

ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

DRILLING OF JHANDIAL-03 WELL IN IKHLAS E.L, DISTRICT ATTOCK



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PAKISTAN OILFIELDS LIMITED (POL)



**ENVIRONMENTAL IMPACT ASSESSMENT
(EIA)**

STUDY FOR

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**Final Report
April 2023**

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EXECUTIVE SUMMARY

Pakistan Oilfields Limited (POL) is a leading oil and gas exploration and production company listed on Pakistan Stock Exchange. The Company's prime focus is to deliver performance through excellence in the field of exploration, drilling and production of crude oil and gas. Pakistan Oilfields Limited maintains a highly diversified exploration and production portfolio. POL is presently operating nine Development and Production leases i.e. Pariwali, Meyal, Joyamair, Minwal, Dhulian, Khaur, Pindori, Turkwal and Balkassar. Two new exploration licenses have been awarded to POL in Dera Ghazi Khan and Rajanpur Blocks in January 2010. POL intends to conduct Drilling of Jhandial-03 Well near Jhandial, District Attock and Punjab. The ultimate aim of this drilling activity is to explore untapped hydrocarbons and test the hydrocarbon potential of Eocene and Paleocene reservoirs from the sub-thrust of Balkassar structure. The prime objective of this drilling activity is to increase the current level of oil and gas production as per increasing demand of the country to meet the energy crisis.

In order to execute the exploratory and development programs, POL has also developed a sound equipment and operational base which includes Drilling rigs, Work over rigs, Geological Field Party, Seismic parties, Engineering Field Parties, Gas Gathering and Pipeline Construction Party, Seismic Data Processing Centre, Geological Analysis Laboratory, Wire line Logging Unit, Cementing Units and Data Logging Unit.

This document presents the findings of an Environmental Impact Assessment (EIA) carried out by NCPC (National Cleaner Production Center) for Drilling of Jhandial-03 well. NCPC specializes in a wide range of services including Initial Environmental Examinations (IEEs), Environmental Impact Assessments (EIAs), Environmental and Social Monitoring, Environmental and Social Audits, Analytical Services, Incineration of Hospital Hazardous Waste, Air Quality Impact Assessments (AQIAs), Bioremediation of Oily Sludge and Oil Spillages, Energy Audits, Cleaner Production Projects and Trainings for capacity building etc. NCPC has also established Federal EPA certified Environment laboratory.

This EIA report has been prepared to conform to the requirements of Review of EIA and IEE Regulations 2022, Punjab Environmental Protection Act 2012 and Assessment Rules 2000. It covers potential effects of the proposed project activities in the project area. Potential impacts on the physical, biological, socio-economic and cultural environment that may arise from the exploration, mining and production operations and the mitigation measures to be adopted have been assessed and presented in the report.

Objectives of the EIA

The objectives of the Environmental Impact Assessment (EIA) are to:

- Assess the existing environmental conditions in the project area, including the identification of environmentally fragile areas and develop a baseline of its prevalent environmental and socioeconomic conditions;



- Identify and investigate all impacts of the proposed exploration and associated development activities on the biological, physical as well as socioeconomic environment of the project area;
- To propose mitigation measures that would help POL in conducting the proposed drilling of well and associated activities in an environmental sustainable manner;
- To uncover the planning and operational phase impacts up to microenvironment levels in which project is proposed to be sited; and
- To develop a project specific Environmental Management Plan (EMP) that would assist POL in the effective implementation of the recommendations of the EIA.

Pakistan Oil Fields Limited (POL) – The Proponent

POL is a leading oil and gas exploration and production company listed on Pakistan Stock Exchange. The Company's prime focus is to deliver performance through excellence in the field of exploration, drilling and production of crude oil and gas.

Pakistan Oilfields Limited maintains a highly diversified exploration and production portfolio. POL is presently operating nine Development and Production leases i.e. Pariwali, Meyal, Joyamair, Minwal, Dhulian, Khaur, Pindori, Turkwal and Balkassar. Two new exploration licenses have been awarded to POL in Dera Ghazi Khan and Rajanpur Blocks in January 2010. POL exploration team is proactively evaluating exploration and exploitation opportunities within and outside Pakistan with an ultimate aim to sustain long-term production goals and bring value for the shareholders.

In addition to exploration and production of oil and gas, POL also manufactures LPG, Solvent Oil and Sulphur. POL markets LPG under its own brand named POLGAS as well as through its subsidiary CAPGAS (Private) Limited. POL also operates a network of pipelines for transportation of its own as well as other company's crude oil to Attock Refinery Limited. Around 28,000 barrels per day of crude oil is being pumped to Attock Refinery through POL's pipeline network.

NCPC – The Consultant

National Cleaner Production Center (NCPC) is working for the environment and social sector of Pakistan since 1999. The Center was established by UNIDO and is registered under Section 42 of the Companies Ordinance, 1984 by Government of Pakistan in 2002. NCPC is working as a non-profit organization and is certified by Pakistan Centre for Philanthropy (PCP) and also by FBR.

NCPC offers a wide range of services including Initial Environmental Examinations (IEEs), Environmental Impact Assessments (EIAs), Environmental and Social Monitoring, Environmental and Social Audits, Analytical Services, Incineration of Hospital Hazardous Waste, Air Quality Impact Assessments (AQIAs), Bioremediation of Oily Sludge and Oil Spillages, Energy Audits, Cleaner Production Projects and Trainings for capacity building etc. NCPC has also established Federal EPA certified Environment laboratory.





NCPC has a wide range of professional staff constituting environmental scientists, environmental engineers, chemical engineer, economist, biologist, social scientists, plant taxonomist, administrative and support staff. The core staffs have been selected to cater the diverse services offered by NCPC. NCPC can assemble multi-disciplinary teams from its other NCPCs worldwide and from its extensive list of external consultants. Diverse range of projects has been completed in this way. NCPC has about 22 years of experience in providing various services in its areas of expertise.

Project Details

This Environmental Impact Assessment (EIA) study has been carried out for drilling of **Jhandial-03** well. The activities associated with the proposed development program will comprise of drilling of development well, associated activities and if successful then tie-in to existing nearby facility in future. Geological and seismic surveys can identify the possibility that petroleum is present, but the only way to ascertain this is to drill a well. If drilling proves fruitful, and the petroleum reservoir is to be commercially exploited, the field has to be developed for oil and/or gas production.

Table 1-1: Table Showing General Project Details

Nature of the Project	Drilling of oil well
Type of the Project	Onshore Drilling
Name of the Proponent	Mr. Razzaq Goraya (AGM Operations)
Location of the Project Site	Jhandial, District Attock and Punjab
Proposed Operational Area	134 kanal and 10 Marlas (Rig site =118 kanal, Camp site 16 kanal , 10 Marlas)
Estimated Cost of the Project	Est. 19,827 Million \$
Project lifetime	160 Days (Tentative)
Project Process	Drilling will be carried out using conventional practices and will use a water or oil based mud system.
Distance from the Community	Jhandial Village is located 1.50 Km away from the proposed project site.
No. of Labor during Construction/Operational Phase	Construction: 60-70
	Operation: 120 – 150 (POL/Contractor/Sub-Contractor)

EIA Methodology

Various steps undertaken in the EIA preparation included sharing of TORs and complete relevant information with key stakeholders; understanding of the proposed operations; review of relevant laws, legislations and guidelines; EIA scope and methodology; collection of secondary data including physical, biological and socioeconomic environments and heritage



aspects; field data collection; stakeholders consultation; review of alternatives; impacts identification; recommendations for mitigation and monitoring measures; development of environmental management plan (EMP) and reporting.

Field survey for EIA study was carried out by a team of environmental, wildlife and flora, fauna specialists on November 01, 2022 and second week of March, 2023. Field data collection also included validation of available secondary information. Secondary information was collected from POL, in-house sources like previous environmental studies in the block and closer vicinities in addition to respective District Census Reports (DCRs) as well as respective district development profiles published by Government of Punjab. Applicable environmental assessment procedures prepared by the Pakistan EPA were followed in the preparation of the EIA.

Baseline, Social and Economic Conditions

A detailed survey of the site was conducted to establish the background environmental EIA for Drilling of Jhandial -03 Well. This included but not limited to topography, geology, hydrology, climate, ambient air quality, seismology, flora and fauna, socio-economic conditions, archaeology, present infrastructure and future proposed development plans for the project area. Information describing the existing environment was gathered from various sources including the client, statutory bodies, and local interest groups and published work. The information collected was used to compose profiles of the natural and socioeconomic environments likely to be affected by the project. Information for the section describing the project came mainly from POL.

Environmental Impacts and Mitigation Measures

The probable environmental impacts arising from the project activities like construction, drilling and operation on the area's geomorphology, soil, water resources, air, biological resources and socioeconomic condition were assessed and mitigation measures were identified that will reduce, if not eliminate the project's adverse impacts.

In the report environmental matrix and checklists have been developed to formally assess the project and present an overview of its impacts. The matrix and checklist structure take into account the environmental issues and effects of the project as well as the concerns of the community impact. POL is committed to comply with all environmental laws and regulations applicable in Pakistan. The company will strive to operate in environment friendly manners leaving no significant impacts over the environment due to its planned and ongoing projects. The emissions and wastes will be reduced and kept under allowable limits by continuous monitoring and auditing the facilities on regular basis. The staff will be trained in order to handle emergencies that might have an adverse impact over the environment and encouraged to report such environmental incidents to avoid recurrences.

The construction activities will cause less to minor disturbance to soil and landscape. Existing access roads will be used as much as possible to minimize environmental impacts



in the area. Development of new tracks other than those covered in the EIA shall be avoided. The access track will be properly compacted at the time of construction and thereafter properly maintained by watering and compaction (where required) throughout the entire construction and drilling operation.

Environmental Management Plan

A detailed assessment of project activities was carried out during the Environmental Impact Assessment study which involved identification of all major and minor impacts from the proposed exploration and mining activities. The following major factors have been assessed in particular in addition to other impacts:

- Emissions to air
- Wastewater and solid waste
- Alteration of landscape
- Damage to natural ecosystems/biological resources
- Resource consumption
- Socioeconomic impacts
- Occupational safety risks and hazards
- Management of hazardous materials

The above aspects have been covered in detail in the EIA study and mitigation measures are suggested side by side to manage the impacts that arise. The EMP reflects the commitment of POL to safeguard the environment as well as the surrounding population. The Plan provides a delivery mechanism to address the adverse environmental impacts, to enhance the project's benefits and to introduce standards of best practices to be adopted for all phases of the project. EMP has been developed for the project to provide a comprehensive action plan for each key player of the project particularly the HSE Manager, Site Supervisor and the Manager Operations to undertake and monitor each of the project activities in compliance with the EMP and other applicable guidelines.

Environmental Monitoring Report will be prepared of the project activities carried out during the construction phase of the project and will be submitted to Punjab Environmental Protection Agency.

Public Consultation

Communities were consulted as per public consultation processes including women, men and institutional stakeholders. The aim of public consultation was to assure the quality, comprehensiveness and effectiveness of the EIA; as well as to ensure that the views and opinions of the local people were adequately taken into account in the decision making process. Public consultation is an essential component of EIA. NCPC consulted the persons and organizations potentially affected by the proposed project and associated infrastructure,





and informed and engaged any interested individuals, groups, stakeholders and aboriginal communities in this assessment.

Conclusions and Recommendations

The EIA has fully examined the proposed project activities, the background environmental conditions of the project area and the environmental impacts likely to arise from the proposed drilling of well and associated operation activities. Overall, the EIA report for proposed has drilling of well and associated operation activities predicted that the project will comply with all applicable environmental standards and legislations before and during the project. This EIA has also demonstrated the acceptability of the residual impacts from the project and the protection of the identified environmentally sensitive resources. Environmental monitoring mechanism have been recommended before and during the proposed operation, where necessary, to verify the accuracy of the EIA predictions and the effectiveness of recommended mitigation measures. Based on the above, this report concludes that there are no potential adverse environmental impacts from proposed project activities in Jhandial-03 Well. Impacts of less significance can be mitigated to an acceptable level by adequate implementation of the mitigation measures identified and suggested hence, no significant or unacceptable change in the baseline environmental conditions will occur. Similarly, the operation will have a visible positive impact on the socioeconomic conditions of the local residents and significantly boost the economy of the area. Mitigation measures to help alleviate the potential identified environmental impacts have been recommended and a project specific EMP has been provided for implementation of these mitigation measures. These impacts can be controlled by regular monitoring as POL would comply through drilling contractor with national and international environmental, safety and health standards. Protection and monitoring measures will be incorporated at each phase of the proposed project activity.





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LIST OF ACRONYMS

AQIA	Air Quality Impact Assessment
CSR	Corporate Social Responsibility
D & P	Development and Production
DGPC	Directorate General of Petroleum Concessions
IEE	Initial Environmental Examination
EMMP	Environmental Monitoring and Management Plan
EMS	Environmental Management System
GoP	Government of Pakistan
HSE	Health, Safety and Environment
IEE	Initial Environmental Examination
NCPC	National Cleaner Production Center
NCS	National Conservation Strategy
NEAP	National Environmental Action Plan
NEQS	National Environment Quality Standards
NGO	Non-Governmental Organization
NOC	No Objection Certificate
PEPA	Punjab Environmental Protection Agency
PEPA	Pakistan Environmental Protection Act
PEPC	Pakistan Environmental Protection Council
PEPO	Pakistan Environmental Protection Ordinance
PEQS	Punjab Environment Quality Standards
POL	Pakistan Oilfields Limited
QC	Quality Control
SMART	Self-Monitoring and Reporting Tool
SMRS	Self-Monitoring and Reporting System



1 INTRODUCTION AND BACKGROUND

1.1 Background

This Environmental Impact Assessment (EIA) report identifies and evaluates the potential environmental and social impacts which may result from Project-related activities and, where necessary, introduces measures to mitigate adverse impacts. It ensures that possible adverse environmental impacts are identified and avoided or minimized. It finds ways and means to reduce adverse impacts and shape projects to suit the local environment and present the predictions and options to decision-makers.

Pakistan Oilfields Limited (POL), a leading oil and gas exploration and production company, intends to conduct **Drilling of Jhandial-03 Well in Ikhlas E.L, District Attock, Punjab**. The exploration activities will lead to addition of new hydrocarbon reserves. In the same perspective POL intends to drill a new Jhandial Well-03 in Ikhlas E.L which is located approximately 83 km southwest of Islamabad, in district Attock, Pakistan.

National Cleaner Production Center (NCPC) has been hired to carry out an Environmental Impact Assessment (EIA) for the proposed drilling activity in Jhandial for drilling of Well-03. The Environmental Impact Assessment (EIA) aims to ensure that environmental factors are considered early in the decision-making process. It ensures that possible adverse environmental impacts are identified and avoided or minimized. EIA find ways and means to reduce adverse impacts and shape projects to suit the local environment and present the predictions and options to decision-makers. The Review of EIA and IEE Regulations 2022 and Punjab Environmental Protection Act 1997 requires proponents of all projects involving any change in the environment, to submit an Initial Environmental Examination (IEE) report or where the project is likely to cause any adverse environmental effects, an Environmental Impact Assessment (EIA) report to the Provincial EPA.

The EIA study team consists of Environmental Engineers, Environmentalists, Chemical Engineers, Air Quality Management Experts, Flora and Fauna Expert and Socio-Economist capable of carrying out the study. The EIA has been prepared to conform the requirements of the Review of EIA and IEE Regulations 2022, Punjab Environmental Protection Act 1997 (Amendment 2012) and Punjab Environmental Quality Standards (Approved 2016).

This document presents the findings of an Environmental Impact Assessment (EIA) carried out by National Cleaner Production Center Foundation (NCPC) for the “Drilling of Jhandial-03 Well” in Jhandial, District Attock and Punjab.



1.2 Project Objectives

The objective of the project is to explore the hydrocarbon potential of Paleocene reservoir (Lockhart Formation) and appraise the potential from Eocene reservoirs (Chorgali, Sakesar and Nammal formations).

1.3 Project Categorization

The Review of Initial Environmental Examination (IEE) and Environmental Impact Assessment Regulations (EIA), 2022 categorizes projects in two categories provided in Schedule I and II. Schedule I categorizes the projects requiring an Initial Environmental Examination while Schedule II categorizes projects requiring an Environmental Impact Assessment (EIA). According to this categorization, Drilling of Well Jhandial -03 falls within Point 5 of Section A, Energy of Schedule II of Review of IEE and EIA Regulations, 2022.

- **Oil and gas extraction projects including exploration, production, gathering systems, separation and storage.**

1.4 Purpose of EIA

The Environmental Impact Assessment (EIA) is a collection of data, prediction of quantitative and qualitative impacts, comparison of alternatives, evaluation of preventive, compensatory and mitigation measures, formulation of environmental management and training plans and monitoring arrangement, and framing of recommendations in simplest form, a planning tool that is now generally regarded as an integral component of sound decision making

The purpose of this EIA process is to:

- Provide information for decision-making on the environmental consequences of proposed actions for drilling of Jhandial-03 Well
- Identification and Assessment of all major and minor impacts during the construction activities.
- Promote environmentally sound and sustainable development through the identification of appropriate enhancement and mitigation measures.
- Propose mitigation measures to minimize eliminate or compensate the potential adverse impacts identified in the EIA report.
- Identify all significant impacts that may require detailed assessment.

The identification, assessment and management of environmental effects have become an integral part of the development planning in the last two decades. An impact on the environment is defined as any incremental change in the biophysical and/or social environment caused by or directly related to a former, on-going, or proposed activity. The biophysical





component addresses all living organisms and the natural and physical environment that sustain them (terrestrial, aquatic and atmospheric). The social component deals with socio-economic aspects, human health, safety, and well-being of the society.

1.5 Objectives of the EIA

The objectives of the Environmental Impact Assessment (EIA) are to:

- Assess the existing environmental conditions in the project area, including the identification of environmentally fragile areas and develop a baseline of its prevalent environmental and socioeconomic conditions;
- Identify and investigate all impacts of the proposed exploration and associated development activities on the biological, physical as well as socioeconomic environment of the project area;
- To propose mitigation measures that would help POL in conducting the proposed drilling of well and associated activities in an environmental sustainable manner;
- To uncover the planning and operational phase impacts up to microenvironment levels in which project is proposed to be sited; and
- To develop a project specific Environmental Management Plan (EMP) that would assist POL in the effective implementation of the recommendations of the EIA.

1.6 Proposed Environmental Approval and Management System

Preparation and approval of subject environmental assessment covers construction and drilling of wells in Jhandial.

- Sufficient data collection and assessment of impacts to cover all environmental sensitivities;
- A mechanism that would require a site specific short study (if required) prior to start of each activity to incorporate any additional impacts and mitigation measures that were not addressed in the EIA; and
- A mechanism by which Punjab Environmental Protection Agency (Punjab-EPA) can continue to exercise its control over the proponent's activities and follow up on the environmental performance of the operations.

POL and NCPC have been fully cognizant of the above listed issues and have addressed them in the EIA by undertaking or proposing the following:

- The EIA is based on primary as well as secondary data. Primary data is collected on all physical, biological and socioeconomic aspects;





- Assessment of all generic potentially significant impacts on the physical, biological and socioeconomic receptors due to the proposed exploration and associated surface facilities development activities have been addressed in the EIA. Relevant mitigation measures have also been discussed in detail.
- In order to ensure that Punjab EPA continues to regulate and oversee the environmental performance of proposed project activities within the concession, the EIA has recommended the following environmental approval, monitoring and management protocol:
 - Once any activity is initiated, POL will undertake environmental monitoring according to the requirements of the project specific EMP and any additional requirements/bindings specified by the Punjab EPA; and
 - POL will accommodate any visits by Punjab EPA or other concerned stakeholder's officials for the purpose of external audits or on-site inspections

1.7 Project Overview

1.7.1 Objectives

The objective of the project is to explore the hydrocarbon potential of Paleocene reservoir (Lockhart Formation) and appraise the potential from Eocene reservoirs (Chorgali, Sakesar and Nammal formations) which will enhance oil production of the country. Land Drilling Rig will be deployed to drill the well to the depth of **±17,850 Ft.**

1.7.2 Project Cost

Estimated development cost of the proposed project is **16,729 Million \$** and installation cost including testing and completion cost **3,098 Million \$**, with the total project cost of **19,827 Million \$**.

1.7.3 Project Activities

Drilling will be carried out using conventional practices and will use a water based mud system. Land drilling rig will be deployed to drill the proposed Jhandial-03 well to the depth of **± 17,850 ft.** The total project duration is estimated to be approximately seven months. Resources utilized from within the project area **134 kanal and 10 marlas** (Rig site =118 kanal, Camp site 16 kanal , 10 marlas) will include local manpower, land, gravel and water.

The project will be completed in three phases:

- **Phase I: Well Construction**
 - Civil contractor's mobilization
 - Development of access road



- Rig camp construction
- Well site construction
- Civil contractor's demobilization
- **Phase II: Well Drilling**
 - Well drilling and possible testing
 - Vertical Seismic Profiling (VSP)
 - Site Restoration (depending on the failure or success of the well)
- **Phase III: Well Operation**

1.8 Project Location

The satellite imagery shows the proposed well location **33° 22' 47.10" N and 72° 32' 42.52" E**. The estimated terrain above is 464 meter above sea level. The site is located approximately 83 km southwest of Islamabad, in district Attock, Pakistan.

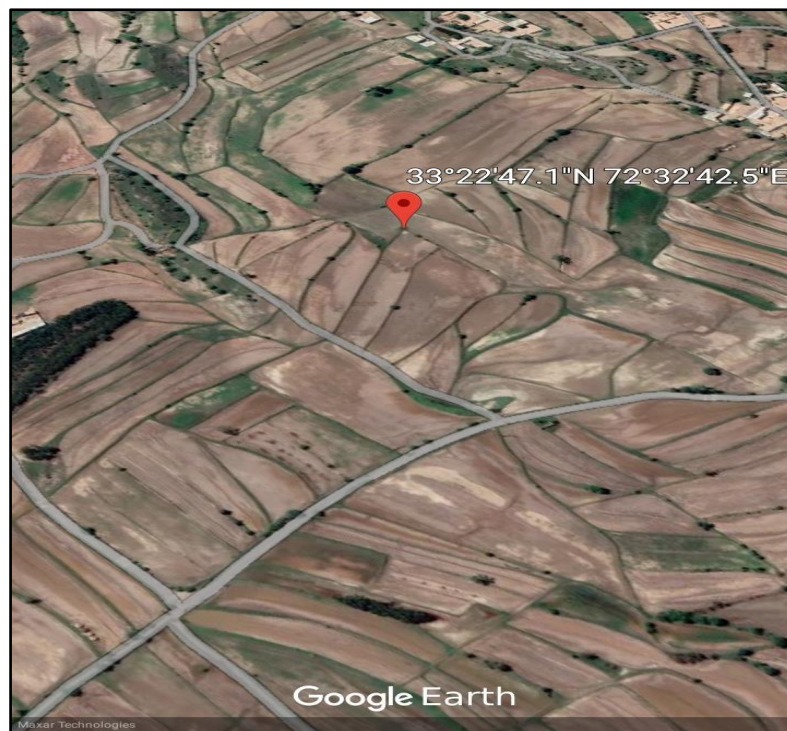


Figure 1-1: Satellite Image showing Jhandial 03 Well Location



1.9 Site Visit

The credibility of the EIA study depends on the quality and reliability of the baseline information used in order to evaluate the impacts that the proposed project might have on the environment of the area.

Site visit to the location of the proposed project and adjoining areas including Jhandial Village, Khidwal and Lundh were undertaken by NCPC team on November 01, 2022 and second week of March, 2023 to gain first hand detailed knowledge of the environmental baseline of the area.

During the visits, baseline data regarding the physical, biological and socio-economic environment of the area of the proposed project was collected, including information regarding the topography, geology, soils, surface and groundwater resources, climate, flora and fauna, cultural, archaeological or historical sites and socio-economic conditions prevalent in the area.



Figure 1-2: Road Leading to Project Site

1.10 Project Details

This Environmental Impact Assessment (EIA) study has been carried out for drilling of **Jhandial-03** well. The activities associated with the proposed development program will comprise of drilling of development well, associated activities and if successful then tie-in to existing nearby facility in future. Geological and seismic surveys can identify the possibility that petroleum is present, but the only way to ascertain this is to drill a well. If drilling proves fruitful, and the petroleum reservoir is to be commercially exploited, the field has to be developed for oil and/or gas production.

Table 1-1: Table Showing General Project Details

Nature of the Project	Drilling of oil well
Type of the Project	Onshore Drilling



Name of the Proponent	Mr. Razzaq Goraya (AGM Operations)
Location of the Project Site	Jhandial, District Attock and Punjab
Proposed Operational Area	134 kanal and 10 marlas (Rig site =118 kanal, Camp site 16 kanal, 10 marlas)
Estimated Cost of the Project	Est. 19,827 Million \$
Project lifetime	160 Days (Tentative)
Project Process	Drilling will be carried out using conventional practices and will use a water or oil based mud system.
Distance from the Community	Jhandial Village is located 1.50 Km away from the proposed project site.
No. of Labor during Construction/Operational Phase	Construction: 60-70
	Operation: 120 – 150 (POL/Contractor/Sub-Contractor)

1.11 Pakistan Oil Fields Limited – The Proponent

Pakistan Oilfields Limited (POL) is a leading oil and gas exploration and production company listed on Pakistan Stock Exchange. The Company's prime focus is to deliver performance through excellence in the field of exploration, drilling and production of crude oil and gas.

Pakistan Oilfields Limited maintains a highly diversified exploration and production portfolio. POL is presently operating nine Development and Production leases i.e. Pariwali, Meyal, Joyamair, Minwal, Dhulian, Khaur, Pindori, Turkwal and Balkassar. Two new exploration licenses have been awarded to POL in Dera Ghazi Khan and Rajanpur Blocks in January 2010. POL exploration team is proactively evaluating exploration and exploitation opportunities within and outside Pakistan with an ultimate aim to sustain long-term production goals and bring value for the shareholders.



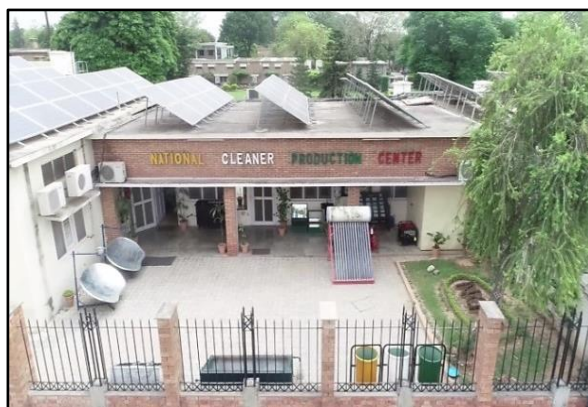
In addition to exploration and production of oil and gas, POL also manufactures LPG, Solvent Oil and Sulphur. POL markets LPG under its own brand named POLGAS as well as through its subsidiary CAPGAS (Private) Limited. POL also operates a network of pipelines for transportation of its own as well as other company's crude oil to Attock Refinery Limited. Around 28,000 barrels per day of crude oil is being pumped to Attock Refinery through POL's pipeline network.



1.12 NCPC – The Consultant

National Cleaner Production Center (NCPC) is working for the environment and social sector of Pakistan since 1999. The Center was established by UNIDO and is registered under Section 42 of the Companies Ordinance, 1984 by Government of Pakistan in 2002. NCPC is working as a non-profit organization and is certified by Pakistan Centre for Philanthropy (PCP) and also by FBR.

NCPC offers a wide range of services including Initial Environmental Examinations (IEEs), Environmental Impact Assessments (EIAs), Environmental and Social Monitoring, Environmental and Social Audits, Analytical Services, Incineration of Hospital Hazardous Waste, Air Quality Impact Assessments (AQIAs), Bioremediation of Oily Sludge and Oil Spillages, Energy Audits, Cleaner Production Projects and Trainings for capacity building etc. NCPC has also established Federal EPA certified Environment laboratory.



By providing quality services, NCPC has achieved Green Apple Award 2015 & 2014, ECO Green Industry Award 2011, 8th Annual Environmental Excellence Award 2011 (AEEA) by National Forum for Environment & Health (NFEH) and Platts Global Energy Award on Corporate Social Responsibility for the year 2007.

NCPC has a wide range of professional staff constituting environmental scientists, environmental engineers, chemical engineer, economist, biologist, social scientists, plant taxonomist, administrative and support staff. The core staffs have been selected to cater the diverse services offered by NCPC. NCPC can assemble multi-disciplinary teams from its other NCPCs worldwide and from its extensive list of external consultants. Diverse range of projects has been completed in this way. NCPC has about 22 years of experience in providing various services in its areas of expertise.

1.12.1 NCPC Team

Sr. #	Name of Team Members	Role	Education
1.	Mr. Muhammad Irshad Ramay	Environmental Engineer	M.S Environmental Engineering and Management B.Sc. Chemical Engineering
2.	Dr. Amir Haider Malik	Hydrologist	PhD in Water, Soil and Environment
3.	Mr. Azhar Qureshi	Flora Fauna Expert	MSc in Zoology
4.	Mr. Tariq Khan	Biologist and Botanist	M. Phil Environment Sciences



5.	Mr. Tahir Hussain	Chemist	MSc Chemistry
7.	Mr. Naveed Akhtar	Socio-Economist	M. Phil Sociology
8.	Mr. Nayyar Humair	Air Quality Expert	MSc Chemistry
9.	Ms Sana Tahir	Environmental	M. Phil Environmental Sciences
10.	Mr. Bilal Muzammil	Environmental	B.S Environmental Sciences
11.	Ms Waliha Noor	Engineer	B.Sc. Environmental Engineering

1.13 Contact Information

1.13.1 POL

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1.13.2 NCPC

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Designation: Coordinator NCPC

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1.14 EIA Scope and Methodology

1.14.1 Scope of EIA

The Environmental Impact Assessment (EIA) study for the proposed project has been conducted under requirement of the Review of EIA and IEE Regulations 2022 and Punjab Environmental Protection Act, 1997 (Amended 2012). The EIA has been prepared on the basis of secondary published and unpublished information, primary data collected during a site visit to the project area and past experience of undertaking similar studies.

Depending on the nature, scope and significance of the project the assessment includes consideration of ecological, economic, cultural, aesthetic, health and safety, social and amenity impacts in relation to the decisions on the sustainable management of natural and physical resources.



The scope of EIA is given below:

- Collect information and evidence needed for developing an Initial Environmental Examination for the proposed project in its entirety.
- Generate all the necessary data for establishing the environmental baseline conditions of the proposed project area.
- Support the goals of environmental protection and sustainable development.
- Develop a site specific Environmental Management Plan to mitigate the environmental impacts during all phases of proposed project.

Demonstrate that a systematic approach has been adopted in identifying, evaluating and characterizing as well as proffering cost-effective mitigation measures for the potential and associated impacts.

1.14.2 The EIA Methodology

The various steps undertaken in the EIA preparation are summarized below:

1.14.3 Understanding of the Proposed Project and Review of Alternatives

Details of the proposed project activities were collected from POL and understood by the EIA Consultant. All alternatives to the proposed operations were reviewed including; the no project option, alternative site selection, timing and alternative technologies to establish the context that proposed operations will not depreciate the environmental quality/soundness of the project area. Details of the proposed project and a review of alternatives have been provided in **Chapter # 03 and Chapter # 04** respectively of this EIA.

1.14.4 Review of Policies, Legislation and Guidelines

National and provincial legislations, international agreements, environmental guidelines, best industry practices and POL's environmental policy were reviewed to set environmental standards that POL would be required to adhere to during the project. A synopsis of these is provided in **Chapter # 02** of the EIA.

1.14.5 Secondary Data Collection

Previous environmental assessments for exploration projects in the area and other published and unpublished information was collected in order to gain a complete understanding of existing environmental conditions in the area including the following:

- **Physical environment** – topography, geology, geomorphology, soils, surface and groundwater resources and climate;



- **Biological environment** – habitat types, flora and fauna (particularly rare or endangered species), critical habitats and vegetation communities within the wildlife or forest protected areas falling in the proposed project area;
- **Socioeconomic environment** – settlements, socioeconomic conditions, infrastructure and land use; and
- **Heritage aspects** – sites of cultural, archaeological or historical significance.

1.14.6 Field Data Collection

Field survey for EIA study was carried out by a team of environmentalist, wildlife specialist and environmental engineers in the second week of March, 2023. Field data collection also included validation of available secondary information. Secondary information was collected from POL, in-house sources like previous environmental studies in the block and closer vicinities in addition to respective District Census Reports (DCRs) as well as respective district development profiles published by Government of Punjab. Where required, the secondary data collected from desktop analysis was also consulted for preparation of this EIA and analyzed by the experts.

A description of baseline physical, biological and socioeconomic conditions of the project area, impacts due to proposed project activities and their mitigation measures are provided in **Chapters # 04** and **Chapter # 06** of the EIA report respectively. The project area for EIA contains agriculture areas including orchards and human settlements and streambeds and springs. The sampling location was randomly selected, ensuring that sufficient locations are sampled for each identified habitat.

1.14.7 Community/Public Consultation

The communities within the project area were meticulously consulted during the fieldwork. The objectives of the consultation were to brief the communities about the proposed exploration and development and to collect their views and concerns regarding the same. The outcome of the consultations is detailed in **Chapter # 08** of the EIA report.

1.14.8 Impact Identification and Assessment

The potential impacts arising from each phase/segment of the proposed project activities were comprehensively identified. These include effects of the proposed project activities on the physical, biological, socioeconomic, archaeological and cultural environments of the area and are detailed in **Chapter # 06** of this EIA. Impacts were identified and assessed on the basis of field data, secondary data, experts' opinion and monitoring results of previous oil and gas exploration projects in Pakistan particularly in Punjab province.

1.14.9 Recommendations for Mitigation and Monitoring Measures

Mitigation measures to prevent or minimize all potential adverse environmental impacts of the project were identified based on a range of options including management and monitoring practices, alternative technologies, physical controls or compensation. The proposed mitigation





measures are based on an appreciation of the sensitivity and behavior of environmental receptors within the project area, past experience, case studies, legislative controls, environmental guidelines and experts' advices.

Monitoring measures have been recommended for residual impacts (impacts remaining after applying the recommended mitigation measures) or for impacts that cannot be accurately predicted at the EIA stage. In such cases advice on requisite monitoring measures was sought from experts involved in the EIA and case studies of similar monitoring exercises carried out in wildlife or forest protected areas elsewhere.

1.14.10 Development of Environmental Management Plan (EMP)

An Environmental Management Plan (EMP) for the proposed project activities has been prepared and provided in **Chapter # 08** of this EIA report. The EMP provides a framework for implementing and managing the mitigation and monitoring measures recommended in the EIA. The EMP includes the following:

- A mitigation and monitoring plan;
- Definition of roles and responsibilities of the project proponent, execution contractors and monitoring teams;
- Requirements for communication, documentation and trainings during the project;
- Restrictions on design, timing and conduct of the project; and
- Change Management Plan to cover unforeseen events/environmental conditions during the project.



2 POLICY, LAWS AND REGULATIONS

Before initiation of any project, the mandatory legislations enacted by government and other regulatory agencies need to be studied. This chapter is intended to develop the legislative framework for the proposed project involving drilling of **Jhandial -03** well by providing a synopsis of environmental policies, legislation and guidelines applicable to the project. Governments from time to time have enacted many environmental rules, regulations, laws and guidelines specifying different requirements for diverse kind of projects. Therefore, it would be necessary to study those environmental laws pertaining to the project before its execution so that the protection of environment can be ensured.

Legal responsibilities of the proponent in the context of the environmental and social management are described in subsequent sections. POL, the proponent of this project will be required to adhere to the requirements of the policies and legislations during the mining activities. In this section, policies, guidelines and legislation have been proposed for the relevant project. The proponent of the project should ensure that it conforms to all rules and regulation of environmental excellence during all aspects of its operation. The local and international laws are to be complied with it.

This chapter describes the basic laws and regulations involved in drilling well in environmentally sustainable manner and current legal responsibilities of the proponent in the context of the environment and sustainable development and the institutions that exist in the country that may influence the environmental management of the proposed project i.e., well drilling.

This project will comprehensively practice the applicable requirements of policy documents, legislative framework and recommendations described in national and international guidelines of the project and will follow the institutions existing in the country that may influence the environmental management of the proposed project. These laws and guidelines have been incorporated in the mitigation measures and Environmental Management Plan (EMP), which ensure for the better environmental, ecological and social management.

Why well drilling for oil needs environmental laws and regulation?

- Pollution impact communities (all living communities i.e., Flora Fauna)
- Dangerous emission of fuel cause climate change
- Oil and gas development can ruin wild lands
- Fossil fuel extraction might disturb the historical value of the land
- Drilling might disturb wildlife habits
- Oil spills may cause death of animals
- It might involve some occupational hazards for workers





- Destroys natural beauty of the land

2.1 HSE Policy of POL

POL's HSE Policy is the principal policy document and is committed to give priority to Health, Safety and Environment as well as security of all its employees and of other personnel affected by its activities. Emphasis is given on the recognition and elimination of risks rather than blaming it to someone. POL also confers its overriding commitment towards minimizing impacts of its activities on the natural environment. The policy also encourages an active participation with government and other responsible institutions in meeting applicable national and international health, safety and environmental rules and regulations.

The policy emphasizes on adoption of advance and best practices in order to attenuate adverse impacts on the environmental receptors. The policy also highlights a need to seek economics ways to minimize environmental degradation and sustaining the environment. Improvement of business processes, in conformity with defined strategic goals and objectives for achieving technological excellence in day to day activities is also accentuated. In addition, maintaining knowledge throughout organization by effective communication of information through education and training of staff and maintaining updated contingency plans is to be exercised throughout the Company. In the end measuring and analyzing the HSE performance and implementation of management systems is stressed to ensure effective feedback of information for continual improvement.

2.2 Environmental Laws

The definition of environmental law can be derived from the legal definition of 'environment'. In Section 2 of the Pakistan Environmental Protection Act 1997 (PEPA 1997) environment is defined to include air, water, land, and layers of the atmosphere; living organisms and inorganic matter; the ecosystem and ecological relationships; buildings, structures, roads, facilities and works; social and economic conditions affecting community life; and the interrelationship between these elements.

From this definition, an environmental law can be considered to include all laws that are designed to, or that directly or indirectly affect, the management of natural resources including the control of pollution of these natural resources.

By this definition, environmental laws include a) laws that have been specifically enacted to protect the environment such as the PEPA 1997, and b) laws relating to subject such as forest, water resources, wildlife, land, agriculture, health, and town planning.

2.3 Constitutional Provision

Incorporation of provisions for environmental safety and management in national legislations has steadily gained priority in Pakistan since the late 1970s. The Pakistan Environmental Protection Ordinance, 1983 was the first piece of legislation designed specifically for the



protection of the environment. The promulgation of this ordinance was followed, in 1984, by the establishment of the Pakistan Environmental Protection Agency, the primary government institution dealing with environmental issues.

The Fourth Schedule of the constitution provides two lists of issues. One list, the *Federal Legislative List*, includes issues on which only the federal government has legislative powers. The second list, the *Concurrent Legislative List* includes issues on which both the federal and the provincial governments have legislative powers.

If a particular legislation passed by a provincial assembly comes into conflict with a law enacted by the national assembly, then according to the constitution, the federal legislation will prevail over the provincial legislation to the extent of the inconsistency.

The subject of ‘environmental pollution and ecology’ is included in the concurrent list of the constitution. Thus, allowing both the federal and provincial governments to enact laws on the subject. To date, only the federal government has enacted laws on environment, and the provincial environmental institutions derive their power from federal law.

Article 9 of the constitution defines the right to life as a fundamental right in these words “No person shall be deprived of life or liberty save in accordance with law”.

2.4 National Conservation Strategy

The National Conservation Strategy (NCS) is the primary policy document of the Government of Pakistan (GOP) on national environmental issues. The policy was approved by the Federal Cabinet in March 1992. The Strategy also attained recognition by the 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.

A mid-term review of the achievements of the NCS in 2000 concluded that achievements under the NCS have been primarily awareness raising and institutional building rather than actual improvement to environment and natural resources and that the NCS was not designed and is not adequately focused as a national sustainable strategy (GoP, November 2000). The need therefore arose for a more focused National Environmental Action Plan (NEAP) required to bring about actual improvements in the state of the national environment with greater emphasis on poverty reduction and economic development in addition to environmental sustainability.

The National Environmental Action Plan was approved by the Pakistan Environmental Protection Council under the chairmanship of the President/ Chief Executive of Pakistan in February 2001. NEAP also constitutes the national environmental agenda and its core objective is to initiate actions that safeguard public health, promote sustainable livelihoods, and enhance the quality of life of the people of Pakistan.



The Government of Pakistan and United Nations Development Program (UNDP) have jointly initiated an umbrella support program called the National Environmental Action Plan-Support Program signed in October 2001 and implemented in 2002. The development objective supported by NEAP-SP is environmental sustainability and poverty reduction in the context of economic growth. The objective of new policy has total 171 guidelines on sectorial and cross sectorial issues. The objectives of new policy include assurance of sustainable development and safeguard of natural wealth of country.

The following are the approved Sectorial Guidelines:

- Water Supply and Management
- Air Quality and Noise
- Waste Management
- Forestry
- Biodiversity and Protected Areas
- Climate Change and Ozone Depletion
- Energy Efficiency and Renewable
- Agriculture and Livestock

2.5 Environmental Pollution and Ecology

Environmental pollution is one the major problems that affects biodiversity, ecosystems, and human health worldwide by contaminating soil and water. Well drilling might harm all 3 components of the Environment i.e., Air, water and land, this issue cannot be resolved through conventional tools and traditional strategies so, Environmental rules and regulations must be required to control Environmental Pollution and to protect natural Ecosystem. Following laws and acts must be considered in this regard.

2.6 Biodiversity Action Plan, 2000

Pakistan is a signatory to the Convention on Biological Diversity and is thereby obligated to develop a national strategy for the conservation of biodiversity. The Government of Pakistan has constituted a Biodiversity Working Group under the auspices of the Ministry of Environment, Local Government and Rural Development to develop a Biodiversity Action Plan for the country.

The Biodiversity Action Plan (BAP), which was designed to complement the NCS and the proposed provincial conservation strategies, identifies the causes of biodiversity loss in Pakistan and suggests a series of proposals for action to conserve biodiversity in the country. The BAP recognizes that an environmental assessment 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 environmental assessment needs to be initiated at an early



stage of project development and that public participation in the review of potential effects is important.

2.7 National Environmental Policy 2005

The National Environment Policy (NEP) aims to protect, conserve and restore Pakistan's environment in order to improve the quality of life of the citizens through sustainable development. In NEP, the further sectorial guidelines, Energy Efficiency and Renewable directly related to building energy code for newly constructed buildings were introduced. Government of Pakistan has notified National Environmental Policy 2005, for different projects/aspects in which guidelines/priorities have been given to undertake/commence the projects having significant environmental impacts.

The National Environmental Policy (2005) provides a framework for addressing the environmental issues (particularly pollution of fresh water bodies and coastal waters, air pollution, lack of proper waste management, deforestation, loss of bio diversity, desertification etc.) confronting Pakistan. It recognizes the goals and objectives of the Pakistan National Conservation Strategy (PNCS, 1992), National Environmental Action Plans, and other existing environment related national policies, strategies, and action plans. It also provides broad guidelines to the Federal Government, Provincial Governments, federally administrated territories and local governments to address their environmental concerns and to ensure effective management of their environmental resources.

2.8 Regulations for Environmental Assessment

Under Section 12 (and subsequent amendment) of the PEPA (1997), a project falling under any category specified in Schedule I of the IEE/EIA Regulations (SRO 339 (IO/2000)), requires the proponent of the project to file an IEE with the concerned provincial EPA. Projects falling under any category specified in Schedule II require the proponent to file an EIA with the provincial agency, which is responsible for its review and accordance of approval or request any additional information deemed necessary.

2.9 Regulatory Clearance

In accordance with provincial regulatory requirements, an IEE/EIA satisfying the requirements of the Punjab Environmental Protection Act 1997 and IEE/EIA Regulations (2022) is to be submitted to Punjab Environmental Protection Agency (Punjab-EPA) for review and approval, and subsequent issuance of NOC before the commencement of construction. As per guidelines project is falling in Schedule I of IEE/EIA regulation, 2022 and requires that an EIA shall be prepared and submitted to Punjab-EPA for review and necessary approval.

2.10 Approvals and Leases Required

All development activity is now required by law to obtain a No Objection Certificate (NOC) from the Provincial or Federal EPA.



Any oil and gas project requires the approval of the Chief Inspector of Explosives who issues the approval if the project design is in accordance with the petroleum rules of Pakistan. The rules focus on regulating the import, transportation, refining, storage and testing of petroleum products.

The rules are very detailed and there are specific requirements for compliance with regard to storage and transportation of the petroleum products.

2.11 Punjab Environmental Protection Agency (Review of IEE and EIA Regulations), 2022

Punjab Environmental Protection Agency (Review of IEE and EIA Regulations), 2022 (the Regulations) prepared by the Punjab Environmental Protection Agency under the powers conferred upon it by the Act, provide the necessary details on preparation, submission and review of the IEE and the EIA. Categorization of projects for IEE and EIA is one of the main components of the Regulations.

Projects have been classified on the basis of the expected degree of adverse environmental impacts. Project types listed in Schedule-I are designated as potentially less damaging to the environment and those listed in Schedule-II as having potentially serious adverse effects. Schedule-I projects require an IEE to be conducted, provided they are not located in environmentally sensitive areas. For the schedule-II projects, conducting an EIA is necessary.

Categories of projects requiring IEE and EIA are issued through two schedules attached with the regulations. Salient features of the regulation, relevant to the proposed project are listed below:

- A fee, depending on the cost of the project, has been imposed for review of EIA and IEE.
- The submittal is to be accompanied by an application in prescribed format included as schedule IV of the Regulations.
- The EPA is bound to conduct preliminary scrutiny and reply within 10 days of submittal of the 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 IEE within **30 days** and of the EIA within **45 days**, of the issue of confirmation of completeness.
- EPAs accord their approval subject to following conditions:
 - 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 EPA a written confirmation of compliance with approval conditions and requirements of the IEE/ EIA.
- An EMP is required to be submitted with the request for obtaining confirmation of compliance.
- The IEE/ EIA approval will be valid for three years from the date of the accord.
- A monitoring report is required to be submitted to the EPA after completion of construction, followed by annual monitoring reports during operations.

2.12 Pakistan Environmental Protection Act of 1997

PEPA, 1997 is an improvement over PEPO of 1983. The Pakistan Environmental Protection Act, 1997 (PEPA) was the basic environmental legislation in the country, enacted on 6 December 1997 with the objective of "protection, conservation, rehabilitation and improvement of environment for the prevention and control of pollution, and promotion of sustainable development".

The Pakistan Environmental Protection Act (Amendment 2017) was appeared to amend the Pakistan Environmental Protection Act 1997. The project will be subjected to four basic provisions relating to pollution control under the Pakistan Environmental Protection Act, 1997 (Amended 2012), as contained in section 11, 13, 14 and 15 as follows:

- “Section 11” prohibits discharge or emission of any effluent or waste or air pollutant or noise in excess of the PEQS, or the established ambient standards for air, water or land.
- “Section 13” prohibits the import of hazardous wastes.
- “Section 14” prohibits the handling of hazardous substance except under license or in accordance with the provision of any local law or international agreement.
- “Section 15” prohibits the operation of motor vehicles for each air pollutant or noise is being emitted in excess of the PEQS or the established ambient standard.

2.13 Punjab Environmental Quality Standards (PEQS), 2016

With the PEPA, 1997 the Pak EPA revised the NEQS with full consultation of the private sector, industrialist, trade and business associations and NGOs. The municipal and liquid industrial effluent standards cover 32 parameters. The standards for industrial gaseous emissions specify limits for 16 parameters, and the standards for motor vehicles prescribe maximum permissible limits for smoke, carbon monoxide and noise. Revised standards cover discharges limits of effluents into inland water, sewage treatment plant and the sea. The PEQS are primarily concentration based. Unfortunately, the limits on industrial effluents are neither industry specific nor do they have any relationship with the quantum of production. The PEQS prohibit dilution, but this can be easily circumvented.



2.13.1 PEQS for Gaseous Emission

The Punjab Environmental Quality Standards (PEQS) for permissible limits of gaseous emission from industry are presented in **Table 2-1**.

Table 2-1: PEQS for Gaseous Emission

Parameter	Source of Emission	Standard
Smoke	Smoke opacity not to exceed	40% or 2 Ringlemann Scale or equivalent smoke number
Particulate Matter	Boilers and Furnaces:	
	Oil Fired	
	Coal Fired	300
	Cement Kilns	500
	Grinding, crushing, clinker coolers and related processes, metallurgical processes, converters, blast furnaces and cupolas	300
Hydrogen Chloride	Any	400
Chlorine	Any	150
Hydrogen Fluoride	Any	150
Hydrogen Sulphide	Any	10
Sulphur Oxides	Sulfuric Acid/sulphonic Acid Plants	5000
	Other Plants except power plants operating on oil and coal	1700
Carbon Monoxide	Any	800
Lead	Any	50
Mercury	Any	10
Cadmium	Any	20
Arsenic	Any	20
Copper	Any	50
Antimony	Any	20
Zinc	Any	200
Oxides of Nitrogen	Nitric Acid Manufacturing Unit	3000
	Other plants except for power plants operating on oil or coal:	
	Gas fired	400
	Oil fired	600
	Coal-fired	1200



2.13.2 PEQS for Municipal and Liquid Industrial Effluents

The Punjab Environmental Quality Standards (PEQS) for the municipal and liquid industrial effluents are presented in **Table 2-2**.

Table 2-2: PEQS for Municipal and Liquid Industrial Effluents (Source: PEQS)

Parameters	Into Inland Waters	Into Sewage Treatment
Temperature	$\leq 3^{\circ}\text{C}$	$\leq 3^{\circ}\text{C}$
pH Value	6-9	6-9
Biological Oxygen Demand (BOD) ₅	80	250
Chemical Oxygen Demand (COC)	150	400
Total Suspended Solids (TSS)	200	400
Total Dissolved Solids (TDS)	3500	3500
Grease and Oil	10	10
Phenolic Compounds (as phenol)	0.1	0.3
Chlorides (as Cl')	1000	1000
Fluoride (as F')	10	10
Cyanide (CN') total	1.0	1.0
An-ionic Detergents (as MBAs)	2.0	20
Sulphate (SO'')	600	1000
Sulphide (S')	1.0	1.0
Ammonia (NH ³)	40	40
Pesticides	0.15	0.15
Cadmium	0.1	0.1
Chromium (trivalent and hexavalent)	1.0	1.0
Copper	1.0	1.0
Lead	0.5	0.5
Mercury	0.01	0.01
Selenium	0.5	0.5
Nickel	1.0	1.0
Silver	1.0	1.0
Total Toxic Metals	2.0	2.0



Zinc	5.0	5.0
Arsenic	1.0	1.0
Barium	1.5	1.5
Iron	8.0	8.0
Manganese	1.5	1.5
Boron	6.0	6.0
Chlorine	1.0	1.0

2.13.3 PEQS for Vehicular Emissions

The Punjab Environmental Quality Standards (PEQS) for permissible limits of exhaust emissions from vehicles are presented in **Table 2-3**.

Table 2-3: PEQs for Vehicular Emissions

Parameters	Standards (Maximum permissible limits)	Measuring Method
Smoke	40% or 2 on the Ringlemann Scale during engine acceleration mode	To be compared with Ringlemann chart at a distance of 6 meters or more
Carbon Monoxide	6%	Under idling conditions: non-dispersive infrared detection through gas analyzer.
Noise	85 dB (A)	A sound meter at 7.5 meters from the source

2.13.4 PEQS for Drinking Water Quality

The Punjab Environmental Quality Standards (PEQS) for drinking water quality 2016 are presented in **Table 2-4**.

Table 2-4: PEQS for Drinking Water Quality

Parameter	Standard Values	WHO Standards
Biological		
All water intended for drinking (E. Coli or Thermo-tolerant Coliform bacteria)	Must not be detectable in any 100 ml sample.	Must not be detectable in any 100 ml sample.
Treated water entering the distribution system (E. Coli or Thermo-tolerant Coliform and total Coliform bacteria)	Must not be detectable in any 100 ml sample.	Must not be detectable in any 100 ml sample.





Treated water in the distribution system (E. Coli or Thermo-tolerant Coliform and total Coliform bacteria)	Must not be detectable in any 100 ml sample. In case of large supplies, where sufficient samples are examined, must not be present in 95% of the samples taken throughout any 12-month period.	Must not be detectable in any 100 ml sample. In case of large supplies, where sufficient samples are examined, must not be present in 95% of the samples taken throughout any 12-month period.
Physical		
Color	≤ 15 TCU	≤ 15 TCU
Taste	Non-objectionable / Acceptable	Non-objectionable / Acceptable
Odour	Non-objectionable / Acceptable	Non-objectionable / Acceptable
Turbidity	< 5 NTU	< 5 NTU
Total hardness	< 500 mg/L	---
TDS	< 1000	< 1000
pH	6.5- 8.5	6.5- 8.5
Chemical		
Essential Organic	mg/Litre	mg/Litre
Aluminium	≤ 0.2	0.2
Antimony	≤ 0.005 (P)	0.02
Arsenic	≤ 0.05 (P)	0.01
Barium	0.7	0.7
Boron	0.3	0.3
Cadmium	0.01	0.003
Chloride	< 250	250
Chromium	≤ 0.05	0.05
Copper	2	2
Toxic Inorganic	mg/l	mg/l
Cyanide	≤ 0.05	0.07
Flouride	≤ 1.5	1.5
Lead	≤ 0.05	0.01
Mangnese	≤ 0.5	0.5
Mercury	≤ 0.001	0.001
Nickel	≤ 0.02	0.02
Nitrate	≤ 50	50
Nitrite	≤ 3 (P)	3





Selenium (Se)	0.01 (P)	0.01
Residual Chlorine	0.2 – 0.5 at consumer end 0.5 – 1.5 at source	-
Zinc (Zn)	5.0	3
Organic		
Pesticides mg/l		
Phenolic Compounds		<0.002
Polynuclear aromatic hydrocarbons (as PAHS) g/l		0.01 (By GC / MS Method)
Radioactive		
Alpha emitters bq/L or pCi	0.1	0.1
Beta emitters	1	1

2.13.5 PEQS for Ambient Air and Noise

The Punjab Environmental Quality Standards (PEQS) for Ambient Air and Noise, 2016 are presented in **Table 2-5** and **2-6**.

Table 2-5: PEQS for Ambient Air Quality and Noise

Pollutants	Time Weighted Average	Concentration in Ambient Air (ug/m ³)
Sulfur Dioxide (SO ₂)	Annual Average*	80
	24 hrs**	120
Oxides of Nitrogen gas (NO)	Annual Average*	40
	24 hrs**	40
Oxides of Nitrogen gas (NO ₂)	Annual Average*	40
	24 hrs**	80
Ozone (O ₃)	1 hour	130
Suspended Particulate Matter (SPM)	Annual Average*	360
	24 hrs**	500
Respirable Particulate Matter (PM ₁₀)	Annual Average*	120
	24 hrs**	150
Respirable Particulate Matter (PM _{2.5})	Annual Average*	15
	24 hrs**	35
	1 hr	15
Lead (Pb)	Annual Average*	1
	24 hrs**	1.5
Carbon monoxide (CO)	8 hrs	5 mg/m ³
	1 hr	10 mg/m ³



*** Annual Arithmetic mean of minimum 104 measurements in a year taken twice a week 24 hourly at a uniform interval*
** 24 hourly /8 hourly values should be met 98 % of the year, 2 % of the time, it may exceed but not on two consecutive days.*

2.13.6 PEQS for Noise

Category of Area / Zone	Limits in db (A) Leq*	
	Day time	Night-time
Residential Area (A)	55	45
Commercial Area (B)	65	55
Industrial Area (C)	75	65
Silence Zone (D)	50	45

** Time weighted average of the level of sound in decibel on scale A which is relatable to human hearing*

2.14 Clean Air Act

On the occasion of the World Environment Day 2021, the Ministry of Climate Change (MOCC) of Pakistan is announcing the revised Pakistan Clean Air Plan (PCAP) which was prepared with the support of the Asian Development Bank (ADB) funded technical assistance project on “Strengthening Knowledge and Actions for Air Quality Improvement”. The project aims to improve air quality and livability in 7 Asian cities through establishment of Clean Air Action Plans (CAAP). Peshawar and Sialkot in Pakistan are 2 of the 7 cities. The revised PCAP assesses ongoing air pollution reduction efforts being made by national and local stakeholders in Pakistan and includes feedback received from provincial stakeholders. The PCAP aims to improve air quality in the country through systematic monitoring and implementation of various policy, technological, and management-based measures.

2.15 Punjab Soil Reclamation Act, 1952

This Act provides for the speedy reclamation and improvement of waterlogged and saline areas and the prevention of damage to maximize agriculture production. The Act’s main objectives are to: control operations of tube wells; regulate groundwater supplies; increase revenues; etc. The Act further provides for the establishment of the Punjab Land and Water Development Board and defines its internal organization. The Board shall carry out surveys for schemes including afforestation and area treatment, execute works and incur any expenditure for the improvement, reclamation and lowering of the water table in the subsoil. In addition, the Act provides for: acquisition of land for the purpose of reclamation; abandonment of acquisition; reclamation fees; establishment of a Board Fund; rule and bylaw making powers of the Government; penalties; etc.

2.16 The Punjab Water Act, 2019

Punjab became the first province to pass its own water legislation in 2019. The Punjab Water Act 2019 in effect replaces the colonial-era Easements Act (1882). While all landowners could



previously extract groundwater on their property independently and without any state oversight, the new act establishes a licensing regime. The act establishes the Punjab Water Resources Commission, a body tasked with conserving and allocating water resources in Punjab and ensuring their proper usage.

This Act aims to fully manage and regulate Punjab's water resources in the interests of conservation and sustainability. It is expedient to provide for comprehensive management of all water resources in the Punjab and to regulate their use in the interest of conservation and sustainability. The act regulates the water undertaker to develop and maintain an efficient and economical system of water supply within its area and to ensure that all the arrangements are made for providing water in the area and for maintaining, improving and extending the water mains.

2.17 Wildlife Protection Ordinance, 1974

This Act aims to protect the province's wildlife resources directly and other natural resources indirectly. It classifies wildlife by degree of protection (i.e. animals that may be hunted on a permit or special license, and species that are protected and cannot be hunted under any circumstances). The Act specifies restrictions on hunting and trade in animals, trophies, or meat. The Act also defines various categories of wildlife protected areas (i.e. national parks, wildlife sanctuaries and game reserves). Provisions in this Act will be applicable throughout the design, construction, operation and maintenance, and decommissioning phases of the proposed Project.

2.18 The Punjab Forest (Amendment) Act 2016

Amendment in section 34-A of Act XVI of 1927 and Amendment in section 27 of Act XVI of 1927

(a) Satisfies the Government with cogent reasons in writing that there is no other option but to use the proposed protected forest land for purposes of a national project of strategic importance.

(b) provide a substitute plant-able land agreed to by the Government, which is (i) equal to or bigger than the protected forest land (ii) in a compact form and is, as far as possible, situated close to the protected forest land; and (c) provide funds for immediate forestation and maintenance of the substitute land as may be prescribed.

2.19 Occupational Safety

Occupational health and safety law is a body of law that requires employers to implement safety measures for the benefit of their employees. The purpose of occupational health and safety laws is to encourage and require safe working conditions with minimal risks for employees. Well drilling operations also involve risk of occupational hazards therefore



following occupational safety laws and regulations must be followed by proponent while well drilling.

2.20 Regulations for Mineral, Oil and Natural Gas Extraction

Well drilling specifically for the purpose of oil extraction also involve release of some other natural resources i.e., Natural gas and mineral thus According to Bureau of Mineral Resources, Ministry of Petroleum and Natural Resources Natural Gas Rules, 1960 certain rules and regulations will also be applied here that project proponent needs to follow while drilling well for oil extraction.

2.21 Petroleum Act, 1934

The Petroleum Act was enacted to consolidate and amend the law relating to the import, transport, storage, production, refining and blending of petroleum and other inflammable substances. The Petroleum Rules 1937 were made under the Act. According to this act, no one is permitted to import, transport and store any petroleum products and only federal government is the authority regulating the import of petroleum products, prescribing places where petroleum may be imported and prohibiting its import elsewhere.

Federal government also has the authority to prescribe the conditions subject to which petroleum may be produced, refined or blended and regulate the removal of petroleum from places where it is produced, refined or blended.

2.22 Safety in Mines, Factories and Oilfields

Mines can be hazardous environments and the possibility of fire, flood, explosion, and collapse has the potential to simultaneously affect many people. National Occupational Standards (NOS) in mining have been developed for a range of posts, in consultation with the mining industry that should be followed by project proponent while drilling well.

2.23 Pakistan Petroleum (Exploration and Production) Rules, 1986

These rules were developed to regulate the exploration, drilling and production of oil within Pakistan. The act states that if a petroleum right is held by two or more companies, they shall be liable jointly towards the Government for obligations and liabilities, resulting from their activities. Furthermore, the holder must ensure the use of Pakistani goods and services to the extent such goods and services are competitive with regard to price, quality, services and schedule of delivery.

2.24 Factories Act, 1934 (Amendment 2012)

This Act aims to consolidate and amend the law regulating labor in factories. The clauses relevant to the project are those that concern the health, safety, and welfare of workers, disposal of solid waste and effluent and damage to private and public property. The Factories Act also



provides regulations for handling and disposal of toxic and hazardous materials. Given that construction activity is classified as ‘industry’, these regulations will be applicable to the project contractors

The main objective of the Factories Act is to **regulate the conditions of work in manufacturing establishments coming within a factory**. This act contains detailed provisions regarding safety, health, and welfare of the employees of a factory.

2.25 Antiquities Act, 1975

The Antiquities Act of 1975 ensures the protection of cultural resources in Pakistan. The Act is designed to protect antiquities from destruction, theft, negligence, unlawful excavation, trade, and export. Antiquities have been defined in the Act as ancient products of human activity, historical sites, or sites of anthropological or cultural interest, national monuments; etc. The law prohibits new construction in the proximity of a protected antiquity and empowers the Government of Pakistan to prohibit excavation in any area that may contain such articles of archaeological significance. The Act states that no person shall, except for carrying out the purposes of this Act, destroy, break, damage, alter, injure, deface or mutilate or scribble, write or engrave any inscription or sign on, any antiquity or take manure from any protected antiquity.

Under this Act, the proponents are obligated to ensure that no activity is undertaken in the proximity of a protected antiquity, and during the course of the project if an archaeological discovery is made, it should be reported to the Department of Archaeology accordingly.

No archaeological and cultural site as protected under Antiquities Act 1975 is present near the project site.

2.26 Cutting of Trees (Prohibition) Act, 1992

The Cutting of Trees Act prohibits cutting or chopping of trees without prior permission of the Forest Department. Section 3 of this Act states that “No person shall, without 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 growing within the five miles belt along the external frontiers of Pakistan.”

Only those trees will be cut /removed where installation is to be made in the project area and access road, possible conservation of trees would be done on priority.

2.27 Labor Laws

There are three categories of laws, firstly, the law that regulates the relations between Employer and Employee; secondly those laws that provide for compulsory levies and thirdly those that provide for minimum standards for Employees; the same are as follows:





- Labor Laws regulating the Relation of Employer and Employee
- Labor Laws Assigning Levies
- Labor Laws Assigning Standards for Wages
- Labor Laws Setting Standards for Workplace

Following are the salient features of the labour laws:

- Improvement in health and safety at the workplace through promulgation of new OSH law.
- Ensure payment of wages through scheduled banks by all the industrial establishments in the province with the objective to address wage evasion, under payment, less payment and nonpayment of wages
- Promoting efforts towards sustained elimination of child and bonded Labor in the province.
- Facilitation of the workers in provision of their basic rights, social protection and welfare measures through education and awareness and establishment of facilitation desks.
- Special measures for youth, persons with disabilities and transgender including skill development, employment promotion and enterprise development.
- Improvement in enforcement of Labor laws through framing subsidiary rules of Labor laws, capacity development of inspection staff and research and development.



3 PROJECT DESCRIPTION

3.1 Project Categorization

The Review of Initial Environmental Examination (IEE) and Environmental Impact Assessment Regulations (EIA), 2022 categorizes projects in two categories provided in Schedule I and II. Schedule I categorizes the projects requiring an Initial Environmental Examination while Schedule II categorizes projects requiring an Environmental Impact Assessment (EIA). According to this categorization, Drilling of Well Jhandial -03 falls within Point 5 of Section A, Energy of Schedule II of Review of IEE and EIA Regulations, 2022.

- **Oil and gas extraction projects including exploration, production, gathering systems, separation and storage.**

3.2 Project Objectives

The objective of the project is to explore the hydrocarbon potential of Paleocene reservoir (Lockhart Formation) and appraise the potential from Eocene reservoirs (Chorgali, Sakesar and Nammal formations).

3.3 Background of the Proposed Project

Pakistan Oilfields Limited aims to enhance the Oil and Gas production by unleashing the potential of **Jhandial-03** well in Jhandial that will contribute for the better economy and resource up gradation of country. As the energy demands continue to increase, there is an urgent necessity to apply the advancements of technology in exploration and production for paving the path of sustainable development. Oil exploration activity may generate business and employment opportunities across a spectrum of industries. The objective of the project is to explore the hydrocarbon potential of Paleocene reservoir (Lockhart Formation) and appraise the potential from Eocene reservoirs (Chorgali, Sakesar and Nammal formations) which will enhance oil production of the country. Land Drilling Rig will be deployed to drill the well to the depth of **±17,850 Ft.**

Based upon proposed geophysical investigation campaigns/surveys and their interpretations, POL has planned to drill a well as part of its exploration/ development plan. It is pertinent to mention that, most certain/prospective surface location for drilling of well have been identified. Furthermore, in case of discovery of hydrocarbons at the proposed well location further development activities will be planned by POL and initiated accordingly subject to separate environmental assessment(s) of the area.





Figure 3-1: Proposed Project Site Location for Well Drilling

This EIA report is based on factual information and the satellite imagery shows the proposed well location at 33° 22' 47.10" N, 72° 32' 42.52" E.



Figure 3-2: Map of Drilling of Jhandial 03 Well and Adjoining Areas



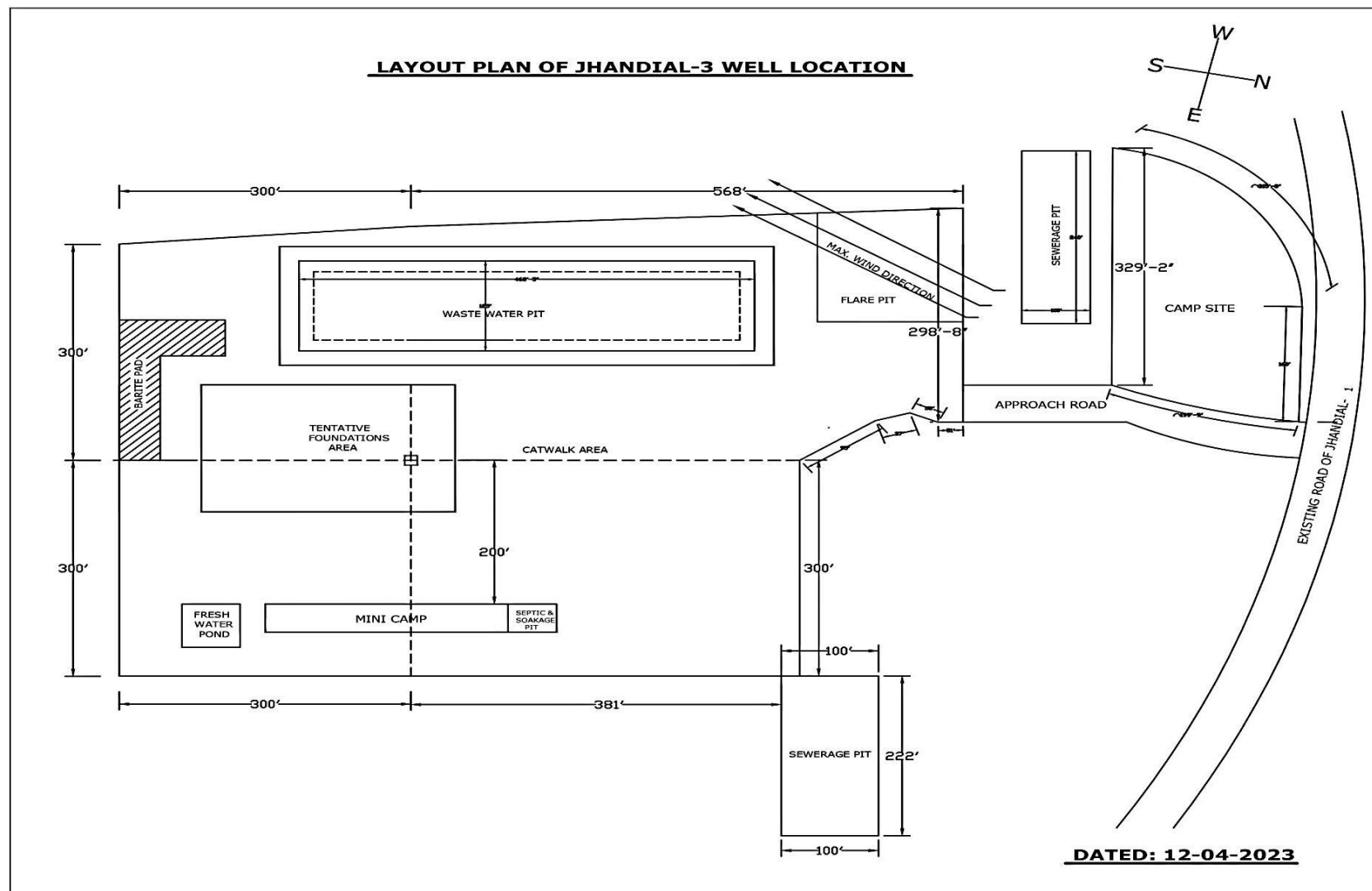


Figure 3-3: Layout Map of Jhandial -03 Well (Including Campsite, Wastewater Pit, Flare Pit and Access Road)



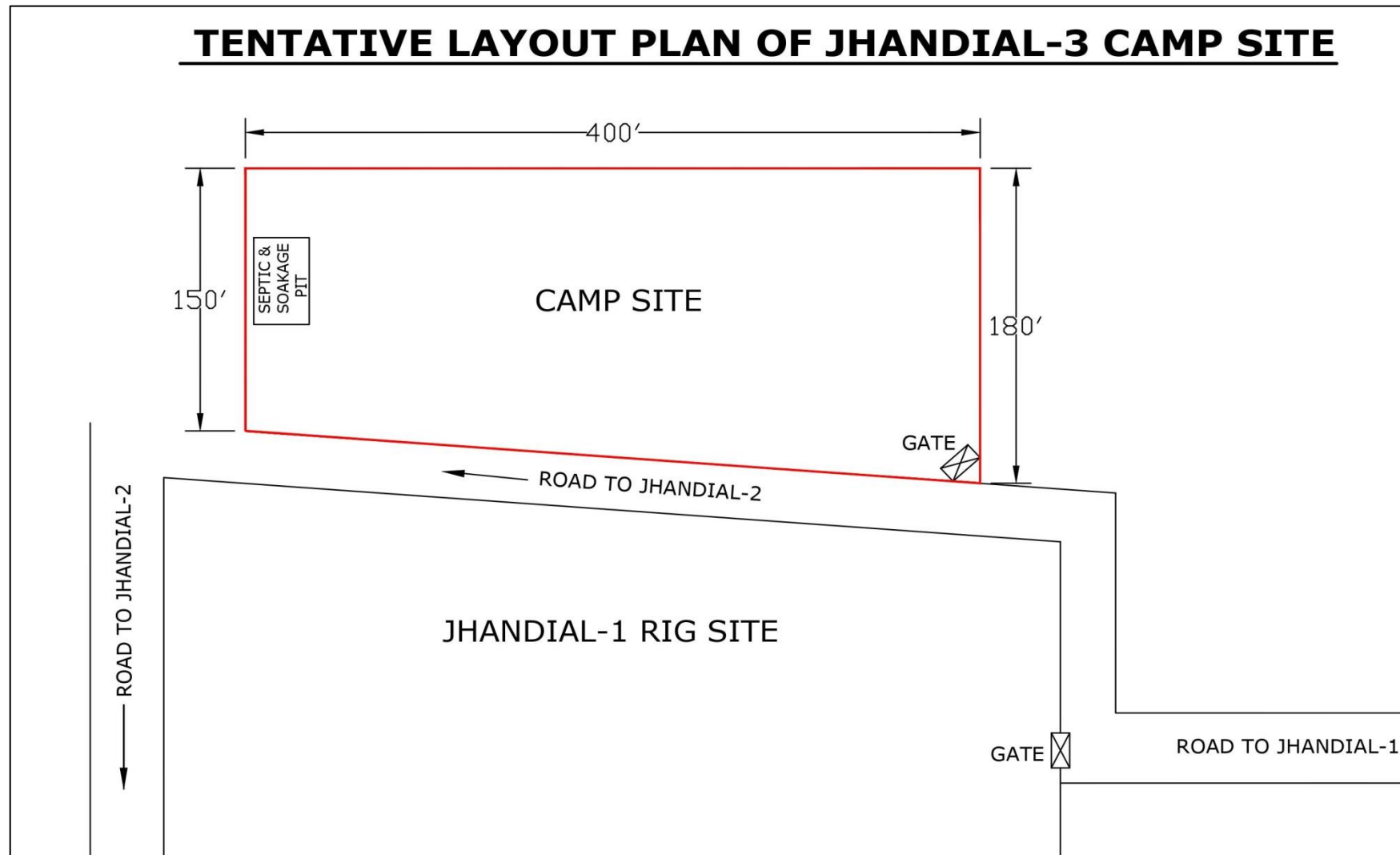


Figure 3-4: Layout Map of Jhandial -03 Well Campsite



3.1.1 Land Use on Site

The project area is rich in oil and gas resources. Majority of the area around Jhandial is agricultural with scattered population. Local population is located at a safe distance from the project site. Besides, no resettlement plan is required for the local people at this stage as construction and operation activities will be away from population.

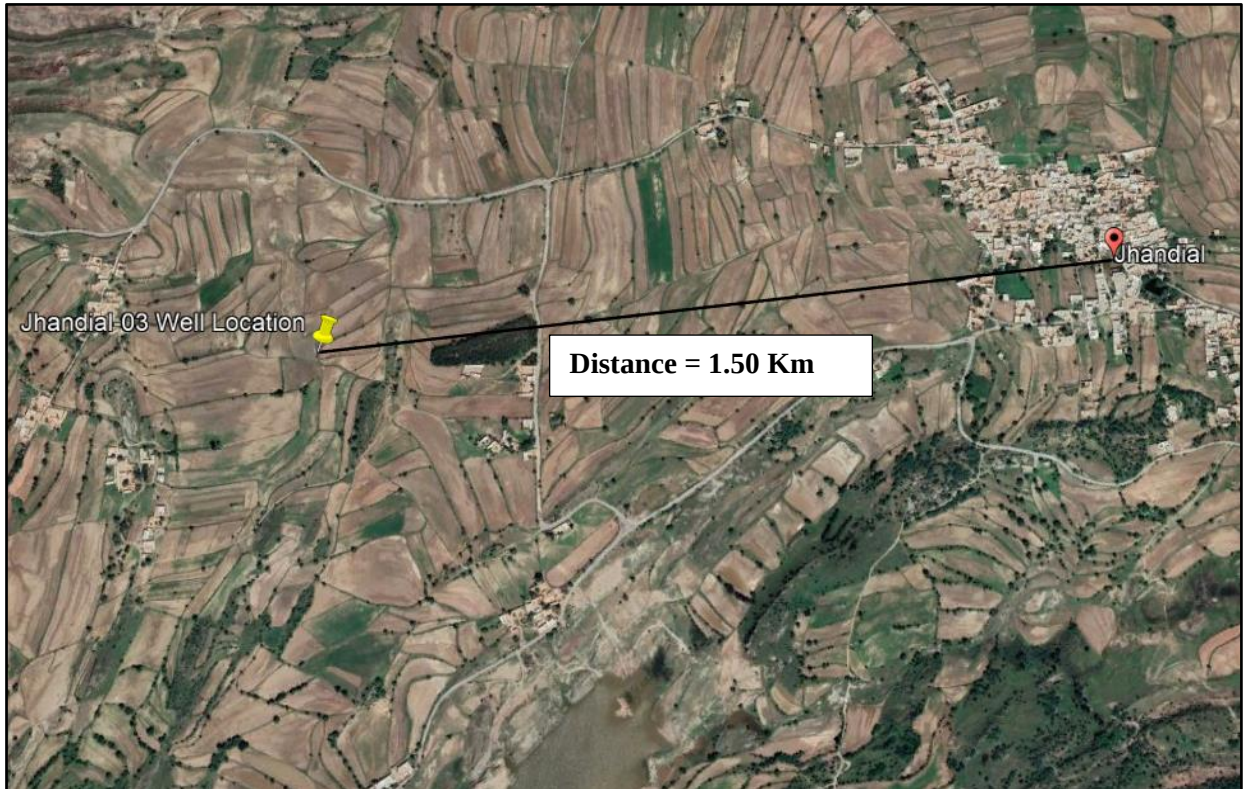


Figure 3-5: Distance between Proposed Well Site and Jhandial Village

3.3.1 Project Schedule

The detailed feasibility studies and designing of the project are underway. Necessary legal, administrative and financial formalities are being finalized. The entire duration of the project is expected to take about 160 days. The project is expected to be started as soon as the NOC is issued. After the completion of the project activities all equipment and personnel will be demobilized and all areas restored following the EMP requirements of the EIA. Subsequently the operational and maintenance aspects of the project will be undertaken by the proponent.





3.1.2 Project Cost

Estimated Project Cost is given in the table below:

Table 3-1: Table Showing Cost of the Project

Sr. No.	Phase	Cost
1	Development	Estimated 16,729 Million \$ (Pre-commencement/ Dry Hole)
2	Installation	Estimated 3,098 Million \$ (Testing/ Completion)
3	Total	Estimated 19,827 Million \$

3.2 Project Components

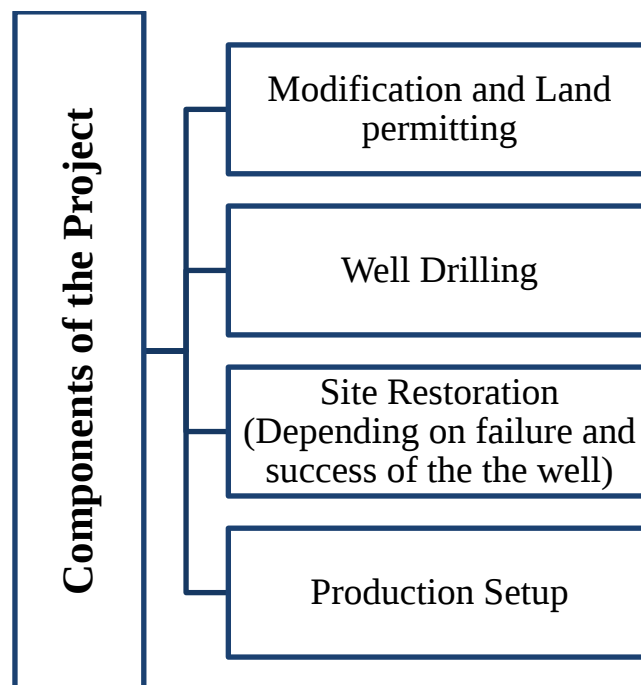


Figure 3-6: Summary of Project Activities

3.3 Drilling

Drilling of well will be done by POL in order to explore oil and gas reserves. Land drilling rig will be deployed to drill the proposed Jhandial -03 well to the depth of **±17,850 ft.** After drilling the well to the target depth, all equipment and personnel will be demobilized and all areas restored following the requirements of the EIA.

3.3.1 Project Phases

The project will be completed in three phases:

- **Phase I:** Well Construction





- Civil contractor's mobilization
 - Development of access road
 - Rig camp construction
 - Well site construction
 - Civil contractor's demobilization
-
- **Phase II: Well Drilling**
 - Well drilling and possible testing
 - Vertical Seismic Profiling (VSP)
 - Site Restoration (depending on the failure or success of the well)
-
- **Phase III: Well Operation**

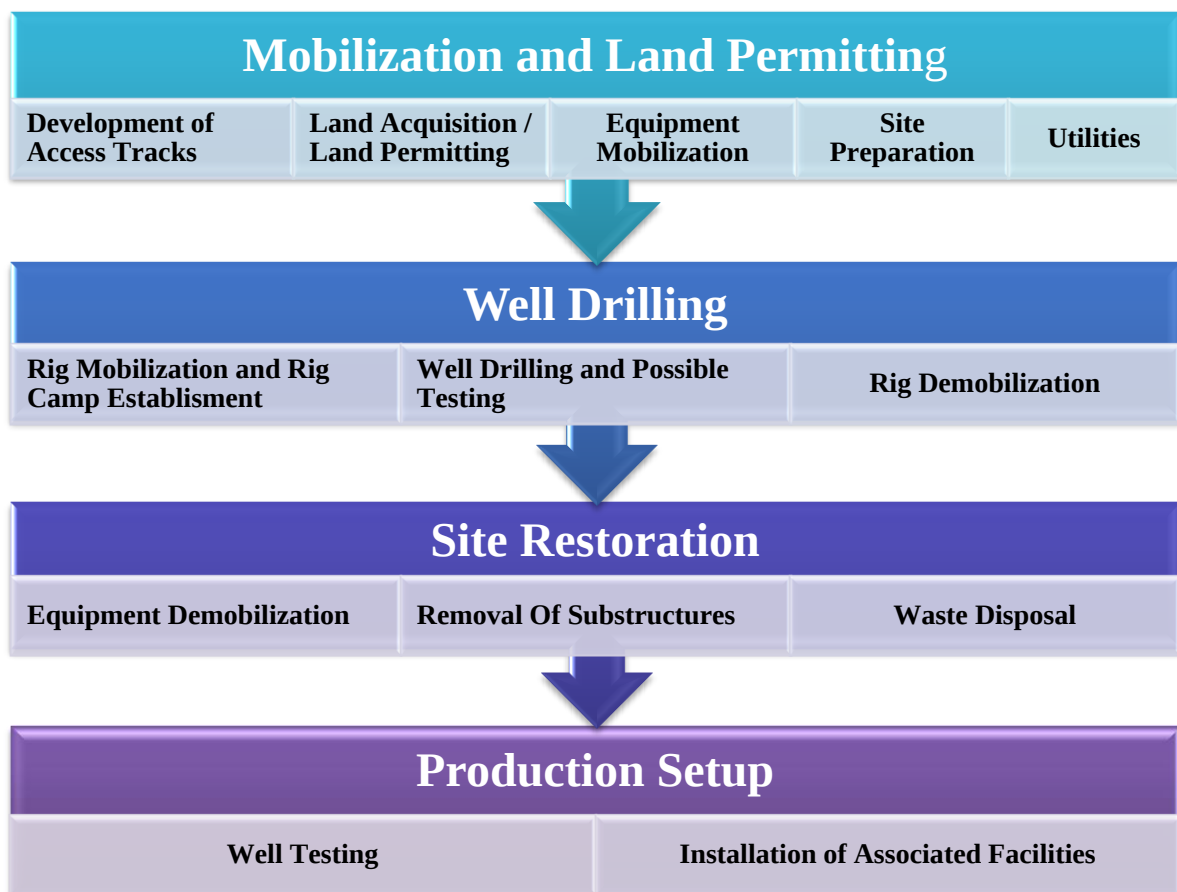


Figure 3-7: Flowchart showing Project Phases





3.3.2 Phase I: Construction

In this phase of the project, each well site, rig camp, security camp and access track will be developed. The construction contractor will develop its own temporary camp for construction purposes. The contractor will ensure that local people are also hired for unskilled and semi-skilled jobs. Construction contractor will be solely responsible for handling/dealing with all sorts of community and related matters.

The construction works i.e. well site and associated access track will take approximately **60-70** working days to complete. Well site construction will involve the following:

- Site clearance, levelling and compaction.
- Construction of the drilling rig pad and cellar.
- Construction of drill cuttings pit, water pit and waste water pit.
- Construction of flare pit.
- Construction of fuel storage tank with sump and loading/un-loading pad.
- Installation of a fence around the well site.
- Solid Waste Management site.

The rig camp site will consist of portable cabins and mess room etc. for which limited construction works including levelling, grading, filling and compaction will be required. Development of campsite includes, but not limited to the following:

- Levelling and compaction of area for the site.
- Provision of drainage works in and around the site.
- Laying and compaction of the gravel topping in the site.
- Construction of fuel storage tank with sump and loading / un-loading pad
- Provision of fence, access and emergency gates.
- Construction of septic tank and soak pits.
- Installation of security guard wooden cabins.

An existing track will be used as much as possible to access the drilling location. Due to the network of existing tracks in the area, development of new tracks is limited. The construction work includes, but not limited to the following:

- Cutting and filling.
- Levelling, grading and compaction of sub grade.
- Laying and gravel compaction.
- Provision of earthen catch drains.





- Provision of pass points.
- Provision of milestones, road and safety signs.

Existing tracks will be utilized as much as possible to access the proposed drilling locations. Due to the network of existing tracks in the area, development of new tracks will be limited to short reaches of a few kilometers only. The existing tracks will be upgraded/ built to a standard that is suitable for movement of 40 ft. trailers. The newly proposed access road will be 1000 RFT long, consisting of 200 mm gravel top and 0.5 m of earthen shoulder on either side.

Water required during construction will be obtained from Khaur which will be transported by bowzers. Approximately **71,550 liters** of water would be required per day during construction phase for both construction and domestic purposes. After completion of construction activities, all except for a few equipment, machinery and personnel required for maintenance of the access track will be demobilized from the area.

3.3.3 Phase II: Rig Mobilization

Following the construction of each well site, rig camp and access road mobilization of the rig and related machinery and equipment will commence. Mobilization will involve the transportation of the following to the designated drilling location.

- The land drilling rig;
- Ancillary equipment such as power generators, mud pumps, mud tanks, shale shakers, cementing unit, drill pipes and collars;
- Porta-cabin style camp, complete with all catering, power generation, laundry and other facilities
- Drilling and other necessary support personnel; and
- Drilling materials such as casing and associated accessories, wellheads, drill bits, drilling fluid chemicals and liner hanger equipment.

The drilling rig will be transported to the site using long trailers. Depending on the type of rig truckloads of equipment will be transported during mobilization. The rig will be assembled and erected over the well location.

3.3.2 Phase III: Well Drilling

Drilling will be carried out using conventional equipment, techniques and practices for hydrocarbon exploration. A rotary drilling rig will be used in this operation.

The derrick will be mounted on a steel platform known as the rig floor. The rig floor will provide working area for the drilling operations and personnel. A hoisting drum called draw works will be mounted on the rig floor at the base of the derrick. A wire rope called the drilling



line will pass from the draw works to the top of the derrick through a system of pulleys called the crown block and will be attached to a further system of pulleys known as the hook and block.

At the end of drilling each section, these steel casings will be cemented into place by pumping cement into the space between the casing and the surrounding strata. The sections of the well will be drilled in this manner until the desired target depth is achieved. The drilling operation will be undertaken on a round-the-clock basis with two 12-hour shifts. The total time of drilling activity is four months. The sections of the well will be drilled in this manner until the desired target depth is achieved. Anatomy of a generic rotary drilling rig is shown in **Figure 3-8**.

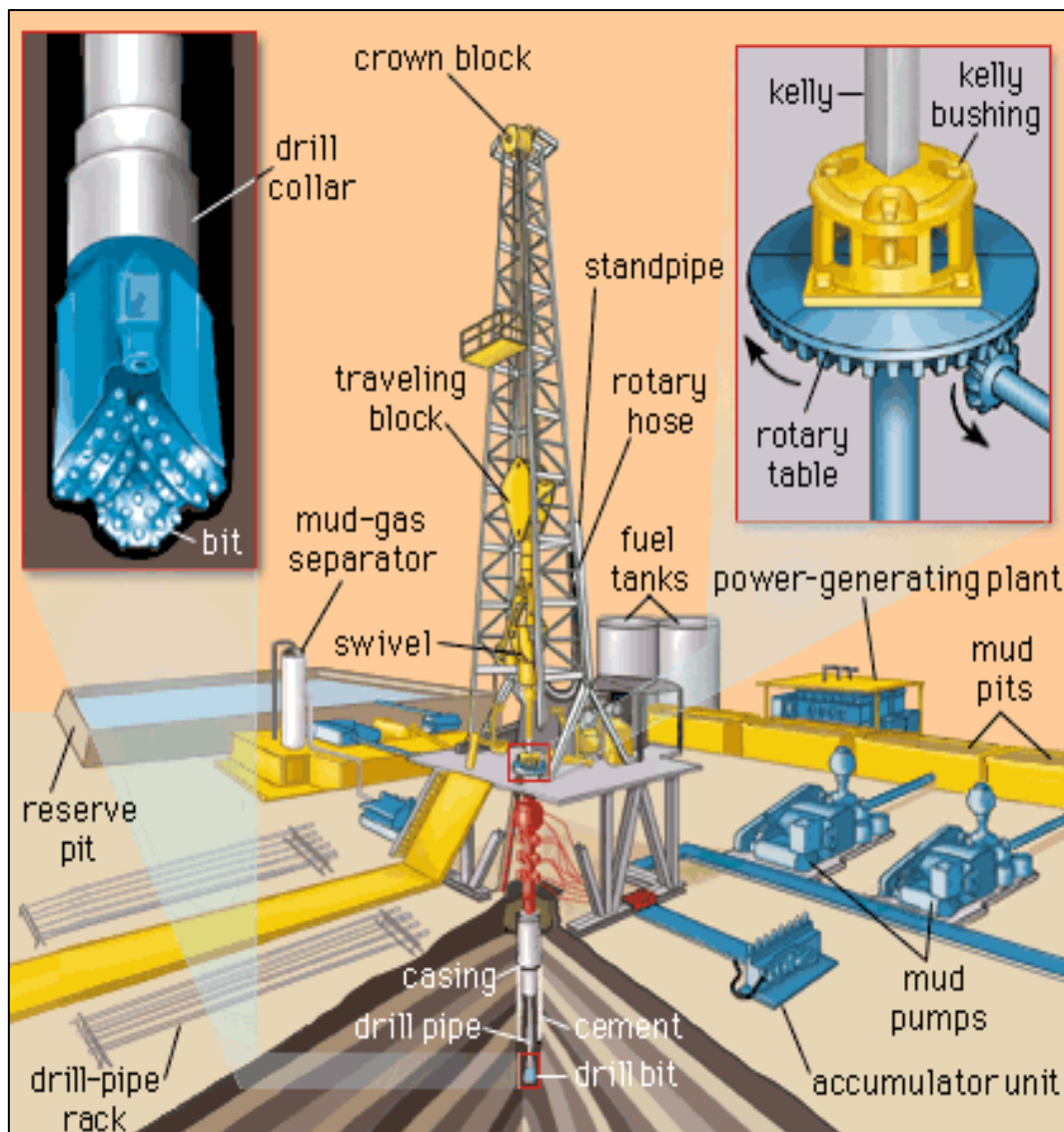


Figure 3-8: Anatomy of a Rotary Land Drilling Rig

The whole system of wire rope and pulleys will operate like a crane. A drill string made up of uniform lengths of hollow steel pipes will be suspended from the hooks. Suspended from the drill string will be the drill bit. The drill bit will drill through the formations by the combined





effect of the weight of the drill collar and the rotary action provided to the bit by a rotary table mounted on the rig floor.

Based on the sections of the well, drill bits with diameter 26, 17-1/2, 12-1/4, 8-1/2 and 6 inches could be used. As drilling progresses in a given section of the well the length of the drill string will be increased by the addition of new lengths of pipes. Steel pipes known, as casing will be lowered into the hole to line the sides of the well and prevent the hole from collapsing.

3.3.2.1 Drilling Mud

Drilling muds are traditionally based on water, either fresh water, seawater, naturally occurring brines, or prepared brines. Many muds are oil-based, using direct products of petroleum refining such as diesel oil or mineral oil as the fluid matrix. The oil-based muds are better for greater depths or in directional or horizontal drilling, which place greater stress on the drilling apparatus. The oil-based drilling fluids have previously been preferred, including high-temperature, high pressure (HTHP) wells. The oil based muds are usually cleaned and re-circulated (though some muds, particularly water-based muds, can be discharged into the surrounding environment in a regulated manner). Larger drill cuttings are removed by passing the returned mud through one or more vibrating screens, and sometimes fine cuttings are removed by passing the mud through centrifuges. The initial cost of Oil-Based mud is high, especially those formulations based on mineral or synthetic fluids.

- Flushing out drilled solids from the bottom of the hole and their transport to the surface.
- Lubrication and cooling of the drill bit and string.
- Deposition of an impermeable layer on the wall of the well bore so as to seal the drilled formations.
- Countering the natural formation pressures and preventing uncontrolled flow of fluid from the formations.

3.3.2.2 Coring and Well Logging

In the potential reservoir section, cores of rock will be taken from the borehole, and a number of well logs performed. Cores and well logs will be used to confirm the geology of the structures being bored through and assess the accuracy of the seismic survey data interpretation done before drilling. Coring and well logging will also help identify possible hydrocarbons.

3.3.2.3 Well Evaluation

If data collected from coring, logging and well testing shows that the well can be used as a producing well then a completion string together with a few items of subsurface equipment (such as a subsurface safety valve) to enable production from the well will be installed just





above the producing formation. The mud in the well will be displaced by completion fluid, which will be water with a chemical for pH control.

Drill Stem Testing (DST) is conducted to isolate, stimulate and flow a down hole formation to determine the fluids present and the rate at which they can be produced. The main objective of a DST is to evaluate the commercial viability of a zone's economic potential by identifying productive capacity, pressure, permeability or extent of an oil or gas reservoir. These tests can be performed in both open and cased hole environments and provide exploration teams with valuable information about the nature of the reservoir. If test results show that gas has been encountered, it becomes necessary to conduct further tests to determine the gas composition and the reservoir's permeability. Hydraulic fracturing may be deemed necessary to ensure the flow of hydrocarbons which require large quantities of water and chemicals which are injected into the drilled reservoir. Fracking can pose a threat to local water resources especially in areas where water is already a scarce resource. However, mitigation measures suggested in this EIA will ensure environmentally sustainable operation and no cumulative impact will occur due to hydraulic fracturing job.

Once the temporary or permanent valves are in place, it is ensured that the mud column is more than adequate to counteract any formation pressures that could be released. After that, a mechanical plug is used to plug off the area of the formation being tested, and tubing is run through the plug. A Blowout Preventer (BOP) is kept in place throughout the test.

3.3.2.4 Well Control and Blowout Prevention (BOP)

In addition to careful monitoring and control of the mud system and the installation of casing in each section of the well, a surface wellhead consisting of a series of BOPs' will be installed at the top of the casing. The function of the BOP is to prevent uncontrolled flow from the well by positively closing in the well bore as and when required. The BOP is made up of a series of hydraulically operated rams, and is designed to withstand pressures well in excess of those expected to be encountered.

3.3.3 Phase IV: Well Operation

After completion of drilling activities, a pipeline will be laid down for the transportation of crude oil to processing plant. At processing plant, lighter components will be removed from crude oil and then it will be delivered for further processing.

3.4 Rotary Drilling

Drilling for oil and natural gas requires two major constituents: manpower and hardware systems. The manpower encompasses a drilling engineering group and a rig operation group. The first group provides engineering support for optimum drilling operations, including rig selection and design of the mud program, casing and cementing program, hydraulic program, the drill bit program, the drill string program and the well control program after drilling begins, the daily operations are handled by the second group which consists of a tool pusher and





several drilling crews (derrick and motor personnel, drillers etc.). The hardware systems that make up a rotary drilling rig are:

- A Power generation system
- A hoisting system
- A drilling fluid circulating system
- A rotary system
- A well blowout control system
- A drilling data acquisition and monitoring system

3.4.1 Power Generation System

A drilling rig needs power to operate the circulating, rotating, and hoisting systems. This power comes from two or more diesel engines. Power is transmitted to the drilling rig from either generators that provide electricity or mechanical drivers that use a series of pulleys and belts to transmit power from the engines to the components that require the power.

3.4.2 Hoisting System

The hoisting system consists of the derrick, traveling and crown blocks, the drilling line, and the draw works. The drilling rig uses a derrick to support the drill bit and pipe (drill string). The derrick is a steel tower that is used to support the traveling and crown blocks and the drill string. There may be no more identifiable symbol of the oil and gas industry than the derrick on a drilling rig. The crown and travelling blocks are a set of pulleys that raise and lower the drill string. The crown block is a stationary pulley located at the top of the derrick. The travelling block moves up and down and is used to raise and lower the drill string. These pulleys are connected to the drill string with a large diameter steel cable.

The cable is connected to a winch or draw works. The draw works contain a large drum around which the drilling cable is wrapped. As the drum rotates one way or the other, the drilling cable spools on or off the drum and raises or lowers the drill string.

Several elements are needed to drill the hole successfully and economically including:

- A force acting downward on a drill bit
- Rotation of the drill bit
- Circulation of fluid called drilling fluid (liquid, gas or gasified liquid), from the surface through the tubular called the drill string and back to the surface through the annular space, the area between the hole wall and outside wall of the drill string





3.4.3 Circulating System

The drilling operation uses fluids to reduce friction and remove rock fragments or cuttings. The circulating system pumps these drilling fluids down the hole, out of the nozzles in the drilling bit, and returns them to the surface where the debris is separated from the fluid.

Drilling fluid is also known as drilling mud because of its characteristic brown color. The drilling mud is mixed in tanks. The mud is pumped through a hose to the swivel, down the Kelly, and into the drill pipe. The mud goes down the drill string and out of the drilling bit nozzles. The mud carries the cuttings from the bottom of the hole to the surface in the space between the outside of the drill string and the inside of the hole.

The cuttings are separated from the mud in a vibrating screen called a shale shaker. The cuttings are trapped on the screen and the mud passes through the screen into the mud pits. The circulating pumps pick up this clean mud and send it back down the hole. The cuttings are collected in a plastic-lined pit for disposal.

Drilling mud is a mixture of water, clay, and special minerals and chemicals. Drilling mud removes cuttings from the hole and cools and lubricates the drilling bit. Mud also maintains pressure in the hole to keep fluids in the formation from entering the hole and producing a gusher of oil on the surface. Different muds are used during the drilling process to adjust to rock formations, temperature, and pressure.

3.4.4 Rotary System

In rotary drilling, the drill bit has to be rotated at a certain speed to cut and advance through the rock. Rotation of the drill bit may be accomplished from the surface or down hole. Surface rotation is done through the use of conventional rotary table or top drive motor. Bottom hole rotation is achieved by using down hole motors that directly rotate the drill bit without drilling string rotation.

The rotating equipment turns the drilling bit. This equipment consists of the swivel, the Kelly, the rotary table, the drill pipe, the drill collars, and the bit. The swivel is attached to the bottom of the traveling block and permits the drill string to rotate. The Kelly is a square or hexagonal shaped section of pipe that is attached to the swivel. The Kelly fits in a matching slot in the rotary table. As the rotary table turns the Kelly is also turned. The movement of the Kelly rotates the drill string and the drill bit.

Drilling pipe is round steel tubes about 30 feet long with a diameter of from 4 to 5 inches. The drill collars are used to add weight on the bit. Drill pipe has threaded connections on each end that allow the pipe to be joined together to form longer sections as the hole gets deeper.

The drilling bit is used to create the hole. Drilling bit sizes range from six inches to three feet in diameter. The most common drill bits are roller cone bits and diamond bits. Roller cone bits have three cones containing rows of teeth. The cones rotate on bearings and turn as the drilling bit rotates. The teeth cut and crush the rock to create the hole. The bit also contains small





nozzles that spray drilling fluids to remove the rock fragments from the bottom of the hole. Diamond bits have a single fixed head that contains many small diamonds. As the bit turns the diamonds cut the rock. Diamond bits also have nozzles to wash away the broken pieces of rock. Different drilling bits are used depending on the type of rock that is encountered.

3.4.5 Rotary Drilling Rigs

The function of a rotary drilling rig is to allow the drilling and completion of the usable hole at the lowest overall well cost.

Rotary drilling rigs are classified as onshore (land) and offshore (marine) rigs. Their main design features are mobility, flexibility and maximum depth of operation. Rig components in general are common to both onshore and offshore rigs, the only major difference is the utilization of an extension pipe (drilling riser) between rig floor and seabed when drilling in a marine environment.

Derrick is the component of the rig that is designed such that it can be assembled and disassembled with ease; its functions are to carry load that are suspended in the wellbore and to provide space between the rig floor working area and the crown block, such that a certain length of string can be made. A rig can handle singles, doubles or triples allows length of 30ft, 60ft or 90 ft sections of drill string to be made, respectively. As drilling progresses, these sections are called strands.

3.5 Staffing and Supplies for Drilling

It is expected that around **120-150** people will be required for drilling operation including contractual staff, security personnel and casual labor. Local people will preferably be hired for unskilled jobs. During the drilling operation, the supplies, with the exception of casing, will be transported to the rig in smaller trucks. Casing will be carried to the rig in flatbed trucks. General supplies transported will include camp supplies (food etc.), fuels, oils and chemicals and equipment maintenance parts.

Water required during construction will be obtained from Khaur which will be transported by bowzers. Approximately 71,550 liters of water would be required per day during construction phase for both construction and domestic purposes. Any surface water resources will not be used during drilling phase.

3.6 Demobilization and Site Restoration

After completion of the drilling and testing operations, the rig will be dismantled and demobilized off the site. The wellhead will remain in situ, but all other equipment and materials including empty drums used and unused chemicals, fuels and lubricants will be removed from the well site by their respective suppliers. After well evaluation, a decision on whether to abandon or further develop the well will be taken. If it is decided that the well is to be restored, the site will be brought back, as far as possible, to its original condition. All the concrete will be broken up and removed, the fencing will be removed and the area levelled. All the broken





concrete may be taken outside of the project area for disposal, reused for backfilling of pits or provided to locals for re-use. All waste products, solid and liquid will be disposed of in accordance with the requirements of the EIA. All pits will be backfilled including drill cuttings will be disposed of within the lined cuttings pit at the well site.

The access roads may be left intact if local people desire to use them. If not, they too will be restored and the land returned to its original use.

3.7 Project Utilities

Table 3-2: Table showing Utilities Requirement during Project Phases

Sr. #	Utility Information	Source	Project Phase and Capacity
1.	Power	Generators	Capacity: 1500KVA – 1700KVA approximately
2.	Water	Water Bowsers	<u>Construction Phase:</u> 1000 liters /day <u>Drilling Operations:</u> 71,550 liters/day (Estimated)
3.	Fuel	Diesel	Drilling Phase: 7000 liter/day (Estimated)
5.	Labor/Workforce	-	Drilling Phase: 120-150 personnel (POL/Contractor/Sub-Contractor)

3.3.4 Water

During the construction activity **1000 liters/day** and drilling phase of the project, maximum of about **71,550 liters/day** of water will be required for the construction and drilling activities. The water will be consumed via ground water.

3.3.5 Fuel

For the construction equipment and vehicle, diesel will be required. Fuel consumption during drilling activities will be **7,000 liter/day**.

3.3.6 Power

Power Requirement for operation of the Rig and associated activities will be obtained from diesel engines and generators. There will be no power consumption from the electrical grid. Generator having a total capacity of 1500 – 1700 KVA will be installed to fulfill the power requirement. Fuel for operation of generators and diesel engines is included in overall fuel consumption of the project.





3.4 Chemical Storage

The drilling rig will have storage tanks for fuel oil, while required chemicals and the necessary tubular and equipment will be stored with water proof covering. The storage places will be clearly marked with safe operating facilities and practices.

3.5 Noise, Air Emissions, Effluents and Solid Waste Generation

3.5.1 Noise

Noise is likely to be generated by the following during the proposed project will include:

- Vehicular traffic on the access road.
- Construction machinery operation along the access road, and at the well site and campsite.

Vehicular traffic is expected to generate 60 to 70 dB of noise and construction machinery up to 98 dB (measured at 15 m). Necessary measures will be taken to minimize the noise level, if required.

3.5.2 Wastes and Effluents

Categories of wastes generated during construction and drilling along with their proposed methods of disposal are discussed below:

- **Sewage and Grey Wastewater:** Sewage and grey water will be disposed of through septic tanks and soak pits.
- **Medical Wastes:** These will be stored separately from other wastes and sent to an offsite commercial or private incinerator.
- **Combustible Wastes:** Combustible wastes will include kitchen wastes, paper, packaging material etc. and will be disposed of by burning in a burn pit located and operated at the campsite.
- **Recyclable Wastes:** These will include used oil, glass, tin, plastic, metals, workshop wastes etc. All recyclable wastes will be sent to waste contractors for recycling or re-use.

Categories of wastes generated during construction and drilling and their proposed methods of disposal are discussed below:

- **Drill Cuttings and Mud:** The drill cuttings and mud will be stored at the well site in lined pit. The drilling mud will be allowed to evaporate inside the mud pit. The drill cuttings will also be allowed to dry out. After that, the mud pit and the cuttings pit will be backfilled;
- **Sewage and Grey Wastewater:** Sewage and grey water will be disposed of through septic tanks and soak pits;





- **Medical Wastes:** These will be stored separately from other wastes and sent to an offsite commercial or private incinerator;
- **Combustible Wastes:** Combustible wastes will include kitchen wastes, paper, packaging material etc. and will be disposed of by burning in a burn pit located and operated at the campsite; and
- **Recyclable Wastes:** These will include used oil, glass, tin, plastic, metals, workshop wastes etc. All recyclable wastes will be sent to waste contractors for recycling or re-use.

3.5.3 Emissions

Emissions produced during the proposed project will include:

- Exhaust emissions from vehicles and machinery;
- Dust emissions caused by vehicle and equipment operation, excavation, and other similar activities.

3.5.4 Fuels, Oils and Chemicals

Used fuels, oils, and chemicals will be stored in containers in areas lined with impervious floors. Recyclable material will periodically be transported out of the project area and sold to contractors. Non-recyclable material will be transported to lined pits or burn pits for appropriate disposal. The contaminated soil will be collected and buried, or burned, as appropriate.

3.5.5 Solid Waste

Septic tanks of adequate size will be provided for the treatment of sewage. Excess water from the septic tanks, as well as effluents from kitchen and washing areas will be released into soaking pits. The solid residue from the septic tanks will be transported periodically to a municipal sewage treatment facility. The main types of waste that will be generated are:

- Fuels, oils, and chemicals
- Sewage
- Medical waste
- Demolition waste

Sewage and Grey Wastewater: Sewage and grey water will be disposed of through septic tanks and soak pits.

Medical Wastes: These will be stored separately from other wastes and sent to an offsite commercial or private incinerator.

Recyclable Wastes: These will include used oil, glass, tin, plastic, metals, workshop wastes etc. All recyclable wastes will be sent to waste contractors for recycling or re-use.





3.5.5.1 Solid Waste Management System

The Solid waste will be managed in proper way by following operations:

- Placement of separate waste bins for domestic and project related waste in all working areas and designated points.
- Collection of waste from all the working areas at one designated point by the sanitary workers on daily basis.
- Careful collection of ash and sludge on regular basis and temporary storage at designated point.

After collection of waste from designated area and handling to the solid waste contractors for its final disposal.

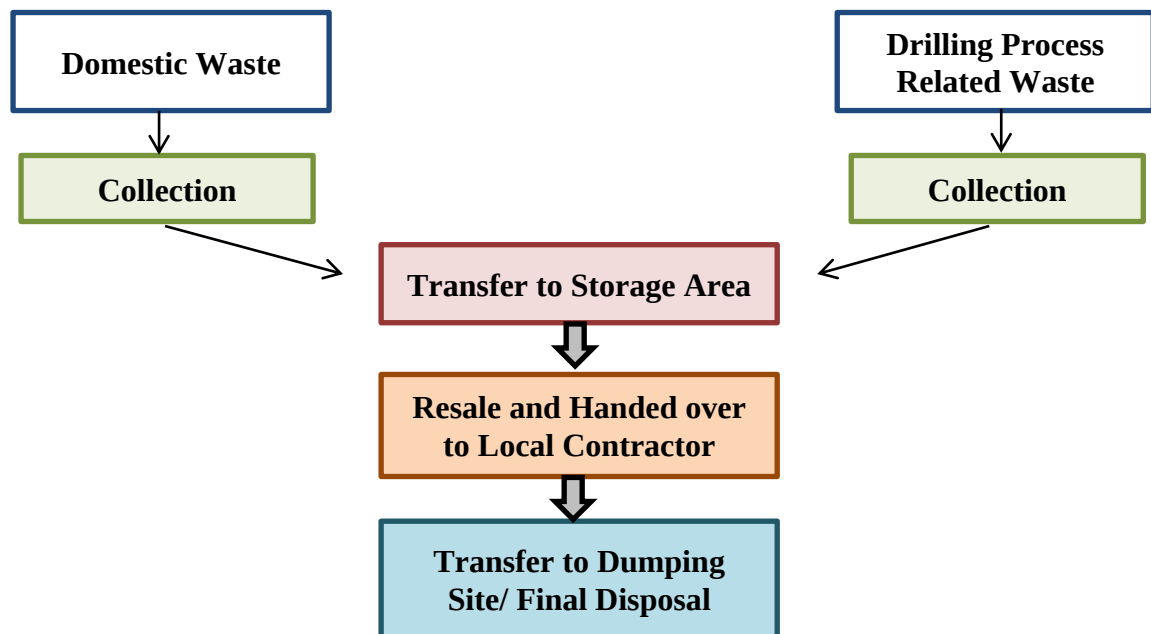


Figure 3-9: Flowchart Showing Solid Waste Management Plan

3.6 Occupational Health and Safety

All the methods and procedures for machinery and chemical handling and storage will be displayed and implemented at the project site. Health and safety rules for chemical handling and storage will be maintained.

3.6.1 Personal Protective Equipment

Following PPEs will be available for the workers in the proposed unit:

- Coveralls





- Dust Mask
- Ear Plugs
- Ear muffs
- Safety Boots
- Safety Gloves
- Safety Belt
- Helmet
- Goggles

Table 3-3: Types of PPEs used during Construction and Operation Phase of the Project

Protection	Occupational Hazards	PPEs
Head Protection	Falling objects, inadequate height clearance, and overhead power cords	Helmets with or without electrical protection
Hand Protection	Hazardous material, cuts or lacerations, vibrations, extreme temperature	Synthetic or Rubber gloves, leather, insulating material etc.
Eye and Face Protection	Flying particles, molten metal, liquid chemicals, gases or vapors, light radiation	Glasses, shield protective, etc.
Hearing Protection	Noise, ultra sound	Hearing protectors like ear plugs, ear muffs
Respiratory Protection	Dust, fogs, fumes, gases, smokes, vapors, oxygen deficiency	Facemasks or air supply
Body Protection	Extreme temperatures, hazardous materials, biological agents, cutting and laceration	Aprons, insulating clothing etc. of appropriate materials

3.8 Fire Protection System

Fire extinguishers, pressurized fire water network will be installed at all sensitive places within the unit. The smoke detectors will be available for in time fire detection (if any).

3.7 Restoration and Rehabilitation Plan

All possible precautions will be taken to prevent an untoward incident in terms of life and property losses. The demolition materials will possibly be reused and recycled. All excavated surfaces will be termite proofed. On completion of the project, the debris will be removed from the site in order to maintain aesthetics of the project. The rig will be dismantled and demobilized off the site, after completion of the drilling and testing operations. All equipments and materials including empty drums used and unused chemicals; their respective suppliers will remove fuels and lubricants from the well site, except the wellhead which will remain in situ. After well evaluation, a decision will be taken whether to abandon or further





develop the well. If it is decided that the well is to be abandoned, as far as possible the site will be restored to its original condition. All the concrete will be broken up and removed, the fencing will be removed, and the area will be leveled.

For disposal, reused for backfilling of pits or provided to locals for re-use all the broken concrete may be taken outside of the project area. In accordance with the requirements of the EIA all waste products, solid and liquid will be disposed of. All pits will be backfilled. At the well site drill cuttings will be disposed of within the lined cuttings pit. Drilling mud and other liquids will be allowed to evaporate inside the lined pit after which the pits will be backfilled. The access roads may be left intact if local people desire to use them. If not, that too will be restored and the land returned to its original use. All measures will be undertaken for ensuring occupational safety, security and clean environment in the project area.



4 BASELINE OF THE PROJECT AREA

This chapter covenants with the prevailing environmental conditions of the project area. Information that has been collected from different sources, including public literature, reports of other studies conducted in this area, knowledge with the proponent and the concerned government departments and the first-hand surveys and field measurements has been presented in this section. This encompasses all the important aspects of local environment; such as biological resources, socioeconomic development and quality of living values.

The proposed project “**Jhandial Well-03**” is located in the District of Attock, Punjab. Attock district is bordered by the Haripur and Swabi districts of KPK Province to the north, the district of Rawalpindi to the east, the district of Chakwal to the southeast, the district of Mianwali to the southwest, and districts of Kohat and Nowshera to the west and northwest. The river Indus forms the western boundary of the district. According to 2017 census, the district has a population of 1,883,556. The Awans, Milars and Khattaks are major tribes of the Attock District.

Jhandial is a small village in the Pindigheb Tehsil of District Attock. The ratio of men and women is 50:50. Jhandial is **498 m** above sea level at the distance of 83 km from Islamabad.

4.1 District Attock

- **Population:** 1,883,556 persons
- **Area:** 6,857 km²
- **Tehsils:** 6 (Attock Tehsil, Fatehjang Tehsil, Jand Tehsil, Pindi Gheb Tehsil, Hasan Abdal Tehsil, Hazro Tehsil (newly established).)

Attock is located at the rim of the Potowar (Potohar) Plateau, overlooking the Kabul-Indus River confluence to its north. It is the historic gateway to Central Asia. It is located between 33° 46' 20" to 34° north latitude and 71°43' to 72° 56" east longitude. It has an altitude of 348 m (1,145 feet). The district is bounded on the north by Haripur and Swabi districts of Khyber Pakhtunkhwa (KP), in the east by Rawalpindi district, by Chakwal district in the southeast, Mianwali district in the southwest, and by Kohat and Nowshera of KP in the west and northwest respectively. The River Indus forms the western boundary of the district.

Under the Local Government and Community Development Act, Attock district has one District Council and 6 Municipal Committees as follows:

- Attock
- Hazro
- Hassan Abdal



- Fatehjang
- Pindi Gheb
- Jand

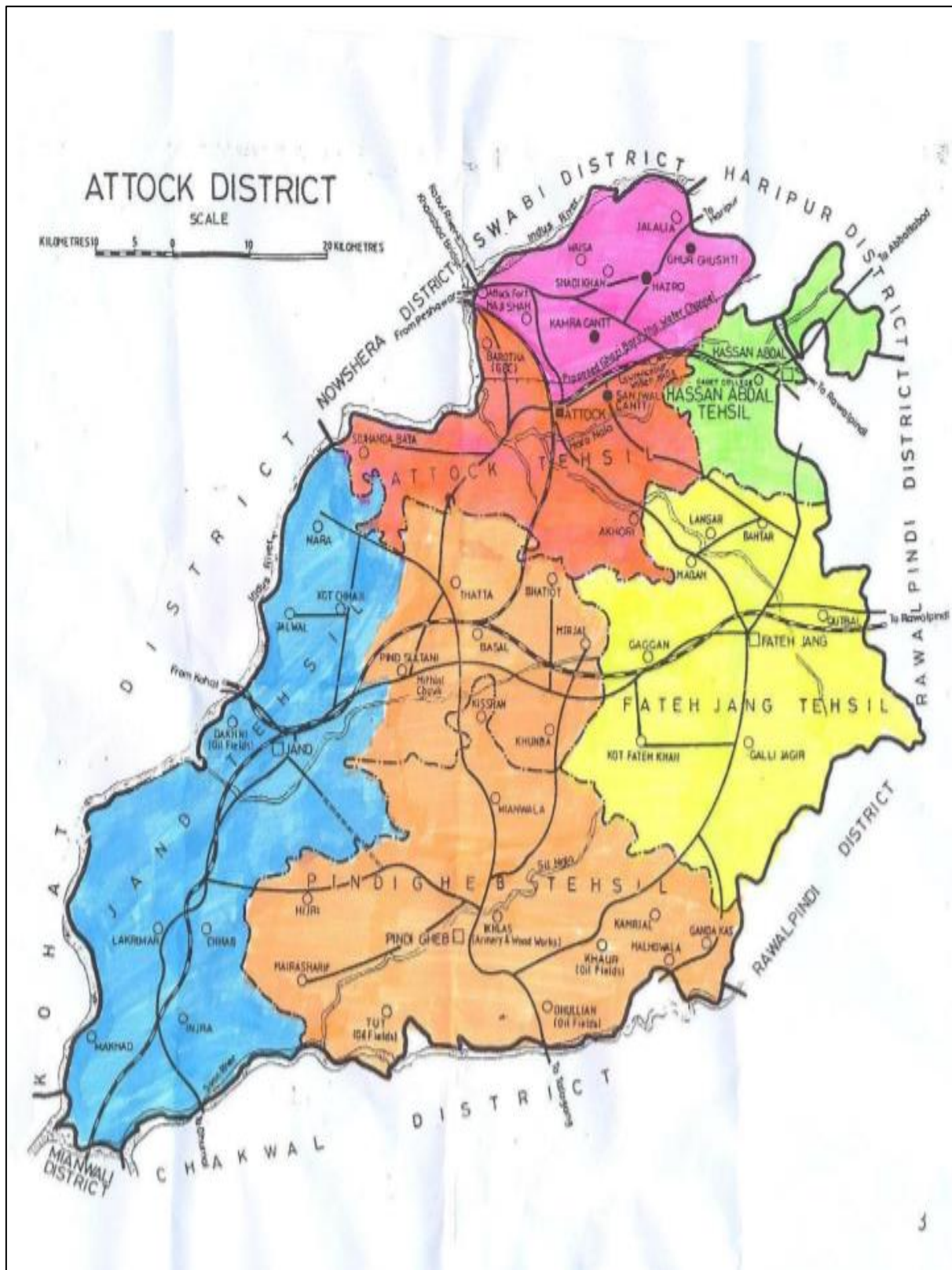


Figure 4-1: Map of District Attock





4.2 Physical Environment

This part examines the physical resources such as topography, soil, climate, surface and ground water resources and quality, ambient air quality and geology of not only the project site but also the city as a whole to assess whether the project under assessment can or does have any impacts on any of these parameters.

4.2.1 Topography

The topography of the Attock district is a combination of hills and plains. The proposed area and its surroundings is a blend of mountainous and plain areas. The plain areas are mostly used for agricultural purposes. Only near Pindi Gheb town does the broad bed of the Sill River show a bright oasis of cultivation among the dreary uplands which compose the rest of the tehsil.

Most of Attock district is located in the Potowar plateau of Punjab. Geographically, the district consists of mainly hills, plateaus, and plains. The Indus River flows on the northern and western borders of the district. The district is in the shape of an irregular oval; on its north, there are hills which are the southern extensions of the hills of Abbottabad district (the southern hills of the Gandgar Range of Haripur district) that form a projection in the north of Attock tehsil. In the middle of the district, along its western boundary in Jand and Attock tehsils, are the Kala Chitta Mountains. This range of mountains divides the district into 2 distinct parts, with one on the north and northwest of the Kala Chitta Range, and the other to the south and east of it. The former includes Attock and Hasan Abdal Tehsils and the latter includes Fatehjang, Pindi Gheb, and parts of Jand tehsils. The Kala Chitta Range of mountains is almost 56 km long; its greatest height in the west, near River Indus, is more than 1,000 m. The range is rugged and covered with brush forests, and consists of several limestone ridges.

Another range of mountains, the Khari Moorat Range is situated in the Fatehjang tehsil. This range rises to a height of about 950 m and consists mostly of limestone ridges. The southern boundary of the district is formed by the Soan River, which is a tributary of River Indus.

Fatehjang and Pindi Gheb tehsils are upland plains which are dissected by numerous streams and hills.

The northern extremity of Attock district falls into two (02) zones: the northern and the southern. The northern zone is the fertile Chhachh plain and the southern is a dry, sandy, and stony tract which rises to the Kala Chitta Range of mountains.

An important feature of the topography of Attock district is the general slope, the direction of which is northeast to southwest.



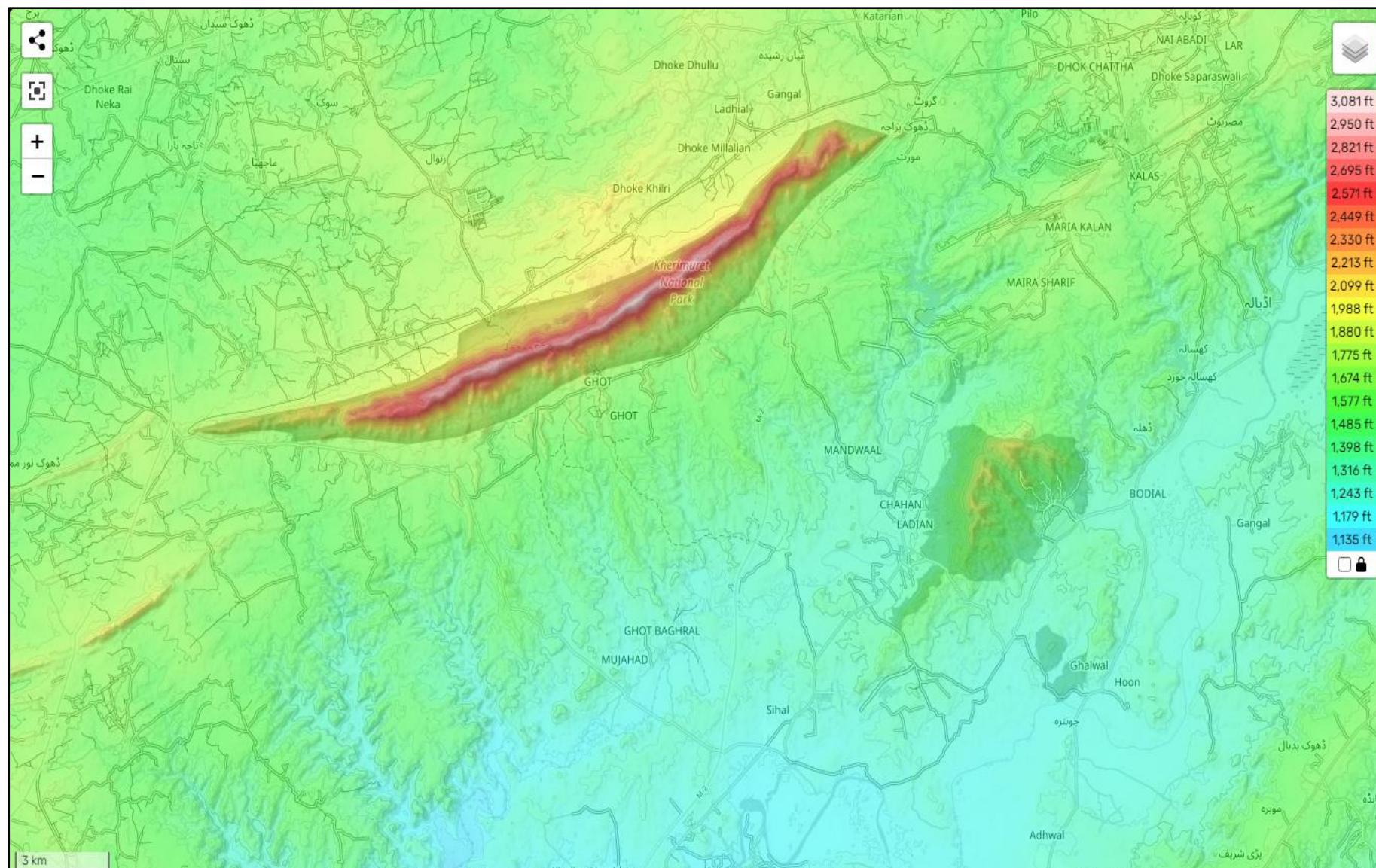


Figure 4-2: Topographic Map of District Attock





- **Average Elevation: 1,729 Feet**
- **Minimum Elevation: 1,391 Feet**
- **Maximum Elevation: 2,933 Feet**

4.2.2 Geography

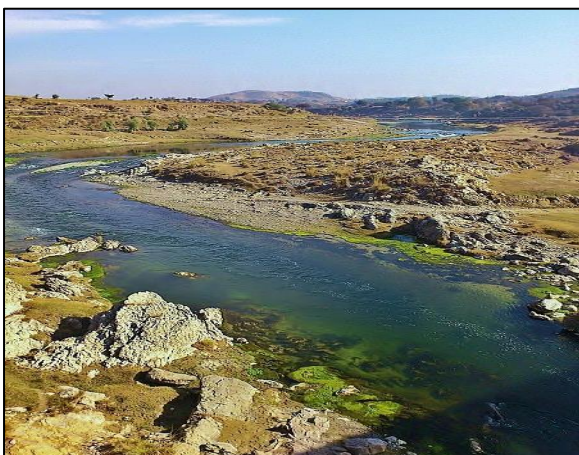
Attock is located near the Haro River, a tributary of the Indus River, 80 km (50 mi) from Rawalpindi, 100 km (62 mi) from Peshawar, and 10 km (6 mi) from the Pakistan Aeronautical Complex, Kamra. Geographically, the District is mainly hills, plateaus, and dissected plains. The Indus River flows on the northern and western borders of the district. After Haripur, the Haro River passes through the north of the Tehsil of Attock where there is a flood plain with fertile soil.

4.2.3 Rivers, Streams and Lakes

The River Indus flows on the western and northern sides of the district; Soan River flows along the eastern boundary of the district and joins River Indus. The Haro River originates from Haripur town and passes through the Attock tehsil on the north of the Kala Chitta Range. There are 14 perennial streams and nullahs in the district. These are Haro, Soan, Sill, Naindna, Dotal, Raisi, Ghambir, Namal, Soka, Gandakas, Saghar, Ghanir, Jhablat, and Kala Pani.

There are a number of small and mini-dams built on various streams for the collection and storage of water. The common reservoir of these dams attracts a large number of migratory birds.

The ground water resources are limited. The main sources of water for humans and livestock are wells and dugout ponds. The drainage is satisfactory. The entire area is drained off to the west into the Indus River, largely through Soan River. Springs are mostly seasonal, and flow only during the rains.



(a)



(b)

Figure 4-3: (a) River Haro passing through Kala Chitta Range and (b) Indus River next to Attock City





4.2.4 Forests

The following Table 4-1 shows the total area of and types of, forests in the district:

Table 4-1: Forest Area Statistics in District Attock

Total Forest Area	180,247 Acres	Under Provincial Govt	815 Acres
Resumed Lands	4,412 Acres	Linear Plantation	679 km
Reserved Forests under provincial Govt.	175,020 Acres		

The forests of the district are Subtropical Scrub Forests and are mostly located on the Kala Chitta and Khairi-Moorat Ranges. These forests support a scattered growth of olives, khair (*Acacia catechu*) and lesser shrubs. Other trees found in these forests are shisham (*Dalbergia sissoo*) and dhreh.

Some of the Reserved Forests of the district are Mukhad West Forest, Ghoko Forest, Tora Bera Forest, Amanpur Forest, Ban Ramay Sha Forest, Naka Afghan Forest, Mera Nilhad Forest, Tanwin Forest, Maryala Forest, Kali Dilli Forest, Nara Forest, Sanwalian Forest, Chatti Forest, and Dhoke Tahli Forest.

4.2.5 Soils

Attock slates are Precambrian and contain gritty layers of an arenaceous type. On weathering, they give rise to fertile, loamy clay, which collects only in sheltered places. The major part of the area (of the Kala Chitta forest area) is composed of limestone.



Figure 4-4: Soil Structure and Characteristics in the Project Area





4.2.6 Climate

The climate of Attock district is extreme. The western portion of the district is hotter and drier than the eastern and northern parts. The winter is bitterly cold, while the summer is unbearably hot. The temperature rises first in April and then remains almost steady due to windstorms from Baluchistan, up to the middle of May, when it shoots up again. June and July are the hottest months (average maximum temperature 42 °C), while December and January are the coldest months (average minimum temperature 1.7 °C). The monsoon begins by the third week of July and continues till the beginning of September when the nights get cooler. The cold weather sets in by the middle of October. During winter, the days are bright, and the nights are clear. Early spring frosts are common, and sufficiently severe to cause widespread injury to plants, even to the indigenous tree growth in a fairly advanced stage of development. Frost may occur, especially at the upper altitudinal limits and in the depths of the valleys.

The area south of the Kala Chitta Range is an upland plateau, and is intensely hot in the summer, while in winter, a chilly North Wind prevails. In Attock tehsil, the summer is short while the winter is severe and long. The minimum, maximum and average temperatures for District Attock from 2009 to 2022 are displayed in **Figure 4-5** below.

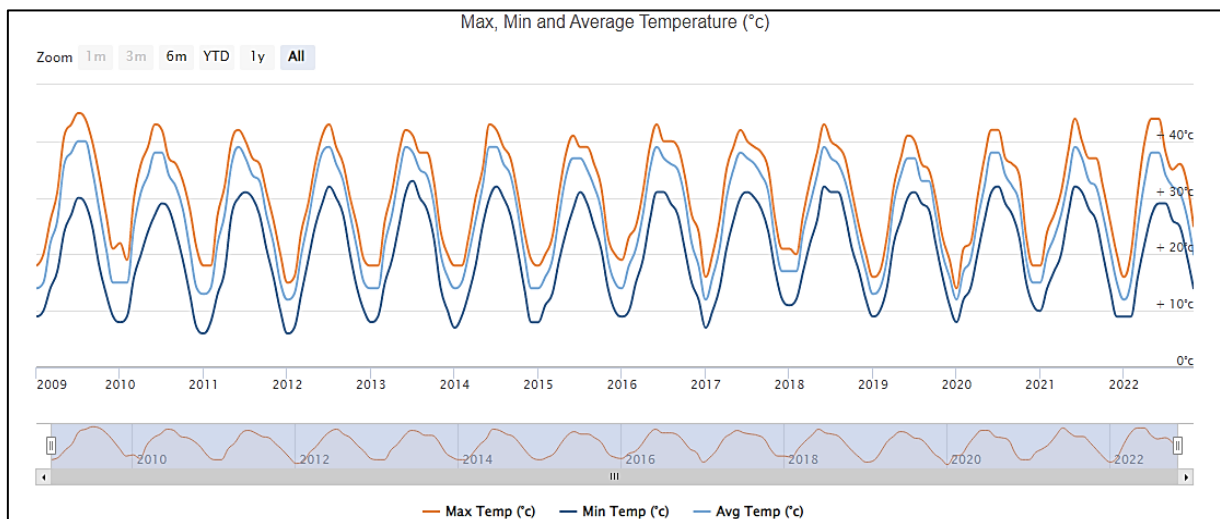


Figure 4-5: Minimum, Maximum and Average Temperature of District Attock

Rainfall is scanty and uncertain, and its annual distribution is very uneven. The annual rainfall varies from 250 to 750 mm. Monsoons start late in July, and most of the annual rain falls before September. Spring and fall rains are rare and uncertain. Winter rains start by the end of December and stop by the end of February when the windstorms set in. Winter rains generally extend over a shorter period than the Monsoons, which are followed by a prolonged period of dry weather. The average rainfall for District Attock from 2009 to 2022 is displayed in **Figure 4-6** below.



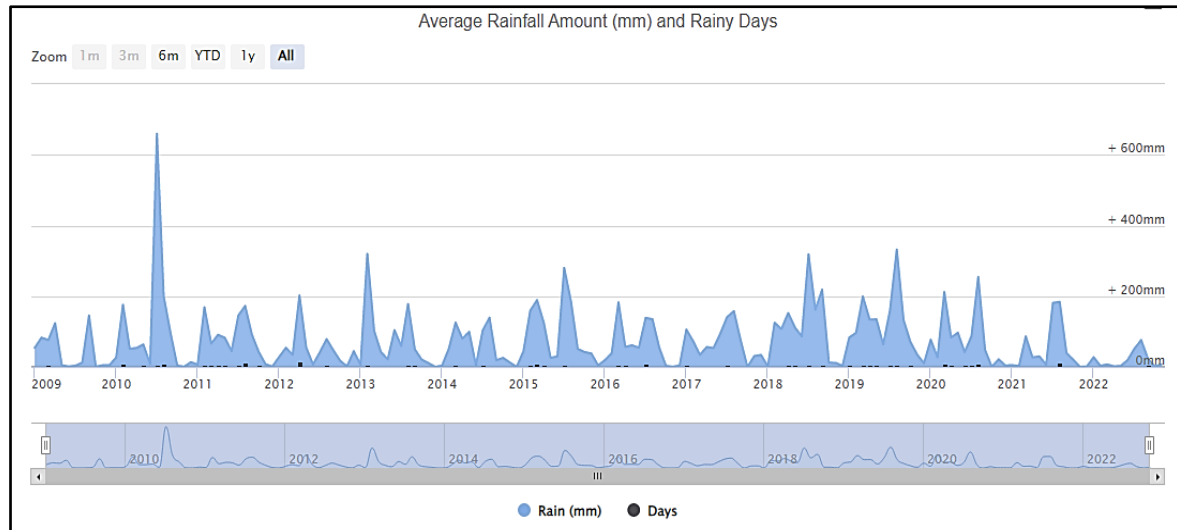


Figure 4-6: Average Rainfall of District Attock

4.2.6.1 Humidity

Attock City experiences extreme seasonal variation in the perceived humidity. The muggier period of the year lasts for 3.7 months, from June 13 to October 2, during which time the comfort level is muggy, oppressive, or miserable at least 23% of the time.

4.2.6.2 Wind

The windier part of the year lasts for 3.7 months, from May 6 to August 30, with average wind speeds of more than 4.7 miles per hour. The windiest day of the year was once recorded on July 20 with an average hourly wind speed of 5.7 miles per hour.

The meteorological data of Project Area (Jhandial) is attached in **Annexure XI**.

4.2.7 Ambient Air

The project area lies predominantly in an agricultural area. The industrial activities in the area were quite low as no appreciable number of industries was witnessed during the field visit. The minor sources of air pollution are vehicular emissions and dust from kacha tracks whose effect is fairly localized. The air quality in this project area appears good based on observation during the study period. Emissions, if any, shall be controlled at source under the EMP. There will be a few items of powered mechanical equipment to be used in the proposed works that may give rise to limited quantities of dust and other emissions. However, these should be minor and easily dissipated.

Ambient air quality is a key to measure the concentration of the various chemicals in atmosphere; especially of the chemicals which pose detrimental effects on health, safety and environment, to have a comparison with their safe concentrations, as established in WHO Standards and NAAQS. The ambient air monitoring was conducted at the project site and ambient air monitoring report is attached in **Annexure III**.



4.2.8 Noise Level

There is no continuous major source of noise in the existing well site and its surroundings. Intermittent sources include farm tractors, farm equipment, and road traffic. Considering the intermittent nature of these noise sources, it can be concluded that the noise pollution in the area is low and is below the various guideline values. The noise monitoring was conducted at the project area and report is attached in **Annexure III**.

4.2.9 Water Resources and Drainage System

The main water supply in Jhandial is from Ikhlās area. The presence of a groundwater aquifer containing considerable amount of water was observed in the project area. The water table is **45 - 80 feet**. A number of open dug wells and bores in and around the project area were observed. Water quality of these water sources is sweet and is being used for drinking and domestic purposes. Few hand pumps were also observed that had been installed by locals along with a number of bores.



Figure 4-7: Water Catchments at Project Site

Water sample from the project area was taken from the well and the report is provided as **Annexure II**.

4.2.10 Minerals

Important minerals like limestone, marble, and fire clay are found in the area. Limestone is found abundantly in the Mar gala Hills and marble in the western section of Mar gala Range. Clay soils in the district exhibit five distinct strata, from bottom to top: (i) coarse pebbles with sand or clay, (ii) an alluvial stratum deposited by an older river system in the Soan Basin, (iii) alluvial deposits of the present river system, (iv) an airborne top layer of silt or clay (loess), and (v) conglomerate and loose gravel deposits.





4.2.11 Seismic Activity/Seismicity

The district belongs to Zone 2B of the Seismic Zone Map of Pakistan which means there will be minor to moderate damage due to earthquakes.

4.3 Biological Environment

Attock district forms part of the Potowar Plateau which typically consists of dry, sparsely vegetated plains intersected by streams and rivers that cut valleys and gorges into sandstones, siltstones, and shales. Low rainfall, the clearing of vegetation for fuel wood, and the development of agricultural land contribute to the parched nature of the landscape.

The district's Chhachh plain, with its numerous wells, is extremely fruitful. The remainder of the district is deficient in natural resources. The landscape is dominated by wild expanses of Desert Mountains and rock. The soil is light and shallow, with stone on the surface and steep ravines separating it. Besides the Kala Chitta Range, the Makhad, and Narrara hills enclose the barren ravines of the central zone of the district.

4.3.1 Flora of District Attock

The main flora of Kala Chitta Range consist of phulai (*Acacia modesta*), babul or kikar (*Acacia nilotica*), puth kunda or prickly chaff plant (*Achyranthes aspera*), sufaida or snow bush (*Aerva javanica*), wild fig (*Ficus polymata*), bakain (*Melia azerdorach*), kikar (*Acacia nilotica*), pipal (*Ficus religiosa*), Dhrek (*Melia azadirach*), poplar (*Populus alba*), Ber (*Ziziphus nummularia*), Paper Mulberry (*Broussonetia papyrifera*), mulberry (*Morus alba*), simal (*Bombax ceiba*), shisham (*Dilbergio sissoo*), white sirin (*Albizia procera*), siris or shirin (*Albizia lebbeck*), aloe or kanwar gandal (*Aloe vera*), amaranth or khardar chulari (*Amaranthus spinosus*), amaranth or chulai (*Amaranthus viridis*), kuntze or gulabi booti (*Anisomeles indica*), peanut or moong phali (*Arachis hypogaea*), musli (*Asparagus adscendens*), neem (*Azadirachta indica*), koch or black mustard/ kali surson (*Brassica nigra*), swallow wort or aak (*Calotropis procera*), naudin or chibar (*Cucumis melo* var. *agrestis*), khabal grass (*Cynodon dactylon*), Stapf or murga ghas (*Datura innoxia*), sanatha (*Dodonaea viscosa*), globe thistle or untkatara (*Echinops echinatus*), and snake weed or chatri dudhak (*Euphorbia helioscopia*).

Vegetation grows for the most part in scattered clumps. No forests are present at the proposed site. A total of 49 species belonging to 29 families of medicinal plants are found in the district.

The major Kharif crops usually include maize, bajra, jawar and most commonly ground nuts while Rabi crops include wheat, gram, mung, and other pulses, etc.

Table 4-2: Life forms of Floral Species with Percentage Presence in the Project Area

S. No	Life form	Percentage %
1	Herbs	39.47
2	Grasses	22.36
3	Trees	19.73



4	Shrubs	14.47
5	Sedges	2.63
6	Parasite	1.31



Figure 4-8: Flora near the Proposed Project Site

4.3.2 Fauna of District Attock

The forests of Kala Chitta Range are home to 9 different species of mammals, which include Punjab urial, barking deer, goral, chinkara, wild sheep, gazelle, wolves, leopards, Asiatic jackal, rhesus monkeys, wild boar, flying squirrel, porcupine, fox, and palm squirrel. Urial, chinkara, chakor, hare, mongoose, wild boar, and yellow-throated martin are also abundant.

The rocky areas and rangelands provide both feeding and breeding habitat for several bird species, which include black and grey partridges, see-see partridge, chakor, bank myna, cuckoo, bulbul, hoopoe, parrots, egrets, ruddy shelduck, mallard, falcon, shikra, eagle tilor, and dove.



4.3.2.1 Bird Species

Based upon the observations collected during the field visit, twenty bird species were recorded in the project area. These areas also include larger as well as smaller patches of dry scrub vegetation which further extended up to the scrub forests of the Potwar plateau.

Overall little number of bird species has been counted, perhaps due to the closeness of the project area to the residential areas. On the other hand it is interesting that number of birds of each recorded species is encouraging.

Calls of Brown Partridge could be abundantly heard from the surrounding areas of scrub vegetation, while few calls of Black Partridge also proved their presence in the vicinity of project area. Abundant presence and prey of Brown Partridge and common Quail was proved by interviewing of locals from the Jhandial village. They further added about less common status of Black Partridge in the area.

Apart from above mentioned species of interest, common species were also observed. These include House sparrow, House crow, Parakeet, Red vented Bulbul, Collared dove and Rock Pigeon. All these species are commonly found in other ecological zones of the country including Black Partridge and one migratory species.

4.3.2.2 Mammalian Species

Although most of the study area comprises of agricultural lands, but due to presence of scrub forest patches in the surroundings, including information about their presence, status etc. Dense vegetation of these forests provides living shelter to the mammals like Asian Jackal, Indian Porcupine, Indian wild boar, Wild Rabbit and Wolf. Loamy and sandy soils of boundaries of agricultural fields provide suitable habitat to Grey Mongoos, Indian Porcupine and Asian Jackals. Based upon the comments of locals it is concluded that Wild Hare also residing in the agricultural fields of the study area, while growing crops (Ground nuts in particular) of these agricultural fields directly or indirectly provide food to these mammals.



Figure 4-9: Mammals in the Project Area



All the seven species are commonly found in the project area as well as in country and not any significant threat can be expected from any activity.

4.3.2.3 Reptilian Species

Reptiles are also very important taxa among animals. During the study, several types of burrows and droppings were found which indicate the presence of concerned reptiles. Presence of Garden lizard was confirmed by direct sighting. Similarly, the local knowledgeable confirmed the presence of Saw scaled viper, and Indian Monitor. Some of the common reptiles of the district include frogs, house geckos, lizards, water snakes, sand snakes, Indian python, kraits, vipers, cobra, rat snake, and fresh water turtles.

A detailed list of flora and fauna is attached in **Annexure VII** of the EIA report.

4.3.3 Protected Wildlife Areas and Endangered Fauna

Some of the Protected Wildlife areas include:

- **Kala Chitta:** This is a protected Game Reserve which was given the status of Nature Park under the Pakistan Environmental Protection Act in 2009. Indian wolf, jungle cat, barking deer, panther, and common serotine bat (chimgadur) are threatened species of mammals and are given protection in the Kala Chitta Game reserve. It includes a wildlife breeding center
- Rakh Kheri Murat Game Reserve
- Zoo and Wildlife Breeding Center (Wildlife Park) Attock

4.4 Socioeconomic Environment

4.4.1 Population

Attock district is spread over an area of 6,857 Sq. km comprising of following six tehsils:

1. Attock;
2. Fateh Jang;
3. Jand;
4. Hassan Abdal;
5. Hazro, and
6. Pindi Gheb.

Total population of the district is 1.4 million, 0.26 million (20%) of which is urban while the remaining 1.04 million (80%) is rural. Annual increment in population is 2.2%. Population growth is influenced by many factors, like birth rate, death rate, disasters, migration etc.



Table 4-3: Population Growth in District Attock

Attock District		Households	Male	Female	All Genders	1998-2017 Average Annual Growth Rate
	Total	306,649	936,811	946,683	1,883,556	2.07
	Rural	228,435	686,723	706,811	1,393,550	1.81
	Urban	78,214	250,088	239,872	490,006	2.90

The Awans, Milars and Khattaks are major tribes of the Attock District. Punjabi Language is being spoken in the area. The dialect of Punjabi in Pindi Gheb is called "Ghebi". Ghebi is quite similar to the Potowari dialect, but differs slightly. English is also spoken by educated people.

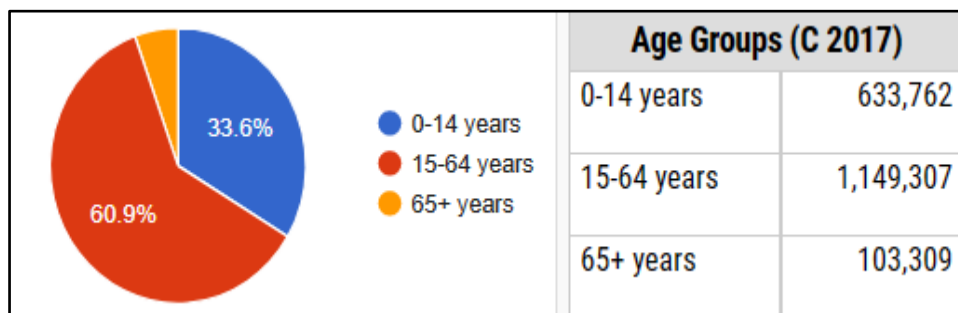


Figure 4-10: Age Groups Distribution Chart in District Attock

4.4.2 Economic Activity

The major economic activity of the rural areas of the district is agriculture and its allied livestock breeding. The major employers of the district include:

- Agriculture with its Allied Livestock Breeding and Fishing (50%)
- Elementary Workers (37.3%)
- Service, Shop and Market Sales (6.7%)
- Professionals (3.5%)

4.4.3 Irrigation Network

The district relies heavily on rains for its agriculture. The total area under barani irrigation is **374,613 acres** and **43,818 acres** are irrigated through wells and tube wells. There are a total of **3,737** government and privately-owned tube wells in the district.

There are a large number of small dams which store rain water for irrigation purposes.[5] These include Tanaza Dam, Sipiala Dam, Bango Dam, Ratti Kassi Dam, Qibla Bandi Dam, Kanjoor Dam, Chani Bor Dam, Shahpur Dam, Kamra Dam near Kamra, Nurpur Kamalia Dam, Kalu



Khurd Dam on Nullah Sehat, Nara Kas Dam on Nara Kas stream, Dhok Jhalar on Nochindi Kas stream, Saghri Dam on Namal Kas stream, Trimni Kas Dam on Trimni Kas stream, Jabbi Dam on Lelamar Nullah, Shakarda Dam on Shakarda Kas stream, and Mirwal Dam on Noorpur Kas stream.

In addition, there are more than 26 mini-dams in the district.

The following **Table 4-4** shows the mode of irrigation and the area served by the system as per Punjab Development Statistics 2018-19:

Table 4-4: District Attock Irrigation Statistics

Irrigation Type	Area	Irrigation Type	Area
Total Area Sown	216,000 Hectares	Irrigated Area	30,000 Hectares
Un-Irrigated Area	186,000 Hectares	Canal Irrigated	3,000 Hectares
Dug Wells	16,000 Hectares	Tube Well Irrigated	7,000 Hectares
Canal Well Irrigated	1,000 Hectares	Canal Tube Wells	–
Others	3,000 Hectares		

4.4.4 Land Use

The following **Table 4-5** shows the main land use statistics of the district as per Punjab Development Statistics 2018-19:

Table 4-5: District Attock Land Statistics

Total Area	685,700 Hectares	Reported Area	692,000 Hectares
Total Cultivated Area	320,000 Hectares	Net Sown	204,000 Hectares
Current Fallows	116,000 Hectares	Total Uncultivated Area	372,000 Hectares
Culturable Waste	42,000 Hectares	Forest Area	73,000 Hectares

4.4.5 Agriculture

The district falls under the Barani Agro-Ecological Zone of Pakistan and relies on rain for its agriculture. The main crops of the district are bajra, barley, guar seeds, ground nut, jowar, khariff pulses, moong, maash, maize, rapeseed and mustard, sunn hemp, sugarcane, sesanum, tobacco, wheat, and millet.

The main fruits grown in the area are apricots, citrus, and guavas.

Main vegetables include onions, potatoes, tomatoes, spinach, olives, chilies, coriander, garlic, peas, cauliflower, eggplant, and cucumber.





4.4.6 Livestock

Dhanni cow and Salt Range sheep are famous livestock breeds of Attock district. The district is also known for horse breeding. The following **Table 4-6** shows the livestock population as of the 2010 Census of Livestock as quoted in Punjab Development statistics 2018-19:

Table 4-6: District Attock Livestock Statistics

Livestock	Number	Livestock	Number	Livestock	Number
Cattle	391,000 Heads	Buffaloes	124,000 Heads	Sheep	125,000 Heads
Goats	442,000 Heads	Camels	2,366 Heads	Horses	2,191 Heads
Mules	561 Heads	Asses	28,277 Heads		

4.4.7 Poultry Farms

There are a total of 392 government owned poultry farms in the district. Also according to Punjab Development Statistics 2018-19 there are 389 broilers, 62 layer and 02 poultry breeding privately owned farms in the district.

4.4.8 Fishing

There is a fish breeding center at Hattian in Attock district, from where fish seeds are supplied to privately-owned fish farms as well as to government-owned farms. The fish seeds are also stocked in small dams across the district. Mahseer, Bachwa, and other fish are caught in Haro, Soan, and the Indus Rivers. Most of this fish is consumed locally.

Fishing is carried out in River Indus Tehsil Attock and Jand as well as Sukh Nullah and Shahpur Dam Reservoir. Reservoirs of other small dams are also used for fishing.

4.4.9 Bee Keeping/Apiari

Commercial bee keeping is carried out in various forests and farms in the district.

4.4.10 Minerals and Mining

Attock has the distinction of being the first region in Pakistan to have an oil well, which is in Khore. It was established in 1946. Attock also has an oil and gas field, Dakhini, near Jand, and in Fatehjang tehsil.

Argillaceous clay, fire clay, marble, silica sand laterite are mined in Attock district. Coal is found in the Kala Chitta Range. Limestone and gypsum occur abundantly.

4.4.11 Industry and Manufacturing

Kamra Aeronautical Complex and Sanjawal Ordinance Factories are located in the district. There are a total of 52 industrial units in the district. Major industries include flour mills, glass



and glass products, industrial/ burn gases, iron and steel re-rolling mills, packages, poultry feeds, textile spinning, vegetable ghee and cooking oil production and woolen textile spinning and weaving mills.

The following **Table 4-7** shows the number and type of industry present in the district:

Table 4-7: Industries Statistics of District Attock

Type of Industry	Number	Type of Industry	Number
Carpets	02	Cement	01
Cold Storage	02	Flour Mills	30
Food Products	01	Glass And Glass Products	03
Iron And Steel Re-Rolling	01	Light Engineering	01
Motor Pumps	01	Packaging	01
Poultry Feeds	01	Power Generation	01
Textile Spinning	02	Vegetable Ghee/Cooking Oil	03
Woolen Textile/Spinning	02		

4.4.12 Handicrafts

The traditional crafts of Attock include embroidered shoes, painted and lacquered woodwork, calico printing, and handloom cloth and blankets. Attock and Pindi Gheb produce elegant zari embroidered shoes. Pindi Gheb is also famous for lacquer woodwork, toys, and carved legs used for bridal beds. Calico printing of bed sheets, table covers, and similar articles are done at Fatehjang. Iron vessels are made at Mukhad and blankets are manufactured in Pindi Gheb and Fatehjang tehsils.

4.4.13 Road Statistics

Some of the important roads include:

- Pindi Gheb-Attock Road
- Jand-Pindi Gheb Road
- National Highway N-80 passes very near to Jand and connects the district to National Highway N-55 or Indus Highway, which connects Karachi and Peshawar, running on the east bank of River Indus.



Figure 4-11: Kohat Road near Rangli, District Attock



The following table shows the road statistics of the district, as per Punjab Development Statistics 2018-19:

Table 4-8: District Attock Road Statistics

Roads	Total Length (Km)
Total Road length	2,407.8
National Highways	68.5
Provincial highways	2331.26
Motorways	8.0

4.4.14 Rail and Airways

The main Peshawar-Karachi railway line passes through Attock district. The district is also linked with Rawalpindi and Peshawar through the railway network. The main railway stations are Attock, Basal, and Jand.

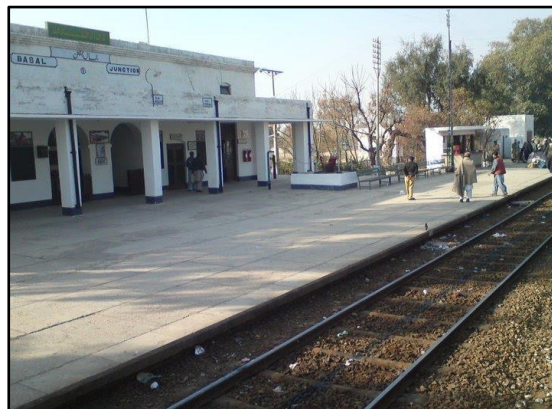


Figure 4-12: Basal Railway Junction, District Attock

There is a military airbase (Kamra Airbase or Minhas Airbase) in the district.

4.4.15 Economic Infrastructure

The district is linked with Rawalpindi, Kohat, Nowshera, Haripur, Mianwali, and Chakwal districts through black topped roads. The G.T. Road (now known as N-5) passes through Attock city. There is a railway track which links Attock to both Peshawar and Karachi.

4.4.16 Radio and Television

There is a private local radio station called Awaz Radio FM 105 broadcasting in the district. Cable TV can also be viewed throughout the district.



4.4.17 Telecommunications

There are 56 telephone exchanges operating in the district, each ranging in capacity from 50 lines to 45,639 lines. Nearly all of the major cellular companies also operate in the district.

4.4.18 Educational Institutions

The following table shows the details of educational facilities in the district as per Punjab Development Statistics 2018-19:



Figure 4-13: School and College in District Attock

Table 4-9: District Attock Educational Institutes

Institution	Boys/Girls	Institution	Boys/Girls
Primary Schools	420/429	Middle Schools	88/113
Secondary Schools	119/96	Higher Secondary	13/12
Degree Colleges	10/07	Other Higher Secondary	07/-
Other Degree Colleges	01/-	Technical Training Institutes	06/-
Vocational Institutes	-/05	Commercial Training Institutes	03/-
Universities	01	Govt. Mosque Schools	—
Medical Schools	01	Engineering Schools	—

There are two (02) privately-owned universities in the district and a government-owned Cadet College at Hasan Abdal.

In addition there are number of primary, middle and high schools that are privately-owned in the district.



4.4.19 Healthcare Facilities; Attock District

The District Health Officer (DHO) is in charge of health services provided in the district. The DHO is supported by doctors, paramedics, technicians, and other support staff. The following **Table 4-10** shows the number of health institutions in the district as per Punjab Development Statistics 2018-19:

Table 4-10: Health Care Institutes of District Attock

Institution	No./Beds	Institution	No./Beds
Government hospitals	08/535	Dispensaries	20/38
Rural Health Centers	05/100	Basic Health Units	63/126
T B Clinics	-/-	Mother Child Health Centers	05/-
Private Dispensaries/ Hospitals	50/NA	Sub Health Centers	02/-

4.4.20 Language

The below **Table 4-11** provides a real picture of languages spoken in the District Attock and percentage spoken.

Table 4-11: Languages in District Attock

Languages	Number	Percentage Spoken
Urdu	34,080	1.80%
Punjabi	1,224,870	65%
Sindhi	4,222	Negligible
Pushto	274,230	14.5%
Balochi	1,215	0.064%
Kashmiri	5,652	0.3%
Saraiki	8,502	0.2%
Hindko	311,493	16.5%
Brahvi	1,865	0.099%
Other Language	20,249	1.07%



4.4.21 Archaeological and Cultural Sites

4.4.21.1 Shrines

There are two main shrines present in the area which are very famous. The one is Baba Laal Hussain and the other is Suhray wali Sarkar. People come with great respect and recite fatiha and say prayers. They come with great belief of fulfilling their wishes. In Prem nagar, the famous tomb is Mundran Wali Sarkar.



Figure 4-14: Shrine in the Project Area

4.4.21.2 Attock Fort

Attock fort was completed in 1583 under the supervision of Khawaja Shamsuddin Khawafi, a minister of Emperor Akbar. The Mughal caravan sarai outside the fort, which is almost on the G.T. Road, was also built during this period.

4.4.21.3 Gandhara

Gandhara was an historic region of ancient India, (which corresponds to areas of North West Pakistan including Attock). Situated astride the middle Indus River, the region had Taxila and Peshawar as its chief cities. It was originally a province of the Persian Empire and was reached (327 B.C.) by Alexander the Great. The region passed to Chandragupta, founder of the Maurya Empire, in the late 4th cent. B.C., and under Asoka was converted (mid-3d cent.) to Buddhism. It was part of Bactria from the late 3d cent. To the 1st century B.C., under the Kushan dynasty and especially under Kanishka, Gandhara developed a noted school of sculpture, consisting mainly of images of Buddha and relief's representing scenes from Buddhist texts, but with marked Greco-Roman elements of style.



5 ANALYSIS OF ALTERNATIVES

A key challenge of the EIA process is the consideration of alternatives. Most guidelines use terms such as ‘reasonable’, ‘practicable’, ‘feasible’ or ‘viable’ to define the range of alternatives that should be considered. Essentially there are two types of alternatives:

- Incrementally different (modifications) alternatives to the project.
- Fundamentally (totally) different alternatives to the project.

Fundamentally different alternatives are usually assessed at a strategic level, and EIA practitioners recognize the limitations of project-specific EIAs to address fundamentally different alternatives. An analysis of the available alternatives is necessary to establish that the most suitable management and technology options will be adopted for the project.

This chapter helps to analyze whether the project should be carried on or not. An analysis of the available alternatives is necessary to establish that the most suitable management and technology options will be adopted for the project. Identification and assessment of feasible alternatives to project design and implementation is among the main components of EIA

5.1 Management Alternatives

5.1.1 No Project Option

Energy is the prime mover of current day economies and is vital to the sustenance of economic growth, which depends crucially on the long-term availability of energy from sources that are accessible, sustainable as well as affordable and environment friendly. The energy sector plays a key role in the development and growth of Pakistan's economy. Throughout its history, Pakistan's economy has paced at an unsteady rate with extended phases of low growth following moderate stints of high growth. If one looks at the pattern of energy supplies, Pakistan has remained an energy deficit country, crucially dependent upon imports, mostly oil and oil products.

The ‘No Project Option’ is the option of not drilling the well Jhandial -03 and the opportunity of providing oil and petroleum services to Pakistani people will be thrown away. Basic economic theory suggests that any industry or a factory improves economy and add value to the country's GDP. This alternative would have following effects:

- Opportunity for income generating would be lost to many individuals.
- Lack of employment for the intended staff members, and job or business opportunities in general.
- The population surrounding the proposed site would lose an opportunity to develop income generating projects.
- No taxes collected for the State treasury.





The ‘No-Project’ option, if taken, will prevent the country from exploring the potential to significantly increase its oil production. Petroleum products are necessary to run the wheel and for economic development. Other impacts of the ‘No-Project’ option would be loss in employment and social welfare in the project area, as the project is bound to create jobs and improve the existing condition of the community of the area through different community development and social welfare projects.

POL has done many Social Welfare Projects to fulfill its Corporate Social Responsibility (CSR). From the environmental point of view, this option would result in a loss of opportunity in further improvement of the environmental management of the area, environmental baseline data, and the mitigation and compensatory programs.

From the environmental point of view, this option would result in a loss of opportunity in further improvement of the environmental management of the area, environmental baseline data, and the mitigation and compensatory programs.

This alternative would eventually evade any short-term potential negative impacts from project execution. To this end, any potential positive impacts envisaged during midterm and long-term project implementation will be missed.

The proposed project intends to add value and meet the increasing demand of petroleum products. This industry will give better performance, meet higher market demand, and achieve better market development.

5.1.2 Alternative Site Option

To fulfill the commercial aspects of the project under reference of this EIA Report, it is to be sited at a place where commercial processing activity is either already going on or there are bright prospects of the same. Concurrently, it must also meet the legal requirements of the Punjab Environmental Protection Act, 1997 (Amended 2012, 2017) and Review of EIA and IEE Regulations 2022. Availability of land at the best convenient place is equally important among other considerations for the site selection. Availability of access roads, communication facilities, electricity, basic infrastructure, sewerage etc. is yet the other necessary requirements. Obviously, environmentally sound, neat and clean environment are the other considerations for site selection.

Several concession areas and exploration sites exist in Pakistan and a number of national and international companies, in addition to public sector organizations, are already actively engaged in oil and gas exploration.

The site for oil or gas exploration is chosen after extensive geological and land surveying. Jhandial-03 Well is considered an attractive area for oil exploration for a variety of geological reasons. Geological and geophysical investigations have been undertaken to assess the characteristics of reservoir rocks whether they hold hydrocarbons within their pores or not. This information helped in accurately planning locations for drilling, reducing the probability





of drilling dry wells and consequently the need for further drilling, minimizing the environmental impact of the oil and gas exploration.

Factors that influence the selection of a particular method include type of land use (e.g. cultivated or non-cultivated), economic factors, and environmental concerns. Great care must be exercised in selecting the method to ensure that geophysical data of the highest possible quality are collected. The site is well located in regard to the following:

- Easy road access to the market.
- No settlements in close vicinity.
- No watercourse within a safe distance.
- No ecologically sensitive or declared protected area within 10 km of the selected site.

5.1.3 Timing of the Operation

The proposed exploration project will have to follow strict project schedule in order to meet production targets, obligations imposed by DGPC under the license agreement and to reduce national gas shortages for supporting the country's economy. Restrictions on the timing of the proposed operation may be necessary if the operations significantly affect the breeding of key wildlife species of the area.

On the basis of assessment of the impacts done in the EIA restrictions on timing are considered necessary as environmental sensitive areas including wildlife areas and reserved forests fall in the project area. Surface water bodies including rivers, wetlands, springs and associated margins falling in the project area are visited by the migratory birds particularly during winter season.

Therefore, the EIA has recommended measures to minimize the duration of activities within environmental sensitive areas and to maintain minimum safe distance from all sensitive environmental receptors. Exploration activities during breeding season of key wildlife species of the area will be avoided to provide relief to the existing precious wildlife species.

5.2 Technological Alternatives

5.2.1 Drilling Technique

Conventional rotary drilling proposed by POL has been historically used for the drilling of oil and gas wells. Other drilling techniques include Coiled Tubing and Slim Holes. Despite some environmental gains in the use of coiled tubing and slim holes (reduced well site area, reduced waste volumes etc.) both techniques seem to share a number of technical disadvantages and operational limitations. Moreover, the rigs are not available in Pakistan and in case of a breakdown required backup and service facilities may not be available as readily as for conventional rigs. Advantages of the two techniques therefore, do not outweigh their





disadvantages. Conventional drilling technique proposed by POL is therefore evaluated to be the best alternative.

5.2.2 Disposal of Drilling Wastes

Conventional drilling waste management involves discharging the mud and cuttings into a lined waste pit (HDPE lined). The waste management system is considered to be technologically and environmentally the most preferred option. The drill cuttings and mud will be disposed of at the well site within lined waste pits.

5.2.3 Water Abstraction

Water is without any doubt one of the most undervalued resources on earth. Globally, there is increasing pressures on water resources. In particular, population growth and economic development are putting pressure on available freshwater resources. Water quality is inextricably linked to human health in many ways and poor water quality can lead to diseases, reduced food availability and malnutrition. Improved access to fresh water has a direct positive impact on people and communities leading to significant social, economic and environmental benefits.

Use of brackish water will be maximized for proposed exploration and associated development activities wherever possible. The surface water resources will not be used particularly during drilling activities.





6 POTENTIAL IMPACTS AND ITS MITIGATION MEASURES

The environmental implications may be beneficial or adverse, but the main objective of impact identification is to specify areas that are likely to be affected by the implementation of a project. Environmental impact, by definition, implies an alteration of environmental conditions or creation of a new set of adverse or beneficial environmental consequences caused by the action under consideration.

Although, in general, several impacts can be identified while describing the project, all the impacts may not be considered significant. Hence it is necessary to identify the critical impacts that are likely to cause significant impact on various components of environment due to proposed project. This chapter of the EIA discusses the potential positive and negative impacts that may arise from the proposed project activities and the mitigation measures that will be adopted to reduce or completely alleviate these impacts. The potential impacts and mitigation related to physical, biological and socioeconomic environment have been discussed under three separate headings.

6.1 Design and Construction Phase

6.1.1 Probable Environmental and Social Impacts

The construction of camps by the contractors will possibly cause the following environmental impacts:

- Damage to soil by digging and earth moving
- Damage to natural habitats by vegetation clearance
- Soil contamination
- Pollution of soil, ground water and surface water by discharge of untreated/poorly treated effluent
- Damage to crops and agriculture lands
- Dust pollution, affecting communities and crops
- Additional traffic in the project area
- Increased soil erosion caused by heavy traffic on unsurfaced roads
- Impairment to visual amenity by poorly managed camp
- Noise pollution
- Damage to roads and tracks
- No major risk to soil and water pollution during construction phase





- Disturbance to local population by construction activities, including accidents caused by vehicle movement

6.1.2 Noise

Noise disturbance is possible during the construction phase for local population. Noise level varies depending on the types and numbers of machines and vehicles.

6.1.3 Dust

During the period when the construction work is in progress the air quality of the area in the vicinity of the project may be temporarily affected by fugitive dust emitted during land preparation, ground excavation cut and fill operation. The emission may also result from vehicular traffic over access paths.

6.1.4 Vehicular Traffic

Impacts to traffic flows may occur during construction however; no significant alteration of current conditions is expected to occur. Temporary impacts to traffic flow may occur at project area.

6.1.5 Potential Pollution Sources

The pollution impact on soil and water due to the up-gradation project construction, commissioning and operation are as follows:

- Dust emissions produced during earthworks and construction for base camp
- Dust raised on dirt tracks by project-related vehicles
- Dust from drilling of deep holes
- Combustion products (nitrogen oxides, sulfur dioxide, particulate matter, carbon monoxide, and volatile organic compounds) from diesel engine used in the camps to generate electric power
- Combustion products from vehicles used for project-related activities
- Dust raised on dirt tracks by project-related vehicles

6.1.6 Local Population

The project activities may affect the residents of nearby areas while more employment opportunities will arise from the POL project that will increase the income of the communities. The affect will be limited to inconvenience to the local residents and disturbance due to noise and dust.





6.1.7 Resettlement

No resettlement of local population will be required.

6.1.8 Vegetation

No trees will be removed during the project activities.

6.1.9 Archaeological and Cultural Environment

No site of archaeological and cultural heritage is being affected by the project.

6.1.10 Development of formerly Inaccessible Land

Most of the area adjacent to the refinery is currently accessible in one form or another (vehicle, animal, or on foot). This accessibility lends itself to the potential for development beyond what currently exists.

6.1.11 Flora

The environmental impacts of project to biological environment will be very limited. The following impacts may be caused:

- Minor damage to nearby vegetation or tress by contractors during construction
- Some disturbance to the protected and sensitive bird species during construction, including the risk of hunting
- Impact on aquatic ecosystem resulting from accidental spillage of oils and construction material during construction

6.1.12 Fauna

Impacts to wildlife species (birds, etc.) will result largely from individuals being disturbed, displaced or suffer mortality as a result of construction. More mobile species may be displaced from the construction area to the surrounding area into similar nearby habitats.

6.1.13 Soil Erosion

Where vegetation is removed from slopes and plane surface there is a risk of localized erosion, although no significant earthmoving and no platform cutting is required in the project area. No significant soil erosion problems are envisaged as a result of construction work.

6.1.14 Alteration of Drainage Pattern

Slight changes in elevation can alter drainage pattern resulting the diversion of storm water and no possibility of water logging of impounded area.





6.1.15 Fragmentation of Habitat

The proposed project has been subjected to some form of human related activity, e.g. habitation, cultivation, grazing, harvesting. Consequently, little un-fragmented habitat occurs around the proposed project area, and any subsequent construction will result in negligible additional trees / shrubs fragmentation.

6.1.16 Project Location

The area for the proposed project activity is legally designated by the Government of Pakistan to POL. The site is chosen after extensive geological and land surveying. POL conducted the 3D seismic survey, processed the seismic data and after interpretation proposed a well Jhandial-03.

The proposed well location lies in agricultural area with scattered population. The local population is resided at a safe distance from proposed well location. Compensation in terms of money would be provided to the locals for their seasonal crops.

6.2 Operation Phase

6.2.1 Potential Environmental Impacts

The environmental impacts of proposed project activity result primarily from gaseous emissions, wastewater discharges, solid wastes, and noise, odor and visual or aesthetic effects.

6.3 Contamination of Soil and Water

- Effluents released as a result of project activities, if not contained properly, may contaminate the soil. Water quality may deteriorate if pollutants are mixed with surface runoff during rain and carried to water resources in the vicinity, or if pollutants leach into the ground.
- Fuel or oil stains, leakage or spill during construction and drilling operations can result in contamination of soil and water.
- Rig wash will result in contaminated water, which will ultimately contaminate ground water, or the surface water of the area. The major pollutants from rig wash include mud, heavy metals, oil and lubricating oil.
- **Minor Spills:** Leaks from vehicles, equipment, or storage containers at campsites or work areas outside the campsite or oil or fuel stains produced during handling and transfer operations such that the area and depth of soil contaminated is less than 01 m² and 0.3 m respectively. The contaminated soil will be removed and burnt in the burn pit.





- **Moderate Spills:** Oil spills during transfer or handling operations resulting in spillage of no more than 200 liters of fuel or oil. The contaminated soil will be removed and burnt in the burn pit in small volumes.
- **Major Spills:** These may occur during transportation of oil to the campsites or failure of the oil containment arrangement at the campsites resulting in spillage of oil significantly more than 200 liters in volume. The contaminated soil may require specialized treatment such as incineration or bioremediation.

6.3.1 Climate and Ambient Air Quality

Air emissions from project-related activities are likely to include:

- Mud chemicals and Exhaust from rig engines
- Combustion products (nitrogen oxides, sulfur dioxide, particulate matter, carbon monoxide, and volatile organic compounds) from diesel engine used in the camps to generate electric power
- Possible Hydrogen Sulphide emissions in case of emergency
- Emissions during flaring
- Combustion products from vehicles used for project-related activities
- Emissions from the burn pit

6.3.1.1 Dust Emissions due to Construction and Road Travel

Dust emissions due to construction and road travel shall be minimized by practicing good construction practices (such as keeping stock piles down wind and away from communities and camps) and sprinkling water over the access roads wherever required.

6.3.1.2 Drilling Operation

- Generators and vehicles used during construction and drilling operations will be maintained in a good working condition to ensure that emissions are kept to a minimum level;
- During drilling and construction dust emissions due to road travel will be minimized by regulating and monitoring vehicles speed and watering of the access track wherever required; The access track selected to access each well location will maintain a reasonable distance from communities; and
- Flare pit will be kept downwind of the well site and at least 500 m from the nearest community. The duration of flaring during well testing will be kept to the minimum required.





6.3.2 Noise

Potential sources of noise pollution during the project are listed below:

- Noise from well site and rig camp
- Noise from project vehicles and machinery

6.3.3 Biological Environment

- **Natural Vegetation**

Project activities that may affect the area's natural vegetation include the establishment of the following:

- Establishment of base camps
- Clearing of vegetation from construction activities
- Quarrying of gravel
- Construction of well site and rig camp
- Wildlife

Potential sources of impacts on wildlife during the project are listed below:

- Presence of people in the area
- Disturbance from access road usage during the project
- Light and noise from the camp
- Light and noise from well site (including flaring at the well site)

6.4 Socioeconomic Environment

Development projects stimulate associated impacts that manifest themselves as altered socioeconomic receptors. Socioeconomic impacts vary from project to project and are not always easily quantifiable. These are consequences of project activities on the human population that alter the ways in which people live, work, interact, relate to one another, organize to meet their needs and generally exist as members of society. These also include more long-term impacts such as cultural impacts involving changes to the norms, values and beliefs that guide and rationalize their cognition of themselves and their society. In the past socioeconomic impacts of large development projects were mitigated through monetary compensation, or were altogether ignored. However, the importance of these impacts has been recognized, and it is very strongly felt that impacts on a community's cultural activities, local practices, and day-to-day activities have far reaching impacts on their psychological, emotional and social wellbeing, whereby having an effect on their quality of life.





In this section of the EIA report, the effects and impacts of the proposed drilling with associated development activities on various socioeconomic parameters have been assessed and methods to mitigate these impacts have been proposed.

6.4.1 Potential Source of Impact

6.4.1.1 Sustenance Income

The livelihood of local communities largely depends on agricultural, livestock, mining and other land related activities. Particularly, for the construction and drilling operations land will have to be leased from locals. Compensation of the leased land and for standing crops is a standard mitigation practice in the oil and gas industry. The compensation rates, however, should be defined on the basis of prevailing market rates for land and crops and should be agreed with the local communities. In addition, the respective district/tehsil administration should be involved whilst disbursing the compensation amounts so that the rightful owners of the land are compensated. Any delays in disbursement of compensation amounts should also be avoided so that the already marginalized communities of the area are not affected. Reduction in farm income may also occur as agricultural lands become incapacitated as a result of oil spills into fields or water courses. This should be avoided by adhering to the waste management guidelines recommended in this EIA/EMP. Positive impacts of the project may include:

- Increased turnover of local businesses and shops due to an increased demand from project contractors and their employees; and
- An increase in income of the locals may occur due to employments in the project related activities.

a. Employment

- Distribution of employment opportunities during construction and operation phase subject to availability of local resource as per POL required competency criteria and in accordance to all applicable laws.

b. Culture and Religion

- Damage to cultural, archaeological or religious sites (if encountered).

6.4.1.2 Impact Assessment

Potential issues related to sustenance incomes have been assessed below:

- Leasing of agricultural land – Land might have to be leased or acquired for gravity and magnetic base camps, seismic camp/s, seismic lines, well sites, rig campsites, access tracks to well sites and construction campsite/s. Land for the project activities shall be leased as per local regulations and according to mutual consent and deliberations of both parties. In addition, POL has established procedures for leasing of land and its





compensation following which the landowner will be paid a lease amount for the land and a compensation amount for the standing crop affected at the time of the lease.

- Uptake of livestock grazing area/Effect on mobility of livestock herds/Potential for loss of livestock due to road accidents – The project facilities will also cover livestock grazing areas. Compared to the total available grazing area, the land uptake/disturbed by the project facilities will not be significant and will not have any measurable significant impact. Project vehicles will follow safe speed limits, especially on seeing a livestock herd near the road to avoid any road accidents.
- Employment –There will be some opportunities for wage labors in the project area. Similarly, the interest of local residents in relation to employment during the project is expected to be high. A positive impact of the project will be creation of employment by POL and its contractors for local skilled, unskilled staff and labor. The actual number of persons employed and their wages will dependent on the contractors' requirements. Core activities of construction and drilling operations, roads and well sites construction require skilled and trained labor force, which is not available in the area. However, the project will also to a great extent require the services of unskilled workforce. All unskilled and some semi-skilled workforce shall therefore preferably be hired equitably from within the local communities and the different tribes in the area.

Community sensitive project planning and implementation as prescribed through the recommended mitigation measures will minimize the occurrence of any such impacts. The access roads should be routed away from communities and employment should be provided in a transparent manner with local communities' consultation.

- Disturbance from noise – Construction camp and well site will be located **1.50 km** away from Jhandial village. As per assessment done in the section for physical environment no effect of the project noise will occur on the local communities if the mitigation measures recommended controlling the effect of noise are adhered with.
- Cultural and religious opportunities – Cultural sites in the form of shrines and graveyards exist in the project area. Location of construction campsites, rig sites and access tracks alignment should be planned at appropriate distances from cultural sites to avoid damage and hindrance caused to access of local communities (especially woman) to these sites.

6.4.1.3 Cumulative Impact

Considering that for all land uptakes local communities will be appropriately compensated and all other effects on sustenance income will be mitigated following the recommendations of the EIA, no cumulative impacts will occur.

6.4.2 Mitigation Measures

- Contractors staff shall be taken through a Community and External Affairs Induction program before commencement of each component of the project activities;





- Loss of standing crops, traditional land rights and community ownership will be given due consideration while determining compensation amounts;
- All mitigation related to management of wastes, noise and dust emissions suggested in the EIA will be adhered with;
- POL and its contractors will employ local residents during proposed project activities;
- Skilled and unskilled labor from local communities will be recruited equitably from amongst the various tribes, avenues for conflict resolution will be open, and the employment procedures will be transparent;
- Local residents living closest to the project location will be given priority in the employment process;
- Local water sources currently being used for irrigation and domestic purposes by the resident communities will be exploited only after complying with relevant requirements of the EIA;
- Flow of water in rivers, water crossings, seasonal streams/ ponds etc. will not be impeded;
- Any damage to watercourses, roads or other infrastructure during project activities will be repaired or compensated as per mutually agreed terms;
- Use of local firewood for cooking or heating by contractor staff to be prohibited;
- Strict compliance will be observed to POL's HSE guidelines;
- Drivers will be trained in responsible and safe driving practices, a speed limit shall be set and maintained, in addition vehicle logbooks will be maintained and inspected for compliance;
- A complaints register regarding environment will be maintained on site for registering of local complaints;
- Project staff will respect local cultural norms; and
- Appropriate offsets will be provided from sites of religious, cultural or archaeological significance.

6.5 Screening of Environmental Impacts

6.5.1 Check List of Project Activities

The study has been divided into the following activities for convenience in determining probable environmental impacts of proposed project.

- Development of access road





- Construction of contractor's camp
- Camp's operations
- Camp's solid waste disposal
- Camp's effluent disposal
- Camp's traffic communication
- Construction of temporary fence wall
- Equipment mobilization
- Construction of well site and rig camp
- Drilling of exploratory well

Checklist has been prepared for these activities against the impact on surface water, geology, land quality, flora fauna, aesthetics, resettlement, archaeological/ historical value, air quality, soil erosion, fisheries, terrestrial wildlife, land use, occupational/public health, ground water, agriculture and livestock. . The checklists for various activities are provided in **Annexure IX**.

6.5.2 Environmental Issues, Impact Analysis and Rating

The next step of the process consisted in a quantitative and qualitative analysis of the impacts generated by the Project on the different environmental components. The following criteria were retained for each component of the existing environment:

- The value of the component in its environment
- The intensity of the impact on the component

The value of each environment component must be taken into consideration. The value of these components is the following:

- High negative impact, medium negative impact, low negative impact, high positive impact, medium positive impact and low positive impact

A summary of waste generated due to project activities, including type and description of waste and recommended waste disposal methods are provided in **Table 6-1** below:





Table 6-1: Table showing Type of Waste Generated during Project Activities and their Disposal Methods

Sr. #	Activity			Description	Disposal Method
	Construction	Drilling	Operation		
1.	✓	✓	✓	Food waste: Kitchen waste e.g. fruit, meat, vegetable residues etc.	Deposition in bury pit/composting
2.	✓	✓	✓	Recyclable and Non-recyclable waste: Paper, plastic, textiles, cardboard, rubber, wood, glass, tin cans, metal scrap, aluminum cans, ferrous/nonferrous materials, plastic or aluminum pipe protection etc.	• Reuse • Recycling • Incineration if required
3.	✓	✓	✓	Oily and Hazardous waste: Oily rags, used oil, batteries, mercury lighting etc.	• Recycling • Incineration if required
4.	✓	✓	✓	Clinical waste: Syringes, glass bottles, used bandages, expired drugs etc.	• Incinerate at appropriate facility
5.	✓	✓	✓	Grey water: Wastewater from kitchen, laundry and showers etc.	• To be first sent to septic tanks and finally disposed of in soak pits • In case the soak pits get filled during the operation, grey water will be transferred to nearest municipal drains with prior approval of concerned authorities
6.	✓	✓	✓	Sewage/ Black water: Wastewater from toilets	• To be disposed of in septic tanks and then soak pits
7.		✓		Drilling waste: Drill cuttings, excess or spent drilling mud, rig wash water etc.	Water Based Mud (WBM) will primarily be used during drilling. The drill cuttings and WBM will be stored at the well site in lined pit. The drilling mud will be allowed to evaporate inside the mud pit and also dry out. After that, the mud pit and the cuttings pit will be backfilled





8.		✓	✓	Minor Spill Oil spills/soil contaminated by oil leakages or stains – Leaks from vehicles, equipment, or storage containers at campsites or work areas outside the campsite or oil or fuel stains produced during handling and transfer operations Quantity: Area and depth of soil contaminated; < 1m² and 0.3m respectively Moderate Spill Fuel, oil or chemical spills during transfer or handling operations. Quantity: Spill less than 200 liters Major Spill Spill during transportation of fuel, oil or chemicals or failure of the containment areas Quantity: Spill more than 200 liters	• Specialized treatment such as incineration or remediation such as thermal, chemical or biological • Best industrial guidelines will be followed • In case of chemical spill the contaminated soil to be land filled • Dykes will be constructed around fuel tanks to avoid spillage in area and to ensure proper containment in case of leakage
9.			✓	Produced Water Condensate	• To be disposed of in impermeable (HDPE) lined evaporation ponds • To be re-injected into deep subsurface formations where possible as per DGPC guidelines
10.	✓	✓	✓	Solid Waste: Concrete, building materials, off cut pipe, plastic sheeting, cables, drums etc.	• Recycling • Landfilling

6.6 Recommended Mitigation Measures

6.6.1 Construction Phase

The recommended mitigation measures for construction of project are discussed in the following sub section:

6.6.1.1 Camp Construction

The mitigation of camp construction and operation are as follows:





- Selection of camp location to minimize need for soil movement, unutilized land and on advice of ecological/wildlife experts
- Stored materials in controlled areas, including storage of fuels and other liquids with in sealed bunds and limited in size
- Establish solid waste collection, storage and offsite disposal system
- Use only the existing access roads. Where improvement of existing tracks or development of short lengths of new tracks is unavoidable the width of the access track will not exceed 4m
- Leveling or widening along the access road will be carried out in sections which will be adequately sprinkled with water and compacted, if necessary
- Align access road away from populated areas and establish camp and construction traffic control rules
- Establish proper liquid effluent collection, treatment and disposal system, including latrine and washhouse, septic tanks emptying and disposal system
- Proper management of potential pollution and provision of suitable fuel supply to camps
- Enforcement of regulations forbidding cutting trees and monitor proper boundary controls

6.6.1.2 Local Population

Efforts will be made to establish a relationship with the local communities prior to commencement of the work to ensure that their natural concerns about possible socio impacts is taken into account.

The construction activities of proposed project will be carried out with a minimum level of disturbance to a local population. The local population will be involved in the construction work and support services. As such the project will create an economic opportunity with local population in terms of jobs and demands for daily merchandise from local shops.

6.6.1.3 Noise

Local population is located at a safe distance from the proposed project location. Since the operations will be carried out during the day, the noise to be produced by construction activities will not be more than the noise of vehicular traffic on roads adjacent to the project area.

6.6.1.4 Dust

The level of dust emissions will be very low owing to the soil characteristics. Regular watering of the area will control further whatever emissions will take place. It is estimated that the watering reduces the emission by more than 50%.





6.6.1.5 Vehicular Traffic

Temporary impacts to traffic flow may occur at project area.

6.6.1.6 Resettlement

No change in settlement pattern due to project is envisaged. As such no mitigation will be required.

6.6.1.7 Road Side Plantation

There will be minimal vegetation removal from the project site as the proposed project is only the extension of the existing facilities. However tree plantation in the vicinity of the project area is the part of the project and will be implemented after the completion of the project.

6.6.1.8 Archaeological / Cultural Sites

No such sites are present in the vicinity of the project.

6.6.1.9 Development of Formally Inaccessible Land

Significant addition development is not anticipated as a result of the project.

6.6.1.10 Pollution of Soil and Water

The following measures will be employed by POL to avoid any of the above hazards:

- Appointment of Safety, Health, Environment officer at each work site and at each campsite to ensure that work and living does not deteriorate the environment
- Concrete septic tanks and soak pits shall be constructed at each work and campsite for the disposal of domestic liquid waste
- Establish solid waste collection storage and off-site disposal system
- Keep storage area away from watercourses, canals, ditches etc.

6.6.2 Biological Environment

Ecological impacts of the proposed project are likely to be localized on small scale. Nevertheless, attention will need to be paid to safeguard any small pockets of important or sensitive habitats that may be encountered close to these sections. Access tracks will be avoided from passing through patches of dense vegetation.

In relation to the amount of similarly habitat in the region, any impact resulting from the POL's oil exploration activity will be insignificant.





6.6.2.1 River and Stream Crossing

No river and stream is passing through the project area.

6.6.2.2 Wetlands

There are no wetlands known to occur along the project area and as such no impact is likely to occur.

6.6.2.3 Alteration of Drainage System

Restoration of the drainage system will be ensured if damaged / blocked during proposed project activity due to any project related activities. POL will ensure that Contractor adopt best construction practices all along the project area to restore counters to their pre-construction slopes. If this practice is effectively implemented, very little alteration of drainage patterns will be anticipated as a result of construction.

6.6.3 Operation Phase

6.6.3.1 Contamination of Soil and Water

- For project activities that require vegetation cover removal etc. the activity will be carried out in a way that would minimize disturbance to natural topography and soils
- Wastes will not be disposed off in the open. For collection of wastes at the project sites, adequate number of waste bins will be provided. Grey wastewater will be collected in soak pits
- The wastewater, if found in compliance with the PEQS could be sprinkled over the access road. Alternatively it will be transferred from the site in tankers and disposed off into municipal drains of nearest city
- Waste oil shall be provided to contractors in nearby town / city approved by the POL Site Representative where it will be reused
- Sewage generated from the toilets shall be collected and treated in septic tanks. The septic tanks shall be built of concrete and brick masonry to avoid leaching of wastewater from the tanks. The overflow from the tanks shall discharge into soak pits. In case the soak pits get filled the wastewater shall be transferred from the site in a tanker and disposed off into municipal drains in nearest city. Soak pits shall be built in absorbent soil and located 300 m away from a surface water source or ground water well
- Vehicles will be refueled daily in order to minimize travel and chances of spills; all operating vehicles will be checked regularly for signs of fuel, oil, or battery fluid leakage.





- Vehicles will only be washed in designated areas within campsites and will be daily checked for fuel or oil leaks, If leaks are found they will not be operated until repaired
- Precautionary materials, including shovels, plastic bags, and absorbent materials, will be kept available near fuel and oil storage areas.

6.6.3.2 Climate and Ambient Air Quality

- All equipment, generators, and vehicles used during the project will be properly tuned and maintained in good working condition in order to minimize exhaust emissions
- Imposing speed limits and encouraging more efficient journey management will reduce the dust emissions produced by vehicular traffic. Water will be sprinkled where necessary to control dust emissions
- Emissions in the form of oxides of carbon, nitrogen and sulphur will be produced during flaring. Emissions from flaring will have no effects on communities or rig site workers and local air quality because the flare pit will be kept downwind of the well site and more than 500 m from the communities and the emissions will disperse and dilute with prevalent wind currents
- The quantity of waste burnt at one time in the burn pit will be managed such that excessive smoke does not arise during burning
- All project vehicles will be checked regularly to ensure that engines are in sound working condition and are not emitting smoke

6.6.3.3 Noise

- It will be ensured that generators, vehicles and other potentially noisy equipment used are in good condition
- Use of horns, in particular the pressure horns by project vehicles shall not be allowed. Movement of all project vehicles and personnel shall be restricted to work areas
- Noise levels at communities nearest to the project site; POL Site Representative will monitor campsite and access tracks. In case these are found to exceed safe acceptable limits appropriate mitigation will be taken
- Base camp will be located at least 500m away from nearest communities
- The use of horns by project vehicles will be minimized. The use of pressure horns will not be allowed





- Personal Protective Equipments (PPE) like ear plugs and earmuffs will be provided to the workers who are continuously exposed to high-level noise

6.6.3.4 Biological Environment

Natural Vegetation

- Access tracks will be avoided from passing through patches of dense vegetation.
- Open fires will not be allowed anywhere outside the campsites.
- Fuel-wood and shrubs will not be used as fuel during project activities.
- Unnecessary damage to vegetation will strictly be avoided.
- Clearing of vegetation will be minimized by keeping the road width to 5 m (except at bends where greater width will be required for safety reasons), and by keeping the length of new sections of the road to a minimum
- When clearing a campsite, disturbance to topsoil and vegetation rootstock will be avoided to the greatest possible extent.

Wild Life

- Areas identified as active denning, nesting, spawning, and migration and feeding areas, will be avoided as far as possible. However, this will be a bit difficult since the drilling involves considerable movement of workforce and equipment mobilization.
- A 'no-hunting, no-trapping, no-harassing' policy will be strictly enforced.
- The project staff's movement will be strictly restricted to the work area.
- The project staff will be educated and instructed to avoid killing or chasing wild animals.
- Safe driving practices will be observed to minimize the accidental killing of reptiles or small mammals crossing the road.
- Off-road driving will not be allowed.
- Unnecessary damage to the natural topography and landscape will be kept to a minimum to the extent possible.

6.6.3.5 Archaeological Sites

There are no archaeological sites protected under observed /reported close to the access road or camp site that are likely to be damaged or desecrated by the operation.

- A safe distance will be maintained from sites of archaeological significance (if present) and must be reported to supervisor





- The road will be realigned to maintain safe distance from the edge of any graveyard (if found)

6.6.3.6 *Sharing of Water Source*

- The quantity of water used during proposed project activity will be kept to the minimum
- Water from the microenvironment of the Project will not be used in view of its scarcity in the area
- The project water usage should not affect the accessibility of locals to the water source in the long or short term. Water from this source will only be used after ensuring that the abstraction process will not result in any water shortages

6.6.3.7 *Mitigation Measures for Domestic and Medical Wastes*

- Sewage will be disposed of into septic system comprising of septic tanks and soak pits;
- Wastewater from laundry, kitchen washings and showers will be disposed of into separate soak pits;
- Septic tank and soak pit shall be covered properly to avoid any obnoxious smell in surrounding areas;
- Soak pits will be built in absorbent soil and located 300 m away from surface water source or water well;
- Soak pits will be constructed such that surface runoff cannot enter the pits;
- Soak pits will be designed to accommodate wastewater generated during the total duration of the operation;
- Sprinkling of grey water will not be allowed. In case soak pits get filled wastewater will be transferred to the nearest municipal drains with prior formal approval from the concerned authorities;
- In case the septic tank gets filled with sludge, septic tank shall be emptied through vacuum truck and material shall be transferred to treatment facility or approved municipal drain;
- No solid waste will be disposed of in the field. All solid wastes will be disposed of in waste bins provided within the working and residential areas;
- Combustible, noncombustible and hazardous wastes will be temporarily stored on site and handed over to Punjab EPA's approved waste contractor for recycling purposes and safe disposal;





- At the time of restoration, septic tanks will be dismantled in place and backfilled with at least 1 m of soil cover above the buried dismantled septic tank;
- At the time of restoration, soak pits will be backfilled with at least 1 m of soil cover keeping in view landscape of surrounding natural surface; and
- Medical wastes will be temporarily stored onsite separately and incinerated at appropriate facility

6.6.3.8 Mitigation Measures for Oily Wastes

- Used oil and wastes will be transported to local contractors for recycling;
- Shovels, plastic bags and absorbent material should be present near fuel and oil storage or handling areas to attend spills and leaks;
- A Spill Prevention and Contingency Plan will be prepared to deal with moderate and major spills;
- The soil contaminated from major spills may require specialized treatment such as incineration or bioremediation. In case of chemical spill, the contaminated soil may have to be treated or landfilled;
- The soil contaminated from minor and moderate spills will be removed and properly buried in such a manner that it does not contaminate the surrounding soils or groundwater. In the case of spill >200 liters the contaminated soil will be disposed of in line with the best industrial practices and guidelines;
- Fuels tanks will be daily checked for leaks and all such leaks will be plugged immediately;
- Fuel and oil storage areas will have secondary containment in the form of concrete or brick masonry bunds. The volume of the containment area should be equal to 125% of the total volume of fuel stored;
- All fuel tanks will be properly marked to highlight their contents;
- All fuel and oil storage areas will have a concrete pad underneath to prevent soil contamination in case of leaks or spills; and
- Vehicles will be daily checked for fuel or oil leaks. Vehicles with leaks will not be operated until repaired.





6.6.4 Site Restoration

a. Potential Sources of Impacts

After completion of the proposed exploration and associated development operation, project facilities e.g. campsites, well sites and access tracks will be restored to as close to its original condition as possible if they are not needed for future developmental activities. A photographic record shall be maintained for comparison purposes. Mitigation measures to alleviate the adverse environmental impacts are detailed below.

b. Mitigation Measures

- Demobilization of all equipment and machinery;
- Disposal of any waste material remaining at the time of completion of the operation;
- Backfilling of all soak pits and septic tanks according to the guidelines suggested in this EIA/EMP;
- Dismantling and removal of fence or barriers surrounding the campsites area; and
- General restoration of the site area including landscaping and restoration of drainage where required.

c. Drilling Operation

Complete Restoration – Dry Well

- All wastes at the well sites will be disposed of according to the requirements of the EIA/EMP;
- Liner from the water and waste pits at the well sites may be taken out and re-used or disposed of in the existing pits with proper restoration;
- All concrete structures at the well sites will be broken and either transported out of the project area or site restoration contractors will send it for sale or reuse or disposed of into the pits;
- All pits at the well sites will be backfilled; and
- The areas covered by the portion of the access track that will be of no use for other wells will be restored, in that all gravel topping will be removed. This scenario will be applicable only if the locals require the portions of the track to be restored or otherwise it will be left on the site with the consent of locals.

Partial Restoration – Producing Well

- The well sites and access roads will be retained to support well access work for further testing or during the production phase;





- The outer chain link fence will be retained as a safety measure to keep wildlife away from the pit areas;
- The wellhead will be enclosed by a locked steel cage. This will serve as both a safety and security measure as the site will be down-manned pending further production operations work; and
- The constructed pit areas will be retained but all liquid and solid waste material will be removed from the site and disposed of in line with the requirements of this EIA/EMP.





7 ENVIRONMENTAL MANAGEMENT PLAN

7.1 Background

The Environmental Impact Assessment (EIA) for the “**Drilling of Jhandial-03 Well, District Attock, Punjab**” project has identified potential impacts that are likely to arise during the project. Though the impacts in the project area will be insignificant, yet the Environmental Impact Assessment has examined in detail both negative and positive impacts at each stage of the project including camp establishment, construction activities of the project, equipment installation and operation of oil drilling.

The EIA for the drilling of POL Drilling of Jhandial-03 well has identified potential impacts that are likely to arise during the project. Though the impacts of the exploration and drilling activity in the project area will be insignificant, yet the EIA has examined in detail both negative and positive impacts at each stage of the project.

To minimize the effects of adverse impacts the EIA recommends mitigation measures. These mitigation measures include the use of alternative options, management and physical controls, or compensation in monetary terms. The proposed mitigation measures are based on the understanding of the sensitivity and behavior of environmental receptors in the project area, the legislative controls that apply to the project and a review of good industry practices while operating in sensitive environments.

For the effective implementation and management of the mitigation measures an Environmental Management Plan (EMP) has been prepared. The EMP satisfies the requirement of the Review of Initial Environmental Examination and Environmental Impact Assessment Regulations 2022.

7.1.1 Objectives of the Environmental Management Plan

This EMP provides a delivery mechanism to address potential impacts of the project activities, to enhance project benefits and to introduce standards of good practice in all project activities. The EMP has been prepared with the objective of:

- Outlining mitigation measures required for avoiding or minimizing potential impacts assessed by the EIA;
- Developing a monitoring mechanism and identifying requisite monitoring parameters to confirm effectiveness of the mitigation measures recommended in the EIA;
- Defining roles and responsibilities of the project proponent for the implementation of EMP and identifying areas where these roles and responsibilities can be shared with other parties involved in the execution and monitoring of the project; and





- Defining the requirements necessary for documenting compliance with the EMP and communicating it to all concerned regulatory agencies.

7.1.2 Methodology

The basic approach to prepare this plan mainly comprise of:

- A review of relevant environmental policies, legislations and guidelines;
- A review of past environmental studies carried out in Jhandial
- A review of relevant environmental data in Jhandial and project area in particular;
- On the basis of past experience gained during the monitoring of similar projects in relation to drilling and production; and
- Consultation with POL's staff.

7.1.3 Structure of the EMP

The EMP consists of the following sections:

- Legislations, policies and guidelines;
- Organizational structure with roles and responsibilities
- Change management plan; and
- Mitigation management matrix.

7.2 Legislation and Guidelines

This EIA has discussed national and international legislation and guidelines and their relevance to the proposed project. POL shall ensure that the operation is conducted in conformance to POL's corporate environmental policy, national legislation and relevant international conventions and that guidance is sought from national and international guidelines. All relevant legislation, guidelines, convention and corporate requirements are discussed in Chapter # 02 of this EIA. POL shall also ensure that the key project management staffs are aware of these legislation and guidelines.

- **Review of EIA and IEE Regulations 2022:** The project will be conducted in conformance with EIA regulations and relevant international conventions and that guidance is sought from national and international guidelines.
- **PEQS Requirements:** PEQS will be followed throughout the project activities and operation. The PEQS are available for industrial gaseous emissions, motor vehicle emissions and noise levels, and industrial and municipal effluents.





7.3 Organizational Structure with Roles and Responsibilities

7.3.1 Organizational Structure

The proposed project includes the following main organizations:

- POL as the project proponent and owner of the EMP;
- Project Contractors including the gravity and magnetic, seismic, construction and drilling contractors as the executors of the EMP;
- Independent Monitoring Consultants (IMC) as the monitors of the execution of the EMP and effects monitoring; and
- These organizations will have the following roles and responsibilities during the project activities.

7.3.2 Roles and Responsibilities

Abovementioned organizations will have the following role and responsibilities during the proposed project activities.

7.3.2.1 Roles and Responsibilities of POL

As project proponent, POL will be responsible for ensuring the implementation of the EMP. POL Drilling department and drilling contractor HSE department will be responsible for the overall environmental performance during the proposed operations. Drilling Manager will delegate a representative from POL who will have functional responsibilities for HSE matters during the project operational phase. POL will hold prime responsibility for ensuring that the environmental performance of the project is in accordance with governing legislations, POL's corporate objectives and the recommendations of this EIA. The POL will ensure that the provisions of the EMP are translated into the contractor's requirements and that these requirements are implemented to the full extent.

7.3.2.2 Roles and Responsibilities of Project Contractors

For the proposed project, POL Drilling Manager will appoint contractors for different field operations. These contractors will be responsible for the implementation of/or adherence to all provisions of the EIA and the EMP and with any environmental and other codes of conduct required by POL. Overall, responsibility for the contractor's environmental performance will rest with the person holding the highest management position within the contractor's organization in Pakistan. Reporting to their management the contractor's site manager will be responsible for the effective implementation of the EIA and the EMP. The contractor's HSE Officer will have functional responsibilities to ensure implementation of or adherence to the requirements of the EMP.





7.3.2.3 Roles and Responsibilities of IMC

To fulfill the monitoring requirements within area of operation, POL will also appoint an Independent Monitoring Consultant (IMC). The IMC will be responsible for carrying out monitoring according to the requirements of the EMP. IMC's field representatives will have functional responsibilities to ensure monitoring of the project activities as per the requirements of the EMP. The IMC will report directly to POL who will then disseminate the IMC reports and findings to Punjab EPA.

7.3.2.4 Roles and Responsibilities of Regulators

In pursuance to requirements of Pakistan Environmental Protection Agency (Review of IEE and EIA) Regulations, 2000 (The 2000 Regulations), Punjab EPA, the Review of IEE and EIA Regulations 2022 after receiving the subjected EIA from the proponent and issuing the confirmation of completeness, it will simultaneously publish a notice in any English or Urdu national newspaper and or a local newspaper of general circulation in the area affected by the project, a public notice mentioning the type of project, its exact location, the name and address of the proponent and the places at which the EIA of the project, subject to the restrictions in the regulations 2022.

The notice will fix a date and time and place for the Public Hearing for any comments on the project or the EIA. Punjab EPA is required to make every effort to complete the EIA review process within 45 days of the issue of confirmation of completeness under Regulation 10 of Review of IEE-EIA Regulations, 2022. In case the project is issued an NOC, Punjab EPA will monitor compliance of project proponent with the requirements of EMP of the project and any additional mitigation measures provided in the NOC for the proposed drilling project.

7.3.3 Planning and Design of the Operation

7.3.3.1 Design of the Operation

Project details regarding proposed drilling, production and associated developmental activities have been discussed in Chapter # 03 of the EIA report. Following approval of the EIA, any changes to the proposed project activities will be handled through the Change Management Plan provided in this EMP.

7.3.3.2 Contractual Provisions

EMP will be the fundamental part of the contract between POL and all project contractors. All project contractors will implement the mitigation measures, provisions and recommendations provided in the EMP during the execution of the proposed exploration and associated development project.





7.3.4 Implementation of the Proposed Project

7.3.4.1 Environmental Management Systems

POL and the project contractors will ensure that the mitigation measures mentioned in the Mitigation Management Matrix for proposed construction, drilling of well and operation are adhered to and organizational HSE Management Systems are implemented during the proposed project activities. The contractors will abide by the relevant contractual provisions relating to the environment.

7.3.4.2 Minimum Distances

This EIA specifies minimum distances to be maintained from environmental features including communities, water resources, wildlife or forest sensitive areas and archaeological sites etc. These minimum distances from sensitive environmental features for project activities are provided in **Table 7-1**. The Contractors shall ensure that these minimum distances are adhered to during the operation and are inspected by HSE officer and POL officials.

Table 7-1: Recommended Distance from Environmental Receptors during Proposed Drilling and Associated Construction Activities

Distance (m)			
Area/Facility	Community	Archaeological or Cultural Site (including graveyard, religious sites and shrines)	Surface Water Resource/Water Well
Access track	300	300	100
Well site	500	300	300
Rig camp	500	300	300
Soak pits	-	-	300 m from ground/surface water resources
Construction camp	500	300	-

7.3.4.3 Monitoring

POL, contractors of the project and IMC will ensure that monitoring of the project activities is carried out according to the monitoring program given in the EMP. A tentative frequency of monitoring mitigation measures is provided in **Table 7-2**.



Table 7-2: A Tentative Frequency of Monitoring Mitigation Measures

Item	Frequency
Access track inspection	Prior to start work on any of access track development
Camp construction	At the time of camp construction
Waste disposal at campsites	Once a week as a minimum
Waste disposal at rig site	Daily during routine field visits
Waste disposal along access tracks and survey lines	Daily during routine field visits
Water use	Once every week
Recycling contractors	At the time of approval and then once during the operation
Access tracks and road travel	Daily during routine field visits
Preparation of survey lines	During survey of seismic lines
Shot holes/Upholes drilling, shooting and recording	On a routine basis on selected seismic lines
Vehicles – Field inspections	Daily during routine field visits
Vehicles – Camp inspections	Twice a week as a minimum
Handling of fuels, oils and chemicals	Once during camp construction and twice a week during camp operation
General controls	Daily during routine field visits
Restoration	During restoration

7.3.4.4 Emergency Procedures

POL and the project drilling contractor will prepare contingency plans to deal with any emergency situation that may arise during the operation e.g. major oil spills, medical, evacuation and communicate these to the regulatory agencies if required by these agencies.

7.3.4.5 Approvals

The project consultant and proponent will be responsible for obtaining all relevant approvals from EPA as specified.

7.3.4.6 Trainings

All contractors engaged in the activities will be responsible for the selection and training of their staff capable of completing the project activities properly and efficiently. The contractor will be responsible for providing trainings to their staff members according to the training program.

7.3.4.7 Record Keeping

For effective monitoring, management and documentation of the environmental performance during the project activities, environmental matters will be discussed during daily meetings





held at site. Environmental concerns raised during the meetings will be mitigated accordingly. Any issues that require attention of POL's higher management will be communicated to them for appropriate action. POL and the contractors will ensure that the communication and documentation requirements specified in the EMP are fulfilled during the entire course of the operations.

7.3.4.8 Change Management Plan

The EIA for the proposed project activities recognizes that changes in the operation or the EMP may be required during the operation and therefore provides a Change Management Plan to manage such changes. Overall, responsibility for the preparation of change management statements will rest with POL.

7.3.4.9 Restoration

POL will be responsible for the final restoration of work areas according to the requirements of the EIA.

7.4 Environmental Monitoring

The objective of the environmental monitoring during the construction, drilling, production and associated development activities will be as follows:

- To check compliance of the contractors and POL with the EMP by monitoring activities of the project;
- To monitor impacts of the operation in which there has been a level of uncertainty in prediction such as impacts on wildlife and to recommend mitigation measures if the impacts are assessed to be in excess of or different from those assessed in the EIA. The aim will be attained through Effects Monitoring; and
- To ascertain residual impacts of the entire course of the operation. This will be achieved by Post-Project Monitoring.

To achieve these objectives, the following monitoring program will be implemented.

7.4.1 Compliance Monitoring

Compliance monitoring will be carried out to ensure compliance with the requirements of the EIA and to document and report all non-compliances. The Mitigation Management Matrix for construction, drilling and their associated activities are provided in the EMP will be used as a management and monitoring tool. Inspections may be carried out using checklists provided in the EMP. The drilling contractor HSE Officer will be responsible for monitoring the compliance of their organization with the relevant EMP requirements. POL drilling and HSE departments will monitor the contractor's compliance and will also ensure that during activity a





system and plan is in place for effective compliance monitoring. Any non-compliance observed will be recorded in non-compliance recording forms and discussed during the environmental meeting. POL's representative will make regular checks on the contractor's works; keep record of all non-compliances observed during the execution of the project activities and the details of all remedial actions taken to mitigate the project impacts.

7.4.2 Effects Monitoring

HSE Officer will be responsible to carry out the required effects monitoring during proposed geophysical investigations, construction and drilling activities.

Table 7-3: Effects Monitoring Requirements

Parameter	Potential Issue	Monitoring Parameter	Method	Frequency	Responsibility
Physical Parameters Water	Lowering of groundwater table or reduced discharge in water wells used by the project and within 300 m radius	Water well discharge	Volumetric discharge measurement	Monthly during each project	IMC
Biological Environment Wildlife	Disturbance to wildlife, including key species of the area	Presence and distribution of wildlife in the area of operation	Wildlife surveys	For each project the frequency will be as follows: Pre project, at regular intervals during the projects and after restoration	IMC
Socioeconomic Environment Communities	Disturbance to communities and community complaints	Community complaints	Community consultation and community complaints register	Consultation with communities through POL site representative prior to and throughout each project	IMC

7.4.3 Post-Project Monitoring

The objective of this monitoring will be to determine the level of residual impacts of the project activities on physical, biological and socioeconomic receptors of the project area. The monitoring may be carried out on quarterly basis as directed by EPA during all activities in the project area. As part of the post-project monitoring methodology restoration of sites will also be checked.





7.5 Communication and Documentation

7.5.1 Kick-off Meeting

For proposed construction, drilling and operation, prior to commencement of work and after setup of the field camp, a meeting will be held on-site to discuss implementation of the EMP, show commitment to adhere with the EMP and check readiness of the contractors to start the project. The meeting will be attended by relevant management staff from POL and the contractors. The purpose of the kick-off meeting will be to present the EMP to project staff and discuss its implementation and to discuss any event of environmental significance that has happened in the under-discussion industry or a similar industrial unit to investigate its route causes and develop its solutions.

At the beginning of the project, a meeting will take place at the main contractor's camp to discuss the environmental issues. The following personnel will attend the meeting:

- **POL**
 - AGM (Operations)
 - Drilling Manager
 - HSE Representative
- **Contractor**
 - Site Manager
 - HSE Officer
 - Senior Supervisor
 - Camp In charge

7.5.2 Meetings and Reports

A daily meeting will be held during the construction and subsequent drilling activities to discuss the environmental conduct of the operation, non-compliances noted and their remedial measures. The meeting will be attended by the POL's site representatives and contractors and their HSE staff. The meetings will be recorded in the form of a Daily Environmental Report. The report will include:

- Summary of project activities on that day;
- Contractors' environmental representatives present onsite; and
- Non-compliances observed and mitigation measures taken or require.





7.5.3 Social Complaints Register

The POL's site representative will maintain a register of complaints received from local communities and measures taken to mitigate these concerns. All community complaints received will be sent to the POL's HSE Management for further action.

7.5.4 Change Record Register

All changes to the EMP or the project will be handled through the Change Management Plan provided in the EMP. These changes will be registered in a Change Record Register.

7.5.5 Photographic Record

POL will ensure that a photographic record including the following is maintained:

- All areas used by the project activities; before use, during use and after restoration;
- Key non-compliances; and
- Key project activities.

7.6 Mitigation Management Matrix

Mitigation Management Matrix for well drilling with associated construction activities is provided in **Table 7-4**. The Mitigation Management Matrix will be used as a management and monitoring tool for implementation of the mitigation measures required by the EIA. The matrix lists down:

- The required mitigation measures recommended in the EIA;
- The person/organization directly responsible for adhering to or executing the required mitigation measures and monitoring adherence to the mitigation measures;
- The parameters which will be monitored to ensure compliance with the mitigation measures; and
- The timing at which the mitigation or monitoring has to be carried out.

POL will hold primary and overall responsibility for ensuring full implementation of the EMP.





Table 7-4: Mitigation Management Matrix for Construction and Drilling Activities of Proposed Project

Sr. #	Impact and Mitigation Measures	Responsibility/ Execution	Action/Monitoring Parameter/Monitoring Method	Timing
1.0 Soil Erosion and Changes in Landscape				
1.1	Access tracks in the undulating areas will follow natural contours to minimize disturbance to natural topography and soils. Cutting along the sides of the slopes will be minimized	POL, CC	Monitor clearing operation	During land clearing activities
1.2	Clearing of vegetation will be kept to a minimum, especially dense patches of vegetation in the protected areas	POL, CC	Monitor land clearing activities	Prior and during the land clearing operation
1.3	The cutting of trees will be prohibited in wildlife or forest protected areas	POL, CC	Supervise land clearing activities	During land clearing for access track, well site and campsites
1.4	Total land uptake by each well site, camp and access road to the well site will be kept to the minimum required	POL, CC	Monitor land clearing activities and randomly check compliance with actual design	During construction activities
1.5	The access track to each well site will be selected to utilize existing tracks as much as possible	POL, CC	Monitor land clearing activities	Prior to each construction activity
1.6	The well site, rig camp and construction camp will preferably be located in existing clearing and levelled land	POL, CC	Check location of project facilities	At the time of site selection for each well site, rig camp, and construction base camp
1.7	The access track will be properly compacted at the time of construction and thereafter properly maintained by watering and compaction throughout the entire construction and drilling operation	POL, CC	Check compaction and maintenance	During the entire operation
1.8	During construction movement of construction equipment will be restricted to work areas only to avoid unnecessary disturbance to soils in the project area	POL, CC	Monitor movement of vehicles and off-road travel	During construction of project facilities





1.9	Off-road travel shall be avoided and observance of this should be monitored during the operation	POL, CC, DC	Approve access track and monitor off-road travel	During the entire project
1.10	Periodic trainings shall be provided to drivers on mitigation measures related to off-road travel and speed limits	POL, CC, DC	Check training log and provide trainings	During the entire project
1.11	During construction, dumping of gravel on or close to the access track being improved or constructed shall not be allowed	POL, CC	Ensure compliance	During construction activities
1.12	Uncontrolled and unnecessary clearing, dozing, excavations or quarrying, storage of construction material etc. will be avoided	POL, CC	Ensure compliance	During the entire project
1.13	Photographs will be taken before any activity to record the conditions of campsite, roads and well site at particular locations that are likely to undergo soil erosion. Similar photographs will be taken at time intervals throughout the operation to monitor any changes and soil conditions	POL, CC	Supervise and ensure compliance	During the entire project

2.0 Soil and Water Contamination

2.1	Sewage Treatment Plant (STP) shall be most preferred option for handling of black/grey water under environmental sustainability, but in case of unavailability of STP, septic tank and soak pits shall be provided. Septic tank and soak pit shall be covered properly to avoid any obnoxious smells or nuisance in surrounding areas	POL,CC	Check provision of STP or septic tanks and soak pits	During the design and construction of facilities
2.2	Wastewater from laundry, kitchen washings and showers will be disposed of into separate soak pits	POL,CC	Check provision of soak pits at campsites	During the construction of campsites
2.3	Soak pits will be built in absorbent soil and located 300 m away from a surface water source or a water well	POL,CC	Check soil condition and distance between the soak pits and the nearest water body	During the construction of campsite
2.4	Soak pits will be constructed such that surface runoff cannot enter the pits	POL,CC	Check design of the soak pit and monitor construction	During the construction of campsites
2.5	All soak pits will be designed to accommodate wastewater generated during the total duration of each drilling operation	POL,CC	Check design of soak pit	Before construction activity
2.6	In case the soak pits get filled during the operation, grey water will be discharged in the nearest municipal drains after getting formal approval from local authorities. Sprinkling of grey water will be	POL, CC and DC	Check provision of soak pits and monitor the wastewater transfer activity	During the entire operation





	not be allowed			
2.7	No solid waste will be disposed of in the field. Within the camp areas and all solid wastes will be disposed of in waste bins provided within the camp area	POL, CC and DC	Check provision of waste bins	During the entire operation
2.8	All types of combustible, non-combustible or hazardous waste including plastic or glass bottles and cans will be temporarily stored on site and later sold/handed over to a waste/recycling contractor who will utilize these wastes for recycling purposes	POL, CC and DC	Check compliance	During the entire operation
2.9	Construction of burn pit and burning of waste will not be allowed	POL, CC and DC	Check compliance	During the entire operation
2.10	At the time of restoration septic tanks will be dismantled in place and backfilled with at least 1 m of soil cover above the buried dismantled septic tank	POL, CC	Supervise restoration and randomly check thickness of soil cover	During the restoration phase
2.11	At the time of restoration soak pits will be backfilled with at least 1 m of soil cover keeping in view landscape of surrounding natural surface	POL, CC	Supervise restoration and randomly check thickness of soil cover	During the restoration phase
2.12	It will be ensured that after restoration activities the campsites are clean and that no refuse has been left behind	POL, CC	Visually check the restored site and identify non-compliance, if any	After restoration activity
2.13	All concrete structures at the campsites will be removed and buried in garbage or soak pits and the pits backfilled with at least 1 m of soil cover above pits	POL, CC	Supervise removal and burial of concreted structures and randomly check thickness of soil cover	During restoration activity
2.14	Vehicles will only be washed in designated areas within campsites only	POL, CC and DC	Ensure provision of washing areas and monitor any non-compliances	During the entire operation
2.15	Vehicles will be daily checked for fuel or oil leaks. Vehicles with leaks will not be operated until repaired	POL, CC and DC	Check maintenance logs and ensure daily inspection of vehicles for leaks	During the entire operation
2.16	All fuel tanks will be properly marked to highlight their contents	POL, CC and DC	Ensure that proper signs are placed with the tanks	During the entire operation
2.17	Fuel and oil storage areas will have secondary containment in the	POL, CC	Check containment volume of the	At the time of





	form of concrete or brick masonry bunds. The volume of the containment area should be equal to 125% of the total volume of fuel stored		fuel or oil bounded area	construction
2.18	Fuels tanks will be daily checked for leaks and all such leaks will be plugged immediately	POL, DC and CC	Inspect fuel tanks for leaks	During the entire operation
2.19	The soil contaminated from minor, moderate and major spills will be removed and disposed of in accordance to best industrial guidelines. Specialized treatment methods like incineration or bioremediation can be employed for moderate or major spills. In case of chemical spill the contaminated soil may have to be landfilled or can be disposed of along with the drill cuttings	POL, DC and CC	Check compliance	During the entire operation
2.20	A Spill Prevention and Contingency Plan will be prepared to deal with moderate and major spills	POL, DC and CC	Study and examine the plan and identify any flaws, if any before its approval	Before the commencement of project
2.21	Shovels, plastic bags and absorbent material shall be present near fuel and oil storage or handling areas to attend spills and leaks	POL, DC and CC	Check provision of HDPE liner and other equipment	During the entire operation
2.22	Used oil and vehicle related waste will be transported to local contractors for recycling	POL, DC and CC	Approve waste contractor and randomly check proper recycling	During the entire operation
2.23	Medical wastes will be temporarily stored onsite separately and incinerated at nearest facility	POL, DC and CC	Check Compliance	During the entire operation
2.24	A water and oil based mud system will be used for drilling of wells	POL, DC and CC	Ensure Compliance	During drilling operation
2.25	Waste pits at each well site will be lined with an HDPE liner	POL, DC and CC	Check provision of HDPE liner	Before commissioning of waste pits
2.26	The drill cuttings and drilling mud will be disposed into pits lined with impermeable geo-membrane. The pits will be larger than the required capacity to accommodate overflows. At the time of restoration the pits will be backfilled with the cuttings encapsulated within the liner and with a top soil cover	POL, DC and CC	Check design of waste pit and ensure provision of geomembrane. Monitor restoration with provision of proper soil cover	Before commissioning, during operation and after restoration of waste pits





2.27	Produced formation fluids will be flared along with the gas or collected inside the lined waste pit at each well site. In case the fluids discharge into the flare pit the soil at the sides of the flare pit will be excavated and disposed of into the lined waste pit at the well site	POL, DC and CC	Check compliance	Prior to and during disposal of waste fluids
2.28	Produced formation fluids will be re-injected into deep subsurface formations (wherever possible)	POL, DC	Check compliance	Prior to and during disposal of waste fluids
2.29	Sprinkling of untreated excess wastewater used for drilling purposes will not be allowed. Sprinkling of treated wastewater will only be done if meeting PEQS	POL, DC and CC	Check compliance	During the entire operation
3.0 Use of Water				
3.1	The surface water resources will not be used during construction and drilling activities	POL, DC and CC	Check sources of water abstraction and ensure compliance	During the entire operation
3.2	The quantity of water used during construction and drilling will be kept to the minimum required by taking prudent water conservation measures on site	POL, DC and CC	Check consumption of water	During the entire operation
3.3	A complete record of water consumption during construction and drilling will be maintained	POL, DC and CC	Check Compliance	During the entire operation
3.4	If a new water well is to be installed, the well will be located 300m from existing local wells and will be designed to abstract water preferably from deep aquifer not being used by local communities	POL, DC and CC	Monitor distance from the existing wells	Before start of the operation
4.0 Deterioration of Ambient Air Quality				
4.1	Generators, equipment and vehicles used during construction and drilling operations will be maintained in a good condition to ensure that emissions are kept to a minimum level	POL, DC and CC	Check maintenance logs	During the entire operation
4.2	Each well site and campsite will be located at least 500 m away from nearest community	POL, DC and CC	Check distances of well site and campsite from communities	Prior to construction of well site and campsite
4.3	During drilling and construction dust emissions due to road travel will be minimized by regulating and monitoring vehicles speed	POL, DC and CC	Set and monitor speed limits. Monitor sprinkling of access track	During the entire operation





	and watering of the access track wherever required			
4.4	The access track selected to access each well location will maintain a reasonable safe distance from communities	POL, CC	Check alignment of the access track	Prior to improvement and construction of the access track
4.5	Dust emissions during construction activities will be minimized by good management practices such as locating stock piles out of the wind direction, keeping the height of the stock piles to a minimum, keeping earthwork areas damp etc.	POL, DC and CC	Monitor dust emissions during earthworks. Train CC on good management practices	During the construction operation
4.6	Flare pit will be kept downwind of the well site and at least 500 m from the nearest community. The duration of flaring during well testing will be kept to the minimum required	POL, DC and CC	Check location and distance of the flare pit from nearest community and monitor flaring	Prior to construction of the flare pit and during flaring
4.7	No burning of waste (any sort) will be allowed on site	POL, DC and CC	Ensure compliance	Prior to construction of the burn pit
4.8	Appropriate measures will be taken to avoid ozone depletion and global warming e.g. prohibit use of CFC gases etc.	POL, DC and CC	Check compliance	During the entire operation
4.9	During operation, emissions from all point sources shall be monitored to check compliance with PEQS	POL, DC and CC	Ensure compliance	During the entire operation
5.0 Noise Pollution				
5.1	It will be ensured that generators, vehicles and other potentially noisy equipment used are in good working condition	POL, DC and CC	Monitor noise levels	Prior to and during use of machinery and vehicles
5.2	Well site, construction camp and rig camp will be located 500 m away from nearest community	POL, DC and CC	Check distances from the community	Prior to construction of the well site, rig camp and campsite
5.3	The use of horns by project vehicles will be minimized. The use of pressure horns will not be allowed	POL, DC and CC	Truck drivers, check vehicles and record and non-compliances	During the entire operation
5.4	Movement of all project vehicles and personnel will be restricted to within work areas only	POL, DC and CC	Advise all drivers and investigate non-compliances from staff	During the entire operation
5.5	Regular noise monitoring will be carried out from all noise generating sources to ensure PEQS compliance	POL, DC and CC	Check monitoring records	During the entire operation
5.6	Blasting during construction activities (if deemed necessary) should be carried out with due diligence ensuring relief to the	POL, CC	Ensure compliance	During construction activities





	sensitive environmental receptors of the area			
5.7	The construction camp and rig camp will be located in existing clearings and will avoid areas of dense vegetation. Preferably well sites shall be selected outside the wildlife or forest protected areas	POL, CC	Check compliance	During construction and operation
6.0 Blocking of Natural Drainage				
6.1	Area around the wells and campsites shall be landscaped to avoid blocking natural drainage	POL, CC	Check compliance	During construction activities
6.2	Causeways and pipe culverts will be provided at all watercourses and minors crossings to avoid blocking of natural drainage	POL, CC	Ensure not to block the natural drainage	During construction activities
6.3	Uncontrolled and unnecessary clearing, dozing, excavations or quarrying, storage of construction material etc. will be avoided	POL, CC	Ensure compliance	During the entire project
7.0 Clearing of Vegetation and Loss of Habitat				
7.1	The well site and rig camp areas will be kept to the minimum required	POL, CC	Check design and ensure compliance	Before and during the construction activity
7.2	The construction camp and rig camp will be located in existing clearings and will avoid areas of dense vegetation. Preferably well sites shall be selected outside the protected areas	POL, CC	Check compliance	During construction And operation
7.3	The access road to the well site will be aligned to minimize clearing of dense patches of vegetation and will use existing tracks as much as possible	POL, CC	Check alignment of access road and use of existing facilities	Before construction and operation
7.4	The cutting of trees or tall shrubs will be avoided as much as possible	POL, CC	Supervise land clearing activities	During land clearing activities
7.5	Use of local vegetation as fuel by crew personnel will be prohibited	POL, CC and DC	Check compliance	During the entire operation
7.6	Dust emissions on access tracks will be reduced by keeping speed limits below 40 km/hr	POL, CC and DC	Check compliance	During the entire operation





8.0 Disturbance to Wildlife				
8.1	Prior to commencement of each drilling operation, awareness trainings will be provided to contractor's management and field crew on matters related to the requirements of the EMP in this regard	POL, CC and DC	Provide environmental awareness training	Before commencement of construction and drilling operation
8.2	Hunting, fishing, trapping, feeding, harassment or killing of wildlife will be strictly prohibited	POL, CC and DC	Check compliance	During the entire operation
8.3	Vegetation clearing and land uptake will be minimized	POL, CC and DC	Check compliance	During the entire operation
8.4	Locate each well site and campsite 300 m away from any surface water body or sensitive environmental receptor	POL, CC and DC	Randomly check distances and identify any non-compliances	Before the construction activity
8.5	The drilling of wells within the areas where dense population of wildlife is confirmed shall be avoided as much as possible	POL, CC and DC	Check compliance	Before the drilling operation
8.6	For preparation of access tracks, routes involving minimum clearing of vegetation will be selected, clearing of dense patches of vegetation will be avoided	POL, CC and DC	Check alignment of access tracks/routes and monitor clearing operation	During land clearing activity
8.7	Food wastes will not be left or disposed of in open	POL, CC and DC	Check compliance	During the entire operation
8.8	Night traveling will be strictly prohibited and will only be allowed in case of emergency	POL, CC and DC	Check compliance	During the entire operation
8.9	Equipment and vehicles will be maintained in good working condition and provided with muffles to reduce noise	POL, CC and DC	Check maintenance logs and ensure the provision of muffles	During the entire operation
8.10	The duration and intensity of flaring at the well site will be kept to the minimum required	POL, CC	Monitor flaring activity	During flaring activity at well site
9.0 Disturbance to Communities				
9.1	Contractors' staff shall be taken through a Community and External Affairs Induction program before commencement of each component of the project activities	POL, CC and DC	Ensure compliance	Before commencement of each component of project





9.2	All community grievances will be recorded and maintained in a Community Complaints Register. In addition to this close liaison will be maintained between the community and the site representatives of POL throughout the construction and drilling activities	POL, CC and DC	Check the provision of complaint register and maintaining a close liaison of site representatives with locals	During the entire operation
9.3	Compensation amounts for land leased for various project components will be disbursed in equitable and transparent manner on fast pace	POL, CC	Check compensation records	Before the commencement of project activities
9.4	Compensation amounts will be paid to land owners before land is acquired, if not possible, then amounts shall be paid as soon as possible	POL, CC	Monitor time taken for the payment of compensations and identify any sluggishness, if any	Before the commencement of project activities
9.5	Loss of standing crops, traditional land rights and community ownership will be given due consideration while determining compensation amounts	POL, CC	Monitor adherence with the requirement during the assessment of land value to provide compensations	Before the commencement of project activities
9.6	Compensation amounts will be settled based on prevailing market rates and will be settled at mutually agreed terms and conditions	POL, CC	Monitor adherence with the requirement during the assessment of land value to provide compensations	Before the commencement of project activities
9.7	All mitigation related to management of wastes, noise and dust emissions suggested in the EIA will be adhered with	POL, CC	Check Compliance	During the entire project
9.8	POL and its contractors will employ local residents during project activities subject to Company's competency criteria	POL, CC and DC	Monitor adherence with the requirement	During the entire operation
9.9	Skilled and unskilled labor from local communities will be recruited equitably from amongst the various tribes, avenues for conflict resolution will be open, and the employment procedures will be transparent	POL, CC and DC	Monitor adherence with the requirement	During the entire operation
9.10	Local residents living closest to the project location will be given priority in the employment process	POL, CC and DC	Monitor adherence with the requirement	During the entire operation
9.11	Water sources currently being used for irrigation by the resident communities will be exploited only after complying with relevant requirements of the EIA	POL, CC and DC	Monitor adherence with the requirement	During the entire operation





9.12	Flow of water in water crossings e.g. canals etc. will not be impeded	POL, CC and DC	Check compliance	During the entire project
9.13	Any damage to watercourses, roads or other infrastructure during project activities will be repaired or compensated as per mutual understanding with the communities	POL, CC and DC	Check for damages along watercourses, roads or other infrastructure and ensure its repair is conducted	During the entire operation
9.14	Strict compliance will be observed to POL's HSE guidelines	POL, CC and DC	Check compliance	During the entire operation
9.15	Drivers will be trained in responsible and safe driving practices. Safe speed limits for vehicles will be followed	POL	Provide training and monitor compliance	During the entire operation
9.16	In order to keep nearby local communities informed of the progress of the operation, communication channels will be maintained between local spiritual leaders, community elders and POL	POL, CC and DC	Check compliance	During the entire operation
9.17	Project staff will respect local cultural norms	POL, CC and DC	Train project staff on social norms and sensitivities	During the entire operation
9.18	Appropriate offsets will be provided from sites of religious, cultural or archaeological significance if encountered	POL, CC and DC	Check compliance	During the entire operation

10.0 Sites Restoration

Dry Well

10.1	All equipment and machinery at the well site will be demobilized	POL and DC	Check compliance	During site restoration
10.2	All wastes at the well site will be disposed of according to the requirements of the EIA	POL and DC	Check compliance	During site restoration
10.3	Liner from the water and waste pits at the well site may be taken out and re-used or disposed of in the existing pits with proper restoration	POL and DC	Check compliance	During site restoration
10.4	All concrete structures at the well site will be broken and either transported out of the project area by demolition or site restoration contractors for sale or reuse or disposed of into the pits	POL and DC	Check compliance	During site restoration
10.5	All pits at the well site will be backfilled	POL and DC	Check compliance	During site restoration
10.6	The areas covered by the portion of the access track that will be of	POL and DC	Check compliance	During site restoration





	no use for other wells will be restored, in that all gravel topping will be removed. This scenario will be applicable only if the locals require the portions of the track to be restored or otherwise it will be left on site on the consent of locals			
Producing Wells				
10.7	The well site and access roads will be retained to support well access work for further testing or during the production phase	POL, CC	Check compliance	During site restoration
10.8	The outer chainlink fence will be retained as a safety measure to keep wildlife away from the pit areas	POL, CC	Check chain link fence is retained	During site restoration
10.9	The wellhead will be enclosed by a locked steel cage. This will serve as both a safety and security measure as the site will be down-manned pending further production operational works	POL, CC	Inspect wellhead is enclosed by locked steel cage	During site restoration
10.10	The constructed pit areas will be retained but all liquid and solid waste material will be removed from the site and disposed of in line with the requirements of this EIA	POL, CC	Ensure that all liquid and solid waste is removed	During site restoration

*CC = Construction Contractor

*DC = Drilling Contractor





7.7 Change Management and Operation Plan

An environmental assessment of the proposed project has been made on the basis of the project description available at the time the EIA was conducted. However, it is possible that changes in the project design will be required when the project is implemented. This section describes the mechanism that will be put into place to manage changes that might affect the project's environmental impact. The changes in the project design have been categorized as first-order, second order, and third-order. These are defined below:

7.7.1 First-order Change

A first-order change is one that leads to a significant departure from the project described in the EIA and consequently requires a reassessment of the environmental impact associated with the change. In such an instance, an independent consultant will be required to reassess the environmental impact of the proposed change, the results of which will then be sent to the EPA for approval. Examples of such changes include:

- Change in the location of campsite such that minimum distances required in the EIA are not met
- Increase in water requirement by more than 50%
- Increasing the crew size by more than 50%

7.7.2 Second-order Change

A second-order change is one that may entail project activities not significantly different from those described in the EIA, which may result in project effects whose overall magnitude would be similar to the assessment made in this report. In the event of such changes, the HSE Manager POL will be required to reassess the impact of the activity on the environment, specify additional mitigation measures, if necessary, and report the changes to the EPA. Examples of such changes include:

- An increase in project personnel by more than 25%.
- Increase in the water needs by more than 10% but less than 50%.
- A change in the location of the campsite such that minimum distances required in the EIA are still met.

7.7.3 Third-order Change

A third-order change is one that is of little consequence to the EIA findings. This type of change does not result in effects beyond those already assessed in the EIA; rather it may be made onsite to minimize the impact of an activity, such as relocating construction campsites to





minimize clearing vegetation, etc. The only action required for such changes will be to record the change in the Change Record Register.

7.8 Training Program

Environmental trainings will be part of the continual environmental improvement program. The training will be directed towards all personnel for general environmental awareness. The suggested training program for drilling of wells (exploration/appraisal) with associated construction activities is provided in **Table 7-5** below:

7.8.1 Objectives

The key objective of training program is to ensure that the requirements of the EMP are clearly understood and followed throughout the project. The trainings to the staff will help in communicating environmental related restrictions specified in the EIA and EMP.

7.8.2 Roles and Responsibilities

The contractors will be primarily responsible for providing environmental training to all project personnel on potential environmental issues of the project. The contractors will be responsible to arrange trainings and ensure the presence of targeted staff.

7.8.3 Roles and Responsibilities

The environmental awareness, EIA and EMP trainings will also be carried out during the entire course of the proposed exploration and associated development operation on the basis of following criteria.

a. Training Logs

All training logs will be maintained by the contractors. The training log will include:

- Topic
- Date, time and location
- Trainer
- Participants

b. Training Needs Assessment

In addition to the training specified in the training log special/additional trainings will be provided during the project activity. The criteria to assess the need of training will be based on the following:

- When a specified percentage of staff is newly inducted in the project;
- When any non-compliance is repeatedly reported refresher training will be provided regarding that issue;





- When any environmental incident/accident of minor or major nature occurs;
- Arrival of new contractor/sub-contractor; and
- Start of any new process/activity.

c. Training Material

The contractors will develop and prepare training material regarding environmental awareness, sensitivity of the area, EIA, EMP and restrictions to be followed during the project. Separate training material will be prepared for each targeted staff.

Table 7-5: Environmental Training Program

Staff	Trainer	Contents	Schedule
Selected Management Staff From POL and Contractors	Project Coordinator	- Environmental sensitivity of the project area - Mitigation measures - EMP - Social and cultural values of the area	Prior to the start of the project activities
All Personnel	Contractor/ HSE Manager	- Environmental sensitivity of the project area - Wildlife and vegetation - Community issues - Mitigation measures - Contingency plan - Social and cultural values	Prior to the start of the project activities
Drivers	Contractor/ HSE Manager	- Road safety - Road restrictions - Vehicle restriction - Defensive driving - Waste disposal - Cultural values and social sensitivity	Before and during the field operations
Mechanics	Contractor/ HSE Manager	- Waste disposal - Vehicle restrictions	Before and during the field operations
Camp Staff	Contractor/ HSE Manager	- Camp operation - Waste disposal - Natural resource conservation - Housekeeping	Before and during the field operations
Restoration Teams	Contractor/ HSE Manager	- Restoration requirements - Waste disposal	Before the start of the restoration activities





8 EMERGENCY RESPONSE PLAN (ERP)

The study has developed an ERP including execution from explosion, medevac, emergency spill response management, emergency evacuation plan etc. It is discussed in this section as follows:

8.1 Purpose

This Control Procedure supports the POL Health, Safety and Environment Management System. Business priorities in any emergency situation are firstly people, followed by environment, and property including reputation.

8.2 Scope

This document defines responsibilities and actions to be taken by Rig team and field-based management to provide organized assistance and response to an emergency related to or arising out. This document covers the management of emergencies arising from POL current and future planned activities in Jhandial and its operational locations, which are but not limited to:

- Construction and Drilling
- Projects (Well sites / pipelines / process plant) activities
- In addition, emergencies may occur independently of these activities, for example:
 - Community / Civil unrest
 - Security related emergencies
 - Natural disasters

8.3 Emergency

A state arising out of sudden, unexpected, unplanned incident(s) at a Location or Off Location that warrants immediate and definite response to mitigate damage and to bring the Location back to the normal state, is declared as Emergency.

An Emergency may or may not turn into a Crisis. Following incidents are classified as Emergency and can lead to crisis:

- Toxic Release
- Major Fire
- Explosion
- Medical
- Environmental Contamination





8.4 Emergency Classification

Three levels of emergency have been defined in relation to the magnitude, the provision of resources for response and Company's involvement.

1. Level 1

An emergency that can be dealt with by the Location / Project / installation / operating unit utilizing its own resources

2. Level 2

An emergency that the Location / Project / installation / operating unit can handle utilizing its own and local resources without requiring intervention of the Head Office personnel and third party equipment

3. Level 3

An emergency that the Location / Project / installation / operating cannot handle independently, requiring intervention of the Head Office, personnel and third party equipment from national sources including local authorities, other companies and contractors.

8.5 Management Team

The Management team at project site includes the following:

- HSE Officer
- Company Man
- Construction Contractor
- Drilling Contractor (DC)
- Drilling Engineer

8.6 Major Incident

- a) Incidents that fall under one of the following categories, and which can have a negative effect on the image of the Company name and / or are likely to attract media attention.
 - Location Invasion / Protest Demonstrations
 - Natural Disaster
 - Chemical / Toxic Incident, including uncontrolled 'blow out'
- b) Incidents resulting from sudden, unexpected events that occur at a Location in which there is a question of emissions, fire or an explosion, or as a consequence of which activity is disrupted to a considerable extent, resulting in:





- Grave negative consequences for a number of people within and or outside the Company (e.g. death, injuries, health effects requiring medical treatment, hospitalization, etc.) and / or Considerable damage to property, animals and or crops or harvest, including significant pollution of water, ground or air, and which can have a negative effect on the image of the Company name, and / or are likely to attract media attention.

8.7 Local Management Team (LMT)

The team at POL and contractor rig location formally nominated with individual responsibilities, assigned, trained, prepared and tested, for rapid assembly with the objective of implementing emergency management procedure in an expeditious manner to achieve quick control and positive resolution of Level 1 and 2 events.

8.8 On Site Coordinator (OSC)

The OSC is an individual nominated by position (can be HSE Officer) to attend the incident. The OSC should provide initial situation reports to the LMT advising on the need for available / additional resources.

The OSC will coordinate the efforts at the scene of various groups depending on the specific incident. The OSC maintains communications with the LMT and provides clear direction to the Emergency Response Team / Offsite Response Team to ensure the tactical response is applied to meet the objectives set by the LMT.

8.9 Support Functions

Functional expertise, resource, and advice from the ‘Support Functions’ in POL, where HSE Officer has determined that such Functional Support is necessary to effectively respond to the Level 3 Emergency / Crisis.

8.10 Incident Management Team (IMT)

IMT shall assess the overall implications of the Emergency, agree on the management requirements and initiate immediate and ongoing responses in support and assistance of Emergency Response plan activated by the Location.

The IMT will be responsible for providing support and guidance to the Local Management Teams in the management of the emergency. The IMT will also be responsible for managing the response to any incident that occurs in Head office itself and for planning and assisting in any post incident recovery operations. It shall be headed by General Manager Operations or his delegate.

8.11 Local Management Teams for Temporary Activities

For POL operations such as geological field work, drilling, road access and well site construction and project construction operations, Local Management Teams will be





established. As these activities are all carried out by the contractors on behalf of POL, the presence of POL personnel at site is very limited.

The selected contractor for the activities will prepare Emergency Response Plans specific to the nature and scope of activity and location. Relevant POL department/ Contractor HSE Officer will ensure that POL site organization develops and maintains a bridging document that clearly outlines the structure of Local Management Team and relevant interfaces between the contractor's emergency response plan (ERP) and POL Emergency Management Plan (this document).

8.12 Role of Location Management Team (LMT)

When activated, the Location Management Team (LMT) provides field based technical, logistical, planning resources, HSE, security and community support and assistance to the emergency response teams handling immediate situation on incident site. The primary role of the LMT will to:

- Seek out accident / incident details
- Provide support and backup resourcing for Emergency Response Operations
- Inform, and obtain the necessary support and guidance from the Chairman of the IMT at Head Office.
- Liaise with the HSE Officer at the affected area and provide tactical support.
- Inform and liaise with relevant local government, community and regulatory authorities as appropriate.
- Provide support to the affected area in the planning and implementation of the recovery phase
- Ensure that the Emergency Response Teams follows the policies established by the LMT for managing the event
- Document all aspects of ER activities, decisions and communications
- Determine where Company Intervention has become necessary at Level 2.

8.13 Site Doctor

The Site Doctor will be responsible for the treatment of any casualties resulting from an incident. He will also responsible for managing and co-coordinating the efforts of other first aiders or the Triage Team. He will also be responsible for informing the LMT Chairman of the status and numbers of any casualties.





8.14 Role of IMT

Upon being activated (Emergency level-2) IMT shall access the overall implications of the Emergency, agree on the management requirements and initiate immediate and ongoing responses in support and assistance of Emergency Response plan activated by the Location. The primary role of IMT shall be:

- Collect information about the Emergency from Field through LMT Leader
- Coordinate with LMT and provide necessary guidance, support and specialist advice during the activity specifically for following:
 - ✓ Security considerations
 - ✓ Equipment and practices
 - ✓ Evacuation and emergency procedures
 - ✓ Medical treatment
 - ✓ Oil spill procedures
 - ✓ Environmental issues
- Arrange all Emergency handling equipment, personnel, etc., as required by LMT, on urgent basis
- Co-opt more members for Emergency Management Team (if required)
- Ensure that HSE Officer is informed if Emergency is of high magnitude and requires communication with partners and public
- Ensure that proper reporting is done about the incident/ accident to concerned Government agencies
- Keep Company's Partners, Government agencies, stakeholders, and authorities informed and updated on the Emergency and its management
- Continue to review the progress of the above actions until the safe conclusion of the Emergency situation
- Passing accurate and consistent information onto contractors with personnel involved and other directly involved parties as required.

8.15 Action

- Upon being called and briefed by the HSE Officer, decide if the nature of the emergency requires the call out of the IMT and, if so, the team make up required;
 - ✓ Determine the need to activate a Support Teams





- ✓ Go to the Company Emergency Control Center and delegate an IMT Member to set it up
 - ✓ Brief the HSE Officer as soon as possible and at regular intervals as required
 - ✓ Consider strategic issues arising from the Incident together with others, including the HSE Officer, as necessary
 - ✓ Appoint a Status Board Log Keeper and ensure that an adequate timed log of all events and actions is kept
 - ✓ Provide the overall strategy for the response to the emergency
 - ✓ Work continuously using sessions, timeouts and periodic team updates subject to the personal style of the IMT Leader. Wherever possible, use written reports to pass accurate information
- Decide on the intervals between timeouts at the outset. Timeouts may need to be more frequent in the early stages of the response. Timeouts should take no more than 5 minutes
 - Give all team members a warning prior to each timeout
 - At the appointed time, call for phones to be diverted to support services center. Continued contact with the OSC by telephone or mobile may be necessary
 - Stop movement in and out of the room and ensure a scribe is ready to update boards. Invite each member to report progress on tasks and identify any new issues. Do not allow questions or debate until everyone has reported
 - Summarize the update, set priorities and allocate responsibilities for actions. Set the time for the next update
 - Mobilize additional IMT members when necessary if a full team was not initially called out
 - Keep Company's Partners, Government agencies, stakeholders, and authorities informed and updated on the Emergency and its management by himself or by Services Support Center.
 - ✓ Find the facts regarding life, property and the environment and impacts on Business Continuity, liability and reputation.
 - ✓ Identify a list of stakeholders and seek to notify these through Support
 - ✓ Allow the IMT to focus on the immediate tasks in relation to saving life, protecting property and minimizing damage to the environment, but brainstorm and prioritize supporting tasks.
 - ✓ Identify and hand off business continuity, reputation / media and liability issues to the line of business, IMT as necessary.





- ✓ Implement an emergency plan to regain control of the event.
 - ✓ Identify longer term emergency tasks and potential issues, and determine if they are best handled either by the IMT.
 - ✓ Brainstorm and prioritize the key POL issues and develop strategy.
 - ✓ Continuously repeat the process until the affected organization can return to normal
- Line Management

8.16 Spill Management Plan

Liquid waste spills that are not appropriately managed have the potential to harm the environment. Following steps can be taken to manage the spill:

i. Correct Liquid Storage

All liquids should be stored in sealed containers that are free of leakage. All containers should be on sealed ground and in an undercover area. These are simple things that can be checked regularly. Keep sharp parts and items away from containers containing liquid to avoid damage and leaks.

ii. Bunding

To prevent spills from having an effect on the operations or the environment, bunding should be placed at all external exits and around contaminant storage areas. A bund can be a low wall, tray, speed bump, iron angle, sloping floor, drain or similar and is used to capture spilt liquid for safe and proper disposal.

iii. Awareness and Training

To enable spills to be avoided and to help the cleanup process of any spills, both management and staff members should be aware of spill procedures. By formalizing these procedures in writing, staff members can refer to them when required thus avoiding undertaking incorrect spill procedures. POL can also practice spill procedures by holding drills. A spill management plan can be as simple as stating the steps taken when a spill occurs (stop, contain, report, clean up and record). A map can also be included showing the locations of spill kits or other cleaning equipment. This document could be attached to the spill kits or where other cleaning equipment is stored to ensure easy access.

iv. Spill Kits

Spill kits are purpose designed units that contain several items useful for cleaning up spills that could occur. Typical items are:

- Safety gloves and appropriate protective clothing (depending on the type of chemicals held onsite)





- Absorbent pads, granules and/or pillows
- Booms for larger spills
- Mops, brooms and dustpans.

Spill kits are used to contain and clean up spills in an efficient manner. Businesses should have enough spill kits or big enough spill kits to deal with any potential spills. Spill kits should be kept in designated areas that are easily accessible to all staff. Staff members should be trained in using the spill kit correctly.

After cleaning up a spill, make sure the materials used to clean up are disposed of correctly. Used absorbent materials that leak or drip cannot be sent to landfill. Rather, these materials should be disposed of at a legal facility or be an authorized contractor. In addition, some materials in the spill kit may need to be refilled. This should be checked.

i. Stop the Source

If it is safe to do so, the source of the spill should be stopped immediately. This may be a simple action like upturning a fallen container.

ii. Contain and Control the Flow

To stop the spill from expanding, absorbent materials and liquid barriers should be placed around the spill. Work from the outside to soak up the spill.

It is vital that spilt liquid is not allowed to reach storm water drains, sewer drains, natural waterways or soil.

iii. Report to Relevant Authorities

For large scale spills that involve hazardous materials, the Fire Brigade must be alerted. If a contaminant causes pollution, the company has a duty to report the incident to the relevant authorities. Failure to report a pollution incident that has the potential to cause material harm to the environment is an offence. If the spill is small, contained inside the workshop and easily cleaned up then there is no requirement for the company to alert any authority body.

iv. Clean up

Using information from Material Safety Data Sheets (MSDS) about the properties of the liquid spilled and the spill equipment available, spills should be cleaned up promptly.

v. Record the Incident

By keeping a simple log of all spills, precautionary measures can be put in place to avoid similar accidents from occurring in the future. Recording spills demonstrates that the company is motivated to prevent pollution from spills occurring.

Make sure Material Safety Data Sheets (MSDS) are available to staff members for every chemical onsite. MSDS provide a broad range of information on the chemicals used including clean up procedures and safety concerns that will affect both personnel and the





environment. They are available from chemical suppliers and/or manufacturers. This is a Work Cover requirement.





9 PUBLIC CONSULTATION

Consultation with general public and concerned stakeholders is a tool used for the purpose of communication, taken to include; information dissemination, exchanging views, soliciting feedback and suggestions on issues pertaining to the project, plan future actions, initiate a needs assessment and identify areas of concern.

During the EIA field survey for this study, meetings were held with the communities residing within the project area of Jhandial and its immediate surroundings. Each village's headman was particularly sought after for community consultations. The objective of these meetings and focused group discussions was to explore and record their needs, views and concerns for inclusion in project design at the planning phase.

In the same vein, meetings were held with community and members of local and provincial government. All the stakeholders were briefed regarding the proposed exploration and associated development activities planned by POL. Their concerns and suggestions were recorded in details which are reproduced in this chapter.

Various stakeholders including the local communities, local leaders, local government representatives, NGOs, workers/ employees of POL and others were consulted in detail about the proponent's likely activities in the area.

9.1 Objectives of Public/Stakeholders Consultation

Consultation with stakeholders and public/communities residing in the project area i.e. where the project activities are planned, provides better dissemination of information about project and also gives the proponent a clearer understanding of the stakeholder's and general public's perspective. Effective consultation process can add substantial value to the EIA process. The information gained through consultation process can provide stakeholders/public concerns, interests and their ability to influence decision making and also helps to identify key causes of environmental problems.

This can be used to evaluate direct and indirect environmental impacts and assess short term and long-term resources use implications. The input from local communities and affected stakeholders can help evaluating alternatives and strengthen the management planning by incorporating local inputs and know-how. These factors contribute towards improved project implementation sensitized to the socioeconomic environment of the area. The objectives of stakeholders/public consultation were to:

- Promote better understanding of the proposed operation through explaining its objectives and potential positive and negative impacts particularly on the local communities;
- Identify and address the concerns of all interested and affected stakeholders;





- Provide a mechanism to resolve issues identified by communities, before project plans are finalized and development begins thereby, avoiding public outcry and resentment; and
- Instill trust between various stakeholders and the proponent to promote cooperation

9.2 Project Stakeholders

Stakeholders are those people who may be directly or indirectly affected by the project or who may have an influence on, or an interest in, the project. While planning the public consultation process, stakeholders were split into two categories: primary stake holders and secondary stakeholders.

- The term ‘**primary stakeholder**’ has been used for all those people who may be directly affected by the project activities. For this project, primary stakeholders are limited to local community members.
- The term ‘**secondary stakeholders**’ refers to individuals and organizations that will not be directly affected by project implementation, but that do have an influence on or an interest in the area.

During the field survey, significant efforts were made to identify the possible categories of stakeholders and their stakes. Different stakeholders were identified during the field survey and they had different types of stakes and concerns according to their professions.

9.3 Community Consultations

Community consultations were carried out in the project area through formal and informal meetings, focus group discussions and in depth interviews especially covering issues related to ‘gender’. Environmentalist having a vast experience of carrying out socioeconomic surveys & consultations, initiated the sessions by giving a brief, simple and non-technical description of the project providing an overview of all likely positive and negative impacts. This was followed by an open discussion in which all participants were encouraged to voice their concerns and opinions. Feedback obtained from the stakeholders was documented and all issues and suggestions raised were recorded in detail. Through this process the consultant reached out to a wide segment of the population of the area, whereby actively involving all stakeholders in the decision making process.

All information was imparted to the communities and other stakeholders in such a manner that their expectations were not unnecessarily or unrealistically raised in order to avoid any future conflict involving local public, leaders or administrators.

Formal and informal community consultations and focused group discussions were carried out in almost all visited villages during the field survey for the EIA.





9.4 Community's Concerns and Reservations

All people with whom meetings were held were open to the idea of development in the project area. No adverse concerns were raised; neither were there any objections to the project concept. Most people welcomed the idea of project activities sensing a relative boom in the localized economy particularly employments and provision of better civic amenities in the area. They envisaged the project activities a short-term as well as long term benefit for the communities residing in the area. However, the communities raised some legitimate concerns. The main concerns common to most communities are listed below:

- Local villagers should be given priority during employment process for various project-related activities, especially local unemployed educated people should be given preference for technical jobs;
- Proponent should also work with the local and provincial departments to uplift the socioeconomic conditions of the area by providing necessary and basic civic amenities;
- Local cultural norms should be respected with letter and spirit;
- Communities' water resources shall not be over-exploited during project execution phase; and
- Safety and security of the local communities should also be given due consideration during the proposed project activities.

9.5 Scoping Session

During the public consultation process, both primary and secondary stake holders were consulted. Consultation with the primary stakeholders was in the form of informal meetings and interviews in the villages and towns located near the project area. The consultations with the secondary stakeholders were more formal, since most of them are government functionaries or professionals.

During these interviews, a simple, non-technical description of the project was given, along with an overview of the project's likely impacts on people and the environment. Following the project description, a discussion as held so that people could voice their concerns.

Table 9-1: Table Showing Stakeholders Category

Sr. #	Stakeholder Category
1	Workers
2	Nearby Residents
3	Shopkeepers
4	Local Organizations





9.6 Key Findings and Issues

- Most of the communities and to some extent the local influential people are not concerned over the environmental issues. They are mostly interested in getting maximum benefits in terms of employment, local market boom and community development programs;
- People have hopes that the Company would employ locals during its operations;
- The biggest aspiration of the locals is getting one thing i.e. ‘employment’;
- People have hopes that the Company would provide basic civic amenities, develop roads and improve the infrastructure of area; and
- Compensations for land acquired/leased and standing crops should be disbursed in a transparent manner on fast pace.

9.7 Results

The concerns voiced by the stakeholders consulted at this stage of the consultation process are provided below.

1. **Compensation:** There is no issue of compensation in monetary terms as the drilling will be carried out on land acquired on lease by POL. However, compensation will be provided if any concern is recorded at any stage.
2. **Employment:** Due to the high rates of unemployment and poverty in the project area, it was stressed that local people should be given the maximum number of jobs possible.
3. **Impacts on Ecological Resources:** People have concerns relating to the potential damage to ecological resources i.e., the wild flora and fauna, by the project activities.
4. **New Tracks:** Opinion was divided on the subject of new tracks. People felt that any land disturbed by new tracks developed for project activities should be restored to its original condition, some of the local administration officials favored maintaining such tracks for the convenience of the local population.

9.8 Other Stakeholders

In addition to holding consultation meetings with communities, meetings with members of local and provincial government and NGOs were also deemed essential. All the stakeholders were given maximum project information verbally, by sharing TORs and project area maps. Their concerns and suggestions were noted which have been reproduced below. A complete list of these stakeholders consulted is provided in **Table 9-2**.



Table 9-2: Table Showing Major Concerns/ Suggestions and Expectations from the Proposed Project

Sr. #	Name	Study Area	Major Concerns/ Suggestions	Mitigation Measures	Expectations
Local Organizations					
1	Aurangzaib	Government Boys High Secondary School-Malal	Disturbance caused due to project activities Impacts on local flora and fauna	No unnecessary damage to vegetation will be caused and project activities will be commenced in a manner which causes minimum impacts on local population as well as flora and fauna	Job opportunities for local population Economic benefit for the country as well as local area
2	M. Feroz Awan Mumtaz Ahmed	Government Primary High School	- Public health concerns - Solid Waste should be properly disposed off	Project activities will be undertaken in a way that poses minimum threat to the environment. This includes implementation of effluent and solid waste management plan	Employment opportunities and infrastructure development
3	M. Nawaz Awan	Union Council (Malal)	- Dust emissions due to vehicular movement	- Road should be paved to reduce dust emission - Controlling speed to reduce dust emission	Employment opportunities and infrastructure development
4.	Naseem Khan Bilal Ashraf	Union Council (Gali Jagir)	Cutting of trees and pollution due to leaks/ spillage	No unnecessary damage to vegetation and Implementation of effluent management plan	Proposed mitigation measures for the study will be followed.
Employees/ Workers					
5	Khawar (Site Incharge)	Jhandial well -01	No concern	-	-
6	Moladad (Driver)	Jhandial	Impact on local community and environment	There will be no unnecessary damage to vegetation and contractors will ensure that minimum impact is caused to local community due to project activities	Job opportunities for local people



Shopkeepers					
7	Mohammad Imran	Dhok Nathian	Culture will be impacted by outsiders	The workers and staff members will abide by local cultural values	Benefit for local community
8	Malik Sikandar	Khidwal	More loss than benefit if EMS is not addressed	Contractor will fully comply with Punjab Environmental Laws	Economic development of the area
9	Abdul Rehman	Jhandial	Environmental pollution and deterioration of aesthetic view	The project contractors will ensure to fulfill all the requirements of environmental protection so that minimum environmental disturbance is created	Improvement of the economy
Locals					
10	Imran Taj M. Arshad Raza Shah	Khidwal	Health Issues	The project contractors will ensure to fulfill all the requirements of environmental protection so that minimum disturbance is caused to local wildlife	Project contractors should spend some part of the revenue for protection of local wildlife.
11	Sardar Jabir Sardar Ijaz Khan Sardar Shabir Shaukat Hayat	Jhandial	Damage to Environment	Contractors will ensure the adoption of appropriate mitigation measures so That minimum harm comes to the environment.	Employment opportunities
12	Alawal Mehdi M. Ghufraan Ch. Ijaz Khan	Village Lundh	Damage to Environment	There will be no unnecessary damage to vegetation and aesthetics of the area	Economic development
13	Kaleem Mehdi Altaf Hussain M. Muzaffar	Jhandial Village	-	Ensure compliance with Punjab environmental laws and waste parameters.	Economic development in Chakwal District
14	Jalil ur Rehman M. Iqbal Raja Amir	Gali Jagir	Health Impacts due to improper waste disposal	Contractors will follow the waste management plan to proper disposal of waste from the project site	Economic development and job opportunities



9.9 Pictorial Evidence

	
Opinions Shared by Local Wheat Grinder Shop	Public Consultation with Locals
	
An Interaction with the Math Teacher in Government Primary High School	An Interactive Session with Teachers in Government Boys High Secondary School
	
A Meeting in Gali Jagir Union Council	A discussion with Locals at Project Site

Figure 9-1: Pictorial Evidence of Stakeholder Consultation



10 CONCLUSIONS AND RECOMMENDATIONS

Oil and gas exploration and production have the potential to transform and can help to revolutionize the energy mix existing within the country and can significantly improve Pakistan's economy. However, if country makes concreted and dedicated efforts, the same obstacles may be transformed into opportunities. It is essential to act now, and to develop our oil and natural gas resources, especially in the wake of acute shortages. Moreover, the report also discusses the generation of economic activity through oil and gas exploration and the possible benefits for thousands of Pakistanis who are in need of sources of sustainable livelihoods.

10.1 Conclusions

Environmental Impact Assessment (EIA) was conducted for the drilling of Jhandial-03 Well. The findings of the environmental assessment study have been categorically presented in the current report. To ensure compliance of both the study and formulation of the reporting, all relevant national and international legislations were followed and adhered.

The Environmental Impact Assessment of the proposed Drilling of Jhandial-03 Well has achieved the following goals;

- Identification of regulatory requirements that apply to the proposed activities in the context of environmental protection.
- Identification of the environmental features of the project and the likely impact of the project on the environment.
- Recommendation of appropriate mitigation measures that will incorporate into the project design to minimize all adverse environmental impacts.

A baseline survey was conducted by the EIA team to establish the baseline environmental and social profile of the area for assessment of impacts from the project on the project area's natural, socioeconomic and cultural environments. Baseline environmental and socioeconomic information was collected from a variety of sources, including published literature and field surveys. The information collected was used to compose profiles of the natural and socioeconomic environments likely to be affected by the project. All proposed drilling and production activities were assessed. For mitigation of these impacts, a comprehensive Environmental Management Plan has been put together and provided in the report for adherence which will ensure the avoidance of environmental degradation or contamination.

Information for the section describing the project came mainly from management of Pakistan Oilfields Limited. An assessment was then made of the potential impacts of the described project on the area's natural and socioeconomic environments.





EIA study concludes that the proposed project will not put any adverse environmental impacts of such nature and magnitude that would require a more detailed report in the form of an EIA.

After screening of probable environmental impacts it can be concluded that:

- The impacts of construction activities in most of the project area will be insignificant, provided the mitigation measures proposed in this report are implemented. Elements on which activities may have a significant impact, additional mitigation measures are given to reduce impacts to as low as reasonably possible.
- Project construction activities will cause temporary impact on local environment all of which are reversible.
- Existing access roads will be used as much as possible to minimize environmental impacts in the area.
- The access track will be properly compacted at the time of construction and thereafter properly maintained by watering and compaction (where required) throughout the entire project activities.
- No significant damage to wildlife, vegetation or habitats is anticipated from the proposed project.
- No residential property, cultural/historical or archaeological sites would be affected by the project.
- No adverse socio-economic impact of the project is envisaged.
- Employment opportunities will be provided to local population.
- By adopting recommended mitigation and safety measures little environmental impact of the project can be eliminated.
- Apart from adopting of earlier discussed mitigation and safety measures during construction and operation phases of the project an environmental management plan has been proposed. This plan will further ensure that any adverse environmental impact is mitigated and managed appropriately.

After assessing the proposed project activities and investigating the project area, the environmental consultants, have concluded that: ***“Project will bring positive changes in physical, biological and socioeconomic environments. Some activities under this project have been identified to cause low to moderate environmental negative impacts and their mitigation measures have been prescribed. Proper and timely execution of these measures will reverse most of the negative impacts in the long term. These impacts can be controlled by regular monitoring as POL would comply through drilling contractor with national and***





international environmental, safety and health standards. Protection and monitoring measures will be incorporated at each phase of the proposed project activity.”

10.2 Recommendations

In view of the above conclusion following recommendations are made;

- In view of the comprehensive screening process and findings of the present study there is no need of conducting further investigations.
- Adoption of mitigation and environmental management plan during construction and operation phases of the project.
- Regular Environmental Monitoring during construction and operation phase.
- Tree plantation inside the unit and near the unit is recommended.
- Bioremediation of oily sludge.
- Incineration of hazardous waste.
- Recycling and proper management of the non-hazardous waste.
- Following good housekeeping practices.
- The untreated wastewater should not be reused for irrigating the vegetation and lawns.
- Strictness of HSE rules and regulations.
- Regular employees training on HSE practices during construction and operation phase.

The present EIA report is enough to meet the administrative and legal framework. Therefore, the environmental approval may be accorded for the present project





Annexure I: References

- Pakistan Meteorological Department (<http://www.pmd.gov.pk/cbp/index.php?type=h>)
- National Environmental Quality Standards
- Water Resources of Pakistan (waterinfo.net.pk)
- Pakistan Botanical Society (<http://www.pakbs.org>)
- Zoological Society of Pakistan (<http://zsp.com.pk>)
- Fauna and Endangered Wildlife of Pakistan (<http://pakistanpaedia.com>)
- Worldwide Fund Pakistan (<http://www.wwfpak.org/>)
- World Health Organization (<http://www.who.int/en/>)
- International Union for Conservation of Nature (<http://www.iucn.org/>)
- Flora Fauna (<https://florafaunaweb.nparks.gov.sg>)
- Survey of Pakistan (<http://www.surveyofpakistan.gov.pk>) Guidelines for the Preparation and Review of Environmental Reports, Government of Pakistan, November 1997.
- Pakistan Council of Research in Water Resources (PCRWR) (<http://www.pcrwr.gov.pk/Index.html>)
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- Balanced structural cross-section of the central Salt Range and Potwar Plateau of Pakistan – Shortening and over thrust deformation by Baker, D.M., Oregon State University, 1988.
- Multiple Indicator Cluster Survey (MICS) Punjab 2007-08, Volume 31, Chakwal, Government of Punjab, Planning and Development Department, Bureau of Statistics, March 2009.
- District Education Profile 2011-12, National Education Management Information System, Ministry of Education, Government of Pakistan.
- Pakistan District Education Rankings 2017 by Alif Ailaan and SDPI
- District Profile of Chakwal, Pakistan Bureau of Statistics, Government of Pakistan
- Pakistan Seismic Activities and Zoning Map by Seismic Monitoring and Early Tsunami Warning Center, Pakistan Meteorological Department.
- Survey of Pakistan, 1997. Atlas of Pakistan. Director Map Publication, Survey of Pakistan, Rawalpindi.



**Annexure II: Water Quality Analysis Report****National Cleaner Production Center Foundation**

Registered under Section 42 of the Companies Ordinance, 1984



NCP/EL/F20-9/20032023

March 20, 2023

Test Report of Drinking Water Analysis
EIA Study of POL Jhandial Well - 3
District Attock

Sample Description: Drinking water	Contact Person: Mr. Nayyar Humair
Date of Sampling: 09-03-2023	Customer's Address: EIA Study of POL Jhandial Well - 3, District Attock
Date of Reporting: 20-03-2023	No. of Samples: 01
Sample No: EL/23/11	

Sr. No.	Parameter	Results	PEQS	LOD	Units
1.	pH	7.3	6.5-8.5	0.01	-
2.	TDS	2,891	< 1000.0	1.0	mg/L
3.	Chloride	984	< 250.0	0.24	mg/L
4.	Total Hardness	1,306	< 500.0	0.1	mg/L
5.	Alkalinity	132	-	0.5	mg/L
6.	Turbidity	11.97	< 5.0	0.1	NTU
7.	Nitrate	0.6	≤ 50	0.1	mg/L
8.	Odor	Non-Objectionable	Non-Objectionable	-	-
9.	Taste	Non-Objectionable	Non-Objectionable	-	-
10.	Color	< 1.0	≤ 15 TCU	1.0	Pt/Co
11.	Sodium	12	-	0.0037	mg/L
12.	Potassium	0.9	-	0.0009	mg/L
13.	Calcium	312	-	1.0	mg/L
14.	Magnesium	128	-	1.0	mg/L
15.	Sulphate	578	-	0.41	mg/L
16.	Carbonates	< 0.12	-	0.12	mg/L
17.	Bi-Carbonates	158	-	1.2	mg/L
18.	Conductivity	4,360	-	1.0	μs/cm
19.	Total Coliform	Positive	Must not be detectable in any 100mL sample	-	Cfu/100mL
20.	Fecal Coliform	Negative	Must not be detectable in any 100mL sample	-	Cfu/100mL
21.	E. Coli	Negative	Must not be detectable in any 100mL sample	-	Cfu/100mL

PEQSDW: Punjab Environmental Quality Standard for Drinking Water

NGVS: No Guideline Value Set

BDL: Below Detection Limit

MPN: Most Probable Number

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REFINERY P.O. MORGAH, RAWALPINDI (PAKISTAN)
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 EMAIL: ncp.rwp@gmail.com Website: www.ncpc.com.pk





National Cleaner Production Center Foundation

Registered under Section 42 of the Companies Ordinance, 1984

Note:

1. All Parameters results are in mg/L except pH, Colour, Turbidity, Electrical Conductivity, Total Coliform, Faecal Coliform and E. Coli

REMARKS:

1. This report shall not be reproduced / made part of any investigation / inquiry or for any litigation purpose.
2. Tests performed by EPA certified laboratory. NCPC is an EPA Certified Laboratory (Certificate No. 168/DD (Lab) /EPA /05 /2019) w.e.f May 28, 2019.

[Signature]

Environmental Lab Incharge

Date: 20-03-2023

[Signature]
Coordinator NCPC

Date: 20-03-2023



**Annexure III: Ambient Air and Noise Analysis Report****National Cleaner Production Center Foundation**

Registered under Section 42 of the Companies Ordinance, 1984

NCPC/EL/F20-9/23122022
December 23, 2022**Test Report of Ambient Air Analysis**
EIA Study of POL Jhandial Well - 3
District Attock

Sample Description: Ambient Air Analysis	Contact Person: Mr. Nayyar Humair
Date of Testing: 19,20-12-2022	Customer's Address: EIA Study of POL Jhandial Well - 3, District Attock
Date of Reporting: 23-12-2022	No. of Samples: 01
Sample No: EL/23/11	

Sr. No	Parameters	Results	PEQS	Unit
1	Carbon Monoxide (CO)	4.3	5.0 (08 Hours)	mg/Nm ³
2	Sulphur Dioxide (SO ₂)	1.95	120 (24 Hours)	µg/Nm ³
3	Nitrogen Dioxide (NO ₂)	55.2	80 (24 Hours)	µg/Nm ³
4	Nitrogen Oxide (NO)	2.2	40 (24 Hours)	µg/Nm ³
5	Ozone (O ₃)	3.2	130 (01 Hours)	µg/Nm ³
6	Respirable Particulate Matter (PM ₁₀)	101.4	150 (24 Hours)	µg/Nm ³
7	Respirable Particulate Matter (PM _{2.5})	13.23	35 (24 Hours)	µg/Nm ³

PEQS: Punjab Environmental Quality Standards.

Remarks:

- This report shall not be reproduced / made part of any investigation / inquiry or for any litigation purpose.
- NCPC laboratory is an EPA certified laboratory (Certificate No. 168/DD(Lab) /EPA /05 /2019) w.e.f May 28, 2019.

Environmental Lab Incharge

Date: 23-12-2022

Coordinator NCPC

Date: 23-12-2022

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**National Cleaner Production Center Foundation**

Registered under Section 42 of the Companies Ordinance, 1984



NCPC/EL/F20-9/23122022

December 23, 2022

Test Report of Noise Monitoring Analysis
EIA Study of POL Jhandial Well - 3
District Attock

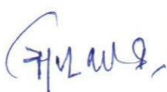
Sample Description: Noise Level	Contact Person: Mr. Nayyar Humair
Date of Testing: 19,20-12-2022	Customer's Address: EIA Study of POL Jhandial Well - 3, District Attock
Date of Reporting: 23-12-2022	No. of Samples: 01
Sample No: EL/23/11	

Sr. No	Sampling Locations	PEQS (Industrial Area) 75 dB (A) Day Time 65 dB (A) Night Time
1	Point 1	43.5

PEQS: Punjab Environmental Quality Standards.

REMARKS:

1. This report shall not be reproduced / made part of any investigation / inquiry or for any litigation purpose.
2. Test performed by NCPC EPA certified laboratory (Certificate No. 168/DD(Lab) /EPA /05 /2019) w.e.f May 28, 2019, but Noise monitoring is not certified.


Environmental Lab Incharge
 Date: 23-12-2022


Coordinator NCPC
 Date: 23-12-2022

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EMAIL: ncpc.rwp@gmail.com Website: www.ncpc.com.pk



**Annexure IV: Soil Analysis Report****National Cleaner Production Center Foundation**

Registered under Section 42 of the Companies Ordinance, 1984

NCPC/EL/F20-9/20032023
March 20, 2023**Test Report of Soil Analysis**
EIA Study of POL Jhandial Well - 3
District Attock

Sample Description: Soil	Contact Person: Mr. Nayyar Humair
Date of sampling: 09-03-2023	Customer's Address: EIA Study of POL Jhandial Well - 3, District Attock
Date of Reporting: 20-03-2023	No of Sample.: 01
Sample No: EL/23/11	

Sr. No	Parameter	Results	Units
1	pH	7.8	-
2	Electrical Conductivity	0.4	mS/cm
3	Arsenic	< 0.01	ppm
4	Lead	0.25	ppm
5	Zinc	2.7	ppm

REMARKS:

1. This report shall not be reproduced / made part of any investigation / inquiry or for any litigation purpose.
2. Test performed by EPA Certified Laboratory. NCPC laboratory is an EPA certified laboratory (Certificate No. 168/DD (Lab) /EPA /05 /2019) w.e.f May 28, 2019.

Signature
Environmental Lab Incharge
Date: 20-03-2023

Signature
Coordinator NCPC -
Date: 20-03-2023



**Annexure V: EPA Validation Sheet**

ENVIRONMENTAL PROTECTION AGENCY
GOVERNMENT OF THE PUNJAB
National Hockey Stadium, Gate No. 08
Gaddafi Stadium Complex, Lahore

**Validation for Stack & Ambient Monitoring / Sampling**

Emission Monitoring under CTM-34 or OTM-39			
Facility Name & Address	Pakistan Oilfields Limited POL Jhandial Well-3 Durrat Attack	No of Stacks / Sampling Point	01
Industry Category	Oil & Gas Industry		
Analyzer Model & Make			
Average stack emission Values of CO, NOx (in mg/nm ³)			
Excess Air / Excess Oxygen (%age):-			
Analyzer exposed for Ramp-Up phase to the sample gas for 5 minutes	Yes	No	NA
Analyzer flow rate and EC temperature monitored during calibration and testing	Yes	No	NA
Test Data Phase of sample gas recorded with 15 second interval	Yes	No	NA
All key requirements to ensure QA/QC complied for said EPA approved Method	Yes	No	NA
Particulate Matter (PM) Monitoring / Sampling under USEPA Method 5 / 17			
Model & Make of Iso-kinetic PM Assembly			
The PM sampling train is complete as per Method 5 & 17	Yes	No	NA
Leak Test performed prior to sampling	Yes	No	NA
Field data Sheet for PM Sampling filled during PM sampling	Yes	No	NA
Data for determining of "K" factor & DGM "Y" Factor filled during sampling	Yes	No	NA
All method key requirements during sampling were complied to ensure QA/QC	Yes	No	NA
Filter of Particulate matter is suitable for metal Testing	Yes	No	NA
SOx sampling as per Method 8 (Thorin Indicator Method)			
The right absorbent solution are available for SOx Sampling	Yes	No	NA
The equipment is capable to maintain flow rate @ 2.0 LPM or as per method 8 requirement	Yes	No	NA
Sampling for SOx is performed as per method	Yes	No	NA
Ambient Air Quality Monitoring by Automatic Monitors for CO, O ₃ , SO ₂ , NOx, PM _{2.5} & PM ₁₀			
In case of continuous monitoring at a site, One Point QC Check Single analyzer & Zero/span check is performed every 14 days.	Yes	No	NA
The CE of NOx analyzer is ensured to be maintained within 96% - 104.1%	Yes	No	NA
Zero/span check is performed prior to starting ambient monitoring	Yes	No	NA
All key requirements for Critical & Operational Criteria for ambient air monitoring by automatic monitors were complied during monitoring	Yes	No	NA
The measuring techniques of monitors comply PEQS	Yes	No	NA
Ambient Air Sampling of SPM, PM ₁₀ , Pb by High Volume Sampler			
In case of Sampling for SPM through samplers, the flow rate of sampler comply PEQS (1.1m ³ /min).	Yes	No	NA
Calibration of Sampler performed prior to sampling	Yes	No	NA
Vehicular Emissions & Noise Measurement			
Sampling of Vehicle emissions and noise measurement have been performed as per method and SOPs	Yes	No	NA

Remarks (If Any):-

Signature

Name of EPA Officer with office Address

Muhammad Amin Bait
Research Officer
Environmental Protection Agency
Govt of the Punjab, Rawalpindi

Dated

Atul Kumar
Chemist NERC 20/12/2022

Signature

Name of Assistant /Deputy Analyst, Analyst





ENVIRONMENTAL PROTECTION AGENCY
GOVERNMENT OF THE PUNJAB
National Hockey Stadium, Gate No. 08
Gaddafi Stadium Complex, Lahore



Validation for Wastewater & Drinking Water

Facility /Project Name & Address Phone	Pakistan Oilfields Limited POL Jhandial Well-3 District Attock		Sampling Point	Ground Water Well	
Waste Water (WW) Treatment facility			Drinking Water (W) Treatment Facility		
Primary Secondary Tertiary NA					
Total WW collected Sample			Total Collected Drinking water samples		
Sample Tag for testing parameter is assigned on sample container			Yes	NO	NA
Sample is preserved properly for each testing parameter			Yes	NO	NA
Sample size is adequate for testing the target parameters			Yes	NO	NA
Wastewater Flow Measurement performed to ensure sample representativeness			Yes	NO	NA
No. of Waste Water outlets	Waste Water Flow m ³ /hr from each outlet (Optional)	Water intake m ³ /hr (Optional)	Water Mass balance compiled during sampling (Optional)	Sample Type	
			Yes No	Grab	Composite
Parameter	Matrix W WW	Container	Sample Size	Preservation	Yes NO NA
Coliform, Total or Fecal	✓	Sterile Container	100 mL	Refrigerate 6 C	✓
Coliform, Total or Fecal, Chlorinated Water		Sterile Container	100 mL	0.008% Thiosulphate & cooled 6 C	
Color, Turbidity	✓	P.G	500 mL	Cool 6 C	✓
Hardness, Total	✓	P.G	500 mL	HNO ₃ to pH < 2	
Nitrogen, Nitrate + Nitrite		P.G	2000 mL	H ₂ SO ₄ to pH < 2, Cool 6 C	
Phenolic Compounds		P.G			
Oil & Grease, COD, NH ₃		P.G			
Metals, General		P.G Rinsed 1:1 HNO ₃	500 mL	HNO ₃ to pH < 2	
Cyanide, Total		P.G	500 mL	NaOH to pH > 12, Cool 6 C	
Pesticides, General		Class	1 Liter	Cool 6 C	
Field Parameters*					
Field parameter	pH meter, Model Make		Measurement Method	Calibrated In Field	Validated
pH				Yes NO	
Temp					
Cl					

* Field testing parameters only be validated by RAs, ROs, OD (Labs)

Remarks for Sample Quality (if Any):-

Signature

Name of EPA Officer with office Address

Inspectors /RAs / ROs or ADs /ODs

Muhammad Nadeem Bhatti

Research Officer

Environmental Protection Agency
Govt. of the Punjab, Rawalpindi

Dated

Muhammad Hanan
Chemist, HCR
09/03/2023

Signature

Name of Assistant /Deputy Analyst, Analyst
with Name of Private Lab along with Address





Annexure VI: Extension in the Exploration License



PAKISTAN OILFIELDS LIMITED

Ref: POL/COMM/IKHLAS/EL/22/43

6 September 2022

Mr. Kashif Ali
Director General Petroleum Concessions
Ministry of Energy, Petroleum Division
3rd Floor, Petroleum House, Sector G-5/2
Islamabad.

**SUBJECT: REQUEST FOR EXTENSION IN PHASE-II OF THE
PETROLEUM EXPLORATION LICENCE OVER BLOCK
NO.3372-18 (IKHLAS E.L)**

Dear Sir,

This refers to the subject cited above and the 18 months extension w.e.f 30.03.2021 which was granted to Pakistan Oilfields Limited (POL) vide DGPC letter no. Expl-7(3) (POL-Ikhlasp/2017-Vol-II dated March 11, 2021.

Till date, the JV has spent more than USD 192.4 million in the Ikhlasp E. L and has acquired (1297 L.Kms) of 2D seismic and (220.56 sq. km) of 3D seismic.

Initially, the contract for 213 sq.km 3D Seismic Data Acquisition over Langrial prospect in Ikhlasp E.L was awarded to M/s Xian Senshe Electronic Technology Corporation (Pvt) Ltd in April 2019. In wake of massive thefts of cables and equipment coupled with permitting problems created by local community, only 47 sq.km 3D Seismic data could be acquired by M/S Senshe and the contract had to be terminated on May 08, 2020 despite payment of US\$ 2.2 million to the contractor.

After getting the extension of 18 months, POL had planned to re-bid for the remaining data acquisition project but meanwhile M/s Xian Senshe again approached with a proposal to Re-Contract for the said project. A re-contract was signed with M/s Xian Senshe on 27th September 2021, for the remaining 166 sq.km Langrial 3D seismic acquisition project.

M/s Xian Senshe started work on the remaining Langrial 3D Seismic project on October 01, 2021 and the contracted date for completion of project was June 21, 2022. After the re-grant of the contract, the first challenge M/s Senshe had to face was to get the NOC and formal approval for the destruction of the left-over stock of explosives and detonators in the magazines. It was obtained after long procedure of almost 2 months and the ex-stock was destroyed in the presence of relevant authorities.

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Second challenge in the project was the clearance of outstanding payments by M/s Xian Senshe against crops and land compensations, salaries of crew staff etc. After several meeting and negotiation, it was revealed that restart of project will be subject to clearance of outstanding dues which were settled. However, till date only 8.214 sq.km (4.95 %) out of 166 sq.km has been acquired.

The theft of cable and equipment continues unabated. However, the situation got worse due to non-cooperation, greed and theft by locals. M/s Xian Senshe has brought these cases to the notice of relevant authorities but they seem helpless in resolving them.

Upon POL's request a letter dated July 19, 2022 has been sent to DC Attock by the DGPC office seeking security cover of the law enforcement agencies in order to safeguard the personnel and equipment of M/s Xian Senshe.

M/s Xian Senshe is in process of arranging the cables both locally and from abroad. Based on all prevailing ground realities, planning and initiatives, a realistic and practical time schedule has been shared with POL. The management of M/s Xian Senshe has agreed to arrange financials, equipment and invest all the resources again.

M/s Xian Senshe has requested POL for an extension in the existing contract as per submitted time schedule, enabling them to give a chance to push the operations with new management and new team while keeping in view the above genuine reasons and untoward situation that arouse during last phase.

A Gantt chart (as Annex -A) is attached with the laid down activities/ timeline in lieu with the work program (attached as Annex-B) given by M/s Xian Senshe with demobilization date of 30th April 2023. Keeping in view the time required for acquisition, processing of 3D seismic, interpretation, well staking and civil works, it is requested that an extension of two (2) years may kindly be granted in the Ikhlas EL.

Yours truly,
For Pakistan Oilfields Limited


 Sajid Nawaz
Managing Director





Block Name: IKHLAS (E.L)

Annex -A

Activities planned for Langrial Structure

ACTIVITIES	2022				2023				2024				REMARKS									
	Extension Granted by DGPC				Extension Required																	
	J	F	M	A	M	J	J	A	S	O	N	D		J	F	M	A	M	J	J	A	S
Langrial 3D seismic Data Acquisition				*																		165.506 sq.km 3D Seismic Data Acquisition re-contract has been awarded to M/s Senshe but project is suspended since July 09, 2022.
Langrial 3D seismic Data Processing Upto PSTM																						Subject to the completion of Langrial 3D Seismic Acquisition.
Langrial 3D seismic Data Structural Interpretation & Seismic Base Fracture.																						Subject to the completion of Langrial 3D Seismic Processing Upto PSTM .
Approval for the way forward																						
Langrial-1 LLI's completion, Well Proposal/prognosis, Well Staking and Civil Works																						Based on the results of Integrated G & G study

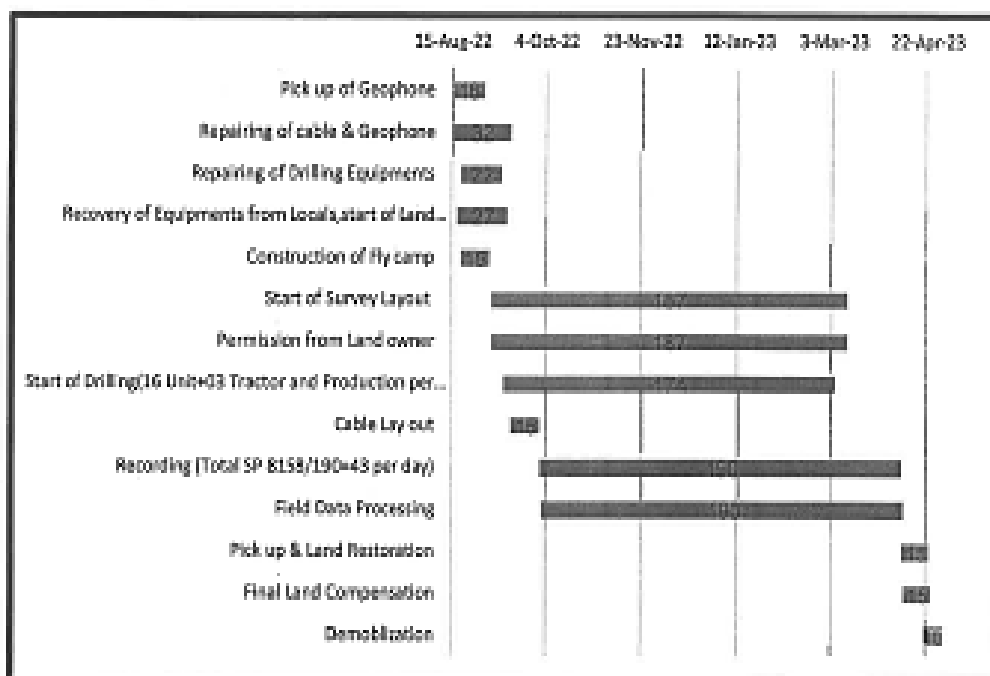
* A re-contract for remaining 165.506 sq.km Langrial 3D Seismic Acquisition project was awarded to M/s Senshe in September, 2021. The project completion date was June 21, 2022 but 8.21 Sq.Km out of 165.5 Sq.Km have been acquired till June 09, 2022. The project was suspended on July 09, 2022 due to permitting problems and huge number of ground electronics equipment stealing by locals. M/s Senshe has submitted a revised schedule to complete the remaining project. As per submitted plan Survey Layout will be started on September 05, 2022 and the project





WORK RESUME SCHEDULE FOR POL LANGRIAL 3D FROM BLOCK-1

Sr. No.	Activity	Start	End	Days
1	Pick up of Geophone	16-Aug-22	31-Aug-22	16
2	Repairing of cable & Geophone	15-Aug-22	15-Sep-22	32
3	Repairing of Drilling Equipment's	20-Aug-22	10-Sep-22	22
4	Recovery of Equipment's from Locals, start of Land Compensation and Pre-Permitting	18-Aug-22	13-Sep-22	27
5	Construction of Fly camp	20-Aug-22	3-Sep-22	15
6	Start of Survey Layout	5-Sep-22	10-Mar-23	187
7	Permission from Land owner	5-Sep-22	10-Mar-23	187
8	Start of Drilling(16 Unit+03 Tractor and Production per day 40 SP Per day)	12-Sep-22	4-Mar-23	174
9	Cable Lay out	16-Sep-22	30-Sep-22	15
10	Recording (Total SP 8158/190=43 per day)	1-Oct-22	8-Apr-23	190
11	Field Data Processing	2-Oct-22	9-Apr-23	190
12	Pick up & Land Restoration	9-Apr-23	23-Apr-23	15
13	Final Land Compensation	10-Apr-23	24-Apr-23	15
14	Demobilization	21-Apr-23	30-Apr-23	10





Annexure VII: List of Flora and Fauna

A. Flora of the Area

Sr. #	Botanical Name	Family	Life Type	Status	Habitat type	
					Agri. Land	Eroded Shrub Land
1	<i>Acacia modesta</i>	Mimosaceae	Tree	C		✓
2	<i>Acacia nilotica</i>	Mimosaceae	Tree	C	✓	✓
3	<i>Achyranthus aspera</i>	Amaranthaceae	Herb	C	✓	✓
4	<i>Acrachne ramosa</i>	Poaceae	Grass	C	✓	✓
5	<i>Aerva javanica</i>	Amaranthaceae	Herb	R	✓	
6	<i>Amaranthus graecizans</i>	Amaranthaceae	Herb	R	✓	
7	<i>Amaranthus viridis</i>	Amaranthaceae	Herb	C	✓	
8	<i>Aristida mutabilis</i>	Poaceae	Grass	C	✓	✓
9	<i>Artemisia scoparia</i>	Asteraceae	Herb	C	✓	✓
10	<i>Boerhaavia procumbens</i>	Nyctaginaceae	Herb	C	✓	✓
11	<i>Broussonetia papyrifera</i>	Moraceae	Tree	R	✓	
12	<i>Brachiaria ramosa</i>	Poaceae	Grass	C	✓	✓
13	<i>Calotropis procera</i>	Asclepiadaceae	Shrub	C	✓	✓
14	<i>Capparis deciduas</i>	Capparidaceae	Shrub	R		✓
15	<i>Carthamus oxycantha</i>	Asteraceae	Herb	C	✓	✓
16	<i>Cenchrus ciliaris</i>	Poaceae	Grass	C	✓	
17	<i>Chenopodium album</i>	Chenopodiaceae	Herb	C	✓	
18	<i>Chrozophora obliqua</i>	Euphorbiaceae	Herb	C	✓	✓
19	<i>Chrysopogon aucheri</i>	Poaceae	Grass	C	✓	✓
20	<i>Alternanthera sessilis</i>	Amaranthaceae	Herb	C		✓
21	<i>Convolvulus arvensis</i>	Convolvulaceae	Climber	C	✓	
22	<i>Asphodelus tenuifolius</i>	Liliaceae	Herb	C		
23	<i>Conyza canadensis</i>	Asteraceae	Herb	C	✓	✓
24	<i>Cordia myxa</i>	Boraginaceae	Tree	R	✓	
25	<i>Cymbopogon jwarancusa</i>	Poaceae	Grass	C		✓
26	<i>Coronopus didymus</i>	Brassicaceae	Herb	C	✓	
27	<i>Cuscuta reflexa</i>	Cuscutaceae	Parasite	C	✓	✓
28	<i>Celosia argenia</i>	Amaranthaceae	Herb	C	✓	
29	<i>Albizia lebbek</i>	Meliaceae	Tree	R	✓	
30	<i>Cynodon dactylon</i>	Poaceae	Grass	VC	✓	
31	<i>Schoenoplectus sp.</i>	Cyperaceae	Sedge	C	✓	
32	<i>Cyperus rotundus</i>	Cyperaceae	Sedge	VC	✓	
33	<i>Dactyloctenium scindicum</i>	Poaceae	Grass	VC	✓	
34	<i>Dalbergia sissoo</i>	Papilionaceae	Tree	C	✓	
35	<i>Cassia absus</i>	Caesalpiniaceae	Herb	C	✓	
36	<i>Desmostachya bipinnata</i>	Poaceae	Grass	VC	✓	✓





37	<i>Dicanthium anulatum</i>	Poaceae	Grass	C	✓	
38	<i>Fagonia indica</i>	Zygophyllaceae	Herb	C	✓	✓
39	<i>Dodonea viscosa</i>	Sapindaceae	Shrub	R		✓
40	<i>Eragrostis japonica</i>	Poaceae	Grass	C	✓	✓
41	<i>Eucalyptus globulus</i>	Myrtaceae	Tree	Cult.	✓	
42	<i>Heliotropium strigosum</i>	Boragnaceae	Tree	cult	✓	✓
43	<i>Ficus religiosa</i>	Moraceae	Tree	Cult.	✓	
44	<i>Ficus virgata</i>	Moraceae	Shrub	C	✓	
45	<i>Heliotropium europaeum</i>	Boraginaceae	Herb	R		✓
46	<i>Ipomoea carnea</i>	Convolvulaceae	Shrub	C	✓	
47	<i>Imperata cylindrica</i>	Poaceae	Grass	C		✓
48	<i>Lantana camara</i>	Verbenaceae	Shrub	C	✓	✓
49	<i>Launaea procumbens</i>	Asteraceae	Herb	C	✓	✓
50	<i>Mangifera indica</i>	Anacardiaceae	Tree	Cult.	✓	
51	<i>Euphorbia helioscopia</i>	Euphorbiaceae	Herb	C		
52	<i>Pongamia pinnata</i>	Papilionaceae	Tree	Cult.		
53	<i>Malva sylvestris</i>	Malvaceae	Herb	C		
54	<i>Malvastrum coromendelianum</i>	Malvaceae	Herb	C	✓	✓
55	<i>Maytenus royleanus</i>	Celastraceae	Shrub	C		✓
56	<i>Melia azadirach</i>	Meliaceae	Tree	Cult.	✓	
57	<i>Prosopis glandulosa</i>	Mimosaceae	Shrub	C		✓
58	<i>Morus alba</i>	Moraceae	Tree	C	✓	
59	<i>Ochthocloa compressa</i>	Poaceae	Grass	VC	✓	✓
60	<i>Parthenium hysterophorus</i>	Poaceae	Grass	VC	✓	✓
61	<i>Pennisetum orientale</i>	Poaceae	Grass	C	✓	✓
62	<i>Pennistum typhoides</i>	Poaceae	Grass	Cult.	✓	
63	<i>Periploca aphylla</i>	Asclepiadaceae	Shrub	C		✓
64	<i>Persicaria glabra</i>	Polygonaceae	Herb	R	✓	
65	<i>Echinops echinatus</i>	Asteraceae	Herb	R		✓
66	<i>Phoenix sylvestris</i>	Palmae	Tree	R	✓	
67	<i>Populus euphratica</i>	Salicaceae	Tree	Cult.	✓	
68	<i>Pupalea lappacea</i>	Amaranthaceae	Herb	R		✓
69	<i>Psidium guajava</i>	Myrtaceae	Tree	Cult.	✓	
70	<i>Tamarix aphylla</i>	Tamaricaceae	Tree	R		✓
71	<i>Salvia aegyptiaca</i>	Labiatae	Herb	C	✓	✓
72	<i>Solanum indicum</i>	Solanaceae	Shrub	R	✓	✓
73	<i>Saccharum bengalense</i>	Poaceae	Grass	C	✓	✓
74	<i>Saccharum spontaneum</i>	Poaceae	Grass	C		✓
75	<i>Salvia moorcroftiana</i>	Labiatae	Herb	C		✓
76	<i>Solanum nigrum</i>	Solanaceae	Herb	C	✓	✓
77	<i>Sorghum halepense</i>	Poaceae	Grass	C	✓	
79	<i>Sorghum vulgare</i>	Poaceae	Grass	Cult.	✓	
79	<i>Tribulus terrestris</i>	Zygophyllaceae	Herb	C	✓	
80	<i>Withania somnifera</i>	Solanaceae	Herb	C	✓	✓





81	<i>Xanthium strumarium</i>	Asteraceae	Herb	C	✓	✓
82	<i>Zaleya pentandera</i>	Aizoaceae	Herb	C	✓	✓
83	<i>Ziziphus nummularia</i>	Rhamnaceae	Tree	C	✓	✓
84	<i>Musa indica</i>	Musaceae	Tree	Cult.	✓	

C: Common

VC: Very Common

R: Rare

Cult: Cultivated

B. Birds observed in the area

Sr. #	Scientific Name	Common Name	Status				Occurrence	
			Abundant	Common	Less Common	Rare	Migratory	Resident
1	<i>Trachybaptus ruficollis</i>	Little Grebe		X				X
2	<i>Coturnix coturnix</i>	Common Quail		X				X
3	<i>Columba livia</i>	Rock Pigeon		X				X
4	<i>Psittacula krameri</i>	Parakeet		X				X
5	<i>Centropus sinensis</i>	Common crow		X				X
6	<i>Alcedo atthis</i>	Kingfisher		X				X
7	<i>Merops orientalis</i>	Blue tailed ant eater		X				X
8	<i>Coracias benghalensis</i>	Indian roller/ Blue jay		X				X
9	<i>Pycnonotus cafer</i>	Red vented, Bulbul		X				X
10	<i>Saxicola caprata</i>	Pied bush		X				X
11	<i>Acridotheres ginginianus</i>	Myna		X				X
12	<i>Francolinus francolinus</i>	Black Partridge			X			X
13	<i>Streptopelia decaocto</i>	Collared dove		X				X
14	<i>Francolinus pondicerianus</i>	Grey Partridge	X					X
15	<i>Corvus splendens</i>	House Crow	X					X
16	<i>Passer domesticus</i>	House Sparrow	X					X
17	<i>Acridotheres tristis</i>	Indian Myna		X				X
18	<i>Streptopelia senegalensis</i>	Little Brown Dove		X				X
19	<i>Pycnonotus leucogenys</i>	White cheeked Bulbul		X				X





C. Mammals Observed in the Area

Sr. #	Scientific Name	Common Name	Status				Occurrence	
			Abundant	Common	Less Common	Rare	Migratory	Resident
1	<i>Canis aureus</i>	Asian Jackal		X				X
2	<i>Canis lupus</i>	Wolf		X				X
3	<i>Felis chaus</i>	Jungle Cat		X				X
4	<i>Herpestes javanicus</i>	Grey Mongoos		X				X
5	<i>Hystrix indica</i>	Indian Porcupine		X				X
6	<i>Lepus nigricollis</i>	Indian Hare, Wild Hare		X				X
7	<i>Sus scrofa</i>	Indian Wild Boar		X				X

D. Reptiles Observed in the Area

Sr. #	Scientific Name	Common Name	Status				Occurrence	
			Abundant	Common	Less Common	Rare	Migratory	Resident
1	<i>Calotes versicolor</i>	Garden Lizard		X				X
2	<i>Echis carinatus</i>	Saw scaled viper			X			X
3	<i>Spalerosophis diadema</i>	Diadem Snake			X			X
4	<i>Uromastix hardwicki</i>	Spiny Tailed Lizard			X			X
5	<i>Varanus bengalensis</i>	Indian Monitor			X			X

C: Common

VC: Very Common

LC: Less Common

R: Rare

Cult: Cultivated



Annexure VIII: Waste Management Plan

This annexure provides the waste disposal plan that will be employed during the proposed project activities.

Oily Waste

- **Geomembrane Pits**

One popular method of treating oily waste water involves storing it in evaporation ponds or storage ponds. Lined pits are common across a wide range of oil extraction facilities. The decision of which liner material to use is typically made by the engineers designing the pit, after consulting with geotechnical and soil engineers. Some pits are used only for a few months. Others need liners that last for decades. Drilling reserve pit liners provide an impenetrable barrier between potentially toxic drilling fluids in reserve pits and the groundwater and soil below.

Wastewater will be deposited in large open ponds allowing water to evaporate through solar radiation and wind, leaving a pond of concentrated residual waste for treatment. If there will be a substantial amount of reclaimable oil on the surface of the pit, it would be skimmed off and reused. If the floating layer of hydrocarbons cannot be skimmed off, it would be processed together with the pit solids. After evaporation of liquids inside the lined pits, the pits will be closed in accordance with the regulations. This dehydrated oil sludge can further be treated by a number of methods. Amongst these methods, bioremediation is most often used. Bioremediation is a comparatively slow process but it is cost effective with high efficiency value. The future of oily sludge will be decided by POL itself.

- **Bioremediation**

NCPC suggest anaerobic bioremediation method for the treatment of oily sludge of oil storage tanks. The method has been applied successfully for the treatment of hydrocarbons. Bioremediation is the process of using living microorganisms to clean up a contaminated site. Microorganisms decompose the hydrocarbon compounds by using enzymes, specific proteins that control reactions in living cells. Organisms that produce enzymes capable of degrading petroleum are useful in cleaning up oily sludge.

- **Environmental Consideration**

The operating activities of oil storage tanks have the potential to impact the environment adversely as a result of the generation of large quantities of wastes. Wastes are generated from a variety of activities associated with oil Storage tanks. These wastes can potentially harm the environment in many ways due to the release of heavy metals, salts, and hydrocarbons, which can threaten the surrounding ecosystem due to their toxicity. The most common methods for the disposal of oily sludge wastes are incineration and bioremediation.





The incineration may result in emissions of toxic gases depending upon the conditions of incineration and the nature of the material subjected to incineration. In addition, the ash remaining at the bottom of the incinerator after burn down often contains heavy metals that may leach out.

Bioremediation is eco-friendly, cost-effective and accounts for the maximum transformation of contaminants in soils. Bioremediation of oily sludge together with the application of cleaner production nutrients has attracted considerable attention as a safe method to get rid of the toxic organic contaminants.

Summary of Waste Disposal Plan

Waste will be segregated at the base camp prior to being picked up and taken to the approved contractor. The nine areas of segregation are:

1. Glass;
2. Paper/cardboard/wood and foodstuff;
3. Metal/tin;
4. Plastic;
5. Used oil, fluids, oily rags;
6. Contaminated sand;
7. Hazardous materials and clinical waste;
8. Dry Cell Batteries; and
9. Milk Packets

Sr. #	Type of Waste	Description	Phase	Disposal Method
1.	Camp Waste	Food, fruits and vegetables residue, domestic garbage	All Phases	Recyclable waste to be given away for recycling; Non-recyclable, combustible to be burned at burn pits or buried in lined pits. Food waste will be buried in the burial pit layer wise.
2.	Packaging Waste	Paper, plastic, textiles, cardboard, rubber, wood, glass, tin cans, aluminium cans	All Phases	Combustible waste to be burned at burn pits, recyclable waste to be provided to recycling contractor.
3.	Medical Waste	Syringes, glass bottles, soiled bandages, expired drugs, dressings	All Phases	Medical waste will be incinerated through licensed contractor. If no such incineration facility is available, then medical waste will be placed in a glass jar, some acid will be added, and the jar will then be buried in a pit under





				supervision.
4.	Workshop Waste	Used oil, ferrous / non-ferrous materials, batteries, oil	All Phases	Used oil and ferrous/non-ferrous materials to be provided to local gasoline stations for reuse. Batteries to be hauled away for recycling to certified waste contractor.
5.	Sewage and Grey Wastewater	Grey Water: Wastewater from kitchen and washing areas; Black Water: sewerage	Operational Phase	Grey water will also be collected in soak pits. Soak pits will be designed to accommodate wastewater generated during the total duration of the operation. In case the soak pits get filled during the operation, grey water will be sprinkled over access tracks. Sprinkling of grey water will be done in a manner such that ponding of water is avoided.. Sewerage to be treated in a septic tank and soakage pit. And when the black water pits get filled, it will be transported off to municipal drains.
6.	Oil Spills / Soil Contaminated by Oil Leakages or Spills	Contaminated Soil	All Phases	• Soil contaminated by minor spills / leakages (defined as leaks from vehicles, machinery, equipment, or storage containers such that the area and depth of soil contaminated is less than 1 ft² and 03 inches respectively) will be scraped and sent to the burn pit where it will be burned along with other combustible wastes. • Moderate spills defined as spills of a volume less than or equal to 200 liters will be contained and controlled using shovels, sand, and native soil. These materials and equipment will be made available at campsites and the well site during operation. The contaminated soil will be excavated and stored in a bounded area lined with an impermeable base. Depending on the volume, the





				contaminated soil will be either disposed of by burning limited volumes of the soil in the burn pit, or by specialized treatment, such as bioremediations. Major spills of volumes exceeding 200 liters will require the initiation of POL's Emergency Response Procedures. These spills will be handled and controlled according to the measures listed in POL's Oil Spill Contingency Plan, and will require special treatment, such as Bioremediation.
7.	Demolition Waste	Concrete, bricks, other building material	Construction Phase	Dirt, concrete, and plaster to be buried at site. Plumbing, heating and electrical parts to be hauled away for recycling to approved waste contractor.
8.	Excess Construction Material	Sand, aggregate, cement, bricks, reinforcement steel bars, paints and other construction material	Construction Phase	To be sold back or given away to the suppliers or other users.





Annexure IX: Checklists

Checklist for Vehicle

Sr. #	Description	Status	Additional Comments
1.	Are the vehicles maintained and inspected regularly?	Yes/ No	
2.	Are the oil, fuel and other leaks from the vehicles immediately attended to?	Yes/ No	
3.	Are the vehicles with leaks being operated?	Yes/ No	
4.	Has there been any spillage during vehicle re-fueling or maintenance?	Yes/ No	
5.	If yes, have recommended mitigation measures been adhered to?	Yes/ No	
6.	Are the vehicles being washed or serviced in the field?	Yes/ No	
7.	Are the vehicles being washed in designated areas having concrete pad and waste water collection pits?	Yes/ No	
8.	Is vehicle related waste, such as oils, filters, old tires or parts are left lying around?	Yes/ No	
9.	Is vehicle related waste, such as oils, filters, old tires or parts being disposed of properly?	Yes/ No	
10.	Are the vehicles emitting excessive smoke?	Yes/ No	
11.	Do the potentially noisy vehicles have properly functioning silencers (mufflers)?	Yes/ No	
12.	Do all vehicles have provision for containers/trash bags to store trash/refuse?	Yes/ No	
13.	Are POL's HSE guidelines being followed?	Yes/ No	
14.	Have all other mitigations measures specified in the EIA been adhered to?	Yes/ No	

Name: _____

Signature: _____

Date: _____





Checklists for Camp Siting

Sr. #	Description	Status	Additional Comments
1.	Have photographs been taken to record the pre-camping conditions?	Yes/ No	
2.	Has the camp site been selected in existing clearings and on leveled land?	Yes/ No	
3.	Has the camp site been selected at least 500 meters away from any communities?	Yes/ No	
4.	Have compensation amounts been settled based on prevailing market rates?	Yes/ No	
5.	Has any vegetation been cleared?	Yes/ No	
6.	If yes, is the vegetation loss significant?	Yes/ No	
7.	If yes, have the mitigation measures specified in the EIA been adhered with?	Yes/ No	
8.	Have the trees or bushes been used as fuel wood?	Yes/ No	
9.	Have any trees been cut?	Yes/ No	
10.	Does the campsite have a septic system comprising of septic tank and soak pit?	Yes/ No	
11.	Have the soak pits for laundry, kitchen and showers been built?	Yes/ No	
12.	Have the soak pits been built in absorbent soil?	Yes/ No	
13.	Have the soak pits (where required) been built down-slope from the camp?	Yes/ No	
14.	Are the soak pits within 300 meters of any surface water source or a ground well?	Yes/ No	
15.	Have the soak pits been designed to accommodate waste water generated during the total duration of the operation?	Yes/ No	
16.	Can Surface water enter the soak pits?	Yes/ No	
17.	Has plastic sheeting been placed under all concrete?	Yes/ No	
18.	Have all other mitigations measure specified in the EIA been adhered to?	Yes/ No	
19.	Are POL's HSE guidelines being followed?	Yes/ No	





Checklist for Camp Operation

Sr. #	Description	Status	Additional Comments
1.	Has any vegetation been cleared or damaged?	Yes/ No	
2.	Have bushes or trees been used as fuel wood?	Yes/ No	
3.	Is water drawn from a local water source?	Yes/ No	
4.	If yes to point 3, has the yield and demand been determined to ensure there is enough to meet the requirements of locals?	Yes/ No	
5.	If yes to point 3, is water well discharge(s) being checked and recorded on a regular basis?	Yes/ No	
6.	If yes to point 3, is compensation being paid for the water use?	Yes/ No	
7.	Has the natural drainage been disturbed?	Yes/ No	
8.	Are the fuels and oils handled in a safe manner, ensuring no leakage or spillage?	Yes/ No	
9.	Are the soak pits being constructed 300 meters away from a surface water source or ground water well?	Yes/ No	
10.	Has any surface water entered the soak pits?	Yes/ No	
11.	In case the soak pits gets filled during the operation, has the grey water been sprinkled?	Yes/ No	
12.	Is sprinkling of grey water being done in a manner to avoid water ponding?	Yes/ No	
13.	Has arrangements for the transportation of black water to the municipal drains been in place?	Yes/ No	
14.	Are there enough waste bins around the camp?	Yes/ No	
15.	Are the waste bins emptied on a regular basis?	Yes/ No	
16.	Is food waste disposed in the open?	Yes/ No	
17.	Is the combustible waste burnt regularly in the burn pit?	Yes/ No	
18.	Is the burn pit located 500 meters away from the nearest community?	Yes/ No	
19.	Is the non-combustible waste being sent to the approved waste contractor(s)?	Yes/ No	





20.	Is medical waste being disposed of properly i.e., incinerated?	Yes/ No	
21.	Are water consumption figures being maintained?	Yes/ No	
22.	Have requirements of the EIA been adhered to?	Yes/ No	

Name: _____

Signature: _____

Date: _____

Checklist for Road Travel

Sr. #	Description	Status	Additional Comments
1.	Is the number of routes kept to a minimum?	Yes/ No	
2.	Have photographs been taken to record pre-usage conditions?	Yes/ No	
3.	Are the existing routes being used to access the survey lines?	Yes/ No	
4.	Have new access routes been developed?	Yes/ No	
5.	If yes, have requirements of the EIA been adhered to?	Yes/ No	
6.	Are short cuts been used?	Yes/ No	
7.	Has vegetation clearing been minimized?	Yes/ No	
8.	Has off road travel been observed?	Yes/ No	
9.	Is vehicle speed limit of 40 km/h being followed?	Yes/ No	
10.	Are heavily traveled routes watered (where required) on a daily basis to minimize dust?	Yes/ No	
11.	Are the drivers careful and watchful about wild and domestic animals?	Yes/ No	
12.	Has any natural drainage been disturbed or altered?	Yes/ No	
13.	Is any soil erosion observed?	Yes/ No	
14.	If yes, have the mitigation measures been adhered to?	Yes/ No	





15.	Is night travel observed?	Yes/ No	
16.	Is the use of horns avoided as far as possible?	Yes/ No	
17.	Are pressure horns being used?	Yes/ No	
18.	Are POL's HSE guidelines being followed?	Yes/ No	
19.	Do the vehicles carry adequate containers/trash bags for litter/garbage and are they emptied at the campsite or other designated location regularly?	Yes/ No	
20.	Are there any damages caused by project activities to local roads or other infrastructure (where applicable)?	Yes/ No	
21.	If yes, are these damages being repaired?	Yes/ No	

Name: _____

Signature: _____

Date: _____

Checklist for Production

Sr. #	Description	Status	Additional Comments
1.	Are the well logs performed on cores of rocks taken from boreholes?	Yes/ No	
2.	Are the tests for oil or gas presence performed?	Yes/ No	
3.	Are the tests for reservoir permeability done?	Yes/ No	
4.	Are the subsurface safety valves installed?	Yes/ No	
5.	Is the mechanical plug installed?	Yes/ No	
6.	Are the metering devices and valves used?	Yes/ No	
7.	Are the BOP's installed?	Yes/ No	





Checklist for Restoration and Rehabilitation

Sr. #	Description	Status	Additional Comments
1.	Have the camping sites been restored as close as possible to the original condition?	Yes/ No	
2.	Have the campsites been cleaned, leaving no refuse or wastes behind?	Yes/ No	
3.	Have the routes been restored as close as possible to the original condition?	Yes/ No	
4.	Have the survey lines been restored as close as possible to the original condition?	Yes/ No	
5.	Have all flags, stakes, signs and refuse been removed?	Yes/ No	
6.	Have all holes and mud pits made for the purpose of up holes and deep holes been backfilled and restored?	Yes/ No	
7.	Have the photographs of the above mentioned activities been taken to compare with the pre-project conditions?	Yes/ No	
8.	Have all damages caused to local infrastructure during the operation been repaired and restored?	Yes/ No	
9.	Have the erosion control measures been taken where needed?	Yes/ No	
10.	Has it been ensured that the survey lines do not become new routes?	Yes/ No	
11.	Have the concrete blocks from the explosive storage area been removed?	Yes/ No	
12.	Have all the ditches, soak pits and septic tanks been backfilled with an extra cap of 1 meter soil on top to cater compaction?	Yes/ No	
13.	Has the contaminated soil been removed and disposed of appropriately?	Yes/ No	
14.	Have the sites been inspected to ensure the recommended restoration measures have been strictly adhered to?		

Name: _____

Signature: _____

Date: _____



**Checklist for Fuels, Oils and Chemicals**

Sr. #	Description	Status	Additional Comments
1.	Do the fuel storage facilities have adequate secondary containment up to 120% capacity in case of leakage or spillage?	Yes/ No	
2.	Is there any other combustible or flammable material in the fuel storage area?	Yes/ No	
3.	Is regular inspection carried out to check leaks and spills?	Yes/ No	
4.	Have the entire oil and fuel storage areas concrete floor underneath to prevent soil contamination from leaks or spills?	Yes/ No	
5.	Are the fuel tanks properly marked with their contents?	Yes/ No	
6.	Are the fuel transfer arrangements protected against spills?	Yes/ No	
7.	Are the drip trays being used?	Yes/ No	
8.	Are tarpaulin sheets placed under equipment and fuel containers that have the potential to spill or drip fuels, oils or chemicals?	Yes/ No	
9.	Is the fuel transfer operation being supervised?	Yes/ No	
10.	Are the spills and leaks thoroughly cleaned?	Yes/ No	
11.	Are the spilled oil or fuel and used clean-up material being disposed properly?	Yes/ No	
12.	Are the spills and leaks reported and recorded?	Yes/ No	
13.	Is contaminated soil being removed or covered following proper clean-up procedures?	Yes/ No	
14.	Is the emergency response plan available on site?	Yes/ No	
15.	Has all the mitigation measures suggested in the EIA been adhered to?	Yes/ No	
16.	Are POL's HSE guidelines being followed?	Yes/ No	

Name: _____

Signature: _____

Date: _____





General Environmental Checklist

Sr. #	Description	Status	Additional Comments
1.	Are activities taking place in agricultural or grazing areas?	Yes/ No	
2.	If yes, have compensation amounts being settled?	Yes/ No	
3.	Are permitting staff informing village leaders of location and timing of all major activities?	Yes/ No	
4.	Is a community complaints register being managed and maintained?	Yes/ No	
5.	Are there any damages caused by project activities to local roads or other infrastructure (where applicable)?	Yes/ No	
6.	If yes, are these damages being repaired?	Yes/ No	
7.	Are the cultural norms being respected by the project staff?	Yes/ No	
8.	Has off sets been provided from sites of religious, cultural or Archaeological significance? (If found)	Yes/ No	
9.	Is trash, wrappers, shopping bags, paper, cans, bottles or any other kind of litter being left out in the open?	Yes/ No	
10.	Is the “no hunting, no harassment, no fishing and no trapping” policy strictly enforced?	Yes/ No	
11.	Are any Archaeological sites or places of cultural or religious significance disturbed?	Yes/ No	
12.	Is the “no shortcuts” policy followed?	Yes/ No	
13.	Are POL’s HSE guidelines being followed?	Yes/ No	
14.	Has all the mitigation measures suggested in the EIA been adhered to?		

Name: _____

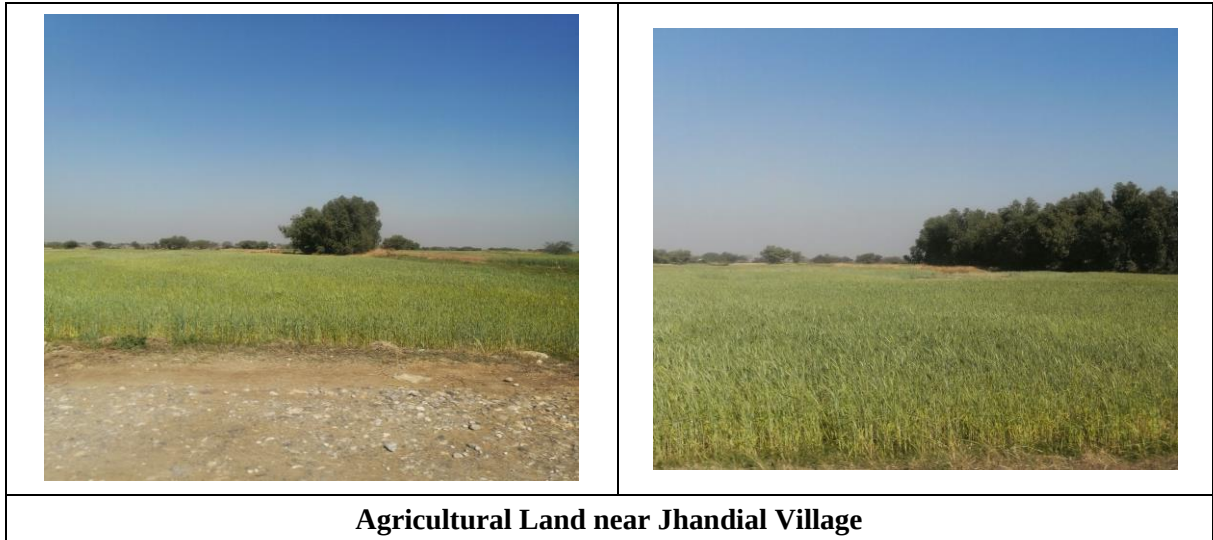
Signature: _____

Date: _____



Annexure X: Photographic Records

	
Road Leading Towards the Project Site	A view of Jhandial Village
	
NCPC Team Visit to Project Site	
	
Mosque observed near Project Area	Proposed location of Jhandial-03 Well





Annexure XI: Meteorological Data



MINIMUM AND MAXIMUM TEMPERATURE RANGE IN JHANDIAL

Dates (month/day/year): 01/01/2022 through 12/31/2022

Location: Latitude 33.3819 Longitude 72.5597

Elevation from MERRA-2: Average for 0.5 x 0.625 degree lat/lon region = 447.46 meters

The value for missing source data that cannot be computed or is outside of the sources availability range: -999

Parameter(s):

T2M MERRA-2 Temperature at 2 Meters (C)

T2MDEW MERRA-2 Dew/Frost Point at 2 Meters (C)

T2MWET MERRA-2 Wet Bulb Temperature at 2 Meters (C)

T2M_MAX MERRA-2 Temperature at 2 Meters Maximum (C)

T2M_MIN MERRA-2 Temperature at 2 Meters Minimum (C)

T2M_RANGE MERRA-2 Temperature at 2 Meters Range (C)

YEAR	MO	DY	T2M	T2MDEW	T2MWET	T2M_MAX	T2M_MIN	T2M_RANG	
2022		1	1	10.01	1.05	5.53	15.02	6.48	-264.6
2022		1	2	9.3	2.95	6.13	17.08	3.36	-259.42
2022		1	3	10.05	4.79	7.41	14.63	6.7	-265.22
2022		1	4	9.82	8.26	9.05	13.53	7.72	-267.34
2022		1	5	7.86	7.14	7.5	9.37	5.15	-268.92
2022		1	6	8.77	6.65	7.71	13.8	4.67	-264.03
2022		1	7	10.26	7.96	9.11	14.38	6.93	-265.7
2022		1	8	9.28	8.01	8.65	12.05	5.94	-267.03
2022		1	9	8.38	6.44	7.41	12.19	6	-266.96
2022		1	10	7.7	4.45	6.08	14.51	3.69	-262.34
2022		1	11	6.95	1.34	4.15	14.42	1.93	-260.66
2022		1	12	7.37	-0.2	3.58	14.56	0.9	-259.49
2022		1	13	9.26	0.25	4.76	15.92	3.49	-260.72
2022		1	14	9.11	1.38	5.25	15.56	3.98	-261.57
2022		1	15	9.08	1.13	5.11	16.02	3.26	-260.38
2022		1	16	10.06	2.78	6.42	15.65	5.55	-263.06
2022		1	17	9.21	3.96	6.58	12.23	6.14	-267.05
2022		1	18	11.7	4.9	8.3	17.47	5.59	-261.27
2022		1	19	10.35	6.69	8.52	13.67	5.75	-265.22
2022		1	20	9.59	6.68	8.13	16.24	4.82	-261.73
2022		1	21	9.58	5.91	7.75	15.55	4.52	-262.12
2022		1	22	8.45	6.12	7.29	11.46	6.21	-267.9
2022		1	23	8.45	5.85	7.15	12.58	5.3	-265.87
2022		1	24	8.63	4.71	6.67	13.51	3.96	-263.6
2022		1	25	8.74	4.16	6.45	14.97	4.27	-262.45
2022		1	26	8.53	1.28	4.9	14.57	2.46	-261.05
2022		1	27	9.16	0.21	4.69	16.07	3.73	-260.81
2022		1	28	9.12	0.15	4.64	16.31	2.88	-259.72
2022		1	29	10.55	1.84	6.19	17.51	5.05	-260.68
2022		1	30	9.96	2.48	6.22	16.45	4.22	-260.92
2022		1	31	11.39	2.68	7.03	18.85	4.03	-258.33

2022	2	1	10.36	4.1	7.23	17.4	4.4	-260.15
2022	2	2	10.27	4.37	7.32	17.12	6.02	-262.04
2022	2	3	9.51	6.13	7.83	14.97	4.89	-263.07
2022	2	4	8.07	4.64	6.35	15.2	3.44	-261.38
2022	2	5	9.55	4.53	7.05	15.65	3.51	-261.02
2022	2	6	11.62	4.33	7.98	16.71	6.85	-263.29
2022	2	7	10.2	5.4	7.8	16.67	4.55	-261.03
2022	2	8	10.49	3.79	7.14	17.21	4.25	-260.19
2022	2	9	10.8	3.41	7.1	17.15	5.37	-261.37
2022	2	10	10.67	2.84	6.76	18.22	4.64	-259.57
2022	2	11	10.69	1.64	6.17	18.48	3.54	-258.21
2022	2	12	12.26	2.05	7.15	20.01	5.85	-258.98
2022	2	13	13.08	4.66	8.87	20.56	5.99	-258.57
2022	2	14	12.9	7.07	9.98	18.2	9.88	-264.83
2022	2	15	13.46	7.25	10.35	19.61	8.21	-261.75
2022	2	16	13.45	7.75	10.6	19.13	8.84	-262.86
2022	2	17	13.08	7.23	10.15	20.19	8.01	-260.97
2022	2	18	11.01	5.82	8.41	18.01	6.71	-261.85
2022	2	19	13.08	4.48	8.78	20.64	6.06	-258.57
2022	2	20	12.88	3.33	8.11	21.71	5.35	-256.79
2022	2	21	12.8	1.88	7.34	21.06	4.05	-256.13
2022	2	22	13.8	6.52	10.16	21.23	8.87	-260.79
2022	2	23	12.94	10.05	11.49	17.23	9.39	-265.31
2022	2	24	13.1	9.69	11.4	18.85	9.37	-263.67
2022	2	25	12.23	9.33	10.79	17.9	8.15	-263.4
2022	2	26	10.73	5.19	7.96	16.78	4.83	-261.2
2022	2	27	11.44	4.98	8.22	18.79	4.62	-258.98
2022	2	28	11.79	4.18	7.98	18.1	4.69	-259.74
2022	3	1	14.09	7.94	11.01	20.84	7.83	-260.14
2022	3	2	13.97	8.65	11.31	20.73	8.18	-260.6
2022	3	3	13.43	10.23	11.83	17.9	10.2	-265.45
2022	3	4	13.33	8.65	10.99	20.78	6.98	-259.35
2022	3	5	13.04	8.71	10.87	18.33	8.33	-263.14
2022	3	6	14.78	12.08	13.43	17.99	12.13	-267.29
2022	3	7	14.1	11.19	12.65	20.29	9.69	-262.54
2022	3	8	15.3	9.83	12.56	22.94	8.6	-258.81
2022	3	9	17.27	11.75	14.51	24.81	11.39	-259.73
2022	3	10	17.94	11.03	14.48	24.87	9.94	-258.22
2022	3	11	20.21	10.72	15.47	26.94	13.19	-259.39
2022	3	12	19.11	12.55	15.83	23.98	13.83	-263
2022	3	13	22.02	13.48	17.75	29.75	13.84	-257.24
2022	3	14	23.76	14.61	19.19	29.65	17.68	-261.17
2022	3	15	22.36	14.79	18.57	28.84	15.95	-260.26
2022	3	16	21.87	12.72	17.3	29.55	14.59	-258.19
2022	3	17	24.07	11.65	17.86	31.94	16.9	-258.11
2022	3	18	21.91	15.49	18.7	29.45	15.46	-259.16
2022	3	19	22.23	16.3	19.26	28.4	16.63	-261.38

2022	3	20	22.36	14.88	18.62	28.6	16.63	-261.17
2022	3	21	22.06	12.9	17.48	29.44	15.23	-258.94
2022	3	22	22.14	10.94	16.54	29.59	14.92	-258.47
2022	3	23	22.09	11.71	16.9	29.79	14.84	-258.2
2022	3	24	21.47	11.94	16.7	27.77	14.92	-260.3
2022	3	25	21.39	9.86	15.62	28.29	13.62	-258.48
2022	3	26	22.07	8.3	15.19	30.31	12.86	-255.7
2022	3	27	22.65	10.3	16.48	31.92	14.48	-255.71
2022	3	28	23.01	10.8	16.9	30.8	15	-257.35
2022	3	29	23.19	10.95	17.07	32.45	15.35	-256.05
2022	3	30	21.49	9.37	15.43	31.92	12.19	-253.42
2022	3	31	23.1	8.61	15.85	31.26	13.65	-255.55
2022	4	1	24.23	8.8	16.51	33.32	15.65	-255.48
2022	4	2	23.61	10.2	16.9	33.52	16.65	-256.27
2022	4	3	22.66	10.57	16.62	31.75	13.28	-254.68
2022	4	4	24.19	8.69	16.44	32.94	14.8	-255.01
2022	4	5	26.65	7.82	17.23	33.97	18.4	-257.59
2022	4	6	27.05	8.48	17.76	34.99	19.83	-257.99
2022	4	7	27.04	9.65	18.35	36.09	17.8	-254.85
2022	4	8	26.65	10.87	18.76	36.19	18.69	-255.66
2022	4	9	26.73	11.48	19.11	36	18.8	-255.95
2022	4	10	28.05	11.26	19.66	36.88	18.48	-254.75
2022	4	11	28.37	11.16	19.76	37.52	19.92	-255.56
2022	4	12	28.17	12.28	20.23	37.99	20.4	-255.56
2022	4	13	25.43	13.15	19.29	33.31	17.15	-256.99
2022	4	14	25.59	12.51	19.05	33.62	17.89	-257.42
2022	4	15	26.26	10.77	18.52	33.26	18.87	-258.75
2022	4	16	26.97	10.05	18.51	34.97	18.33	-256.51
2022	4	17	27.83	9.24	18.54	35.36	18.9	-256.69
2022	4	18	26.84	12.22	19.53	35.87	20.58	-257.85
2022	4	19	26.86	14.34	20.6	35.97	19.43	-256.61
2022	4	20	24.72	14.65	19.69	31.58	20.16	-261.74
2022	4	21	25.07	12.19	18.63	32.87	19.41	-259.7
2022	4	22	25.15	12.02	18.58	32.48	18.4	-259.07
2022	4	23	25.49	11.59	18.54	33.23	17.29	-257.21
2022	4	24	26.68	11.71	19.19	34.62	17.94	-256.47
2022	4	25	26.55	14.08	20.31	33.39	20.15	-259.92
2022	4	26	28.05	9.89	18.98	36.21	19.03	-255.96
2022	4	27	29.3	9.9	19.61	38.64	20.28	-254.79
2022	4	28	30.76	10.91	20.84	40.9	21.28	-253.53
2022	4	29	30.12	12.53	21.33	39.39	21.03	-254.79
2022	4	30	30.33	13.58	21.95	38.87	20.94	-255.22
2022	5	1	32.13	12.3	22.21	41.09	23.58	-255.63
2022	5	2	32.31	12.55	22.43	40.85	22.03	-254.33
2022	5	3	28.12	14.65	21.38	34.93	22.84	-261.07
2022	5	4	25.91	15.9	20.9	34.4	19.86	-258.61
2022	5	5	26.62	14.52	20.57	34.05	18.05	-257.16

2022	5	6	28.94	13.63	21.28	36.65	20.46	-256.96
2022	5	7	30.51	12.71	21.61	38.58	21.41	-255.99
2022	5	8	31.34	11.62	21.48	40.14	22.79	-255.79
2022	5	9	30.91	13.37	22.14	39.71	21.85	-255.29
2022	5	10	31.23	14.83	23.03	38.84	22.65	-256.96
2022	5	11	32.45	14.62	23.54	40.25	24.05	-256.94
2022	5	12	32.46	11.9	22.18	40.69	24.67	-257.13
2022	5	13	31.72	8.97	20.34	40.81	22.5	-254.84
2022	5	14	33.48	7.5	20.49	42.62	24.97	-255.49
2022	5	15	33.43	7.98	20.71	43.16	24.43	-254.42
2022	5	16	32.49	9.08	20.79	41.2	24.76	-256.7
2022	5	17	32.57	8.09	20.33	41	23.79	-255.94
2022	5	18	30.8	11.87	21.33	37.69	22.35	-257.81
2022	5	19	32.76	11.85	22.3	41.23	23.4	-255.31
2022	5	20	30.06	14.8	22.43	38	23.3	-258.45
2022	5	21	30.15	11.37	20.76	38	21.4	-256.56
2022	5	22	30.39	6.14	18.26	39.76	21.32	-254.7
2022	5	23	25.26	5.69	15.48	32.1	19.94	-260.99
2022	5	24	27.51	8.63	18.07	35.81	18.05	-255.4
2022	5	25	30.15	12.17	21.16	37.85	21.36	-256.66
2022	5	26	32.78	10.27	21.52	40.05	23.59	-256.7
2022	5	27	34.06	11.64	22.85	40.93	24.66	-256.88
2022	5	28	32.94	9.23	21.08	40.33	25.26	-258.09
2022	5	29	31.92	10.1	21.01	40.66	23.24	-255.73
2022	5	30	31.9	11.48	21.69	39.76	23.83	-257.23
2022	5	31	32.53	10.94	21.73	39.47	25.02	-258.7
2022	6	1	32.35	7.72	20.04	39.63	23.58	-257.1
2022	6	2	32.56	6.69	19.62	40.66	23.26	-255.75
2022	6	3	33.73	3.39	18.56	42.32	24.3	-255.13
2022	6	4	34.33	1.97	18.15	43.23	23.88	-253.8
2022	6	5	35.17	2.07	18.62	43.28	25.2	-255.07
2022	6	6	36.19	2	19.09	43.65	26.92	-256.42
2022	6	7	36.88	2.73	19.8	44.87	28.59	-256.88
2022	6	8	37.05	4.11	20.58	44.71	28.17	-256.61
2022	6	9	36.73	3.48	20.1	44.63	27.33	-255.85
2022	6	10	36.75	4.5	20.62	44.3	28.33	-257.17
2022	6	11	36.56	5.94	21.25	43.48	28.62	-258.29
2022	6	12	37.28	5.85	21.56	43.98	29.65	-258.82
2022	6	13	35.55	10.36	22.95	41.64	27.49	-258.99
2022	6	14	36.53	12.73	24.62	43.91	28.26	-257.49
2022	6	15	37.75	12.43	25.08	45.75	29.65	-257.05
2022	6	16	36.87	12.4	24.63	43.69	28.89	-258.35
2022	6	17	32.95	17.24	25.1	36.8	27.37	-263.72
2022	6	18	29.9	19.3	24.6	34.51	25.45	-264.09
2022	6	19	27.45	20.37	23.91	31.8	23.74	-265.1
2022	6	20	25.55	18.33	21.94	28.83	21.73	-266.05
2022	6	21	22.14	18.4	20.26	23.9	20.49	-269.74

2022	6	22	24.3	17.96	21.13	29.55	19.14	-262.74
2022	6	23	27.4	15.69	21.55	34.48	18.97	-257.64
2022	6	24	29.87	15.44	22.65	37.21	21.58	-257.52
2022	6	25	30.83	16.51	23.67	38.33	21.74	-256.56
2022	6	26	31.63	17.26	24.44	38.12	24.58	-259.6
2022	6	27	32.76	18.73	25.74	38.99	24.94	-259.1
2022	6	28	33.62	20.36	26.99	40.07	25.86	-258.93
2022	6	29	33.56	20.06	26.81	39.91	26.23	-259.47
2022	6	30	33.26	21.73	27.5	39.19	27.1	-261.06
2022	7	1	31.19	23.01	27.1	35.37	26.94	-264.73
2022	7	2	30.81	24.08	27.44	36.14	25.89	-262.9
2022	7	3	31.84	24.49	28.17	36.27	27.37	-264.24
2022	7	4	32.31	24.86	28.58	37.23	27.69	-263.61
2022	7	5	30.44	25.75	28.09	34.51	26.91	-265.55
2022	7	6	30.52	26.04	28.28	34.42	27.62	-266.34
2022	7	7	29.01	25.35	27.19	33.08	26.55	-266.62
2022	7	8	30.26	25.23	27.74	34.01	26.15	-265.31
2022	7	9	30.27	23.73	27.01	35.01	25.86	-263.99
2022	7	10	28.89	24.42	26.65	31.75	25.9	-267.31
2022	7	11	29.05	24.3	26.67	32.68	24.95	-265.42
2022	7	12	28.81	24.43	26.62	31.88	25.33	-266.6
2022	7	13	30.2	25.71	27.95	34.12	26.5	-265.53
2022	7	14	29.07	24.36	26.72	32.41	25.5	-266.24
2022	7	15	28.33	23.12	25.73	32.89	23.94	-264.2
2022	7	16	29.98	22.89	26.44	34.88	24.01	-262.28
2022	7	17	29.03	23.7	26.37	32.19	25.19	-266.14
2022	7	18	29.86	23.69	26.77	34.94	25.06	-263.27
2022	7	19	30.48	24.37	27.42	34.91	25.05	-263.3
2022	7	20	31.23	25.85	28.54	35.79	26.58	-263.94
2022	7	21	29.3	25.94	27.62	32.9	26.46	-266.7
2022	7	22	27.13	24.13	25.63	29.69	24.86	-268.31
2022	7	23	27.25	23.28	25.26	30.31	24.01	-266.85
2022	7	24	26.73	24.71	25.72	28.9	24.76	-269.02
2022	7	25	27.5	24.7	26.1	29.96	25.23	-268.42
2022	7	26	27.61	24.68	26.14	30.55	24.69	-267.29
2022	7	27	28.5	24.77	26.63	32.81	24.04	-264.38
2022	7	28	28.43	25.42	26.92	32.64	25.3	-265.81
2022	7	29	27.73	25.3	26.51	31.06	24.78	-266.87
2022	7	30	28.68	25.4	27.04	32.62	24.73	-265.25
2022	7	31	28.38	24.98	26.68	31.88	25.22	-266.49
2022	8	1	28.38	24	26.19	31.58	24.63	-266.2
2022	8	2	29	23.98	26.48	32.51	24.83	-265.48
2022	8	3	29.49	24.26	26.87	33.08	25.15	-265.22
2022	8	4	30.09	24.51	27.3	33.69	25.21	-264.67
2022	8	5	28.8	25.24	27.02	32.65	25.17	-265.67
2022	8	6	28.53	24.73	26.62	32.22	25.01	-265.94
2022	8	7	28.9	25.01	26.96	32.66	24.96	-265.45

2022	8	8	29.01	25.65	27.33	32.15	25.64	-266.64
2022	8	9	29.32	25.8	27.56	32.96	25.63	-265.82
2022	8	10	30.26	25.07	27.66	33.69	26.17	-265.64
2022	8	11	28.83	24.93	26.87	33.7	23.13	-262.59
2022	8	12	27.07	21.65	24.36	32.21	22.05	-263
2022	8	13	29.94	23.58	26.76	34.62	25.24	-263.77
2022	8	14	29.94	25.47	27.7	33.48	25.76	-265.42
2022	8	15	28.05	25.71	26.88	30.89	25.79	-268.05
2022	8	16	28.48	23.25	25.86	31.95	24.44	-265.63
2022	8	17	28.29	23.15	25.72	32.27	24.41	-265.29
2022	8	18	28.32	22.97	25.64	32.66	23.94	-264.43
2022	8	19	29.23	23.88	26.55	33.57	24.86	-264.44
2022	8	20	28.68	24.67	26.68	32.1	24.87	-265.92
2022	8	21	27.33	23.69	25.51	30.9	24.55	-266.79
2022	8	22	28.76	22.03	25.4	33.54	23.15	-262.76
2022	8	23	29.56	23.38	26.48	33.96	24.05	-263.24
2022	8	24	26.67	24.35	25.51	29.37	24.3	-268.08
2022	8	25	27.06	24.37	25.72	30.27	23.8	-266.67
2022	8	26	26.73	23.65	25.19	30.46	23.77	-266.46
2022	8	27	27.9	22.53	25.22	31.86	23.45	-264.74
2022	8	28	28.58	22.76	25.67	32.54	25.19	-265.81
2022	8	29	28.81	22.97	25.89	33.01	24.39	-264.53
2022	8	30	28.86	22.85	25.86	33.25	23.84	-263.74
2022	8	31	29.14	23.65	26.4	33.41	24.85	-264.59
2022	9	1	29.33	24	26.67	33.57	25.41	-264.99
2022	9	2	29.48	24.05	26.76	33.12	25.26	-265.28
2022	9	3	28.82	24.49	26.65	33.24	25	-264.91
2022	9	4	27.76	23.69	25.72	31.24	22.98	-264.89
2022	9	5	26.62	23.52	25.07	30.3	22.63	-265.49
2022	9	6	27.15	21.73	24.44	31.58	21.87	-263.45
2022	9	7	28.12	23.68	25.9	31.88	23.98	-265.26
2022	9	8	28.58	24.06	26.33	32.57	24.2	-264.78
2022	9	9	28.81	23.51	26.16	32.69	24.02	-264.49
2022	9	10	28.38	23.67	26.03	32.08	24.87	-265.93
2022	9	11	27.15	23.5	25.33	30.33	23.78	-266.6
2022	9	12	26.76	22.68	24.72	30.02	23.01	-266.13
2022	9	13	27.45	22.51	24.98	30.81	23.39	-265.73
2022	9	14	27.81	22.37	25.08	31.23	23.84	-265.77
2022	9	15	27.31	22.47	24.89	31.4	22.38	-264.13
2022	9	16	26.43	22.9	24.67	29.73	23	-266.42
2022	9	17	26.3	22.58	24.44	29.98	22.39	-265.56
2022	9	18	26.32	21.35	23.83	30.7	21.51	-263.95
2022	9	19	26.76	21.69	24.22	31.64	21.14	-262.65
2022	9	20	26.73	22.19	24.46	30.94	22.18	-264.38
2022	9	21	27.31	22.48	24.9	31.76	22.96	-264.35
2022	9	22	26.9	22.41	24.65	32.05	22.08	-263.17
2022	9	23	26.94	22.2	24.57	31.8	22.44	-263.81

2022	9	24	25.94	22.36	24.15	31.12	21.95	-263.98
2022	9	25	25.05	22.22	23.64	29.42	21.46	-265.19
2022	9	26	25.23	21.55	23.38	29.48	21.15	-264.81
2022	9	27	25.57	21.12	23.34	29.23	21.36	-265.27
2022	9	28	25.65	20.81	23.23	30.15	20.6	-263.6
2022	9	29	26.13	20.76	23.44	30.12	21.98	-265.02
2022	9	30	25.95	20.44	23.19	30.5	20.51	-263.17
2022	10	1	25.39	20.9	23.15	30.8	20.86	-263.2
2022	10	2	25.43	20.3	22.87	29.87	21.64	-264.92
2022	10	3	24.88	19.23	22.05	29.76	20.02	-263.42
2022	10	4	25.65	19.2	22.43	30.39	20.83	-263.6
2022	10	5	24.92	17.76	21.34	30.52	19.82	-262.45
2022	10	6	23.91	18.09	21	29.55	18.6	-262.2
2022	10	7	23.68	17.8	20.74	28.43	18.79	-263.51
2022	10	8	23.56	17.94	20.76	29.02	17.7	-261.82
2022	10	9	23.3	17.51	20.4	29.4	17.66	-261.41
2022	10	10	22.78	17.57	20.18	29.25	18.23	-262.13
2022	10	11	22.55	17.72	20.13	28.09	18.36	-263.42
2022	10	12	22.15	17.18	19.66	26.93	18.18	-264.4
2022	10	13	22.65	15.83	19.24	27.56	17.41	-263
2022	10	14	21.9	15.01	18.46	27.4	17.22	-262.97
2022	10	15	21.19	14.17	17.68	27.63	16.76	-262.27
2022	10	16	20.97	13.62	17.3	27.89	15.4	-260.66
2022	10	17	21.57	13.42	17.5	28.4	16.16	-260.91
2022	10	18	21.4	13.36	17.38	27.95	15.83	-261.02
2022	10	19	20.69	14.84	17.76	27.25	15.71	-261.61
2022	10	20	18.89	14.07	16.48	24.76	12.83	-261.23
2022	10	21	18.73	10.05	14.39	25.42	12.23	-259.95
2022	10	22	19.21	9.18	14.19	25.33	13.26	-261.09
2022	10	23	20.09	10.63	15.37	26.85	13.8	-260.1
2022	10	24	20.07	11.67	15.87	27.05	14.6	-260.69
2022	10	25	20.78	11.51	16.15	27.32	14.87	-260.7
2022	10	26	20.6	11.93	16.26	27.41	15.12	-260.85
2022	10	27	20.75	11.87	16.31	26.9	15.48	-261.72
2022	10	28	20.83	10.94	15.89	27.23	15.01	-260.92
2022	10	29	19.86	11.12	15.49	26.42	14.69	-261.42
2022	10	30	19.81	12.03	15.92	26.9	14.88	-261.13
2022	10	31	19.93	12.67	16.3	27.43	14.72	-260.45
2022	11	1	19.83	12.91	16.37	25.93	14.39	-261.61
2022	11	2	23.04	8.08	15.56	30.97	16.47	-258.65
2022	11	3	23.36	8.42	15.89	30.87	16.13	-258.42
2022	11	4	24.59	7.79	16.19	31.63	18.16	-259.68
2022	11	5	22.45	11.26	16.85	27.74	18.84	-264.25
2022	11	6	21.12	10.91	16.02	27.12	16.49	-262.52
2022	11	7	20.19	10.15	15.17	26.08	14.3	-261.38
2022	11	8	19.19	8.4	13.8	26.97	13.55	-259.74
2022	11	9	17.83	9.18	13.5	24.44	13.23	-261.95

2022	11	10	16.24	9.74	12.99	22.24	12.89	-263.8
2022	11	11	18.02	6.22	12.12	25.38	11.58	-259.35
2022	11	12	18.33	3.58	10.95	26.57	11.4	-257.98
2022	11	13	15.83	5.22	10.52	21.19	11.87	-263.83
2022	11	14	13.79	9.67	11.73	17.69	10.7	-266.17
2022	11	15	14.2	5.73	9.97	21.73	8.6	-260.03
2022	11	16	16.05	5.1	10.58	23.36	9.73	-259.52
2022	11	17	15.69	2.89	9.29	23.36	8.91	-258.7
2022	11	18	-999	-999	-999	-999	-999	-999
2022	11	19	-999	-999	-999	-999	-999	-999
2022	11	20	-999	-999	-999	-999	-999	-999
2022	11	21	15.89	1.66	8.77	24.81	7.93	-256.27
2022	11	22	14.87	-0.15	7.37	24.01	6.75	-255.88
2022	11	23	16.52	-2.07	7.23	25.44	8.3	-256
2022	11	24	16.99	0.04	8.51	27.37	10.86	-256.63
2022	11	25	17.63	1.12	9.37	25.62	11.01	-258.53
2022	11	26	17.55	0.91	9.23	25.4	10.73	-258.48
2022	11	27	17.05	1.54	9.3	24.83	10.99	-259.31
2022	11	28	17.06	1.9	9.48	24.73	10.48	-258.88
2022	11	29	17.01	1.94	9.48	24.51	11.88	-260.52
2022	11	30	16.84	1.08	8.96	24.6	10.12	-258.67
2022	12	1	17.65	1.34	9.5	25.51	10.6	-258.24
2022	12	2	16.11	3.42	9.76	24.33	9.97	-258.79
2022	12	3	15.55	4.38	9.97	23.13	9.59	-259.61
2022	12	4	16.23	3.3	9.77	23.76	10.1	-259.49
2022	12	5	16.2	1.98	9.09	23.82	10.28	-259.61
2022	12	6	16.55	1.37	8.96	23.75	11.7	-261.1
2022	12	7	15.6	0.95	8.28	23.95	8.91	-258.11
2022	12	8	14.26	1.88	8.07	20.24	10.1	-263.01
2022	12	9	14.72	4.37	9.54	23.03	8.27	-258.38
2022	12	10	14.97	4.36	9.66	22.43	10.02	-260.74
2022	12	11	14.8	2.06	8.43	23.26	9.03	-258.92
2022	12	12	15.64	0.22	7.93	22.85	10.23	-260.53
2022	12	13	14.01	-0.2	6.9	22.69	8.62	-259.08
2022	12	14	14.29	-5.19	4.55	23.92	6.8	-256.03
2022	12	15	15.83	-6.68	4.57	24.75	8.66	-257.06
2022	12	16	16.55	-5.23	5.66	25.26	10.17	-258.07
2022	12	17	16.01	-5.06	5.48	25.16	9.12	-257.1
2022	12	18	15.73	-3.87	5.94	24.19	9.56	-258.52
2022	12	19	14.96	-2.2	6.38	22.49	8.87	-259.52
2022	12	20	14.51	-1.85	6.33	22.2	9.33	-260.28
2022	12	21	13.46	-2.27	5.6	21.37	8.52	-260.3
2022	12	22	12.83	-6.07	3.38	21.58	6.54	-258.1
2022	12	23	11.76	-7.38	2.19	19.97	6.41	-259.59
2022	12	24	10.41	-5.3	2.55	17.65	5.19	-260.69
2022	12	25	10.48	-6.88	1.8	17.51	4.66	-260.3
2022	12	26	12.22	-7.03	2.59	20.66	6.08	-258.57

2022	12	27	11.48	-5.35	3.07	18.96	5.37	-259.56
2022	12	28	13.26	-6.26	3.5	20.8	6.44	-258.79
2022	12	29	12.5	0.15	6.33	19.04	8.36	-262.47
2022	12	30	10.37	4.91	7.64	16.63	6.6	-263.11
2022	12	31	10.82	-1.1	4.86	19.26	4.65	-258.55

PRECIPITATION AND HUMIDITY DATA IN JHANDIAL

Dates (month/day/year): 01/01/2022 through 12/31/2022

Location: Latitude 33.3819 Longitude 72.5597

Elevation from MERRA-2: Average for 0.5 x 0.625 degree lat/lon region = 447.46 meters

The value for missing source data that cannot be computed or is outside of the sources availability range

Parameter(s):

PRECTOTCORR MERRA-2 Precipitation Corrected (mm/day)

RH2M MERRA-2 Relative Humidity at 2 Meters (%)

PS MERRA-2 Surface Pressure (kPa)

QV2M MERRA-2 Specific Humidity at 2 Meters (g/kg)

YEAR	MO	DY	PRECTOTC	RH2M	PS	QV2M
2022	1	1	0	55.12	96.96	4.27
2022	1	2	0	66.88	96.89	4.88
2022	1	3	1.12	71.06	96.74	5.62
2022	1	4	10.33	90.44	96.7	7.08
2022	1	5	31.92	94.62	96.41	6.53
2022	1	6	0.76	86.75	96.54	6.41
2022	1	7	16.63	86.38	96.33	6.96
2022	1	8	47.79	92	96.18	6.96
2022	1	9	0.93	88.06	96.49	6.23
2022	1	10	0	81.75	96.61	5.43
2022	1	11	0	69.38	96.71	4.39
2022	1	12	0	60.31	96.56	3.91
2022	1	13	0	54.5	96.52	4.03
2022	1	14	0	59.44	96.66	4.39
2022	1	15	0	58.44	96.75	4.33
2022	1	16	0	61.44	96.77	4.82
2022	1	17	0.01	69.88	96.86	5.25
2022	1	18	0.78	64.44	96.7	5.62
2022	1	19	1.92	78.31	96.37	6.41
2022	1	20	0	82.19	95.99	6.41
2022	1	21	0.57	79.31	95.95	6.04
2022	1	22	20	85.5	95.62	6.16
2022	1	23	16.56	84.31	95.84	6.04
2022	1	24	1.23	78.12	96.2	5.55
2022	1	25	0.12	74.62	96.26	5.37
2022	1	26	0.32	63.12	96.32	4.39
2022	1	27	0	54.94	96.49	4.03
2022	1	28	0	54.75	96.49	4.03
2022	1	29	0	55.5	96.51	4.58
2022	1	30	0	61	96.18	4.76
2022	1	31	0.01	56.5	95.92	4.88
2022	2	1	0.02	66.38	96.09	5.37
2022	2	2	2.32	68.75	95.85	5.49
2022	2	3	1.1	81.06	95.78	6.16
2022	2	4	0.25	80.81	95.72	5.55
2022	2	5	0	73.38	96.17	5.49
2022	2	6	1.22	62.56	96.37	5.37

2022	2	7	0.16	73.56	96.48	5.8
2022	2	8	0	65.5	96.27	5.25
2022	2	9	0.33	61.62	96.4	5.07
2022	2	10	0.01	60	96.63	4.88
2022	2	11	0	55.75	96.47	4.52
2022	2	12	0	50.88	96.22	4.64
2022	2	13	0	58.62	96.15	5.62
2022	2	14	0	68.44	96.21	6.59
2022	2	15	0	67.19	96.2	6.65
2022	2	16	0.01	69.44	96.04	6.9
2022	2	17	0	69.44	96.02	6.65
2022	2	18	0.1	71.88	96.26	6.04
2022	2	19	0	58.25	96.31	5.49
2022	2	20	0	54.69	95.82	5.07
2022	2	21	0	50.75	95.63	4.64
2022	2	22	9.63	63.94	95.79	6.41
2022	2	23	1.67	83.19	96.21	8
2022	2	24	2.44	81.5	96.52	7.81
2022	2	25	11.22	83.44	96.48	7.63
2022	2	26	0.07	71.56	96.67	5.74
2022	2	27	0.47	66.62	96.9	5.62
2022	2	28	6.24	61.75	96.58	5.31
2022	3	1	0.31	68.12	96.56	6.96
2022	3	2	1.49	72	96.56	7.32
2022	3	3	28.87	81.81	96.54	8.06
2022	3	4	0	75.25	96.68	7.26
2022	3	5	0.01	75.94	96.41	7.32
2022	3	6	26.72	84.06	96.19	9.22
2022	3	7	4.86	83.69	96.6	8.61
2022	3	8	0.4	71.62	96.47	7.93
2022	3	9	0	72.5	96.32	9.03
2022	3	10	0	67.25	96.24	8.61
2022	3	11	0	55.88	96.24	8.42
2022	3	12	0	66.75	96.09	9.46
2022	3	13	0	60.5	96.01	10.13
2022	3	14	0	57.38	95.94	10.93
2022	3	15	0	64.19	95.89	11.05
2022	3	16	0	58.44	95.69	9.64
2022	3	17	0	47.31	95.62	9.09
2022	3	18	0.29	68.31	95.7	11.72
2022	3	19	8.74	70.56	95.63	12.15
2022	3	20	0	64.38	95.51	11.11
2022	3	21	0.3	58.69	95.78	9.77
2022	3	22	0	51	95.77	8.54
2022	3	23	0	54.31	95.59	9.03
2022	3	24	1.5	56.81	95.63	9.22
2022	3	25	0	50.25	95.77	8
2022	3	26	0	44.62	95.87	7.2
2022	3	27	0	48.69	95.73	8.3
2022	3	28	0	48.75	95.68	8.48

2022	3	29	0	49.5	95.61	8.61
2022	3	30	0	48.56	95.68	7.75
2022	3	31	0	43.19	95.87	7.32
2022	4	1	0	40.69	95.68	7.45
2022	4	2	0	46.88	95.66	8.18
2022	4	3	0.03	49.88	95.86	8.36
2022	4	4	0	41	95.83	7.39
2022	4	5	0	32.31	96	6.96
2022	4	6	0	33.56	95.97	7.26
2022	4	7	0	38.5	95.88	7.93
2022	4	8	0	41.5	95.65	8.61
2022	4	9	0.01	42.88	95.55	8.97
2022	4	10	0	39.12	95.5	8.79
2022	4	11	0	38.62	95.33	8.79
2022	4	12	0.18	42.94	95.21	9.58
2022	4	13	1.06	51.5	95.38	10.01
2022	4	14	0.51	49.12	95.36	9.58
2022	4	15	0.05	41.94	95.35	8.54
2022	4	16	0	38.69	95.29	8.12
2022	4	17	0	34.81	95.39	7.69
2022	4	18	0	43.88	95.6	9.4
2022	4	19	1.14	51	95.84	10.74
2022	4	20	0.08	55.94	95.74	10.93
2022	4	21	4.92	48.12	95.73	9.34
2022	4	22	3.56	47.88	95.92	9.28
2022	4	23	0	46.19	95.89	8.97
2022	4	24	0.02	43.31	95.68	9.09
2022	4	25	0.39	49.06	95.51	10.56
2022	4	26	0	36.69	95.59	8.06
2022	4	27	0	34.06	95.45	8.12
2022	4	28	0	35.06	95.39	8.79
2022	4	29	0.23	38.75	95.54	9.64
2022	4	30	0.02	40.5	95.14	10.31
2022	5	1	0	34.12	95.02	9.58
2022	5	2	0	33.94	94.94	9.77
2022	5	3	14.49	46.81	95.3	11.05
2022	5	4	8.57	58.44	95.65	11.96
2022	5	5	0	53.25	95.67	10.93
2022	5	6	0.05	43	95.53	10.31
2022	5	7	0	37.75	95.51	9.7
2022	5	8	0	33.62	95.2	9.16
2022	5	9	0	39.19	95.22	10.25
2022	5	10	5.46	41.5	95.35	11.23
2022	5	11	0	37.88	95.11	11.11
2022	5	12	0	32.38	94.98	9.34
2022	5	13	0	29.19	94.86	7.75
2022	5	14	0	23.25	94.77	7.02
2022	5	15	0	24.38	94.74	7.2
2022	5	16	0.05	26.56	94.94	7.69
2022	5	17	0	24.56	94.93	7.14

2022	5	18	7.92	35.12	95.26	9.28
2022	5	19	0	31.5	95.09	9.22
2022	5	20	3.03	42.56	94.91	11.17
2022	5	21	0.63	35.75	94.75	8.97
2022	5	22	0	26.88	94.47	6.47
2022	5	23	0.18	29.69	94.84	6.04
2022	5	24	0	34.44	95.37	7.39
2022	5	25	0	36.44	95.45	9.34
2022	5	26	0	26.94	95.15	8.24
2022	5	27	0	27.31	94.87	9.03
2022	5	28	2.1	26.06	94.81	7.81
2022	5	29	0.97	28.88	94.84	8.18
2022	5	30	0.05	30.88	95	8.97
2022	5	31	1.57	28.69	95.04	8.61
2022	6	1	0.12	24.38	95.16	6.96
2022	6	2	0.13	22.5	95.08	6.47
2022	6	3	0	16.56	94.89	5.13
2022	6	4	0	14.81	94.89	4.64
2022	6	5	0	13.75	94.92	4.64
2022	6	6	0	12.62	94.85	4.64
2022	6	7	0	12.81	94.73	4.88
2022	6	8	0	13.88	94.68	5.37
2022	6	9	0	13.88	94.56	5.13
2022	6	10	0.8	14.56	94.7	5.55
2022	6	11	0.22	16.56	94.8	6.16
2022	6	12	0	15.19	94.84	6.1
2022	6	13	5.34	23.25	95.16	8.36
2022	6	14	0.31	25.75	94.93	9.77
2022	6	15	0	24.5	94.62	9.64
2022	6	16	0.09	24.5	94.68	9.52
2022	6	17	26.72	40.56	94.86	13.12
2022	6	18	17.64	55	94.97	14.83
2022	6	19	18.39	67	95.07	15.81
2022	6	20	3.58	65.25	94.92	13.92
2022	6	21	40.66	79.5	94.83	14.04
2022	6	22	19.78	70	95.47	13.55
2022	6	23	0	52.38	95.54	11.72
2022	6	24	0	44.69	95.14	11.6
2022	6	25	0	46.12	94.87	12.57
2022	6	26	0	45.81	94.99	13.12
2022	6	27	0	46.62	95.07	14.34
2022	6	28	0	49.19	94.73	15.93
2022	6	29	0	49	94.41	15.75
2022	6	30	0	53	94.51	17.33
2022	7	1	11.88	63.19	94.79	18.68
2022	7	2	8.87	69.38	94.71	19.96
2022	7	3	0.25	66.75	94.75	20.45
2022	7	4	3.52	66.62	94.72	20.87
2022	7	5	40.39	77.06	94.81	22.03
2022	7	6	8.74	77.94	95.11	22.34

2022	7	7	22.22	81.25	95.27	21.36
2022	7	8	27.51	76	94.97	21.3
2022	7	9	6.96	70.25	94.76	19.53
2022	7	10	37.68	77.62	94.92	20.32
2022	7	11	13.67	76.56	95.05	20.08
2022	7	12	25.59	77.81	94.95	20.32
2022	7	13	40.49	77.88	94.71	21.97
2022	7	14	11.5	76.75	94.91	20.26
2022	7	15	4.71	75.12	95.2	18.74
2022	7	16	1.99	68.25	95.19	18.43
2022	7	17	2.73	73.69	95.42	19.35
2022	7	18	0.14	71.12	95.17	19.35
2022	7	19	0.14	71.5	94.9	20.26
2022	7	20	5.92	74.62	94.7	22.16
2022	7	21	19.83	82.81	94.97	22.22
2022	7	22	6.49	84.31	95.31	19.9
2022	7	23	2.54	79.56	95.27	18.86
2022	7	24	3.63	88.88	95.26	20.57
2022	7	25	28.2	85.19	95.4	20.51
2022	7	26	6.21	84.56	95.48	20.51
2022	7	27	0.76	81.38	95.34	20.63
2022	7	28	20.11	84.5	95.3	21.48
2022	7	29	66.37	87.06	95.23	21.36
2022	7	30	17.67	83.44	95.04	21.48
2022	7	31	12.84	82.75	94.83	21
2022	8	1	12.63	78.19	94.98	19.78
2022	8	2	1.56	74.81	94.95	19.78
2022	8	3	0	74.5	95.09	20.08
2022	8	4	1.09	72.94	95.09	20.39
2022	8	5	2.52	81.94	95.03	21.3
2022	8	6	3.64	80.75	94.89	20.69
2022	8	7	0.09	80.31	94.82	21.06
2022	8	8	1.3	82.75	94.88	21.85
2022	8	9	4.07	81.94	94.94	22.03
2022	8	10	0.97	74.75	94.8	21.12
2022	8	11	1.55	80.56	94.95	20.94
2022	8	12	3.41	73.81	95.13	17.09
2022	8	13	0.9	69.62	94.91	19.41
2022	8	14	9.46	77.94	95.05	21.61
2022	8	15	30.3	87.5	95.29	21.85
2022	8	16	2.49	75	95.32	18.86
2022	8	17	16.29	74.62	95.32	18.74
2022	8	18	1.27	73.88	95.16	18.49
2022	8	19	0.45	74	95.02	19.65
2022	8	20	6.59	79.88	95.09	20.57
2022	8	21	7.5	81.25	95.17	19.35
2022	8	22	0.03	68.75	94.98	17.52
2022	8	23	1.16	70.62	95.15	19.04
2022	8	24	32.1	87.25	95.46	20.08
2022	8	25	44.97	85.75	95.4	20.14

2022	8	26	2.9	84.12	95.37	19.29
2022	8	27	12.44	73.75	95.23	18.01
2022	8	28	1.9	71.5	95.2	18.31
2022	8	29	2.97	71.81	95.53	18.43
2022	8	30	0.25	71.12	95.68	18.31
2022	8	31	0.09	73	95.41	19.29
2022	9	1	0	74.12	95.36	19.71
2022	9	2	0	73.31	95.49	19.71
2022	9	3	0.38	78.69	95.16	20.32
2022	9	4	8.93	79.31	95.03	19.41
2022	9	5	29.83	83.75	95.32	19.17
2022	9	6	5.97	72.94	95.53	17.21
2022	9	7	0	77.5	95.67	19.23
2022	9	8	0	77.25	95.73	19.71
2022	9	9	0.94	74.06	95.66	19.04
2022	9	10	15.97	76.31	95.55	19.29
2022	9	11	30.33	80.88	95.4	19.1
2022	9	12	29	78.94	95.33	18.19
2022	9	13	0.15	74.94	95.37	18.01
2022	9	14	0	72.88	95.41	17.82
2022	9	15	0	75.94	95.2	18.01
2022	9	16	7.5	81.62	94.92	18.49
2022	9	17	23.03	80.75	95.14	18.13
2022	9	18	0.09	75.31	95.48	16.72
2022	9	19	0	74.69	95.5	17.09
2022	9	20	0	77.25	95.52	17.64
2022	9	21	0	75.88	95.48	17.94
2022	9	22	0.59	77.81	95.5	17.82
2022	9	23	0.02	76.81	95.43	17.64
2022	9	24	2.8	81.88	95.29	17.82
2022	9	25	11.63	85.19	95.27	17.7
2022	9	26	1.26	81	95.79	16.85
2022	9	27	0	77.12	95.6	16.48
2022	9	28	0	75.69	95.52	16.17
2022	9	29	0	73	95.53	16.11
2022	9	30	0	72.88	95.53	15.81
2022	10	1	12.7	77.62	95.42	16.3
2022	10	2	2.26	74.5	95.55	15.62
2022	10	3	0.01	72	95.65	14.65
2022	10	4	0.15	68.56	95.79	14.59
2022	10	5	0	65.81	95.68	13.37
2022	10	6	0.05	70.94	95.73	13.67
2022	10	7	1.69	70.75	95.86	13.37
2022	10	8	0	72	95.89	13.49
2022	10	9	0	71.62	95.91	13.06
2022	10	10	0.07	74.38	95.98	13.12
2022	10	11	1.18	75.5	95.86	13.24
2022	10	12	4.18	74.31	96.03	12.82
2022	10	13	0	66.81	96.12	11.78
2022	10	14	0	65.94	96.1	11.11

2022	10	15	0	66.25	95.98	10.56
2022	10	16	0	64.56	96.21	10.19
2022	10	17	0	61.62	96.18	10.01
2022	10	18	0	61.88	96	10.01
2022	10	19	7.98	71.06	96	11.05
2022	10	20	0.39	74.56	96.24	10.5
2022	10	21	0.96	59.62	96.59	8
2022	10	22	0	53.62	96.58	7.57
2022	10	23	0	55.69	96.47	8.36
2022	10	24	0	59.81	96.06	8.97
2022	10	25	0	56.69	95.85	8.91
2022	10	26	0	59.19	96.13	9.09
2022	10	27	0	58.12	96.21	9.09
2022	10	28	0	55.12	96.21	8.54
2022	10	29	0	58.5	96.22	8.67
2022	10	30	0	62.25	96.28	9.16
2022	10	31	0	65.19	96.26	9.52
2022	11	1	1.11	65.94	96.31	9.7
2022	11	2	0	40.06	96.27	7.02
2022	11	3	0	42.19	96.1	7.26
2022	11	4	0	35.12	96.17	6.96
2022	11	5	1.13	50.69	96.41	8.67
2022	11	6	0.11	54.12	96.44	8.48
2022	11	7	8.42	55.69	96.39	8.12
2022	11	8	0	52.75	96.43	7.14
2022	11	9	0.45	59.44	96.48	7.57
2022	11	10	10.13	67.88	96.68	7.81
2022	11	11	0	49.56	96.6	6.16
2022	11	12	0	40.5	96.49	5.19
2022	11	13	0.04	50.69	96.35	5.8
2022	11	14	4.53	76.69	96.57	7.75
2022	11	15	0	60.12	96.59	5.98
2022	11	16	0	50.69	96.33	5.74
2022	11	17	0	45.31	96.36	4.94
2022	11	18	-999	-999	-999	-999
2022	11	19	-999	-999	-999	-999
2022	11	20	-999	-999	-999	-999
2022	11	21	0	42.94	96.28	4.52
2022	11	22	0	39.62	96.3	3.97
2022	11	23	0	30.44	96.29	3.48
2022	11	24	0	34	96.16	4.03
2022	11	25	0	35.19	96.47	4.33
2022	11	26	0	34.88	96.18	4.27
2022	11	27	0	36.81	95.94	4.52
2022	11	28	0	38.06	96.11	4.58
2022	11	29	0	38.25	96.35	4.58
2022	11	30	0	36.31	96.44	4.33
2022	12	1	0	35	96.28	4.46
2022	12	2	0	45	96.14	5.13
2022	12	3	0	49.75	96.35	5.43

2022	12	4	0	44.56	96.39	5.07
2022	12	5	0	39.94	96.49	4.58
2022	12	6	0	38.06	96.46	4.39
2022	12	7	0	39.44	96.39	4.27
2022	12	8	0.06	44.81	96.41	4.58
2022	12	9	0.02	53.31	96.38	5.43
2022	12	10	0.03	51.31	96.46	5.43
2022	12	11	0	44.75	96.55	4.58
2022	12	12	0	36.81	96.43	4.03
2022	12	13	0	39.75	96.62	3.91
2022	12	14	0	29.75	96.4	2.75
2022	12	15	0	21.94	96.23	2.44
2022	12	16	0	23.38	96.1	2.75
2022	12	17	0	24.88	96.33	2.75
2022	12	18	0	27.31	96.36	2.99
2022	12	19	0	32.06	96.25	3.42
2022	12	20	0	33.94	96.21	3.48
2022	12	21	0	35.19	96.35	3.36
2022	12	22	0	28.69	96.31	2.56
2022	12	23	0	26.81	96.2	2.32
2022	12	24	0	34.06	96.51	2.69
2022	12	25	0	30.75	96.5	2.38
2022	12	26	0	26.88	96.68	2.38
2022	12	27	0	31.88	96.68	2.69
2022	12	28	0	27.12	96.53	2.5
2022	12	29	1.85	48	96.62	4.27
2022	12	30	0.19	71.31	96.89	5.62
2022	12	31	0	50.5	96.74	3.72

WIND SPEED AND DIRECTION IN JHANDIAL

Dates (month/day/year): 01/01/2022 through 12/31/2022

Location: Latitude 33.3819 Longitude 72.5597

Elevation from MERRA-2: Average for 0.5 x 0.625 degree lat/lon region = 447.46 meters

The value for missing source data that cannot be computed or is outside of the sources availability range: -999

Parameter(s):

WD50M MERRA-2 Wind Direction at 50 Meters (Degrees)

WS50M_RANGE MERRA-2 Wind Speed at 50 Meters Range (m/s)

WS10M MERRA-2 Wind Speed at 10 Meters (m/s)

WD10M MERRA-2 Wind Direction at 10 Meters (Degrees)

WS50M MERRA-2 Wind Speed at 50 Meters (m/s)

WS10M_RANGE MERRA-2 Wind Speed at 10 Meters Range (m/s)

YEAR	MO	DY	WD50M	WS50M_R/	WS10M	WD10M	WS50M	WS10M_R/
2022	1	1	167.5	4.22	1.54	167.25	2.25	2.31
2022	1	2	281.56	2.21	2.74	280.94	4.06	0.82
2022	1	3	181.25	6.34	3.03	196.31	4.87	3.8
2022	1	4	105.06	4.16	2.77	104.56	4.66	2.44
2022	1	5	152.56	2.98	2.73	152.31	4.22	2.82
2022	1	6	31.75	1.79	1.97	30.06	2.82	1
2022	1	7	57.31	3.82	2.77	56.69	4.32	3.63
2022	1	8	196.38	4.98	1.68	198.25	2.51	3.5
2022	1	9	131.62	3.13	1.91	131.44	2.61	2.29
2022	1	10	256.81	5.05	1.49	256.69	2.22	2.86
2022	1	11	325.75	2.34	2.95	325.19	4.39	2.07
2022	1	12	199.75	3.73	2.34	198.75	3.49	1.86
2022	1	13	215.38	2.85	1.77	243.38	2.45	1.64
2022	1	14	190.38	2.05	2.31	189.81	3.19	1.99
2022	1	15	184.12	3.13	1.75	183.75	2.5	1.83
2022	1	16	192.31	2.81	1.65	191.75	2.27	2.17
2022	1	17	167.06	4.82	1.86	166.75	2.7	2.77
2022	1	18	294.88	3.9	1.88	295.69	2.51	3.34
2022	1	19	103.62	3.85	1.57	103.75	2.09	3.12
2022	1	20	291.5	3.59	2.05	291	2.93	1.84
2022	1	21	131.62	6.66	1.73	131.94	2.73	2.96
2022	1	22	225.38	5.18	2.75	225.12	4.68	2.75
2022	1	23	169.38	4.41	2.16	184.06	3.08	3.59
2022	1	24	202.88	2.34	1.41	202.44	1.77	2.17
2022	1	25	270	2.12	2.07	270	2.7	2.2
2022	1	26	192.25	2.5	1.61	191.94	2.09	2.31
2022	1	27	196.5	2.66	1.87	197.12	2.5	1.9
2022	1	28	180.69	3.15	1.95	180.44	2.68	2.11
2022	1	29	145.75	2.24	1.67	145.94	2.25	1.3
2022	1	30	182.75	4.3	2.33	182.56	3.29	3.48
2022	1	31	110.25	4.38	1.51	111.62	2.22	2.74

2022	2	1	198	1.62	2.66	197.62	3.73	1.84
2022	2	2	146.62	7.75	2.8	161.12	4.13	4.66
2022	2	3	173.38	5.25	2.57	173.12	4.19	2.74
2022	2	4	92.19	3.69	1.95	92.75	2.54	2.31
2022	2	5	148.75	3.34	1.77	148.94	2.35	2.55
2022	2	6	108.44	4.11	1.59	109.19	2.25	2.35
2022	2	7	233.62	5.12	2.89	232.75	4.69	1.88
2022	2	8	210.81	2.87	2.09	210.44	2.97	1.59
2022	2	9	225.5	2.41	2.26	225.12	3.11	1.43
2022	2	10	187.5	1.91	2.47	187.69	3.44	1.88
2022	2	11	220.19	4.4	2.7	219.94	3.75	3.79
2022	2	12	153.38	3.28	1.92	153.12	2.66	2.11
2022	2	13	131	4.13	1.98	131	2.88	2.32
2022	2	14	253.56	2.34	2.21	253.38	3.16	2.17
2022	2	15	118.12	2.45	1.54	118.81	2.07	1.26
2022	2	16	119	3.27	1.85	119.12	2.6	1.82
2022	2	17	123.19	4.04	2.14	123.81	3.21	2.04
2022	2	18	218.62	3.63	3.28	218.5	5	3.39
2022	2	19	215.38	3.14	2.05	215.94	2.9	1.5
2022	2	20	236.94	4.14	3.31	237.06	4.77	3.68
2022	2	21	265.94	6.29	2.47	265.5	3.69	3.63
2022	2	22	150.94	9.19	3.45	151.12	5.65	6.54
2022	2	23	110.38	5.48	2.62	109.94	4.19	4.44
2022	2	24	114	4.96	2.02	116.94	3.23	2.45
2022	2	25	102.69	4.37	2.25	101.44	3.52	3.04
2022	2	26	232.44	4.33	2.03	231	2.56	3.4
2022	2	27	239	2.88	2.32	238.44	3.24	1.72
2022	2	28	266	4.96	2.07	266.12	3.03	2.86
2022	3	1	113	7.59	2.37	113.44	3.94	2.81
2022	3	2	189.75	2.94	2.56	204.06	3.88	1.61
2022	3	3	126.44	2.49	2.21	126.38	2.99	2.46
2022	3	4	183	3.42	2.42	182.62	3.42	2.15
2022	3	5	253.38	6.97	2.47	253	4.38	2.81
2022	3	6	207.94	5.55	2.13	208	3.34	2.52
2022	3	7	128.19	7.1	3.8	126.19	5.56	4.97
2022	3	8	246	4.02	2.34	245.62	3.59	1.6
2022	3	9	221.38	8.39	2.5	222.44	3.91	5.75
2022	3	10	273.81	6.07	2.36	288.81	3.66	3.21
2022	3	11	207.5	4.34	1.89	207.56	2.57	3.57
2022	3	12	282.75	5.67	2.46	282.19	3.95	2.15
2022	3	13	281.06	4.99	2.11	280.69	3.04	2.82
2022	3	14	160.06	2.95	1.56	159.12	2.1	2.05
2022	3	15	249.62	6.31	2.69	249.5	4.08	2.97
2022	3	16	248.06	2.17	2.99	247.75	4.42	2.2
2022	3	17	190.75	3.64	1.85	189.12	2.59	2.23
2022	3	18	99.81	3.8	3.5	99.06	5.77	2.11
2022	3	19	195.31	4.87	2.23	193.25	3.63	1.91

2022	3	20	152.25	3.29	2.09	151.62	3.03	1.82
2022	3	21	135.44	3.33	2.12	134.62	3.14	1.45
2022	3	22	145.31	3.91	2	145.06	2.84	2.21
2022	3	23	97.25	4.95	2.1	97.19	3.27	2.52
2022	3	24	212.38	4.6	2.21	211.88	3.1	2.95
2022	3	25	256.69	3.12	2.07	255.94	2.84	2.3
2022	3	26	259.56	4.2	2.18	274.5	3.05	2.85
2022	3	27	105	5.8	2.39	104.56	3.85	3.02
2022	3	28	92.94	5.39	2.7	92.5	4.3	2.69
2022	3	29	192.56	9.05	2.73	194.06	4.62	3.55
2022	3	30	262.31	9.21	3.12	263.5	5.05	5.59
2022	3	31	286.19	4.52	2.54	285.44	3.61	2.69
2022	4	1	265.31	4.98	2.16	265.5	3.04	3.02
2022	4	2	99.12	4.22	3.15	98.38	4.86	2.41
2022	4	3	289.88	4.48	2.93	289.25	4.24	2.96
2022	4	4	160	5.18	2.49	160.19	3.52	3
2022	4	5	189.44	2.27	1.34	189.5	1.71	1.62
2022	4	6	142.44	4.39	1.56	143.06	2.12	2.66
2022	4	7	128.62	4.88	2.16	129.56	3.2	2.81
2022	4	8	128.94	5.62	2.21	129.81	3.31	2.67
2022	4	9	145	6.14	2.64	146.25	4.05	3.08
2022	4	10	165.81	5.2	2.2	165.62	3.12	2.98
2022	4	11	145.12	6.28	2.03	145.56	3.02	3.26
2022	4	12	77.06	7.02	2.58	75	4.51	2.61
2022	4	13	268.94	4.7	3.17	268.06	4.69	3.77
2022	4	14	179.75	3.16	3.4	179.56	4.81	2.93
2022	4	15	178.5	3.33	1.68	177.12	2.33	2.1
2022	4	16	178.94	3.65	2.05	178.75	2.78	2.2
2022	4	17	167.25	3.72	1.82	165.88	2.43	2.62
2022	4	18	221.94	7.35	3.03	221.94	4.95	2.83
2022	4	19	292.81	7.33	2.94	293.19	4.88	3.72
2022	4	20	321.81	9.45	4.05	321.75	5.92	8.37
2022	4	21	153.25	9.14	3.59	152.88	4.95	7.73
2022	4	22	144.88	3.28	2.23	145.12	2.97	2.22
2022	4	23	142.06	3.48	2.44	142.5	3.4	1.7
2022	4	24	141	2.65	2.52	141.5	3.53	1.59
2022	4	25	44.31	6.42	3.25	44.06	4.71	3.99
2022	4	26	164	3.32	2.3	164	3.2	2.06
2022	4	27	145.12	2.95	2.47	146.88	3.39	1.27
2022	4	28	81.88	7.07	2.22	83.88	3.58	3.01
2022	4	29	201.88	5.4	2.68	216	4.26	1.48
2022	4	30	299	3.44	2.48	298.44	3.46	2.09
2022	5	1	124.56	3.51	2.2	124.31	3.02	2.36
2022	5	2	101.69	5.32	2.22	100.19	3.41	3.41
2022	5	3	119.5	7.61	3.77	134.5	6.06	4.38
2022	5	4	188.06	5.19	4.2	188.31	6.12	4.36
2022	5	5	266.81	4.45	2.41	266.5	3.09	3.45

2022	5	6	148.38	3.21	1.99	148.62	2.72	1.53
2022	5	7	172.44	3.45	2.16	173.25	2.85	3.11
2022	5	8	164.5	3.71	1.6	166.31	2.2	2.2
2022	5	9	151.06	7.62	2.07	132.69	3.44	3.37
2022	5	10	235.06	7.21	1.95	219.31	2.91	3.3
2022	5	11	168	3.09	1.88	168.31	2.48	2.46
2022	5	12	220.75	2.65	2.28	206	2.91	2.59
2022	5	13	237.81	3.56	3.07	237.94	4.23	2.87
2022	5	14	187.75	2.04	2.29	188.56	2.89	2.23
2022	5	15	147.56	6.78	2.98	144	4.88	2.84
2022	5	16	222.38	6.17	3.98	222.06	5.5	4.47
2022	5	17	157.69	6.38	2.49	158.75	3.9	2.15
2022	5	18	184.44	6.71	2.54	184.25	3.7	3.3
2022	5	19	119.88	8.42	2.09	122.38	3.43	5.46
2022	5	20	294.44	3.98	3.87	293.5	5.48	2.59
2022	5	21	281.56	3.3	3.13	281.25	4.3	2.76
2022	5	22	249.38	8.11	3.73	249.94	5.46	4.65
2022	5	23	176.31	6.94	2.36	189.38	3.41	6.28
2022	5	24	180.75	5.11	1.66	180.12	2.46	2.47
2022	5	25	219.38	4.42	1.99	219.56	2.66	2.87
2022	5	26	196.69	4.09	2.14	196.31	2.69	3.27
2022	5	27	174.88	3.8	2.11	175.75	2.73	2.93
2022	5	28	247.38	3.98	2.41	248.12	3.3	2.83
2022	5	29	176.62	5.17	2.48	179.44	3.59	2.8
2022	5	30	144.38	4.82	2.38	145.75	3.37	3.05
2022	5	31	170.25	5.55	1.96	184.94	2.73	2.42
2022	6	1	169.12	6.66	2.52	168.81	3.63	3
2022	6	2	167.44	4.98	2.13	167.69	3.09	2.55
2022	6	3	163.44	4.62	2.37	164.06	3.23	2.55
2022	6	4	140.25	6.53	2.3	140.88	3.56	3.23
2022	6	5	183.69	6.72	2.2	183.56	3.1	3.23
2022	6	6	193.31	2.49	1.97	194.31	2.44	2.27
2022	6	7	208.88	1.59	2.12	209.19	2.69	1.8
2022	6	8	193.38	3.3	1.93	193.94	2.39	3.08
2022	6	9	165.5	5.35	2.08	166.5	2.89	3.03
2022	6	10	160.81	6.3	2.43	160.44	3.77	2.7
2022	6	11	200.75	5.04	2.43	200.56	3.44	2.84
2022	6	12	148.81	6.92	1.73	148	2.45	3.03
2022	6	13	157.31	7.59	1.96	156.62	2.95	3.46
2022	6	14	199.94	5.09	1.65	199.69	2.45	2.45
2022	6	15	193.19	3.72	3.03	192.25	4.45	1.95
2022	6	16	163.12	3.17	3.12	161.88	4.57	1.9
2022	6	17	182.5	5.01	2.93	181.88	4.41	3.31
2022	6	18	175.81	4.4	2.83	174.06	4.52	1.95
2022	6	19	139.31	2.99	2.67	137.5	3.77	2.49
2022	6	20	63	3.76	3.85	62.81	5.08	4.69
2022	6	21	84.75	8.82	5.06	84.06	6.78	7.75

2022	6	22	241.5	6.62	2.75	241.12	3.82	4.76
2022	6	23	302.62	5.96	2.14	300.75	3.25	2.2
2022	6	24	207.62	2.95	1.47	206.06	1.96	1.81
2022	6	25	178.69	3.43	2.18	177.75	3.2	1.5
2022	6	26	179	4.7	1.72	176.19	2.42	2.57
2022	6	27	154	2.8	1.52	153.62	2.1	1.52
2022	6	28	185.88	4.32	1.73	184.75	2.59	2.39
2022	6	29	157.25	5.45	1.83	158.69	2.95	2.27
2022	6	30	128.12	6.59	3.39	127.81	5.54	2.98
2022	7	1	152.5	5.91	3.4	151.06	4.9	3.21
2022	7	2	216.5	4.2	1.94	215.75	3.05	1.62
2022	7	3	151.94	4.44	2.05	152.38	3.26	2.73
2022	7	4	191.12	5.31	2.03	189.06	3.18	3.2
2022	7	5	184.69	6.93	1.96	185.12	2.68	5.09
2022	7	6	154.5	3.73	1.83	139.5	2.74	2.86
2022	7	7	152	5.65	2.74	151.25	3.91	4.49
2022	7	8	174.75	4.82	2.1	173.69	3.36	1.8
2022	7	9	180.19	4.8	1.47	180.06	2.35	2.45
2022	7	10	131.62	4.53	1.86	131.75	2.89	2.66
2022	7	11	107.19	3.14	2.17	106.12	3.18	2.27
2022	7	12	127.06	3.93	1.6	127.62	2.32	2.6
2022	7	13	133.81	2.05	2.09	133.62	3.12	0.95
2022	7	14	140.31	1.45	1.8	140.19	2.52	1.33
2022	7	15	122.31	3.74	1.99	122.94	3	2.62
2022	7	16	86.44	2.75	1.35	86.69	1.88	1.91
2022	7	17	169.25	3.22	1.87	169.62	2.49	2.19
2022	7	18	242.88	4.91	1.59	242.06	2.24	2.18
2022	7	19	175.44	4.49	1.41	174.06	2.09	1.87
2022	7	20	171.06	4.09	2.14	168.38	3.59	1.32
2022	7	21	159.12	3.08	3.66	158.31	5.48	3.81
2022	7	22	205.81	3.98	1.23	206.69	1.85	1.84
2022	7	23	185.56	3.09	1.57	171.62	2.1	2.52
2022	7	24	128.25	3.3	1.89	128.19	2.78	2.41
2022	7	25	176.31	5.61	2.74	176.19	3.73	4.13
2022	7	26	192	4.4	2.01	191.56	2.85	2.93
2022	7	27	176	3.05	2.33	175.12	3.58	2.29
2022	7	28	183.81	2.65	3.6	183.12	5.39	3.08
2022	7	29	179.31	2.71	4.09	178.75	5.81	3.33
2022	7	30	189.06	3.59	1.98	188.06	3.14	0.95
2022	7	31	183.25	3.74	2.39	182.81	3.96	1.03
2022	8	1	198.75	4.59	1.25	199.31	1.92	2.58
2022	8	2	184.75	1.28	1.1	184.31	1.43	1.03
2022	8	3	192.94	2.76	0.91	192.38	1.3	1.55
2022	8	4	178.38	3.16	1.16	177.31	1.6	1.67
2022	8	5	162.81	2.53	2.82	162.38	4.4	2.53
2022	8	6	213.38	5.18	1.72	212.31	2.67	2.39
2022	8	7	199	2.71	1.66	198.38	2.46	0.89

2022	8	8	181.38	3.74	2.29	180.88	3.45	1.8
2022	8	9	176	3.76	2	175.88	3.05	2.05
2022	8	10	209.12	2.11	1.04	209.06	1.38	1.34
2022	8	11	150.25	7	3.8	149.5	5.25	5.66
2022	8	12	227.5	7.14	2.07	227.62	2.98	5.01
2022	8	13	183	6.54	1.53	180.56	2.41	2.98
2022	8	14	194	6.49	1.78	193.5	2.85	3.18
2022	8	15	158	2.54	2.48	157.31	3.93	1.72
2022	8	16	176.88	4.27	1.27	175.75	1.89	2.41
2022	8	17	181.62	3.4	1.44	180.44	2.23	2.07
2022	8	18	294.31	2.9	1.37	293.62	1.91	2.35
2022	8	19	247.44	3.34	1.31	247.75	1.93	1.28
2022	8	20	207.94	3.29	2.15	207.88	3.34	2.16
2022	8	21	289.38	3.27	1.68	289.88	2.45	2.3
2022	8	22	250.38	3.55	1.27	249.38	1.8	1.83
2022	8	23	60.56	2.84	1.2	60.06	1.68	1.71
2022	8	24	111.06	4.21	2.98	110.81	4.41	3.8
2022	8	25	104	2.8	1.66	103.62	2.64	1.03
2022	8	26	274.75	4.26	1.48	283.94	2.49	2.06
2022	8	27	289.38	4.13	1.35	289.69	1.95	1.8
2022	8	28	273.44	1.85	1.03	274.44	1.35	1.33
2022	8	29	191.31	2.03	1.08	192	1.44	1.22
2022	8	30	163.75	1.49	1.16	176.94	1.6	0.69
2022	8	31	226.19	2.59	1.35	210.31	1.75	2.16
2022	9	1	233.75	2.88	1.37	234.12	1.9	1.7
2022	9	2	202.31	2.16	1.16	201.75	1.51	1.62
2022	9	3	220.56	1.39	2.12	219.75	3.17	1.27
2022	9	4	186.31	1.85	1.7	185.31	2.44	1.47
2022	9	5	141.38	3.25	2.53	140.56	3.77	1.97
2022	9	6	163.81	1.83	0.91	163	1.23	0.86
2022	9	7	206.38	1.12	1.24	206.19	1.71	0.38
2022	9	8	216.75	1.03	1.59	215.69	2.17	1.26
2022	9	9	216.75	3.26	1.5	216.56	2.16	2.3
2022	9	10	188.69	1.41	1.44	187.56	1.97	1.38
2022	9	11	136.94	2.41	1.43	136	1.98	1.66
2022	9	12	227.69	1.75	1.25	227.12	1.74	1.08
2022	9	13	243.19	1.41	0.91	244.19	1.23	0.88
2022	9	14	176.12	1.2	0.69	174.12	0.85	1.06
2022	9	15	163.25	3.9	1.41	163.5	2.16	1.99
2022	9	16	185.31	3.3	1.9	185.19	2.91	2.29
2022	9	17	127.06	3.27	1.3	126	1.98	1.68
2022	9	18	172.06	2.43	1.67	171.75	2.34	1.77
2022	9	19	161.19	3.35	1.34	160.44	1.93	1.77
2022	9	20	120.56	5.72	1.49	120.75	2.55	2.55
2022	9	21	181.38	2.97	1.48	181	2.17	1.64
2022	9	22	165.75	2.98	1.6	164.94	2.44	1.65
2022	9	23	173.12	3.69	1.39	172.62	2.22	2.03

2022	9	24	167.81	5.15	2.11	167	3.57	1.84
2022	9	25	196.94	2.77	2.34	196.12	3.71	1.8
2022	9	26	183.81	4.9	1.78	183.25	2.97	1.94
2022	9	27	192.88	2.21	1.27	192.38	1.62	1.98
2022	9	28	173.75	1.85	1.3	173.31	1.84	1.36
2022	9	29	164.38	1.96	1.15	164.62	1.51	1.46
2022	9	30	158.06	3.21	0.98	158.81	1.4	2.41
2022	10	1	139.06	3.41	1.9	138.5	3.05	1.34
2022	10	2	133.62	3.21	1.36	131.69	2.04	1.66
2022	10	3	96.81	3.47	1.34	97	2.04	1.95
2022	10	4	226.38	3.2	1.55	211.31	2.06	2.45
2022	10	5	133.44	3.82	1.38	133.56	2.01	2.12
2022	10	6	101.06	3.73	2.16	100.56	3.28	1.99
2022	10	7	164.31	3.11	1.98	163.38	2.89	2.1
2022	10	8	198.88	5.84	1.91	197.94	3.09	2.41
2022	10	9	170.31	4.28	1.6	168.94	2.44	2.41
2022	10	10	168.69	3.58	2.01	167.62	3.22	1.39
2022	10	11	172.69	3.95	1.84	172.06	2.86	1.8
2022	10	12	163.5	2.2	1.23	164.12	1.66	1.45
2022	10	13	128.19	1.84	0.77	123.69	1.02	1.42
2022	10	14	139.25	1.71	1.3	139.31	1.75	1.27
2022	10	15	162.44	3.69	1.91	162	2.72	1.98
2022	10	16	150.56	5.1	1.95	150.06	2.97	2.51
2022	10	17	138.06	4.76	1.73	138.12	2.56	2.34
2022	10	18	129.5	4.25	1.52	130.12	2.23	2.34
2022	10	19	103.06	5.05	2.17	102.5	3.49	2.32
2022	10	20	116.19	4.31	2.41	114.94	3.61	2.66
2022	10	21	137.56	4.39	2.03	138	3.02	2.95
2022	10	22	110.56	3.85	1.52	110.19	2.12	2.42
2022	10	23	108.94	2.78	1.46	109.06	2.02	1.77
2022	10	24	134.25	2.07	1.9	134.06	2.66	1.24
2022	10	25	181.5	3.05	1.84	181.69	2.52	2.47
2022	10	26	122.06	3.91	1.86	122	2.71	2.33
2022	10	27	167.81	3.87	1.8	167.69	2.52	2.49
2022	10	28	142	3.39	1.57	141.44	2.22	2
2022	10	29	155.62	4.16	1.95	155.56	2.88	2.15
2022	10	30	160.06	3.72	2.16	159.69	3.23	2.02
2022	10	31	95.88	5.2	1.98	94.81	3.22	2.81
2022	11	1	134.88	4.87	2.19	134.44	3.37	2.46
2022	11	2	205.44	5.99	2.26	205.31	3.47	2.31
2022	11	3	258.25	5.87	2.71	257.88	4.11	2.76
2022	11	4	157	2.62	1.5	157.5	1.99	1.95
2022	11	5	69	7.72	3.66	68.44	5.29	5.71
2022	11	6	46.31	4.72	2.12	44.31	3.56	3.09
2022	11	7	47.31	4.26	1.88	48.56	2.73	3.22
2022	11	8	109.06	4.3	1.64	106.75	2.47	2.52
2022	11	9	129.94	5.65	2.77	129.19	4.5	3.47

2022	11	10	234.69	5.68	3.36	234.06	4.66	5.16
2022	11	11	154	3.32	1.89	154.25	2.55	2.23
2022	11	12	158.25	3.56	1.93	143.19	2.61	2.51
2022	11	13	100.44	6.02	2.3	99.94	3.98	2.33
2022	11	14	80.12	4.49	3.02	78.56	4.55	2.54
2022	11	15	342.38	4.66	2.59	340.94	4.02	3.58
2022	11	16	279.06	3.59	1.91	279.12	2.62	2.03
2022	11	17	210.25	5.47	2.95	210.06	3.86	4.98
2022	11	18	-999	-999	-999	-999	-999	-999
2022	11	19	-999	-999	-999	-999	-999	-999
2022	11	20	-999	-999	-999	-999	-999	-999
2022	11	21	324	3.15	2.45	323.94	3.45	2.05
2022	11	22	326.88	3.02	3.04	326.56	4.18	3.15
2022	11	23	214.06	3.15	1.95	214.12	2.66	1.92
2022	11	24	165.88	3.91	1.73	165.62	2.48	2.53
2022	11	25	143.19	3.73	1.41	143.25	1.88	2.47
2022	11	26	160.06	2.95	1.41	160.25	1.84	2.12
2022	11	27	175.38	2.34	1.23	175.25	1.6	1.62
2022	11	28	148.94	1.71	1.17	148.06	1.52	1.01
2022	11	29	179.75	1.54	1.64	179.69	2.12	1.63
2022	11	30	197.38	1.91	1.42	197.12	1.84	1.41
2022	12	1	194.38	2.06	1.4	194.12	1.84	1.52
2022	12	2	133.94	3.58	2.12	134.06	3.05	2.19
2022	12	3	142	4.72	1.91	142.31	2.91	2.66
2022	12	4	164.44	2.81	1.54	163.69	2.09	1.78
2022	12	5	149.44	2.76	1.48	148.38	1.97	1.92
2022	12	6	179.44	2.3	1.27	180.5	1.68	1.38
2022	12	7	189.88	3.2	2.24	189.94	3	3.07
2022	12	8	44.56	7.72	2.13	73.5	3.73	3.5
2022	12	9	135.25	5.71	2.28	135.88	3.68	2.37
2022	12	10	74.62	6.15	2.44	75.5	4.02	3.13
2022	12	11	209.06	4.31	2.36	208.56	3.48	1.72
2022	12	12	184.81	1.98	1.35	185.56	1.79	1.34
2022	12	13	262.12	3.47	2.89	262.06	4.12	2.05
2022	12	14	303.5	4.7	2.72	303.12	4.04	3.04
2022	12	15	229.94	3.4	2.14	229.75	2.88	3.09
2022	12	16	173.44	3.75	1.79	173.69	2.38	2.92
2022	12	17	199.06	3.48	2.12	198.94	2.84	2.53
2022	12	18	124.25	3.35	1.59	139.06	2.18	2.12
2022	12	19	200.81	2.05	1.36	200.88	1.79	1.27
2022	12	20	188.19	2.52	1.72	187.88	2.31	1.53
2022	12	21	233.06	2.73	1.76	232.62	2.37	1.65
2022	12	22	217.5	2.37	1.8	216.56	2.45	1.46
2022	12	23	197.75	3.14	1.75	197.25	2.4	1.91
2022	12	24	217.12	2.25	1.72	216.06	2.28	1.44
2022	12	25	226.81	3.14	1.95	226.56	2.65	2.35
2022	12	26	278.62	1.7	1.98	277.31	2.71	1.02

2022	12	27	180.06	3.94	2.23	194.94	3.16	2.53
2022	12	28	167.12	1.93	1.18	167.38	1.52	1.46
2022	12	29	113.94	6.55	2.45	113.88	3.46	4.59
2022	12	30	267.31	3.02	2.28	266.88	3.3	1.77
2022	12	31	281.75	2.07	2.62	281.44	3.62	2.32