FINAL ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) REPORT

FOR

THE PROPOSED SAGAMU LDZ NATURAL GAS PIPELINE NETWORK CONSTRUCTION AT IBEFUN LOCAL GOVERNMENT AREA, OGUN STATE

BY

TRANSIT GAS NIGERIA LIMITED

SUBMITTED TO

FEDERAL MINISTRY OF ENVIRONMENT MABUSHI-ABUJA.

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GLOSSARY OF TERMS

Abbreviation	Explanation
%	Percentage
µg/l	Microgram per litre
µg/m^3	Microgram per meter cube
µS	Micro Siemen
<	Less than
>	Greater than
ºC	Degree Celsius
µg	Microgramme
µm	Micrometer
AG	Associated Gas
AGA	American Gas Association
ANSI	American National Standard Institute
ASME	American Society of Mechanical Engineers
AAS	Atomic Absorption Spectrophotometer
AFC	African Finance Corporation
AfDB	African Development Bank
AFFF	Aqueous Film Forming Foam
AGO	Automotive Gas Oil
AIDS	Acquired Immune Deficiency Syndrome
ALARP	As Low As Reasonably Practicable
ANSI	American National Standard Institute
APG	Angiosperm Phylogeny Group
APHA	American Public Health Association
AQMP	Air Quality Management Plan
API	American Petroleum Institute
ASA	American Standards Association
ATS	Auto Transfer Switch
ASRs	Air Sensitive Receivers
ASTM	American Society for Testing and Materials
AWS	Automatic Weather Station
Axxela	Axxela Nigeria Limited
BAT	Best Available Technology

Bb	Barrels
BDL	Below Detection Limit
BEES	Battelle Environmental Evaluation System
BOD_5	Biochemical Oxygen Demand
BOM	Bill of Material
Bpd	Barrels per day
BPSD	Barrel per Stream Day
BSI	British Standards Institution
BTEX	Benzene, Toluene, Ethylbenzene and Xylenes
Ca	Calcium
CAP	Caption
CASHES	Community Affairs, Safety, Health, Environment and Security
CBH	Clean Bill of Health
CBO	Community Based Organization
CC	Canary Current
CCTV	Closed Circuit Television
Cd	Cadmium
CDA	Community Development Association
CDC	Community Development Committee
CEC	Cation exchange capacity
CFC	Chlorofluorocarbons
Cfu	Colony forming unit
Cfu/g	Colony forming units/gramme
cfu/ml	Colony forming unit per millilitre
CH_4	Methane
Cl^-	Chloride ion
CITES	Convention on International Trade on Endangered Species of Fauna and Flora
cm	Centimetre
CMS	Conservation of Migratory Species
CNG	Compressed Natural Gas
CO	Carbon Monoxide
CO_2	Carbon Dioxide
COD	Chemical Oxygen Demand
COO	Chief Operating Officer

CPR	Cardio-Pulmonary Resuscitation
CPU	Central Processing Unit
CSR	Corporate Social Responsibility
CSW	Commercial Sex Workers
COD	Chemical Oxygen Demand
Cu	Copper
Cr	Chromium
dB(A)	Decibel
DCD	Development Control Department
DCP	Dry Chemical Powder
DWT	Dead Weight Tonnage
DPR	Department of Petroleum Resources
E	East
EAG	Environmental Assessment Guidelines
EAR	Environmental Audit Report
E.A	Exchangeable Acidity
EC	Electrical Conductivity
ECC	Equatorial Counter Current
ECMWF	European Centre of Medium and Long Range Weather Forecast
ECOWAS	Economic Community of West African States
EDM	Engineering Design and Materials
EEZ	Exclusive Economic Zone
EGASPIN	Environmental Guidelines and Standards for the Petroleum Industry in Nigeria
EHS	Environment Health and Safety
EIA	Environmental Impact Assessment
EI	Environmental Impact
ELPS	Escravos-OgunPipeline System
EMP	Environmental Management Plan
EMS	Environmental Management System
EP	Equator Principles
EPC	Engineering, Procurement and Construction
EPFI	Equator Principles Financial Institutions
EPRP	Emergency Preparedness and Response Plan

ERP	Emergency Response Plan
ESAP	Environmental and Social Assessment Procedures
ESDS	Emergency Shutdown Systems
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
ETBE	Ethyl butyl ether
EU	European Union
ESD	Emergency Shut Down
F&G	Fire and Gas
FAO	Food and Agriculture Organisation of United Nations
FAOSTAT	Statistics Division of Food and Agriculture Organisation of United Nations
FBE	Fusion Bonded Epoxy
FEED	Front End Engineering Design
FEPA	Federal Environmental Protection Agency
FGD	Focus Group Discussion
FJC	Field Joint Coating
FMEnv	Federal Ministry of Environment
Ft	Feet
FTZ	Free Trade Zone
GTA	Gas Transportation Agreement
GC	Gas Chromatography
GDP	Gross Domestic Product
GHGs	Greenhouse Gases
GIIP	Good International Industry Practice
GIS	Geographical Information Systems
GPS	Global Positioning System
HAZOP	Hazard Operability Studies
Ha	Hectare
Hr	Hour
H_2S	Hydrogen Sulphide
H_2SO_4	Tetraoxosulfate VI Acid
HCFC	Hydrochlorofluorocarbon
HDPE	High-density Polyethylene
HDS	Hydrodesulphurization

HDV	Heavy Duty Vehicle
HDB	Heterotrophic Degrading Bacteria
HDD	Horizontal Directional Drilling
HFC	Hydrofluorocarbon
Hg	Mercury
HH	Hydraulic Head
HIA	Health Impact Assessment
HIV	Human Immunodeficiency Virus
HMI	Human Machine Interface
HP	High Pressure
HSE	Health, Safety and Environment
HSE-MS	Health, Safety and Environment Management System
HTAS	Haldor Topsoe A/S
HUB	Hydrocarbon Utilizing Bacteria
HEMP	Hazard and Effect Management Process
HSE	Health, Safety and Environment
HNO_3	Nitric Acid
IFC	International Finance Corporation
IMM	Impact Mitigation Monitoring
ISA	International Society of Automation
ISO	International Organization for Standardization
IUCN	International Union for Conservation of Nature
IP	Institute of Petroleum
IPAN	Institute of Public Analysts of Nigeria
ITCZ	Inter-Tropical Convergence Zone
ITD	Intercontinental Tropical Discontinuity
K	Potassium
Kg	Kilogramme
Km	Kilometer
Km^2	Square Kilometer
L	Litre
KBR	Kellogg, Brown and Root
KII	Key Informants Interview
LGA	Local Government Authority

LP	Low Pressure
LNG	Liquefied Natural Gas
LOLO	Lift-on/Lift-off
LPG	Liquefied Petroleum Gas
LRP	Livelihood Restoration Plan
m	metre
m/s	Meter per Second
m^3	Cubic metre
Max	Maximum
MEDEVAC	Medical Evacuation
MDB	Main Distribution Board
MFL	Magnetic Flux Leakage
Min	minimum
Mn	Manganese
Mg/kg	Miligramme/Kilogramme
MoU	Memorandum of Understanding
MOSR	Mineral Oil Safety Regulations
MP	Medium Pressure
MPN	Most Probable Number
MSDS	Materials Safety Data Sheet
MSL	Mean Sea Level
MT	Tropical Maritime Air mass
MTBE	Methyl tert-butyl ether
MTBF	Mean Time Between Failures
MTTR	Mean Time To Repair
MVR	Marine Vapor Recovery
mm	Millimetre
MMscf/d	Million Standard Cubic Feet per Day
Na	Sodium
NAG	Non Associated Gas
NA	Not applicable
NAAQS	Nigerian Ambient Air Quality Standards

NACE	National Association of Corrosion Engineers
NCF	Nigeria Conservation Foundation
ND	Not detected
NDT	Non Destructive Testing
NESREA	National Environmental Standards and Regulations Enforcement Agency
NFPA	National Fire Protection Association
NEPZA	Nigerian Export Processing Zone Authority
NG	Natural Gas
NGC	Nigerian Gas Company Limited
NGO	Non Governmental Organization
NH_3	Ammonia
Ni	Nickel
NIDs	National Immunization Days
NIMASA	Nigerian Maritime Administration and Safety Agency
NiMET	Nigeria Meteorological Agency
NIWA	National Inland Waterways Authority
NOSCP	National Oil Spill Contingency plan
NOSDRA	National Oil Spill Detection and Response Agency
NOx	Oxides of Nitrogen
NH_4^+	Ammonium ion
NNPC	Nigerian National Petroleum Corporation
NPC	National Population Commission
NTU	Nephelometric Turbidity Unit
O & G	Oil and Gas
O & Gr	Oil and Grease
ODC	Over Dimension Consignments
ODS	Office of Drainage Services
OECD	Organization for Economic Co-operation and Development
OES	Office of Environmental Services
OGWAMA	Ogun State Waste Management Authority
OGEPA	Ogun State Environmental Protection Agency

OGAPIP	Ogun State Agriculture Production and Industrialization Program
OGMOE	Ogun State Ministry of Environment
OSEMA	Ogun State Emergency Agency
OML	Oil Mining Lease
OPL	Oil Prospecting Lease
OH&SP	Occupational Health and Safety Plan
OPRC	Oil Pollution Preparedness, Response and Co-operation
OPV	Oral Polio Vaccine
OCSCP	Oil and Chemical Spill Contingency Plan
OSCP	Oil Spill Contingency Plan
OSR	Oil Spill Response
PAH	Polycyclic Aromatic Hydrocarbon
PAPs	Project Affected Persons
Pb	Lead
pH	Hydrogen ion concentration
PLC	Public Liability Company
PO_4^{2-}	Tetraoxophosphate (VI) ion
Psig	Pounds per Square Inch Gauge
Psia	Pounds per Square Inch Absolute
Psi	Pounds per square inch
ppm	Parts Per Million
PRMF	Pressure Regulating and Metering Facility
PDA	Project Development Area
PDR	Post Decommissioning Report
P&ID	Piping and Instrumentation Diagram
PLCs	Programmable Logic Controllers
PM	Particulate Matter
PMS	Premium Motor Spirit
PMT	Project Management Team
ppb	Part Per billion
PPE	Personal Protection Equipment
PO_4	Phosphate

PQR	Procedure Qualification Record
PRA	Participatory Rural Appraisal
PS	Performance Standard
PTW	Permit -to -Work
PULP	Premium Unleaded Petrol
PVC	Polyvinyl Chloride
RAP	Resettlement Action Plan
RAGAGEP	Recognized and globally accepted good engineering practices
ROW	Right of Way
RVP	Relative Vapour Pressure
SAFOP	Safety Operability Studies
SAP	Social Action Plan
S	South
SCBA	Self-Contained Breathing Apparatus
SE	South East
SEPA	State Environmental Protection Agency
SHOC	Safe Handling of Chemicals
SO_x	Oxides of Sulphur
Sp	Species (Single)
SS	Suspended Solids
SM	Single Mode
SO_2	Sulphur Dioxide
SO_4^{2-}	Sulfate Ion
SOLAS	Safety of Life at Sea
SPM*	Suspended Particulate Matter
SPM	Single Point Mooring
SPULP	Super Premium Unleaded Petrol
SS	Suspended solids
SSI	Semi Structure Interview
STGs	Steam Turbine Generators
STDs	Sexually Transmitted Diseases
STI	Sexually Transmitted Infections

SW	Surface Water
STDs	Sex Transmitted Diseases
TAME	Tertiary amyl methyl ether
TCE	Tata Consulting Engineers
TDS	Total Dissolved Solids
TEL	Tetraethyl lead
TGNL	Transit Gas Nigeria Limited
THB	Total Heterotrophic Bacteria
THF	Total Heterotrophic Fungi
THC	Total Hydrocarbon
TML	Tetramethyl lead
TMP	Traffic Management Plan
THC	Total Hydrocarbon Content
TOR	Terms of Reference
TPH	Total Petroleum Hydrocarbons
TSP	Total Suspended Particles
TSS	Total Suspended Solids
UF85	Urea-Formaldehyde Concentrate
ULP	Unleaded Petrol
UN	United Nations
UPS	Uninterruptible Power Supply
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
US	United States
USEPA	United States Environmental Protection Agency
V	Vanadium
VES	Vertical Electrical Sounding
VOC	Volatile Organic Compound
WB	World Bank
WD	Water Depth
WHB	Waste Heat Boiler
WHO	World Health Organization
WMP	Waste Management Plan

WPS	Welding Procedure Specifications
Yr	Year
Zn	Zinc

LIST OF ESIA PREPARERS

The ESIA project team includes the following team members

S/N	NAME/QUALIFICATION	PROFESSION
1.	Engr. Kehinde Adeniyi, Master Environmental Mgt.	Team Manager/ Oil & Gas Engineering
2.	Prof. Dele Olowokudejo, Ph.D	Team Leader / Biodiversity& Impact Assessment
3.	Prof. Stan Aribike,Ph.D.	Chemical Engineering/Air Quality
4.	John Okwong Walter M.Sc	Plant Ecology and Vegetation
5.	Mr. Oyetola Oyebanji, M.Sc.	Vegetation Ecology
6.	Mr. Johnson Ojoniyi, M.Sc.	Soil Chemistry
7.	Dr. Bambo Oluwasuji, Ph.D.	Electrical/Electronics Engineering
8.	Mr. Collins Bamjoko, M.Sc.	Socio economics
9.	Olakunmi Ayeni M.Sc, GIS	GIS /Meteorology
10.	Mr. Kehinde Coker, B.Sc.	Safety/ Logistics
11.	Mr. Kehinde Olofintuyi B.Sc	Logistic
12.	Mrs. Aina Toyosi HND	Administration Logistics and Operations

QUALITY ASSURANCE AND QUALITY CONTROL DECLARATION

I declare that this study Environmental and Social Impact Assessment Study of the Proposed Ssagamu LDZ Natural Gas Pipeline Network Construction Project report was carried out in line with the submissions and approved quality assurance and quality control plan for this work. Samples were taken and preserved appropriately. Analysis was carried out using scientifically accepted methodologies and high quality, standard, non-expired reagents. There was adherence to the quality standard required for this ESIA by the Federal Ministry of Environment (FMEnv).

Signature: .....

Name of Environment Consultant **Elohim Sabaoth Limited**

Date: March

EXECUTIVE SUMMARY

1.0 Introduction and Background

A summary of the findings and conclusions of an Environmental and Social Impact Assessment (ESIA) Study for the proposed Sagamu LDZ Natural Gas pipeline Network Construction Project is presented in this section.Transit Gas Nigeria Limited (TGNL), a subsidiary of Axxela Nigeria Limited, commissioned Elohim Sabaoth Limited - an Energy and Environmental Consulting Firm - to carry out the Environment Social Impact Assessment for the project.

The Transit Gas Nigeria Limited (TGNL) was incorporated in 2014 as a limited liability company and a subsidiary of Axxela Nigeria Limited, is the owner of the project. Its principal place of business is at the 8th Floor, The Wings Complex, East Tower, 17a Ozumba Mbadiwe Avenue, Victoria Island, Lagos, Nigeria.

1.1 The Proposed Project

In order to meet the request for the supply of Natural Gas to Rite Foods Nigeria Limited, Ososa, Ogun State, and the future requirements of potential customers for use of Natural Gas, Transit Gas Nigeria Limited (TGNL), a subsidiary of Axxela Nigeria Limited in partnership with Nigerian Gas Marketing Company (TGNL) intends to construct a 12" x 135 km Pipeline Network from KP312 of Escravos Ogun Pipeline System's Above Ground Installation at Ibefun, Ogun State, to Rite Foods Nigeria Limited Ososa, Ogun State. This main line is to serve as a backbone for Natural Gas supply to;

i. KP312 of the Escravos Ogun Pipeline System, Ibefun to Rite Foods Nigeria Limited, Ososa, Ogun State,
ii. Sagamu Interchange to Abeokuta, Ogun State,
iii. Sagamu Interchange to J4, Ogun State,
iv. Sagamu Metering Station, Sagamu-Benin Express Junction, Ogun State.

The entire pipeline network is about 19km long and required land for the project was acquired from the Federal Ministry of Environment and the Ogun State Ministry of Environment.

The estimated lifespan is between 25 years and 30 years.

The pipeline system comprises of the following:

- A tie-in to NGC's 36" Escravos-Lagos Gas Pipeline. The tie-in will be effected through hot-tap connection using split tee 36"x12".
- Scraper Launcher station near tie-in point at KP312.
- 12" NPS x 135km approximate pipeline system.
- The lagoon crossing approximate by means of Horizontal Directional Drilling (HDD).
- River (Bridge) Crossing approximate also by means of HDD
- Line Break valve stations.
- Scraper Receiver station at City Gate Station.
- Future option for 36" x 12" for City Gate Station at a specified location on mainline.
- Scraper Launcher station at City Gate Station online to Rite Foods Plant.
- Pig Launcher/Receiving Facility
- Future valve-tee connections for prospective customers
- The Scraper Receiver is proposed to be installed within the Rite Foods PRMF station. From Scraper Receiver, a line will be routed to Gas/Liquid Separator Vessel (Slug Catcher) for Rite Food PRMF Station.
- The City Gate Station will include a PRMF Station to meet their individual gas requirement. Each PRMF Station shall include Filter Separator skids, online gas analysis system, Metering assemblies, Gas heater/Heat Exchanger, Pressure Reducing facilities (PRF), Vent and drain systems.

Transit Gas Nigeria Limited (TGNL) proposes to carry out an Environment and Social Impact Assessment (ESIA) study of the engineering, construction, operation, and ultimate abandonment of this proposed project in compliance with its corporate policy on environmental protection, the Federal Ministry of Environment (FMEnv) guidelines on ESIAs for projects of this nature, and the environmental and safeguard requirements of International Finance Corporation's Guidelines on ESIAs. TGNL had secured the services of a reputable ESIA Consultant - ELOHIM SABAOTH LTD to perform the ESIA study. The ESIA study has been designed in line with the procedures provided in the PART VIII.A of Environmental Guidelines and Standards for Petroleum Industry in Nigeria (EGASPIN, 2018).

1.2 Environmental and Socio-Economic Aspects

Transit Gas Nigeria Limited - (TGNL) recognizes the importance of comprehensive Environmental and Social Planning and Management to the success of this project and is committed to carrying out the necessary studies to understand the environmental and social peculiarities of Ososa Township and other project areas in Ogun State in order to address areas where significant impacts (Physico-chemical, ecological and socio-cultural) may be experienced.

The ESIA Consultants are working with TGNL on the project (site preparation, construction, start-up and operation) to prepare an ESIA study report that describes the impacts of these activities and the mitigation measures to be taken by TGNL, which are compatible with acceptable Health, Safety and Environmental Management Practices.

The ESIA Report will provide details of the attendant Environmental and Social conditions within the project's area of influence, and include a qualitative and quantitative impact analysis section covering all project phases, based on the anticipated project-environment interactions. Mitigation measures will be proffered to eliminate or minimize impacts of significance to acceptable levels and a comprehensive Environmental and Social Management Plan (ESMP) including monitoring requirements will be developed as part of the report.

1.3 Environmental and Social Impact Assessment

An Environmental and Social Impact Assessment (ESIA) may be defined as a structured and formal set of procedures for identifying and assessing the environmental and socioeconomic consequences of development project, plans, programmers and policies in an attempt to ensure that the best alternative for development is selected. An ESIA can thus be regarded as a decision-making tool, which is primarily concerned with environmental soundness of projects and programmes.

An ESIA compares various alternatives by which desired objectives may be realized and seeks to identify the one which represents the best combination of economic, social and environmental costs and benefits.

The main aim of an ESIA is to ensure that potential problems are foreseen and addressed at the early stage in the project's planning and design. To achieve this aim, the assessments

findings are communicated to all the various groups who will make decisions about the proposed project; the Project Developers and their investors as well as Regulators, Planners and Administrators.

1.4 Objectives of the ESIA Study

The Environmental and Social Impact Assessment (ESIA) study is to be carried out in accordance with contemporary National and International best practice requirements for ESIA studies. The study methodology for the ESIA shall be consistent with the FMEnv's ESIA Decree 86 of 1992 and those of the World Bank as articulated by the International Environmental-related Conventions and Industry best management practices shall be applied. The specific aims of the ESIA study are as follows

a. Establish the existing state of the environment within the general areas of influence of the Project.
b. Identify sensitive components of the existing environment within the Project area and area of influence;
c. Appraise the Project activities (including construction, start-up, operations and decommissioning), determine any potential negative and positive impacts on the environment either as new, add-on or cumulative on the existing state;
d. Recommend alternative and/or measures to avoid, ameliorate, or mitigate the identified impacts; identify any impacts that cannot be avoided and enhance the beneficial ones;
e. Establish an appropriate Environmental and Social Management Plan (ESMP) for the life of the Project; and
f. Prepare a detailed distinct ESIA report for the project, presenting clear and concise information on the environmental impact of the proposed project activities.

1.5 Scope of the ESIA Study

This ESIA study shall involve the following:

1.6.1 Description of the Legal and Administrative Framework

The Legal and Administrative framework affecting the ESIA study of the pipeline will be carefully researched and discussed. This will cover the applicable International, National and State laws, Regulations, Conventions and Treaties.

1.6.2 Review of Existing Information

Available information on the general Project area will be reviewed for relevant information on the environmental and social characteristics of the Project area.

2.0 Administrative And Legal Framework

The constitution of the Federal Republic of Nigeria confers jurisdiction on the Federal Government to regulate the operations and development activities in the industrial sector of Nigeria. This, together with applicable international conventions demand that EIA be conducted for major development projects. The laws and regulations relevant to this project development have been reviewed in Report and include the following amongst others;

- EIA Act Cap E12 LFN 2004.
- EIA Procedural Guidelines of 1995.
- Waste Management and Hazardous Waste Regulations (S. 1. 15) 1991.
- EIA Sectoral Guidelines for Power Generation and Transmission Projects, 1995.
- Interim Guidelines and Standards for Environmental Pollution Control in Nigeria, 1990.
- Land Use Act, 1990.

3.0 Terms of Reference

The Terms of Reference (TOR) for the EIA are:

- Outline the general scope of EIA study including the overall data requirements on the proposed project and affected environment;
- Define the procedures/protocols for identification and assessment of associated and potential impacts;
- Select appropriate mitigation measures for such impacts and develop an effective Environmental Social Management Plan (ESMP) for the project;
- Define the framework for interaction and integration of views of a multidisciplinary project team with regulators, host communities and other stakeholders;
- Define the relevant framework of legal and administrative requirements of the project;
- Prepare the ESIA Report.

Study Approach and Methodology

The general methodology adopted for conducting this ESIA includes the following steps:

- Analysis of the proposed development activities for their potential sources of environmental, socio-economic and health impacts by means of desk studies, literature review, interviews and expert consultations;

- Field studies to document ecological baseline conditions of the ambient environment within 2-3km on each side of the project site boundary, the socio-economic status of the host communities and consultations with stakeholders. These were conducted between in June, 2020
- Analysis of the potential impacts of the project on the environment, socio-economic and health by a variety of tested techniques and expert opinions;
- Development of appropriate impact mitigation measures for each potential impact, and
- Development of an Environmental and Social Management Plan (ESMP) that will ensure environmental sustainability throughout the life of the project.

4.0 Project Justification And Alternatives

The Proposed Project is aimed at (i) generating adequate and reliable electricity to power and (ii) for use in the manufacturing processing at the Rite Foods Nigeria thus ensuring smooth operations. The Project will guarantee power availability, stability and operational efficiency of the factories. This will stimulate economic growth. Analysis of the various project alternatives available such as A 'No Project' Scenario, Alternative sources of electricity and Alternative routes – show that, on the basis of environmental and socio-economic considerations, the proposed route is the best option. There will be minimal social and environmental impact and it will be non-disruptive, thereby ensuring stability and sustainability.

5.0 Project And Process Description

In order to meet the request for the supply of Natural Gas to Rite Foods Nigeria Limited, Ososa, Ogun State, and the future requirements of potential customers for use of Natural Gas, Transit Gas Nigeria Limited (TGNL), a subsidiary of Axxela Nigeria Limited in partnership with Nigerian Gas Marketing Company (TGNL) intends to construct a 12" x 135 km Pipeline Network from KP312 of Escravos Ogun Pipeline System's Above Ground Installation at Ibefun, Ogun State, to Rite Foods Nigeria Limited Ososa, Ogun State. This main line is to serve as a backbone for Natural Gas supply to;

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iii. Sagamu Interchange to J4, Ogun State,
iv. Sagamu Metering Station, Sagamu-Benin Express Junction, Ogun State.

Associated activities and processes include the following:

- Acquisition of additional ROW, surveys and environmental studies.
- Route selection and verification
- Preparation and issuance of detailed engineering, procurement and construction specification, procedures and drawings.
- Project management at all stages of the EPC Contract
- Procurement and supply of all materials and equipment
- Transportation of all materials and equipment to site
- Construction and installation of complete pipeline system
- Coating, painting, pigging
- Relocation and Restoration to the original functions/position of any services disrupted during construction
- Provision of TIE-ins (valved and not valved) to existing pipeline and piping
- Site inspection and pipeline post markers.
- Testing (hydro, NDE including radiography, etc)
- Provision of Cathodic Protection on new line.
- Pre-commissioning and commissioning activities
- Preparation and Issuance of as-built documentation

6.0 Environmental Characteristics of the Project Environment

A baseline account covering biophysical, chemical, socio-economic and health status of the project area has been documented. The characteristics of the project environment obtained from the study are summarized hereunder

- **Climatic Conditions**

The climate of the area is that of humid, semi hot equatorial type with high rainfall. There are two seasons, namely; the rainy and dry seasons. A wet season that runs from March to October and the dry season from November to February; is typical of the project area. The prevailing wind direction is south-westerly with an average speed of 3.5ms^{-1}. Temperature and relative humidity are generally high most of the year with average monthly ranges of 22.96°C – 33.9°C and 42.3% - 87.3%, respectively. The average rainfall is about 1,307.10mm per year. The rain falls mainly between April and October.

- **Air Quality & Noise Level**

The average concentrations of pollutants within the project area and in the surrounding areas were below detection limit for Sulphur Dioxide (SO_2), Nitrogen oxide (NO_2), Carbon monoxide (CO). Hydrogen Sulphide (H_2O), Ammonia (NH) and Volatile Organic Compounds(VOC).The Total Suspended Particulate Matter (SPM) concentrations ranged from 17 to 1494 µg/m^3 in the wet season. All the neighbourhood air pollutant values were below FMEnv and WHO maximum allowable levels (250) for the Nigerian environment.

Noise level survey was carried out at selected locations in all the project sites. The values ranged from 48 to 78dB(A) in the wet season and 44 to 79 during the dry season. The highest noise level was recorded near the Redemption Camp and areas where vehicular traffic loading was relatively high. The noise levels did not exceed the FMEnv and WHO ambient noise standards.

- **Geology**

Ogun State has two main rock types viz: basement complex rocks of the pre-Cambrian age in the northern zone and older sedimentary rocks of both the tertiary and secondary ages in the southern parts. Most of the state is well-drained by many rivers and streams. Three broad groups of soil cover the sate e.g. ferruginoud tropical soil, hydromorphic soil and the ferralitic soil.

- **Vegetation, Ecology and Land Use Charge**

The natural vegetation of Ogun State is the climax lowland rainforest in the south and heavily wooded savanna in the north and west. However, intense cultivation over a long period has decimated the primary rainforest and promoted secondary re-growth dominated by oil palms. A wide range of ecological zones are now quite evident in the state. The study area varies from an aggregation of annual and perennial herds, shrubs and trees to secondary formations, bush fallows and degradated open lands. The species composition is diverse with a wide variety of annual, perennial herbs, shrubs and palms.

- **Wildlife Resources**

Little of wildlife was evident in the study areas due to the proximity to the busy expressway, human settlements human activities. Based on few direct sightings, interviews with community leaders and hunters, a few variety of wildlife found in the areas included mammals, birds, reptiles, molluscs and amphibians. Illegal and unregulated hunting and habital destruction are the most serious threats facing wildlife resources in the state.

- **Soil**

Three soil types viz: Ferruginoud tropic soil which spreads across, much of the Ilishan North and Odogbolu LGAs, the Hydromorphic soil which covers mainly the coastal area of Ogun Waterside and the Ibefun South LGA, and the Ferralitic soil which covers the rest of the state, including the project area.

- **Land use**

The most visible land use features within 2-3km on either side of the project ROW, include human settlements comprising residential houses and estates, transportation infrastructure such as roads and motor parks, educational institutions, small scale industries, worship centres, farmlands and wastelands.

7.0 Socio-Economic and Health Conditions

Ogun State has a land area of 160,085 km and a population of about 2.3 million people with people with Abeokuta as the capital city.It is mainly populated by the Yoruba tribe and other settlers like the Igbos, Hausas, Ijaws. The communities are situated on both sides of the proposed pipeline route viz: Kajola, Bara, Logbara, Onilomo, Idofin, Oba, Ajetutu, Jibowu, Onibata, Shiun, Iyana Ashipa, Kobape, Abeokuta in Sagamu Interchange to Abeokuta Sagamu.

The communities are located in Ilishan, Odogbolu, Ososa LCDA while Sagamu Interchange is located in Sagamu.

Christianity is the dominant religion in all communities followed by Islam and African Traditional Religion. Each community is headed by a **Baale** who is assisted by his appointed chiefs. Youth organizations and Community Development Associations are very vibrant. Households are headed by men. There are primary, secondary and tertiary institutions in close proximity to the communities and a large percentage have primary and secondary education. Trading is the predominant occupation followed by transportation and farming. Land acquisition and ownership are administered by the community heads and chiefs. Aiancome levels are generally low and fall below the level of inflation. Access to potable water, electricity and housing is poor – similar to the national average. Solid waste management is inefficient as evidenced by the existence of numerous unregulated waste dumps in various parts of the communities. Health care facilities are inadequate. Only 50% of the communities have access to primary health centres. The private medical facilities charge high fees. The prevalent diseases include malaria fever, typhoid, gastro-intestinal disorder, dysentery, diabetes and eye infections. The people are favourably disposed to the successful execution of the project because of its

obvious benefits. These include employment, skill acquisition and partnership arrangements for provision of health facilities, schools, potable water and other social amenities.

Consultation Programme

Consultation was accorded high priority in the project planning and pre-development activities as an integral part of the ESIA for the proposed natural Gas pipeline network project. Two broad levels of consultation, i.e. Institutional and Public, were identified at the beginning of the project. Several meetings, discussions and briefings were held and the proceedings recorded. Project proponents will continue to consult with all the relevant parties and stakeholders concerned with or likely to be affected by the project at all stages of the development. This would assist in establishing priorities, partnership and smooth implementation of management plans.

8.0 Potential Impacts and Mitigation Measures

The potential environmental impacts of the proposed Natural Gas Pipeline network and corresponding appropriate mitigation measures and tabulated below. The rankings of both the potential and residual impacts are also indicated.

Mitigation measures Proffered for the Associated and Potential Impacts of t he Construction of the Pipeline and Associated Facilities construction

Project Activity	Potential Associated Impact	Impact Ranking	Critical Point	Control Mechanism	Mitigation Measures	Residual Impact Ranking
Site Survey	Vegetation loss.	**Low**	Pipeline route	Physical Control	• TGNL shall supervise access to and activities at site to minimise negative impacts such as trampling.	**Low**
	Biodiversity reduction.	**Low**	Pipeline route	Physical Control	• TGNL shall ensure non-destruction of plant and animal life by surveyor &field workers.	**Low**
Land Acquisition & Compensation	Reduced access to land.	**Low**	Pipeline route	Formal Control	• TGNL shall negotiate equitable purchase arrangements to compensate landowners ;and • TGNL shall pay agreed sums promptly.	**Low**
	Third party agitation.	**Low**	Affected Community	Formal Control	• TGNL shall pay compensation promptly, work with govt. security agencies; and • TGNL shall implement agreed MoU.	**Low**
Mobilization of machinery workforce equipment and facilities to site	Interference with public transport by Low traffic loading.	**Low**	Mobilization route	Avoidance & Training	• TGNL shall avoid mobilizing during "rush hour" traffic; • TGNL shall ensure orderly and controlled vehicular and personnel movement by developing traffic plan.	**Low**
	Risk of accident leading to injury and death.	**Medium**	Mobilization	Training &Avoidance	• TGNL shall ensure all vehicles are in good working condition before embarking on trip; • TGNL shall conduct competency training for all drivers; • TGNL shall impose load and speed limits and property sign all appropriate roads; and • TGNL shall hold regular safety meetings.	**Low**
	Damage to roads and infrastructure.	**Low**	Mobilization route	Formal Control	• TGNL shall maintain all vehicles at optimal working Conditions.	**Negligible**
	Degradation of air quality by vehicular emissions.	**Low**	Mobilization route	Informal Control	• TGNL shall maintain all vehicles at optimal working conditions; and • TGNL to develop effective journey management plan.	**Negligible**
Vegetation clearing	Destruction of vegetation and	**Low**	Pipeline route	Physical Control	• TGNL shall restrict clearing to site of Pipeline and	**Low**

& De-Stumping	reduction of biodiversity.				areas needed for the development and safety operations; • TGNL shall avoid sensitive habitats by re-routing; and • TGNL shall re-vegetate all unused cleared portions.	
	Damage to farm lands and crops.	**Low**	Pipeline route	Physical Control	• TGNL shall pay affected farmers equitable sum for damage farmlands and crops; and • TGNL shall pay agreed sums promptly.	**Low**
Vegetation clearing & De-Stumping	Destruction of wildlife habitat, loss and forced migration of wildlife.	**Low**	Pipeline route	Informal Control	• TGNL shall ensure non-disturbance of adjacent vegetation as refuge for displaced wildlife; • TGNL shall avoid roosting, breeding and feeding sites by careful routing; and • TGNL shall prohibit poaching and hunting at all project phases.	**Low**
	Landuse of the area affected by land-take.	**Low**	Adjoining areas	Formal control	• TGNL shall restrict all activities to the agreed site; and • TGNL shall restore site to near-original state after decommissioning.	**Low**
	Degradation of surface and ground water quality by sedimentation, situation, runoff, incidental discharges of effluent, sewage, oil, paints, chemicals etc.	**Low**	Pipeline route and Discharge points	Formal	• TGNL shall ensure all effluents are treated to regulatory standards before discharge; • TGNL shall carefully avoid impacts to water bodies and riparian vegetation; • TGNL shall install sediment traps to control runoff and sedimentation; • TGNL shall design fuel, oil and chemical storage areas to fully contain spills and leaks; • TGNL shall carry out environmental awareness training for all personnel; and • TGNL shall Maintain good housekeeping combined with good work practices at all times in the storage handling and use of fuels, oil, paints, grease and chemical, to reduce waste flows.	**Low**
Soil Excavation, Civil works, & Installation of facilities	Degradation of soil by exposure, excavation, compaction and erosion.	**Low**	Pipeline route	Formal	• TGNL shall minimize land area exposed and duration of exposure; and • TGNL shall install temporary (during construction) and Permanent erosion control measures such as silt fencing, silt trap basins, short term seeding and moulding of exposed soil area.	**Low**
	Degradation of air quality by emission from fuel combustion engines (Power generators, pile	**Low**	Pipeline route	Informal	• TGNL shall maintain all equipment at optimal working condition;	**Negligible**

	drivers, bull dozers etc.).				• TGNL shall ensure periodic maintenance of fuel combustion equipment and maintain records; and • TGNL shall install appropriate air pollution control devices and equipment.	
Soil Excavation, Civil works, & Installation of facilities	Construction of waste may create serious environmental problems.	**Low**	Pipeline route	Formal	• TGNL shall ensure adequate on-site and ultimate off-site disposal facilities; • TGNL shall effectively manage all waste by employing the 4Rs system: Reduction at source, followed by Recycling, Recovery or Reuse as preferred options to disposal; • TGNL shall implement its waste management policies; and • TGNL shall maintain good house-keeping combined with good work practices at all times.	**Low**
	Workplace accidents/incidents injury or death.	**Medium**	Pipeline route	Avoidance	• TGNL shall design workplace procedures to meet industrial standards; • TGNL shall enforce the use of PPE; • TGNL shall activate emergency response plan where applicable; and • TGNL shall conduct periodic competency training for all personnel and provide safety reminders to all staff.	**Low**
	Cultural and social conflicts between migrant labourers and natives.	**Medium**	Communities	Avoidance & Training	• TGNL shall establish and maintain cooperative and open working relations with local communities throughout the life of the project; • TGNL shall brief all workers to ensure awareness of , and sensitivity to the local cultures, traditions and lifestyles; and • TGNL shall intimate community heads of projected activities and assist them in identifying impacts that may be of particular concern to them, and have a voice in appropriate mitigation measures.	**Low**
	Increase in community population and demographic changes.	**Low**	Communities	Avoidance	• TGNL shall recruit most of the unskilled labour force from the surrounding communities.	**Negligible**
Soil Excavation, Civil works, & Installation of facilities	Incident of sexually transmitted infections and other diseases amongst workers.	**Low**	Residence and communities	Avoidance & Training	• TGNL shall design a safety and health programme for the work force; • TGNL shall educate workers on the risk of unprotected sex, STIS, HIV, AIDS etc; and • TGNL shall provide medical facilities for all workers.	**Low**
Piling & Back-	Impaired hearing partial or total	**Low**	Point of noise	Formal and	• TGNL shall maintain equipment to optimal	**Low**

Filling	loss of hearing due to noise from generators, pile drivers & other equipment.		generation	Avoidance	working condition; • TGNL shall use silencers/mufflers on diesel equipment and power generators; • TGNL shall limit pile driving to day light hours; • TGNL shall design and use low noise equipment; • TGNL shall enforce the use of PPE, such as ear muffs with sound policies and by example ; • TGNL shall keep records of noise exposure measures of workers for duty schedule in shifts; and • TGNL shall control individual workers exposure to excessive noise by shift arrangement.	
Operations & Maintenance of Facilities	Risk of fire and explosion from equipment malfunction and failure.	**High**	Route & Control	Formal	• TGNL shall maintain facilities to optimal working condition to ensure their reliability and safety; • TGNL shall conduct an annual review and necessary maintenance carried out as required; • TGNL shall activate emergency response plan where applicable;	**Medium**
Decommissioning and abandonment	Corrosion of abandoned structures, towers, causing increase in ambient concentration of iron in the soil.	**Low**	Control station	Formal	• TGNL shall conduct post abandonment monitoring and corrosion protection of facilities if necessary; • TGNL shall, as far as possible, restore the environment to its original state.	**Low**
	Physical disturbance from removal of structures	**Low**	Pipeline route	Training	• TGNL shall ensure proper post abandonment monitoring of all structures and facilities.	**Low**
	Residual contaminating from oil and grease.	**Low**	Control location	Training	• TGNL shall contain all leaks and spill and maintain good housekeeping throughout this process to reduce waste flows.	**Low**

9.0 Environmental and Social Management Plan

An Environmental Management Plan that will ensure the integrity of the Natural Gas Pipeline network project has been developed. This covers the project activities from site preparation, through construction, commissioning, operation and maintenance of the power Gas Pipeline Route, decommissioning and abandonment. The plan relates to: Management of significant impacts and implementation of specific mitigation measures; monitoring programme, measurements and procedures; waste management strategies; audit programme; safety measures and guidelines; emergency planning, education and training and guidelines for decommissioning and abandonment. The overall goal of TGNL Environmental and Social Management Plan (ESMP) is to progressively reduce the impact of the Pipeline network development activities on the environment with the ultimate aim of eliminating them. Additional challenging targets have been set for the project and these include:

- The integration of environment management issues into project plan;
- Encouraging employees and contractors to implement these environmental management guidelines for the project;
- Promoting environmental management awareness among workers: and
- Developing a waste management programme for the development project.

The Proposed Monitoring Programme for the Project is Presented hereunder:

Environmental Component	Impact Indicator	Project Phase		Sampling Location	Sampling Method	Sampling Frequency	Action
		Construction	Operation				
Air Quality	SPM COx SOx NOx VOC	**X**	**X**	Along Pipeline Routes	In-situ Measurement	**Weekly** during excavation & construction **6-monthly** thereafter	TGNL through Third Party Consultant
Soil Quality	pH Organic carbon THC Oil & Grease		**X**	Along Pipeline Routes	AAS, pH Meter	Quarterly after construction	TGNL through Third Party Consultant
Vegetation status	Diversity, Morphology & Pathology	**X**	**X**	Along Pipeline Routes	Field assessment, Taxonomic studies, culturing & Identification	Bi-annual	TGNL through Third Party Consultant
Noise and Vibration	Sound intensity	**X**		Along Pipeline Routes	50m from Row, around communities	In-situ measurement , Noise meter	TGNL through Third Party Consultant
Waste Management	Collection of disposal or re-use	**X**	**X**	Maintenace, Marshalling yards, and along pipeline routes			TGNL through Third Party Consultant

Risk Assessment	Accident Hazards	X	X	Along stretch of project			TGNL through Third Party Consultant
Abandonment or Decommissioning	All environmental and safety indicators	X	X				TGNL through Third Party Consultant

Planned Abandonment/Closure Programme

At the time of project closure, a detailed and comprehensive abandonment, decommissioning and closure plan will be developed, taking into account the most cost-effective and best practicable methods, legal requirements and industry practices at that time. The decommissioning plan will be submitted to the regulatory agencies at least two years prior to scheduled abandonment and decommissioning. The following steps shall be undertaken for decommissioning:

- To ensure that due consideration is given to all options, a detailed evaluation of facilities decommissioning options will be carried out. The evaluation will consider environmental issues in conjunction with technical, safety and cost implications to establish the best practicable environmental options for the decommissioning of the proposed project;

- A risk assessment will be conducted to ensure that nothing, which could be constituted as a hazard for other users of the area or for the environment in general, will be left at the site. The site will be left in a safe and environmentally acceptable condition; and

The appropriate authorities shall be consulted and notified of the project status.

10.0 Conclusions and Recommendations

- The Environmental Social Impact Assessment (ESIA) for the proposed Natural Gas Pipeline Network Project has identified the chemical, biophysical and socio-economic resources of the project area. Baseline data were gathered and interactive sessions held with stakeholders. These activities have provided valuable information for the overall ESIA process. The concerns of the communities over key environmental sensitivities of the proposed project were factored into the Report, especially the Environmental and Social Management Plan (EMP).

- The potential and associated impacts of the project activities were identified, evaluated and quantified and appropriate mitigation measures proffered.

- Regulatory agencies exist at various levels in Nigeria with a common objective to protect and preserve the environment and human health. One of the measures aimed at achieving this is the ESIA Decree No. 86 of 1992, which mandates that the public or private sector of the economy shall not undertake or embark or authorize projects or activities without prior consideration, at the early stage, of the environmental, socio-economic and health effects.

- The ESIA study has not detected potential adverse impacts of sufficient magnitude to halt the execution of the proposed project. The Assessment study recognized the need to incorporate environmental and social considerations into every stage of the Natural Gas Pipeline Network Project. This will ensure the rational use of natural resources, minimize the potential adverse impacts and promote the positive effects that are sustainable.

- The Report shall form an integral part of the Pipeline Route implementation document with particular reference to the Environmental Social Management Plan, which covered the entire project lifespan from site survey to decommissioning. The ESMP shall be effectively implemented and appropriate modifications and improvement integrated into all project phases.

Figure 3.11 Project Gannt Chart for NGC 135km Sagamu LDZ Gas Pipeline Project

S/No	**Milestones**	2017				2018				2019
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1
1	ROW Survey		-	-	-	-	-	-	-	-
2	Engineering Review	-								-
3	Select Construction Contractor	-								-
4	Award Construction Works	-								-
5	Survey Confirmation	-								-
6	Mobilization	-								-
7	Complete Pipe Haulage	-								-
8	Commence Construction	-								-
9	Complete Pipe Stringing/ Welding	-								-
10	Complete River Crossing Works	-								-
11	Complete NDT / FJC	-								-
12	Excavation / Lowering	-								-
13	Tie-ins	-								-
14	Mechanical Completion	-								-
15	Hydro-testing / Purging	-								
16	Completion	-	-	-	-	-	-	-	-	-

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