SSGC

ENVIRONMENTAL IMPACT ASSESSMENT

42" Dia 338Km RLNG-II Pipeline Project

from Pakland to RS NARA

FINAL REPORT

Dec 2015

CONSULTANT:

LEAD CONSULTANT:
BUSINESS SUPPLY & TECHNOLOGY SERVICES

BST Services
Business Supply & Technology

ASSOCIATE CONSULTANT:
ENVIRONMENTAL CONSULTANCY & SERVICES

ECS
Environmental Consultancy & Services

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Executive Summary

Introduction

This Environmental Impact Assessment (EIA) has been prepared for the proposed 42" x 338 Km LNG pipeline from Pakland to Sawan. The Project is being executed in accordance with the Sind Environment Protection Act 2014, Environmental Assessment Regulations and the IEE and EIA Guidelines. This EIA presents information about the Project and the results of its environmental assessment.

Pakistan is heavily dependent on natural gas for energy needs. As the production of natural gas is not sufficient to meet the rising demand and gas shortfall has been widened which resulted in power crisis and consequently load management of CNG fueling stations and gas load shedding of industrial, commercial and domestic customers in almost every part of the country. Government of Pakistan, in order to mitigate the widening gap between natural gas supply and demand in the country, in July 2013 approved LNG import policy with inter-alia includes development of a fast track LNG import terminal. Infrastructure requirements of SSGC and SNGPL for imported LNG was reviewed at Government level and it was directed that all necessary measures shall be taken for timely laying/ installation of the required infrastructure for transporting imported LNG. In order to transport 1200 MMSCFD RLNG from Karachi to Sawan, a 42" x 338 Km LNG pipeline from Pakland to Sawan has been planned. The construction of proposed pipeline will provide sustainable gas supply and availability of additional gas to meet domestic, commercial and industrial as well as power sector demand of north region.

The EIA has been prepared in accordance with guidelines issued by the Sind Environmental Protection Agency to fulfill environmental assessment requirements and will be used by the concerned departments, to determine whether the Project's environmental effects are acceptable and the Project is to proceed.

General

Government of Pakistan is pursuing an ambitious plan to import LNG from Qatar. This has necessitated the need for strengthening the transmission network for the supply of LNG in different parts of the country. Sui Southern Gas Company has been

given the task for laying a 42 inch diameter pipeline from Karachi (SMS Pakland) to Nara. Salient details of the project are:

Salient Project Data

Description	Details
➢ Pipeline Length (KM)	338
➢ Pipeline Dia (Inches)	42
➢ Wall Thickness (Inches)	0.562/0.688/0.812
➢ Pipe Material	API 5L,DIN 30670.EN 12068,API 6 D,API 6FA and ASME / ANSI 31.8
➢ Grade	X70(PSL-2)
➢ Design and Construction Code and Standard	ASME B31.8
➢ Maximum Allowable Operating Pressure(MAOP) Psig	1300
➢ Operating Pressure (Psig)	1200
➢ Design Factor / Heavy Wall Thickness for crossings	0.5/0.6/0,72
➢ Pipeline Coating	3 – Layer PE
➢ Trench Depth / Minimum cover	Maximum 2 Meter Trench depth Minimum 1.00 Meter Cover
➢ Design Capacity of Pipeline	1.2 BCF
➢ Pressure Relief System and Pigging arrangement	Facility of pressure relief system is provided, pipeline is piggable.

Scope of EIA Study

This study has covered all major areas of concern as per regulatory requirement. Scope of the EIA study included collection of data and development of baseline of

the current physical and ecological baseline of the area. In general, the study has been conducted in accordance with the SEPA Act 2014 and SEPA (Review of IEE and EIA Regulations, 2014 and guidelines provided therein.

Environmental Considerations

Atmospheric emissions, water-related impacts, noise impacts and other impacts have been taken into account and mitigation measures have been incorporated in the design. Legislative requirements, National laws, policies, regulations and guidelines pertaining to the different stages of the Project have been reviewed / taken into account. Section-17 of Sindh Environmental Protection Act 2014 and Sindh Environmental Protection Agency (Review of IEE and EIA) Regulations 2014 require that every new development project in Sindh has to be preceded by an Initial Environmental Examination (IEE) or Environmental Impact Assessment (EIA) depending upon the size and severity of impacts anticipated on commissioning of the project. Accordingly the present Report is being submitted as the Environmental Impact Assessment study. Likewise, other applicable legislations viz. Environmental Quality Standards (EQS), Land Acquisition Act 1894 and Sind Irrigation Act 1879 etc have been taken into account.

Project Description:

Route Description

The proposed route has been divided into three major parts from Pakland to Nara. The project consists of the construction of an approx. 338 km long 42" diameter pipeline to supply RLNG to SNGPL at Sawan via Nara.This length has been divided into segments (sub projects) based on convenient landmarks, terrain, logistics and way points available along the route. These divisions are as following:

- Segment – I. 124KM from Karachi (SMS Pakland) to Hyderabad.
- Segment – II. 131 KM from Hyderabad to Nawabshah.
- Segment – III. 82 KM from Nawabshah to Sawan (RS-Nara).
- Segment – IV. Indus River Crossing (1.5 KM).

Contracting

The project is heavily dependent on an effective supply chain operation. It is imperative that the deliveries of the materials are regular and timely, otherwise, the entire project progress will be severely hampered. The following contracting quilt was developed to evaluate feasibility of out sourcing various portions of work:

	Segment-I	Segment-II	Segment-III	Segment-IV
Project Management	SSGC	SSGC	SSGC	SSGC

Design	SSGC	SSGC	SSGC	Outsource
Procurement	SSGC	SSGC	SSGC	Outsource
Execution	Outsource	Outsource	SSGC	Outsource
Commissioning	SSGC	SSGC	SSGC	SSGC
Cathodic Protection (CP)	SSGC	SSGC	SSGC	SSGC

Construction

The following activities have been identified as essential for the project:

- Right of Way (ROW).
- Ditching/Trenching and Stringing.
- Welding, Tie-in & Crossings of 42" diameter Pipeline.
- Installation and commissioning of Compressors.

Conclusion

Significant adverse environmental effects are not predicted in relation to the Project's construction, operation phases, or as a result of accidental events. The Project is therefore, not likely to cause significant adverse environmental effects. A monitoring and follow-up program will be undertaken to assess the accuracy of the effects predictions made in the environmental assessment and to determine the effectiveness of mitigation measures.

The Project will result in considerable socio-economic benefits accruing to the province of Sindh. It will create considerable direct and indirect employment and business opportunities, and contribute substantially to the economy of the local area, as well as that of the province as a whole.

From the above it can be concluded that, laying of this pipeline with well-planned environmental management measures will be beneficial to the local community, the province and to the entire country on the whole, without upsetting the environmental equilibrium of the area.

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CHAPTER 1: INTRODUCTION

1.1 Proponent

The Sui Southern Gas Company began its operations in 1954 as Sui Gas Transmission Company (SGTC) when it laid Asia's first 558 Kms , 16 " diameter long distance high pressure gas pipeline from the gas field Sui to Pakistan's largest city Karachi , where gas distribution was assigned to the newly formed Karachi gas company. Indus Gas Company was setup in Hyderabad to serve other towns in Sindh. SSGC in its current shape evolved when the merged Indus Gas and Karachi gas companies (rename Sui Southern Gas Company) was amalgamated with Sui Gas Transmission Company to form the Sui southern gas Company Limited in 1989. From the original capacity of 90 mmcfd of the 16 inches Indus Left Bank Pipeline (ILBP) in 1955, SSGC gradually increased its network capacity to 600 mmcfd up to 2000 mmcfd. Since its inception the company has been meeting fuel requirement by merging its business plan with national obligation to provide affordable energy in sustainable manner. Today the company gas supply infrastructure consists of 3600 km of high pressure transmission pipeline, 41,000 Kms distribution network covering 928 towns and villages in Sindh and Balochistan, supported by 50,000 horse power gas compression facilities.

Since the original gas field at Sui is now only providing about 12% of its sale the rest of the demand is met through gas that has since then being discovered at Bhit , Zamzama , Sawan , Badin, Miano, Kadanwari, and few other locations , mostly in Sindh. The company continues to explore the possibility of connecting further gas fields in the region; these include potential gas fields in the Zarghun, Khipro, Mirpurkhas, Sanjhoro, Golarchi and Mubaraks areas and additional gas availability from the existing field of Bhit, Zamzama, Kunnar Passaki and Badin. Now to fullfill the additional demand of the consumer SSGC intends to utilize LNG through this project.

1.2 Project Overview

Our country is heavily dependent on natural gas for energy needs. As the production of natural gas is not sufficient to meet the rising demand and gas shortfall has been widened which results in power crisis and consequentlyload management of CNG fueling stations and gas load shedding of industrial, commercial and domestic customers in almost every part of the country.Government of Pakistan in order to mitigate the widening gap between natural gas supply and demand in the country, in July 2013 approved LNG import policy with inter-alia includes development of a fast track LNG import terminal.A meeting was held on 27 Feb 2014 in MP&NR office Islamabad, to review the infrastructure requirements of SSGC and SNGPL for imported LNG. It was directed that all necessary measures shall be taken for timely

laying/ installation of the required infrastructure for transporting imported LNG.In order to transport 1200 MMSCFD RLNG from Karachi to Sawan,a 42" x 358 Km LNG pipeline from Pakland to Sawan has been selected. The construction of proposed pipeline will provide sustainable gas supply and availability of additional gas to meet domestic, commercial and industrial as well as power sector demand of north region.

1.3 Scope of Work

- Complete understanding of the project shall be gained.
- Baseline environmental data shall be collected through field survey and previous literature on:
  - Physical Environment
  - Biological Environment
  - Socio-Economic Environment
- Review of existing environmental legislation guidelines and standards applicable to project activities.
- Public consultation with major stakeholders like, Highway Department, Railway, Irrigation, EPA, Wildlife Department, Forest Department, officials of local administration and locals.
- Identification and evaluation of environmental impacts on traffic, waste management, operational health, safety, eco-systems, ambient air etc.
- Determination of negative impacts of project activity on ground water, air, human and animal life, plants and eco-systems of the area.
- Recommendation of-mitigation measures.
- Development of Environmental Management Plan.

1.4 Methodology

Following methodology was adopted to achieve the objectives mentioned above:

- Collection and mobilization of team to carry out EIA study.
- Obtaining data fromSSGC to establish work procedures and get their input on scope of work, schedules and approach;
- Study the project, project area and gainfull understanding of the various operations which will be employed to lay the pipeline. Gain understanding of the post completion scenario and the potential environmental issues;
- Review of existing data on the area on metrological, geology, climate etc.
- Determine the information gaps and adopt measures to compensate the gaps.
- Secondary data and Field survey to obtain data on:

  - Physical Environment - Topography, location climatic conditions etc.
  - Biological environment - Fauna, Flora, crops etc.
  - Socio economic conditions of the people living closed to the project area.
- Estimation and evaluation of potential negative environmental impact on eco-system and population like waste generation rate, impact of dust on ambient air, impact on water etc.
- Preparation of detailed mitigation measures and plan for their execution at planning and design stage, including socio-economic measures to be taken to minimize the effects of negative impacts. Identify the positive impacts particularly for the local population district, province and country.
- Prepare Environmental Management Plan for construction and operation phase.
- Co-ordinate with SEPA for holding the public meeting and answer the queries raised by the stake holders.
- The above public hearing will, of course take place after the final report is submitted to the SEPA.
- Co-ordinate to get the NOC from SEPA.

1.5 Environmental Impact Assessment

Submission of an lEE or EIA report to the Sindh Environmental Protection Agency is mandatory, according to Section-17 of Sindh Environmental Protection Act 2014 and Sindh Environmental Protection Agency (SEPA) Review of IEE/EIA Regulations 2014. SEPA 2014 requires that every new project in Sindh has to be preceded by an Initial Environmental Examination (lEE) or Environmental Impact Assessment (EIA) depending upon the size and severity of impacts anticipated during construction and commissioning of the project.

1.5.1 Objectives of EIA Study

The objective of EIA study shall be to evaluate possible environmental impact caused by project activities and recommend suitable measures to avoid or minimize the impacts and make the operations socially and environmentally acceptable.

EIA study has been conducted in respond to the regulatory requirement and assure the regulatory authority,(in this case, the Sindh Environmental Protection Agency (SEPA), that the Project and project activities during its different phases will not have adverse impact on its micro-environment and macro-environment and adverse impact, if any, will be appropriately mitigated to make it an environmentally sustainable Project.

This study has been carried out to provide all necessary information on the potential environmental and social impacts of construction and operation of project to SEPA and other relevant agencies.

The main objectives of EIA are to identify the environmental, socio-economic impacts both positive, and negative that may result from activities during the different stages of construction and coming into operation of the proposed project. This EIA highlights the mitigation measures to achieve the objective of sustainable development through appropriate methods of pipe laying, without causing adverse impacts (physical, biological & social) on the environment.

The objectives set for the environmental assessment of this project while considering the prevailing environmental scenario are:

- To identify the aspects of the proposed project that is likely to cause social and environmental impacts in the area;
- To develop a baseline of its current environmental scenario as well as socioeconomic conditions;
- To identify and categorize positive and negative impacts;
- To highlight social issues and aspects together with environmental concerns which are particularly sensitive to impacts and their extent;
- To evaluate impacts due to construction activities, commissioning and operation of proposed project, particularly on social and economic values of the area and its surroundings and compliance with the relevant environmental regulations of Sindh;
- To suggest necessary mitigation measures in order to reduce or minimize the identified impacts on the environment and social domain;
- To provide recommendations / suggestions for the environmental monitoring and management of social and physical environment in the surroundings of project area;
- To ensure that all the important aspects of the project have been considered and all relevant stakeholders have been consulted in the assessment.

1.5.2 Scope of EIA Study

This study has covered all major areas of concern as per regulatory requirement. Scope of the EIA study included collection of data and development of baseline of the current physical, ecological and social baseline of the area. In general, the study has been conducted in accordance with the Sindh Environmental Protection Act, 2014 and SEPA (Review of IEE and EIA Regulations, 2014 and guidelines provided therein.

1.5.3 Components of EIA

In order to conduct EIA study of proposed project, following steps have been undertaken:

A Project Specific Data Acquisition

This was the first step to embark on the study which was initiated by holding meetings with SSGC officials especially with those executing the project. The meetings were held to clarify the nature of activities during the different phases and magnitude of the impact on the physical and social environment. The information provided was used by the experts to screen the potential environmental impacts that the project activities will have on the microenvironment and macro-environment of the Project site.

B Literature Review

The purpose of the desktop study was to acknowledge, acquire and incorporate relevant information available from different studies in the assessment study. This comprised literature survey and review, collection of updated authenticated published / printed data on the physical and social environment related to the site.

C Site Reconnaissance

Initially, experts visited the area and assessed the existing physical scenario followed by detailed study of secondary data and related reports in order to investigate into various domains of environment and socio-economic sector to highlight various issues, and concerns that identified various aspects leading to subsequent assessment of impacts.

D Stakeholder's Consultation

In this regard, stakeholder meeting were arranged which involved meeting with local inhabitants and other officials.

E Potential Impacts & Mitigation Measures

Experts have critically analyzed the anticipated aspects for their potential impacts on the physical and social environment. The impacts arising due to various activities during construction, commissioning and operational phases of the project have been identified.

F Environmental Management Plan

An Environmental Management Plan (EMP) has been proposed for the proponent (SSGC) to follow sustainable development procedures and to protect the environment.

G Documentation & Review

This final step completes the environmental assessment by compiling the work done in a report.

1.6 Report Layout

The EIA report has been structured and compiled as follows:

Chapter-I provides an introduction and overview of the project and justification of EIA.

Chapter-2 details the project description, its objectives; provides details on construction and operations related activities, and on utilities and facilities.

Chapter-3 gives an overview of relevant National regulatory requirements along with relevant International guidelines.

Chapter-4 provides description of the macro environment and microenvironment of the project area. It describes the existing physical andecological conditions that may likely be impacted due to activities during construction and operation of the pipeline.

Chapter 5 describes details about all stakeholders, the consultation process and their concerns and recommendations about the project.

Chapter-6 describes the potential environmental and social impacts of the project on different aspects of the macro and microenvironment. While using the general guidelines it presents the screening of potential environmental impacts during construction, commissioning and operation stages of the project. The screening also yields the residual impacts resulting from adoption of mitigation measures that would be required to minimize the impacts.

Chapter-7 provides the environmental management and monitoring plan to be implemented in order to validate the mitigation measures.

Chapter-8 summarizes the report and presents its conclusions.

CHAPTER 2: PROJECT DESCRIPTION

2.1 Introduction

Pakistan is currently facing a deficit of around 4000 MW in the supply of electric power. Country is facing a massive load shedding. The economic activity as well as industrial production has suffered a lot due to electricity shortage, Domestic consumers have been forced to bear up to eight to ten hours of load shedding in different urban and rural regions of the country.One of the major causes of power shortage is the drop in the availability of economical fuel for the thermal power plants in the country. Availability of Natural gas for the power plant is not adequate enough to run the plants on natural gas. There is an urgent need to import LNG to bridge the gap between demand and supply of gas.

Government of Pakistan is pursuing an ambitious plan to import LNG from Qatar. This has necessitated the need for strengthening the transmission network for the supply of LNG in different parts of the country. Sui Southern Gas Company has been given the task for laying a 42 inch diameter pipeline from Karachi (Sales Metering Station at Pakland) to Nara.

2.2 Existing Transmission Line infrastructure of SSGC transmission system

There are four major transmission networks in the SSGC system i.e. Indus Left Bank Pipeline System, Indus Right Bank Pipeline System, Quetta Pipeline System and Transmission System contracted for SNGPL.The total capacity of SSGC System is 1704 mmscfd. The details of the SSGC transmission Network is given below in Table 1.

Table 1: Gas Transmission Capacities Utilization

S No	Transmission Network/Pipeline (as on June 30, 2015)	Avail Capacity (mmscfd)
A1	**Indus Left Bank Pipeline System**	
	16″ dia. Indus Left Bank Pipeline (ILBP) Nawabshah-Karachi Terminal	**80**
	24″/20″ dia. Kadanwari Pipeline Kadanwari-Malir-Karachi	**180**

	24″ dia. x116 Km loopline from Sind University to FJFC Offtake	**60**
	24″dia. x15 Km Masu-HQ3	**40**
	24″dia. x84 Km HQ2-TandoAdam	**85**
	18″ dia. Badin Pipeline Badin-Hyderabad	**200**
	Sub Total (A1)	**645**
A2	**Indus Right Bank Pipeline System**	
	20″/18″ dia. Indus Right Bank pipeline (IRBP) Dadu-Malir-Karachi	**400**
	24″ dia. x200 Km Bajara-Karachi Loopline	**240**
	Sub Total (A2)	**640**
A3	**Quetta Pipeline System**	
	12″/18″/20″ dia. Quetta Pipeline Jacobabad-Quetta	**90**
	18″ dia. 18 Km abbe-gum to Mach Loopline	**7**
	18″ x31 Km Dingra-Sibi, 18″ x15 Km Mach-Kolpur loopline	**10**
	24″ x30 Km Loopline from Gokart to Abbegum	**6**
	18″ x18 Km Loopline from Dhadar to Gokart	**36**
	12″ x60 Km Zarghun-Quetta pipeline Gas Project	**25**
	Subtotal (A3)	**174**

	Total Capacities for SSGC (A1+A2+A3)	**1459**
B	**Transmission Network Contracted (For SNGPL)**	
	18″ dia. Pirkoh Pipeline (OGDC) Pesh Bogi-Pirkoh	**35**
	16″ dia. ILBP (SNGPL) Hassan-Sui	**30**
	20″ dia. IRBP (Reverse Flow to SNGPL) Dadu-Sui	**170**
	16″ ILBP reverse flow providing regulation between 20″ dia. IRBP & 16″ dia ILBP at RS1	**10**
	Total Contracted Network (B)	**245**
	SSGC Total Transmission Network Capacity (A+B)	**1704**

2.3 Existing Pipelines on the route

There are three existing pipelines in the Indus left bank system which runs almost parallel with the proposed 42 inch with few detours. The existing lines are:

- 16” dia. Indus Left Bank Pipeline (ILBP) Nawabshah-Karachi Terminal.
- 24”/20” dia. Kadanwari Pipeline Kadanwari-Malir-Karachi.
- 24” dia. x116 Km loop line from Sind University to FJFC Offtake.

The above three lines run in parallel with the proposed line route upto 113+745 km, from there on the detour for rhe 42 inch line starts.

At 121+849 km 30 inch line and kadanwari line joins .At 129+000 km the two lines departs from the proposed line route, there is another detour for the proposed line.

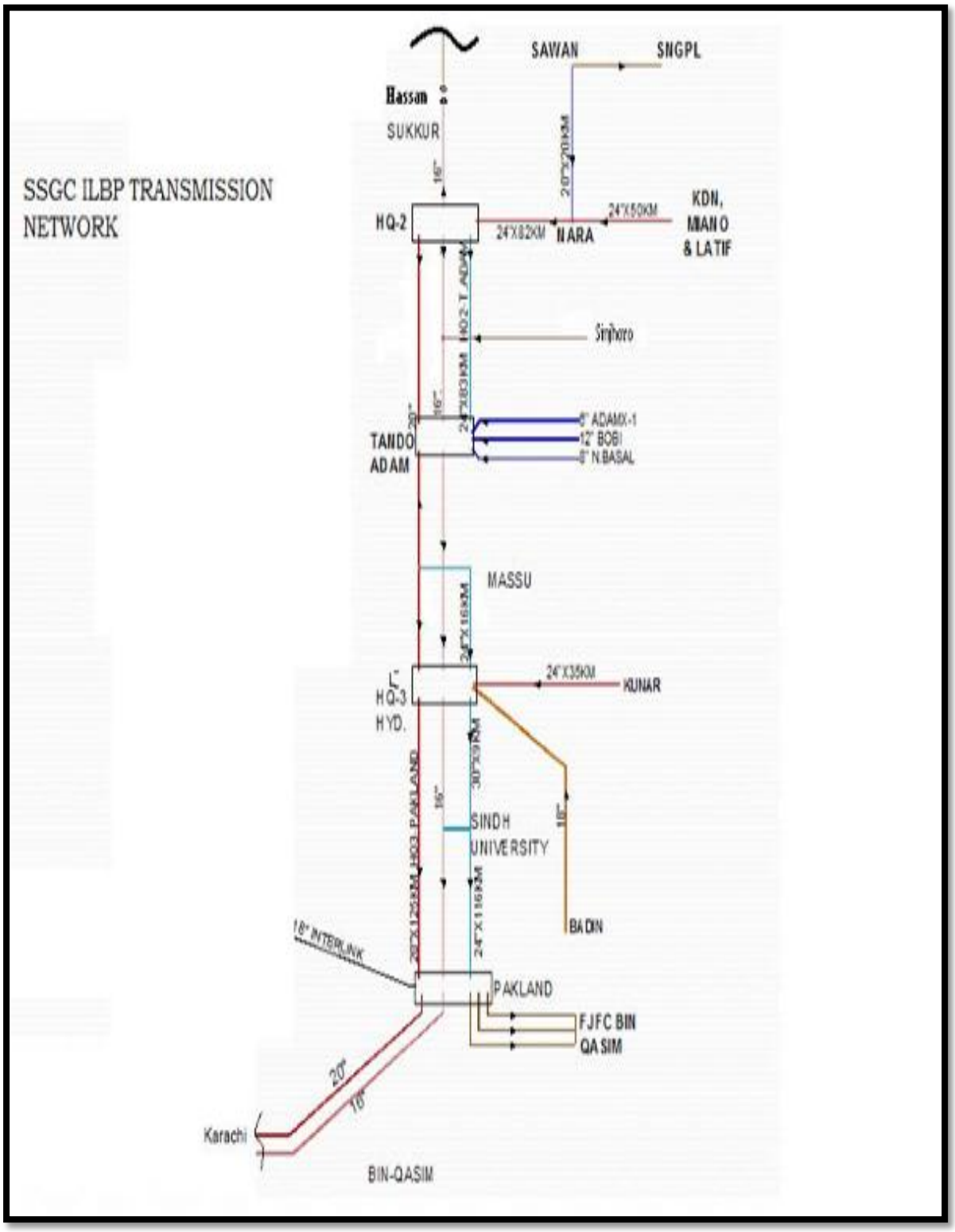


Figure 1:Indus Left Bank Pipeline Route

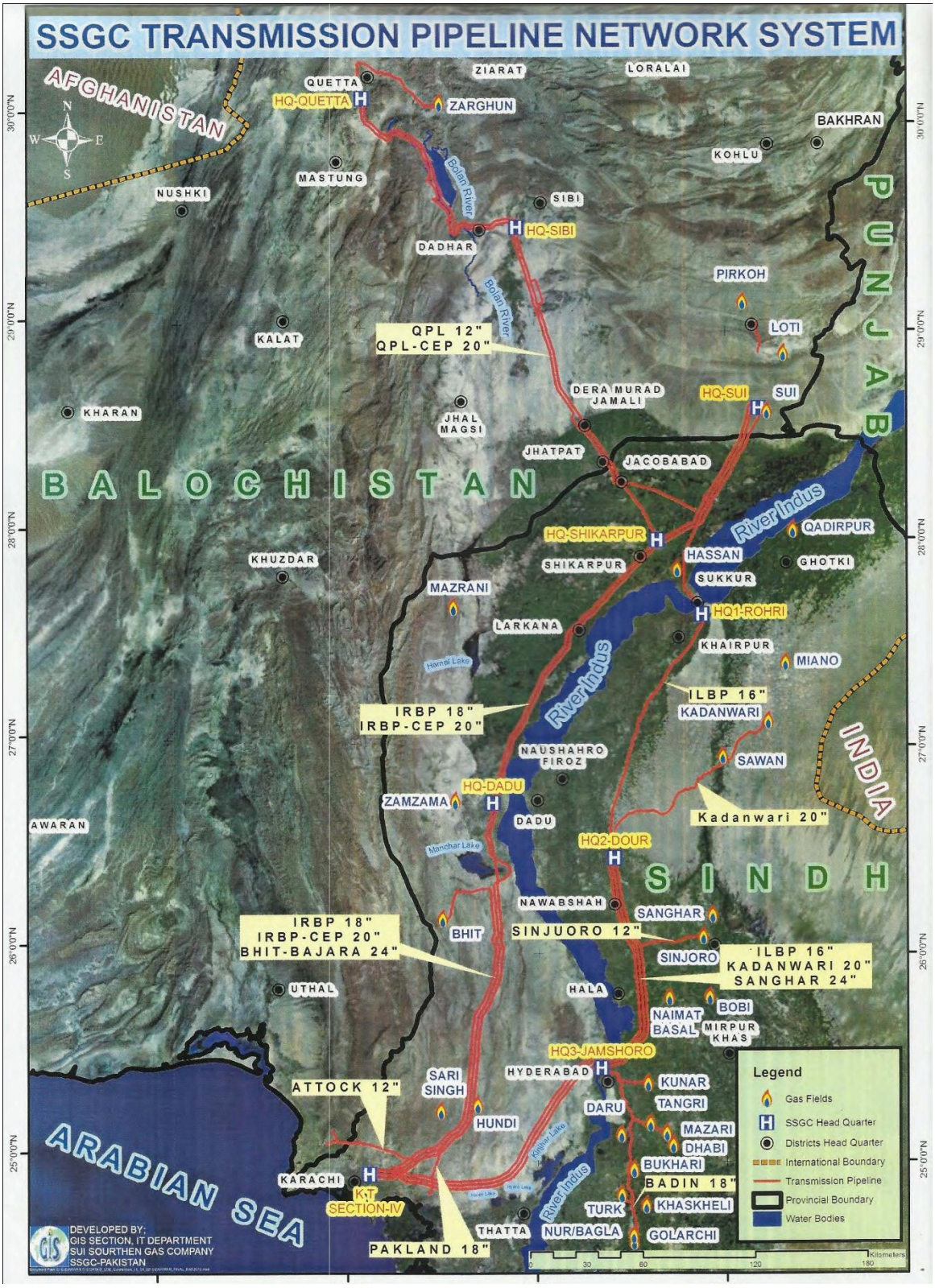


Figure 2: Map showing SSGC transmission lines

2.4 Basic Data / Information for the proposed pipeline

(a) Technical Design Specification

Table 2: Technical Data Specifications

Serial No	Description	Details
1	Pipeline Length (KM)	338
2	Pipeline Dia (Inches)	42
3	Wall Thickness (Inches)	0.562/0.688/0.812
4	Pipe Material	API 5L,DIN 30670.EN 12068,API 6 D,API 6FA and ASME / ANSI 31.8
5	Grade	X70(PSL-2)
6	Design and Construction Code and Standard	ASME B31.8
7	Maximum Allowable Operating Pressure(MAOP) Psig	1300
8	Operating Pressure (Psig)	1200
9	Design Factor / Heavy Wall Thickness for crossings	0.5/0.6/0,72
10	Pipeline Coating	3 – Layer PE
11	Trench Depth / Minimum cover	Maximum 2 Meter Trench depth Minimum 1.00 Meter Cover
12	Design Capacity of Pipeline	1.2 BCF
13	Pressure Relief System and Pigging arrangement	Facility of pressure relief system is provided, pipeline is piggable.

(b) Other Information

Table 3: Other Information

S/ No	Description	Details
1	Gas Composition	Methane = 93% Ethane = 2% Propane = 0.28% CO_2 =2.8%
2	Estimated Project Cost	Rupees 37611 Million, conceptual approval obtained from BOD
3	Detail of Crossings	(a) 65 No of Road / Railway track / Katcha road crossings (b) 60 N0s of Water courses/ Irrigation channels/Nala crossings (c)01 Major crossing on River Indus
4	Source and quantity of water for Hydrostatic testing	(a) Segment 1 Source - KWSB .Kinjhar Lake and River Indus Quantity – Approx 30,000 Million Gallons (b) Segment 2 Source – Rohri Canal. River Indus,Gajjra Wah Quantity – Approx 31,000 Million Gallons (c) Segment 3 Source –Boring water Quantity – Approx 20,000 Million Gallons
5	Number of construction crew / staff required	2400 Numbers (On as and when required basis)
6	Number of Vehicles /Machinery involved during construction	Chain type equipment – 105 Wheel type equipment – 50 Heavy and Light Vehicle – 290

7	Camp Location	Khadeji Base Camp HQ – 3 Hyderabad RS – 5 RS- 3 HQ-2 Daur RS Nara

(c) Comparative Hydraulic Analysis

- Most of the indigenous gas fields are located in SSGC franchise area.
- Imported gas is also injected in to SSGC ' s pipeline network.
- Inorder to transmit import / indigenous gas from southern to northern region , a hydraulic simulation has been carried out.
- To accommodate 1200 MMSCFD upcoming RLNG option, study has been carried out by utilizing Energy Solution International (ESI's) sophisticated pipeline studio software.

(c) Pipeline Hydraulic Study

Table 4: Flow Pressure Study of 42 Inch X 338 Km Pipeline from Pakland to Sawan

S.No.	Description		Units	Parameters
A	**42" x 358 Km Pipeline**			
1	Flow	:	MMcfd	1200
2	Supply Pressure at Tie-In Point	:	Psig	1200
3	Supply Pressure at Pakland	:	Psig	1177
4	Delivery Pressure at Sawan	:	Psig	1115
5	Length	:	Km	358
6	Diameter	:	inches	42
B	**Compressor Station at HQ-2**			
7	Suction Pressure	:	Psig	819
8	Discharge Pressure	:	Psig	1240
9	Compression Ratio	:	-	1.51
10	Fuel Usage Rate	:	MMcfd	4.0
11	Calculated Power	:	HP	23894

NOTE: The least pipeline wall thickness in class location 2(0.688 inch) has been considered

(e) Selection of Pipeline Size

The 42 inch size of proposed RLNG Transmission pipeline has been selected as an optimum choice based on the pressure and volume of RLNG required for catering SNGPL demand in the North.

(f) Selection of Pipe Diameter

Line Pipe will meet the standards and requirements as specified in API 5L

Formula P = 2St x FET/ D

Where

P = Design Pressure, psig

S = Specified minimum yield strength, psi

t = nominal outside diameter of pipe, inch

D = nominal outside diameter of pipe, inch

F = design factor

T = temperature factor

The line pipe size, material grade and compressor station layout/configuration has been optimized for the combination of capital expenditure and operational expenditure.The analysis showed that the optimum diameter is 42 inches. The selected and calculated wall thicknesses are therefore as given in Table 2.3.

(g) Design Factors

The pipeline design factor to be used in the system design and analysis for cross country pipelines will be 0.72, in accordance with ASME B31.8. This factor will bereducedaccordingly, as stipulated in ASME B31.8, when different factors such as population concentration, land use, terrain, geophysical and environmental are encountered along with the selected pipeline route.

- DF 0.72 in regular sections.
- DF 0.60 at important crossings and steep slopes, smaller settlements.
- DF O.50 at public areas or near housing areas.

The design factor within the above ground installations (stations) will be 0.5, as required under OGRA, Natural Gas Transmission Technical Standards Regulation, 2004.

Table 5: Design Parameters

:

Line Pipe Designe (As Per B31.8)
42" Proposed Pipeline Project From Pakland To Nara
March 06 2014

Pipe Grade	Design Factor (F)	Class Location	Nominal Pipe Size (Inch)	OD (inch)	SMYS (Psi)	Max Allowable Pressure	Longitudnal Joint Factor, E (Table 841.115A)	Temprature Derating Factor, T (Table 841.116A)	Minimum Calcluated Wall Thickness (Inch.)	Standard Wall Thickness (Inch.)	d/t on Standard Wall Thickness	Design Pressure Psig (Note-1)
X-70	0.5	3	42	42	70000	1300	1	1	0.780	0.812	51.72	1353.33
	0.6	2							0.650	0.688	61.05	1376.00
	0.72	1							0.542	0.562	74.73	1348.80

1) As per ASME B 31.8, Para 841 based on selected wall thickness.

2) According to ASME B 31.8 Clause 841.113 (a) the minimum wall thickness t required for pressure containment as determined by Para841.11 may not be adequate for other forces to whivh the pipeline may be subjected.

3)Consideration has been taken for loading due to transportation or handler construction weight of water during testing, soil loading and other sector operation.

2.5 Project Proposed Activity Plan

Table 6: Activity Plan

Serial No	Project Proposed Activities	Activity Dates / Number of Days
1	BOD Approval	Jan / Feb 2015
2	OGRA Approval	Jan / Feb 2015
3	Front End Engineering Design	March 2015
4	Preliminary work / Detailed Route Survey	March 2015 to September 2015
5	Design and Engineering	March 2015 to December 2017
6	Land Acquisition	October 2015 to December 2016
7	Material Procurement	April 2015 to April 2016
i	Line pipe	270 Days

ii	Valves	330 Days
iii	Other Material	180 Days
8	Construction Work	December 2015 to December 2016
i	ROW	270 Days
ii	Trenching	270 Days
iii	Stringing	330 Days
iv	Welding	330 Days
v	Padding / Back filling	180 Days
vi	Crossing (Indus River)	270 Days
9	Commissioning	120 Days
10	Compressor House	April 2015 to December 2016
11	Completion	December 2016

2.6 Route Description

The proposed route has been divided into three segments from Pakland to Nara. The project consists of the construction of an approx. 338 km long 42" diameter pipeline to supply RLNG to SNGPL at Sawan via Nara.This length has been divided into segments (sub projects) based on convenient landmarks, terrain, logistics and way points available along the route. These divisions are as follows:

Segment – I.124KM from Karachi (SMS Pakland) to Hyderabad

This segment has easy access to SSGC's Khadeji Base Camp and is expected to have minimal land related problem due to it being scarcely populated.The challenges in this segment relate to the nature of soil, difficult crossings, and scarcity of water.Below are given some photographs from Segment 1 route visit by the team.

	
Zero km at SMS Pakland	Transmission line passing over ROW in Segment-I
	
Poultry Farm near ROW in Segment-I	Another view of ROW in Segment I
	
View of Wind Farms near ROW in Segment -I	SSGC Repeater Station on ROW in Segment-I

Figure 3: Glimpses of Route Visit – Segment 1

Segment – II.131 KM from Hyderabad to Nawabshah

This segment has sufficient availability of water, normal Soil condition, ease of access during dry season and proximity to some of SSGC's key stations.The challenges here relate to high water table, surrounding agriculture land on which ROW will be required as well as a large number of crossings.

Segment – III.82 KM from Nawabshah to Sawan (RS-Nara)

This segment is located in rough sandy terrain with harsh weather conditions. This is the most challenging section where pipeline construction activity will be hindered by sand dunes, hot weather and scarcity of water.

Segment – IV. Indus River Crossing (1.5 KM)

Five bids have been received for Pre-qualification for HDD (Horizontal Directional Drilling) crossing of this segment.

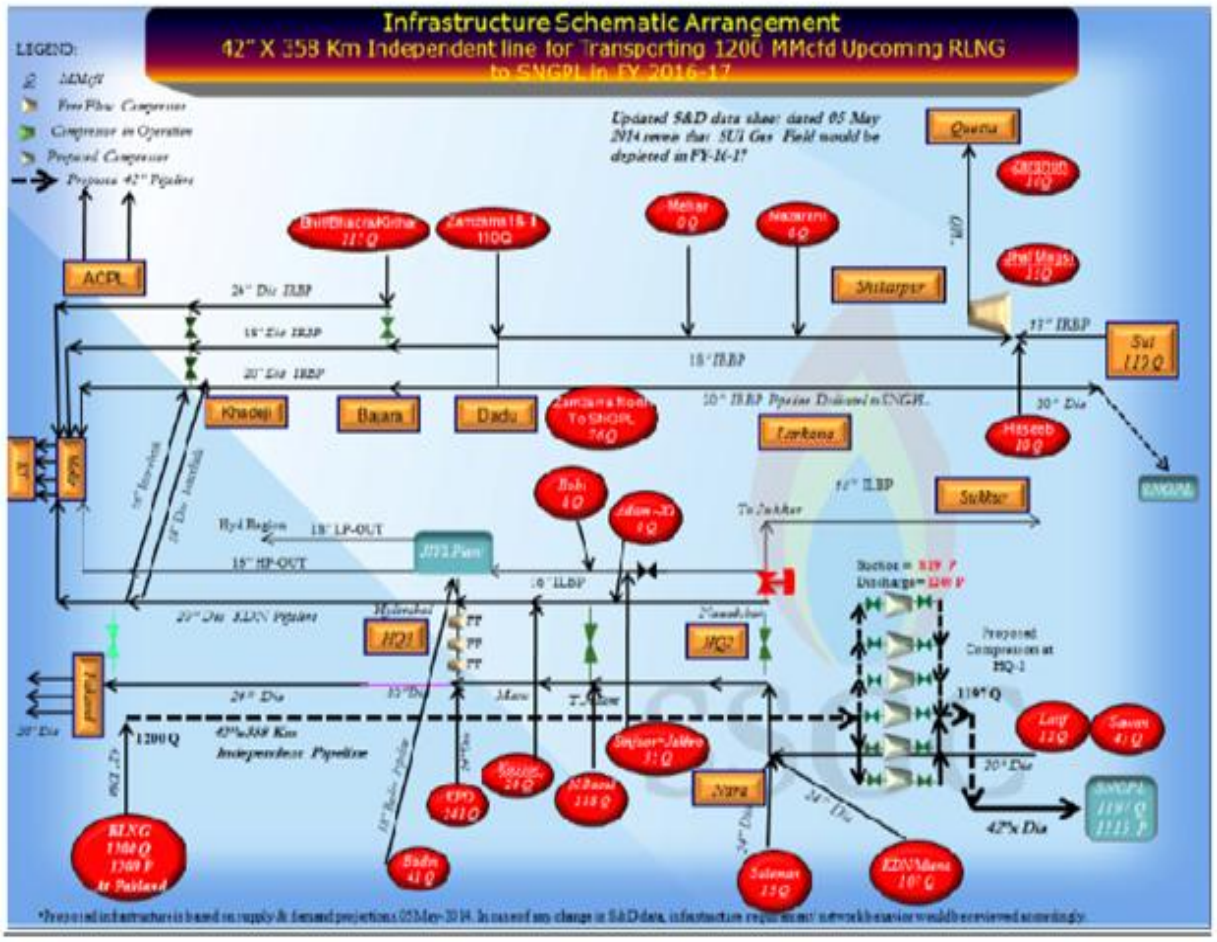


Figure 4: The Infrastructure Schematic Arrangement

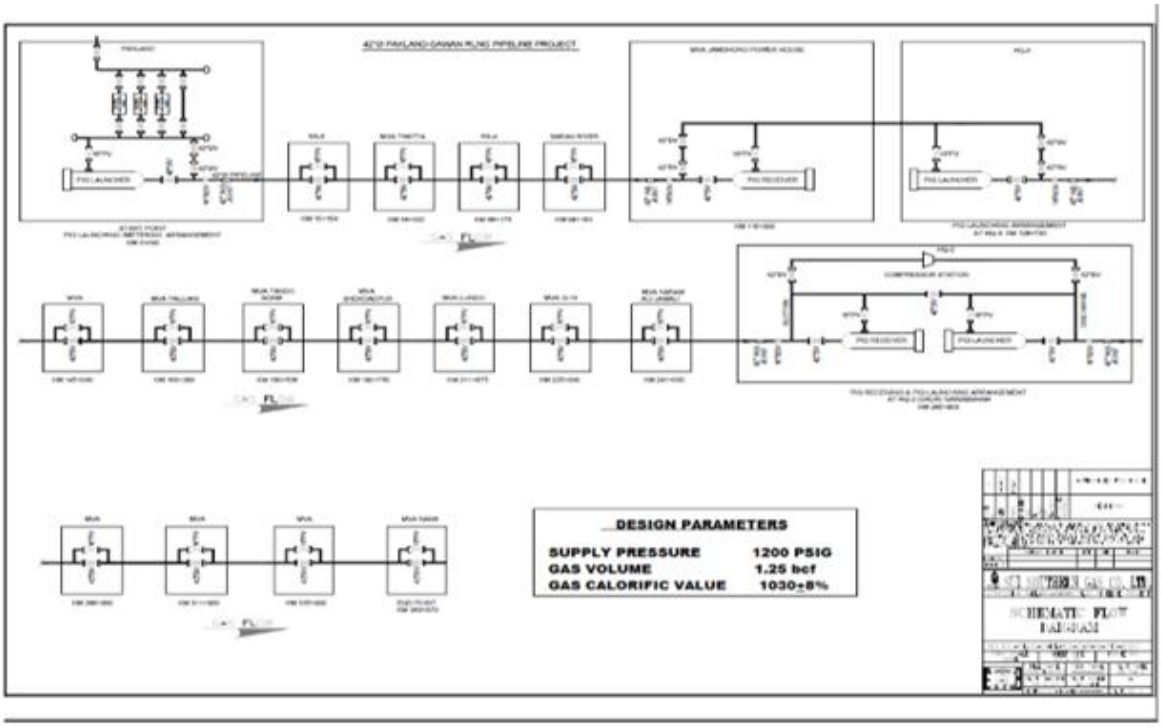


Figure 5: Schematic Flow Diagram of the proposed pipeline

2.7 Compressors

Compressors are needed to meet the SNGPL's demand of 1,115 psig pressure at Sawan. In order to cater for natural pressure drop during flow of gas from Karachi to Nawabshah, 6 compressors of 200 MMcfd each, with a total compression power of 30,000 HP are being proposed. These are expected to arrive towards the end of 3rd quarter 2016.

Additionally, two existing compressors are also being relocated from Dadu. These compressors are more than 30 years old. Their engines have been overhauled in Sweden and one compressor is planned to be installed by mid November 2015 and one compressor by Mid December 2015.Additional Compressor details/location are shown in in Figure below:

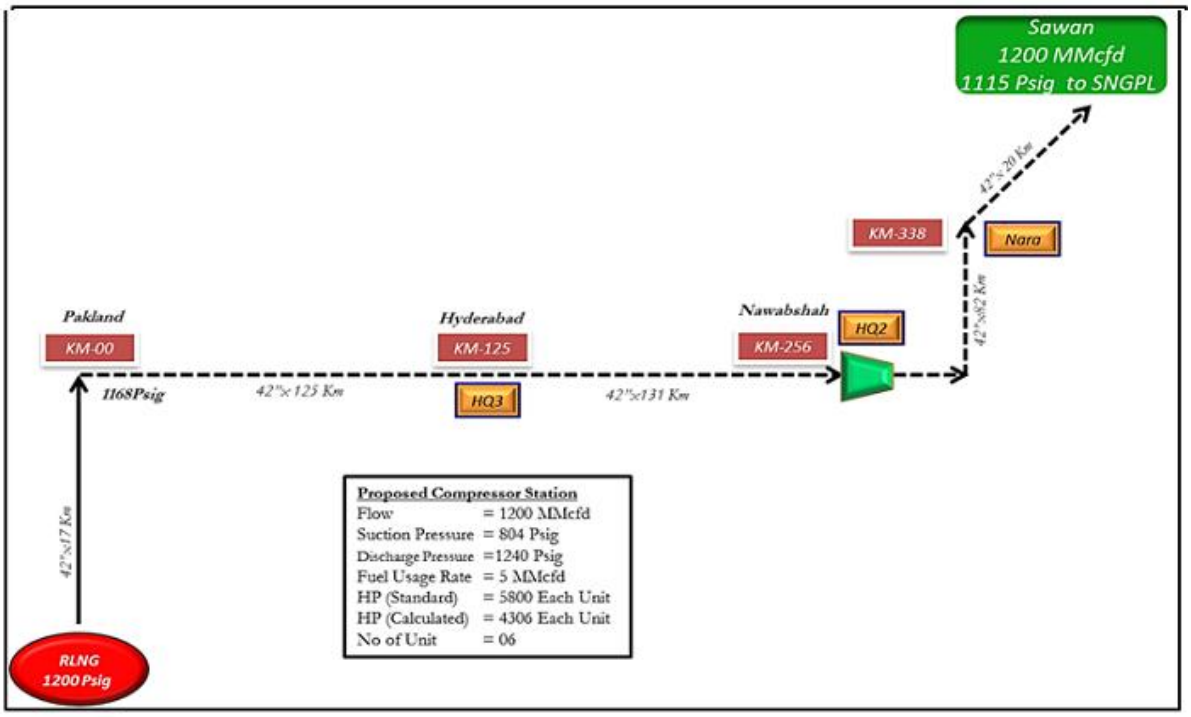


Figure 6: Positioning of Compressors on the Proposed Line

Construction underway on existing compression station

A view of turbo compressors at daur

2.8 Contracting and Construction Methodology

2.8.1 Contracting

The project is heavily dependent on an effective supply chain operation. It is imperative that the deliveries of the materials are regular and timely, otherwise, the entire project progress will be severely hampered.Sufficient planning has been done up front by SSGC so as to allow its Procurement Department reasonable time to transparently process indents and requisitions. All Contracting and Procurement activities shall strictly adhere to all standing government regulations such as PPRA, etc.The following contracting quilt was developed to evaluate feasibility of out sourcing various portions of work:

Table 7: Contracting Quilt

	Segment-I	Segment-II	Segment-III	Segment-IV
Project Management	SSGC	SSGC	SSGC	SSGC
Design	SSGC	SSGC	SSGC	Outsource
Procurement	SSGC	SSGC	SSGC	Outsource
Execution	Outsource	Outsource	SSGC	Outsource
Commissioning	SSGC	SSGC	SSGC	SSGC
Cathodic Protection (CP)	SSGC	SSGC	SSGC	SSGC

2.8.2 Outsourced & In-house Work-packages

Theoretically each box in the quilt above can be treated as a work package and can be outsourced as a separate contract. An evaluation of the pros and cons of out sourcing was carried out to look at various constraints.

Based on the above, a contracting plan has been devised, wherein work-packages comprise: Land acquisition (temporary and permanent land for right of way), Execution (ditching, mainline welding, joint coating, lowering/backfilling, hydrostatic testing and civil works), Commissioning and cathodic Protection, as follows:

Segment – I & II: It is proposed to outsource execution to an experienced and well reputed firm.

Segment – III: It will be carried out through in-house resources. Some manpower contracts will need to be put in place to temporarily arrange skilled and non-skilled manpower for welding and supporting activities.

Segment – IV: Based on SSGCs internal strength and experience it was considered prudent to outsource Segment – IV, which is the river crossing.

2.8.3 Quality Control

A Third party firm will be appointed for inspection of welding joints by visual and Radiographic testing (RT), joint coating, ditching, lowering/backfilling & hydro testing of entire pipeline activities/jobs.

2.8.4 Construction

The following activities have been identified as essential for the project:

- Right of Way (ROW).
- Ditching/Trenching and Stringing.
- Welding, Tie-in & Crossings of 42” dia Pipeline.
- Installation and commissioning of Compressors.

(a) Right of Way (ROW)

To be able to lay the pipeline, a right of way is needed. Obtaining the ROW consists of the following activities:

- Preliminary route survey
- Engineering route survey
- Land survey
- Obtaining the ROW i.e. settling the cost with land owners

Preparation of access along the route is required so that material and equipment can reach the required site.

The equipment and time needed to prepare this access depends upon the terrain and nature of soil.

Preparation of ROW of segment – I and III can be carried out in any season, however for segment – II it can be done only in Rabi (winter) season because of the high water table in the area.

(b) Pipeline Stringing and Ditching / Trenching

Stringing ofLine pipes is placing of pipes along the proposed ditch.

Ditching / Trenching is the excavation to bury welded lengths of the pipeline to the design depth.

Segment – I is predominantly rocky area hence ditching will be done by jack hammering. As three live gas transmission lines are laid in the ROW, hence controlled blasting is not advisable. It is proposed to outsource the mainline welding, ditching, lowering, backfilling and hydro-testing of this segment.

Segment – II is predominantly soft soil/normal soil, therefore ditching can be carried out parallel to other construction activities. It is proposed to outsource the mainline welding, ditching, lowering, backfilling and hydro-testing of this segment as well.

Segment – III is predominantly sandy soil. Ditching will be done sequentially post-welding to avoid collapse of the ditch while welding is in progress.

(c)Crossings

The crossings activity of Segment – III will be carried out through in-house resources. All crossings of Segments – I & Segment – II, including River Indus will be out sourced. Most of the construction equipment procured for the project will be deployed for the construction activity of segment – III.Options of procuring excavators or obtaining excavators on rent from open market would be explored to cater for time constraints and contingencies.

Figure 7: Hyderabad Dadu Railway line

(d) Welding and Weld Repairs

Construction of 82 Km long segment – III (from Nawabshah to RS-Nara) will be carried out by SSGC's in house resources.

The typical welding process for a joint between two pipe-lengths consists of the following four steps:

- Root pass 01 Pass
- Hot pass 01 Pass
- Filling 06 Passes
- Capping 01 Pass

The time and resources needed for these activities to yield a progress of 17 joints per day from each section of the segment, which translates to 0.2 Km/day is shown in the following table:

Table 8: Details of Resources (Labor)

Welding Type	No of Passes	Time (min)	Welders	Supporting Labor				Total Crew
				Fitter	*Grinder Man*	*Brush Man*	*USL / SSL*	
Root Pass	1	45	4	1	1	0	10	**159**
Hot Pass	*1*	*45*	*4*	*0*	*0*	*2*	*6*	
Filling	6	105	20	0	0	20	60	
Capping	*1*	*45*	*6*	*0*	*1*	*6*	*18*	
Total	**9**	**240 mins or 4 hrs**	**34**	**1**	**2**	**28**	**94**	

Based on the above calculations, the section wise progress will be, as shown in the following table:

Table 9: Production Rate

Segment – III (82km)	Production Rate (Planned)		Days
	Joints / day	*Km / day*	
Section – I (27km)	17	0.2	135
Section – II (28km)	*17*	*0.2*	*140*
Section – III (27km)	17	0.2	135

(e) Fabrication and Welding of Valve Assemblies & Pig Launching /Receiving

Fabrication, Welding and Installation of 03 Valve Assemblies, 02 Pig launching / receiving arrangement and filtering/scrubber setup will be carried out in house for segment-III.

2.9 Details of Construction/ Project Activities

2.9.1 Site Preparation

Prior to site preparation, land for the pipeline project would be acquired wherever right of way is not available and owners of the delineated land will be compensated. Land department of SSGC have already surveyed the route. Before bush clearing/site preparation, surveyors have already marked both the boundaries of the working width (right of way) and the center line of the pipeline with posts for the entire Segment 1 and partially for Segment 2.The balance marking work is in progress. The working width of the pipeline will be 25m.

Early activities of the construction phase will include site preparation by clearing vegetation. The activities will be carefully planned and coordinated by SSGC and construction contractors. Disposal activities associated with the above will be handled as described in the Waste Management and Environmental Management Plan (EMP) sections of the EIA report.

Within the working width, vegetation that would be removed would be piled on one side of the trench for the pipeline to prevent excavated materials from washing into the un-cleared areas.

2.9.2 Construction

Construction of the gas pipeline will be executed in accordance with a standard planning framework that will be reviewed as it becomes expedient by project team to ensure: • Maximum efficiency in construction

• Minimum adverse environmental and health impacts

- Earliest completion time
- Compliance with the laws of the land and all regulatory requirements

2.9.3 Construction Materials

All materials to be used in the construction of the gas pipeline shall be tested in accordance with the appropriate International Standard and requirements to verify their suitability for the purpose. The actual quantities of the various bulk materials required will vary depending on the outcome of the detailed design exercise. Sourcing of the materials is the responsibility of SSGC and contractors, subject to any constraints imposed by this EIA report.

2.9.4 Logistics Arrangements

In consideration of the massive movement of construction equipment, materials and resources during the construction phase of the project, the construction work itself will need proper logistics arrangement. The operational focus of the project will be along the pipeline from PAKLAND SITE TO NARA and the logistics support will be provided through various outlets – sea, air and road transport. The bulk of the equipment will be supplied via KARACHI /PORT QASIM port. Some smaller and highly sensitive equipment many be air freighted to KARACHI. Additional facilities required will be storage areas for fuel, work camps complete with water supply, electricity and communication facilities, logistics office and cranes for handling material.

The logistic support for the project shall be provided mainly by road transport through which all materials and equipment including personnel shall be taken to site. Considering the massive movement of construction equipment, materials, and resources during the construction phase of the project, logistic arrangement shall be accorded adequate attention.

The construction of the pipeline will comply with the latest edition of international industry standards “Design and Construction of ANSI/ASME code B31.8-Gas Transmission and Distribution Systems.

The standard method for the construction and installation of buried welded steel pipelines is based on a continuous moving assembly line with each sequential activity maintaining a consistent rate of progress.

2.9.5 Main Construction Team Work (Main Spread Team)

The pipeline length will be constructed in THREE stages, ONE BY SSGC AND THE OTHER TWO BY CONTRACTERS. The activities of this team result in sections of fully welded pipe being laid in the trench and roughly backfilled. In addition, special crews for such operations as field bending of pipes, installation of manifold/valve stations and major water crossings also operate as necessary. In each stage of main

teamwork, construction is a cut and fills process generally involving the stages below:

- Top soil removal
- Ditching involving subsoil removal
- Coating
- Pipe laying
- Cleaning
- Welding
- Inspection
- Hydrotesting
- Backfilling Soil Management/Reinstatement:

i Topsoil Removal

The topsoil would be stripped from the working width and stored in an earth bound, which runs continuously parallel to the trench on one side of the working width.

ii Pipe Laying

Pre-coated pipes would be delivered from the pipe yard. After inspection, the welds and any other area of bare pipe would be coated with "serviwrap" PVC tape and concrete-coated so as to form a continuous protective coating. The pipes would then be laid on stands along the trench. Once a section has been completed, the trench profile is checked, the stands removed and the pipeline is settled on the bottom of the trench.

iii Back-filling

The working procedures for backfilling are determined by the nature of soils of the area and the mode of construction. In general, the first stage will be to return materials excavated from the trench in a reverse order.

iv Pressure Testing

The internal part of the pipeline will be cleaned using two wire brush pigs propelled through the line by compressed air. A gauging pig will then be installed and propelled through the pipeline with water. The gauging pig will identify any deformities in the pipeline shape. The water pressure will be increased and the line hydrostatically pressure tested. Once up to full test, the pressure will be monitored for 24 hours to ensure pressure maintenance. If pressure drops, it may indicate a leak and further inspection will be required.

v Regrading

Once hydrostatic tests have been completed, the working area will be regraded with topsoil and appropriate cultivation undertaken, where necessary. The returned soil

is graded so as to allow settlement. The soil would be spread evenly over the working width to ensure maintenance of the working width bank.

Specialist Team In addition to the main construction spreads, there will be specialist teams that precede the main spread. These are specialists on river crossing, reinstatement topography and erosion. Works in some cases will require the use of special vehicles (tractor and trailer).

i River Crossing

Streams and rivers are either tunneled by boring or directional drilling techniques or may be trenched across using either 'dry' or 'wet' techniques. The length of crossing, rate of flow of water and characteristics of the riverbed will determine the techniques to be chosen. Rivers and streams will be crossed using the same trenching technique employed on the other parts of the route. Rivers and streams likely to be crossed in the 'wet' will be excavated or dredged in the river bed by equipment operating in the water or along drag lines operating in the banks. 'Wet' crossings inevitably involve sediment disturbance and silt sedimentation. Each crossing will be subjected to an assessment of the ecology and water usage. Dry crossing technique involves trenching under the water such that the pipe will be below the riverbed. This has the advantage of reducing impacts on the water quality of the river/stream such as increased suspended particles, turbidity and flow rate. For this project, dry technique for river crossing will be adopted.

ii Restoration/Reinstatement

Correct construction techniques will be employed to guard against any longterm restoration problem, i.e. soil erosion. The success of any restoration process is measured by the similarity of the vegetation and firmness of the soil on the restored land to that of its surroundings.

2.9.6 Noise

The following activities during the construction phase of the project will generate noise: bush clearing, excavation, pipelaying, vehicular movement, operation of equipment and commissioning.

2.9.7 Operation

Operations Control/Monitoring of Gas Pipeline The risks of pollution are small and as the pipeline system will be buried within a ROW, there will be negligible nuisance associated with its operation. Pipeline integrity is vital for operational reasons and management of the operational phase. To achieve effective operations, it is wise to look into the:

- Operational Management;
- Effects of Pipeline Temperature;

- Gas Leak.

Pipeline pressure will be monitored at the pipeline manifold (valve) end and flow will be measured at the terminal points. These measurements will act as additional indicators that the pipeline integrity is being maintained. Communication between the operations at the two will be via both radio and telephone systems.

2.9.8 Maintenance and Inspection

Regular surveillance of the pipeline route will form an integral element of the integrity monitoring system and will seek to:

- Detect and locate any activity which may interact with the pipeline including un-authorized third party activity;
- Locate any local changes or ground conditions which may threaten the pipeline including areas of ground erosion, movement or subsidence;
- Detect any leakage from the pipeline and its facilities.

To reduce the risk to the pipeline from third party activities, most often due to unauthorized building and construction work, valves and alarms shall be incorporated into the design and construction. As part of the operational integrity monitoring, the following inspection procedures will be introduced:

- Initial inspection of the pipeline coating to cover routine surveillance aided by the presence of marker posts at all major crossings and field boundaries.
- The pipeline route will be inspected at monthly intervals.
- Repeater stations/Main valve assembly stations will be regularly visited;
- Close liaison with all communities along the route will be maintained;
- Induced current density readings will be recorded and analyzed to identify any areas where it is indicated that cathodic protection is not at the required level.

2.9.9 PiggingOperations

The pipeline system is provided with “pig” launching facilities. These enable various pigs to be sent down the pipeline for commissioning, maintenance and inspection purposes. Pigs fulfill a number of roles; they:

- Clean the line of unwanted debris;
- Check the pipeline for signs of damages or deformity;
- Detect areas of corrosion;
- The frequency of pigging operations will be determined by operational circumstances.

2.9.10 Wastes and Disposal Activities

Effective and responsible handling and disposal of wastes are key elements in environmental management system. Wastes refer to any material (solid, liquid, gaseous or mixture) that is surplus to requirements. Waste management for the project shall be carried out in consultation and in line with the waste management guidelines of SEPA.

SSGC shall take all practical and cost effective measures to minimize the generation of wastes, by employing the four R's (Reduce, Reuse, Recycle, and Recovery) through process of optimization or redesign, efficient procedures and good housekeeping.

Waste shall be managed in the following ways;

- Making Inventory
- Classification
- Segregation
- Wastes quantification
- Wastes tracking;
- Wastes disposal

Wastes disposal shall be carried out in consultation with the Provincial environmental protection agency.

2.9.11 Solid Wastes

These types of waste include cleared vegetation, domestic refuse, pigging trash, scrap metals, filters, welding torches and spent electrodes. Trees would be felled along ROW and cut into useable lengths. In line with waste management procedures, identified solid wastes will be sorted and disposed of in designated areas.

All chemicals used by SSGC/Contractors would be handled and ultimately disposed of according to the requirements of Safe Handling of Chemicals (SHOC) system. There shall be maintained records of all chemicals stored on site, identifying their Health, Safety and Environmental implications.

Regular checks shall be made by SSGC to ensure that records are maintained and storage facilities are in good handling practices. Solid wastes would be disposed of in the following manner:

Plastic containers depending on their size will either be returned to the supplier, cleaned for reuse or crushed;

The disposal of industrial wastes would be conducted in designated areas in accordance with regulation.

2.9.12 Aqueous /Non Aqueous Wastes

i) Black and Grey Water Black water refers to sewage whereas grey water is domestic wastewater. These shall be disposed off in accordance with national standards and guidelines.

ii) Hydro test Water prior to operation, the pipeline will be pressure-tested using fresh water from River Indus/Canals/Boring water.

iii) Diesel/Oil/Condensate These wastes would emanate from working equipment such as welding machines, excavators, bulldozer etc. These wastes shall be scooped, contained and disposed off in designated sites. Liquid condensate from pigging operations will be reclaimed and sent to fuel depots/refinery for recycling.

2.9.13 Gaseous Emissions and Discharges

The atmospheric emissions principally associated with gaseous discharges during the construction activities are:

- Carbon Dioxide (C02)
- Carbon monoxide (CO)
- Methane (CH4)
- Oxides of Nitrogen (NOx)
- Sulphur Dioxide (SO2).

2.9.14 Commissioning and Decommissioning/Abandonment

At the completion of installation of pipeline, pressure testing will be conducted after which it will be commissioned. A period of approximately two months will be required for the final testing of the pipeline prior to its start-up. The pipeline is designed to last for a minimum of 25 years.

2.10 Crossings

2.10.1 River Crossing

This Indus River crossing is the part of segment -1 from Pakland to Hyderabad. Horizontal Directional Drilling construction methodology would be adopted for construction of Indus River Crossing HDD is the ideal procedure for laying pipelines quickly, economically and without impacting the environment. The trenchless drilling method with only start and exit point, means several kilometers of pipelines can be laid beneath rivers. The surface along the pipeline route remains totally untouched.

2.11 Status of Work Completed and in Progress

- Pipeline Route - SSGC & SNGPL have selected a route along the Left Bank of the Indus River (ILBP) for RLNG transportation.
- Route Survey Studies have been completed

- FEED (Front End Engineering & Design) is nearing completion
- Right of way (R.O.W) – Preliminary Studies and planning have been completed i.e. detour regions and bottle-necks have been identified. Land acquisition for temporary and permanent land has been initiated
- Engineering Survey has been completed.
- Pipeline crossings on the proposed route have been identified. Of these the notable ones are one river crossing, twelve canal crossings, three highway crossings and three railway crossings. Their design studies have been completed. Preparation of drawings has started for railways and other major crossings. Pre-qualification for HDD Indus river crossing has been initiated.
- Request for approvals for Crossings have been sent to railways, NHA and Indus River authorities.
- IEE/EIA (Environmental Impact Assessment) has been initiated.
- The following Design Studies have been completed:
    a) Hydraulics studies for pipe sizing
    b) Simulation studies for flow confirmation.
    c) Simulation studies for compression requirement.
    d) Pipeline Mechanical design
    e) Valve assemblies
    f) Gas compressions
    i. Selection and rating
    ii. Operating parameters
    iii. Equipment plot plan
- Bill of Materials and Specifications for all Line pipe items and ancillaries have been completed.
- Procurement – 75% of the procurement process of the items has been completed. LOIs/P.Os have been issued for line pipe and major construction machinery.
- Project Execution Strategy (this document) has been developed and is being implemented.
- Daily progress tracking has commenced based on inputs from sites.
- Weekly project review meetings are being held to review progress, identify bottlenecks and develop/propose solutions to resolve the issues.

2.12 Stakeholders

Table 10: List of Important Stakeholders

S#	Department	No. of Crossing	City	Jurisdiction

1	NHA	03	Hyd, Jam, M9	Hyderabad
2	Railway	04	Hyd, Nwbshah	
3	KWSB	01	Khi	Khi
4	Irrigation (Indus)	01	Jam	Hyd
5	Irrigation RBOD	01	Jam	Hyd
6	Highway	58	Hyd, Nwbshah	Hyd, Nawabshah
7	Irrigation	34	Hyd, Nwbshah	Hyd, Nwbshah

2.13 Summary from the Schematic Arrangement of the Pipeline

Table 11: Chainnage and Description

S/No	KM + METER	DESCRIPTION
1	0 + 000	MVA and SMS PAKLAND
2	3+ 070	Road
3	3+ 645	Lath Nala
4	4+ 720	Road
5	5+ 659	SMS Dhabeji
6	5+ 759	Hariya Nala
7	8 + 130	Nala and KWSB Water conduit
8	11 + 490	Nala
9	11 + 755	Nala
10	15 + 238	MVA and RS 5

11	16 + 108	Nala
12	16+620	Ran Pathani Naddi
13	26 + 507	Nala
14	27+ 174	Road Darsana Maku
15	31+285	Nala
16	31+ 385	Road
17	31+ 885	Nala
18	36+129	Nala
19	38+ 130	MVA and Thatta SMS
20	52+ 935	Narmari Nala
21	57+ 095	Lyachi Naddi
22	62 + 121	Jhampir Road
23	62+191	SMS Jhampir
24	65 + 135	Nala
25	66+ 286	MVA , Pig launching / receiving assembly, RS 4
26	73+ 120	Nala
27	92 + 414	Bholari Road
28	98+ 269	MVA Baran River
29	98 + 720	Baran River
30	99 + 419	Super Highway (Proposed Motor way)
31	104 + 032	Nala
32	106 + 972	SMS Khotri
33	110+ 634	Nala
34	114+ 845	Nala
35	115+ 950	Nala

36	116 + 161	Indus Highway crossing
37	116+ 964	Nala
38	117 + 350	Nala and Railway Track (Khotri – Dadu Section)
39	117+ 397	Petaro Road
40	121 + 849	MVA
41	122+ 201	Water course
42	122 + 729	Water course
43	123 + 830	RBOD SEM Nala
44	124 + 639	Water course
45	125+ 584	Katcha Area and Indus River overhead pipline crossing
46	126 + 694	Water course
47	127 + 180	Water course
48	127+ 355	Water course
49	127 + 452	Water course
50	127+ 559	Black Top Road
51	127 + 648	Water course
52	127+ 974	Water course
53	128 + 390	Water course
54	128 + 730	Pig receiving and launching arrangement at HQ 3

2.14 Terrain Condition

The terrain for the proposed pipeline route comprise of Clay Gravel, Sand mixture, Rocky portion,and Sand dunes as summarized below from chainage 0+000 to 340+458.

Table 12: Terrain Condition

CHANNAGE	TERRAIN
0+00 TO 7+300	CLAY GRVEL SND MIXTURE

7+300 TO 56+100	ROCKY
56+100 TO 64+500	CLAY GRVEL SND MIXTURE
64+500 TO 67+000	ROCKY
67+00 TO 98+200	CLAY GRVEL SND MIXTURE
98+200 TO 99+100	ROCKY
99+100 TO 106+200	CLAY GRVEL SND MIXTURE
106+200 TO 107+400	ROCKY
107+400 TO 109+300	CLAY GRVEL SND MIXTURE
109+300 TO 112+200	ROCKY
112+200 TO 117 +000	CLAY GRVEL SND MIXTURE
117+000 TO 118+500	CLAY
118+500 TO 120 +600	CLAY GRVEL SND MIXTURE
120+600 TO 268+00	CLAY
268+000 TO 340+458	SAND DUNES

CHAPTER 3: REGULATORY REQUIREMENTS

3.1 Introduction

The principal environmental regulatory agency in Pakistan was the Environmental Protection Agency (EPA) of Pakistan that formulates environmental policies, action plans and legislation. After the 18th amendment the environmental portfolio devolved to provincial governments. Consequently, the Sindh Environmental Protection Agency (SEPA) is empowered to formulate environmental legislation, rules, regulations and standards and their enforcement/implement in the whole Sindh provinces as a formulating, regulatory and monitoring agencies. EPA Sindh head office is located at ST-2/1, Sector-23, Korangi Industrial Area, Karachi.

Presently, the basic legislation on the environment is the Sindh Environmental Protection Act of 2014 (SEPA 2014), Sindh IEE/EIA regulations 2014 and other rules and regulations. SEPA has initiated process of notification for Sindh Environmental Quality Standards 2015 (SEQS 2015). In addition, EPA Sindh has also issued directions through print media and direct communication to the concerned parties for immediate compliance with these legislation and Rules and Regulations made so far.

This section provides synopsis of policies, legislation, and guidelines that may have relevance to the activities carried out by the M/S SSGC within the scope defined for this EIA/EMP. The relevant requirements of the policy documents and legislative framework have also been incorporated in the environmental management and monitoring plan being formulated for the better environmental impacts management. SSGC Management is committed to follow and comply with the relevant requirements of the policy documents and legislative framework for the better management of environmental aspects and impacts of their business related activities

Since SSGC is part of Federal government and fall under the Ministry of Petroleum and Natural Resources, so the PEPA 1997 Act and their rules and regulations are also discussed. However, this report is prepared in accordance with the SEPA 2014 and submitted to Sindh Environmental Protection Agency.

3.2 National Environmental Policy and Guidelines

The enactment of comprehensive legislation on the environment, covering multiple areas of concern, is a relatively new and ongoing phenomenon in Pakistan. The following section presents a brief overview of the existing national policies and guidelines.

3.2.1 National Conservation Strategy (NCS)

The National Conservation Strategy (NCS) is the primary policy document of the Government of Pakistan on national environmental issues. The Policy was approved by the Cabinet in March 1992. The Strategy also attained recognition by international donor agencies, principally the World Bank. The NCS identifies 14 core areas including conservation of biodiversity, pollution prevention and abatement, soil and water conservation and preservation of cultural heritage and recommends immediate attention to these core areas in order to preserve the country's environment.

The main objectives of the strategy are conservation of natural resources, sustainable development and improved efficiency in the use and management of resources. It covers fourteen key priority areas for policy formulation and intervention, including protecting watersheds, supporting forestry and plantations, protecting water bodies and sustaining fisheries, conserving biodiversity, increasing energy efficiency, developing and deploying renewable resources, preventing or decreasing pollution, managing urban wastes and preserving the cultural heritage. Energy policies include promoting efficiency and conservation as well as cogeneration, hydro, biogas, solar and new alternatives. The strategy also includes measures to control and limit pollution - for example, changing import duties to favor the most fuel-efficient vehicles, and regulate gasoline, kerosene and diesel pricing to make the least polluting alternatives the most affordable. Incorporation and integration of environmental and sustainable development themes into educational curricula and in the media is also an important feature of the strategy

3.2.2 National Environmental Policy

This policy covers all sectors and a wide range of means for promoting conservation and environmental protection in water, air and waste management, forestry, and transport. The policy aims to promote protection of the environment, the honoring of international obligations, sustainable management of resources, and economic growth. It calls for the setting of standards and regulations for ambient and indoor air quality, vehicle emissions and manufacture, energy conservation, fuel specification and building codes. It aims to promote mass transit and non-motorized transport as well as cleaner technologies, including, solar, hydroelectric, biogas and cogeneration with waste, and offering tax incentives for efficient products. It also calls for creating increased public demand for environmentally friendly products through education and mass awareness campaigns.

3.2.3 National Sanitation Policy

National Sanitation Policy of Pakistan provides a broad framework and policy guidelines to Governments to enhance and support sanitation coverage in the country through the formulation of their sanitation strategies, plans and programs at all respective levels for improving the quality of life of the people of Pakistan and the physical environment necessary for healthy life.

The Policy will be implemented by the Federal, and local government agencies in accordance with the guidelines, principles and measures spelt out in the policy.

3.2.4 Environmental Institutional Framework

Post 18th Amendment to the Constitution of Pakistan, the provincial Environmental Protection Agencies are fully empowered to initiate, modify and enforce environmental legislation in their respective provinces. In the province of Sindh, the EPA is the prime regulatory and monitoring institute. EPA is headed by a Director General who is the lead responsible person for enforcement of environmental legislation. He is also responsible for the guidance of other provincial departments/institutes on environmental matters and related issues. DG EPA Sindh functions from his registered head office located at Karachi, however, has regional offices in other major cities of the province functioning under senior officers.

EPA Sindh is attached with Environmental Protection Department of Government of Sindh. The EPD, headed by a Secretary, is the administrative body and responsible for coordination with other line departments and agencies of the province. It also performs coordination and communication with other provinces and federal government agencies.

3.2.5 Environmental Guidelines

A. The Sindh Environmental Assessment EIA/ IEE Procedures 2014

In exercise of the powers conferred by Section 37 of the Sindh Environmental Protection Act, 2014, the Sindh Environmental Protection Agency, with the approval of Government of Sindh has notified the 'Sindh Environmental Protection Agency (Review of Initial Environmental Examination and Environmental Impact Assessment) Regulations, 2014' vide notification No. EPA/TECH/739/2014 dated 16th December 2014.

This regulation describes the procedure for conducting environmental assessments and their approval process. Categories for projects requiring IEE, EIA or Environmental Checklists is mentioned in the regulation. The environmental assessment includes preparation of an Environmental Management Plan (EMP).

SEPA Review of IEE/EIA regulations 2014 is attached as Annexure-5 for ready reference and further guidance.

B. National Environmental Quality Standards (NEQS)

Government of Pakistan in early 1990s realized the importance of environmental pollution control by introducing National Environmental Quality Standards (NEQS) through statutory notifications as per recommendations of various advisory committees. Pakistan Environmental Protection Committee (PEPC) in its first meeting held on 10th May 1993 approved the NEQS. Later on, a set of NEQS was announced under SRO 742 (1) 93 dated 24th Aug 1993. These approved 32 parameters prescribing permissible levels of pollutants in liquid effluent while 16 parameters for gaseous emission were of uniform standards applicable to all kinds of industrial and municipal effluent.

Revised NEQS which were approved by the Council in December 28, 1999. These NEQS were made effective under SRO 549 (1) 2000 dated 8th August 2000.

The Council made amendments in S.R.O 742(1)/93 dated 24th August 1993 with its S.R.O. 72(KE)/2009 dated 16th May 2009.

- NEQS which were approved by the Pakistan Environment Protection Council. These NEQS for Municipal and Industrial effluent are attached.
- NEQS which were approved by the Pakistan Environment Protection Council. These NEQS for Industrial Gaseous Emissions, Motor Vehicle Exhaust, Noise and Ambient Air Quality are attached.
- NEQS which were approved by the Pakistan Environment Protection Council. These NEQS for Ambient Noise Level, are attached.

After devolution of the subject of environment to the provinces (as per 18th Amendment), the Sindh EPA has initiated a process of notification of Sindh EQS. The drafts for all the said EQSs have been proposed and are in the process of approval. However, until SEQS are notified, the existing NEQS are the legal enforced standards that SEPA requires all industrial units to comply with. M/s SSGC would comply with the limits of NEQS relevant to the scope of this EIA/EMP, however, once SEQS are notified; the same would be substituted in this EIA/EMP.

3.2.6 Self-Monitoring and Reporting

In exercise of the powers conferred by section 36 of the Sindh Environmental Protection Act, 2014, the Sindh Environmental Protection Agency, with the approval of the Government has notified the “Self Monitoring and Reporting by Industry Rules, 2014” vide notification No. EPA/TECH/739/2014 dated 16th December 2014.

In 2014, the Government of Sindh has taken various concrete steps to attain control over industrial pollution in the Sindh Province. The most significant measure was the enactment of the Sindh Environmental Protection Act 2014, which makes it an obligation upon industrial facilities to restrict their air emissions and effluents to the limits specified in the Environmental Quality Standards (EQS).

3.3 National Environmental Legislations

3.3.1 Pakistan Environmental Protection Act 1997

The Pakistan Environmental Protection Act was enacted on 6th December 1997, repealing the Pakistan Environmental Protection Ordinance, 1983. The PEPA' 1997 provides the framework for implementation of NCS, establishment of Provincial Sustainable development Funds, Protection and conservation of species, conservation of renewable resources, implementation of NEQS, establishment of Environmental Tribunals and appointment of Environmental Magistrates, Initial Environmental Examination (IEE), and Environmental Impact Assessment (EIA).

Pakistan's Environmental Policy is based on participatory approach to achieving objectives of sustainable development through legally, administratively and technically sound institutions. The Federal Environment Ministry was established in Pakistan in 1975 as follow up a Stockholm declaration of 1972. The Ministry was responsible for promulgation of the environmental Protection Ordinance of Pakistan in 1983. It was the first comprehensive legislation prepared in the country. The main objective of Ordinance 1983 was to establish institutions i-e to establish Federal and Provincial Environmental Protection Agencies and Pakistan Environmental Protection Council (PEPC). In 1993 Environmental Quality Standards (NEQS) were designed. The Act is broadly applicable to air, water, soil and noise pollution, as well as the handling of hazardous waste. Penalties have been prescribed for those who contravene the provisions of the Act. The powers of the Federal and Provincial Environmental Protection Agencies (EPAs) were also considerably enhanced under this legislation and they have been given the power to conduct inquiries into possible breaches of environmental laws either of their own accord, or upon the registration of a complaint.

3.3.2 Sindh Environment Protection Act 2014

The Sindh Environmental Protection Act was notified by the Provincial Assembly of Sindh via notification no. PAS/Legis-B-06/2014 dated March 20, 2014. The Act extends to whole of the province of Sindh and is to provide for the protection, conservation, rehabilitation and improvement of the environment, for the prevention and control of pollution, and promotion of sustainable development.

Under Section 2(xxxl), the Act defines "pollution" as the contamination of air, land or water by the discharge or emission of effluent or wastes or air pollutants or noise or

other matter which either directly or indirectly or in combination with other discharges or substances alters unfavorably the chemical, physical, biological, radiation, thermal or radiological or aesthetic properties of the air, land or water or which may, or is likely to make the air, land or water unclean, noxious or impure or injurious, disagreeable or detrimental to the health, safety, welfare or property of persons or harmful to biodiversity.

The Act, under Section 17, empowers the EPA Sindh to acquire from the proponent an EIA/IEE assessment document from the proponent of any project prior to commencement of any construction or operations activity. Section 19, empowers the EPA Sindh to acquire from the proponent an EMP of any project or activity so as to acquire comprehensive appraisal of the environmental aspects of that project or activity SEPA Act 2014 is attached for ready reference and further guidance.

3.3.3 Pakistan EPA Review of IEE and EIA Regulations- 2000

The Pakistan Environmental Protection Agency Review of IEE and EIA Regulations provide the necessary details on preparation, submission and review of the IEE and EIA. Categorization of projects for IEE or EIA is one of the main components of the Regulation. Projects are classified on the basis of expected degree of adverse environmental impacts. Project types listed in Schedule - II are designated as potentially less adverse effects. Schedule- I projects require an IEE to be conducted, rather than a full-fledged EIA, provided they are not located in environmentally sensitive areas.

Salient features of the regulations relevant to the proposed project are listed below:

- Categories of projects requiring IEE and EIA are issued through two schedules attached with the Regulations. Oil and gas extraction projects including exploration, production, gathering systems, separation, and storage are included in an IEE category.

- The IEE / EIA must be prepared, to the extent practicable, in accordance with the Pak-EPA environmental Guidelines discussed in the sections to follow.

- A fee, depending on the cost of the project has been imposed for review of the IEE and EIA.

- The submitted report is to be accompanied by an application in prescribed format included as Schedule - IV of the Regulation.

- The EPA is bound to conduct a scrutiny and reply within 10-days of submittal of report (a) confirming completeness (b) asking for additional information, or (c) requiring additional studies.

- The EPA is required to make every effort to complete the review process for the IEE within 45-days, and of the EIA within 90-days, of issue of confirmation of completeness.

- When EPA accord their approval subject to certain conditions, the following procedure will be followed:

  - Before commencing construction of the project, the proponent is required to submit an undertaking accepting the conditions.

  - Before commencing operation of the project, the proponent is required to obtain from the EPA a written confirmation of compliance with the approval conditions and requirements ofthe IEE/ EIA.

- There is a requirement for an EMP to be submitted with the request for obtaining confirmation of compliance.

- The EPA is required to issue confirmation of compliance within 15-daysor receipt of request and complete documentation.

- The IEE / EIA approval will be valid for three years from date of accord.

  - A monitoring report is required to be submitted to the EPA after the completion of construction followed by annual monitoring reports during operations.

3.3.4 The Sindh EPA Review of IEE and EIA Regulations 2014

In exercise of the powers conferred by Section 37 of the Sindh Environmental Protection Act, 2014, the Sindh Environmental Protection Agency, with the approval of Government of Sindh has notified the 'Sindh Environmental Protection Agency (Review of Initial Environmental Examination and Environmental Impact Assessment) Regulations, 2014' vide notification No. EPA/TECH/739/2014 dated 16th December 2014.

This regulation describes the procedure for conducting environmental assessments and their approval process. Categories for projects requiring IEE, EIA or Environmental Checklists is mentioned in the regulation. The environmental assessment includes preparation of an Environmental Management Plan (EMP). SEPA Review of IEE/EIA regulations 2014 is attached for ready reference and further guidance.

3.4 Other Relevant Laws

3.4.1 National Resettlement Policy and Ordinance

At present, the only legislation relating to land acquisition and compensation is the Land Acquisition Act (LAA) of 1894. The LAA is, however, limited to a cash compensation policy for the acquisition of land and built-up property, and damage to other assets, such as crops, trees, and infrastructure. The LAA does not consider the rehabilitation and resettlement of disrupted population and the restoration of their livelihoods.

The Asian Development Bank (ADB) came forward and provided financial and technical assistance to the GoP in 1999. The MoE and Urban Affairs then engaged consultants who prepared the Draft National Policy which still is in the draft form and has not yet passed cabinet approval.

3.4.2 Land Acquisition Act, 1894

The 1894 Land Acquisition Act (LAA) with its successive amendments is the main law regulating land acquisition for public purpose in Pakistan. The LAA has been variously interpreted by local governments, and some province has augmented the LAA by issuing provincial legislations. The LAA and its Implementation Rules require that following an impacts assessment/valuation effort, land and crops are compensated in cash at market rate to titled landowners and registered land tenants/users, respectively.

The LAA mandates that land valuation is to be based on the latest 3-5 years average registered land sale rates, though, in several recent cases the median rate over the past year, or even the current rates, have been applied. Due to widespread land under-valuation by the Revenue Department, current market rates are now frequently used with an added 15 per cent Compulsory Acquisition Surcharge as provided in the LAA.

(1) Based on the LAA, only legal owners and tenants registered with the Land Revenue Department or possessing formal lease agreements are eligible for compensation or livelihood support.

(2) It is also noted that the LAA does not automatically mandate for specific rehabilitation / assistance provisions benefiting the poor, vulnerable groups, or severely affected PAPs, nor it automatically provides for rehabilitation of income/livelihood losses or resettlement costs. This however it is often done in many projects in form of ad hoc arrangements based on negotiations between a specific EA and the PAPs.

(3) Exceptions to the rule are intrinsic to the fact that the law is elastic and are broadly interpreted at provincial level depending on operational requirements, local needs, and socio-economic circumstances. Recourse is often taken to ad hoc arrangements, agreements and understandings for resettlement in difficult situations. The above is also influenced by the fact that an amendment of the LAA has been considered necessary by the Ministry of Environment. Accordingly, a National Resettlement Policy (NRP) and a Resettlement Ordinance have been drafted to broaden LAA provisions and current practices so as to widen the scope of eligibility and tightening up loopholes (i.e. regarding definitions of malpractices, cut-off dates, political influence on routing, etc.). But both these documents are still awaiting government's approval for implementation.

The Act would apply for all the situations during the project when land area for the purpose of the project is needed to be acquired.

3.4.3 Affected Person Ordinance 2001

This Ordinance was promulgated in 2001 by the federal government to provide relief to persons or households affected by any Project due to loss of land or displacement. The Project under review is not affected by the provisions of this law as no displacement of population is expected to occur.

3.4.4 Biodiversity Action Plan

The key to protection of the biological heritage of Pakistan lies in the involvement of local people and in the support provided by competent institutions for conservation and sustainable use. The Government of Pakistan has recognized the importance of these measures in the preparation of the National Conservation Strategy and in becoming a signatory to, and ratifying, the Convention on Biological Diversity (CBD) in 1994. Developing the Biodiversity Action Plan for Pakistan, 2000 has been the most significant direct steps towards addressing the biodiversity loss

The BAP recognizes that an EIA is used as a tool at a project level to identify environmental effects of a proposed project and to plan for reducing adverse effects. The BAP further stipulates that an EIA needs to be initiated at an early stage of project development and that public participation in the review of potential effects is important.

3.4.5 Canal and Drainage Act, 1873

The Canal and Drainage Act (1873) prohibits corruption or fouling of water in canals(defined to include channels, tube wells, reservoirs and watercourses), or obstruction of drainage. This Act will be applicable to the construction and O&M works to be carried out during the proposed Project.

3.4.6 The Sindh Irrigation Act 1879

This Act empowers the GoS to use the natural sources of water such as lakes, rivers, and streams, for supply of water for irrigation and other purposes. It allows the government to develop the required infrastructure, for example, canals, channels, pipelines, for the supply of water. It also allows the government to charge fee for the supply of water and regulate the water supply. The Irrigation Department of the Government of Sindh is the concerned department to which the project proponents have to apply to seek permit to obtain water from Indus River. The irrigation department will also charge fee as per the prevalent rates.

3.4.7 Employment of child Act, 1991

Article 11 (3) of the Constitution of Pakistan prohibits employment of children below the age of 14 years in any factory, mines or any other hazardous employment. In accordance with this Article, the Employment of Child Act (ECA) 1991 disallows child labor in the country. The ECA defines a child to mean a person who has not completed his/her fourteenth year of age. The ECA states that no child shall be employed or permitted to work in any of the occupations set forth in the ECA (such as transport sector, railways, construction, and ports) or in any workshop wherein any of the processes defined in the Act is carried out. The processes defined in the Act include carpet weaving, bidi (kind of a cigarette) making, cement manufacturing, textile, construction and others. SSGCL and its contractors will be bound by the ECA to disallow any child labor at the Project sites or campsites.

3.4.8 Cutting of Trees Act, 1975&Protection of Trees &Bush Wood Act,1949

The Cutting of Trees Act prohibits cutting or chopping of trees without prior permission of the Forest Department. Section 3 of this Act states “No person shall, without the prior written approval of the local formation commander or an officer authorized by him in this behalf, cut fell or damage or cause to cut, fell or damage any tree.”

Similarly, the Protection of Trees and Bush wood Act, 1949 prohibits cutting of trees and bush wood without permission of the Forest Department. The Act was enforced to prevent unlawful removal /clearing of trees and green areas for any reason without the consent of the Forest Department.

3.4.9 Sindh Wildlife Protection Ordinance, 1972

The Sindh Wildlife Protection Ordinance was approved in pursuance of the Martial Law Proclamation of 25th March, 1969. Under this Ordinance, three types of protected areas viz. National Park, Wildlife Sanctuary and Game Reserve have been notified for protection, conservation, preservation and management of wildlife.

This law declares any such area and its wildlife the sole property of the Government, making it accessible only to public for recreation, education and research. No hunting, shooting, trapping or killing is allowed without obtaining a special permit to do so within specific conditions and time limitations.

3.4.10 Antiquities Act, 1975

The Antiquities Act relates to the protection, preservation and conservation of archaeological/historical sites and monuments.

3.4.11 The Sindh Cultural Heritage (Preservation) Act, 1994

This provincial Act empowers the Government of Sindh (GoS) to preserve and protect any premises or objects of archaeological, architectural, historical, cultural, or national interest in Sindh by declaring them protected.

Among various provisions of this act some are, formation of an Advisory Committee to government to overlook and subsequent right of Acquisition of a protected heritage of architectural, historical, archaeological or national value, custodian/guardianship rights for preservation and declaration of protected heritage, evaluation of ownership rights, take legal action against any offender who attempts to damage, destroy, remove, deface, alter or imperil the protected heritage or to build on or near the site. It also details the purchase, maintenance and repair works of a protected heritage under the government's jurisdiction. The advisory committee may also receive voluntary donations towards the cost of maintenance of a protected heritage site. The act also establishes the right of access to certain protected heritage sites, penalties for violators, formulation of rules and provides protection to the persons working under this Act.

3.4.12 Sindh Local Government Ordinances, 2001

These ordinances issued following the devolution process, establish regulations for land use, the conservation of natural vegetation, air, water, and land pollution, the disposal of solid waste and wastewater effluents as well as matters related to public health and safety.

3.4.13 Forest Act, 1927

This Act provides rules and regulations for the protection of forests, control of timber and other forest-produce transit, village forest and social forestry. The Act is being revised as the law was framed for regulating forests all over India. It was adopted as it is after the creation of Pakistan and it continues to remain in force till to date without assessing whether it fulfils present day`s requirements or not.

This act has been comprehensively formed and specifies concerned agency the power to declare protected and reserved forests by government notification, powers entitled to forest settlement officers, power to acquire land over which right was

claimed, powers to stop ways and water-courses in reserved forests, healing of claims relating to shifting cultivation, power to issue and publish notification to reserve trees, power to make rules for protected forests, power to declare forest no longer reserved, order on rights of pasture or transit forest-produce, record keeping by the forest settlement officer, commutation of right to appeal, time limit for resolution of claims and appeals, notification of acts prohibited in such forests (unlawful cutting of trees), awarding penalties on violations.

3.4.14 National Forest Policy, 2001

The National Forest Policy deals with the Renewable Natural Resources (RNR) of Pakistan such as forests, watersheds, rangelands, wildlife, biodiversity and their habitats with the aim to eliminate the causes of depletion to such resources through the active participation of various concerned stakeholders and government departments.

Some of the main elements of this policy include reducing the impact of socio-economic causes such as population planning, providing substitutes to firewood, poverty alleviation, reducing political interference in the forest and wildlife departments, renovating and invigorating institutions of RNR (local governments i.e. districts), policies for fragile eco-systems (mountain forests, mangroves), development of rain forests, maintaining irrigated plantations, preservation of unique forests, protection of wildlife, rangelands and desert eco-systems, planting of trees and fodders on farmlands and general monitoring and evaluation schemes.

3.4.15 Petroleum Act 1934

The Petroleum Act, 1934, is an Act to consolidate and amend the law relating to the import, transport, storage, production, refining and blending of petroleum. Specifying the nature and condition of all receptacles and Pipelines in which petroleum may be transported.

3.4.16 Mineral Gas Safety Rules 1960

These rules provided for the compression of natural gas for the purpose of storage and filling or distribution of Compressed Natural Gas (CNG). Under these rules the location, construction and operation of pipeline and all works connected with CNG refueling station must be in accordance with licensee granted by the chief inspector of explosives under the minerals gas safety rules 1960.

3.4.17 Mineral and Industrial Gases Safety Rules 2010

These rules provided specification, standards, import and manufacturing and manners of installation of all sorts of compressed/liquefied gas containers (cylinders

and vessels), petroleum storage tanks, compressors, dispensers, piping, fittings, allied equipment, and all kinds of safety devices.

3.5 International Guidelines and Treaties/Conventions

3.5.1 World Bank Guidelines on Environment

The principal World Bank publications that contain environmental guidelines are listed below.

- Environmental Assessment-Operational Policy 4.01. Washington, DC, USA. World Bank 1999
- Pollution Prevention and Abatement Handbook: Towards Cleaner Production, Environment Department, the World Bank, United Nations Industrial Development Organization and the United Nations Environment Program, 1998
- Environmental Assessment Sourcebook, Volume I: Polices, Procedures, and Cross- Sectoral Issues. World Bank Technical Paper Number 139, Environment Department, the World Bank, 1991
- Environmental Assessment Sourcebook, Volume III: Guidelines for Environmental Assessment of Energy and Industry Projects. World Bank Technical Paper No. 154, Environment Department, the World Bank, 1991

The first two publications listed here provide general guidelines for the conduct of an EIA, and address the EIA practitioners themselves as well as project designers. While the Sourcebook in particular has been designed for the Bank projects, and is especially relevant for the impact assessment of large-scale infrastructure projects, it contains enormous information which is useful to environmentalists and project proponents.

3.5.2 International Convention on Biodiversity

The International Conventionon biodiversity was adopted during the Earth Summit of 1992 at Rio de Janeiro. The Convention requires parties to develop national plans for the conservation and sustainable use of biodiversity and to integrate these plans into national development programs and policies. Parties are also required to identify components of biodiversity that are important for conservation, and to develop systems to monitor the use of such components with a view to promoting their sustainable use.

CHAPTER 4: DESCRIPTION OF THE ENVIRONMENT

PART- I -Environmental Baseline

4.1 Description of the Environmental Baseline

4.1.1 Topography and Geomorphology of the Proposed Route

The proposed route for 42" Gas Pipeline passes through several major districts of Sindh which fall under arid or semi-arid climatic zones and most of the area present a deserted look and harbor desert ecosystem. Only segment-II passes through a plain of rich alluvial deposits which is a fertile plain area. The proposed site is also without any mountain or hill range except some hillocks, sand dunes and rocky patches in segment I & II. Broadly the complete route may be classified into two major types of land:

- Deserted land
- Agricultural land.

Figure 8: Topographic divide of the project area (General view)

A ***Segment-I from MVS.SMS Pakland to SSGC Headquarters III in Hyderabad***

The northern region of Malir District through which the pipeline is proposed has a rugged topography due to an offshoot branch of the Kirthar range. In this segment pipeline passes through the district Malir (Karachi, Thatta and Jamshoro. Most of the soil is eroded material of coarse sediments from foot of hill sides and remains mostly unconsolidated deposits under severe weathering process due to semi arid climate. The soil of the region is covered with sand dunes, rock formations including Calcareous rocks and a lot of weathered deposits of sand, stone and shale which is reflected from the flora of the area. The land from MVS SMS Pakland to Jhampir is completely barren. This area is totally unsuitable for agriculture and human settlement, however the shrubs prevailing in this zone are utilized for grazing purpose by goats and sheep of the nearby villages, the population of which is very sparse. The sandy and rocky terrain continues along the proposed route approximately near to Jamshoro and then terrain changes into an alluvial plane.

B ***Segment-II from SSGC HQ- III Hyderabad to SSGC HQ-II Nawabshah.***

In this segment, the proposed pipeline passes through districts Hyderabad, Matiari, Sanghar, and Nawabshah, which are parts of the lower Indus basin that forms the part of western passive continental margin of Indian Plate. The soil of this region is very fertile and composed of alluvial deposits formed by River Indus having various proportions of sand, silt and clays at different locations. There are no mountain or hills along the pipeline route in this segment.

C ***Segment-III from SSGC Headquarters-II, Nawabshah to MVARS-NARA.***

The segment-III of the proposed pipeline passes through northern portion of Nawabshah and southern part of Khairpur districts. The area from SSGC Headquarters-II of Nawabshah to only few kilometers comprises of agricultural land and then deserted area of Nawabshah known GunjoThar starts which continues to valve Assembly Nara. Most of this segment is totally desert with sand dunes, sand hills and desert vegetation.

4.1.2 Climate

The climate of the area has been explained by dividing the project area into following two segments. Details for both segments are given in succeeding paragraphs:

- Karachi-Hyderabad Profile
- Hyderabad-Nawabshah Profile

Karachi-Hyderabad Profile

For the preparation of this climate profile, the climate data of weather observing stations of Pakistan Meteorological Department (PMD) situated at Karachi (airport) and Hyderabad are used.

Karachi experiences an arid climate. There are two summers at Karachi, first is from April to mid-June and the second is from mid-September to October. The highest temperature recorded in Karachi (AP) is 47.8 °C on 9th May 1938 and the lowest temperature is 0.0 °C, which was recorded on 21st January 1934. The highest rainfall during 24-hour period is 207.0 millimeters recorded on 1st July 1977. The highest monthly rainfall is 429.3 millimeters, which was recorded in July 1967; and the highest annual rainfall record is 713 millimeters in 1967.

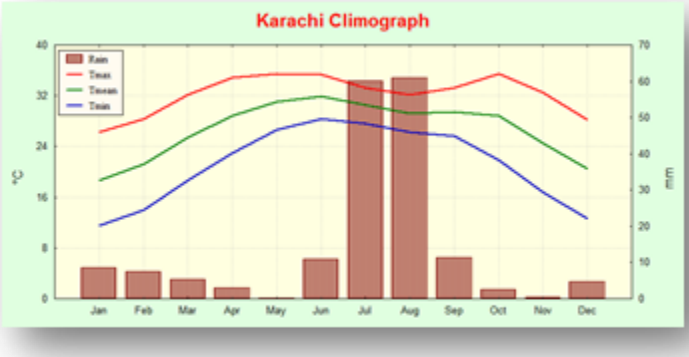


Figure 9: Normal Temperature and rainfall pattern over Karachi

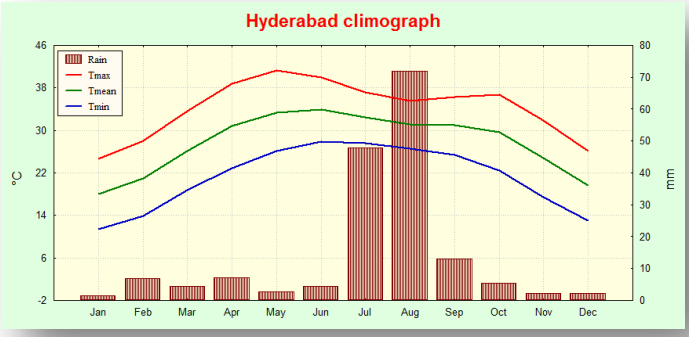


Figure 10: Normal Temperature and rainfall pattern over Hyderabad area

Hyderabad also features an arid climate. The days are hot and dry, usually going up to extreme highs of 40 °C, while the nights are cool and breezy. The highest

temperature recorded in Hyderabad is 50 °C on 9th June 1941 and the lowest temperature is 1.1 °C, which was recorded on 14th January 1935. The highest rainfall during 24-hour period is 250.7 millimeters recorded on 12th September 1962. The highest monthly rainfall is 286 millimeters, which was recorded in September 1962; and the highest annual rainfall record is 526.7 millimeters in 1956.

The area normally experienced around 32-35 °C of maximum temperature annually, as evident from Figure-2 (a). Similarly, the Figure-2 (b) shows the area experienced the minimum temperature of 20-22 °C annually.Figure-3 shows the spatial distribution of annual rainfall over the country. The figure depicted that the area received around 150-250 mm of annual rainfall. The area between Karachi and Hyderabad lies in the largest seismic zone with respect to area, but it has the least seismic activity (Fig-3(b)).In this area, a few but significant historical earthquakes were found, however there were generally few earthquakes in this zone.

4.1.3 Monthly climatic conditions:

Following are the monthly summary of climatic conditions of the area:

January

Cold conditions continue in the area during this month and sometimes get very cold due to the Western Disturbance. Humidity remains low in January. Rains do occur in this month but are low to moderate in intensity. The sky remains partly cloudy in the month. The highest rainfall during this month was 89.3 mm (3.52 in) at Karachi, which occurred in 1995. The lowest temperature of 0.0 °C (32 °F) was recorded on 21 January 1934, while the highest temperature of 33.3 °C (91.9 °F) was recorded on 14 January 1965. On average one rainy day in two years and one thunder storm day in three years. During this month, in morning, wind normally blows from north & northeasterly direction with speed 4-7 km/hr and in afternoon, from southwest direction with speed 10-15 km/hour.

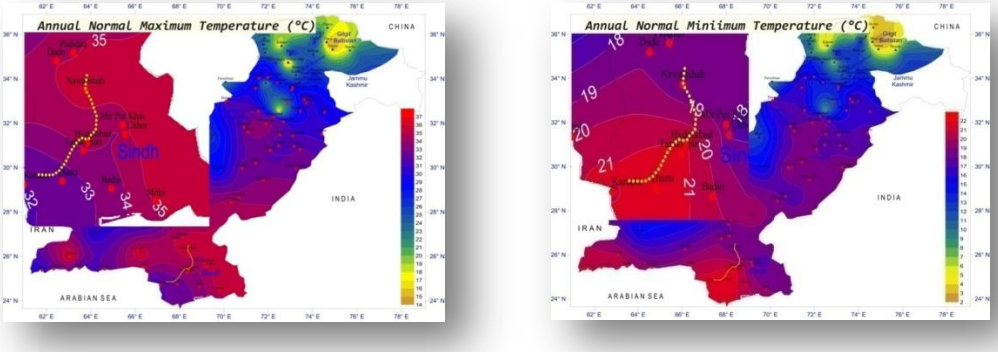


Figure 11(a) & (b): Spatial distribution of max & min temperature over the area

February

The month of February is generally less cool than in January. Humidity remains low in this month. Rains do occur in this month but are low in intensity. The sky remains partly cloudy in the month. Humidity remains between 40-70%. The lowest temperature was 1.5 °C (34.7 °F) on 8 February 2012 at Hyderabad and the highest was 39.4 °C (102.9 °F) on 27 February 1943. The highest monthly rainfall of 106 mm (4.7 inches) was recorded in 2003. On average three rainy days in four years and one thunder storm day in three years. During this month, in morning, wind normally blows from north (N) & northwest (NW) direction with speed 4-7 km/hr and in afternoon, from northwest (NW) & southwest (SW) direction with speed 11-13 km/hour.

March

During the month of March the weather becomes hot. The sky remains partly cloudy. Humidity remains between 40-70%. The lowest temperature ever recorded was 7 °C (45 °F) on 9 March 1979 and the highest was 46.7 °C (116 °F) on 28 March 1949. March's highest rainfall for the area is 130 mm (5.1 in) in 1967 at Karachi. On average three rainy days in five years and one thunder storm day in three years. During this month, in morning, wind normally blows from W/SW direction with speed 4-7 km/hr and in afternoon, from W/SW direction with speed 14-16 km/hour.

April

April becomes somewhat hot. Temperatures increase and the weather remains dry and hot. The humidity remains between 65-75%. The highest temperature during April was 46.1 °C (115 °F), which was recorded on 18 April 1949, while the lowest temperature of 8.9 °C (48 °F) was recorded on 21 April 1953. Rain is rare in this month. The highest monthly rainfall of 52.8 mm (2.08 in) was recorded in 1935. On average three rainy days in ten years and one thunder storm day in five years. During this month, in morning, wind normally blows from W/SW direction with speed 5-8 km/hr and in afternoon, from W/SW & southwest direction with speed 15-21 km/hour.

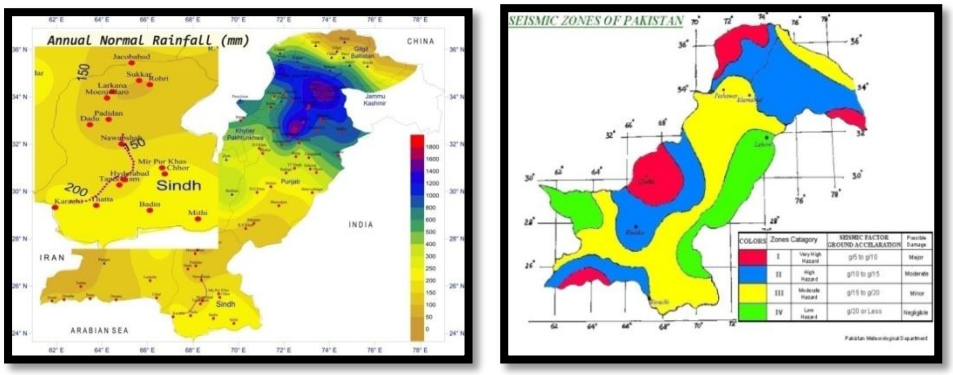


Figure 12(a) &(b): Spatial distribution of rainfall & seismic zones of the area

May

May is the hottest month over this area. The hottest May was on 25 May 1932, when temperatures reached 49.4 °C (120.9 °F); the lowest temperature ever recorded was on 4 May 1989 when 17.7 °C (63.9 °F) was recorded. The humidity is quite high in this month as well between 70–80%. Rainfall remains rare during this month and the sky remains cloudless. The highest monthly rain that occurred was in May 1999, when 51.1 mm (2 inches) rain lashed the city of Hyderabad. In 1999, 2001 and 2010, three major cyclones were formed that came close to Karachi. The 1999 cyclone hit close to Karachi, while the 2001 made landfall near the Indian border. During this month, in morning, wind normally blows from W/SW direction with speed 7-12 km/hr and in afternoon, from west & southwest direction with speed 18-28 km/hour.

June

By the middle of month the sky becomes persistently cloudy and temperature begin to fall. By the middle of June pre-monsoon rains can start, which persisted till the middle of September. The highest temperature of June was 50 °C (122 °F) on 9 June 1941, and the lowest was 20.3 °C (68.5 °F), recorded on 1 June 1997. Storms like tropical cyclones or tropical depressions can form close to the sea of Karachi in this month, as in 2007, when Cyclone Yemyin passed near Karachi. The cyclone produced a heavy rainfall of 110.2 mm (4.34 in) for June in 2007, which broke all previous records for June. Due to cyclone Yemyin strongest winds were observed in city on June 23, 2007 at about 69 mph (111 km/h), with heavy downpours. On June 6, 2010, Cyclone Phet came close to the coast of Karachi as a weak tropical depression, at about 50 km away from the city. Phet produced a very heavy downpour in the city, which broke the previous record of June 2007. About 152 mm (6.0 in) of rain with 35 mph (56 km/h) winds occurred due to Phet. Humidity in June typically remains between 75–85%. On average four rainy days in five years and one thunder storm day in two years. During this month, in morning, wind normally blows from W/SW direction with speed 10-15 km/hr and in afternoon, from the southwest with speed 20-30 km/hour.

July

July has a feature of cloudy weather, rainiest month of the year, the monsoon reaches its peak and produces heavy to very heavy rainfall. As in June, the sky remains overcast, with occasional drizzle at night or early morning. 2-3 thunder storms days and 3-4 rainy days are common in this month. The highest July temperature of 45.6 °C (114.1 °F) was recorded on 23 July 1951 at Hyderabad and the lowest temperature was 21.4 °C (70.5 °F) on 26 July 1989. The highest monthly rainfall for July was 429.3 mm (16.90 in) in 1967 at Karachi. The area's highest rainfall of 207 mm (8.1 in) in 24 hours was recorded on July 1, 1977. Humidity in July remains high, usually between 80–90%, during this month, in morning, wind

normally blows from W/SW direction with speed 12-15 km/hr and in afternoon, from the southwest with speed 20-28 km/hour.

August

The month of August is somewhat identical to that of July. One or two weather systems lash the area in this month, causing significant flooding. The highest rainfall for August is 284 mm (11.2 in), which occurred in 1994 at Hyderabad the highest temperature was 43.9 °C (111 °F) on 1 August 1968, while the lowest temperature was 20 °C (68 °F), recorded on 7 August 1984.The area's highest rainfall in 24 hours occurred on 7 August 1979, which is about 166 mm (6.5 in) of rain. On average three rainy days in year and three thunders storm days in two years. During this month, in morning, wind normally blows from W/SWt direction with speed 11-15 km/hr and in afternoon, from the W/SW with speed 18-204km/hour.

September

Sky starts clearing of clouds by the middle of the month and can have some rains during this period. After the first two weeks, the monsoon completely withdraws from the area. The humidity in this month is 70–80%, and an increase in temperatures. Rain in this month is inconsistent. The highest rainfall for September was 315.7 mm (12.43 in) in 1959. The highest temperature was 45 °C (113 °F) on 22 September 1974 and the lowest temperature recorded was 18.2 °C (64.8 °F) on 23 September 1994. On average four rainy days in five years and one thunder storm day in two years. During this month, in morning, wind normally blows from W/SW direction with speed 9-13 km/hr and in afternoon, from the W/SW with speed 16-22 km/hour.

October

Frequent sultry and hot weather has experienced during the month. October is one of the driest month in the area and very few occasion rainfalls recorded in this month. The highest temperature of 45 °C (113 °F) was recorded on 11 October 1949 and lowest was 10.0 °C (50.0 °F) recorded on 30 October 1949. Morning is hazy and the winds are calm, the sky remains clear with hot conditions. The highest monthly rainfall for October is 103 mm, which occurred in 2004 at Hyderabad. On average one rainy day in five years and one thunder storm day in ten years. During this month, in morning, wind normally blows from W/SW direction with speed 2-5 km/hr and in afternoon, from the W/SE to southwest with speed 10-15 km/hour.

November

November has warm days and cool nights. The driest month of the year recorded highest rainfall of 83.1 mm (3.27 in), which occurred in 1959 at Karachi. The highest and lowest temperatures are 41 °C (105.8 °F) recorded on 4 November 1977 and 5.6 °C (42 °F) recorded on 29 November 1938 respectively. On average one rainy day in five years and one thunder storm day in ten years. During this month, in morning, there is little wind and in afternoon, variable/SE wind with speed 8-12 km/hour.

December

The month of December is the annual winter month and the weather remains cool. The sky remains cloudy for part of the month, causing temperatures to decrease. Some rainfalls did happen in the area during the month of December due to the western disturbance. The highest monthly rainfall of 63.6 mm (2.50 in) was recorded in 1980 at Karachi. The highest recorded temperature for December was 36 °C (96.8 °F) on 9 December 2003 and the lowest temperature was 1.3 °C (34.3 °F), which occurred on 14 December 1986. On average two rainy days in three years and one thunder storm day in five years. During this month, in morning, wind normally blows from N/NE direction with speed 3-6 km/hr and in afternoon, from the W-SW/NE with speed 8-12 km/hour.

Table 13: Normal Climate features of Karachi

Parameters/months		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Maximum Temperature (°C)		26.3	28.4	32.2	34.8	35.5	35.4	33.3	32.1	33.2	35.5	32.5	28.2	32.3
Average Mean Temperature (°C)		18.6	21.2	25.4	28.9	31.1	31.9	30.5	29.2	29.5	28.9	24.6	20.5	26.7
Average Minimum Temperature (°C)		11.5	14.0	18.6	23.0	26.6	28.3	27.6	26.3	25.7	21.9	16.8	12.7	21.1
Monthly Average Rainfall (mm)		8.5	7.5	5.4	3.1	0.2	11.0	60.1	61.0	11.3	2.6	0.5	4.8	176.0
Rainy days (days)		0.7	0.8	0.7	0.2	0.1	0.9	3.6	3.3	0.7	0.3	0.1	0.7	12.1
Wind Speed (morning km/hr)		2.6	3.3	3.7	5.2	8.5	11.1	11.9	11.5	8.5	2.6	1.7	2.6	6.1
Wind Speed (evening km/hr)		9.3	11.9	13.7	15.0	17.6	18.1	17.8	16.1	14.6	10.9	8.7	8.0	13.5
Humidity (Morning %)		65.2	69.6	74.8	78.2	81.2	80.9	81.7	83.4	81.6	77.4	70.3	64.7	75.8
Humidity (Evening %)		33.4	35.2	39.2	45.9	57.7	62.3	67.6	69.7	62.1	43.3	35.8	34.8	48.9

Table 14: Normal Climate features of Hyderabad

Parameters/months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Maximum Temperature (°C)	24.7	28.1	33.7	38.8	41.3	40.0	37.2	35.6	36.3	36.7	31.9	26.2	34.2
Average Mean Temperature (°C)	18.0	21.0	26.2	30.9	33.3	34.0	32.4	31.1	31.0	29.6	24.8	19.6	27.7
Average Minimum Temperature (°C)	11.4	13.9	18.8	22.9	26.1	27.9	27.6	26.5	25.4	22.5	17.4	13.0	21.1
Monthly Average Rainfall (mm)	1.5	6.9	4.4	7.1	2.8	4.5	47.9	71.9	13.1	5.5	2.2	2.2	170.0
Rainy days (days)	0.3	0.7	0.4	0.6	0.4	0.6	2.1	2.2	0.6	0.3	0.2	0.3	8.7

Wind Speed (morning km/hr)	8.9	8.9	9.6	13.7	19.8	22.4	23.5	22.2	17.2	9.3	7.8	8.1	14.3
Wind Speed (evening km/hr)	13.1	13.5	15.0	20.4	28.3	28.2	30.2	27.0	23.9	14.8	10.9	11.9	19.8
Humidity (Morning %)	65.8	65.0	64.1	67.9	76.3	79.2	80.3	82.3	82.5	70.4	65.5	65.8	72.1
Humidity (Evening %)	32.6	28.4	23.9	23.3	31.9	43.4	53.2	57.3	48.2	30.9	30.1	35.1	36.5

Hyderabad-Nawabshah Profile

For the preparation of this climate profile, the climate data of weather observing stations of Pakistan Meteorological Department (PMD) situated at Hyderabad and Nawabshah are used.

Hyderabad features an arid climate. The days are hot and dry, usually going up to extreme highs of 40 °C, while the nights are cool and breezy (Fig-1(a)). The highest temperature recorded in Hyderabad is 50 °C on 9th June 1941 and the lowest temperature is 1.1 °C, which was recorded on 14th January 1935. The highest rainfall during 24-hour period is 250.7 millimeters recorded on 12th September 1962. The highest monthly rainfall is 286 millimeters, which was recorded in September 1962; and the highest annual rainfall record is 526.7 millimeters in 1956.

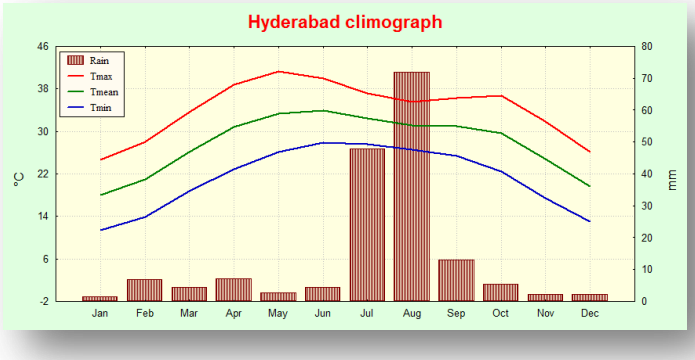


Figure 13: Normal Temperature and rainfall pattern over Hyderabad area

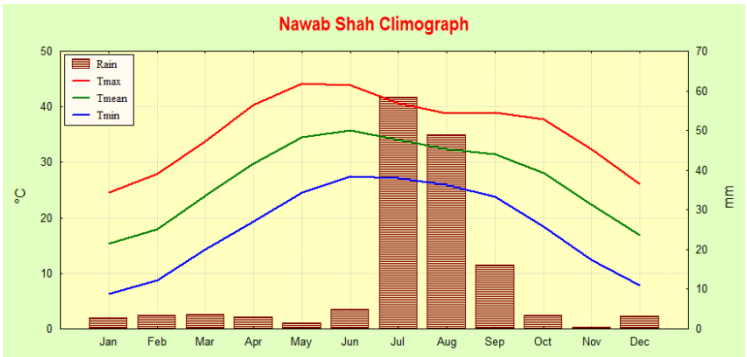


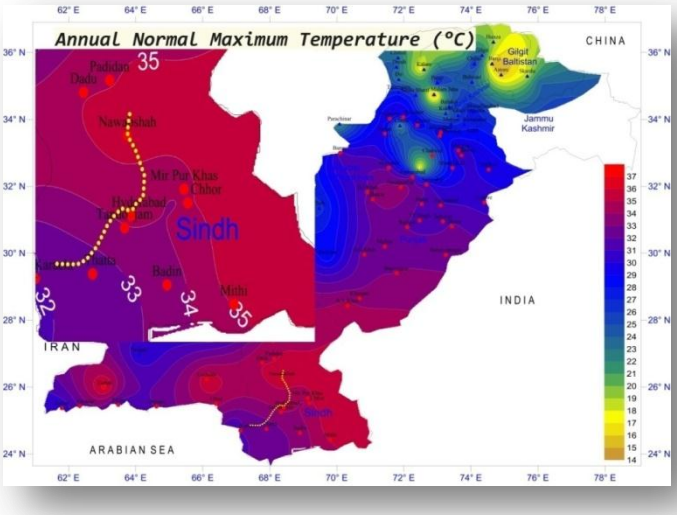
Figure 14: Normal Temperature and rainfall pattern ove Nawabshah area

4.1.4 Monthly weather conditions:

The following is a monthly summary of climatic conditions of the area.

January

Cold conditions persist in the area during this month and sometimes get very cold due to the Western Disturbance. Rains do occur in this month but are low in intensity. The sky remains partly cloudy in the month. The highest rainfall during this month was 30 mm at Hyderabad, which occurred in 1945. The lowest temperature of -2.6 °C was recorded on 15 January 2006 at Nawabshah, while the highest temperature of 33.7 °C was recorded on 13 January 2004. On average one rainy day in four years and one thunder storm day in five years. During this month, in morning, wind normally blows from northwesterly (NW) direction with speed 4-7 km/hr and in afternoon, from NW/NE direction with speed 4-13 km/hour.



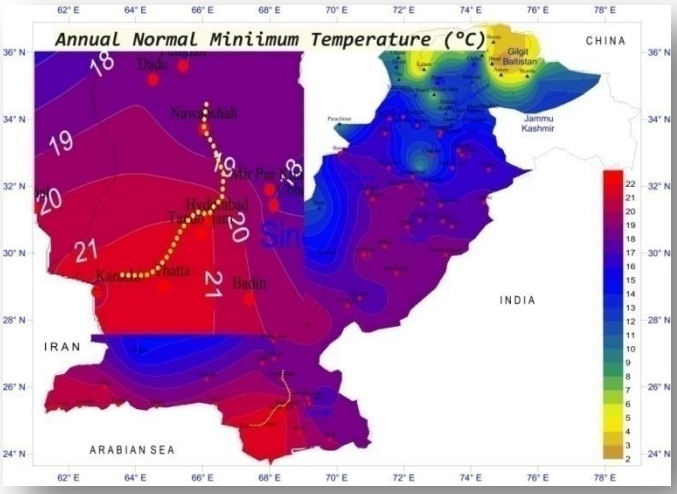


Figure 15: (a) & (b): Spatial distribution of max & min temperature over the area

February

The month of February is generally less cool than in January. Rains do occur in this month but again are low in intensity. The sky remains partly cloudy in the month. The lowest temperature was -3.5 °C on 8 February 2008 at Nawabshah and the highest was 39.4 °C (102.9 °F) on 27 February 1943. The highest monthly rainfall of 106 mm (4.7 inches) was recorded in 2003 AT Hyderabad area. On average three rainy days in four years and one thunder storm day in three years. During this month, in morning, wind normally blows from NW direction with speed 4-9 km/hr and in afternoon, from NW direction with speed 9-15 km/hour.

March

During the month of March the weather becomes hot. The sky remains partly cloudy. Humidity remains between 40-70%. The lowest temperature ever recorded was 1 °C on 6 March 2010 at Nawabshah and the highest was 46.7 °C (116 °F) on 28 March 1949 at Hyderabad. March's highest rainfall for the area is 47 mm in 1967 at Hyderabad. On average three rainy days in four years and one thunder storm day in three years. During this month, in morning, wind normally blows from S/SW direction with speed 4-10 km/hr and in afternoon, from SW direction with speed 8-16 km/hour.

April

April becomes somewhat hot. Temperatures increase and the weather remains dry and hot. The humidity remains between 25-40% (morning) and 65-75% (evening). The highest temperature during April was 48.5 °C, which was recorded on 28 April 2002 at Nawabshah, while the lowest temperature of 7 °C was recorded on 8 April 1994. Rain is rare in this month. The highest monthly rainfall of 46 mm was recorded in 1963 at Hyderabad. On average 2-4 rainy days in ten years and 1-2 thunder storm day in five years. During this month, in morning, wind normally blows from SW/SE direction with speed 3-7 km/hr and in afternoon, from S/SW & southwest direction with speed 12-20 km/hour.

May

May is the hottest month over this area. The hottest May of the area was on 27 May 2010, when temperatures reached 52.2 °C at Nawabshah; the lowest temperature ever recorded was on 3 May 1979 when 15 °C was recorded. The humidity is quite high in this month as well between 70–80% in morning and 40-50% in evening. Rainfall remains rare during this month and the sky remains cloudless. The highest monthly rain that occurred was in May 1999, when 51.1 mm rain in the city of Hyderabad. During this month, in morning, wind normally blows from SW/SE

direction with speed 7-18 km/hr and in afternoon, from southwest direction with speed 12-26 km/hour.

June

By the middle of month the sky becomes remain partly cloudy and temperature begin to fall but still are on very higher side. By the middle of June pre-monsoon rains can start, which persisted till the middle of September. The highest temperature of June was 51 °C on 8 June 2011 at Nawabshah, and the lowest was 17 °C, recorded on 1 June 1982. The highest monthly rainfall of the area was 149.8 mm on June 1648 at Hyderabad. Humidity in June typically remains between 75–85%. On average 3-4 rainy days in five years and 1.-2 thunder storm day in three years. During this month, in morning, wind normally blows from W/SW direction with speed 10-15 km/hr and in afternoon, from the southwest with speed 16-28 km/hour.

July

July has a feature of cloudy weather, one of the rainiest month of the year, the monsoon reaches its peak and produces heavy to very heavy rainfall. 2-3 rainy days are common in this month. The highest July temperature of 48.3 °C was recorded on 8 July 1955 at Nawabshah and the lowest temperature was 20 °C on 6 July 2005. The highest monthly rainfall for July was 326.4 mm in 1956 at Nawabshah.. Humidity in July remains high, usually between 80–90%, During this month, in morning, wind normally blows from SE/SW direction with speed 12-18 km/hr and in afternoon, from SE/SW with speed 16-26 km/hour.

August

The month of August is somewhat identical to that of July. One or two weather systems lash the area in this month, causing significant flooding. The highest rainfall for August is 284 mm, which occurred in 1994 at Hyderabad the highest temperature was 48.5 °C on 3 August 2004, at Nawabshah while the lowest temperature was 18.9 °C, recorded on 30 August 1972. The area's highest rainfall in 24 hours occurred on 3 August 1944, which is about 118 mm of rain.On average 2-4 rainy days in year and 2-3 thunders storm days in two years. During this month, in morning, wind normally blows from SE/SW direction with speed 10-16 km/hr and in afternoon, from the SE/SW with speed 18-22 km/hour,

September

The area can have some rains during this period. After the first two weeks, the monsoon completely withdraws from the area. The humidity in this month is 70–80%. The highest rainfall for September was 328 mm in 2011 at Nawabshah. The highest temperature was 45 °C 22 September 1974 at Hyderabad and the lowest temperature recorded was 14.5 °C on 23 September 1982.On average 1-2 rainy days in month and 1-2 thunder storm day in three years. During this month, in morning,

wind normally blows from SE/SW direction with speed 9-17 km/hr and in afternoon, from the SE/SW with speed 16-24 km/hour.

October

Hot weather has experienced during the month. October is one of the driest month in the area and very few occasion rainfalls recorded in this month. The highest temperature of 45 °C was recorded on 11 October 1949 at Hyderabad and lowest was 7.5 °C recorded on 30 October 1984. The highest monthly rainfall for October is 103 mm, which occurred in 2004 at Hyderabad. On average 1-2 rainy day in five years and one thunder storm day in ten years. During this month, in morning, wind normally blows from SE/SW direction with speed 6-12 km/hr and in afternoon, from the SE/SW to southwest with speed 16-24 km/hour.

November

November has warm days and cool nights. The driest month of the year recorded highest rainfall of only 33.7 mm, which occurred in 1984 at Hyderabad. The highest and lowest temperatures are 41 °C recorded on 4 November 1977 and 2.8 °C recorded on 28 November 1966 respectively.On average one rainy day in eight years and one thunder storm day in ten years. During this month, in morning, wind blow from NW direction and in afternoon, from NE/NW with speed 8-12 km/hour.

December

The month of December is the annual winter month and the weather remains cold. The sky remains partly cloudy for part of the month. Some rainfalls did happen in the area during the month of December due to the western disturbance. The highest monthly rainfall of 48.4 mm was recorded in 2008 at Nawabshah. The highest recorded temperature for December was 36 °C on 9 December 2003 at Hyderabad and the lowest temperature was -1.0 °C, which occurred on 31 December 1990 at Nawabshah. On average 1-2 rainy days in three years and one thunder storm day in five years. During this month, in morning, wind normally blows from N/NW direction with speed 3-6 km/hr and in afternoon, from the NE/NW with speed 8-12 km/hour.

Table 15: Normal Climate features of Hyderabad

Parameters/months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Maximum Temperature (°C)	*24.7*	*28.1*	*33.7*	*38.8*	*41.3*	*40.0*	*37.2*	*35.6*	*36.3*	*36.7*	*31.9*	*26.2*	*34.2*
Average Mean Temperature (°C)	18.0	21.0	26.2	30.9	33.3	34.0	32.4	31.1	31.0	29.6	24.8	19.6	27.7
Average Minimum Temperature (°C)	*11.4*	*13.9*	*18.8*	*22.9*	*26.1*	*27.9*	*27.6*	*26.5*	*25.4*	*22.5*	*17.4*	*13.0*	*21.1*
Monthly Average Rainfall (mm)	1.5	6.9	4.4	7.1	2.8	4.5	47.9	71.9	13.1	5.5	2.2	2.2	170.0

Rainy days (days)	*0.3*	*0.7*	*0.4*	*0.6*	*0.4*	*0.6*	*2.1*	*2.2*	*0.6*	*0.3*	*0.2*	*0.3*	*8.7*
Wind Speed (morning km/hr)	8.9	8.9	9.6	13.7	19.8	22.4	23.5	22.2	17.2	9.3	7.8	8.1	14.3
Wind Speed (evening km/hr)	*13.1*	*13.5*	*15.0*	*20.4*	*28.3*	*28.2*	*30.2*	*27.0*	*23.9*	*14.8*	*10.9*	*11.9*	*19.8*
Humidity (Morning %)	65.8	65.0	64.1	67.9	76.3	79.2	80.3	82.3	82.5	70.4	65.5	65.8	72.1
Humidity (Evening %)	*32.6*	*28.4*	*23.9*	*23.3*	*31.9*	*43.4*	*53.2*	*57.3*	*48.2*	*30.9*	*30.1*	*35.1*	*36.5*

Table 16: Normal Climate features of Nawabshah

Parameters/months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Maximum Temperature (°C)	24.5	27.9	33.8	40.3	44.2	43.9	40.7	38.8	39.0	37.7	32.3	26.1	35.8
Average Mean Temperature (°C)	15.4	18.0	24.0	29.8	34.5	35.7	34.0	32.3	31.5	28.0	22.4	16.9	26.9
Average Minimum Temperature (°C)	6.3	8.7	14.2	19.4	24.6	27.4	27.2	25.9	23.8	18.4	12.4	7.8	18.0
Monthly Average Rainfall (mm)	2.7	3.4	3.6	2.9	1.6	5.0	58.3	48.9	16.1	3.4	0.4	3.2	149.5
Rainy days (days)	0.1	0.3	0.1	0.3	0.4	0.3	1.5	1.4	0.6	0.1	0.0	0.2	5.3
Wind Speed (morning in km/hr)	2.6	2.8	3.1	4.3	7.8	12.2	12.0	10.6	8.5	3.3	1.7	2.2	5.9
Wind Speed (evening in km/hr)	7.4	8.0	9.1	10.2	12.6	16.5	16.9	15.2	12.8	7.4	4.4	5.9	10.6
Humidity (Morning in %)	84.8	80.7	76.7	70.8	69.5	74.3	79.4	82.5	83.8	83.0	83.9	85.1	79.5
Humidity (Evening in %)	43.1	37.4	33.5	28.4	26.4	34.2	48.8	52.8	44.5	36.8	39.1	43.9	39.1

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PART – II, Biological Environment

4.2 Biodiversity of the Proposed Route

4.2.1 Study Area

The study area comprised of the proposed 42" Gas Pipeline route by SSGC starting from MVA & SMS Pakland at Karachi which is zero point and lies in District Malir. It has been planned along the existing ROW of SSGC and passes mainly through Districts Malir (Karachi), Thatta, Jamshoro, Hyderabad, Matiari, Sanghar, Nawabshah, Khairpur (Southern region).

Figure 16: Location demarked as zero point.

4.2.2 Methodology Adopted

In order to compile the biodiversity in the vicinity of the proposed route by SSGC for laying the 42" Gas pipeline, the data and information were obtained from two sources viz. Secondary data from published literature and Primary data based on the field survey conducted along the said route from 30 to 31 October, 2015.

4.2.3 Field Survey

The field survey was conducted by a team comprising representatives of the consultant as well as Sui Southern Gas Company. The surveyed area comprised of three (03) segments as defined below:

Figure 17: Discussion during Field Survey

Segment-I: This segment begins from MVS,SMS Pakland in District Malir, Karachi and ends at SSGC Headquarter-III at Hyderabad. Its length is 127.955 km.

Segment-II: It starts from SSGC Headquarter-III at Hyderabad (Channage 128.20 km) and ends at SSGC Headquarter-II at Nawabshah (Channage 257.80 km) covering a length of approximately 130 km.

Segment-III: This segment commences from the boundary wall of SSGC Headquarter-II at Nawabshah (Channage 258.10 km) and completes the laying of proposed pipeline by SSGC at MVA & RS Nara (Channage 340.46 km).

4.3 Major Habitats (Bio-diversified Features of proposed Route)

The proposed LNG Pipline from Karachi to Nara (Sawan)falls under Saharo- Sindian region, and specifically passes through two main sub eco-regions i.e. Desert-Xeric Shrublands and Sub-Tropical Thorn area. The Desert-Xeric shrubland category includes districts of Malir-Karachi, Jamshoro,Sanghar, Khairpur. The eco-region of Sub-Tropical Thorn area includes rest of the districts i.e. Jamshoro, Hyderabad, Matiari, Nawabshah.

Figure 18: Saharo- Sindian region

4.3.1 Dersert-Xeric Shrublands

The habitat is typically influenced by extreme climate, mainly stretching over desert conditions. Because of low biomass productivity, the litter layer is almost non-existent with very low organic content of soil surface. The land is highly sensitive to grazing, burning, soil disturbance and other cover alteration. Soil restoration potential is very low with very slow regeneration capabilities. Temperatures range from freezing in winter to extremely hot (more than 46^0C) in summer. The desert vegetation is quite varied due to range of temperature with Prosopis shrubs being the characteristic species along with cacti species with specialized photosynthesis mechanism to store more water. The animals found in desert ecosystem (called xerocoles) evolved to survive in this unique environment because they do not sweat and can retain water in their bodies. Most animals found in hot desert are much smaller in size such as rodents, rabbits and lizards.

Figure 19: A typical representation of xeric conditions

4.3.2 Sub-Tropical Thorn Area

This type of habitat includes low, open and pronouncedly xerophytic species in which thorny leguminous species predominate. It occupies almost whole of the Indus plain except the driest parts. The climax tree species are Capparis, Salvadora, Tamarix, Prosopis and Zizyphus. The soils range from flat alluvial to heavy clays, loams and sandy loams. The climate varies from semi-arid (250 to 750 mm rainfall) to arid (less than 250 mm rainfall). The summer temperature in the tract is as high as 480 C. This tract provides an ideal habitat to the wildlife of the area which seasonally migrate according to their needs. Avifauna migration is from the lower hills towards the plains during cold winter in search of food and shelter, and from the flood plains towards the dry areas during floods and towards the rivers during the summer drought.

Figure 20: A typical representation of sub-tropical thorn conditions

4.4 Flora of the Area

The Project Area being part of the lower Indus basin the climate of the tract is semi arid, sub tropical, the original flora of the area consists of tropical thorn forest type vegetation, in which thorny usually hard wooded species predominate, acacia species being particularly characteristic. The trees have usually short boles and low branching crowns, which rarely meet except on exceptionally favorable spots. The usual height of tree is 6-10 m. Based on survey conducted through all three segments of the proposed LNG Pipeline Route from Karachi to NARA as well as information collected from secondary data, the major flora are given below in Table.

Table 17: Major Floral Species Found/ Reported along the Project Route Alignment.

##	Segment	District	Tree		Shrub		Herb	
			English/ Local Name	***Scientific Name***	***English/ Local Name***	***Scientific Name***	***English/ Local Name***	***Scientific Name***
1.	**Segment I**	**Malir& Thatta**	Neem	*Azadirachta indica*	Kikar/Devi	*Prosopisjuliflora*	KhiraWal	*Euphorbia hirta*
			Peepal	*Ficusreligiosa*	*Kikar/Devi*	*Prosopisglandulosa*	*LassiBhatter*	*Launaeanudicaulis*
			Kaner	*Nariumoliender*		*Euphorbia caducifolia -*	JandLani	*Zygophyllum simplex*
			Amaltas	*Cassia fistula*	*Khabar/ Pelu*	*Salvadorapersica*	-	
			GulMohar	*Delonixregia*	Booh	*Aervajavanica*	-	
			Champa	*Calophylluminc ophyllum*		*Sennaovata*	-	
			Babul	*Acacia nilotica*	Lani	*Salsolabaryosma*	-	
2.	***Segment I & II***	***Hyderabad***	*Babul*	*Acacia nilotica*	*Gaduri*	*Cordialatifolia*	-	-
			Kandi	*Prosopiscinerari a*	Ber	*Zizyphusnumularia*	-	-
			Bahan	*Populuseuphrafica*	-	-	-	-

			lai	*Tamarisk gallica*	-	-	-	-
			Jhao	*Tamarisk diocia*	-	-	-	-
			Peepal	*Ficusreligiosa*	-	-	-	-
			Neem	*Azadirachtaindica*	-	-	-	-
			Siras	*Albazialabback*	-	-	-	-
			Tamarind/ Imli	*Tamarandusindica*	-	-	-	-
3.	**Segment II**	**Matiari**	Kandi	*Prosopis cineraria**	Kander	*Alhaji maurorum*		
			Kikar	*Acacia nitolica*	*Khip*	*Leptadenia spartum*		
					Booi	*Aerva javanica*		
					Ber	*Zizyphus nummularia*		
					Lai	*Tamarix dioica*		
					San	*Salvadora oleoides*		
					Khabar	*Salvadora oleoides*		
					Akk	*Calatropis procera*		
					Sehwar	*Rhazia stricta*		
4	***Segment***	***Sanghar***	*Kikar*	*Acacia nitolica*	*Khabar*	*Salvadora*		

.	***II***					*oleoides*		
			Kandi	*Prosopis cineraria**	Ber	*Zizyphus nummularia*		
			Shisham	*Dalbergia sissoo*	*Akk*	*Calatropis procera*	-	-
			Neem	*Azadirachta indica*	-	-	-	-
			Khabar	*Salvadora oleoides*	-	-	-	-
			Sufaida	*Eucalyptus camaldulensis*	-	-	-	-
			Ber	*Zizyphus jujuba*	-	-	-	-
5	**Segment II & III**	**Nawab-shah**	Kikar	Acacia nitolica	-	-		
			Kandi	*Prosopisspecigara*	-	-		
			Peepal	Ficusreligiosa	-	-	-	-
			Sohanjro	*Hyperantherapterygosperma*	-	-	-	-
			Jhaun	Tamerixdioica	-	-	-	-
			Bahan	*Populuseuphratica*	-	-	-	-
			Babul	Acacia arabica	-	-	-	-
			Pilu	*Salavodoraeleoides*	-	-	-	-
			Shishum	Dalbergiasissoo	-	-	-	-
			Neem	*Azadirachtaindi*	-	-	-	-

				ca				
			Tamarind/ Imli	Tamarandusindica	-	-	-	-
6.	***Segment III***	***Khairpur***	*Kandi/ Sangri*	*Prosopis cineraria**	*Khip*	*Leptadenia spartum*		
			Babul	Acacia nitolica	Lai	Tamarix dioica		
			Neem	*Azadirachta indica*	*Akk*	*Calatropis procera*	-	-
					Khabar	Salvadora oleoides	-	-

4.5 Fauna of the Area

The common fauna of the project area and it surrounding are:

Mammals

Mammals found in the Project Area are mainly jackal (*Canisaureus)*, rabbit (*Lepusnigricollis).* Porcupine (*Hystrixindica*) and wild boar (Susscrofa) are common in the plains of Sindh. Domestic animals include cows, buffaloes, sheeps, goats, cats and camels. Another important domestic animal of the area is donkey, which is used for cart pulling.

Reptiles

Reptiles include snakes and small sized lizards which are a common sight in the area.

Rodents

Squirrel (*Funambuluslayardi*) and Mouse (*Musmusculus*) are the basic rodents found in the Project Area.

Amphibian

Toad (*Bufobufo)* and Frog (*Ranatigrina*) are commonly found in the Project Area.

Major fauna reported along the project route and its surrounding are presented district-wise in Table below:

Table 18: Major Fauna Reported along the Project Route Alignment

#.	Segment	District	Fauna	
			English/Local Names	***Scientific Name***
1.	**Segment I**	**Malir**	Deer	*Gazellabenetti*
			Wolf	Canislupuspellipes
			Jackal	*Canisaureus*
			Fox	Vulpesbenglenis
2.	**Segment I & II**	**Hyderabad**	Hyenas	*Hyaneahyanendae*
			Wolves	Canispalfipes
			Jackals	*Canisaureus*
			Fox	Valpesbengalensis
3.	**Segment II**	**Matiari**	Jackal	*Canisaureus*
			Rabbit	Lepusnigricollis
			Porcupine	*Hystrixindica*
			Snake	Elapidaebungaris
			Lizard	*Cnemidophorus spp.*
			Toad	Bufobufo
4.	**Segment II**	**Sanghar**	Rabbit	*Lepusnigricollis*
			Jackal	Canisaureus
			Indian Mongoose	*Herpestesjavanicus*
			Snake	Elapidaebungaris
			Frog	*Ranatigrina*
			Lizard	Cnemidophorus spp.
			Mouse	*Musmusculus*
			Indian Gerbil	Tateraindica

5.	**Segment II & III**	**Nawabshah**	Hyenas (hardly seen)	*Hyaneahyanendae*
			Wolves (hardly seen)	Canispalfipes
			Jackal	*Canisaureus*
			Fox	Valpesbengalensis
			Pig	*Susscrofa*
6.	***Segment III***	***Khairpur***	*Jackal*	Canisaureus
			Rabbit	*Lepusnigricollis*
			Pig	Susscrofa
			Porcupine	*Hystrixindica*
			Snake	Elapidaebungaris
			Frog	*Ranatigrina*
			Mouse	Musmusculus

Avifauna

Important resident bird species/avifauna found in the surrounding of the project area are house sparrow, common crow, kite, dove desert lark, cattle egret, etc. District-wise list of avifauna is mentioned in Table below:

Table 19: Major Avifauna Reported along the Project Route Alignment

#	Segment	District	Birds	
			English/Local Names	***Biological Name***
1.	**Segment I**	**Malir**	Grey Partridge	*Francolinuspondicerianus*
			Chest-nut-billed Sand Grouse	Pteroclespondicerianis
			Rock Dove	*Columbia livia*
			Eurasian Roller	Coraciasgarrulus
2.	**Segment I & II**	**Hyderabad**	Black Partridge	*Francolinusfrancolinus*
			Grey Partridge	Francolinuspondicerianus
			Buft-backed heron	*Bubuleus ibis*

			Mongolian Sand Ploves	Chariadriusmongolus
			Little Brown Dove	*Streptopeliasenegalensis*
			Koel	Eudrynamysscolopalae
			Indian scoopsowl	*Otusbakkamoena*
			Indian great hornedowl	Bubo bubo
3.	**Segment II**	**Matiari**	Sparrow	*Passer domesticus*
			Crow	Corvussplendons
			Dove	*Streptopeliadecaocto*
			Hoopoe	Upupae pops
			Grey Partridge	*Francolinuspondicerianus*
			Kite	Elanuscaeruleus
			Quail	*Cortunixcortunix*
			Common Myna	Acridotherestristis
4.	**Segment II**	**Sanghar**	Dove	*Streptopeliadecaocto*
			Kite	Elanuscaeruleus
			Little Cormorant	*Phalacrocoraxniger*
			Bulbul	Pycnonotuscafer
			Crow	*Corvussplendons*
			Sparrow	Passer domesticus
			Peddy Bird	*Ardeolagrayii*
			Grey Partridge	Francolinuspondicerianus
5.	**Segment II & III**	**Nawabshah**	Grey Partridge	
			Black Partridge	Francolinusfrancolinus
			Quail	*Cortunixcortunix*
6.	***Segment III***	***Khairpur***	*Sparrow*	Passer domesticus
			Crow	*Corvussplendons*
			Kite	Elanuscaeruleus

			Quail	*Cortunixcortunix*
			Black Partridge	Francolinusfrancolinus
			Dove	*Streptopeliadecaocto*

4.6 Endangered Fauna

4.6.1 Mammals

Some mammalian species which were once common in the area have become extinct or near extinction in the area on account of excessive shooting, hunting and loss of habitat. These include Blue bull, Wolf, Wild boar, Hog dear, Chinkara and Black buck.

4.6.2 Birds

Birds like Tilor (Houbara bustard), Marbled Teal (Marmaronettaangustirostris), Black partridge (Francolinusfrancolinus), JalKookri/Coot (Fulicaatra) and Falcon (Falco peregrinus) have been reported from the far surrounding of the proposed Pipeline. The above mentioned species of birds will not be impacted by activities of laying of the proposed pipeline.

4.7 Agriculture

During the survey along proposed route of LNG Pipeline in segment-I from Malir District to Jamshoro none of the major crops were seen growing. Since districts Hyderabad, Matiari, Sanghar, and Nawabshah are part of alluvial plain of Lower Indus Basin, the soil is very fertile and ideal for agriculture, it was observed that the proposed pipeline passes mostly through agricultural area in segment-II and on both sides of existing ROW, major crops seen were sugarcane, cotton and jowar. At several places where cotton had finished, fields were being prepared for next crops. The route falling under segment-III from Nawabshah to Nara is mostly barren and desert ecosystem prevails, hence there is no agriculture.

Table 20: Land preparation for agriculture

4.8 Horticulture

The orchids of main fruits observed along the proposed LNG Pipeline in segment-II were banana and mangoes. Cheeku, guava, jamun and papaya are aslo reported to grow in this segment. In addition to these fruits, flowers particularly roses are also grown in Hyderabad and Matiari.

Table 21: View of the Orchard Farms

4.9 Livestock

While surveying through the proposed LNG Pipeline, sheep, goat, cattle and buffaloes and poultry were observed.

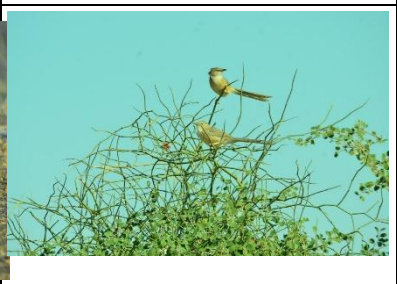
Figure 21: Livestock in the area

4.10 Representative Floral images along the Project Route Alignment

Trees		
 ***Acacia nilotica*** (L.) Delile	 ***Tamarindusindica***L	 ***Azadirachtaindica***Adr. Juss.
 ***Prosopis cineraria*** Lam	 ***Ficusbenghalensis***L.	 ***Meliaazedarach***L.
	 ***Zizyphusmauritaniana***Lam.	.
Shrubs		

 *Euphorbia caducifolia*.	 ***Cressacretica***L.	 ***Salsolabryosma***
 ***Calotropis procera***	 ***Tamarixindica***Willd.	 ***Tamarix pakistanica***Qaiser
	 ***Capparis decidua*** (Forsk.) Edgew	.
Herbs		
 ***Euphorbia hirta***L.		

4.11 Representative Faunal images along the Project Route Alignment

		
Red fox Den	Red fox foot marks	Indian desert gabrial
		
Monitor lizard		Spiny tailed lizard
		
Black crown finch lark	Black drongo	Crested lark
		
Grey partridge	Common babbler	Grey shrike
		
Chesnut shoulder petronia		

	Common mayna	Indian roller

4.12 Protected Areas along the Project Route Alignment

The ROW of proposed pipeline is at a safe distance from various protected areas. These include following:

- Haleji Lake
- Nara game reserve.
- Pai game reserve.
- Deh Akro Wildlife sanctuary.

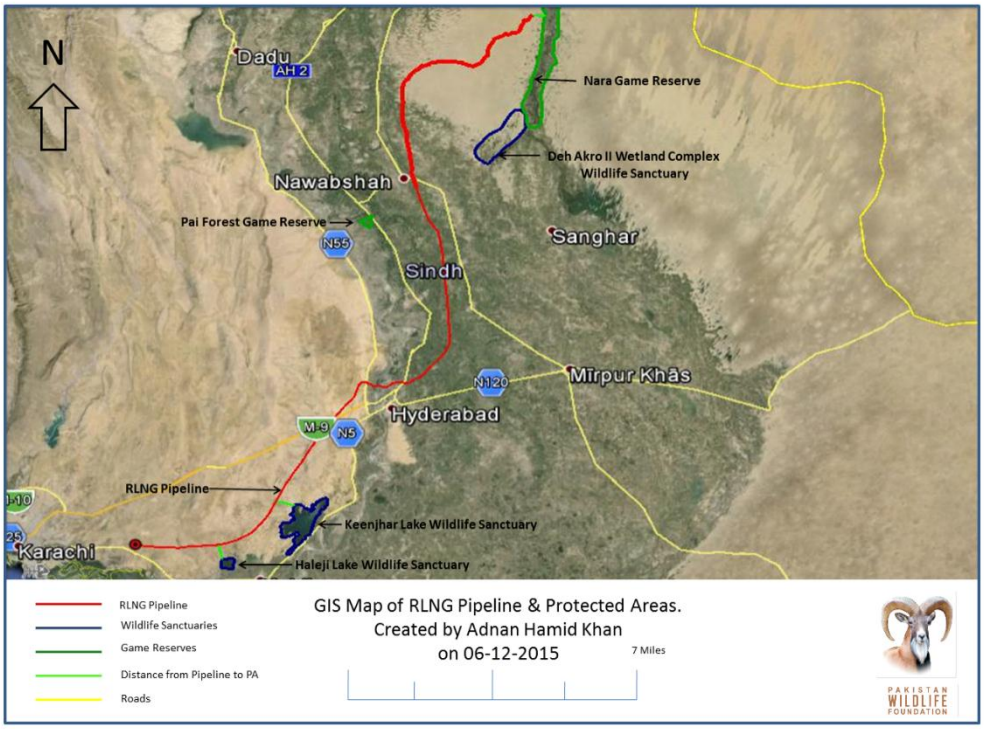


Figure 22: Map showing pipeline and nearby protected areas.

4.12.1 Haleji Lake and ROW

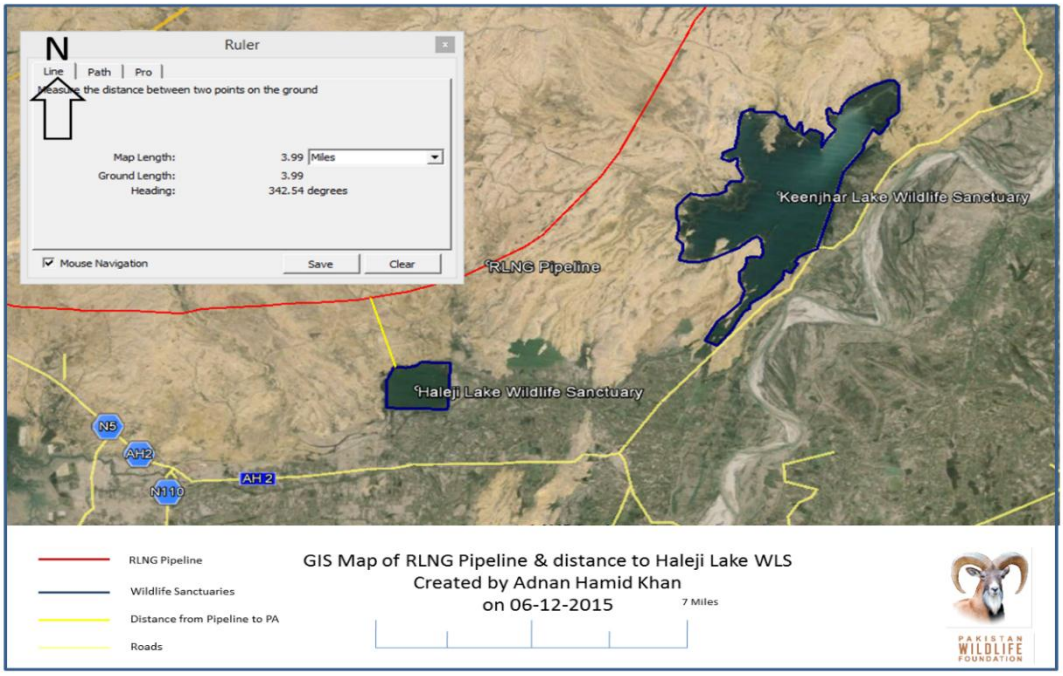


Figure 23: Pipeline distance from Haleji Lake

4.12.2 Nara game reserve and ROW

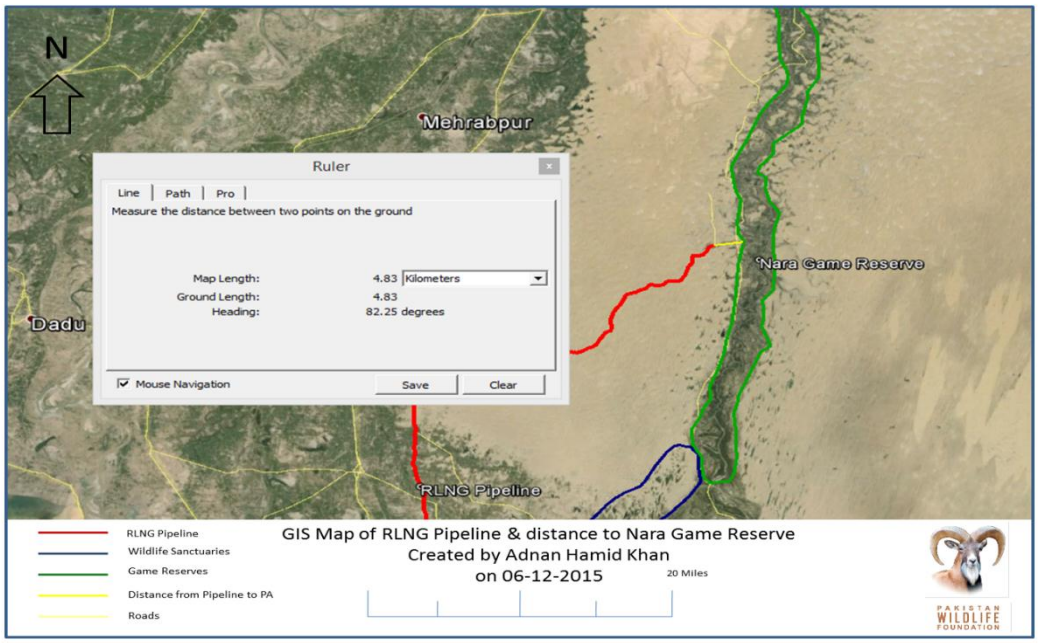


Figure 24: Pipeline distance from Nara Game Reserve

4.12.3 Pai game reserve and ROW

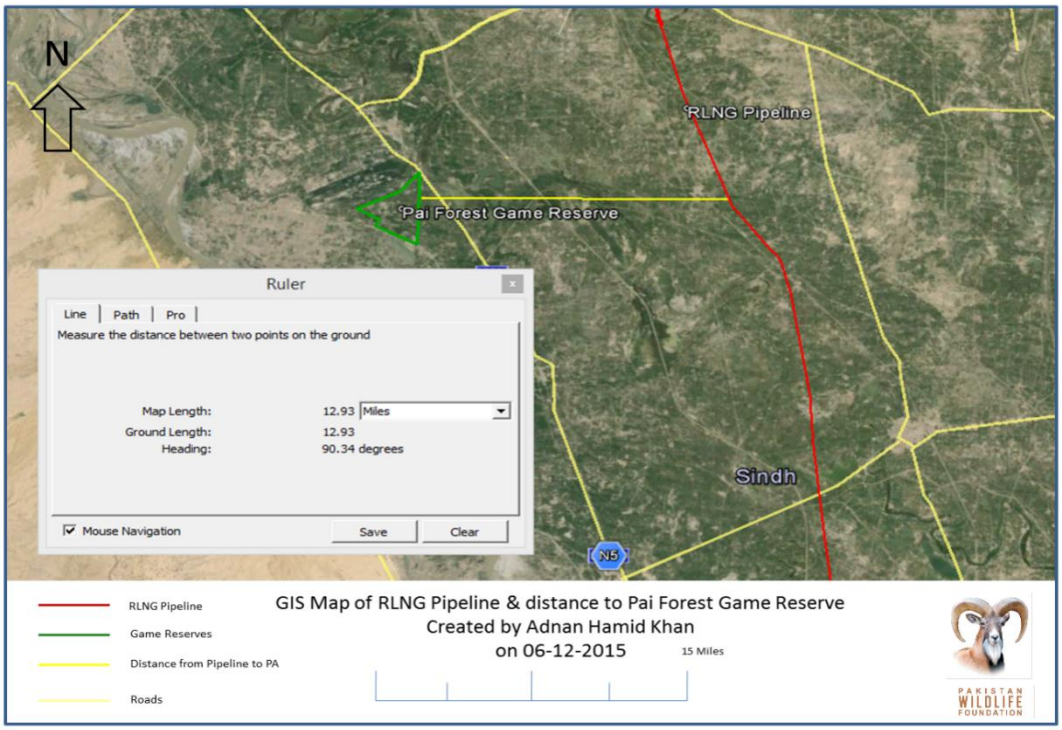


Figure 25: Pipeline distance from Pai Game Reserve

4.12.4 Deh Akro Wildlife Sanctuary and ROW

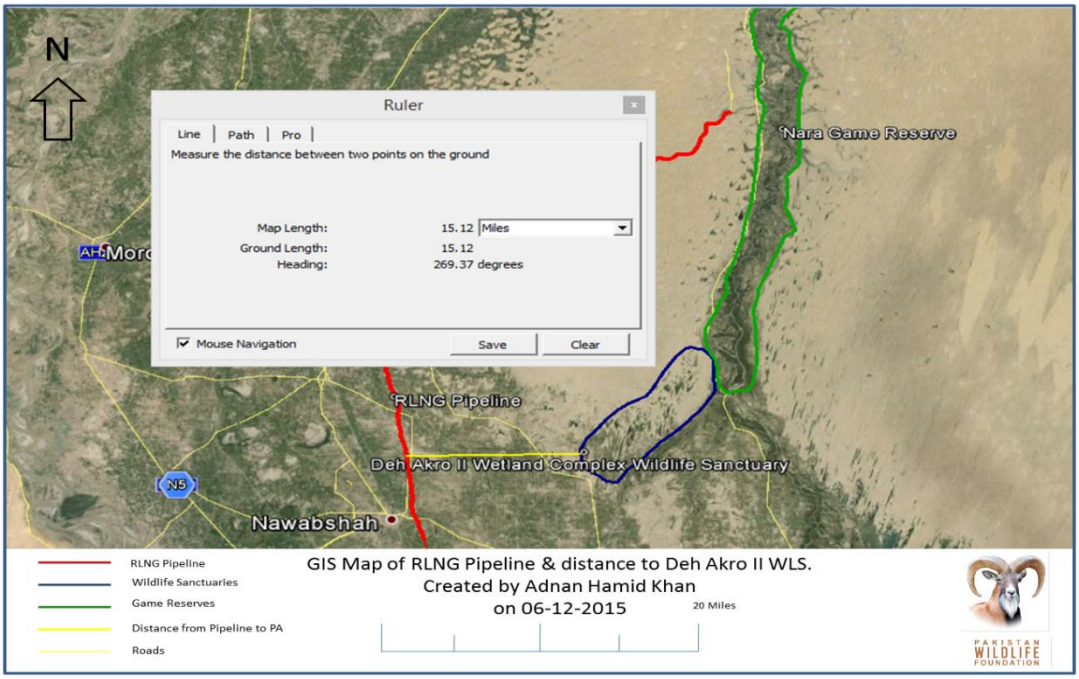


Figure 26: Deh Akro Wildlife Sanctuary

CHAPTER 5: STAKEHOLDER CONSULTATION

5.1 General

Stakeholder consultation is a means of involving all primary and secondary stakeholders in the Project's decision making process in order to address their concerns, improve project design and give the project legitimacy. Stakeholder consultation, if conducted in a participatory and objective manner, is a means of project sustainability.

Community input (both of knowledge and values) on socioeconomic and environmental issues can greatly enhance the quality of decision-making. Stakeholder consultation is to be conducted in the project area not only to satisfy the legal requirements of the EIA process in Pakistan, but also to improve and enhance the social and environmental design of the project.

5.2 Objectives of Stakeholders Consultation

The process of public participation and consultation was endorsed in the United Nations Conference on the Environment and Development (UNCED) in 1992 through one of the key documents of the conference which is Agenda 21. This Agenda 21 is a comprehensive strategy for global action on sustainable development and deals with issues regarding human interaction with the environment. It emphasizes the role of public participation in environmental decision-making for the achievement of sustainable development. Through the public consultation process, one hopes to:

- Promote better understanding of the project, its objective, and its likely impact.
- Identify and address concerns of all interested and affected parties of project area.
- Provide a means to identify and resolve issues before plans are finalized and development commences, thus avoiding public anger and resentment and potential costly delays.
- Encourage transparency and inculcate trust among various stakeholders to promote cooperation and partnership with the communities and local leadership.

5.3 Consultation Process

Stakeholders are consulted during informal and formal meetings held in the project area. The consultation process will be carried out in the Sindhi and Urdu languages. During these meetings a simple, non-technical, description of the project will be

given, with an overview of the project's likely human and environmental impact. This will be followed by an open discussion allowing participants to voice their concerns and opinions. In addition to providing communities with information on the proposed project, their feedback will be documented during the primary stakeholder consultation. The issues and suggestions raised will be recorded in field notes for analysis and interpretation.

By reaching out to a wider segment of the population and using various communication tools—such as participatory needs assessment, community consultation meetings, focus group discussions, in-depth interviews, and participatory rural appraisal—EIA will involve the community in active decision-making. This process will continue even after this EIA has been submitted, as well as during future EIAs in which similar tools will be used to create consensus among stakeholders on specific environmental and social issues in the context of a proposed project.

Stakeholder consultations are more formal with representatives from Government departments including NHA, Pakistan Railways,Sindh Highway Department ,IRSA,Sindh Irrigation Department, Sindh Wildlife Department and KWSB. They have been already briefed on the EIA process, the project design, and other technical details by SSGC.

5.4 Project Stakeholders

A number of key stakeholders were consulted during the project. These included the following:

Table 22:Table of Key Stakeholders

S.NO	KEY STAKEHOLDERS CONSULTED
1.	National Highway Authority (NHA))
2.	Provincial Highway Department
3.	Provincial Irrigation Department
4.	Wildlife Department
5.	Local administration.
6.	Local community

5.5 Stakeholders Consultation Technique/Program

For consultation with Government departments a letter was sent to all the concerned departments inviting their feedback/concerns /suggestions regarding the Social and Environmental Impacts of the project. Copy of the letter is placed at

Annexure L.This purpose of the letter to the concerned officers to in keep them well informed regarding the purpose of the visiting EIA team.

A number of brief consultations with community people were also arranged during the two site visits of the ROW. It was through brief informal interview with hotel owners, shopkeepers and residents of the area. It was conducted near Nawabshah City on Sanghar Road, Petaro Road and at Massu on M-5 Highway. In some or all of the project and its planning process. It is important to be aware of how different power relations can distort participation. It is also important to examine how community skills, resources, and 'local knowledge' can be applied to improve project design and implementation. All of this can be achieved by careful use of the various tools of Stakeholder Consultation mainly by having informal meetings with communities in villages. In recognition of the diversity of views within any community, it is very important to obtain a clear understanding of the different stakeholders and to analyze their capacity and willingness to be involved.

SSGC is already signing agreements with all the concerned Government departments for using their premises for the laying of the RLNG Pipeline. Copies of correspondence already done in this regard is placed at Annexure M to S .Stakeholders survey form that will be used for consultation with the Government departments and individual stakeholders is given at Annexure T.

5.6 Stakeholders Concerns and Recommendations

5.6.1 Consultations with Government Officials / Engineers

The Consultants team met following officials of the government departments and following stakeholders were consulted during the visit:

Table 23: Consultations with Government Officials / Engineers

S NO	NAME	DESIGNATION	DEPARTMENT	DISTRICT
1.	Mr. Asif Masood Memon	Deputy Director-Maintenance	National Highway Authority	Hyderabad
2.	Mr. Jamal Yousuf	Project Director-M9	National Highway Authority	Hyderabad-Karachi
3.	Mr. Shakeel Abro	Addl: Deputy Commissioner	District Management	Hyderabad
4.	Ghulam Ahmed Gaddani	Deputy Conservator	Wild Life Department	Hyderabad
5.	Mr. Muhammad Asif	Assistant Executive Engineer	Coastal Highway	Thatta

6.	Mr. Ashfaque Nooh Memon	Executive Engineer	Nasrat Division, Irrigation Department	Shaheed Benazirabad
7.	Mr. Zulfiqar Ali Khoso	Assistant Executive Engineer	Canal Division Irrigation Department	Shaheed Benazirabad
8.	Mr. Gobind Chattwani	Superintending Engineer	Highways Circle	Shaheed Benazirabad
9.	Mr. Ismail Rajper	Assistant Executive Engineer	Highways Department	Shaheed Benazirabad
10.	Mr. Muhammad Nawaz Sohoo	Deputy Commissioner	District Management	Shaheed Benazirabad
11.	Ghulam Hussain Khatti	Assistant Executive Engineer	Highways Department	Matiari
12.	Ghulam Muhammad Qureshi	Assistant Executive Engineer	Highways Department	Matiari

The main points generally told and agreed upon by majority of the respondents revolved around the following issues and facts:

a) Benefits Of The Project

There was a consensus among the respondents that certainly the project would help in creation of job opportunities. A number of the respondents emphasized that local population should be given preference in jobs related to the project. This would create a lot of confidence among the local people and would result in raising the their standard of living. One of the respondent advised that at least 20% of un-skilled jobs should be reserved for Local people. The project would also result in the development of other infrastructure elements in the area as well as an economic boom. The gas supply position in the country would increase as a result of this project was a point of agreement among all the participants.

b) Damage to Farms

Some of the respondents were of the view that as a result of the project activity there are possibilities of damage to certain farms located on the way. Proper compensation is must for all such damages. Fears of damage to farmland due to water and air pollution as well as related health issues are there. SSGC to make special arrangements for the same.

c) Sustainability of the Project

One of the respondents was of the view that the project should meet the criteria of sustainability , both in terms of operations and maintenance and should complete well in time. The project being of paramount importance for national energy security would definitely be sustainable in all respects.

d) Locations of Camps

The construction camps alongside the under construction M-9 should be located well outside the right of way of the Motorway.

e) Depth for HDD

For HDD method, sufficient depth should be provided while laying the pipeline under the major highways so as to keep the roads in safe conditions.

f) Construction Under Canals

SSGC should keep a proper depth of at least 10-15 feet minimum for laying the pipelines underneath the canals. Extra care should be taken for keeping the canals in safe conditions. SSGC should need special consideration while working on canals in-case of any mishap/leakage. Any major leakage would adversely affect not only the canals but also the adjoining areas resulting in air and water pollution and related health issues. During Construction, welding work requires extra care for the protection of the canals system. SSGC has already coordinated with Irrigation department in this regard as acknowledged by the Irrigation Engineers during the consultation process. Before the start of the actual construction work meeting between engineers of SSGC and Irrigation Department is required.

g) Construction under Roads

SSGC should make strong communication between NHA before the starting of work on NHA jurisdiction. There are chances of air pollution during construction work near the populated areas because of use of heavy machinery and generators. SSGC should take extra measures in this regard. SSGC Should manage proper dust emissions to keep the environment safe and clean for human being as well as species in the area. SSGC should plan a joint site visit before the start of construction to keep NHA-M9 staff well informed. In this regard meetings with FWO staff is also required. Sign indicators should be properly used for the information of commuters and pedestrians and to create a safe working environment. SSGC should make regular contact with Executive Engineer or Sub-Division Assistant Executive Engineer at least 2-3 days before starting the work. SSGC should use sign indicators, marking with reflector during construction work. SSGC should have a comprehensive plan to face any mishap as a result of earthquakes during construction and operation phase of the pipeline. SSGC should barricade in a proper manner the material during the construction work.

h) Coordination With District Management

SSGC should make strong coordination with district management before starting the work and remain in continuous contact during the construction phase.

5.6.2 Consultations with Communities

During the consultation process three communities were interviewed as detailed below:

a) Community interviewed at Village Chakar Khan Rajar- Petaro Road, Jamshoro.

Table 24: Interview with Villagers

S. NO	NAME	QUALIFICATION	AGE (YEARS)	PROFESSION	AREA, DISTRICT	OWN LAND
1.	Mr Ghulam Muhammad	Primary	35	Hotel owner	UC – Petaro, Jamshoro	Yes
2.	Ayaz Ali	Metric	31	Petrol pump worker	UC – Petaro, Jamshoro	Yes
3.	Jalaluddin Rajar	Metric	30	Farmer	UC – Petaro, Jamshoro	Yes
4.	Ali Muhammad Shaikh	Primary	60	Farmer	UC – Petaro , Jamshoro	Yes
5.	Rameez Rajar	Primary	28	Farmer	UC – Petaro , Jamshoro	Yes

Baseline Status:

Village

A. Homes= 500

B. Population= 5000

C. Utilities

- Electricity-Yes
- Gas Supply- Yes
- Water Supply –Yes, but not clean
- School- Primary only
- Dispensary- No

D. Agricultural Cultivation Products

- Wheat
- Katti

- Joar
- Jantar

E. Vegetables

- Tomato
- Potato
- Onion
- Ladyfinger

Suggestion:

a) For employment SSGCL should prefer local people for un-skilled and semi-skilled employment.A number of villagers have experience of working at Jamshoro power plant and local factories as Foreman,,welder, fabricators as well as some of them are qualified and eligible for clerical work.
b) Sufficient compensation should be provided to the landowners for land acquisition.
c) After finalization of the work excavated material should be settled and the excavated land should be leveled accordingly.
d) All of the respondents were well informed about the project as they had earlier interacted with the survey party.

B) Community Interviewed At Hattri, Hyderabad On Hyderabad – Nawabshah Road (N5 Highway):

S. NO	NAME	QUALIFICATION	AGE (YEARS)	PROFESSION	AREA, DISTRICT
1	Muhammad Azeem Halepoto	B.com	40	Government Teacher	Hattri, Hyderabad
2	Abdul Aziz	Primary	40	Security Guard	Hattri, Hyderabad
3	Ghulam Mustafa	B.A	30	Private company worker	Hattri, Hyderabad
4	Sardar Papu Khan	Metric	29	Hotel Owner	Hattri, Hyderabad

Baseline Status:

A. Utilities

- Electricity-Yes
- Gas Supply- Yes
- Water Source- Bore water
- Dispensary- Yes
- School - Yes

Suggestion:

a) For employment SSGCL should prefer local people for un-skilled employment.
b) SSGC should take care of local culture and norms during the construction of pipeline.
c) SSGC should take care of wildlife in the area as well as domestic animals of the villagers during the construction work.
d) The respondents were aware of the upcoming project of the gas pipeline.

C) Community Interviewed At Nawabshah Sanghar Road (Closed to the ROW)

S. NO	NAME	QUALIFICATION	AGE (YEARS)	PROFESSION	AREA, DISTRICT
1	Zulfiqar	Matric	29	Hotel Owner	Nawabshah
2	Mohammad Khan	8th Pass	31	Chowkidar	Nawabshah
3	Asif Ali	Illiterate	38	Labour	Nawabshah
4	Nasrullah	8th Pass	54	Shop keeper	Nawabshah
5	Muneer Ahmed	Illiterate	34	Labour	Nawabshah

Baseline Status:

B. Utilities

- Electricity-Yes
- Gas Supply- No
- Water Source- Bore water
- Dispensary- Yes
- School - Yes

Suggestion:

a) Provision of semi skilled and unskilled jobs for the local labour
b) SSGC should take care of grazing livestock in the area during the construction work any accidental killing of livestock should be compensated accordingly.
c) Pipeline laying activities create lots of dust near farmlands, extra care should be taken for the protection of orchids from dust
d) Left over extracted material shall be removed at the completion of the activity
e) As the adjoining villages have no provision of natural gas, the villagers be provided gas connections.

Table 25:Public Consultation with Local villagers and other agencies

	**Consultation With Elders And Local People**
	**Meeting With Local Representatives At Sui Gas Stop, Sanghar**
	**Consultation with Local Representatives at Village UC-Petaro, Jamshoro**
	**Meeting with Local Representatives at Hattri, Hyderabad**

CHAPTER 6: ANTICIPATED ENVIRONMENTAL IMPACTS & THEIR MITIGATIONS

6.1 General

Mitigation measures with respect to identified anticipated impacts are of major concern. The site selection, construction work and operation of project activities are likely to affect, the surrounding environment to very minor degree. The purpose of the EIA is to quantify the impact and ensure that changes to the environment fall within acceptable pre-defined limits and to give the environment its due place in the decision-making process by clearly evaluating the environmental consequences of the proposed activity. The potential adverse effects of project includes water pollution, air pollution, soil contamination etc.

By suitable means, the impact of all the identified environmental concerns of the environment should be assessed both during construction phase and operational phase and suitable mitigation measures against the potential adverse impacts should be considered such that an effective EMP can be prepared and its strict implementation adhered to during the project construction and operational phases. Early identification and characterization of critical environmental impacts allows for the environmental acceptability of the proposed developmental project.

6.2 Analysis Methodology

In order to evaluate the issues posing as potential impacts and to determine the likely outcome of those impacts when compared to the local conditions, the common significance criteria has been developed. This EIA incorporates the relevance and intensity of impacts criteria to evaluate the severity, which enables efficient identification and focus on those resources most likely to be impacted by the proposed Pipeline Project. Intensity criterion has been established to analytically classify whether potential impacts would most likely be positive, or negative. Negative impacts have been further classified as very high, high, moderate or low. Similarly, relevance criteria divided into four categories i.e. rare, possible, likely and certain. Following Table below illustrates the criteria and Table below describes to classify the impact evaluation.

Table 26: Criteria for Impact Evaluation

Relevance	Low (1)	Moderate (2)	High (3)	Very High (4)
Rare (A)	*I*	*L*	*L*	*L*
Possible (B)	L	M	M	M
Likely (C)	*L*	*H*	*H*	*H*
Certain (D)	L	H	C	C

6.3 Pipeline Route Segments

The total length of this pipeline project has been divided into three segments (sub projects) based on convenient landmarks, terrain, logistics and way points available along the route. These divisions are as follows:

- Segment – I. 124KM from Karachi (SMS Pakland) to Hyderabad.
- Segment – II. 131 KM from Hyderabad to Nawabshah.
- Segment – III. 82 KM from Nawabshah to Sawan (RS-Nara).

6.4 Beneficial Impacts

The Project will have a number of significant positive impacts on national as well as local community economy that provide a clear justification for the project and, in certain aspects, off-set some of the negative impacts. Some of upfront positive impacts are provided below and thereafter socio-economic benefits are given:

- At National level, the project will help in curtailing the ongoing energy crisis.
- Helping reduce greenhouse gas emissions;
- Poverty alleviation, through gender micro financing schemes and jobs to the locals will be boosted;
- Accessibility of gas to settlements;

6.5 Design Phase

Impact and Mitigation

The Design phase involves proposals/ alternatives for optimizing the route and latest construction methodologies to be employed to cross various sensitive water bodies, major road/railway crossings, National Parks (areas of high conservation value), while avoiding Geo-hazards (Faults). Other factors included are logistics, land acquisition issues, rehabilitation, resettlement, security issues, etc. with the aim to minimize the resulting Impacts as far as possible. It also takes into account certain

technical aspects to be adopted to minimize the noise pollution and air pollution impacts, simultaneously. The Impact evaluation of this stage has been based on an assumption that there are no mitigation measures being taken so far.

6.5.1 Rivers & Streams Crossings

The pipeline transverses through different waterways and rivers along the pipeline route corridor. The specific design method to cross such waterways along the pipeline route depends on the extent and location of the waterway and final approval of EPC Contractor. However, preferred method should incorporate the most appropriate state of the art techniques reducing the roam for project delays/accidents/ increased costs.

Various methods are available for crossing the pipeline through rivers and streams i.e. HDD and Open Cut. HDD method requires extensive technology, scour calculations, and a substantial budget. It is basically a trenchless excavation process, utilized in constructing river and stream crossings for high pressure gas pipelines. Installation of a pipeline by HDD involves drilling a small diameter pilot hole along a designated directional path and then enlarging this pilot hole to a diameter which can accommodate the pipeline; the pipeline is then pulled back into the enlarged hole to cross the waterway Open cut method is a technique used in pipeline construction over a river crossing by cutting a trench into the river bed; although cheaper, it can result in severe impacts as this method may damage the river water quality.

Mitigation

- HDD method seems to be the less hazardous, more feasible option for river and stream crossings in terms of cost, technology and minimal impacts to the water quality of the water way being crossed;
- After applying the appropriate mitigation measure, the severity of the impact will become moderate.

6.5.2 Major Road / Railway Crossings

There is a mix of major highways and roads that pipeline will cross. There are many methods available for pipeline construction over road and railway crossings. These methods may be required to be re-evaluated and analyzed for the purpose of security concerns, affects on local water resources and more importantly cost.

Mitigation

- Road crossings of Highway is proposed to be trenchless method (Auger boring);
- Other road crossings are proposed to be open cut (crossing can very often be installed in one working day and the road or ditch temporary reinstated

sufficiently to fulfill the function for which it is required prior to the crew-leaving site for the day) depending on the requirements of the road authorities;

- Railway tracks to be crossed by the pipeline are proposed to be crossed by employing HDD or Open-cut method. The crossing design optimizes the depth of the pipeline at such crossings in order to maintain the integrity of the Railway crossing safety;
- After applying the appropriate mitigation measure, the severity of the impact will become further low.

6.5.3 Compressor Station – Noise & Air Emissions

The relevant sources of air and noise pollution within the CS's are listed below:

Air

- Exhaust stack of the Turbo Compressor units;
- Power generation units;
- Vents stack emergency or maintenance venting.

Noise

- Turbo compressor;
- Control Valves;
- Anti-Surge Valves;
- Gas Coolers;
- Natural gas process piping;
- Waste heat recovery unit;
- Instrument air compressors;
- Power generation.

NEQS defines the limits for industrial gaseous emissions for Carbon Monoxide, Oxides of Nitrogen and Sulphur Oxides as well as noise emissions. If above identified sources emit the emissions not meeting the NEQS, it would generate an adverse impact on human (residents of stations), health, and wildlife and nearby residents, therefore, the impact consequence is very high and likelihood most probably would be likely. The overall impact severity has been worked out to be high.

Mitigation

- Natural gas to be utilized as fuel gas for the TUCO units;

- Gas turbine models from various vendors to be obtained for meeting or to fulfill the NEQS requirements;
- Power generation units emission to be guaranteed by the supplier to be within the NEQS limits;
- Normal operation does not release any natural gas;
- Best way to minimize the noise reduction is directly at the source, therefore, vendor should apply the equipment considering the NEQS limits- noise enclosures of compressors are installed;
- Consider the possibility of installation of an additional attenuation device to reduce the noise level;
- Reduction in noise levels can be achieved by installing noise barriers as a wall or earth wall against the sensitive areas; and
- After applying the appropriate mitigation measures, the severity of the impact will be brought down to moderate.

6.5.4 Wastewater disposal for Camps and Compressor Station

There will be one compressor station and 3 major camps to be developed. Approximately 3,000 workers will be stationed in these camps including various other facilities such as vehicles; equipment etc. Similarly is the case with Compressor Station which will have generators, residential area, vehicles, vents, repair workshops etc. All such facilities directly or indirectly will generate effluent that if not properly disposed will have a negative impact.

The assessment reveals that likelihood of this impact is tagged as likely, the consequence of this impact would be high, and therefore the overall impact is assessed to be of high severity.

Mitigation

- All the waste discharge shall be in accordance with WHO and NEQS guidelines;
- For camps, design should include provision of septic tanks and soak pits for effluent treatment;
- For CS's containerized sewage treatment plants are foreseen; and
- After applying the appropriate mitigation measures, the severity of the impact will decrease significantly to low or moderate.

6.6 Construction, Operation and Maintenance Stage

Land use Impact

Most of the land along the pipeline is barren and waste area. There are some areas of agricultural fields and trees. Some land clearance may also alter the land use but not significantly. The effect of clearance of pipeline route in the flatter areas, may be of moderate intensity. Interestingly, clearance of ROW will not adversely affect the present land use. There exists a risk of contamination of land due to inadequate disposal of liquid waste or accidental spill of chemical or oil especially in the vicinity of proposed construction camps The likelihood of preparation of ROW is *certain* and the consequence is *low* in this segment. Therefore overall severity of the impact is *low.*

Mitigation

- Barren and waste land should be preferred for establishing contractor's facilities;
- The temporary corridor of works will be fenced to prevent people and animals gaining access to the ROW, Compressor Station, contractors camp sites;
- During Trenching the top soil will be kept on site and reinstated back at the completion of project activities;
- Maintain good housekeeping to avoid any accidental spills;
- No agricultural land should be acquired for borrow area and for establishment of EPC contractor's facilities;
- During trenching the top soil will be kept on site and reinstated back at the completion of the project activities;
- Excess spoil to be disposed off at designated places only; and
- By applying the appropriate mitigation measures, the severity of this impact will be reduced to a very low value.

Soil Erosion Impact

Soil erosion can be an issue in areas of highly erosive soils and in areas without vegetation cover (Flat terrain). Construction activities could lead to an increase in erosion and sedimentation, including soil loss from exposed surfaces, compacted soils, soil stockpiles and backfilled areas. This potential erosion of soil could be caused by the intensive excavation works for Compressor Station, for pipeline trenching, tree stumps etc. (performed typically through heavy construction machinery) and movement of other vehicles near the ROW. Before the subsequent backfilling and reinstatement starts, implications could persist as use of land for rehabilitation becomes difficult if nutrients are lost in the top-soil due to soil erosion and hinders re-vegetation Therefore adverse accelerated impacts on the soil quality, increased risk of land slippage and physical scarring of landscape, within the ROW in

this segment might be observed during the construction phase. The possibility of Soil erosion in this segment can be aggravated; as there are three Contractor's camps to be developed here as well. The likelihood of this impact is *possible* and the consequence is of a *moderate* value as the area is mostly flat and barren therefore the overall severity of this impact has been calculated as *moderate*.

Mitigation

- To minimize damaging exposure of the excavated soils while they are in storage, the trench will be back-filled as quickly as possible after each pipeline section is installed;
- The excavated soil/borrow material will be disposed, off site to avoid disturbance to natural drainage;
- Adequate drainage system will be provided especially at streams/river crossings to ensure the surface water flow is not interrupted or diverted due to the project activities and constituting contractor's facilities to avert soil erosion in plain areas;
- By applying the appropriate mitigation measures, the severity of this impact will be reduced to a low value.

Soil Degradation Impact

During the construction phase, adverse impact to soils could occur from a spill or leakage of the supply tanks during transport, transfer or storage of the fuel/chemicals in this flat and barren area. If fuel comes in contact with the soil from a spill or leak the duration of contamination would depend on the specifications of the fuel and the quantity spilled. A second tier tank can contain the spill from the main tank hence the duration of impacts to soil could be limited under normal circumstances. But such spills could potentially raise the pH levels in the soil degrading the quality and may mobilize into the surrounding water bodies with surface water flow or infiltration to the groundwater causing severe deterioration.

Because of the frequent movements of trucks plus materials storage containers along the construction site access roads, Compressor Station, running of heavy machinery near Dump sites and Contractors camps, the likelihood of a leakage or accidental spill of oil or chemicals is *possible*, the consequence of this activity *moderate*. Therefore, the overall severity of the impact on the soil from fuel contamination is *moderate*.

Mitigation

- Loading & unloading of fuel and various materials should be controlled by a competent person;
- Maintain good housekeeping to avoid any accidental spill;

- Applying speed limits and other measures through sign boards and incurring penalties, if required;
- Bulk storage of lubricants and fuels will be permitted only within the designated places;
- Fuel tanks must be properly marked by content and chemicals; Drip trays will be required to contain any leaks under stationary vehicles, items of plant and large vehicles carrying such fuels;
- Inspection for any leaks should be carried out on a daily basis;
- Provide spill kit near oil storage area i.e. sand bags, absorbing pad, shovels etc.;
- Any soil contaminated at the site will be removed and disposed of at the landfill, waste pit or burn pit, as appropriate; and
- By applying the appropriate mitigation measures, the severity of this impact will be reduced to a low value.

Noise and Air Impacts

The Construction activities at the work site may generate noise nuisance as high as 85 decibels (A distance of 350m to 400m is needed to reach the WB/NEQS daytime guideline level of 55dBA for residential receptors) while movement of motor vehicles/large machinery for earth moving (open cut) activities produces toxic dust emissions. The expected level of construction noise and associated activity will cause a few impacts on the grazing and natural habitats of mammals (sheep, goats, cows, camels), and birds to be temporary affected during the construction stage. The health of workforce might also be adversely affected due to the noise nuisance and deteriorating ambient air quality. The likelihood of this impact is *likely* while the consequence of this impact may prove *high*. The overall risk severity is calculated to be *high*.

Mitigation

Movement of Machinery to CS site, pipeline ancillary facilities and along access roads area to the pipeline should be kept to a minimum during work hours to avoid impacts on residential and protected areas;

- Plant and equipment will be maintained and tuned on regular basis to minimize noise pollution;
- Control of vehicular speed and strictly follow the specified speed limit;
- Compliance of vehicles with national air emissions standards (NEQS);

- The noise levels should be monitored on regular basis and levels should be maintained within the NEQS level;
- Regular spray of water (twice a day) will be carried out to minimize the dust pollution; and
- By applying the appropriate mitigation measures, the severity of this impact will be reduced to a moderate value.

Table 27: Impacts Identification Matrix

Activities	Environmental Attribute							
	Air	**Noise**	**Surface Water**	**Ground water**	**Climate**	**Land & soil Ecology**	**Socio Economics**	**Aesthetics**
Pre and Construction Phase								
Site Clearing	Yes	Yes	-	-	-	Yes	Yes	-
Vehicular Movement	Yes	Yes	-	-	-	Yes	-	-
Preparation (indirect)	-	-	-	-	-	Yes	-	-
Construction activities (Digging/trenching)	Yes	Yes	-	-	-	Yes	-	-
Operational phase								
Operation of DGs	Yes	Yes	-	-	Yes	Yes	-	-
Solid waste disposal (indirect)	Yes	Yes	Yes	Yes	-	Yes	-	-
Wastewater disposal	-	-	-	Yes	-	Yes	-	-
Storage and handling of pipes and other raw materials	Yes	Yes	-	-	-	Yes	-	Yes
Vehicular Movement	Yes	Yes	-	-	-	Yes	-	-
Air Emissions compressor station	Yes	-	-	-	-	-	-	-

Table 28:Environmental Impacts from Pre-Construction and Construction Activities

Activity	Environmental Attributes	Cause	Impacts Characteristics			
			Nature	**Duration**	**Reversibility**	**Significance**
ROW clearing	Air Quality (SPM and RSPM)	Dislodging of particles from the ground	Direct Negative	Short term	Reversible	Low, if Personnel Protective Equipment (PPE) are used
	Noise levels	Noise generation from earth excavating equipment	Direct Negative	Short term	Reversible	Low, if PPE are used by workers
	Land Use	Industrial land use	Direct Negative	Long Term	Irreversible	Low
	Ecology	Removal of vegetation and loss of flora and fauna	Direct Negative	Long Term	Reversible	Low (No cutting of trees and shrubs)
Transportation of construction material	Air Quality (SPM SO2, NOx, CO)	Transport of construction material in trucks & Exhaust emission from vehicles	Direct Negative	Short term	Reversible	Medium if regular emission checks are performed
	Noise levels	Noise generation from vehicles	Direct Negative	Short term	Reversible	Low if regular vehicle maintenance is done.
	Risk	Risk of accidents during transit	Direct Negative	Long Term	Irreversible	Low, if safety measures are taken to prevent accidents
Construction activities / Pipe laying activity	Air Quality (SPM, SO2, NOx, CO)	Operation of construction machinery, welding activities and others	Direct Negative	Short term	Reversible	Low, if PPE are used by workers
	Noise levels	Noise generation fromuse of machinery	Direct Negative	Short term	Reversible	Low, if PPE are used by workers
	Land use	Setting up of Project	Direct Negative	Long term	irreversible	The area is designated as Industrial area
	Ecology	Loss of vegetation	Direct Negative	Short term	Reversible	Low (No cutting of trees and green belt development is envisaged)

Table 29: Characteristics of Environmental Impacts from Operational Activities

Activity	Environmental Attributes	Cause	Impacts Characteristics			
			Nature	***Duration***	***Reversibility***	***Significance***
Emissions from various generators and Compressor station	Air Quality (SPM, SO2, NOx, CO, HC)	Unit operations Vehicle operation and fuel combustion	Direct Negative	Long Term	Reversible	Low as Ambient air Monitoring, vehicle maintenance will be performed.
	Noise levels	Noise generation from vehicles	Direct Negative	Short term	Reversible	Low, with periodical maintenance of vehicles
	Employment generation	Direct and indirect employment	Direct Positive	Long term	Irreversible	High, new opportunities of steady income for many families
	Quality of life	In-flow of funds in the region/nation	Direct Positive	Long term	Irreversible	High, the project will generate employment
Solid waste disposal	Land and soil	Generation of solid	Direct Negative	Short term	Reversible	Low, proper collection and disposal.
Wastewater discharge	Water quality	Generation of wastewater	Direct Negative	Short term	Reversible	Low, as Septic Tank and soak pit will be provided
Power Generation	Air quality	Exhaust emissions	Direct Negative	Short term	Reversible	Medium (DG set is only a standby).
	Noise levels	Noise generation	Direct Negative	Short term	Reversible	Low due to noise protection measures (enclosures, PPE etc.)

CHAPTER 7: ENVIRONMENTAL MANAGEMENT AND MONITORING PLAN

7.1 Introduction

Environmental Impact Assessment (EIA) is the process used to integrate environmental management with planning for proposals. EIA is an established process for:

- Ensuring that proponents assume primary responsibility for protection of any environmental values that may be affected by their proposals;
- Addressing the environmental management of the life of proposals;
- Forming a basis for statutory decisions on whether a proposal meets ecologically sustainable development principles, and if so, relevant environmental management and monitoring conditions;

Infrastructure development is an important constituent in our pursuits for economic growth, employment generation and betterment in the quality of life. On the other hand, these activities, without proper precautionary measures for environmental protection are known to cause pollution and associated problems. Hence, it is necessary to comply with the regulatory norms for prevention and control of pollution. Alongside, it is also imperative to go beyond compliance through adoption of clean technologies and improvement in management practices. Commitment and voluntary initiatives of industry for responsible care of the environment will help in building a partnership for pollution control.

Preparation of Environmental Management Plan (EMP) is required for formulation, implementation and monitoring of environmental protection measures during and after commissioning of the proposed project. This Environmental Management Plan has indicated the details as to how various measures have been or are proposed to be taken. The base line settings of different relevant environmental components in the study area are predicted potential impacts on those components due to the proposed project are documented. In this plan, mitigation measures for the identified environmental impacts are documented for both construction and operational stages of the proposed project in the form of an Environmental Management Plan (EMP).

7.2 Environmental Management duringConstruction Stage

i. During digging and trenching activity, there is a scope for local fugitive dust emissions. These will be controlled through speed control method.
ii. There is a likelihood of fugitive dust from the construction activity and material handling from the truck movement in the area of the proposed project. These will also be controlled through speed control .
iii. It will be ensured that these construction vehicles are properly maintained. The vehicle maintenance area will be located in such a manner, so as to prevent contamination of water sources by accidental spillage of oil.

iv. Proper care will be taken for storage of flammable material etc. Location will be identified for the storage of such flammable liquids, away from the ROW. The storage will be as per institutional safety standards.
v. The construction workers will be provided with sufficient and suitable toilet facilities to allow proper standards of hygiene.
vi. Onsite workers using high noise equipment will adopt noise protection devices. Noise prone activities will be restricted to daytime hours only.
vii. Hazardous material will be stored in proper areas.
viii. After completion of construction activities, the rubbish will be cleared and disposed to nearby authorized sites.

Table 30: EMP for Construction Phase Impacts "Site Clearing"

Environmental Impacts	Mitigation	Remarks
Soil erosion	▪ Extent of vegetation removal will be minimized to prevent extent of soil erosion.	Implementation responsibility: ▪ Contractor ▪ SSGC.
Noise generation	▪ Selection of equipment withless noise generation to be used. ▪ The earth moving equipmentwill be periodically checked and maintained for noise levels. Since the site is more or less even, use of these earth-moving equipment may not be necessary. ▪ The workers will be provided with adequate PPE such as earplugs to reduce impact of high noise levels.	Implementation responsibility: ▪ Contractor ▪ SSGC.
Dust generation	▪ The site cleared will be periodically watered to reduce emission of dust particles. ▪ The workers will be provided with PPE such as nose masks and goggles to reduce impacton health.	Implementation responsibility: ▪ Contractor ▪ SSGC.

Table 31: EMP for Construction Phase Impacts "Transportation of Const. Materials"

Environmental Impacts	*Mitigation*	*Remarks*
Noise generation	▪ *Periodic maintenance of vehicles is required*	*Implementation responsibility:* ▪ *Contractor* ▪ *SSGC.*
Dust generation	▪ *Construction materials will be covered with tarpaulinsheets to prevent thematerial from being airborne.* ▪ *The vehicle speed will beregulated.* ▪ *The workers transporting materials will be provided with PPE such as nose maskto reduce impact of airborne dust on their health.*	*Implementation responsibility:* ▪ *Contractor* ▪ *SSGC.*
Vehicular emissions	▪ *Periodic emission check for vehicles is required.* ▪ *Clean fuel will be used for vehicles.* ▪ *Regular maintenance and tunning of vehicles.*	*Implementation responsibility:* ▪ *Contractor* ▪ *SSGC.*

Table 32: EMP for Construction Phase Impacts "Execution of Const. Activities"

Environmental Impacts	Mitigation	Remarks
Noise generation	▪ *Personnel ProtectiveEquipment (PPE) such as ear plugs and helmets will be provided for construction workers.* ▪ *The working hours will beimposed on constructionworkers.*	*Implementation responsibility:* ▪ *Contractor* ▪ *SSGC.*

Dust generation	▪ PPE in the form of nose masks will be provided for construction workers. ▪ Use of water sprays to prevent the dust from being air borne. ▪ Speed reduction.	Implementation responsibility: ▪ Contractor ▪ SSGC.
Air Emissions from construction machinery	▪ *Periodic check and regular maintenance of construction machinery for emissions* ▪ *Clean fuel will be used in equipment.*	*Implementation responsibility:* ▪ *Contractor* ▪ *SSGC.*

7.2.1 Water Resources and Quality

Following mitigation measures will be adopted to avoid impact on water resources

- Construction equipment requiring minimum water for operation and having optimum effectiveness will be chosen.
- Appropriate sanitation facilities, septic tank and soak pits will be provided for the workers onsite and offsite to reduce impact on water resources. Regular maintenance will be done during the entire life cycle.
- No discharge of construction wastes to surface water bodies or ground water will be allowed during construction (while environmental profile of the area suggests that there is no water body in and around project area).
- Efforts will be made for reuse of water and its conservation.

During Construction period in rainy season, the water quality is likely to be affected due to the construction work and loosening of topsoil. This is likely to increase the suspended solids in the run – off during heavy precipitation. In order to reduce the impact on water quality, temporary sedimentation tanks will be constructed for the settlement of the suspended matter. However, it is envisaged that the monsoon period will be avoided for cutting and filling of earthwork. Additionally, appropriate sanitation facilities will be provided for the construction workers to reduce impact on ground water resources and also to maintain hygienic conditions.

There is no likelihood of ground water contamination, as no waste will be discharged to ground water bodies during construction. However sewage generated during the construction phase will be treated in the Soak Pit. Wherever construction wastes need to be disposed off on land or offsite, the same will be disposed off in a proper manner and permission will be taken from the concerned statutory authorities.

7.2.2 Air Quality

During Construction period, there is likelihood of generation of dust and NOx emission. This can be attributed to leveling activity and vehicular movement. The transport vehicles using petrol or diesel will be properly maintained to minimize smoke in the exhaust. Since, there is likelihood of fugitive dust from the construction activity, water sprinkling will be done. In addition, following measures will be taken during the construction phase to reduce the impact on the air quality.

- Any vehicle not meeting the vehicular pollution standards will not be allowed within the construction activity.
- Vehicles delivering loose and fine materials like sand and fine aggregates will be covered by tarpaulin to reduce spills on roads.
- The height from which excavated materials are dropped will be controlled to a minimum practical height to limit fugitive dust generation from unloading.
- The random Ambient Air Quality Monitoring will be done to ensure that the significant impacts are being mitigated adequately.

7.2.3 Noise Level

The noise impact on the surrounding population during the construction phase will be within the acceptable limits. High noise generation equipment, if used will be operated during the daytime only and completely restricted during night hours and this eliminates any possible discomfort to the nearby communities. Community noise levels are not likely to be affected because of the distance and likely attenuation due to the physical barriers. The following recommendations will be implemented:

- Provision of insulating caps at the exit of noise source on the machinery;
- Construction equipment generating minimum noise and vibration be chosen:
- The use of damping materials such as thin rubber / lead sheet for wrapping the work places line compressors, generators sets.
- Shock absorbing techniques will be adopted to reduce impact;
- Inlet and outlet mufflers will be provided which are easy to design;
- Ear muffs will be provided to the workers and it will be enforced to be used by the workers;
- Ambient Noise Level Monitoring will be conducted at suitable location at periodic intervals during construction phase to conform to the stipulated standards both during day and night time.

7.2.4 Solid /Hazardous Waste Management

The hazardous materials used during the construction may include petrol, diesel, welding gas and paints. These materials will be stored and handled according to the standards and guidelines.

- Diesel and other fuels will be stored in separate enclosures;
- Wherever possible, hazardous raw materials to be substituted by nonhazardous materials.
- Vehicle maintenance area to be designed to prevent contamination of ground water by accidental spillage of oil.

7.2.5 Site Security

Adequate security arrangement will be made to ensure that the local inhabitants and the stray animals are not exposed to the potentials hazards of construction activities.

7.2.6 Traffic Pattern

Heavy vehicular movement will be restricted to daytime only and adequate parking facility will be provided.

7.2.7 Solid Waste Generation

- The solid waste generated during the construction phase is usually excavated earth material and construction debris.
- Excavated earth material will be reused for backfilling; to fill up the low-lying areas and topsoil will be reused for Landscaping.
- Construction debris as far as possible will be reused / recycled for back filling / sub base work for roads & pavements and excess will betransported to nearby authorized disposal sites.

7.2.8 Ecological Aspects

- Stabilization of all disturbed slopes before the onset of rains to avoid soil erosion.
- Operation of high noise producing equipment will not be used during night time to avoid impact on the immediate vicinity of the proposed project site surroundings.
- Use of best available construction technology to minimize impacts on flora and fauna of the project site area.

7.2.9 Aesthetics

- Existing aesthetics of the site will be tried to maintain by taking appropriate measures in different activities.
- Existing peaceful environment will be maintained in the vicinity of the project site.

7.2.10 Socio-Economic

- Local people from nearby villages will be employed for construction work to the maximum extent possible.

- Proper facilities for domestic water supply and sanitation services will be made available to the construction workers at the site.

7.2.11 Solid Waste

Generated Solid waste and Hazardous wastes will have disposal mechanism as follows:

- Used oil will be collected and stored in barrels/drums and later disposed to the approved waste oil re-processors/dealers.
- Any other solid waste generated from the facility will be disposed off by using proper disposal mechanism.

Table 33: Waste Disposal Summary

Type of Waste	Description	Phase	Disposal Method
Food Waste	Animal, fruit or vegetable residue	Construction&operation	Burning in a pit near campsite outside the premises.
Packaging Waste	Paper, Plastic, textiles, cardboard, rubber, wood, glass, tin cans, aluminum cans	Construction&operation	Combustibles waste will be burnt in a pit. Recyclable wastes will be provided to a certified recycling contractor.
Medical Waste	Syringes, glass bottles, soiled bandages, expired drugs, dressings	Construction&operation	Incinerated at the nearest available hospital incinerator or an equivalent facility.
Workshop Waste	Used oil ferrous/non-ferrous materials, batteries, oil	Construction&operation	Provided to a certified recycling contractor.

Sewage & Grey wastewater	Waste water from kitchen and washing areas, sewage	Construction&operation	Sewage will be disposed of using soak pits. Waste water from kitchen and washing areas will be disposed of in soak pits. The solid residue from the septic tanks will be periodically transported to a municipal sewage treatment facility in nearby available facility.

7.2.12 Socio Economic Aspects

- The project has very strong positive employment and income effectswhich is likely to result in the improvement of economic situation of the area.
- Overall people's perception on the project is a mix of advantages and disadvantages.
- As an impact of identification of the project, small-scale industrial economy is likely to flourish in the surrounding area . In this way, an overall development may take place in this area.
- The process of development will have maximum impact on the lifestyle of the local people. The project and the consequent peripheral industrial economy will generate income to the local and migrated people which will increase the aggregate demand.

CHAPTER 8: CONCLUSION

Pakistan is an energy deficient country and it is, therefore, an urgent need to explore for additional energy sources. The EIA conducted for this project shows that there are very minimal potential adverse impacts. However, with the Mitigation Measures, as proposed in this report, which SSGC intends to fully implement, means that the proposed pipeline laying activity will have NO SIGNIFICANT IMPACT on the physical, biological and socio-economic environment in the project area. On the other hand it would have a positive impact on socioeconomic conditions as it would provide more job opportunities to the local people and generate opportunities for more business.

Further it is concluded that for this particular project activity, the EIA is adequate and covers all the environmental issues. Finally the EIA reaches a finding of NO SIGNIFICANT IMPACT in accordance with the national laws and regulations.

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ANNEXURES

Annex A	Photo Gallery - Segment 1
Annex B	Photo Gallery - Segment 2
Annex C	Photo Gallery - Segment 3
Annex D	SEPA Act 2014
Annex E	SEPA (Review of IEE & EIA) Regulation 2014
Annex F	Pak-EPA (Review of IEE & EIA) Regulation 2000
Annex G	National Environmental Quality Standards (NEQS)-1993
Annex H	NEQs Amendment -2000
Annex I	NEQs Amendment -2009
Annex J	Draft NEQS for Ambient Air
Annex K	Draft NEQS for Noise Levels
Annex L	Copy of Letter
Annex M	Copy of National HighwayAuthority Karachi
Annex N	Copy of National HighwayAuthority Hyderabad
Annex O	Copy of Pakistan Railway Karachi
Annex P	Copy of Pakistan Railway Sukkur
Annex Q	Copy of Executive Engineer Highways Division Thatta
Annex R	Copy of Executive Engineer Highways Division Matiari
Annex S	Copy of XEN Highways Division, Shaheeed Benazirabad
Annex T	Individual Stakeholder Consultation Form.
Annex U	First Aid Box – List of Items
Annex V	Emergency Response Plan
Annex W	Gas Leakage Contingency Plan

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