6 – Moderate	3 – Medium-term (4-40 years)	3 – Regional	2–Medium (Capacity to withstand change and further stress is reduced)	3 – Medium probability
4 – Low	2 – Short-term (0-3 years)	2 – Local		2 – Low probability
2 – Minor	1 – Immediate	1 – Site only	1–Low (Significant capacity to withstand change & further stress)	1 – Improbable
0 – None			0 – Non	0 – None

The highest Significance score or Significance Points (SP) is 100. It is obtained by multiplying the consequence with the probability. The significance of environmental, safety and health effects is then classified as follows:

SP>60	High (-ve) & High (+ve) significance
SP = 30 to 60	Moderate significance
SP <30	Low significance

ENVIRONMENTAL / SOCIAL ASSESSMENT OUTCOMES

8.2 Biophysical Environment

The biophysical environment covers soil, hydrogeological and biological aspects of the environment.

Identified Potential Ecological Impacts

8.2.1.1 Soil

Soil contamination

There are many activities that can potentially contaminate the soil such as vehicle breakdowns, or mishandling of hazardous materials. Construction vehicles breakdown due to the pressures of the job but sometimes it is due to lack of proper servicing. Breakdowns may occur anywhere and they should be attended to on the spot and there is a potential for fuel spillages. Construction vehicles and generators that power the pumping station at Mbalambi Pump Station will require fuelling and there is always a potential for fuel spillages which will result in soil contamination.

Assessment

Severity = 8 (High)

Duration	=	4 (Long term)
Spatial scale	=	2 (Local)
Probability	=	5 (Definite probability)
SP	=	56 (Moderate)

Significance of Impact

This impact is considered to be moderate because there are various activities that can potentially contaminate the soil.

Mitigations

- All vehicles and machinery should be regularly serviced off site and kept in good working condition and without leaks.
- Specific sites should be gazetted and bunded (concrete floors to contain spillages) for onsite maintenance of machinery and for fuelling.
- Spillages should be cleaned immediately with the appropriate absorbents or chemicals.
- Waste oil containers should be provided on site.
- Machine and equipment operators should be trained about proper handling of used oil on site.
- All the drained oils must be properly stored and transported to oil depots by a licensed waste oil collector.
- Proper labelling and storage of chemicals and potential pollutants must be done to avoid possible spillages or contact with the environment.

Significance of impact after mitigation - **LOW**

Water Resources

Impact: Groundwater contamination

Fuel spillages are very common during construction, some due to accidents whereas some are caused by mishandling and these and other chemicals can result in possibility of ground water contamination.

Assessment

Severity	=	8 (High)
Duration	=	5 (medium)
Spatial scale	=	2 (Local)

Probability = 4 (High probability)

SP = 60 (Moderate)

Significance of Impact

The significance of the impact is rated moderate due to the soil's high infiltration capacity but can be lowered with implementation of the suggested mitigation measures.

Mitigations

- Service construction vehicles and machinery regularly and properly to reduce breakdowns and seal any leakages. This should take place off-site.
- Provide leak proof receptacles or drums for storing used oil and they should be kept in a protected area.
- Servicing should be done on protected area where spillages can be contained (bunded area that is seepage free).

Significance of impact after mitigation is **LOW**

Biological Resources

Impact: Loss of vegetation cover

Construction of physical infrastructure of the magnitude of the proposed project always result in destruction and displacement of vegetation to give way for structures. Vegetation cover serves multiple ecological benefits including primary production, prevention of soil erosion, regulation of water flow, regulation of micro-climate and mitigation against climate change through storage of carbon. Also, additional land cleared for the water pipeline will result in net reduction of habitat available for production of veldt products like mopane worm and firewood. Due to routine clearing of water pipeline routes for ease of access for maintenance purposes, this impact is expected to be restricted to the operational phase of the project.

Assessment

Severity = 4 (Low)

Duration = 3 (Medium term)

Spatial scale = 1 (Site only)

Probability = 3 (Medium probability)

SP = 24 (Low)

Significance of Impact

The significance of the impact is rated low since the vegetation clearance will be limited to the site only.

Suggested Mitigation Measures

- In the bid to reduce amount of vegetation clearing, and hence project's ecological footprint, consider aligning new water pipelines and other installations with existing structures, where technically feasible e.g. existing road reserves, firebreaks and fence lines.
- Perform a comprehensive systematic inventory of cleared vegetation; area cleared and species composition
- If creation of easement is unavoidable restrict vegetation clearance to the area needed for infrastructure development and make any wood available to locals for use as firewood, as well as save medicinal/ ornamental plants for use/ relocation.

Impact: Increased risk of wildlife mortality due to pitfalls

The laying of water pipeline entails digging of a narrow trench of up to 1.5 m deep with repeated pressure valve concrete chambers at specific intervals. Open trenches by their nature present significant risk of pitfalls for wildlife (and even livestock) that can lead to injury or death. This risk is compounded further by the narrow width of the trenches that can hinder ease escape of any animal from the trench. Similarly, during decommissioning, open trenches will be dug to remove the buried water pipes, hence creating the same open trench that poses a risk of pitfall to wildlife. However, in the exception of the increasing Africa elephant population, the risk of wildlife pitfalls is considered low due to the inherent low wildlife density in the project area. Therefore, the risk of pitfalls is expected to be of low significance during both the construction and decommissioning phases. As no open trenches are expected during the operational phase, this stage of the project is expected to carry very low to no risk of wildlife pitfalls.

Assessment

Severity	=	6 (Moderate)
Duration	=	1 (Immediate)
Spatial scale	=	2 (local)
Probability	=	3 (Medium probability)
SP	=	27 (Low)

Significance of Impact

The significance of the impact is rated low; although the area host wildlife and livestock excavations will be limited in time and space such that their effect would insignificant considering the proposed mitigation measures.

Suggested Mitigation Measures

- The amount/length of open trenches left overnight should keep to the minimum possible.
- Use reflective red tape, or some brightly coloured visual cues to mark all open trenches at all times.
- Monitor wildlife injury and/or mortality due to the pitfalls
- Report any incident of wildlife mortality/injury to the Department of Wildlife and National Parks or the nearest Police Station

Impact: Changes in wildlife behaviour and wildlife habituation

The behaviour of wildlife is determined by the spatio-temporal distribution of resources and inversely related to threats or its perception. Wildlife can habituate to physical structures (roosting, nesting, safety from predators) or resources that can be derived from the structures. In the case of the later in this particular project, water, the primary limiting factor in project area, is one such resource that can attract wildlife at points of leakage. A second source of habituation that can lead to changes in wildlife behaviour is related to food and sewage waste generated by construction crews. Many mammalian (e.g. elephant and spotted hyaena (*Crocuta crocuta*)), and avian species (hornbills (*Tockus* spp, doves and gallinaceous birds (francolins, guinea fowl (*Numida meleagris*))) are prone to habituation to anthropogenic borne food and water sources, particularly waste food and overflowing or accessible waste storage facilities. One danger of habituation and behavioural change is that when “project-borne” resources (e.g. water, waste water and food) are withdrawn at the end of construction it is likely to result in increased risk of mortality where such species do not have high behavioural elasticity to quickly switch to natural food and water resource base. In addition, habituation by its nature encourages loss of fear for human with possible close interactions that can have implications on human animal conflict (injury) and human health safety. However, due to the low wildlife diversity and density in the project area, this impact is expected to of low significance. Changes in wildlife behaviour and habituation to construction camps will be restricted to the construction and decommissioning phases. Structure and water leakage induced changes in wildlife behaviour and habituation is anticipated only during the operation phase.

Assessment

Severity	=	6 (Moderate)
Duration	=	1 (Immediate)
Spatial scale	=	2 (local)
Probability	=	3 (Medium probability)
SP	=	27 (Low)

Significance of Impact

The significance of the impact is rated low; although the area host wildlife and livestock excavations will be limited in time and space such that their effect would insignificant considering the proposed mitigation measures.

Suggested Mitigation Measures

- Development of a comprehensive water leaks' monitoring and detection system for early warning; i.e. routine patrols of the water pipeline.
- Maintain and repair, at the earliest opportunity, all water leaks from the water infrastructure.
- Proper management (designate site for waste storage, onsite handling & storage & disposal) waste food and water. Waste food should be treated on site (e.g. drying) and accumulated on site in aerated enclosures not accessible to wildlife. Covered ground pits can be an option for disposal of organic food waste and such pits should be routinely back-filled with soil to stop wildlife accessing the waste.
- Display warnings sign to constantly remind construction crews of the dangers of wildlife, e.g. "Wild Animals are Dangerous do not feed or Approach too Close"
- Report all incident of habituation to the nearest Department of Wildlife and National Parks office or Police Station.

Impact: Increased incidents of negative human-wildlife interaction

Negative human animal interaction (human animal conflict) occurs as a result of close interactions between people and wildlife. Human Animal Conflict (HAC) can cause damage to property, injury and in some instance death. Considering the low density of wildlife, including of dangerous species (e.g. predatory large carnivores (tau lion *Panthera leo*, nkwe leopard *P. pardus*, phiri spotted hyaena *Crocuta crocuta*), negative human animal conflict is not anticipated to be a significant problem. However, African elephant related incidents are likely to increase commensurate with the gradually increase in the species in the past few years in the project area. The nature of the project, water, could also compound elephant problems particularly during the dry season when distribution of surface water is limited and when water carrying structures fail (water leakages). When very limiting, elephants can be very bold in their determination to access water resources. In this regard the risk of negative human-elephant interaction is anticipated. Often, response to HAC is to destroy the particular problem individual (i.e. retributive killing). Therefore, HAC is always associated with diminishing wildlife populations particularly those that cause damage and threaten human safety. In this manner, HAC is a human safety and wildlife conservation issues that requires to be prevented effectively. Elephant related HAC is expected to occur at varying magnitude across all phases of the proposed water infrastructure development. Waste food and water mediated problem elephant incidents are anticipated during the construction and decommissioning phases due to presence of construction camps. However, the short term nature of the two phase diminish the significant of the impact. Water leaks mediated HAC due to defective structures is exclusively related to the long-term operational phase.

Assessment

Severity	=	6 (Moderate)
Duration	=	2 (Short term)
Spatial scale	=	2 (local)
Probability	=	3 (Medium probability)
SP	=	30 (Moderate)

Significance of Impact

The significance of the impact is rated moderate, the area host wildlife such as elephants which could be fatal on direct contact with people. However given that the construction duration would be relatively short the impact would be lowered subject to implementation of the mitigation measures.

Suggested Mitigation Measures

- Appropriate management waste food and water; elephant and wildlife proof waste storage and routine frequent disposal at appropriate sites.
- Conduct staff training workshops/seminars on management of HAC, particularly problem elephants; causes, preventative strategies, consequence on human and wildlife, response procedures and others
- Routine maintenance and repair of leakages at the earliest possible time
- Develop and implement HAC monitoring system. This should include elephant movement patterns
- Report all incident of HAC to the nearest Department of Wildlife and National Parks office or Police Station.

Impact: Increased risk of illegal harvesting of biodiversity resources (including poaching)

Various natural resources, some of which are regulated by Laws of Botswana, find application in human lives. These include food and meat products, medicinal/herbal remedies, firewood and ornamentals. Consumption and preference for wildlife meat (bush meat) and natural herbal remedies are common in Botswana. Gallinaceous birds (quail, spurfowl, francolins and guinea fowl) and small herbivores are popular sources of game meat. Although hunting was recently banned in Botswana, bird hunting is still allowed. A permit to hunt birds can be bought from the Department of Wildlife and National Parks. However, violation of permits prescriptions is plausible, e.g. exceeding quota limits, hunting out of season and wrong hunting techniques. The use of plants for traditional medicine and remedies is also common in Botswana. Examples of plant species used in traditional remedies in Botswana include monenepe (*Cassia abbreviata*), mokgalo (*Ziziphus mocrunata*) and others. Ordinarily harvesting of

such veldt products also require a permit from the Department of Forest & Range Resources. Harvesting and collection of firewood is also regulated by the DFRR. The project area in particular carry high biomass of mopane, a very popular firewood species. There is also a tendency by some people to take animals parts (e.g. bones, hooves, skins and horns) for decorative, ornamental or medicinal purposes. According to the Wildlife Conservation and National Parks Act of 1992 Part X11 (Section 71), such specimen are government trophy and their possession without authority is a punishable offence. Finally, due to high incidence of mopane tree, mopane worm (*Gonimbrasia belina*), a popular protein source, is also seasonally common in the project area. Harvesting of the mopane worm is also regulated by the DFRR. This proposed water infrastructure project is expected to increase the risk of illegal procurement of natural resources through an increase in the number of people in the area. Specifically, the construction teams represent a potential additional market with high purchasing power for illegally procured biodiversity and could also bring with it first-hand illegal procurers (poachers). As a result, the risk of increased intensity of poaching is expected to be most predominant during the construction and decommissioning phases due to sudden increase in the number of people.

Assessment

Severity	=	4 (Low)
Duration	=	2 (Short term)
Spatial scale	=	2 (local)
Probability	=	3 (Medium probability)
SP	=	24 (Low)

Significance of Impact

The significance of the impact is rated low; given that the area is already relatively low in biodiversity and as such there is already little in the wild to attract poachers. However, the rare cases of poaching can be contained through law enforcement and through other mitigation measures.

Suggested Mitigation Measures

- Conduct training workshops/seminar for all construction staff on the dangers and possible consequences of illegal use of biodiversity, i.e. effect on biological species conservation, penalties & fines
- Increase monitoring and surveillance for poaching through regular visits by the Department of Wildlife and National Parks, Department of Forestry and Range Resources and other security agencies.
- Report all incidents of poaching or illegal acquisition of biodiversity to the Department of Wildlife and National Parks, Department of Forestry and Range Resources or Botswana Police Service

- Develop and implement a poaching surveillance and monitoring system.

Impact: Increased incidents of wild fires

Wildfires are a significant biodiversity conservation and socio-economic concern. Fires can degrade the quality of habitat, cause wildlife mortality, regulate short to medium term spatio-temporal redistribution wildlife, and does destroy some veldt products (e.g. thatch grass, wild fruits, fuel wood and mopane worm) that some local livelihoods are dependent upon. An influx of construction teams bring with it increased risk of wildfires, i.e. more domestic fires (cooking, smoking and other sources) and hence increased risk of escape into the wild. Grinding of metal can also cause fire. As fire risk is directly related to number of people, the risk of increase in veldt fires is expected to be most pronounced during the construction and decommissioning phase as a result of an influx of construction & decommissioning teams respectively. Of particular importance here is to note that fire frequency in the project area (**Figure 5-5**) has been very low compared to other districts. Increased risk of wild fires in a high human density area like the project can have far reaching consequences; i.e. impact on livelihood and an already overstretched natural environment.

Assessment

Severity	=	6 (Moderate)
Duration	=	2 (Short term)
Spatial scale	=	2 (local)
Probability	=	2 (Low probability)
SP	=	20 (Low)

Significance of Impact

The significance of the impact is rated low given that the area already has a low frequency of wild fires. This coupled with the low fuel loads and other suggested mitigation measures renders the impact insignificant.

Suggested Mitigation Measures

- Conduct staff training workshops on basic fire management and response procedures, and fire suppression
- Develop internal fire reporting and response procedures
- Report all incidents of fires to the nearest Department of Forestry and Range Resources office or any Botswana Police Service station
- Monitor fires occurring along the water infrastructure route; frequency, intensity, direction and possible expansion

8.3 Socio-economic

Impact: Employment Creation

The proposed water supply project will create direct employment opportunities in the project areas. Short-term direct employment of both skilled and unskilled labour will be created during the mobilisation, construction, and the few during defects liabilities stages. A total of about 98 employment opportunities will be created during the construction phase. The majority (80%) of these will be unskilled labour. It is anticipated that unskilled and semi-skilled labour will be sourced locally through involvement of local Tribal Administration. Since the rate of unemployment in North East and Tutume Sub-District is predominantly females. The employment of local youth will temporarily generate income and alleviate economic hardship among individuals and their families.

Direct employment will also assist in the development of local skills that can be applied elsewhere. During public consultations, the communities raised concern over previous developmental projects where the Contractor brought their own unskilled labour, thus preventing community benefit from employment.

Assessment

Severity	=	10 (High)
Duration	=	2 (Short term)
Spatial scale	=	3 (Regional)
Probability	=	4 (High probability)
SP	=	60 (High significance)

Impact Significance:

Although employment opportunities associated with the project development will be short-term and mainly during the construction phase, the high rate of unemployment in the area makes the impression rating to be of **High significance**.

Mitigation Measures

- Advertising employment opportunities locally using local language i.e. Kalanga, Setswana and English
- Development of a recruitment strategy that takes into consideration the locally available resources e.g. “Yes or No” method.

- Recruitment should adhere to the provisions of the employment Act CAP 47:01 Item (1) The Act advocates for equal opportunities for qualifying applicants, irrespective of gender, tribe, religion, or political beliefs.
- Implementation of labour intensive rather than capital intensive work methods whenever possible
- Employ women to facilitate gender balance in the work force

Impact: Boost to the Local Economy

Disposable income from the project will result in increased spending levels in the local economy. Civil works will require procurement of goods and services associated with the construction phase i.e. small equipment, stationary, hiring of portable toilets etc.; thus presenting an opportunity for Small Medium and Micro Enterprises (SMMEs) to benefit from such opportunities. Adequate water supply will further attract potential investors to North East and Tutume Sub-District Villages. Those employed by these SMMEs will earn indirect income which will facilitate provision of an enabling environment to advance the local economy.

Assessment

Severity	=	8 (High)
Duration	=	3 (Medium term)
Spatial scale	=	2 (local)
Probability	=	4 (Highly probable)
SP	=	52 (Moderate)

Impact Significance:

The impact is rated **Low to moderate** after mitigations

Mitigation Measures

- Contractor to source goods and services locally where applicable i.e. housekeeping, catering and security services
- Sub contraction should favour citizen owned SMMEs in line with Citizen Economic Empowerment Drive (EED)
- Facilitate continued water supplies

Impact: Potential Encroachment onto Existing Properties i.e. Homesteads

Given that the project will be developed in close proximity to some residential properties and other development will take place along the road reserve for pipeline both at North East and Tutume Sub-District. There is a possibility of property encroachment which could reduce full utilization of properties.

It is worth noting that preliminary survey and consultations are ruling out the potential encroachment hence they could happen due to unforeseen circumstances.

Assessment

Severity	=	6 (Moderate)
Duration	=	2 (Short term)
Spatial scale	=	2 (Local)
Probability	=	5 (Definite probability)
SP	=	50 (Moderate)

Impact Significance

North East and Tutume Sub District Water Supply Project construction activities will take place in close proximity to some homesteads and associated properties, although disruption will be temporary. The impact is rated **Moderate** so it is accorded the requisite attention it deserves.

Mitigation Measures:

- Ensure all compensation disputes are addressed at onset of construction activities through The World Bank Resettlement Policy Framework and Involuntary Resettlement OP 4.12.
- Engage the Land Board so matters are resolved accordingly through Tribal Act 1968, Section 33 (2) provides that compensation is payable when land is required for project and the acquiring body is financially responsible for all aspects of the project; this include payment for compensation to claimants. The displaced may be granted the right to use other land available, and is entitled to adequate compensation.
- Avoid where possible trespassing onto private properties such as homesteads especially if owners are not around.
- In the event where construction activities damage properties compensation should be paid to the affected immediately by the contractors.
- Photographs should be taken for all properties closer to pipeline before construction commences.

Impact: Shortage of Facilities (amenities)

Due to the influx of job seekers into the area, there will be added demand for provision of public services such as health and justice within the project community villages (North East District and Tutume Sub-District). Similarly, contractor's employees will also seek the same services thus increase pressure on facilities.

Assessment

Severity	=	6 (Moderate)
Duration	=	2 (Short term)
Spatial scale	=	2 (Local)
Probability	=	2 (Medium probability)
SP	=	20 (Low)

Impact Significance:

The impact is rated **Moderate to Low** after mitigations

Mitigation Measures:

- Provide first aid at the construction site to cater for minor ailments such as headaches, fever, flu etc. This will minimise workers patronising of health facilities even for minor ailments
- Recruitment of unskilled labour should be done locally to minimise human movement.

Impact: Safety hazards due to excavation and construction activities (compromised human safety)

Excavations for pipes, and construction of pump station at Mbalambi Village and other project sites within Tutume Sub-District and North East villages have the potential to result in accidents. Animals and people may fall into openings if not barricaded. Trenches and deep excavations can also collect water and attract children, livestock and wildlife which can result in entrapment and/or drowning. The sandy substrate may result in trench sidewalls collapsing.

Assessment

Severity	=	6 (Moderate)
Duration	=	2 (Short term)
Spatial scale	=	2 (Local)
Probability	=	4 (High probability)
SP	=	40 (Moderate)

Significance of Impact

This impact is considered to be moderate because trenching will be done only on site specific areas and the length of open trench at any one point in time kept to a minimum (not more than 7m to the next egress).

Mitigation measures

- Trenches and excavations for pump station should be barricaded and the slopes should be gentle to allow access.
- Soil stockpiles should be kept at a reasonable height (not more than 4m high) and with a wide base for stability.

- The entire construction sites should be barricaded and access should be controlled by means of, but not limited to, appropriate and clear signage.

Impact: Compromised safety for employees working at heights

Some components of the project such as construction of elevated tanks will require that work be done at heights. Under such scenario

Assessment

Severity	=	6 (Moderate)
Duration	=	2 (Short term)
Spatial scale	=	2 (Local)
Probability	=	4 (High probability)
SP	=	40 (Moderate)

Significance of Impact

This impact is considered to be moderate significance.

Mitigation measures

- All elevated construction activities should be provided with scaffold.
- The scaffolding must be erected, altered and dismantled according to standards
- After erection, inspection of any scaffolding must be carried out by a competent person and thereafter further inspection as per legislation must be observed to ensure safety
- Scaffolds must be fitted with the necessary toe-boards
- Elevated storage areas must comply with standards and the base must be strong enough to carry load.
- Elevated works areas must be provided with handrails
- Proper access ladders to all levels of the scaffolding must be provided
- Conduct daily tool box talks to create awareness on dangers of working at heights
- Always has a first aid medical kit on site for emergencies

Impact: Compromised Ambient Air Quality due to Dust

Construction activities such as trenching, vehicular movement, vegetation clearance and excavation are most likely to generate dust which has potential to pose public health hazard especially that the project will be executed in an area adjacent to residential properties. Although statistics on dust levels are not available, it can be assumed that since the area is for most part of the year dry, dust occurs naturally, hence dust to be generated from the project activities is likely to only increase the levels temporarily at

times of activity. However, implementation of mitigation measures will highly reduce the cumulative impacts of dust generated by the project.

Assessment

Severity	=	6 (Moderate)
Duration	=	2 (Short term)
Spatial scale	=	2 (Local)
Probability	=	4 (High probability)
SP	=	40 (Moderate)

Significance of Impact

Therefore the impact is regarded to be of medium significance with potential to be further reduced to low significance.

Mitigation measures

- Appropriate PPE should be provided to all employees i.e. dust masks and goggles
- Dust suppression measures should be employed on site during construction activities and at dust prone zones i.e. water spraying
- Vegetation clearance should be confined to areas required for the purpose of construction only
- Monitor PM₁₀ on a monthly basis and undertake appropriate measures if permissible limits are exceeded
- All employees in dust prone areas to undergo annual medical exams for respiratory system and other conditions associated with decline in air quality

Waste Management

Land pollution due to improper disposal of waste

Waste is generated at all project phases and improper disposal of such waste can result in land pollution. Project activities result in the generation of waste as rubble, packaging materials, cut offs and food leftovers from various activities. Disposal and management of waste is usually given less priority and often dumped haphazardly in the nearby bushes which is very improper.

Assessment

Severity	=	6 (Medium)
Duration	=	4 (Long term)
Spatial scale	=	2 (Local)
Probability	=	3 (Medium probability)
SP	=	33 (Medium)

Significance of Impact

This is considered to be of medium significance.

Mitigation

- Provide and label litter collecting receptacles for garbage disposal.
- Separate waste at source to allow for possible reuse or recycling.
- Litter should be collected regularly and disposed at a designated dumping site.
- Reduce waste actively by seeking out operations that can recycle the waste generated.
- Portable toilets should be provided on the construction site to prevent the bush from being used as a toilet. There should be one portable toilet for every 5 construction workers.
- Workers to be provided with appropriate PPE (Including overalls, dust masks, gloves etc.)

Table 8-2: Summary of Potential Impacts

Phase	Environmental/Social Aspect	Potential Environmental/Social Impact	Impact Significance Rating (e.g. Low, Moderate, high)		Impact Significance (Negative, Neutral, Positive)
			Before Mitigation	After Mitigation	
Construction					
	Biophysical				
	Soil	Soil contamination	Moderate	Low	Negative
	Water Resources	Groundwater contamination	Moderate	Low	Negative
	Biological Resources				
	Flora	Loss of vegetation cover	Low	Low	Negative
		Increased risk of wild fires	Low	Low	Negative
	Fauna	Increased risk of wildlife mortality due to pitfalls	Low	Low	Negative
		Changes in wildlife behaviour & wildlife habituation	Low	Low	Negative
		Increased incidents of negative human-wildlife interactions	Moderate	Low	Negative
		Increased risk of illegal harvesting of biodiversity resources	Low	Low	Negative
	Socio-economic				
		Employment creation	High	High	Positive
		Boost to local economy	Moderate	Moderate	Positive
		Potential encroachment onto existing properties	Moderate	Low	Negative
		Shortage of amenities	Moderate	Low	Negative

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Phase	Environmental/Social Aspect	Potential Environmental/Social Impact	Impact Significance Rating (e.g. Low, Moderate, high)		Impact Significance (Negative, Neutral, Positive)
			Before Mitigation	After Mitigation	
		Compromised safety due to excavation works	Moderate	Low	Negative
		Compromised safety from working at heights	Moderate	Low	Negative
		Compromised air quality due to dust generation	Moderate	Low	Negative
		Land pollution (from improper waste management)	Moderate	Low	Negative
Operation/Maintenance					
	Biophysical				
	Soil	Soil contamination	Low	Low	Negative
	Water Resources	Groundwater contamination	Low	Low	Negative
	Socio-economic				
		Improved livelihoods due to water availability	High	High	Positive
Decommissioning					
	Biophysical				
	Soil	Soil contamination	Moderate	Low	Negative
	Water Resources	Groundwater contamination	Moderate	Low	Negative
	Socio-economic				
		Employment creation	Moderate	Moderate	Positive
		Compromised safety due to decommissioning works	Moderate	Low	Negative
	Land pollution (from improper waste management)	Moderate	Low	Negative	

9 ARCHAEOLOGICAL IMPACT ASSESSMENT

9.1 Archaeological and Cultural Heritage

The study area falls within a region where evidence suggests that Stone Age (SA) occupations occurred; with Middle Stone Age (MSA), and Late Stone Age (LSA) materials being the most visible. The Department of National Museum and Monuments site register has recorded over 107 archaeological sites in and around the Project Area. These including all the Stone Age phases and Historic sites. Site of similar nature were expected to be found while undertaking this study.

9.2 Historical Background

The North East District is believed to be rich in history and most people of the north east are the Kalanga. This is one of the largest ethnic groups in Botswana. The Kalanga are a branch of the Shona people and have lived in their present areas for over 1500 years. The Kalanga once had the largest kingdom in southern Africa. Around 1540AD, the Kalanga who occupied Tati area in Botswana and further west inside Zimbabwe were part of a powerful empire known as Butwa. This empire explored gold that left prehistoric mines that were later exploited by European explorers.

9.3 Archaeological Issues

Due to the fact that most cultural/heritage remains may occur below surface, the possibility exists that some features or artefacts may not have been discovered/ recorded during the survey. There is therefore a high possibility that at construction stage and during the operational phase, more archaeological materials will be encountered. The more digging is done, the more likely that important materials possibly belonging to the early stages of human development will be encountered. Only the proposed pipe line alignment was surveyed as indicated in the location maps. It is therefore incumbent upon the developer to stop operations and inform the relevant heritage agency should further cultural remains, such as stone tool scatters, artefacts, bones or fossils, be exposed during the process of development. Any changes or deviations of the water supply line will have to be assessed separately.

There were no excavations undertaken because none of the sites identified required sub surface definition. In addition, no surface collections were conducted. Most of the surface materials found were probably secondary in the areas after being transported by post depositional processes. Therefore, the whole development route is ranked No.4; systematic preventative sampling sufficient. Ranking No. 4 means that there should be Archaeological Watching Brief (monitoring) and Archaeological Awareness Program (AAP) during all earthworks. The programs should be implemented and monitored by an accredited Archaeologist with the DNMM on periodic basis during the implementation of the project. Archaeological Awareness Program should also be undertaken prior to the commencement of the project to cater for chance discoveries in the absence of an archaeologist.

The archaeological investigations were focused within the primary area of the proposed project in the selected villages. The map below (Figure 10) shows all the archaeological site that falls within the North East District. Most of identified sites are not of threat or threatened by the proposed development.

Figure 9-1: Archaeological Sites within North East District

9.4 Recommendations

Against this background therefore, it is recommended that the project be permitted to process with the following conditions:

- Care should be taken not to disturb grounds or land beyond the proposed project reserve without the permission or consent of the relevant authorities (e.g. in the case of archaeology, the Botswana National Museum)
- During the construction phase, should subsurface cultural deposits be encountered, the director of the DNMM should be immediately notified. In this event, excavations or any form of ground disturbing activity should be suspended until an archaeologist or appropriately qualified specialist, as may be sanctioned by the director, is on site to assess the significance of such occurrences and recommend the necessary and appropriate mitigation measures in the prevailing circumstances.

10 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

10.1 Organisational Structure and Responsibilities

Central to the implementation of the ESMP is the designation of roles and responsibilities. This does not only encourage accountability but also saves on resources such as time and minimizes or eliminates duplication of efforts.

Environmental Management Plan Components

Definition of key components of the ESMP

The following are the basic definitions of the terminology that is used in this ESMP:

- **Environmental component** – broad factors that make up an environment, for instance, public health, air, land use, economy, etc.
- **Activity** – an action undertaken, which leads to the identified impact.
- **Environmental aspect** – elements of project activities or services that can interact with the environment.
- **Mitigation action** – a management measure taken to ameliorate or enhance negative or positive impacts respectively.
- **Responsible agency** – is assigned to key people who will be accountable for ensuring that their assigned tasks are carried out.

Components of the ESMP

Impact Mitigation/Management Plan

The mitigation plan is presented in a tabular form that enables cross-referencing of an impact, its mitigation measures (objectives and target), Key Performance Indicators (KPI's), responsibilities, resources required and time frames for undertaking tasks.

The impact management plan addresses all impacts that are rated medium to high when subjected to the impact evaluation criteria in **Chapter 7** of the Report with the view to minimize impacts on all facets of the receiving environment. This plan will serve to:

- Translate mitigation measures into actions that can be easily resourced and implemented.
- Outline roles and responsibilities for environmental and social impact management
- Allow for management of identified impacts and monitoring of mitigation measures.

The Impact Management Plans for the construction, operation and decommissioning phases, which are presented in Table 10-1 and respectively consists of the following;

- The project activity

- Potential environmental impact
- Management Objectives
- Proposed mitigation measures
- Institutional responsibility
- Cost

Table 10-1: Impacts Mitigation Plan

Phase	Project Activity	Potential Environmental/Social Impact	Management Objective	Proposed Mitigation Measures	Institutional Responsibility	Estimated Costs Pula (BWP)
Biophysical Environment						
Soil and Land						
Construction Phase	Trenching and Deep Excavations using hydrocarbon powered machinery	Soil Contamination	To minimize soil contamination	a) Specific areas on all construction sites should be gazetted and bunded (concrete floors to contain spillages) for onsite maintenance of machinery and for fuelling. b) Spillages should be cleaned immediately with the appropriate absorbents or chemicals. c) Waste oil containers should be provided on site. d) Machine and equipment operators should be trained about proper handling of used oil on site. e) All the drained oils must be properly stored and transported to oil depots by a licensed waste oil collector.	Contractor (Include Institutions)	40 000.00

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Phase	Project Activity	Potential Environmental/Social Impact	Management Objective	Proposed Mitigation Measures	Institutional Responsibility	Estimated Costs Pula (BWP)
				f) Proper labelling and storage of chemicals and potential pollutants must be done to avoid possible spillages or contact with the environment.		
Construction Phase	Trenching and Deep Excavations using hydrocarbon powered machinery	Soil Contamination	To minimize soil contamination	<p>a) Specific areas on all pump stations should be gazetted and bunded (concrete floors to contain spillages) for onsite maintenance of machinery and for fuelling.</p> <p>b) Spillages should be cleaned immediately with the appropriate absorbents or chemicals.</p> <p>c) Waste oil containers should be provided on site.</p> <p>d) Machine and equipment operators should be trained about proper handling of used oil on site.</p> <p>e) All the drained oils must be properly stored and transported to oil depots by a licensed waste oil collector.</p>	Water Utilities Corporation- Project Manager	500 000.00

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Phase	Project Activity	Potential Environmental/Social Impact	Management Objective	Proposed Mitigation Measures	Institutional Responsibility	Estimated Costs Pula (BWP)
				f) Proper labelling and storage of chemicals and potential pollutants must be done to avoid possible spillages or contact with the environment.		
Construction Phase	Trenching and Deep Excavations using hydrocarbon powered machinery	Groundwater Contamination	To prevent groundwater contamination	<p>a) Service construction vehicles and machinery regularly and properly to reduce breakdowns and seal any leakages.</p> <p>b) Provide leak proof receptacles or drums for storing used oil and they should be kept in a protected area.</p> <p>c) Servicing should be done on protected area where spillages can be contained (bunded area that is seepage free).</p>	Contractor	50 000.00
Waste Management						
Construction	Generation of waste during work	Land Pollution	To minimize land pollution	a) Provide and label litter collecting receptacles for garbage disposal.	Contractor	20 000.00

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Phase	Project Activity	Potential Environmental/Social Impact	Management Objective	Proposed Mitigation Measures	Institutional Responsibility	Estimated Costs Pula (BWP)
				b) Separate waste at source to allow for possible reuse or recycling. c) Litter should be collected regularly and disposed at a designated dumping site. d) Reduce waste actively by seeking out operations that can recycle the waste generated. e) Portable toilets should be provided on the construction site to prevent the bush from being used as a toilet. There should be one portable toilet for 5 construction workers.		
Construction	Trenches and Deep Excavations	Compromised safety due to water pipeline trenching and deep excavation works	To prevent injury from project activities	a) Trenches and excavations for pump station should be barricaded and the slopes should be gentle to allow access. b) Soil stockpiles should be kept at a reasonable height	Contractor	50 000.00

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Phase	Project Activity	Potential Environmental/Social Impact	Management Objective	Proposed Mitigation Measures	Institutional Responsibility	Estimated Costs Pula (BWP)
				(not more than 4m high) and with a wide base for stability. c) The entire construction sites should be barricaded, and access should be controlled.		
Construction	Trenching of the pipeline	Compromised safety due to water pipeline trenching and deep excavation works	To minimize hazards within the project site	a) Trenches and excavations for pump station should be barricaded and the slopes should be gentle to allow access. b) Soil stockpiles should be kept at a reasonable height (not more than 4m high) and with a wide base for stability. c) The entire construction sites should be barricaded, and access should be controlled.	Contractor	50 000.00
Water Resources						
Operation & Maintenance	Waste Management	Groundwater Contamination	To prevent contamination of groundwater resources	a) Evaporation ponds should be properly lined and maintained throughout its life span to eliminate seepage.	Water Utilities Corporation	500 000.00
Biodiversity						

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Phase	Project Activity	Potential Environmental/Social Impact	Management Objective	Proposed Mitigation Measures	Institutional Responsibility	Estimated Costs Pula (BWP)
Construction	Creation of easement through vegetation clearance	Loss of vegetation cover	To minimize loss of vegetation during construction	Align new water pipelines and other installations with existing structures (e.g. existing road reserves, firebreaks and fence lines). Systematic inventory and monitoring of cleared vegetation; area cleared and species composition	Project Proponent DFRR	150 000.00
Construction and Operation	Trenching of the pipeline and operation of the scheme	Increased risk of wildlife mortality due to pitfalls	To minimize loss of biodiversity	Keep to the minimum possible the amount/length of trenches left open every night. Use reflective red tape, or some brightly colored visual cues to mark all open trenches at all times. Monitor wildlife injury and/or mortality due to the pitfalls Report any incident of wildlife mortality/injury to the DWNP or the nearest Botswana Police Station	Project Proponent Construction Company DWNP	250 000.00
Construction/Operation phase	Trenching of the pipeline and operation of the scheme	Changes in wildlife behavior and wildlife habituation	To minimize loss of biodiversity	Development of a comprehensive water leaks' detection and monitoring system.	Project Proponent	500 000.00

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Phase	Project Activity	Potential Environmental/Social Impact	Management Objective	Proposed Mitigation Measures	Institutional Responsibility	Estimated Costs Pula (BWP)
				<p>Maintain and repair, at the earliest opportunity, all water leaks from the water infrastructure.</p> <p>Proper management waste food and water.</p> <p>Display warnings sign to constantly remind construction crews of the dangers of wildlife, e.g. "Wild Animals are Dangerous do not feed or Approach too Close"</p> <p>Report all incident of habituation or abnormal wildlife behavior to the nearest DWNP office or Botswana Police Station.</p>	<p>Construction Company</p> <p>DWNP</p> <p>Department of Waste Management & Pollution</p> <p>North East District Council & Central District Council</p>	
Construction & operation phases	Trenching of pipeline and operation of scheme	Increased incidents of negative human-wildlife interaction	To prevent loss of life due to human wildlife conflict.	<p>Appropriate management waste food and water; elephant and wildlife proof waste storage and routine frequent disposal at appropriate sites.</p> <p>Conduct staff training workshops/seminars on management of HAC</p>	<p>Project Proponent</p> <p>Construction Company</p> <p>DWNP</p>	100 000.00

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Phase	Project Activity	Potential Environmental/Social Impact	Management Objective	Proposed Mitigation Measures	Institutional Responsibility	Estimated Costs Pula (BWP)
				<p>Routine maintenance and repair of leakages at the earliest possible time</p> <p>Develop and implement HAC monitoring system.</p> <p>Report all incident of HAC to the nearest DWNP office or Botswana Police Station.</p>		
Construction & decommissioning phases	Pipeline trenching	Increased risk of illegal procurement of biodiversity resources (poaching)	To minimize loss of biodiversity	<p>Conduct training workshops/seminar for all construction staff to sensitize them about poaching</p> <p>Develop and implement poaching monitoring and surveillance (e.g. regular visits by DWNP, DFRR and other security agencies.</p> <p>Report all incidents of poaching to DWNP, DFRR or BPS</p> <p>Develop and implement a poaching surveillance and monitoring system.</p>	<p>Project Proponent</p> <p>Construction Company</p> <p>DWNP</p> <p>BPS</p> <p>Other Security Agencies</p>	50 000.00
Construction and decommissioning phases	Trenching and dismantling of infrastructure components	Risk of increased incidents of wild fires	To minimize incidents of fires	Conduct staff training workshops on basic fire management, response procedures and fire suppression	Project Proponent	50 000.00

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Phase	Project Activity	Potential Environmental/Social Impact	Management Objective	Proposed Mitigation Measures	Institutional Responsibility	Estimated Costs Pula (BWP)
				<p>Develop an internal fire reporting and response procedures</p> <p>Report all incidents of wildfires to the nearest DFRR office or any BPS station</p> <p>Monitor fires occurring along the water infrastructure route</p>	<p>Construction Company</p> <p>DFRR</p>	
Socio-economy						
Construction	Recruitment and job seeking	Provision of unskilled, semi-skilled and skilled employment	To promote engagement of indigenous people in the project work	<p>a) Contractor should notify community of job opportunities at start up and types and number of labourers and skilled people required.</p> <p>b) Recruitment process to adhere to labour procedures and policies. (Employment Act CAP 47:01 Item (1). The Act advocates for equal opportunities for qualifying applicants, irrespective of gender, tribe, religion, or political beliefs.)</p> <p>c) Advertising employment opportunities locally.</p> <p>d) Development of a recruitment strategy that takes into consideration locally</p>	<p>Contractor</p> <p>Water Utilities Corporation- Project Manager</p> <p>Social Officer</p> <p>Community Liaison Officer</p> <p>Environmental Officer</p>	BWP 10 000.00

Updated Environmental and Social Impact Assessment for the North East District and Tutume Sub District Water Supply Upgrading Project

Phase	Project Activity	Potential Environmental/Social Impact	Management Objective	Proposed Mitigation Measures	Institutional Responsibility	Estimated Costs Pula (BWP)
				<p>available skills. The strategy will be included in code of conduct and its implementation will be supervised by the environmental consultant.</p> <p>e) Implementation of labour intensive rather than capital intensive work methods wherever possible.</p> <p>f) The Contractor to be encouraged to procure goods and services from local service providers.</p> <p>g) Education and training of employees to enable skills transfer.</p>		
	<p>Procurement of Goods and services</p> <p>Influx of people</p> <p>Working for the contractor</p> <p>Hawkers selling goods and cooking for contractors</p>	Boost to the Local Economy	To encourage growth of local economy.	<p>a) Contractor to source goods and services locally where applicable i.e. housekeeping, catering and security services</p> <p>b) Sub contraction should favour citizen owned SMMEs in line with Citizen Economic empowerment Drive (EED)</p> <p>c) Facilitate continued water supplies</p>	<p>Contractor</p> <p>Water Utilities Corporation- Project Manager</p> <p>Social Officer</p> <p>Community Liaison Officer</p> <p>Environmental Officer</p>	10 000.00
	Recruitment (Influx of people)	Erosion of societal norms and values	To preserve the integrity of the local communities	a) Raise awareness amongst the local communities on social ills	Contractor	75 000.00

Updated Environmental and Social Impact Assessment for the North East District and Tutume Sub District Water Supply Upgrading Project

Phase	Project Activity	Potential Environmental/Social Impact	Management Objective	Proposed Mitigation Measures	Institutional Responsibility	Estimated Costs Pula (BWP)
				<p>and their implications by Community liaison officer and environmental consultant</p> <p>b) Sensitise the construction workers on community values and norms by Community liaison officer and environmental consultant</p> <p>c) Participate in local crime prevention activities by Crime Prevention Clusters and environmental consultant</p> <p>d) Closely liaise with the police and other crime law enforcement authorities to address crime and social problems.</p>	<p>Water Utilities Corporation- Project Manager</p> <p>Social Officer</p> <p>Community Liaison Officer</p> <p>Environmental Consultant</p> <p>Crime Prevention Clusters</p> <p>Botswana Police Services</p>	
	Excavation of trenches and pipe laying Tank installations	Potential Encroachment onto Existing Properties i.e. Homesteads	To prevent loss of property right	<p>a) Ensure all compensation disputes are addressed at onset of construction activities through The World Bank Resettlement Policy Framework and Involuntary Resettlement OP 4.12.</p> <p>b) Engage the Land Board so matters are resolved accordingly through Tribal Act 1968, Section 33 (2) provides that compensation is payable when land is required for project and the acquiring</p>	<p>Contractor</p> <p>Water Utilities Corporation- Project Manager</p> <p>Social Officer</p> <p>Community Liaison Officer</p> <p>Environmental Officer</p>	1 000 000.00

Updated Environmental and Social Impact Assessment for the North East District and Tutume Sub District Water Supply Upgrading Project

Phase	Project Activity	Potential Environmental/Social Impact	Management Objective	Proposed Mitigation Measures	Institutional Responsibility	Estimated Costs Pula (BWP)
				<p>body is financially responsible for all aspects of the project; this include payment for compensation to claimants. The displaced may be granted the right to use other land available, and is entitled to adequate compensation.</p> <p>c) Avoid where possible trespassing onto private properties such as homesteads especially if owners are not around.</p> <p>d) In the event where construction activities damage properties compensation should be paid to the affected immediately by the contractors.</p> <p>e) Photographs should be taken for all properties closer to pipeline before construction commences.</p>		
	Erection of elevated tanks and construction of reservoirs	Compromised safety of employees working at heights	To prevent injuries and potential death associated with working at heights and promote safety at all sites.	<p>a) All elevated construction activities should be provided with scaffold.</p> <p>b) The scaffolding must be erected, altered and dismantled according to standards</p>	Contractor Water Utilities Corporation- Project Manager Environmental Officer	100 000.00

Updated Environmental and Social Impact Assessment for the North East District and Tutume Sub District Water Supply Upgrading Project

Phase	Project Activity	Potential Environmental/Social Impact	Management Objective	Proposed Mitigation Measures	Institutional Responsibility	Estimated Costs Pula (BWP)
				<p>c) After erection, inspection of any scaffolding must be carried out by a competent person and thereafter further inspection as per legislation must be observed to ensure safety</p> <p>d) Scaffolds must be fitted with the necessary toe-boards</p> <p>e) Elevated storage areas must comply with standards and the base must be strong enough to carry load.</p> <p>f) Elevated works areas must be provided with handrails</p> <p>g) Proper access ladders to all levels of the scaffolding must be provided</p> <p>h) Conduct daily tool box talks to create awareness on dangers of working at heights</p> <p>i) Always has a first aid medical kit on site for emergencies</p>		
	Site preparation (clearance), trenching and vehicular movement	Compromised air quality	To maintain ambient air quality within the BOS 498: 2012 acceptable limits.	<p>a) Appropriate PPE should be provided to all employees i.e. dust masks and goggles</p> <p>b) Dust suppression measures should be employed on site during construction</p>	Contractor Water Utilities Corporation- Project Manager Environmental Officer	20 000.00

Updated Environmental and Social Impact Assessment for the North East District and Tutume Sub District Water Supply Upgrading Project

Phase	Project Activity	Potential Environmental/Social Impact	Management Objective	Proposed Mitigation Measures	Institutional Responsibility	Estimated Costs Pula (BWP)
				<p>activities and at dust prone zones i.e. water spraying</p> <p>c) Vegetation clearance should be confined to areas required for the purpose of construction only</p> <p>d) Monitor PM10 on a monthly basis and undertake appropriate measures if permissible limits are exceeded</p> <p>e) All employees in dust prone areas to undergo annual medical exams for respiratory system and other conditions associated with decline in air quality</p>		
Operation	Operation and maintenance	Increased operation cost due to vandalism	To promote low operational costs	<p>a) Step up security patrols around the reservoirs tanks, treatment plants, booster pump station and boreholes to minimize loss of water resources and other important equipment's.</p> <p>b) Promote activities towards improving relations between WUC and the concerned community</p> <p>c) Facilitate provision of reliable water supplies through all the time.</p>	Contractor Water Utilities Corporation- Project Manager	15 000.00

Monitoring Plan

The monitoring plan serves to evaluate the success of impact mitigations employed. As such its main functions include but not limited to;

- Proposed mitigation measure
- Parameter to be monitored
- Location
- Measurements (including methods & Equipment)
- Frequency of measurement
- Responsibilities (including review and reporting)
- Costs (equipment and individuals)

The Monitoring Plans for all project phases are presented in **Table 10.2** .

Table 10-2: Environmental and Social Monitoring Plan

Project Phase	Environmental/Social Impact	Parameter to be Monitored	Location	Measurements	Frequency of Measurement	Responsibility (incl. review and reporting)	Cost (equipment & individuals)
Biophysical Environment							
Soil and Land							
Operation Phase	Soil and Land Pollution	Soil Toxicity	All Pump Stations and Booster Stations	pH Moisture content/soil porosity Bulk density Total organic matter/total organic carbon Salinity (as assessed by electrical conductivity) Macronutrient levels (nitrogen, phosphorous). Exchangeable cation concentrations (potassium, calcium, sodium, magnesium)	Quarterly	WUC SHE & Environmental Monitoring Team	Soil augers pH meter
Water Resources							
Operation Phase	Soil and Land Pollution	Soil Toxicity	All Pump Stations and Booster Stations	pH Moisture content/soil porosity Bulk density Total organic matter/total organic carbon Salinity (as assessed by electrical conductivity) Macronutrient levels (nitrogen, phosphorous).	Quarterly	WUC SHE & Environmental Monitoring Team	pH meter Soil Augers

Project Phase	Environmental/Social Impact	Parameter to be Monitored	Location	Measurements	Frequency of Measurement	Responsibility (incl. review and reporting)	Cost (equipment & individuals)
				Exchangeable cation concentrations (potassium, calcium, sodium, magnesium)			
Biodiversity							
Construction	Loss of vegetation cover	Area cleared of vegetation (amount of cleared vegetation biomass) Number of mature plant species felled Number of classified vegetation species felled	Project area only	Biodiversity loss (loss of mature trees)	Routine Daily during site preparation Ad hoc	Contractor Project Proponent	Brochures promoting biodiversity conservation
Construction	Increased risk of wildlife mortality due to pitfalls	Amount/length of trenches left open daily Length of trenches marked in reflective tape Species and number of wildlife mortality/injury due to pit falls	Project area only	Wildlife mortality	Opportunistic (as and when an incident occurs)	Contractor Project Proponent DWNP	Brochures promoting biodiversity conservation Wildlife mortality log sheets

Project Phase	Environmental/Social Impact	Parameter to be Monitored	Location	Measurements	Frequency of Measurement	Responsibility (incl. review and reporting)	Cost (equipment & individuals)
		Number of reported cases of wildlife mortality or injury					
Construction/ Operation	Changes in wildlife behavior and wildlife habituation	Number of incidents of stray wild animals	Project area & immediate surrounding	Percentage/fraction of staff trained in wildlife habituation Number of habituated species Frequency of visits by habituated individuals (spatio-temporal patterns) Number of reported habituation incidents	Routine Daily Weekly Monthly Seasonally	Resources Persons (trainer) Contractor Project Proponent Environmental Officer	Brochures promoting human-wildlife co-existence Resource persons, training materials & attendance register Wildlife occurrence books & HAC registers Private Consultant, HAC & Habituation log sheets, structured surveys & opportunistic
Construction/ Operation	Increased incidents of negative human-wildlife interaction	Number of human wildlife conflict cases	Project area and immediate surroundings	Levels of Human-wildlife interactions (No. of human-wildlife contact)	Routine Daily Weekly Monthly	Resource Persons (trainer) Contractor	Brochures promoting human-wildlife co-existence

Project Phase	Environmental/Social Impact	Parameter to be Monitored	Location	Measurements	Frequency of Measurement	Responsibility (incl. review and reporting)	Cost (equipment & individuals)
					Seasonally Number of HAC cases reported (species, frequency & spatio-temporal patterns)	Project Proponent DWNP	Resource persons, training materials & attendance register Spot checks, informants, poaching registers Formal agreements with security agencies DWNP & Police poaching registers & occurrence books Private consultant, poaching monitoring registers, monitoring systems, reporting procedures
Construction/ Operation	Increased risk of illegal harvesting of biodiversity resources (poaching)	Biodiversity loss	Project area and immediate surroundings (North East District and Tutume Sub-District)	Percentage/fraction of staff trained on anti-poaching or illegal harvesting Number and frequency of routine visits by DWNP and other security agencies	Routine Daily Weekly Monthly Seasonally	Resource Person (Trainer) Contractor Project Proponent	Brochures promoting biodiversity conservation Resource persons, training materials

Project Phase	Environmental/Social Impact	Parameter to be Monitored	Location	Measurements	Frequency of Measurement	Responsibility (incl. review and reporting)	Cost (equipment & individuals)
				Number of recorded incidents of poaching reported to DWNP, DFRR & BPS Species affected by poaching		DWNP DFRR BPS Other Security agencies	& attendance register Spot checks, informants, poaching registers Formal agreements with security agencies DWNP & Police poaching registers & occurrence books Private consultant, poaching monitoring registers, monitoring systems, reporting procedures
Construction	Increased incidents of wild fires	Incidents of wild fires	Project area and immediate surroundings	Percentage/fraction of staff trained in basic fire management Published internal fire reporting and management procedures	Routine (Seasonally)	Resource Persons (Trainer) Contractor Project Proponent	Fire-beaters Fire-Extinguishers Resource persons, training materials & attendance register

Project Phase	Environmental/Social Impact	Parameter to be Monitored	Location	Measurements	Frequency of Measurement	Responsibility (incl. review and reporting)	Cost (equipment & individuals)
				Number of fires reported to DFRR or PS Frequency of active fires and area burnt (including spatio-temporal patterns)		DFRR	Private consultant, official fire response & reporting procedures Fire reports from DFRR, BPS & DWNP Subscribe to fire monitoring systems (e.g. Advanced Fire Information System – www.afis.meraka.org.za) for daily data on fire risk assessments, active fires and monthly burnt area
Socio-economy							
Construction	Creation of employment opportunities	Employment of local manpower	Tutume & North East Villages	Numbers citizens recruited and retained Review of employment records	Weekly onset of projects, Quarterly thereafter	Contractor/ Project manager/Supervisor Engineer (project committee)	Print media, Posters and pamphlets

Project Phase	Environmental/Social Impact	Parameter to be Monitored	Location	Measurements	Frequency of Measurement	Responsibility (incl. review and reporting)	Cost (equipment & individuals)
Construction	Boost to the Local Economy	Purchasing power and sales of goods and services	Tutume & North East Villages	Number of people in the project area graduating from dependence on social services	Quarterly	Monthly monitoring reports to the project committee	Local services e.g. cleaning, garden, securities, construction materials and caterings services
Construction	Potential Encroachment onto Existing Properties i.e. Homesteads	Grievances reported and addressed through GRM Blocked access to homesteads or facilities	Tutume & North East Villages	Number of reported complaints by the public	Quarterly	Monthly monitoring reports to the project committee	Camera Adjacent property inventory
Construction	Injuries associated with working at heights	Unsafe acts Workers' safety	Construction sites (elevated tanks and Reservoirs)	No. of near misses, incidents, injuries and deaths	Daily during construction of elevated structures	Daily incidents notes and weekly updates to feed into the monthly monitoring report.	Safety gear Safety billboards Sign Post Tool box talks
Construction	Compromised air quality due to dust generation	Air quality	Project site	Dust fallout levels	Daily	Monthly monitoring reports by the Environmental officer	Dust buckets Water Dust-Suppressants
Construction	Shortage of Facilities	Demand for provision of public services	Tutume & North East Villages	Complaints register indicative of shortage of facilities	Monthly	Monthly monitoring reports to the project committee	Health facilities, Sewer lines, Shops and Customary Court

Project Phase	Environmental/Social Impact	Parameter to be Monitored	Location	Measurements	Frequency of Measurement	Responsibility (incl. review and reporting)	Cost (equipment & individuals)
Operation & Maintenance	Increased operation cost due to vandalism	Maintenance rate	Tutume & North East Villages	Strengthening of crime prevention initiative among the community	Monthly for 6 months at onset of project operation and thereafter, quarterly	Monthly monitoring by WUC operators	Maintenance equipment

10.2 Public Disclosure Plan

In line with the principle of participatory planning, where the public is involved in decision making process of matters that have potential to affect their welfare right from design stage; Public Disclosure Plan (PDP) provides leeway to continually update Interested and Affected Parties (IAPs) throughout the project life cycle.

The aim of the PDP is to ensure that adequate and timely information is provided to project IAPs as well as give stakeholders opportunity to voice their opinions and concerns to influence decision-making. Water Utilities through the Project Officer is tasked to facilitate the process. The objectives of the PDP are to:

- Give feedback on the study findings
- Provide IAPs with regular information on project plans, progress, issues and related implications
- Provide an opportunity for consultation with IAPs in identifying any significant new issues arising from the project.
- Solicit public input on on-going decision-making
- Monitor the implementation of mitigation measures through feedback from IAPs
- Ensure concerns raised are addressed promptly

Methodology

A variety of approaches will be employed for the PDP, these include:

- Public meetings held with the community
- Workshops for local authorities
- Face-to-face discussions

The PDP which is presented in tabular form indicates stakeholder group/type, the reasons for appraisal, frequency of consultations, and parties responsible for ensuring that relevant information is disseminated to stakeholders. The PDP presented in the table below serves as a guide and it will be updated as and when necessary throughout the project cycle.

Table 10-3: Public Disclosure Plan

STAKEHOLDER	Stakeholder Type (Interested/Affected /Authority)	REASON FOR APPRAISAL	FREQUENCY OF CONSULTATION	RESPONSIBILITY
Project Steering Committee constituting of: Project Manager Senior Environmentalist EIA Team Lead Resident Environmentalist Resident Archaeologist Resident Engineer	Authority	Progress Update	Quarterly	WUC- Project Officer
NGOs and community organizations	Interested	Social responsibility and	Quarterly	Resident Environmentalist

		Community development opportunities		
Tribal Authorities Neighboring Communities (Village Development Committees, Parents Teachers Associations etc (All those consulted during the development of the ESIA)	Affected/Interested	Employment Consultation and update on project issues of community concern. opportunities Feedback on how their concerns will be addressed as part of project implementation Feedback on project progress	Before onset of construction, Thereafter once every month during construction period and/or <i>ad hoc</i> depending on nature of issues as hand.	Resident Environmentalist Resident Engineer
Tutume Sub District and North East District Full Councils	Interested	Feedback on project progress Update on project implementation timelines.	As per the scheduled full council meetings.	Resident Environmentalist Resident Engineer

10.3 Decommissioning Plan

Decommissioning would entail demolition and/or removal of the entire infrastructure provided during development of the water supply scheme at the end of the project life. This would be coordinated by the Proponent or any other authority responsible for water provision at that particular time. Decommissioning would have to follow the appropriate procedure which includes the following:

- Establishment of a decommissioning committee (with affected communities)
- Assessment of impacts on stakeholders
- Notification of community, especially if there is salvageable materials
- Scheduling the process and related activities

However, given that the pipeline is submerged, it would not be necessary to unearth it but only to seal it off, as per WUC standard practice. The prominent structures that would require demolition are the water tanks, reservoirs and accompanying pump stations. Such demolition will necessitate the disposal of considerable quantities of concrete and steel wastes, and the grading and scarifying of the site's surface to facilitate plant cover re-establishment.

That notwithstanding, with the area's longstanding history of water shortage it is unlikely that any permanent decommissioning would be undertaken except partial demolition for upgrading of infrastructure such as reservoirs and tanks to meeting demand over the years.

11 CONCLUSIONS AND RECOMMENDATIONS

This Chapter presents conclusions and recommendations of the ESIA and Site Specific ESMP study based on issues identified as part of the scoping exercise, as well as the outcome of the impact assessment process undertaken to identify significant impacts and suggest mitigations/ management actions to ameliorate negative impacts and enhance positive impacts.

Conclusions

Water Resources

- Receptacles for solid waste should be provided on site and waste should be collected and disposed of at the designated refuse disposal site in Francistown. The waste receptacles should be covered to prevent access by wild animals, vermin and minimize odour.
- At least one well equipped first aid box and fire extinguishers should be available at site at all times in order for the contractor to achieve reasonable response time to accidents and incidents.
- The contractor should ensure that all tipping trucks are covered during haulage of materials as per the Directive from the Department of Waste Management and Pollution Control to prevent loose materials or stones from falling and littering the haul roads.
- Monitoring of the construction activities should be rigorous to avoid any pollutants being transferred into the Shashe Dam, Nata River and other regional ephemeral streams.
- The contractor's workers should be removed from site should they be found fouling the environment.

During Operation

- There should regular training of personnel who are to oversee the operation and maintenance of all the facilities under this project.
- There should be regular maintenance of the Mbalambi Pump Station including the Ntimbale Dam and Treatment Plants infrastructure.

Biodiversity

The ecological assessment for the North East Water Supply Scheme Project has identified a number of possible ecological impacts associated with the proposed development. All identified impacts were rated as being of moderate and low ecological impact. This derives from the fact that the current natural environment of the project area has realised long-term anthropogenic influences that have over time diminished the value of biodiversity, i.e. drastic reduction in wildlife populations, save in private holdings and high human density that is often inversely related to biodiversity value.

In conclusion, as the project area has been extensively modified by anthropogenic effects and the identified ecological impacts are of comparatively lower significance and all can be effectively mitigated, this assessment recommends implementation of the project.

Socio-Economy

Economy Aspects

The most significant result from the study is that most of the people welcome the intended water supply project. The reasons put forward by the respondents were that there would be economic opportunities created by the adequate water supply. The local economy, employment, lifestyle and community wellbeing among others would be improved. This also includes most importantly the improvement in service delivery and infrastructure as health facilities and schools among others will have adequate water supply.

However, the community had welcomed the project and asked to be expedited as they are suffering from shortage of water. The perceived improvement in local community lifestyle and wellbeing (among others) due to improved economic opportunities. Project village communities, local contractors and suppliers are likely to benefit greatly from the project as part of labour force and sub-constructors respectively. If deliberate measures are put in place to empower locals the benefits in the form of income multiplier and employment multiplier could have far reaching benefits. The envisaged benefits, notwithstanding could be offset by social ills that may result from an influx of job seekers.

Health and Safety Aspects

The nature of the proposed project inherently has aspects which are likely to compromise the health and safety of both the public and the construction crew. The latter will mostly be exposed to occupational health issues such as site hazards and compromised air quality and the former are posed for the risk of exposure to hazards from civil works such as open trenches and dust. That notwithstanding, health and safety issues identified can be contained through implementation of the suggested mitigation measures.

Archaeology

The results of the field evaluation exercise provide provisional information that may at this stage of the development be seen as appraising to a confidence level such information as may be used to begin the execution of the construction of the project referred to in here as Environmental and Social Impact Assessment for Botswana Emergency Water Security and Efficiency Projects – North East District and Tutume Sub-District Water Supply Project

It should be appreciated that the archaeological status at the proposed project site at this stage may not and should not be appropriated to imply a total lack of archaeological or general heritage sensitivity. This information may only be used as guidance during the development process so as to allow for the making or carving of mitigation strategies should such a need arise.

R e c o m m e n d a t i o n s

Water Resources

- Receptacles for solid waste should be provided on site and waste should be collected and disposed of at the designated refuse disposal site in Francistown. The waste receptacles should be covered to prevent access by wild animals, vermin and minimize odour.
- At least one well equipped first aid box and fire extinguishers should be available at site at all

times in order for the contractor to achieve reasonable response time to accidents and incidents.

- The contractor should ensure that all tipping trucks are covered during haulage of materials as per the Directive from the Department of Waste Management and Pollution Control to prevent loose materials or stones from falling and littering the haul roads.
- Monitoring of the construction activities should be rigorous to avoid any pollutants being transferred into the Shashe, Nata and other regional ephemeral streams.
- The contractor's workers should be removed from site should they be found fouling the environment.
- There should be regular training of personnel how to operate and maintain all the facilities under this project.
- There should be regular maintenance of the Mbalambi Pump Station including the Ntimbale Dam and Treatment Plant infrastructure.

Biodiversity

Furthermore, the assessment makes the following specific recommendations:

- Staff training has been recommended as part of mitigation of a number of identified ecological impacts. For cost effectiveness purposes, it is recommended that all trainings be combined into one training session or closely related themes should be combined into one training session.
- The project proponent should strongly consider partnerships with local academic and research institutions in environmental monitoring. This will allow for comprehensive, credible and systematic monitoring. It would also generate credible scientific information that can be referenced in similar future developments. Partnership with academic institutions in particular will also contribute towards technical capacity development of Botswana.

Socio-Economy

Economy Aspects

- The process of hiring local community workers should be fair and transparent and in accordance with existing relevant labour laws; where possible the locals should be given priority for unskilled and semi-skilled jobs.
- The compensation for, and the re-location of the affected property should be carried out properly by the relevant authorities.

Public Health and Safety Aspects

To promote safety, public and occupational health issues such as site hazards and compromised air quality should be abated by clearly pointing out the risks and hazards posed by the civil works such as open trenches and dust to both the public and the construction crew through public and occupational health and safety awareness campaigns, signage and cordoning of hazardous sites.

Archaeology

Overall Study Conclusions

The water supply scheme which is subject of this report has been operational and this study was only instituted to provide an update on the status of the receiving environment in preparation for upgrading the scheme. It is therefore without doubt that implementation of the suggested mitigation measures will accomplish the much need sustainable development initiative from the project. Compliance to the requirements of the World Bank Operational Policies also strengthens observance of local environmental legislature.

Overall Study Recommendations

The study has looked at all the proposed project activities and their potential impacts on the receiving environment. Most of the impacts fall within the low to medium significance band and can be mitigated to reduce their severity resulting in low impact significance levels. It is therefore recommended that the proposed project proceed subject to implementation of all the suggested impact mitigation and management measures.

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