Communication &
Works Department

COMMUNICATION AND WORKS DEPARTMENT (CWD) PUNJAB

ENVIRONMENTAL IMPACT ASSESSMENT (EIA) OF DUALIZATION AND REHABILITATION OF EXISTING FAISALABAD-CHINIOT-SARGODHA ROAD SECTION (67KM)




DECEMBER 2020

ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

(VOLUME 01 OF 02)

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Geotechnical & Geoenvironmental Engineering Division

Consultant

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02								

DISCLAIMER

This report has been prepared based on the Project information available to NESPAK. Environment team of NESPAK is not responsible or control over the changes in the project design data which may require update of this report in future.

ACKNOWLEDGEMENT

NESPAK wish to express their appreciation and gratitude for the co-operation, assistance and hospitality provided by Government and Non-Governmental Organizations (NGO's) and the locals and Provincial departments of Punjab including but not limited to the Communication and Works Department (CWD), Punjab Environmental Protection Departments, Forest, Wildlife, Agriculture and other line Departments for the completion of this Study.

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LIST OF ABBREVIATONS

BCP	Buildig Code of Pakistan
CDA	Canal and Drainage Act 1873
CDM	Clean Development Mechanisms
CWD	Communication and Works Department
CCMP	Construction Camp Management Plan
COVID-19	Coronavirus disease
CoI	Corridor of Impact
CCI	Council of Common Interest
ECO	Economic Cooperation Organization
EIA	Environmental Impact Assessments
EMP	Environmental Management Plan
EMMM	Environmental Mitigation and Management Matrix
EPA	Environmental Protection Agency
EPD	Environmental Protection Department
FGDs	Focused Group Discussions
GHG	Global Greenhouse Gas
GoP	Government of Pakistan
GoPb	Government of Punjab
HCS	Highway Capacity Software
IEE	Initial Environmental Examination
IGF	Inspector General Forestry
ILO	International Labour Organization
KPH	Kilometres Per Hour
LAA	Land Acquisition Act
LOS	Level of Service
MSDS	Material Safety Data Sheets
NESPAK	National Engineering Services Pakistan
PEQS	Punjab Environmental Quality Standards
NOC	No Objection Certificate
NPO	No Project Option
NPZ	Noise Perimeter Zones
NGO's	Non-Governmental Organizations
PMD	Pakistan meteorological department
NCS	Pakistan National Conservation Strategy
PGA	Peak Ground Acceleration
PPE	Personnel Protective Equipment
PAPs	Project Affected Persons
PEPA	Punjab Environmental Protection Agency
PEQs	Punjab Environmental Quality Standards
PPP	Public Private Partnership
QMP	Quarry Management Plan
R & D	Research and Development
STDs	Sexually-Transmitted Disease
SSEMP	Site Specific EMP
SOP	Standard Operating Procedures
SC	Supervisory Consultant

EXECUTIVE SUMMARY

INTRODUCTION

An efficient transportation framework is the foundation of any Nation's economy. Better transportation system leads not only to the development of a country but also helps in boosting countries economy. A huge number of population travel by means of roads in our nation. Better transportation system is inevitable for the prosperity of our country.

Due to presence of industrial zones and expansion of economic markets in the Project Area, numerous problems comprising traffic congestions, time delays, extra fuel consumption, accidents, environmental degradation (air and noise pollution), wear and tear of roads and vehicles have been originated on the existing Faisalabad - Chiniot - Sargodha Road. Thus, traffic loads have become a major concern in the Project Area. At present, the existing Faisalabad - Chiniot - Sargodha Road is in poor condition and the capacity of this road is insufficient to handle existing/future traffic volume and unable to provide safe and smooth travelling. In order to cope with traffic issues and to control this situation, CWD has proposed to dualize the existing Faisalabad - Chiniot – Sargodha Road.

Communication and Works Department (CWD) Punjab has engaged National Engineering Services Pakistan (NESPAK) Limited to provide Consultancy Services of the proposed Project. In light of the consultant's scope and to fulfil the national requirement, preparation of Environmental Impact Assessment (EIA) study is one of the key tasks. This Environmental Impact Assessment (EIA) report has been prepared for the proposed dualization and rehabilitation of existing Faisalabad - Chiniot - Sargodha to fulfil the requirements of the Punjab Environmental Protection Agency (PEPA).

ES-2 REGULATORY AND POLICY REVIEW

Following are the major relevant strategies, policies, acts and legislation, from environmental perspective, considered in the proposed project: National Conservation Strategy, 1992, National Environmental Policy, 2005, National Forest Policy, 2001, National Climate Change Policy, 2012, National Water Policy 2018, National Drinking Water Policy, 2009, National Sustainable Development Strategy, 2012, National Action Plan for COVID-19 Pakistan, Punjab Environmental Protection Act, 1997 (Amended, 2012 & 2017), Pakistan Environmental Protection Agency, (Review of IEE and EIA) Regulations, 2000, Punjab Environmental Quality Standards (PEQS), 2016, Guidelines for the Preparation and Review of Environmental Reports, 1997, Guidelines for Environmental Assessment, Punjab Wildlife Act, 1974, Punjab Plantation and Maintenance of Trees Act, 1974, Protection of Trees and Brushwood Act, 1949, Explosives Act, 1884, Explosives Act, 1884, Pakistan Penal Code, 1860, Labour Laws as part of Constitution of Pakistan 1973, Cutting of Trees (Prohibition) Act, 1975, Pakistan Antiquities Act 1975 & Punjab Antiquities Amendment Act 2012, Pakistan Climate Change Act, 2017, Land Acquisition Act (LLA), 1894 Including Later Amendments, Punjab Environmental Protection (Motor Vehicles) Rules, 2013, The Punjab Occupational Safety And Health Act, 2019, Building Code of Pakistan, 2007 and International Conventions.

ES-3 ALTERNATIVE ASSESSMENT

Following alternatives are considered for the proposed project:

Alternative I: No Project Option: The Faisalabad - Chiniot - Sargodha Road is a very important and very busy Inter District route, which links District Faisalabad with Chiniot and Sargodha. Due to high population growth, tremendous traffic problems has been originated at the existing Faisalabad - Chiniot - Sargodha Road. Without the proposed project, the existing road will continue to be the main transportation corridor in the area. Traffic congestion is expected to increase in the future and road conditions are expected to deteriorate due to ever increasing traffic volume. Therefore, without the project, the existing transport problem at these roads and the level of service will further aggravate with the passage of time. Thus, it is important to upgrade the existing road facilities to cater the ease in travelling of public.

Alternative II: Dualization of Existing Faisalabad-Chiniot-Sargodha Road: This Faisalabad - Chiniot - Sargodha Road is becoming over-crowded day by day and the traffic situation is worsening due to increase in the number of vehicles which hinders smooth flow of traffic causing unnecessary delays. In order to alleviate this problem, the road needs to be widened. Rehabilitation and widening of existing the Faisalabad - Chiniot - Sargodha Road will entail some population displacement/ loss of infrastructures, and cutting of trees along the road sides. However, the widening of the Project Road will resolve the issue of traffic problem as population is increasing rapidly, migration of rural people into cities is also increasing for better life style, educational, health facilities and resultantly expansion of urban areas. Therefore, this option is feasible in terms of environmental and social economic aspects.

ES-4 DESCRIPTION OF PROJECT

The proposed Project involves dualization and rehabilitation of existing Faisalabad-Chiniot-Sargodha Road Section (67km) into an improved highway facility along with rehabilitation of existing structures including the rectification of cross drainage structures to make the existing link an all-weather road. Road furniture comprising lane markings, traffic signs, guardrails and reflectors will be provided. Provision of service lanes wherever required for the smooth movement of traffic will also be considered. The alignment of proposed project is inter-connected with various existing roads that includes Allama Iqbal Road, Kaloowal Road, Kot Ammer Shah Road, Baraf Khana road, Chiniot Bypass, Jhang-Chiniot road and Rajoa Sadat road. The geometric design will be carried out as per AASHTO Criteria of Highway Design. Design speed for the proposed project on main carriageway is 120 Kilometers per hour (KPH). The materials used for construction purpose would include coarse aggregates (crush), fine aggregates (sand), steel, water, asphalt, reinforcement, cement etc. Good quality natural fine aggregate or sand of acceptable gradation will be obtained from nearby licensed or approved entities dealing with fine aggregates. Asphalt, reinforcement and cement material will be transported from the Sargodha for road construction. Total man power required for the proposed project will be estimated by the contractor at construction stage. As per Consultant's previous experience, the workforce for proposed project (67 km) has been estimated as 250 workers comprising 70 skilled and 180 unskilled labourers. The proposed Project is expected

to be completed within twenty four (24) months. The estimated cost of the construction works of proposed Project is Rs. 11.7 billion.

ES-5 DESCRIPTION OF THE ENVIRONMENT

Considering the potential impacts of the proposed Project, existing baseline environmental conditions of the proposed project's Corridor of Impact (CoI) has to be used as a benchmark for comparison of the physical, ecological and socio-economic conditions before and after construction phases of the Project. This baseline will also provide the datum for assessing the impacts and suggesting the mitigation measures, which will be implemented effectively at various phases of the project activities.

The baseline data has been collected from the primary and secondary sources.

PHYSICAL ENVIRONMENT

The proposed project falls under administrative jurisdiction of District Faisalabad, Chiniot and District Sargodha. The proposed Project as per Building Code of Pakistan (BCP), 2007 (Seismic Provisions) falls entirely in the Zone-2A (Moderate Hazard) category with Peak Ground Acceleration (PGA) 0.08 to 0.16 of the seismic zonation.

The Project Area is characterized by hot summers and mild winters. The summer starts from April and lasts till September, with mean minimum and maximum temperature ranges from 28^0C to 42^0C. The winter seasons lasts from November to March, with mean minimum and mean maximum temperature ranges from 3^0C to 18^0C.

The environmental monitoring for ambient air, noise level, surface water and groundwater was conducted at the Proposed Project site from December 08, 2020 to December 11, 2020 for establishing the baseline profile of the Study Area. The environmental monitoring results indicates that all the parameters related to ambient air are well within the permissible limits of Punjab Environmental Quality Standards (PEQS), 2016, except Particulate Matter ($PM_{2.5}$), the average noise values at Point 2 and 3 during night time are also exceeding the limits due to the movement of heavy vehicular traffic. All physical, chemical and microbiological parameters of Drinking Water samples are well within permissible limits of PEQS, 2016, except at point 2 and 3, where Total Coliforms, Fecal Coliforms, Total Dissolved Solids and Chloride exceeding the permissible limits. However, all physical, chemical and microbiological parameters of surface/waste water quality are well within permissible limits of Punjab Environmental Standards for Waste Water Quality (Municipal and Liquid Effluents), 2016.

Major Sensitive receptors, i.e. residential areas, mosque/ religious places, school/ college were recorded based on the Arc GIS tool and field visit survey for the proposed project.

ECOLOGICAL ENVIRONMENT

Flora: The major tree species in the Project Area are Prosopis ineraria (Jhand), Capparis decidua (Karir, Karil), Zizyphus mauritiana (Ber), Tamarix aphylla (Farash) and Salvadora

oleoides (Pilu, wan). Natural Flora of the Project Area enriched with Shrubs, Trees, Medicinal Plants, Forbs, Herbs, Weeds, and Grasses

Fauna: Mammals of the track is dominant by Jackal (Canis aurecus), Squirrel (Funambulus), Fox (Vulpus vulpus), Rats (Mus musculus) and Mangoose (Herpestes auropunctatus). Wild bear (Sus scrofa) is also reported in the area. There are no wetlands in the Project Area. There is no game reserve, wild sanctuaries and National Park present in the Project Area.

SOCIO-ECONOMIC ENVIRONMENT

The study area falls in three (03) districts i.e. Faisalabad, Chiniot and Sargodha. The overall population of 99 households was calculated as 663 numbers. Average household size was concluded as about 6.7. The sex ratio (males per 100 females) for the Study Area is found to be 106.9. Punjabi is the predominant language being spoken in the Study Area. The population of the villages is predominantly Muslim and Ahmadies with few number of Christians.

ES-6 STAKEHOLDER CONSULTATION

A series of public consultations were conducted to get the feedback/concerns of the different category of stakeholders including provincial departments (Environment, Wildlife, Forest, and Social Welfare Department) district level departments, potential PAPs, local community and other general public residing in the Study Area. Consultation process included focus group discussion, village/Town .meetings, semi-structured interviews, one to one meeting and interviews with the government, private and civil society institutions.

ES-7 ANTICIPATED PROJECT IMPACTS AND MITIGATION MEASURES

Significant efforts were made to identify the main environmental (physical, ecological, social, and cultural) issues related to the design, construction and operation of the proposed project. The positive impacts due to the proposed project are: The rehabilitation with improved facilities shall provide an efficient / intelligent transport corridor; It will provide a safe, congestion free and high speed facility to the commuters of project area and heavy traffic travelling from Faisalabad to Sargodha; and the corridor will largely contribute to the economic and social development of the region as well as monitory benefits to Provincial Government through tolling.

The significant adverse impacts and their mitigations during the construction and operation phases are here under:

- The RoW for the proposed project is already available and owned by CWD. However, 1100 Kanals of land will be acquired for RoW. This may result in loss of land and structures which eventually affects livelihood and commercial activities. The detail of land under the impact and record of ownership status will be prepared by the Revenue Department. This impact will be permanent and high adverse in nature. Compensation should be made to

the affected people as per Land Acquisition Act, 1894 and market value for the loss of assets;

- The noise and vibration will be produced due to the operation of construction machinery and equipment. Sources of noise and vibration during construction are heavy machinery such as bulldozers, excavators, stabilizers, concrete mixing plant, pneumatic drills, stone crushers, asphalt plants and other equipment's. Noise and vibration are perceived as one of the most undesirable consequences of construction activities. The above machinery is expected to generate noise levels that would be severe in the project area. There are a variety of ways by which construction equipment and worksite noise can be controlled that includes use of Quieter Equipment, Modification of Existing Old Equipment, Barrier Protection, change in Work Activity Schedule and Maintenance of vehicle/equipment.
- Wastewater will be generated at the construction camps and from construction activities. If the generated wastewater is not properly treated or disposed of, this may contaminate the surface water sources such as nullahs, drains and water channels. The wastewater generation is estimated to be 8,000 liters/day for 250 construction workers comprising 70 skilled and 180 unskilled labourers for the proposed Project. Domestic and chemical effluents from the construction camp will be disposed by the development of on-site sanitation systems i.e. septic tanks. Proper monitoring to check the compliance of PEQS will be carried out; and sewage from construction camps will be disposed of after proper pre-treatment and processes such as soakage pit;
- A total of about 125 kg of solid waste (for about 250 labourers) will be generated from construction camps on daily basis. All the solid waste from the camps will be properly collected at source by placing containers and disposed of through proper solid waste management system. The Contractor will coordinate with local representatives and administration of the concerned solid waste management department for the disposal of solid waste;
- Air quality will be affected by fugitive dust emissions from construction machinery; dust from the unpaved surface and construction vehicles. Emissions from batching / asphalt plants can be controlled efficiently by the installation of cyclone / scrubbers. Diesel operated equipment should be equipped with well-maintained fuel filter and may be replaced timely (if required). In addition to that, regular maintenance activities comprising changing of lubricating oil, changing the air and fuel filter, cleaning the fuel system, draining the water separators and proper tuning may also help in reducing the emissions from diesel generators. Construction materials (sand, gravel, and rocks) and spoil materials will be transported trucks covered with tarpaulins and all vehicles (e.g., trucks, equipment, and other vehicles that support construction works) will comply with the PEQS (as amended) for carbon emissions and noise; Regular water sprinkling of the site should be carried out to suppress excessive dust emission(s);
- The project will involve destruction of vegetation cover on construction areas particularly along proposed road construction. It is initially examined that approximately 1,800 of trees / saplings may be affected. A tree plantation program has been formulated with the recommendations of compensatory planting for ten (10) trees against each fallen tree of similar floral function at the available spaces in/around the project area;

- Mostly the alignment of the proposed project falls in very rich agricultural area and damages of crops, orchards and trees are expected during construction activities. The clearance of RoW may affect about 1100 kanal of agriculture which may cause loss of income to affectees. The compensation value shall be calculated based on market value of the crops and average yields in the project area; In order to reduce the loss of agricultural land during the construction stage, existing haul routes will be preferred by the contractor, and the width of any new haul route shall be limited to the bare minimum required and approved by the engineer;
- Due to the proposed construction activities and movement of heavy project vehicles for construction material supply, traffic problems may arise for the commuters and transporters travelling to the Project Area. A Traffic Management Plan (TMP) will be implemented by the contractor to avoid traffic accidents, jams/public inconvenience.; and
- Due to the construction camps, loss of vegetation and dis-satisfaction of rehabilitation measures during and after completion of construction phase may occur. These impacts may include waste, soil pollution, groundwater pollution, dust, etc. The construction activities and vehicular movement at construction sites may result in road side accidents particularly inflicting local communities who are not familiar with presence of heavy equipment. Institutions along the route may also suffer during construction period due to air, noise and road accidents. Conflicts may arise between the local community and the construction workers, which may be related to religious, cultural or ethnic differences, or based on competition for local resources. Contractor will ensure the proper control on construction activities. Contractor will also take due care of the local community and observe sanctity of local customs and traditions by his staff. Contractor will warn the staff strictly not to involve in any unethical activities and to obey the local norms and cultural restrictions.

ES-8 ENVIRONMENTAL MANAGEMENT PLAN (EMP)

The EMP of the proposed project mainly comprises Institutional Requirements; Environmental Mitigation and Management Matrix; Environmental Monitoring Plan; Planning for EMP Implementation; Training and Capacity Building; Communication & Documentation; Management Plans; and EMP Cost. The Contractor will be responsible for implementation of EMP of the proposed project during construction phase in coordination with the CWD. However, Concessionaire/CWD will be responsible for implementation of EMP during operational phase. The total cost required to effectively implement the mitigation measures is approximately Rs. 24.94 Million, which includes cost of training, environmental monitoring, tree plantation and Health and Safety etc. during construction and operational phases. The EMP will be part of the contract document with the Contractor.

ES-9 CONCLUSION AND RECOMMENDATIONS

Project is socio-economically viable and environment friendly, if EMP is implemented in true letter and spirit. Results of the EIA Study have shown that the impacts of the project activities on the physical environment will be low to moderate significant. However, there will be significant impacts on the ecological and social environment. These impacts could be reduced

by proper and judicious compensation to the affectees and well planned meticulous design of the road and by implementing an appropriate tree plantation plan. An Environmental Management Plan (EMP) for both the phases (construction and operation) has been developed as part of the report which provides a detailed mitigation matrix that covers impacts, mitigation measures roles and responsibilities and timings to avoid, minimize or mitigate the adverse impacts of the project.

The EMP, its mitigation and monitoring programs, contained herewith will be included within the Bidding documents for project works for all Project components. The Bidding documents will state that the Contractor will be responsible for the implementation of the requirements of the EMP through his own SSEMP which will follow all of the conditions of the EMP. This ensures that all potential bidders are aware of the environmental requirements of the Project and its associated environmental costs.

1 INTRODUCTION

1.1 PROJECT BACKGROUND

An efficient transportation framework is the foundation of any Nation's economy. Better transportation system leads not only to the development of a country but also helps in boosting countries economy. A huge number of population travel by means of roads in our nation. Better transportation system is inevitable for the prosperity of our country.

The Faisalabad - Chiniot - Sargodha Road is a very important and very busy Inter District Route, which links District Faisalabad with District Chiniot and Sargodha. Faisalabad City is also known as “Manchester of Pakistan” for being a significant contributor in the GDP of Pakistan. Faisalabad houses the number of manufacturing and repair industries such as railway repair yards, engineering works and mills that produces sugar, flour, oil, superphosphates, cotton, and silk textiles, hosiery, dyes, industrial chemicals, beverages, apparels, pulp and paper, agricultural equipment and ghee. Sargodha is the 11th largest city in Pakistan with a population of 1.5 million. It has Pakistan’s best Citrus producing space and stone crushing industry. It plays its vital role in exchange by exporting its Citrus merchandise, supplying crushed stone in all parts of the country and earning exchange by trading their finished merchandise on the part of Sargodha Textile Mills and Midday Sugar Mills.

Due to presence of industrial zones and expansion of economic markets in the Project Area, tremendous traffic problems i.e. time delays, extra fuel consumption, accidents, environmental degradation, wear and tear of roads and vehicles have been originated on the existing Faisalabad - Chiniot - Sargodha Road. Thus, traffic loads have become a major concern in the project area. At present, the existing Faisalabad - Chiniot - Sargodha Road is in poor condition and the capacity of this road is insufficient to handle existing/future traffic volume and unable to provide safe and smooth travelling.

In order to cope with traffic issues and to control this situation, CWD has proposed to dualize the existing Faisalabad - Chiniot – Sargodha Road. After rehabilitation of project road along with improved facilities will provide an efficient transport corridor in the project area. Main objective of the proposed project is to provide a safe, congestion free and high speed facility to the commuters of project area and heavy traffic travelling from Faisalabad to Chiniot to Sargodha. The corridor will largely contribute to the economic and social development of the project area and its vicinity.

CWD Punjab has engaged National Engineering Services Pakistan (NESPAK) Limited to provide Consultancy Services of the proposed Project. In light of the consultant’s scope and to fulfil the national requirement, preparation of Environmental Impact Assessment (EIA) study is one of the key tasks. This Environmental Impact Assessment (EIA) report has been prepared for the proposed dualization and rehabilitation of existing Faisalabad - Chiniot – Sargodha Road to fulfil the requirements of the Punjab Environmental Protection Agency (PEPA).

1.2 REQUIREMENT FOR EIA STUDY OF THE PROPOSED PROJECT

The Proposed Project is located in Punjab Province, therefore the Punjab Environmental Protection Act, 1997 (Amended 2012 & 2017) is the core environmental law for the Proposed Project. Under Section 12 (1) EIA is mandatory for the subject project, which states that:

"No proponent of a project of public and private sector shall commence construction or operation unless he has filed an Initial Environmental Examination / Environmental Impact Assessment with the Punjab Environmental Protection Agency, as the case may be, or, where the project is likely to cause adverse environmental effects; and has obtained approval from the Provincial Agency in respect thereof".

According to the Pakistan Environmental Protection Agency (Review of IEE and EIA) Regulations 2000, the proposed project falls under category D (Transport) of Schedule II, which requires an EIA study before commencement of construction.

1.3 OBJECTIVE OF EIA

The prime objective of the EIA study is to fully meet the statutory requirements set forth by the Punjab Environmental Protection Act, 1997 (Amended 2012 & 2017) to facilitate decision making by the PEPA regarding grant of No Objection Certificate (NOC)/Environmental Approval for the Proposed Project.

The overall objective of this EIA is to elucidate the anticipated aspects of the proposed intervention and to propose necessary mitigation measures to prevent/minimize adverse impacts on surrounding environment and community. To achieve this objective, an assessment of the existing environmental conditions of the project corridor is a prerequisite and therefore, included after collecting the baseline data of major environmental attributes acquired from secondary sources. This EIA has been prepared to ensure adequate environmental and social management during pre-construction, construction and implementation stages of the proposed project. It provides mechanisms to ensure that potentially significant environmental and social impacts of the proposed project are identified, assessed and mitigated as appropriate.

More specific objectives of this EIA report are to:

- Facilitate proponents of the project in ensuring environmental and social sustainability of the project;
- Establish a baseline of existing social and environmental conditions prior to project initiation by collecting secondary data/information on physical, biological and socio-economic environment of the project area;
- Identify potentially significant environmental and social impacts (both positive and negative) during all stages of the Project;
- Avoid, minimize, and suggest mitigation measures for significant adverse impacts;
- Conduct, record and report and ensure e-consultations with major stakeholders; and
- Provide Environmental Management Plan (EMP) for all stages of the project as a tool for the implementation of the suggested measure along with monitoring and

evaluation mechanism with adequate resources including implementing agencies capacity building.

1.4 NATURE, SIZE AND LOCATION OF THE PROJECT

The proposed Project is a linear project that involves dualization and rehabilitation of existing single road from Faisalabad - Chiniot - Sargodha (67 km) to make it an improved highway facility and to alleviate the traffic congestion issues in the project area.

The proposed dualization and rehabilitation of subject road starts from Faisalabad City at Faisalabad Bypass Chowk and ends at Sargodha Bypass in District Sargodha. **Figure 1.1** shows the Location Map of the Proposed Project.

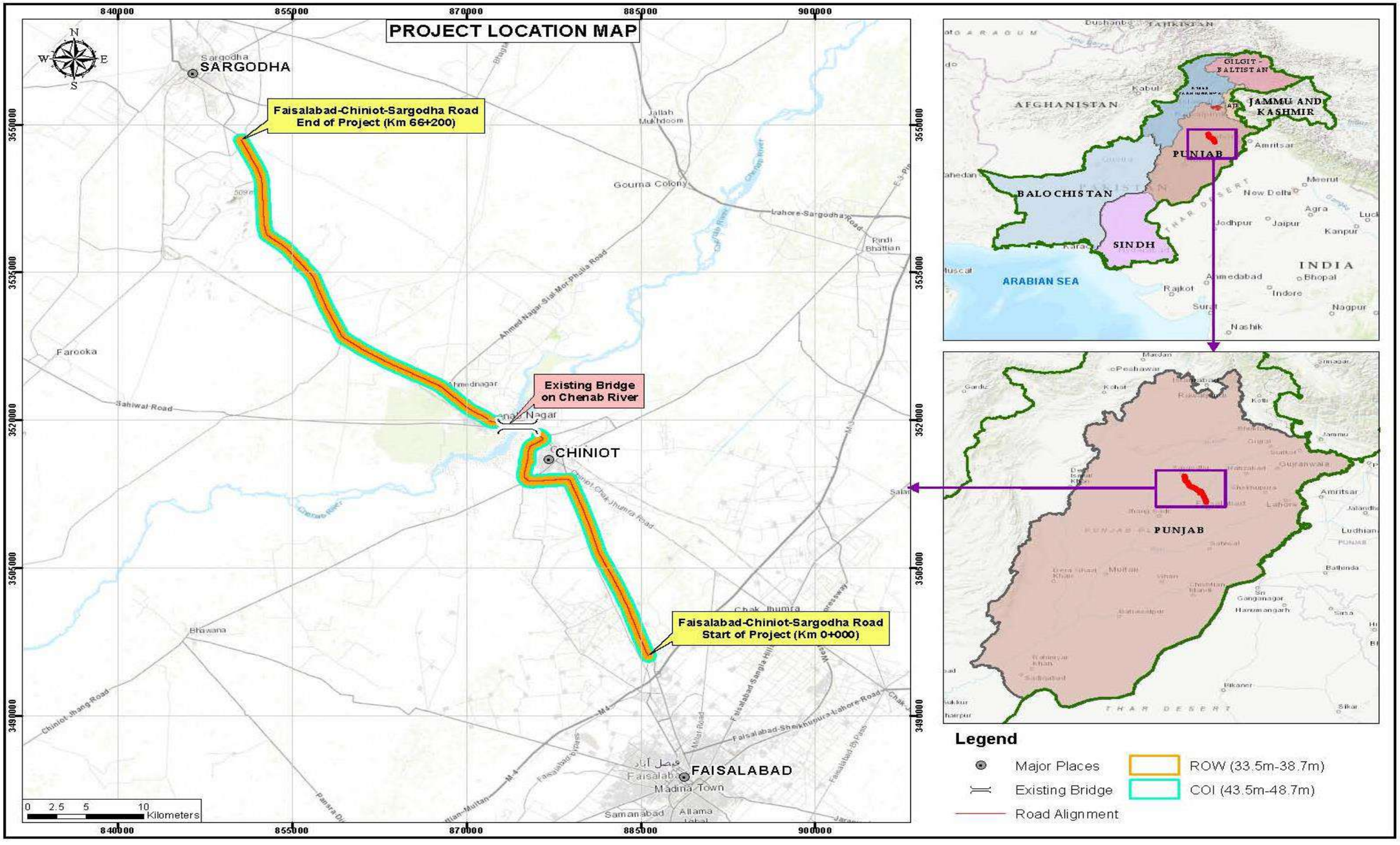

Figure 1.1: Location Map of the Proposed Project

1.5 THE PROPONENT AND CONSULTANT

a) Proponent Contact/Address

Communication & Works Department (CWD)
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b) Consultant Contact/Address

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Telephone Number: 92-42-99090233
Fax Number: 92-42-99231950
Company E-mail Address: info@nespak.com.pk
Company Website: www.nespak.com.pk

1.6 CONSULTANT'S EIA TEAM

Based on the requirements of ToR and objectives of the study, NESPAK formed a team of experts comprising a team leader (Environmental Specialist) with professional support from the Environmental Engineer, Environmental Scientists, Sociologist and Ecologist. The professional staff was involved in analyzing the data, impact assessment and mitigation measures and report compilation. In addition, the EIA team worked in close coordination with the design team and several inputs were provided by the design specialists to the EIA team. Detail of EIA team is given in **Table 1.1** below:

Table 1-1: Team Composition for the EIA Study

Sr. No.	Name of Expert	Designation
1.	Muhammad Shariq Ahmed	Team Leader/Head ERSD
2.	Ms. Shehnila Hanif	Sr. Environmental Scientist
3.	Ms. Ridha Kamran	Jr. Environmental Scientist
4.	Mr. Muhammad Waqar Saleem	Sr. Sociologist
5.	Mr. Ibadullah Khan	Sr. Ecologist

1.7 APPROACH AND METHODOLOGY

The following approach and methodology was adopted for carrying out the EIA study of the proposed project:

1.7.1 Orientation

Meetings and discussions were held among the members of the EIA Consulting Team. This activity was aimed at achieving a common ground of understanding of various issues of the study. Subsequent to the concept clarification and understanding, a detailed data acquisition

plan was developed for the internal use of the EIA consulting team. The plan identified specific data requirements and their sources; determined time schedules and responsibilities for their collection; and indicated the logistics and facilitation needs for the execution of the data acquisition plan.

1.7.2 Data Collection

In this step, primary and secondary data were gathered through field observations, concerned departments and published materials to establish baseline of physical, biological and socio-economic environmental conditions.

- Literature Review;
- Site Reconnaissance;
- Analysis of Maps and Plans;
- Public Consultations; and
- Environmental Sampling, Testing and Analysis.

1.7.3 Review of Environmental Laws and Institutional Requirements

All applicable national and international laws, legislations, guidelines along with relevant international protocols were reviewed relevant to the proposed project components.

1.7.4 Delineation of Corridor of Impact (COI)

COI/Study Area include the actual Project Right of Way (ROW) as well as the area in the surroundings in which positive and adverse impacts may be foreseen due to the implementation of the proposed Project.

The COI for the proposed project was taken as 10 m on each side from the outer edge of the RoW to anticipate adverse impacts as well as for the baseline survey. COI Index map is shown as **Figure 1.2**.

1.7.5 Survey of COI

A team of Environmental Scientists, Ecologist and Sociologist carried out the environmental and social survey of the COI from 24th October to 28th October, 2020 to familiarize themselves with the local conditions and the environmental settings. During the survey, the information regarding the topography, soils, surface water, groundwater, flora & fauna, affected infrastructure, social settings and villages/towns along the COI was observed.

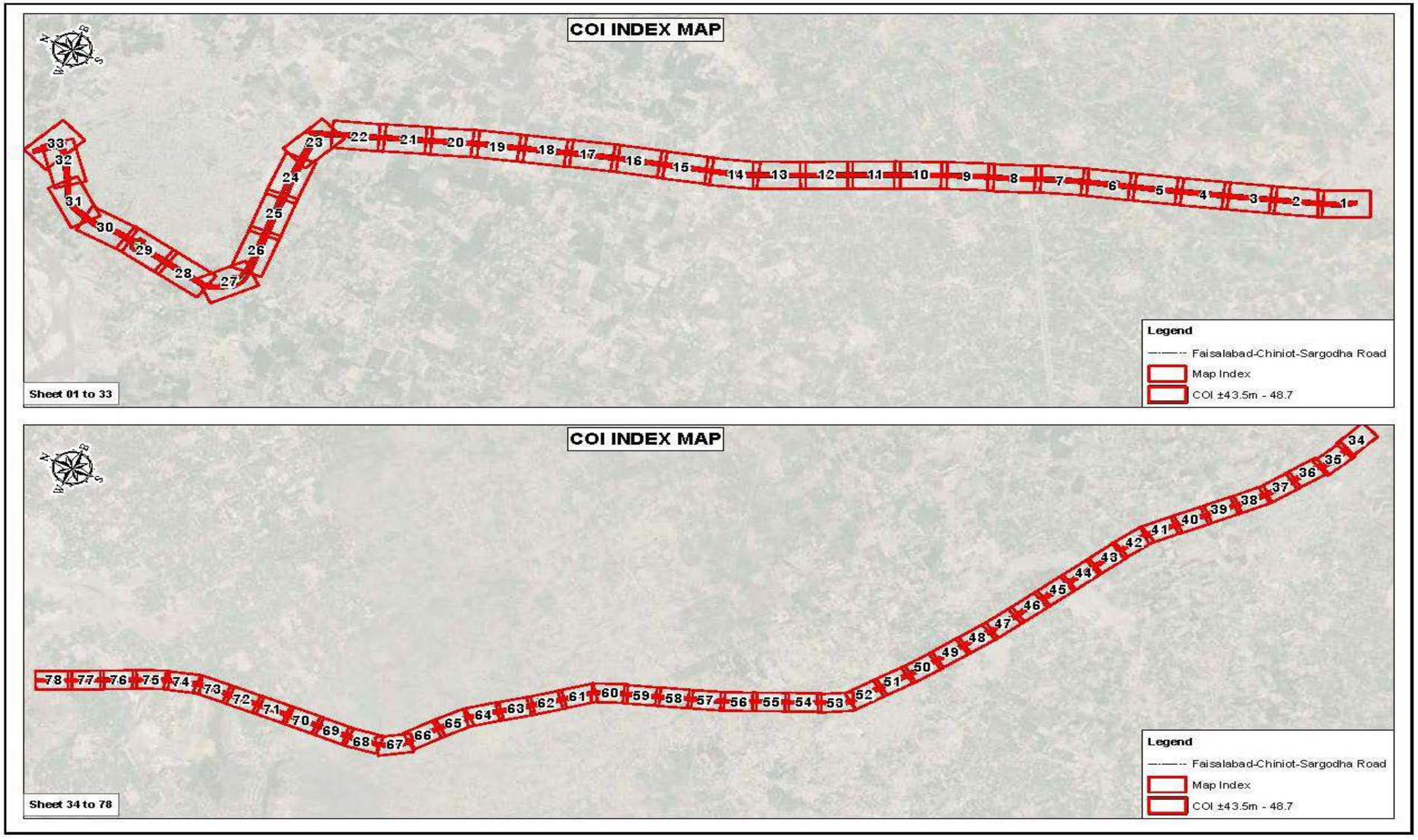


Figure 1.2: COI Map of the Proposed Project

1.7.6 Environmental Baseline Survey of the Project

Detailed environmental and social survey was carried out within the COI. Prior to the start of field activities, comprehensive checklists, proformas and maps were developed covering the following main parameters:

Physical Environment

The information acquired for the establishment of physical environment baseline included the following main parameters:

- Land resources (including landuse pattern, soil composition, contamination of soil and soil erosion etc.);
- Water resources (including available surface and groundwater resources and natural streams, hydrology, spring water, water supply, water contamination etc.);
- Climate data (including temperature, rainfall, humidity, wind speed and direction etc.);
- Ambient air quality and noise level monitoring data;
- Existing solid waste management and effluents disposal practices and storm water drainage;
- Buildings and infrastructure details, including residential, commercial and animal shed for complete/partial relocation;
- Religious, cultural and heritage information (mosques, shrines, graveyards);
- Archaeological monuments; and
- Other private/public infrastructures such as roads, telephone poles, hand pumps, tube wells etc.

Ecological Environment

The status of the flora and fauna of the study area were determined by a review of literature of the area, and an assessment of both terrestrial and aquatic environments.

a) Flora

The vegetative communities were identified and classified into community types. Identification was carried out of dominant tree species, assessment of stage of growth (mature or sapling), etc.

b) Fauna

Information on fauna was gathered from existing literature on reported species as well as observations in the field.

c) Reserved/Protected Areas

Data regarding reserved forests, guzara forests, community forests/ private forests and wildlife sensitive or notified areas in CoI/RoW was collected.

d) Endangered species

Endangered species (both flora and fauna, if any) was collected.

Socio-Cultural Environment

The consultants utilized a combination of literature, field investigations, census report, meetings through public consultation and interviews to describe the existing social environment and assessment of the potential impact of the construction of the proposed project. Data was gathered on the following aspects of the social environment:

- Land use and Municipal Status;
- Demographics;
- Livelihoods;
- Community Facilities;
- Solid Waste Management;
- Proposed Developments;
- Archaeological and Cultural Heritage; and
- Identification and Evaluation of Environmental Impacts.

1.7.7 Stakeholder Consultations

The Consultant identified Project stakeholders and held meetings with them during the surveys to receive feedback on the expected environmental issues related to the Project impacts and suggested mitigation measures. Meetings were carried out with the Project affectees, relevant departments including Environment Department, Agriculture Department, Revenue Department, Forest and Wildlife Department etc. to discuss the issues/constraints and get their views and feedback to mitigate the potential environmental as well as social impacts associated with the implementation and operation of the Project.

1.7.8 Impact Assessment

A logical and systematic approach was adopted for impact identification and assessment. The process began during the screening and continued through scoping which identified the key issues and classified them into different categories. The tools that were used for impact assessment, are:

- Checklists;
- Matrices; and
- Overlays.

Identification of potential environmental and social impacts in terms of their nature, magnitude, extent, location, timing and duration were carried out. The impacts were correlated to the Project location, design stage, construction stage and operation stage. Based on the impacts prediction methods and as a result of public/stakeholder consultations, the Consultants screened the adverse environmental impacts for inclusion in the mitigation measures and EMP. The same process was followed for the identification of social impacts.

1.7.9 Mitigation Measures

The Adequate mitigation measures and implementation framework were proposed so that the proponent could incorporate them beforehand in the design phase.

1.7.10 Environmental Management Plan (EMP)

An EMP has been prepared to ensure the adequacy and effectiveness of the proposed protocol by clearly identifying the roles and responsibilities of the agencies, responsible for implementation, monitoring and auditing of EMP activities, existing and suggested framework, necessary approvals and the required further studies. EMP also include organizational setup, a monitoring mechanism, monitoring plan, environmental and social parameters to be monitored with their frequency. Similarly, costs for environmental monitoring and social component/social mitigation measures were also included as part of the EMP. Environmental monitoring, evaluation, auditing and reporting mechanism were also proposed in the EMP.

1.8 STRUCTURE OF THE REPORT

Section **1 "Introduction"** briefly presents the project background, objectives, methodology and need of the EIA study.

Section **2 "Policy, Legal and Administrative Framework"** comprises policy guidelines, statutory obligations and roles of institutions concerning EIA study of the proposed Project.

Chapter 3 "**Alternative Assessment**" provides details on alternate options considered for the proposed project;

Section **4 "Description of Project"** furnishes information about the studied alternatives, location of the proposed project, cost and size of the project, its major components and alternatives considered for the proposed project to select at the preferred alternative for detailed environmental assessment.

Section **5 "Environmental Baseline"** describes physical, biological and socio-economic conditions prevalent in the project area.

Section **6 "Public Consultation"** identifies the main stakeholders and their concerns raised through scoping sessions, and deals with the measures to mitigate the social impacts.

Section **7 "Anticipated Environmental Impacts and Mitigation Measures"** identifies and evaluates impacts of the project activities during the construction and operation stages and recommends with the measures proposed to mitigate potential environmental impacts of the road project.
Section **8 "Environmental Management and Monitoring Plan"** outlines institutional arrangements for the implementation of the proposed mitigation measures, training needs of the staff for implementation of the mitigation measures, monitoring requirements, monitoring cost etc.

Section **9 "Conclusion and Recommendations"** elaborates the conclusion of subject environmental study and suggests the recommendations to address the issues raised from proposed construction activities.

2 POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORKS

2.1 GENERAL

This section provides an overview of the policy, legal, and administrative framework that apply to the proposed project to control environmental and social issues during construction and operational phase. The proposed project is anticipated to comply with all relevant policies, laws, guidelines, acts and legislations of Pakistan / Punjab and other related environmental aspects.

2.2 NATIONAL POLICY FRAMEWORK

The Ministry of Climate Change is the responsible authority for environmental protection policy making in Pakistan. The summary of major relevant strategies and policies from environmental perspective are briefly described below:

a) National Conservation Strategy, 1992

The Pakistan National Conservation Strategy (NCS) that was approved by the federal cabinet in March 1992 is the principal policy document on environmental issues in the country (EUAD/IUCN, 1992). The NCS outlines the country's primary approach towards encouraging sustainable development, conserving natural resources, and improving efficiency in the use and management of resources. The NCS has 68 specific programs in 14 core areas in which policy intervention is considered crucial for the preservation of Pakistan's natural and physical environment.

b) National Environmental Policy (NEP), 2005

NEP is the primary policy of Government of Pakistan addressing environmental issues. The broad Goal of NEP is, “to protect, conserve and restore Pakistan’s environment in order to improve the quality of life of the citizens through sustainable development”. The NEP identifies a set of sectoral and cross-sectoral guidelines to achieve its goal of sustainable development. It also suggests various policy instruments to overcome the environmental problems throughout the country. The Clause (b) of sub-section 5.1 of policy states that EIA related provisions in Environmental Protection Act, 1997, will be diligently enforced for all developmental projects.

c) National Climate Change Policy, 2012

The National Climate Change Policy was approved by the Federal Cabinet on September 26, 2012. With an overall goal, ‘to ensure that climate change is mainstreamed in the economically and socially vulnerable sectors of the economy and to steer Pakistan towards climate resilient development’, the Policy puts forward comprehensive policy objectives of sustained economic growth, integration of climate change into inter-related national policies, pro-poor gender

sensitive adaptation and cost-effective mitigation, water, food and energy security, disaster rehabilitation and Resilience (DRR), effective decision making and coordination, creating awareness, building capacities, and conservation of natural resources and long term sustainability. It also seeks effective use of financial opportunities, and public and private sector investment in adaptation measures. This policy will be applicable as it ensures conservation of natural resources and cost effective measures to mitigate impact on prevailing environmental conditions.

d) Punjab Public Private Partnership (PPP) Policy, 2009

The PPP Policy aims to include the promotion of social development and inclusive economic growth, protection of environment and interests of all stakeholders, which the policy aims to achieve by complying with relevant laws and regulations of Punjab and Pakistan and ensuring fairness, transparency and access to information. Prior to submitting PPP proposals, the policy requires undertaking feasibility studies (including environment and social impact assessments), obtaining the necessary approvals from Punjab Environment Protection Agency (PEPA) for IEEs and EIAs and acquiring land using the Punjab Land Acquisition Rules 1983 and Pakistan's Land Acquisition Act of 1894. This policy is applicable, as the proposed project will be implemented under PPP mode.

e) Biodiversity Action Plan

The plan recognizes EIA/IEE as an effective tool for identifying and assessing the effects of a proposed operation on biodiversity.

f) National Water Policy

The National Water Policy aims at efficient management and conservation of existing water resources, optimal development of potential water resources, steps to minimize time and cost overruns in completion of water sector projects, improving urban water management by increasing system efficiency and reducing non-revenue water through adequate investments to address drinking water demand, sewage disposal, handling of wastewater and industrial effluents; equitable water distribution in various areas and canal commands, measures to reverse rapidly declining groundwater levels in low-recharge areas, increased groundwater exploitation in high-recharge areas, effective drainage interventions to maximize crop production, improved flood control and protective measures, steps to ensure acceptable and safe quality of water, minimization of salt build-up and other environmental hazards in irrigated areas, institutional reforms to make the managing organizations more dynamic and responsive. This policy will applicable as the proposed road alignment traverses through Jhang Branch Canal and Saim Nullah along with few distributaries.

g) National Drinking Water Policy

The National Drinking Water Policy provides a framework for addressing the key issues and challenges facing Pakistan in the provision of safe drinking water to the people. Drinking water is the constitutional responsibility of the provincial governments and the specific

provision function has been devolved to specially created agencies in cities and Towns and Tehsil Municipal Administrations under the Local Government Ordinance 2001. This policy will be applicable to ensure safe drinking water to Contractor staff during construction phase and to the road users during operation phase as per PEQS, 2016.

h) Operational Strategy for CDM, 2006

The Operational Strategy for CDM has been developed to fulfill the requirements of establishing a Designated National Authority (DNA) and ensuring transparent, participatory and effective management of CDM process in the country. The strategy describes the functions and powers of the DNA and the national approval process. It builds on preliminary studies for initial projects including Asia Least Cost Greenhouse Gases Abatement Strategy (ALGAS) and Pakistan's Initial Communication on Climate Change which provides a general framework for operating CDM in Pakistan.

i) National Resettlement Policy, 2002

In March, 2002 Pakistan Environmental Protection Agency (Pak-EPA), GOP has issued its National Resettlement Policy, which explains the basis for compensation, rehabilitation and relocation of the affectees. It also explains the requirements and implementation of Resettlement Action Plan (RAP). This policy will be trigger if resettlement issues will arise for the construction of proposed road alignment.

j) National Disaster Risk Reduction Policy, 2013

Disasters have an enormous and significant adverse impact on the development of key sectors of economy like agriculture, infrastructure, housing, health, and education and above all the environment, they result in a serious social and economic set-back to the sustainable development. Disasters also pose threat to increasing poverty and resultantly back slide the national development targets set to achieve the Millennium Development Goals (MDGs). Climate change induced disasters pose even greater threat to sustainable development in developing country like Pakistan which is ranked quite amongst the most vulnerable countries. Continuous floods of 2010, 2011 and 2012 are seen as an indication of more intense and frequent extreme events in the future.

Disaster risk reduction interventions were being carried out in the country till date by different departments / agencies in isolation at national, province and district levels. There was a strong need to give them directions and sound guidelines to align their activities in line with the true spirit of National Disaster Management Act, 2010 to counter the threats of disasters faced by the country. NDMA, being the lead focal agency for disaster preparedness and management, has therefore, embarked upon formulation of a comprehensive National Disaster Risk Reduction Policy through wider consultations with all stakeholders including all provinces, state of AJ&K and regions. This policy covers disasters risk reduction in a more holistic way and introduces a proactive and anticipatory approach by laying special emphasis on risk assessment and prevention. This policy will be elicit if any unforseen natural and man-made disaster occurs during construction and operation phase.

k) Pakistan Labour Policy, 2010

The Labour Policy envisages a harmonious working relationship between workers and employers for improving the performance and efficiency of the work at workplace. This policy will be elicited as the proposed project involves hiring of the labour for the construction activities.

l) National Forest Policy, 2001

The goal of this policy is to foster the sustainable development of renewable natural resources (RNR) in Pakistan, through maintenance and rehabilitation of these essential resources and enhancement of sustainable livelihoods of rural masses, particularly women, children and other deserving groups. The main components of the policy are: (i) reducing poverty, powerlessness and unemployment; (ii) population planning in critical ecosystems; (iii) reducing the impact of socio-economic factors; (iv) providing substitutes to firewood in the mountain-woods; (v) reducing political interferences in Forestry and Wildlife Departments; (vi) renovating and invigorating the institutions of RNR; (vii) supporting Local Governments in the sustainable development of their RNR; (viii) policies for fragile ecosystems; (ix) riverside forests; (x) irrigated plantations; (xi) preservation of sensitive and unique forests; (xii) wildlife conservation; (xiii) rangelands and desert ecosystems; and (xiv) planting trees and fodder on farmlands. The proposed project does not passes through any reserve forest or other notified areas, however; policy will be applicable for the components like wildlife conservation, planting trees, reducing impact of socio-economic impacts and reducing poverty.

m) National Sustainable Development Strategy, 2012

The National Sustainable Development Strategy is an attempt to define sustainable development and the pathway to a “green economy” in Pakistan’s context. It lays out an adaptive system and approach that can be continuously improved, through regular updates, to respond to evolving challenges. The focus has been on integrating not only across the three overall dimensions of economic, social and environment but also integrating the goals with the existing development paradigm with the aim of shifting it to a more sustainable pathway.

This strategy will be applicable as the proposed project involves the construction of roads and bridges to improve the traffic situation with least environmental burden and sustainable operation of transportation in the cities.

n) National Action Plan for COVID-19, 2020

Government of Pakistan has launched National Action Plan for COVID-19 in Pakistan to combat the challenge of prevailing virus (pandemic) and to ensure safety of citizens at (i) workplace; (ii) commercial areas; and (iii) medical and educational institutions. The plan will be applicable as proposed project will be implemented during this pandemic.

2.3 LEGAL FRAMEWORK

Prior to the adoption of the 18th Constitutional Amendment, the Pakistan Environmental Protection Act (PEPA), 1997 was the governing law for environmental conservation in the country. Under PEPA, 1997 the Pakistan Environmental Protection Council (PEPC) and Pak EPA were primarily responsible for administering PEPA, 1997. Post adoption of the 18th Constitutional Amendment in 2011, the subject of environment was devolved and the provinces have been empowered for environmental protection and conservation. The legal framework for proposed project is discussed below:

2.3.1 Regulations for Environmental Assessment, Pakistan EPA

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 (I0/2000), 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 concerned provincial agency, which is responsible for its review and accordance of approval or request any additional information deemed necessary.

2.3.2 Punjab Environmental Protection Act (Amended), 2012 and Amendment, 2017

Post adoption of the 18th Constitutional Amendment in 2011, the Punjab government amended PEPA, 1997 as Punjab Environmental Protection Act (Amended), 2012, and Amendment, 2017 and now Punjab Environment Protection Agency (Punjab-EPA) is responsible for ensuring the implementation of provisions of the Act in Punjab territorial jurisdiction along compliance with the PEQS, and in establishing monitoring and evaluation systems.

Under Clause 12 of Punjab Environmental Protection Act (Amended), 2012, and Amendment, 2017, entails the provision of filing an initial environmental examination or environmental impact assessment (where the project is likely to cause an adverse environmental effect) and obtaining environmental approval from the Agency, in respect thereof before the construction of the proposed project.

As proposed project fall in the jurisdiction of Faisalabad, Chiniot and Sargodha District therefore Communication & Works Department (CWD), Government of the Punjab, as implementing agency will ensures the execution of Punjab Environmental Protection Act (Amended), 2012 and Amendment, 2017 during design, construction and operational phases of the project.

2.3.3 Regulatory Clearances, Punjab EPA

In accordance with provincial regulatory requirements, an IEE/EIA satisfying the requirements of the Punjab Environmental Protection Act (Amended), 2012 and Amendment, 2017 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 of proposed project.

2.3.4 Guidelines for Environmental Assessment, Pakistan EPA

The Pak-EPA has published a set of environmental guidelines for conducting environmental assessments and the environmental management of different types of development projects. The guidelines that are relevant to the proposed project are listed below:

- Guidelines for the Preparation and Review of Environmental Reports, Pakistan, EPA 1997;
- National Environmental Guidelines Policy and Procedures for the Filing, Reviewing and Approval of Environmental Assessments, 2000;
- Sectoral Guideline: (Roads), Pakistan Environmental Assessment Procedures, Pakistan Environmental Protection Agency, October 1997;
- Guidelines for Sensitive and Critical Areas - Pak-EPA, 1997;
- Guidelines for Public Consultations; Pakistan EPA May, 1997.

2.3.5 Punjab Environmental Quality Standards (PEQS), 2016

In exercise of the powers conferred under clause (c) of sub-section (1) of section 4 of the Punjab Environmental Protection Act, 2012 (XXXIV of 1997), the Environmental Protection Council has approved the Punjab Environmental Quality Standards (PEQS), 2016. They endow information on the permissible limits for discharges of municipal and industrial effluent parameters and industrial gaseous emissions in order to regulate environmental pollution (the detailed PEQS are available on Punjab EPA website[1]).

2.4 OTHER ENVIRONMENT RELATED LEGISLATIONS

2.4.1 Acts

a) Pakistan Climate Change Act, 2017

This act aims to meet obligations under international conventions relating to climate change and to provide for adoption of comprehensive adaptation and mitigation policies, plans, programmes, projects and other measures required to address the effects of climate change and for matters connected herewith and ancillary thereto. This act will not accelerate because vehicular emissions resulting due to traffic jams and congestions and narrow roads will be reduced due to the construction of the proposed project.

b) Land Acquisition Act (LLA), 1894 Including Later Amendments

The Land Acquisition Act, 1894, is a “law for the acquisition of land needed for public purposes and for construction and for determining the amount of compensation to be paid on account of such acquisition”. The exercise of the power of acquisition has been limited to public purposes. The principles laid down for the determination of compensation, as clarified by

[1] www.epd.punjab.gov.pk/info_desk

judicial pronouncements made from time to time, reflect the anxiety of the law-giver to compensate those who have been deprived of property, adequately. The land needed for the construction of development projects will be acquired under normal conditions based on prevailing market prices or negotiated prices between CWD and the owners of land. Instead, the land will be purchased under willing-seller willing-buyer deal at agreed upon market rates and the seller will have the option not to sell the land, in case an acceptable deal for both the parties is not reached. This act will be elicited as proposed project may involve permanent acquisition of land for the construction of proposed road, and temporary acquisition of land in the project area for the construction camps.

c) Canal and Drainage Act, 1873

This act entails provisions for the prevention of pollution of natural or man-made water bodies. This act provides the provision that prohibits the discharge of any solid or liquid matter or combination of both from any source into any river, canal and drainage including natural Channel (Sec 59 A (4), save disposal of discharges without harming the natural environment of receiving water body as well as corrupting and fouling of water channel so as to render it unfit for the purpose for which it is ordinarily used (Sec 70 (8)). Any person who fails to follow the provisions shall be incurred with the penalty provided under the act. This act will be triggered if construction waste (liquid and solid) disposed into nearby canal (Jhang Branch Canal) and open drain (Saim Nullah) directly.

d) The Punjab Water Act 2019

This act ensures comprehensive management and regulation of water resources in the Punjab in the interest of conservation and sustainability. This this act will be triggered as Jhang Branch Canal and Saim Nullah along with few distributaries also crosses the proposed road alignment.

e) The Punjab Irrigation and Drainage Authority Act, 1997

It empowers the Punjab Irrigation and Drainage Authority to implement the strategy of the Government of Punjab for streamlining the Irrigation and Drainage System in the province, to achieve economical and effective operation and maintenance of the irrigation, drainage and flood control system; to make the irrigation and drainage network sustainable on a long-term basis and introduce participation of beneficiaries in the operation and management. It also enforces to undertake anti-erosion operations including conservation of forests and reforestation, to restrict or prohibit the clearing or breaking up of land in the catchment areas of any rivers, hill torrents and other streams and to conduct studies with a view to regularly analyze and evaluate the impact of the operations and policies of the Authority on the ecology and environment within the Province with a view to establish the various available options for the minimization of the adverse impact of such operations and policies, if any, and to adopt the optimal options for further action. This this act will be triggered if clearing or breaking up of land in the catchment areas of Jhang Branch Canal and Saim Nullah along with few distributaries will be required for the construction of the proposed project.

f) The Punjab Highway Authority Act, 1989

This act deals with the establishment of an authority for construction, development, improvement and maintenance of highways and other projects. This act will be triggered as the proposed project is implemented to upgrade and improve the Highway network in province that forms the part of road network to international standards.

g) The Punjab Emergency Service Act, 2006

It deals with the establishment of emergency service for a purpose of maintaining a state of preparedness to deal with emergencies, to provide timely response, rescue and emergency medical treatment to the affected persons and recommending measures to be taken by related organizations, to avoid any emergency situation. It describes procedures to establish emergency service, emergency board, emergency fund, emergency ambulance and rescue vehicles, offence and punishment, etc. This act will be triggered if any unforeseen emergency arises during construction and operation phase of the proposed Project.

h) The Punjab Public Private Partnership Act, 2019

This act entails the provision to create an enabling environment to promote the private sector participation and investment in partnership with the public sector for provision of public infrastructure and services for accelerated economic growth; to bridge the gap in demand and supply of public infrastructure and services; to harness the substantive role of public private partnership as a means of mobilizing private sector funding, resources and expertise; and for the matters connected therewith or ancillary thereto. This act will be applicable as the proposed Project will be implemented under Public Private Partnership mode.

i) Punjab Municipal Water Act, 2014

The basic aim of the act is to recognize, regulate and manage present and future municipal water supply and sanitation services and to establish rights of access to basic water supply and basic sanitation, and to ensure conservation of water resources in the Province. This act will be elicited if there is misappropriation of water supply during construction activities.

j) Fisheries Act, 1897

This act aims at the protection of fish in water bodies by rules of State Government. This act will not be trigger as no species of fish is present in water bodies of the proposed project area.

k) Protection of Trees and Brushwood Act, 1949

This act prohibits cutting or lopping of trees and brushwood without permission of the Forest Department. The Forest Department will be approached for permission to cut trees along the proposed project site, if required.

l) The Punjab Plantation and Maintenance of Trees Act, 1974

This act entails provision for plantation and maintenance of trees in the Province of the Punjab.

m) Cutting of Trees (Prohibition) Act, 1975

This act forbids cutting of trees without acquiescence of the Forest Department.

The act mentioned in section “k, l and m” will be stimulated if tree cutting involved during construction phase within ROW of the proposed project.

n) Punjab Forest Act (Amended), 2010

The act empowers the provincial forest departments to declare any forest area as reserved or protected. It empowers the provincial forest departments to prohibit the clearing of forest for cultivation, grazing, hunting, removing forest produce, quarrying and felling, lopping and topping of trees, branches in reserved and protected forests. The proposed project is urban in nature and thus no protected forest is situated in and around the Project area.

o) The Punjab Wildlife (Protection, Preservation, Conservation & Management) Act, 1974

This act provides for the protection, preservation, conservation and management of wildlife in the Province of Punjab. This act defines the wildlife sanctuary, game reserves, protected areas and national parks. It also defines the rules and responsibilities of the relevant authorities and the relevant personnel to protect the ecological resources. It also describes the penalties and punishments on offenses against the sections given in the act. This act will not be violated because no wildlife species exists in the proposed project area.

p) The Antiquities Act, 1975

The Antiquities Act, 1975, administered by the Provincial Government, is aimed at safeguarding the preservation of cultural heritage, destruction, damage or defacement of antiquities and it is an offence under the act. This act will not be triggered as no antiquities are present in and around the proposed project route.

q) The Punjab Heritage Foundation Act, 2005

This act entails preservation, conservation, maintenance and rehabilitation of the Punjab Heritage through various means, including technical or financial assistance and to create awareness among the people for preservation of the Punjab Heritage. This act will not be triggered as no heritage sites are present in and around the proposed project route.

r) The Punjab Polythene Bag Rules, 2004

This rule prohibits the manufacturing, sale, use and import of polythene bags that is below 15 micron thickness. This rule will be elicited if polythene bags with more than 15 micron thickness used during construction activities.

s) National Clean Air Act, 2000

The act aims to control vehicular emissions, pollution from industry, and indoor air pollution in rural and urban areas. This act will be trigger if vehicles and machinery used for construction activities emanates air pollutants above the permissible limit.

t) Seismic Building Code of Pakistan 2007

This code stipulates the minimum requirements for seismic safety of building and structures and the provisions of the Building Code of Pakistan (Seismic Provisions-2007) shall apply for engineering design of buildings, like structures and related components.

Construction of buildings in defilement of the Building Code shall be considered as violation of professional engineering work specified under clause (XXV) of section 2 of the act. This Code is applicable to the proposed project as it includes the formation of structures.

u) The Parks and Horticulture Authority Act, 2012

This act entails regulation, development, and maintenance of public parks, green belts and green areas in the Punjab; regulation of billboards, sky signs and outdoor advertisements; to promote open and unrestricted views of the Punjab. This act will be triggered if green belts along the proposed project route are affected during construction phase.

v) Handling of Hazardous Substances Act, 2000

Subject to the provisions of this act, no person shall generate, collect, consign, transport, treat, dispose of, store, handle or import any hazardous substance except under a license issued by the Federal Agency and in such manner as may be prescribed; or in accordance with the provisions of any other law for the time being in force, or of any international treaty, convention, protocol, code, standard, agreement or other instrument to which Pakistan is a party customary under sub- clause (a) and (b) of clause 13. This act will be trigger during construction and operation phases for handling, management and disposal of hazardous waste.

w) Punjab Environmental Protection (Motor Vehicles) Rules, 2013

Subject to the provisions of this act, and the rules and regulations, no person shall operate a motor vehicle from which air pollutants and noise are being emitted in an amount, concentration or level which is in excess of the Punjab Environmental Quality Standards, or where applicable the standards established under clause (g) of subsection (1) of section 6 of the act. This act will be elicited during construction and operational phase due to use of motor vehicles that produces air pollutants and noise.

x) Labor and Health and Safety Legislation

The Constitution of Pakistan contains a range of provisions with regards to labor rights, in particular:

- Article 11 of the Constitution prohibits all forms of slavery, forced labor and child labor;
- Article 17 provides for a fundamental right to exercise the freedom of association and the right to form unions;
- Article 25 lays down the right to equality before the law and prohibition of discrimination on the grounds of sex alone; and
- Article 37(e) makes provision for securing just and humane conditions of work, ensuring that children and women are not employed in vocations unsuited to their age or sex, and for maternity benefits for women in employment.

Labor law is controlled at both provincial and national levels with compulsory employment agreements containing the terms set out by the labor laws. There are various laws containing health and safety requirements including: Mines Act 1923; Factories Act 1934; Factories Rules; Hazardous Occupations Rules 1963; Provincial Employees Social Security Ordinance 1965; and Workmen's Compensation Act 1923. This legislation will be triggered during project implementation stage as project involves hiring of labors.

y) ISO 18001 Occupation Health and Safety Assessment Series (OHSAS)

OHSAS 18001 is an Occupation Health and Safety Assessment Series for health and safety management systems to help organizations to control occupational health and safety risks. The OHSAS specifications are applicable to any institute that desires to establish an OH&S management system to eradicate or reduce risk to employees and other interested parties who may be exposed to the risks allied with the project activities. The construction of the proposed project may involve various health and safety issues to construction labour, therefore these ISO 18001 guidelines will be applicable and pertinent. This series will be triggered during construction and operational phase to ensure health and safety of workers associated with the project activities.

z) The Punjab Occupational Safety And Health Act, 2019

This act entails provision of occupational safety and health of the workers at workplace and to protect them against risks arising out of the occupational hazards; to promote safe and healthy working environment catering to the physiological and psychological needs of the employees at workplace. The act will be triggered during construction and operational phase to ensure health and safety of workers at workplace associated with the project activities.

aa) Punjab Restriction on Employment of Children Act, 2016

According to the sub-section 11(a) of this act, an occupier who employs or permits a child (person under the age of 15 years) to work in an establishment shall be liable to punishment with imprisonment for a term which may extend to six months, but which shall not be less than seven days, and a mandatory fine between 10,000 to 50,000 rupees. This act will be trigger if

contract higher skilled and unskilled labour under the age of 15 during construction phase of the proposed project.

bb) Punjab Protection of Women against Violence Act, 2016

This act counters gender-based discrimination, violence against women, and economic and social empowerment of women. This act will be entail if gender based violence observed in the project area during construction phase.

cc) Disaster Management Act, 2010

The act is administered by federal government which provides guidelines for the provision of disaster management plans, offer necessary technical assistance to the Provincial Governments and Provincial Authorities as well for preparing their disaster management plans in case of any mishap. This act is valid to the subject project in case of any unseen situation.

2.4.2 Regulations, Standards and Guidelines

a) Pakistan Environmental Protection Agency Review of IEE and EIA Regulations, 2000

The Regulation classifies projects on the basis of expected degree of adverse environmental impacts and lists them in two separate schedules. The Schedule I list projects that may not have significant environmental impacts and therefore require an IEE. The Schedule II list projects of potentially significant environmental impacts requiring an EIA. The Regulations also require that all projects located in environmentally sensitive areas require preparation of an EIA. It also lists Projects not requiring either an EIA or an IEE. The CWD will be responsible to file an EIA for obtaining environmental approval before the construction of proposed project as per requirements mentioned in these regulations.

b) Sectorial Guidelines, 1997

Pakistan Environmental Assessment Procedure deals with general guidelines as well as the sectoral guidelines for the environmental assessment studies. “Sectoral guidelines for construction of road are used as a reference in this document.

c) Environmental Assessment Guidelines for Punjab Public Private Partnership (PPP) Projects, 2018

These guidelines provide methodology for carrying out environmental assessments of the projects to be implemented under PPP mode. These guidelines are used as a reference for preparing EIA of the proposed project.

d) Pakistan Penal Code, 1860

The Code deals with the offences where public or private property or human lives are affected due to intentional or accidental misconduct of an individual or organization. The Code also addresses control of noise, noxious emissions and disposal of effluents and authorizes fines, imprisonment or both for voluntary corruption or fouling of public springs or reservoirs so as to

make them less fit for ordinary use. This code will be triggered if any damage occurs to public property or human lives due to the proposed project and release of vehicular emissions, noise and discharge of effluent beyond the limit suggested in PEQS, 2016.

e) Hazardous Substance Rules, 2003

Hazardous Substance Rules, 2003 deals with handling, storage, transportation and health & safety procedures to be followed in the workplace. These rules deal with generation and handling of any kind of hazardous substance (solid, liquid & gas) as listed in Schedule I of the rules. These Rules provide Safety plan, waste management plan, transportation of hazardous materials procedures as well as reporting mechanism in case of any accident. Under these rules a license has to be taken from Federal/Provincial Agency for handling and transportation of hazardous material (Schedule II of Rules).

The contractor for handling hazardous waste shall be the licensed contractor. Contravene to any of these rules may cause cancellation of the license by Federal/Provincial Agency as the case may be

f) Solid Waste Management Guidelines, 2005

Guidelines for Solid Waste Management have been issued as a draft by the Pakistan Environmental Protection Agency in coordination with JICA and UNDP in 2005. These guidelines explain the waste generation, discharge and composition. The handling, transportation and final disposal of waste generated during construction and operation phase of the proposal project should be done in view of these guidelines.

2.4.3 International Conventions

a) United Nation Framework Convention on Climate Change (UNFCCC) Amended, 2015

The objective of the Convention is to stabilize greenhouse gas concentrations "at a level that would prevent dangerous anthropogenic (human induced) interference with the climate system." Such a level should be achieved within a time frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner. The implementation of the proposed project will reduce the emission of greenhouse gases (GHG) in the atmosphere due to the construction of the proposed project and will ensure the economic development in a sustainable manner.

b) Kyoto Protocol (Amended), 2012

The Kyoto Protocol aimed to reduce carbon dioxide (CO_2) emissions and the presence of greenhouse gases (GHG) in the atmosphere. The implementation of the proposed project will reduce the emission of greenhouse gases (GHG) in the atmosphere due to the construction of the proposed project.

c) UNESCO Convention on the Protection of the World's Cultural and Natural Heritage, 1972

The convention aims the protection of the natural and cultural heritages. The convention will not be applicable as no world's cultural and natural heritage site is present in and around the project area.

d) Paris Agreement, 2015

The Paris Agreement's central goal is to strengthen the global response to the threat of climate change by keeping a global temperature rise this century well below two degrees celsius above pre-industrial levels and to pursue efforts to limit the temperature increase even further to one and half degrees celsius. Additionally, the agreement aims to increase the ability of countries to deal with the impacts of climate change, and at making finance flows consistent with a low GHG emissions and climate-resilient pathway.

The implementation of the proposed project will reduce the emission of greenhouse gases (GHG) in the atmosphere due to the construction of the proposed project.

e) The Convention on Conservation of Migratory Species of Wild Animals

The Convention requires countries to take action to avoid endangering migratory species. The term "migratory species" refers to the species of wild animals, a significant proportion of whose members cyclically and predictably cross one or more national jurisdictional boundaries. The parties are also required to promote or cooperate with other countries in matters of research on migratory species. There are no endangered species of plant life or animal life in the vicinity of the Project area.

f) Basel Convention, 1994

In 1994, Pakistan signed Basel Convention that restricts trans-boundary movements of "Hazardous Waste and their Disposal'' with aim to protect human health and surrounding environment by minimizing the use of hazardous waste production. The proposed project will not be necessitating the endowment of this convention.

g) International Union for Conservation of Nature and Natural Resources Red List, 2000

This enlists wildlife species experiencing various levels of threats internationally. Some of the species indicated in the IUCN red list are also present in the wetlands of Pakistan. However, no wildlife species experiencing various levels of threats are present in and around the surroundings of project area.

h) Ramsar Convention on Wetlands of International Importance, 1971

The Ramsar Convention is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources. The convention is an international treaty for the conservation and sustainable utilization of wetlands. It is the only global environmental treaty that deals with a particular ecosystem. No Ramsar Site is present in and around the proposed project area.

i) Sustainable Development Goals (SDGs)

The Sustainable Development Goals (SDGs) were adopted in the General Assembly of the United Nations in the year 2000 by all the countries of world and the world's leading developmental institutions. The SDGs that will prevail for the proposed project are as follows:

- Promote Gender Equality and Empower Women: The contractor during construction phase will be responsible to hire women for construction activities to elude gender discrimination and to promote women empowerment.
- Combat HIV/AIDS Malaria and Other Diseases: Contractor will be responsible to conduct medical surveillance of the workers before hiring to combat HIV/AIDS Malaria and other diseases.
- Ensure Environmental Sustainability: Contractor will be responsible to ensure environmental sustainability of the proposed project areas by ensuring implementation of EMMP to mitigate adverse environmental impacts from construction activities during construction phase.

2.5 ADMINISTRATIVE FRAMEWORK

2.5.1 Communication & Works Department (CWD), Government of Punjab

CWD is responsible for ensuring that the project complies with the laws and regulations and mitigations measures suggested in EMP of the proposed project for controlling the environmental and social concerns of Dualization of Faisalabad-Chiniot Sargodha Road during pre-construction, construction and operation phase, and that all preconstruction requisites, such as permits and clearances are met.

2.5.2 Environmental Protection Agency, Punjab

Pakistan Environmental Protection Agency is meant for the enforcement of environmental laws in Pakistan. They have delegated powers to provincial environmental protection agencies for review, approval and monitoring of environmental examination/assessment projects. As the proposed Project also falls in Rawalpindi District therefore Punjab-EPA will be responsible for reviewing the report, issuing environmental approval and overall/broad based monitoring of the proposed project activities.

3 ALTERNATIVE ASSESSMENT

3.1 GENERAL

As the Proposed Project involves dualization and rehabilitation of existing Faisalabad - Chiniot - Sargodha road, there is no technical alternate options available for the proposed project. Whereas, the feasibility of the implementation of the subject project is discussed below:

3.2 ALTERNATIVE I: NO PROJECT OPTION

The Faisalabad - Chiniot - Sargodha Road is a very important and very busy Inter District route, which links District Faisalabad with Chiniot and Sargodha. Due to high population growth, tremendous traffic problems i.e. time delays, extra fuel consumption, accidents, environmental degradation, wear and tear of roads and vehicles etc. has been originated at the existing Faisalabad - Chiniot - Sargodha Road. Thus, traffic loads has become a major concern in the project area. At present, the capacity of this road is insufficient to handle existing/future traffic volume and unable to provide safe and smooth travelling.

According to the Traffic Projection Survey, capacity of all the road segments i.e from Faisalabad to Chiniot, from Chenab Nagar to Lalian and Lalian to Sargodha were analyzed for future projected traffic volumes up to year 2045. It was learnt that improved dualized road will cater the future traffic demand effectively.

Without the proposed project, the existing road will continue to be the main transportation corridor in the area. Traffic volume on the existing Faisalabad - Chiniot - Sargodha Link Road is anticipated to increase with the passage of time as indicated from the traffic projection survey. Traffic congestion is expected to increase in the future and road conditions are expected to deteriorate due to ever increasing traffic volume.

Therefore, without the project, the existing transport problem at these roads and the level of service will further aggravate with the passage of time. Existing environmental condition will also prevail. Moreover, by the increase in future traffic loads air quality and noise level may deteriorate. Thus, it is important to upgrade the existing road facilities to cater the ease in travelling of public.

3.3 ALTERNATIVE II: REHABILITATION OF EXISTING FAISALABAD - CHINIOT - SARGODHA ROAD

The single carriageway road between Faisalabad - Chiniot - Sargodha is an important link road and the traffic volume on the road is increasing. The project aims to improve capacity and safety along this road. For this purpose, the road dualization is proposed. With increasing traffic demand, the Level of Service (LOS) on existing road is deteriorating with already low travel speed and diminishing safety on the road. Additionally, increase of opposing traffic volume on undivided roads make them dangerous requiring conversion to at least 2-lanes dual carriageways to enhance safety and capacity of road.

This Faisalabad - Chiniot - Sargodha Road is becoming over-crowded day by day and the traffic situation is worsening due to increase in the number of vehicles which hinders smooth flow of traffic causing unnecessary delays. In order to alleviate this problem, the road needs to be widened. Rehabilitation and widening of existing the Faisalabad - Chiniot - Sargodha Road will entail some population displacement/ loss of infrastructures, and cutting of trees along the road sides.

However, the widening of the Project Road will resolve the issue of traffic problem as population is increasing rapidly, migration of rural people into cities is also increasing for better life style, educational, health facilities and resultantly expansion of urban areas. Therefore, this option is feasible in terms of environmental and social economic aspects.

4 PROJECT DESCRIPTION

4.1 GENERAL

The proposed Project involves dualization and rehabilitation of existing Faisalabad - Chiniot - Sargodha Road section (67km) into improved highway facility along with rehabilitation of existing structures including the rectification of cross drainage structures to make the existing link an all-weather road. Road furniture comprising lane markings, traffic signs, guardrails and reflectors will be provided. Provision of service lanes wherever required for the smooth movement of traffic will also be considered.

The details of the proposed Project, project components, design considerations, construction aspects, and operation and maintenance activities are discussed in the following sections.

4.2 OBJECTIVES OF THE PROJECT

The main objectives of the dualization and rehabilitation of existing Faisalabad - Chiniot - Sargodha Road section (67km) is to:

- Provide a safe, congestion free and high speed facility to the commuters of the project area and heavy traffic travelling from Faisalabad to Chiniot to Sargodha road section;
- Decrease in Vehicle Operating Cost and traffic accidents due to improved/upgraded Highway Safety Standards;
- Add impetus to commerce and trade activities in the vicinity near the carriageway; and
- Contribute to the economic uplift and social development due to fast, safe and reliable journey after up-gradation.

4.3 PROJECT ADMINISTRATIVE JURISDICTION

The proposed project falls under administrative jurisdiction of the District Faisalabad, District Chiniot and District Sargodha, Punjab.

4.4 PROJECT LOCATION

The existing road from Faisalabad - Chiniot - Sargodha is very important Inter District Highway Link of almost 67 km in length running between the Faisalabad, Chiniot and Sargodha districts of Punjab Province. The proposed dualization and rehabilitation of subject road starts from Faisalabad city at Faisalabad Bypass Chowk and ends at Sargodha Bypass in district Sargodha.

The alignment from Faisalabad - Chiniot - Sargodha passes through plain terrain with thickly populated small towns and green fields/orchards at some locations. Major settlements along the project road includes Chak 4 JB, Chak 2 JB, Bhutto Colony, Muslim Colony, Chenab

Nagar, Dar-ul-Sadr, Ahmad Nagar, Lalian, Qasaeyan Wala and Chak 46. **Figure 1.1** shows the Location Map of the Proposed Project.

4.5 ACCESSIBILITY OF THE PROJECT AREA

The alignment of proposed project is inter-connected/accessed with various existing roads that includes Allama Iqbal Road, Kaloowal Road, Kot Ammer Shah Road, Baraf Khana Road, Chiniot Bypass, Jhang-Chiniot Road and Rajoa Sadat Road.

The proposed alignment also crosses the River Chenab, Jhang Branch Canal, one main saim Nullah along with few distributaries. Project Area Accessibility Map is shown in **Figure 4.1**.

4.6 LAND ACQUISITION

Approximately 1100 Kanal of land acquisition involved in proposed widening and rehabilitation of existing Faisalabad - Chiniot - Sargodha road section.

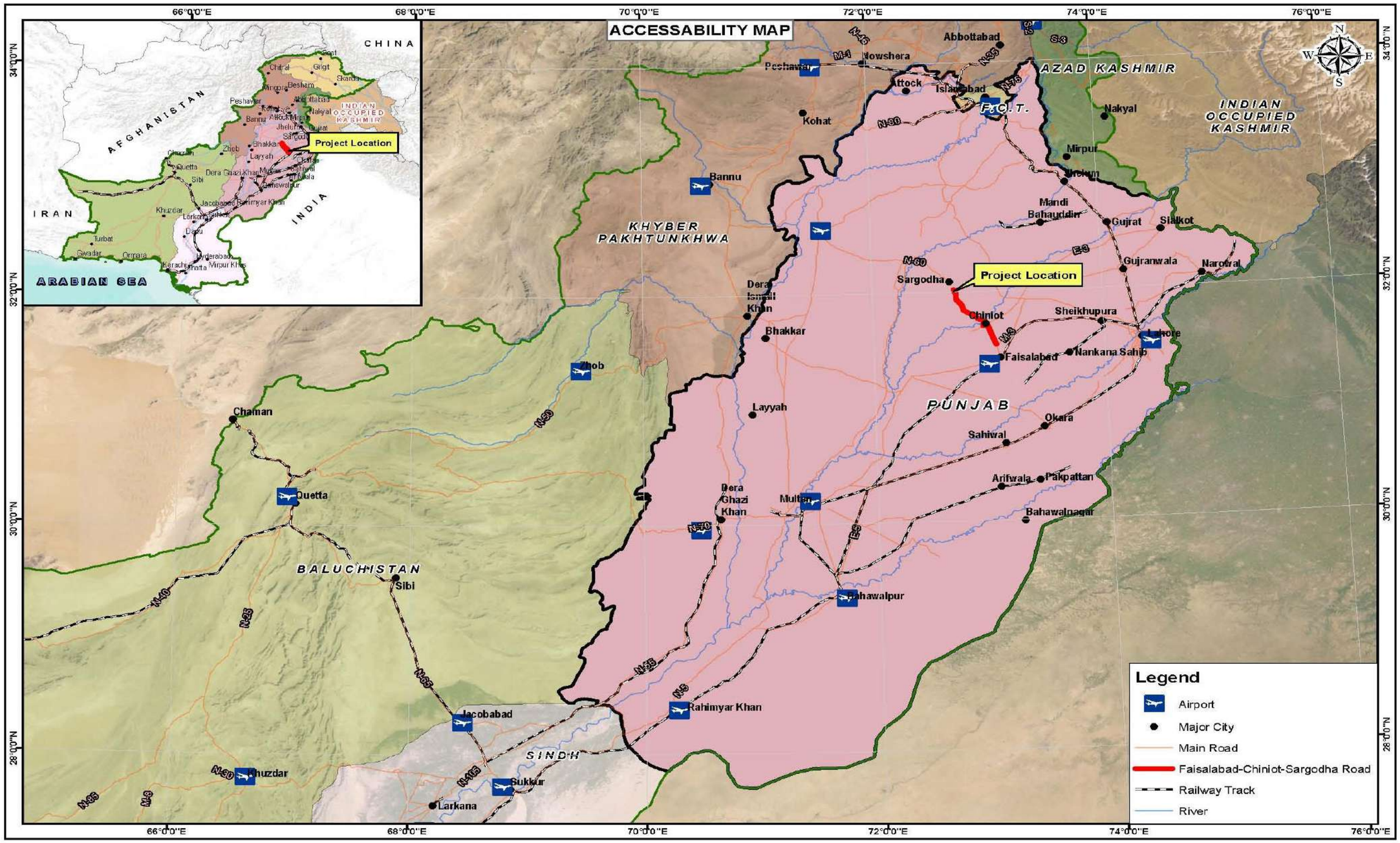


Figure 4.1: Project Area Accessibility Map

4.7 TRAFFIC STUDY

The main objective of Traffic Studies is to assess the volumes and composition of traffic load likely to use the proposed road immediately after the project implementation. The projected volumes of traffic for the future years will be used to judge the future load of vehicles on the proposed road. Capacity analysis of the road segments and major intersections along the alignment is also carried out and the improvements in geometry required are recommended on the basis of the analysis.

4.7.1 Traffic Forecast (Year 2020-2045)

After completion of proposed dualization and rehabilitation of existing Faisalabad - Chiniot - Sargodha Road, it is expected that improvement of serviceability and traffic mobility will generate some extra traffic volume on the project road due to increase in local development and enhanced mobility.

In order to make assessment for future traffic, Origin and Destination (O&D) Surveys, were conducted by the NESPAK. The basic purpose of the O&D surveys was to assess the volume of traffic likely to divert to Faisalabad - Chiniot - Sargodha Road and the volume of traffic likely to continue to use the existing roads/routes.

Traffic forecasts have been made for 25 years (2020-2045) period for the subject road (**Table 4.1, 4.2 & 4.3**) based on growth rates calculated by NESPAK by using the following factors that affecting traffic growth directly or indirectly i.e.:

- Growth of registered vehicles in Pakistan;
- Growth of registered vehicles in Punjab Province;
- Rate of increase in fuel consumption by the transport sector in Pakistan; and
- Trend in GDP growth.

This traffic forecasts has been conducted in three sections i.e. from Faisalabad to Chiniot, from Chenab Nagar (near Chiniot) to Lalian and Lalian to Sargodha Section. The traffic categories noted during count survey on all the three sections includes Motorcycles, Rickshaws, Cars/Jeeps/Taxis, Pajeros, Loader Pickups, Buses, Mini Buses/Coasters, Tractors/Tractor Trolleys, Trucks 2–Axles, Trucks 3–Axles, Large Trucks/Trailers/4-Axles, etc.

Table 4-1: Traffic Projections (Year 2020-2045)

Faisalabad to Chiniot Section

Years	VEHICLES									TRUCKS				Total Traffic
	Motor Cycle	Rickshaw	Car/Jeep Taxi	Pajero Suzuki Pickup	Hiace Wagon	Mini Bus	Bus	Loader pickups	TRACTOR TROLLY	2-AXLE	3-AXLE	4-AXLE	TRAILER / 5-AXLE &Above	
2020	7762	885	4093	353	740	184	181	476	201	1324	2267	157	112	**18736**
2021	8295	942	4271	369	758	188	185	501	208	1369	2344	162	116	**19707**
2022	8827	998	4448	384	775	192	189	526	215	1414	2421	168	120	**20677**
2023	9360	1054	4624	399	792	196	194	551	222	1459	2497	173	124	**21646**
2024	9893	1110	4801	414	809	201	198	577	229	1503	2574	178	127	**22613**
2025	10426	1165	4976	430	826	205	202	602	235	1548	2650	184	131	**23580**
2026	10958	1221	5152	445	843	209	206	627	242	1592	2726	189	135	**24546**
2027	11491	1277	5327	460	860	213	210	652	249	1637	2802	194	139	**25511**
2028	12024	1333	5503	475	876	217	214	677	256	1681	2878	199	143	**26476**
2029	12557	1388	5678	490	893	221	218	702	262	1725	2954	205	146	**27440**
2030	13089	1444	5852	505	909	225	222	727	269	1769	3029	210	150	**28403**
2031	13622	1500	6027	520	925	229	226	752	276	1814	3105	215	154	**29366**
2032	14155	1555	6202	535	942	233	230	777	282	1858	3180	220	158	**30328**
2033	14688	1611	6376	551	958	238	234	802	289	1902	3256	225	161	**31290**
2034	15220	1667	6550	566	974	242	238	827	296	1946	3331	231	165	**32252**
2035	15753	1722	6724	581	990	246	242	852	302	1990	3406	236	169	**33213**
2036	16286	1778	6898	596	1006	249	246	877	309	2033	3481	241	172	**34174**
2037	16819	1833	7072	611	1022	253	250	902	316	2077	3556	246	176	**35135**
2038	17351	1889	7246	626	1038	257	254	927	322	2121	3631	252	180	**36095**
2039	17884	1944	7420	641	1054	261	258	952	329	2165	3706	257	184	**37055**

Years	VEHICLES									TRUCKS				Total
	Motor Cycle	Rickshaw	Car/Jeep Taxi	Pajero Suzuki Pickup	Hiace Wagon	Mini Bus	Bus	Loader pickups	TRACTOR TROLLY	2-AXLE	3-AXLE	4-AXLE	TRAILER / 5-AXLE &Above	Traffic
2040	18417	2000	7594	656	1070	265	262	977	336	2209	3781	262	187	**38015**
2041	18949	2055	7767	671	1086	269	265	1002	342	2252	3856	267	191	**38975**
2042	19482	2111	7941	680	1113	274	269	1027	349	2296	3931	272	195	**39941**
2043	20015	2166	8114	690	1140	280	273	1052	356	2340	4006	277	198	**40908**
2044	20548	2222	8288	700	1167	285	277	1077	362	2383	4080	283	202	**41874**
2045	21080	2277	8461	710	1194	290	281	1102	369	2427	4155	288	206	**42840**

Table 4-2: Traffic Projections (Year 2020-2045)

Chenab Nagar (near Chiniot) to Lalian Section

Years	VEHICLES									TRUCKS				Total Traffic
	Motor Cycle	Rickshaw	Car/Jeep Taxi	Pajero Suzuki Pickup	Hiace Wagon	Mini Bus	Bus	Loader pickups	TRACTOR TROLLY	2-AXLE	3-AXLE	4-AXLE	TRAILER / 5-AXLE &Above	
2020	10164	1677	3915	466	783	347	317	510	307	967	3679	198	147	**23477**
2021	10862	1784	4084	486	801	355	324	537	317	1000	3804	205	152	**24713**
2022	11559	1890	4253	506	819	364	332	565	328	1033	3929	212	157	**25946**
2023	12257	1996	4422	527	837	372	339	592	338	1065	4053	218	162	**27179**
2024	12955	2102	4591	547	855	380	346	619	349	1098	4177	225	167	**28410**
2025	13652	2208	4759	567	873	387	354	646	359	1130	4301	232	172	**29640**
2026	14350	2314	4927	587	891	395	361	673	369	1163	4425	238	177	**30869**
2027	15048	2419	5095	607	908	403	368	700	380	1195	4548	245	182	**32097**
2028	15745	2525	5262	627	926	411	375	727	390	1228	4671	252	187	**33324**
2029	16443	2630	5430	647	943	419	382	753	400	1260	4794	258	192	**34551**
2030	17140	2736	5597	666	961	426	389	780	410	1292	4917	265	196	**35777**
2031	17838	2841	5764	686	978	434	396	807	421	1324	5039	271	201	**37002**
2032	18536	2947	5931	706	995	442	403	834	431	1357	5162	278	206	**38227**
2033	19233	3052	6097	726	1012	449	410	861	441	1389	5284	285	211	**39451**
2034	19931	3157	6264	746	1030	457	417	888	451	1421	5406	291	216	**40675**
2035	20628	3263	6431	766	1047	464	424	915	461	1453	5528	298	221	**41898**
2036	21326	3368	6597	786	1064	472	431	942	471	1485	5650	304	226	**43121**
2037	22024	3473	6763	805	1081	480	438	968	482	1517	5772	311	231	**44343**
2038	22721	3578	6930	825	1097	487	445	995	492	1549	5894	317	235	**45566**
2039	23419	3684	7096	845	1114	494	451	1022	502	1581	6015	324	240	**46787**

Years	VEHICLES									TRUCKS				Total Traffic
	Motor Cycle	Rickshaw	Car/Jeep Taxi	Pajero Suzuki Pickup	Hiace Wagon	Mini Bus	Bus	Loader pickups	TRACTOR TROLLY	2-AXLE	3-AXLE	4-AXLE	TRAILER / 5-AXLE &Above	
2040	24116	3789	7262	865	1131	502	458	1049	512	1613	6137	331	245	**48009**
2041	24814	3894	7428	885	1148	509	465	1076	522	1645	6258	337	250	**49230**
2042	25511	3999	7594	897	1176	519	472	1102	532	1677	6380	344	255	**50459**
2043	26209	4104	7760	910	1205	529	478	1129	543	1709	6501	350	260	**51687**
2044	26907	4209	7926	923	1234	539	485	1156	553	1740	6622	357	265	**52915**
2045	27604	4314	8092	936	1262	549	492	1183	563	1772	6744	363	269	**54143**

Table 4-3: Traffic Projections (Year 2020-2045)

Chenab Nagar (near Chiniot) to Lalian Section

Years	VEHICLES									TRUCKS				Total Traffic
	Motor Cycle	Rickshaw	Car/Jeep Taxi	Pajero Suzuki Pickup	Hiace Wagon	Mini Bus	Bus	Loader pickups	TRACTOR TROLLY	2-AXLE	3-AXLE	4-AXLE	TRAILER / 5-AXLE &Above	
2020	11651	1489	3248	160	326	104	160	292	249	404	3857	124	108	**22172**
2021	12451	1583	3389	167	334	106	163	308	258	418	3989	129	112	**23405**
2022	13251	1678	3529	174	341	109	167	323	266	431	4119	133	115	**24637**
2023	14051	1772	3669	181	349	111	171	339	275	445	4250	137	119	**25867**
2024	14850	1866	3809	188	356	113	174	354	283	459	4380	141	123	**27096**
2025	15650	1960	3949	195	364	116	178	369	292	472	4510	145	126	**28325**
2026	16450	2054	4088	202	371	118	182	385	300	486	4639	150	130	**29553**
2027	17249	2147	4227	208	378	120	185	400	308	499	4768	154	134	**30780**
2028	18049	2241	4366	215	386	123	189	416	317	513	4898	158	137	**32007**
2029	18849	2335	4505	222	393	125	192	431	325	526	5026	162	141	**33233**
2030	19649	2428	4644	229	400	127	196	447	333	540	5155	166	144	**34458**
2031	20448	2522	4782	236	407	130	199	462	342	553	5284	170	148	**35683**
2032	21248	2616	4921	243	414	132	203	477	350	567	5412	175	152	**36908**
2033	22048	2709	5059	249	422	134	206	493	358	580	5540	179	155	**38132**
2034	22847	2803	5197	256	429	136	210	508	367	593	5668	183	159	**39356**
2035	23647	2896	5336	263	436	139	213	523	375	607	5796	187	162	**40580**
2036	24447	2989	5474	270	443	141	217	539	383	620	5924	191	166	**41803**
2037	25246	3083	5612	277	450	143	220	554	391	634	6052	195	169	**43026**
2038	26046	3176	5750	283	457	145	224	569	400	647	6179	199	173	**44249**
2039	26846	3270	5888	290	464	148	227	585	408	660	6307	203	177	**45472**

Years	VEHICLES									TRUCKS				Total Traffic
	Motor Cycle	Rickshaw	Car/Jeep Taxi	Pajero Suzuki Pickup	Hiace Wagon	Mini Bus	Bus	Loader pickups	TRACTOR TROLLY	2-AXLE	3-AXLE	4-AXLE	TRAILER / 5-AXLE &Above	
2040	27645	3363	6025	297	471	150	231	600	416	674	6434	208	180	**46694**
2041	28445	3456	6163	304	478	152	234	615	424	687	6562	212	184	**47916**
2042	29244	3550	6301	308	490	155	237	631	433	700	6689	216	187	**49141**
2043	30044	3643	6439	313	502	158	241	646	441	714	6816	220	191	**50366**
2044	30844	3736	6576	317	514	161	244	661	449	727	6944	224	194	**51591**
2045	31643	3829	6714	322	526	164	248	677	457	740	7071	228	198	**52816**

4.8 DESIGN ASPECT

Following is the brief description of the design aspects of the proposed dualization/rehabilitation of the existing road.

4.8.1 Design Criteria

The geometric design will be carried out as per " AASHTO Criteria on Geometric Design of Highways, based on the following main parameters. The cross-section of the proposed project is attached as Figure **4.2 (a & b)**.

a. Right of way (ROW)

- Rural Area : 110 feet
- Urban Area : 127 feet

b. Design speed

Design Speed for the proposed project on main carriageway is 120 Kilometres per hour (KPH).

c. Road Cross Section

- No of Lanes : 2 lanes on each side
- Lane width : 3.65 m
- Shoulder Width
  - Inner (Paved) : 1.2 m
  - Outer (Rural) : 2.4 m + 0.5 m rounding
  - Outer (Urban) : 1.2 m

d. Carriageway cross slope

- Pavement : 2%
- Outer shoulder TST : 2%
- Inner shoulder : 2%

e. Horizontal Alignment

- Super elevation : 6%
- Minimum radius : 756 m
- Absolute minimum curve radius at turnings/channelizing islands : 22 m

f. Vertical Alignment

- Maximum Gradient : 3%
- Minimum Gradient : 0.3%
- K value for crest vertical curve : 95

- K value for sag vertical curve : 63

g. Design life of pavement : 10 Years

4.8.2 Codes and Standards:

The following codes and standards have been considered and adopted for the design of the project road:

- Geometric Design: AASHTO
- Material & Testing: AASHTO – ASTM
- Pavement Design: AASHTO

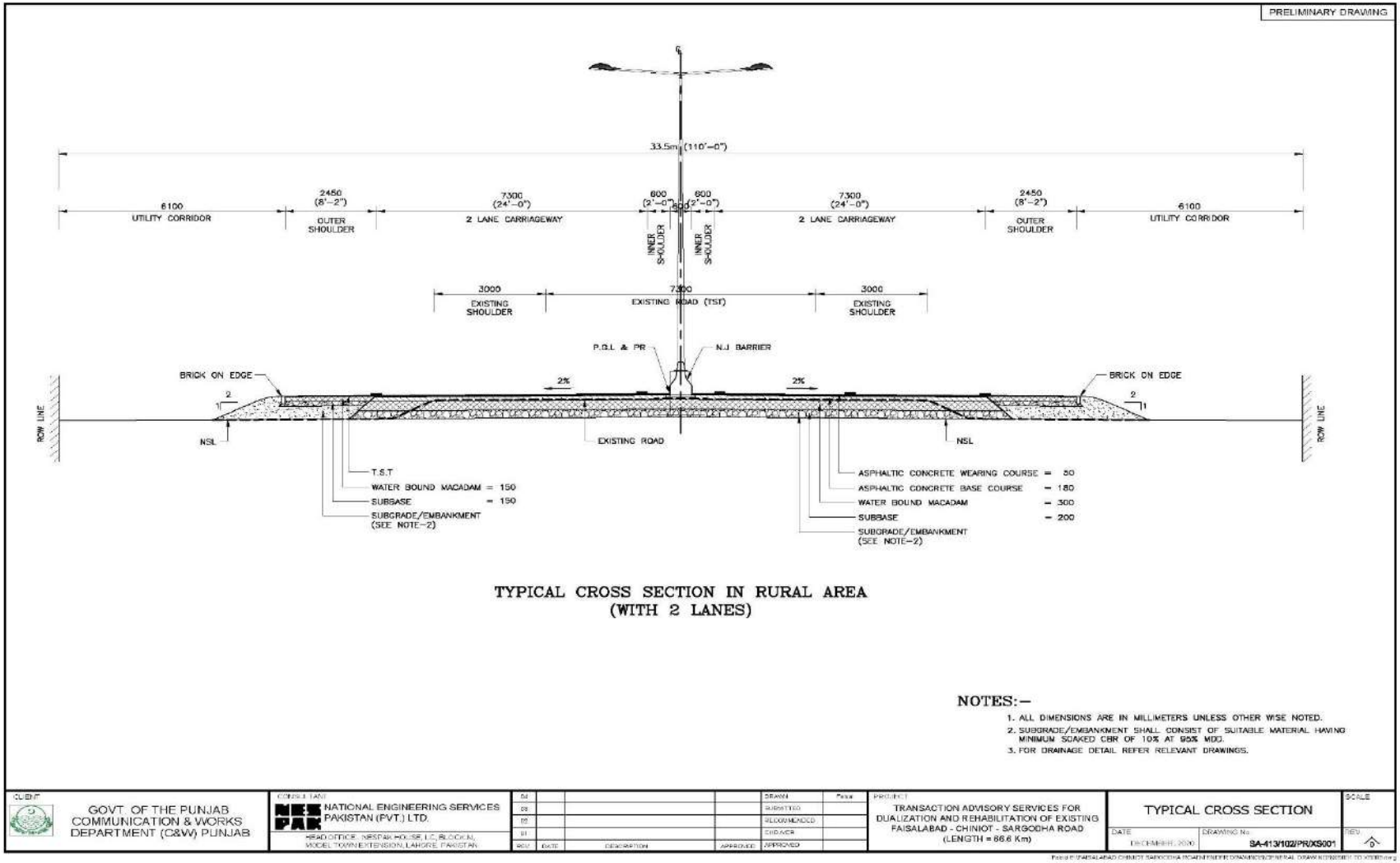


Figure 4.2 (a): Typical Cross-section of the proposed project (Rural Area)

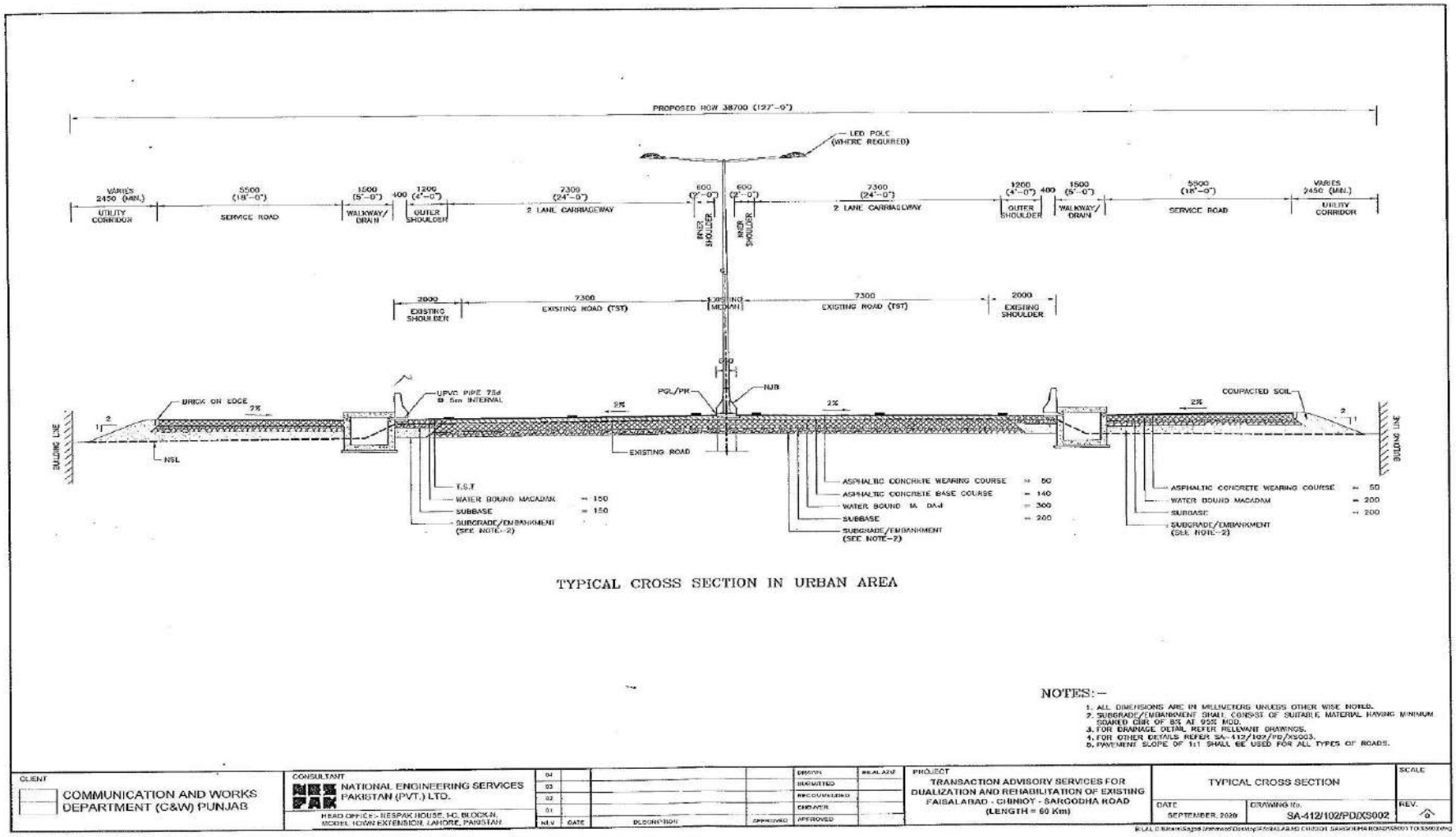


Figure 4.2 (b): Typical Cross-section of the proposed project (Urban Area)

4.9 CONSTRUCTION ASPECTS

4.9.1 Construction Materials

The materials used for construction purpose would include coarse aggregates (crush), fine aggregates (sand), steel, water, asphalt, reinforcement, cement etc. Fine aggregates are locally available in the area, while the soil/ crushed aggregate will be procured from Sargodha. The details of the construction material for the proposed project are given as under:

a) Sargodha Quarries (Crushed Aggregate Source)

Sargodha rock quarries are located on the left side of Faisalabad – Sargodha Road. The Precambrian basement complex near Sargodha is spread over an area of about 200 sq. Km between Chiniot and Sargodha. These hills are called Kirana hills. The rocks are exposed as isolated ridges in an otherwise level plain, filled by alluvium. The rocks in this area comprise meta sediments, represented by quartize, phylite and slate. The volcanic rocks include rhyolite, volcanic tuff and brecciate volcanic matter.

By crushing these aggregates, desired size can be produced without producing a significant amount of flat and elongated particles. However, aggregates produced by crushing slate contain a considerable amount of flat and elongated particles. The inclusion of slate may therefore be avoided during blasting and crushing. Crush stone were tested by the Design Consultant and suggested that this material is suitable for use in road construction, after crushing to the specified size and gradation. The quantities available are quite large and mining leases have already been obtained by various parties.

b) Fine Aggregate (Sand)

Good quality natural fine aggregate or sand of acceptable gradation will be obtained from nearby licensed or approved entities dealing with fine aggregates.

c) Asphalt, Reinforcement and Cement

Asphalt, reinforcement and cement material will be transported from the factories near Faisalabad/Sargodha for road construction.

4.9.2 Work Force

Man power demand estimation is an essential component to facilitate deployment of manpower. Total man power required for the proposed project will be estimated by the contractor at construction stage, whereas as per consultant's previous experience the workforce for proposed project has been estimated as 250 workers (70 skilled and 180 unskilled labourers).

4.9.3 Construction Activities and Required Machinery

Construction activities involve following:

- Earth work (clearing of vegetation/ trees and top soil);
- Roadwork (Levelling, preparation of sub grade, sub base, base and wearing course); and
- Structure works.

The list of the machinery and the equipment required for the proposed Project is provided in **Table 4.4**.

Table 4-4: Machinery and Equipment Requirement

Sr. No.	Type of Machinery/ Equipment	Sr. No.	Type of Machinery/ Equipment
1	Bulldozer	12	Rollers
2	Excavator	13	Tandem
3	Dump Trucks	14	Vibratory Combination Rubber Mounted Tandem Roller
4	Grader	15	Crane
5	Grader with Scarifier	16	Beam Launching Truss
6	BackHoe	17	Piling Equipment
7	Water Tanker	18	Vibrator for Concrete
8	Front End Loader	19	Road Marking Machine
9	Paver	20	Concrete Batching Plant
10	Power Broom	21	Asphalt Premix Plant
11	Bitumen Pressure Distributor	22	Laboratory with Equipment (1 permanent & 1 mobile)

4.9.4 Construction Camps

Camp sites will be selected keeping in view the availability of adequate area for establishing camp sites, including parking areas for machinery, stores and workshops, access to communication and local markets, and an appropriate distance from sensitive areas in the vicinity. Keeping in view the following criteria guidelines, the Contractor has to identify the construction camp sites before start of the construction activities:

- There should be no resettlement issue for the location of the camps;
- Camp site should be away from the residential areas and sensitive receptors;
- Selection of sites for construction camps shall be near the project area having proper access to the nearby main/link road;
- The camps must be located in a place where the drainage from and through the camps will not threaten any domestic or public water supply;
- Camp site must be adequate in size to prevent overcrowding of necessary structures;
- The camp site should consider avoiding any damage of property, vegetation, irrigation, and drinking water supply systems;
- The camp site must not be subject to periodic flooding; and

- There should not be any ecological sensitive areas e.g. wildlife sanctuaries, game reserves, national parks, forest areas, etc. near to the construction camp site.

4.9.5 Water Requirement

The source of water during the construction phase will be from water bowser tanks and groundwater (if available) from local sources will be used. The water consumption is estimated to be 10,000 liters /day[2] for 250 construction workers comprising 70 skilled and 180 unskilled labourers (approx.) for the proposed Project.

4.9.6 Wastewater Generation

The wastewater generation is estimated to be 8,000 liters/day for 250 construction workers for the proposed Project.

4.9.7 Solid Waste Estimation

Due to construction activities, waste will be generated at construction site and contractors camp. The contractor will provide the estimated quantity of excavation material during the construction phase. These wastes will be generated due to the construction activities and the up to the extent possible the excavated materials will be reused, where applicable, for construction purposes.

The solid waste generation is estimated to be 125 kg/day (as per 0.5 kg/capita/day waste generation)[3] for 250 construction workers for the proposed Project.

4.9.8 Power Requirement/ Power Source

The main source of electricity/electric power during construction phase will be diesel generators for construction camps and construction machinery and during the operational phase it would be taken from main electric power grid, supplying power to the main city. The Contractor(s) will provide the details about capacity, type and number of generators to be utilized during construction phase.

4.10 PROJECT IMPLEMENTATION SCHEDULE

The proposed Project is expected to be completed within twenty four (24) Months.

4.11 COST OF THE PROJECT

The estimated cost of the construction works of proposed Project is Rs. 11.7 billion.

2. Tentative Work Force Requirements Including Client and Contractor Staff"
   = (250) x (40) = 10,000 liters/day
   = (250) x (80% of wastewater) =8,000 liters/day
3. Source: The World Bank Report 2012 – What a Waste: A global review of solid waste management. Based on UNEP estimates for waste generation in the Asia Pacific. Average is 0.45 kg/capita/day

5 DESCRIPTION OF THE ENVIRONMENT

5.1 GENERAL

For any development project, the prevailing environmental conditions need to be assessed prior to the stages of planning, designing and execution of the project. Identification of physical, ecological and social aspects of environment and collection of relevant data is essentially important for the evaluation of impacts as well as for the suggestion of adequate mitigation measures, which forms the basis for the implementation of the proposed project in terms of prevailing environmental and social conditions in the study area.

The existing environmental conditions of the proposed project have been considered within a COI /AOI of 43.5m to 48.7 meters that also includes the RoW (33.5 to 38.7 m). This is limited to the 10 meters on either side of the ROW for collection of baseline information as shown in **Figure 5.1** with respect to physical, biological and socio-economic aspects. Information has been collected from variety of sources, including published literature, DCRs, field observations and surveys, conducted specifically for this Project have been analyzed for this study. Consultations were also held with the general public and stakeholders of the project area in order to seek the public opinion on the implementation of the proposed Project. Various questionnaires and checklists were utilized as a tool for baseline data collection during field visit which are attached as **Annex-I**.

5.2 PHYSICAL RESOURCES

The following section provides an overview of the information on physical environment of the proposed Project study area collected from primary as well as secondary sources. The major parameters covered include Physiographic and Topography, Geology, Soil, Seismicity, Climate and Meteorology, Ambient Air & Noise, Water Resources, Solid Waste, and Land Use.

5.2.1 Physiographic and Topography

a) Faisalabad

Faisalabad, formerly known as Lyallpur, is the third-most-populous city in Pakistan, and the second-largest in the eastern province of Punjab. The total area of the district is of 58.56 square kilometer. It lies between longitude 73^{o} and 74^{o} East and latitude 30^{o} and 31.5^{o} North, at an elevation of 150[4] meters above sea level in the rolling flat plains of northeast Punjab. The flat alluvial plan is formed by Chenab and Ravi rivers. The River Ravi flows along the southern-eastern boundary of the district. The land close to the river is relatively lower than that away from the river towards the west. There is no interruption in the monotony of the plain and there is only a fall of some 38 meters from north-east to the south-west of the district. **Figure 5.2** shows the topography map of the Faisalabad.

[4] District Census Report Faisalabad, 1998

b) Sargodha

Sargodha is a city and capital of Sargodha Division, located in Punjab province, Pakistan. It is Pakistan's 12th largest city by population and one of the fastest growing cities of the country. Sargodha is also known as the City of Eagles. The total area of the district is of 155[5] square kilometer. It lies between longitude 72º and 73º East and latitude 31º and 32º North, at an elevation of 190 meters above sea level. Sargodha mainly comprises flat, fertile plains, although having few small hills on the Sargodha-Faisalabad Road. The River Jhelum flows on the western and northern sides, and the River Chenab on the eastern side of the city. **Figure 5.3** shows the topography map of the Sargodha.

[5] District Census Report Sargodha, 1998

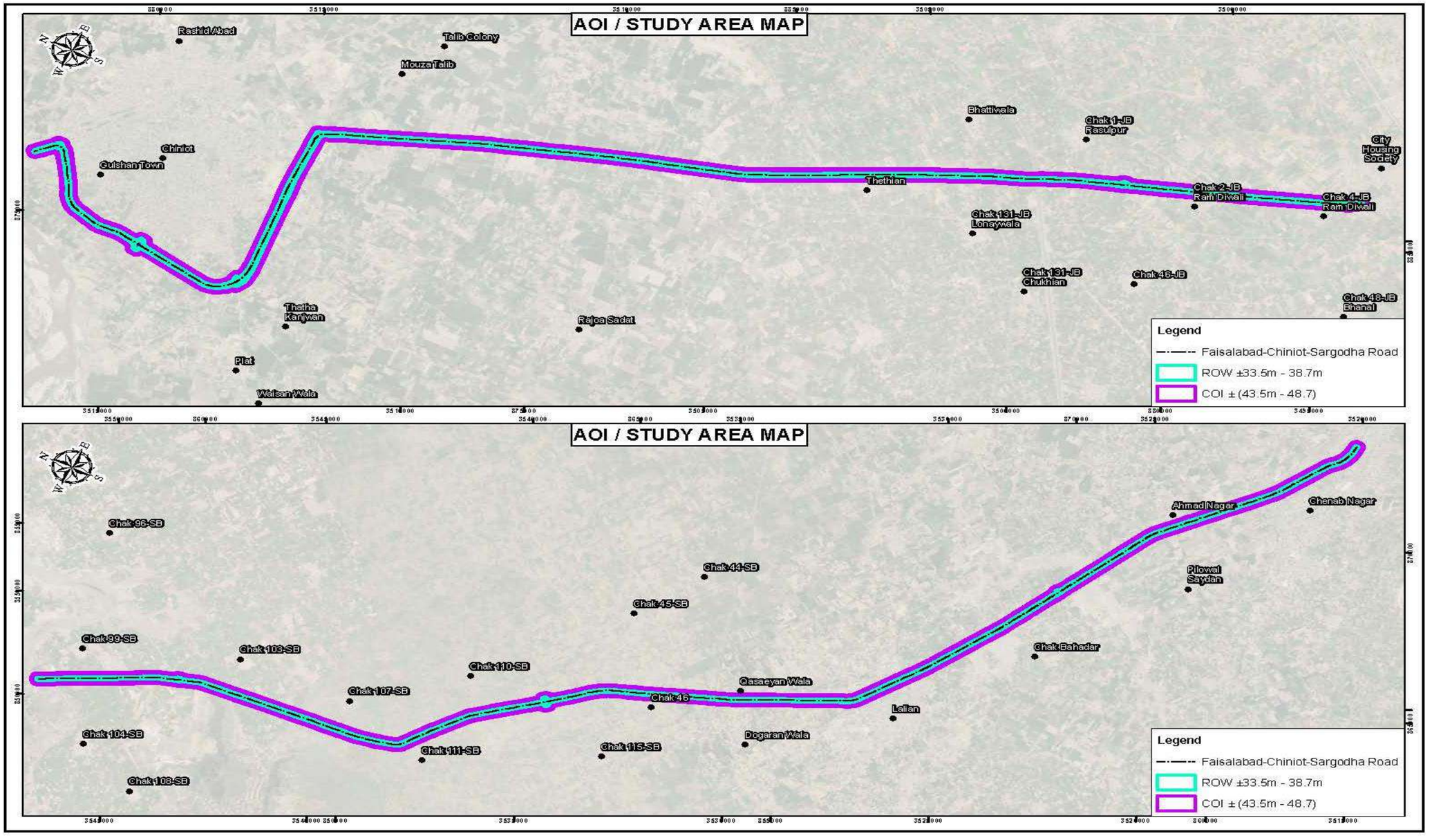


Figure 5.1: Study Area (COI / AOI) Map of the proposed Project

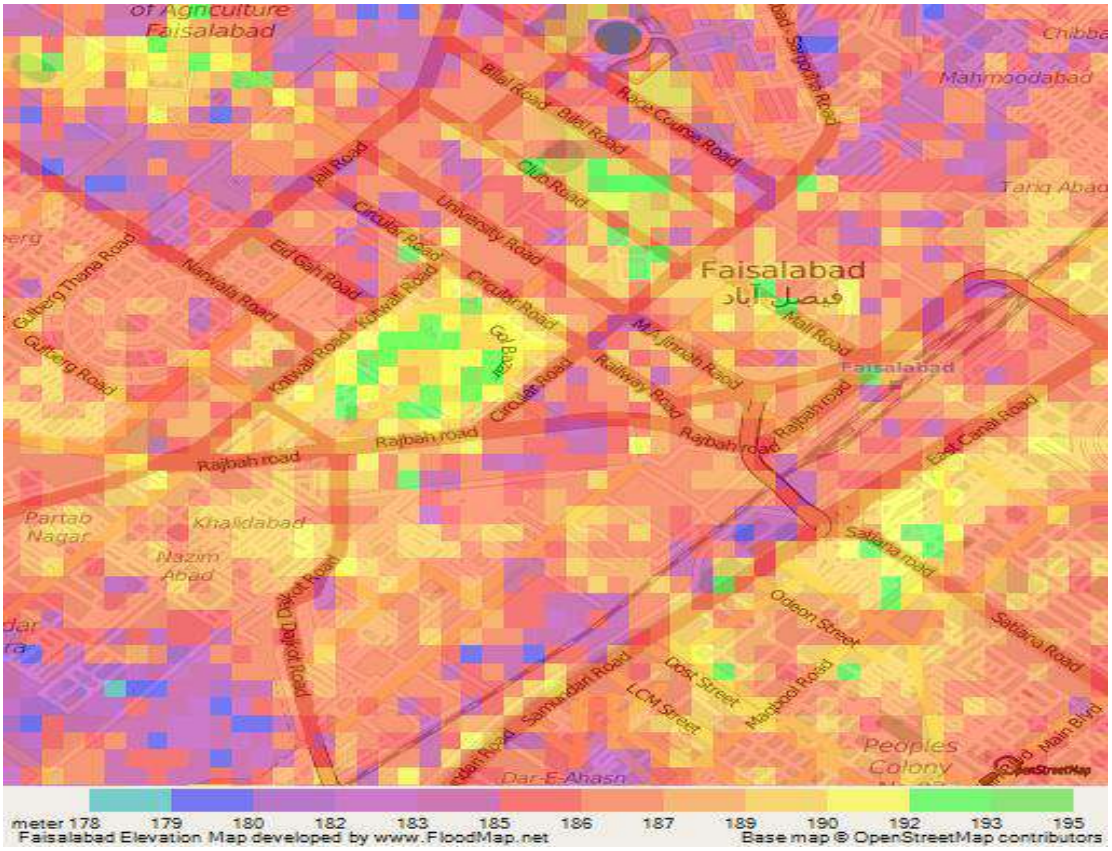


Figure 5.2: Topography Map of the Faisalabad

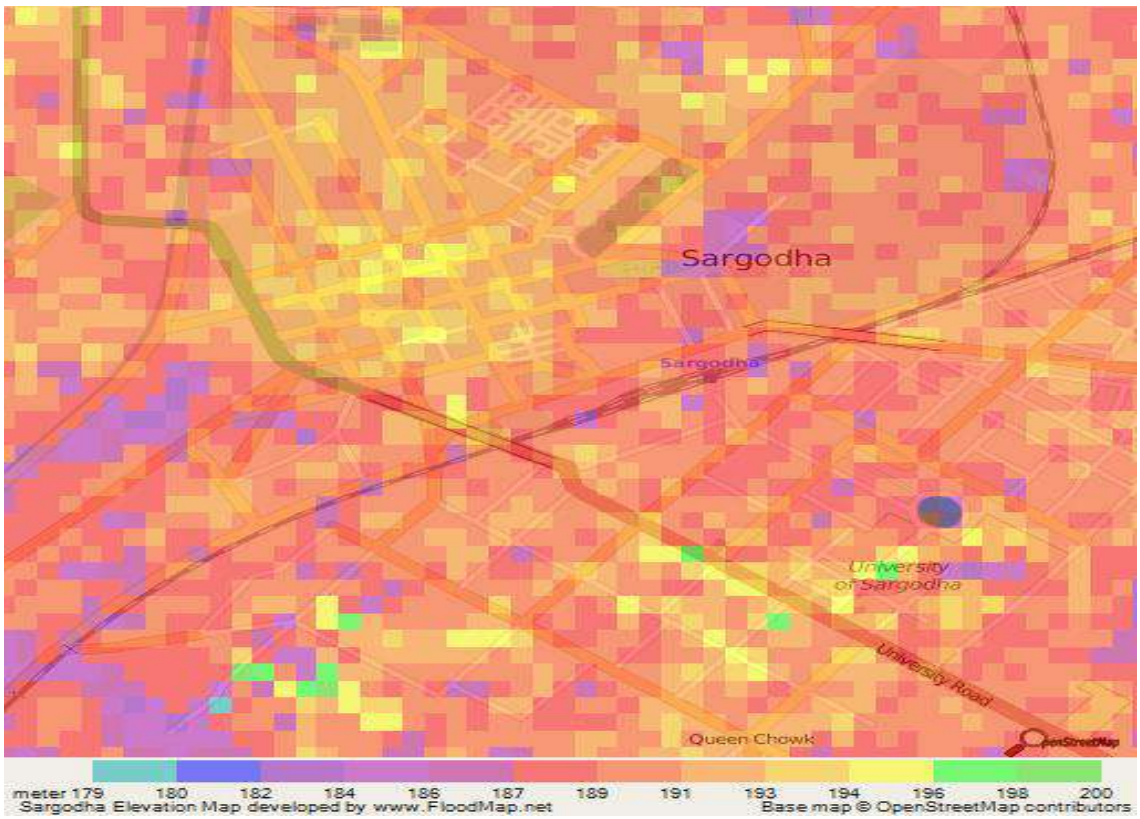


Figure 5.3: Topography Map of the Sargodha

c) Chiniot

Chiniot is loacated at the intersection of the Faisalabad-Sargodha and Lahore-Jhang Roads, in Punjab province, Pakistan. The total area of the district is of 10 square kilometer[6] with an average elevation of 179 meters. It lies between longitude 72º and 73º East and latitude 31º and 31.5º North. Chiniot city lies on left bank of the Chenab River, and is located on a small rocky hill. Much of the surrounding area consists of alluvial plains, interspersed with rocky outcroppings of slate and sandstone that reach up to 400 feet in height around Chiniot. **Figure 5.4** represents the topography of the Chiniot.

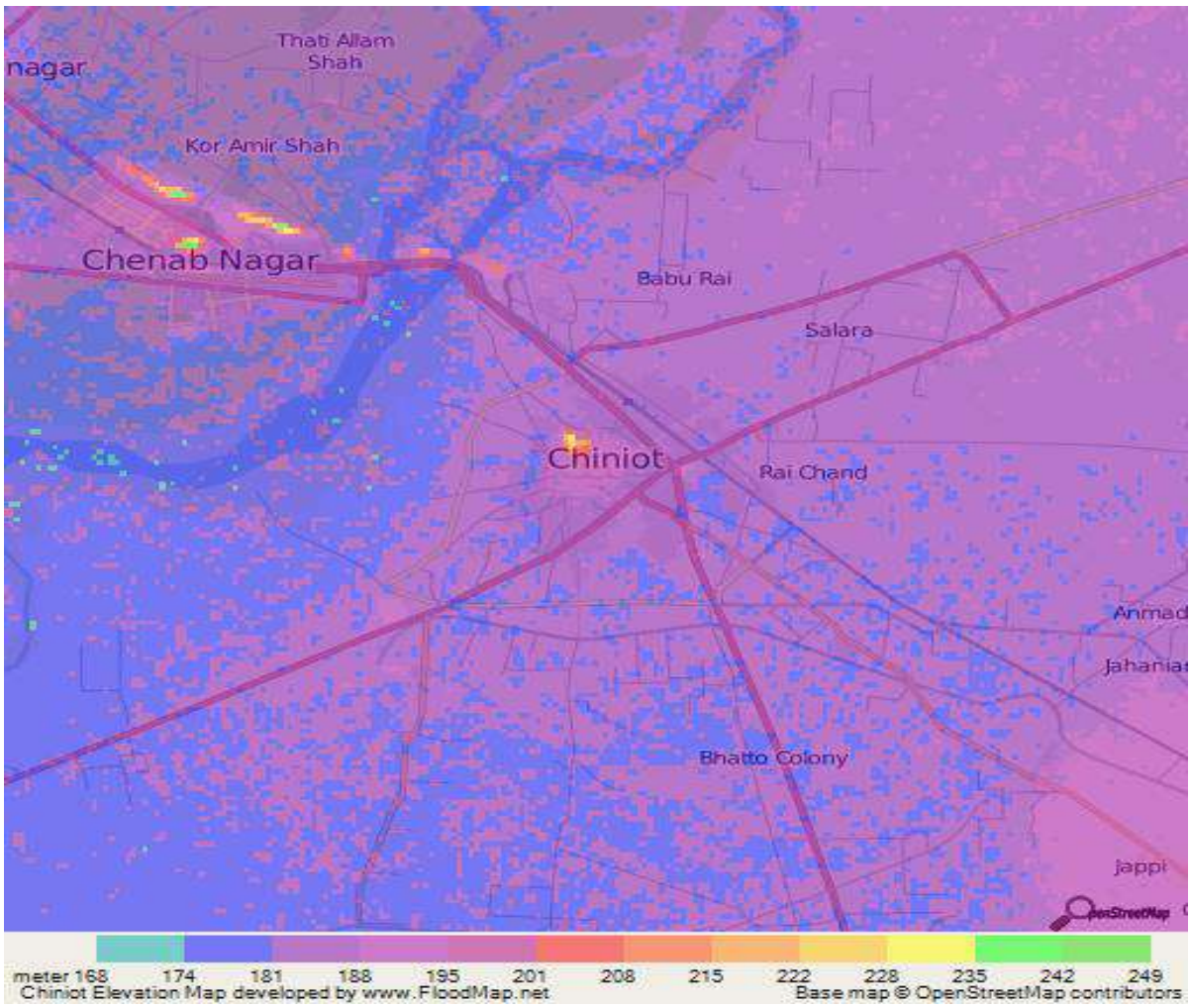


Figure 5.4: Topography Map of the Chiniot

Study Area

The study area of the proposed project falls in both upland (North) and lowland (South) areas. It lies between 32º and 28º East and 34.9º and 35.4º North at an average elevation of 186 m, surrounded by roads, mountains, agricultural land, rivers, canals, nullahs, valleys, mosques, graveyards, shrines, residential areas, medical and health institutions and commercial area. **Figure 5.5** represents the topography of the study area of the proposed Project.

[6] Chiniot City Profile, Punjab Cities Improvement Investment Program , 2018 The Urban Unit P & D Department, Punjab

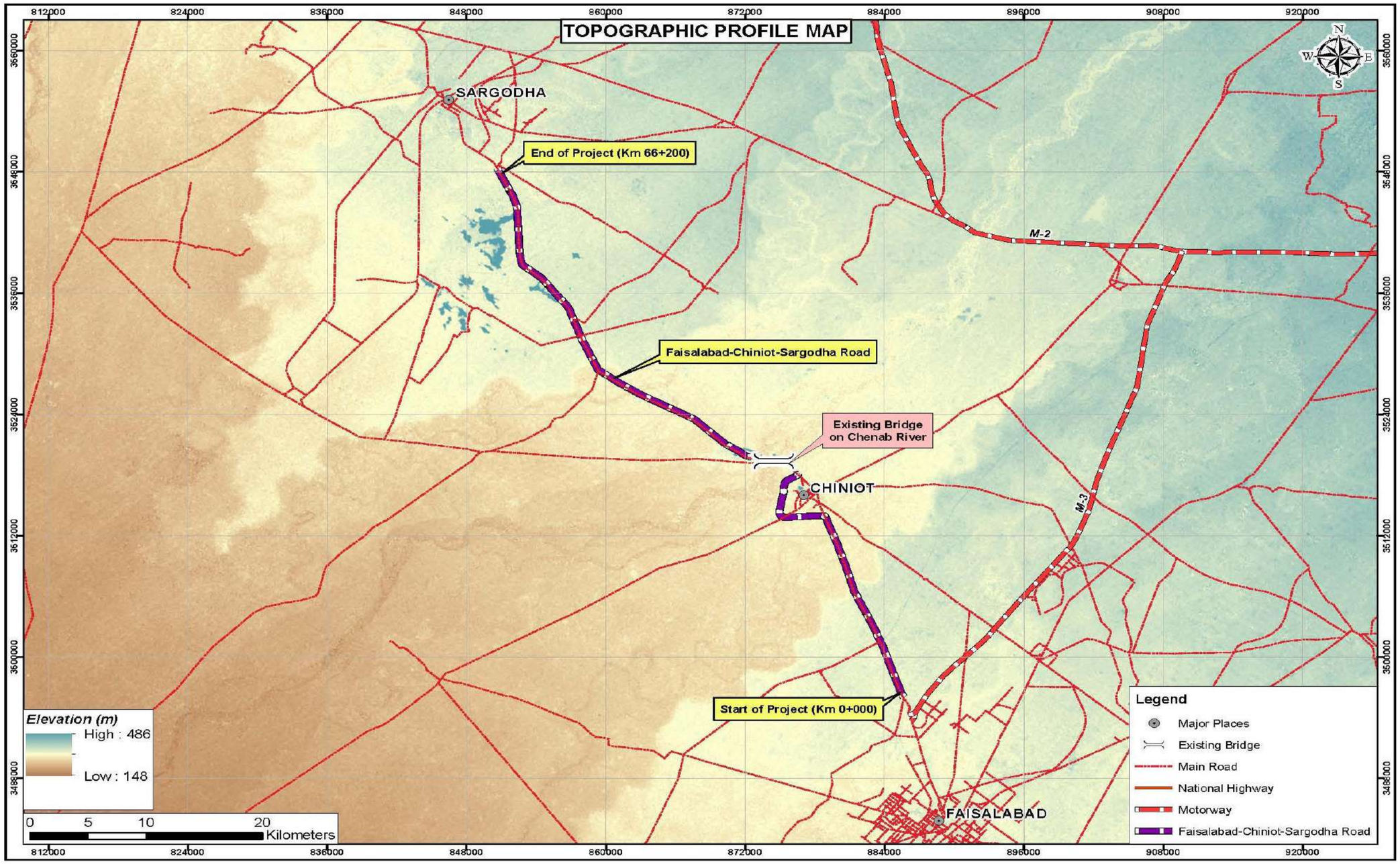


Figure 5.5: Topography Map of the Study Area

5.2.2 Geology

a) Faisalabad

The district of Faisalabad is part of the alluvial plains between the Himalayan foothills and the central core of the Indian subcontinent. The alluvial deposits are typically over a thousand feet thick. The interfluves are believed to have been formed during the Late Pleistocene and feature river terraces. These were later identified as old and young floodplains of the Ravi River on the Kamalia and Chenab Plains. The old floodplains consist of Holocene deposits from the Ravi and Chenab rivers[7]. The Quaternary deposits comprised of silty clay and sand in varying proportions which are accumulated by braided tributaries of Indus river system, originating from the north-west Himalayas[8].

b) Sargodha

The district is a part of west Indus basin that has gradually filled up by alluvium brought by the Indus and its tributaries from the north. The alluvial deposit is generally more than 300[9] meters thick and extends down to several hundred meters at places. Towards the south of Sargodha, this alluvium is locally interrupted by rock out crops of a buried hill range known as Karana hill. This is a range of Precambrian age which is known as Dehbi Shahpur ridge. The land occupying the area has their origin between the late Pleistocene and recent time. Consequently; three (03) major geographical surfaces have been recognized. The youngest and the lowest are recent flood plains where deposition of fresh sediments is still going on or has stopped only recently. The middle surface (sub recent flood plains) belongs to early and middle Holocene age. The recent and the sub recent flood plains are collectively called as Jhelum Flood Plains. The highest and oldest (old river terrace) is most probably of Pleistocene age and comprises the highest strip of land locally known and Karana Bar.

c) Chiniot

The consolidated exposed rocks near Chiniot, Sangla and Shahkot represent the remnants of the buried ridge of metamorphic or igneous origin forming the basements of the alluvial deposits. The rocks are known as the Kirana Hills and are of the Pre-Cambrian age. These rocks cover the central part of the Rechna Doab, forming their longitudinal section across the width of the Doab. The alluvial fill was deposited in subsiding troughs by the ancestral and present tributaries to the Indus River. Overlying the Pre-Cambrian metamorphic or igneous rocks in the basement, the unconsolidated alluvial deposits are of the Pleistocene to recent age deposited through the continuing meandering flows of the river systems that developed in ancient times.

The monotony of the alluvial plain is broken by scattered hills and bedrock outcrops near Chiniot, Sangla Hill and Shahkot in the Rechna Doab. The bedrock hills are projections of the northwest-trending Delhi-Shahpur (or Sargodha) ridge, which is largely buried by alluvium.

[7] Jahangir, Waqar Ahmed; Qureshi, Asad Sarwar; and Ali, Nazim (2002). "Physiography of the Rechna Doab". Conjunctive Water Management in the Rechna Doab: An Overview of Resources and Issues. International Water Management Institute. p. 3

[8] Commission on Engineering Geological Maps of the International Association of Engineering Geology - CEGM-IAEGC, No. 15, 1976.

[9] District Census Report Sargodha, 1998

The ancient crystalline rocks trend towards southeastward across the Rechna Doab, starting from Sargodha and existing beneath Kirana, Chiniot, Sangla Hill, Shahkot and Mangtanwala.

Figure 5.6 shows the regional geological map of the study area.

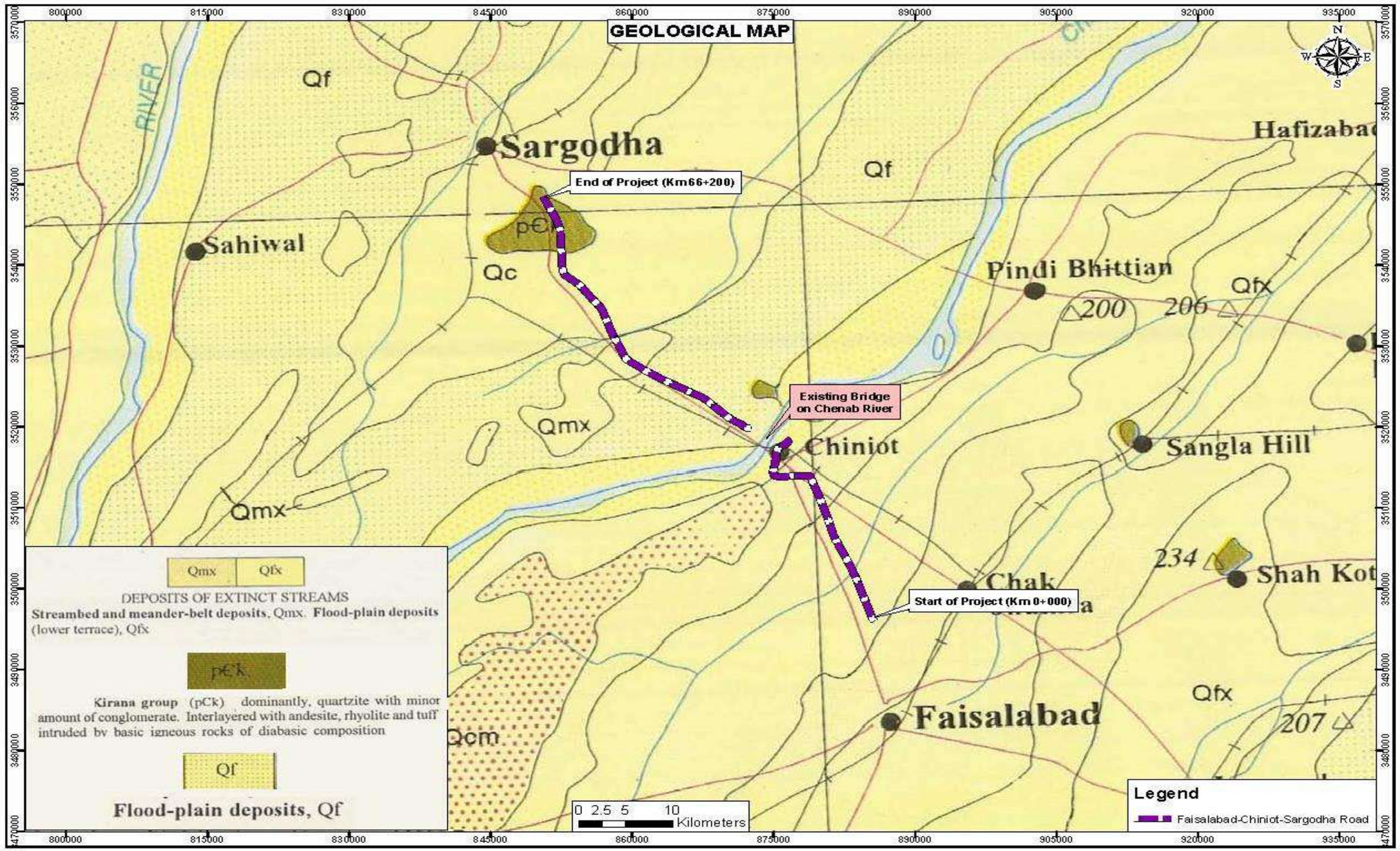


Figure 5.6: Regional Geological Map of the Study Area

5.2.3 Soil

a) Faisalabad

The soil of Faisalabad comprises of alluvial deposits mixed with loess (silt loam or very fine sandy loam) having calcareous characteristics. The sub soils and sub strata encountered in the area have been formed by alluvial transported by ancient streams of the Indus River System. The soil is generally very fertile in nature[10].

b) Sargodha

The soil of the Sargodha district is formed from alluvial deposits mainly by the Jhelum River with minor contribution of Chenab River in southwestern part of the district.

c) Chiniot

The soil of the Chiniot is formed from the Quaternary alluvial deposits comprising silty clay and sand, accumulated by braided tributaries of Indus River system, originating from the north-west Himalayas[11].

The Rechna Doab[12] encompasses the Faisalabad, Sargodha and Chiniot district therefore; soils of the districts are also classified into five series based on vertical and horizontal textual variations as shown in **Figure 5.7**. **Table 5.1** represents the names and characteristics of the soil series.

Table 5-1: Names and Characteristics of the Soil Series

Sr. No.	Type of Series	Characteristics
1.	Jhang: Coarse (Sand and Loamy Sand)	The soils are very permeable, usually slightly calcareous, and seldom have a zone of lime accumulation. Owing to their coarseness, these soils are unlikely to build up higher levels of salinity or fertility.
2.	Farida: Moderately Coarse (Sandy Loam and Fine Sandy Loam)	These are the most extensive soils in the Rechna Doab. Derived from older alluvial deposits, they are generally found on smooth, nearly leveled topography. The surface is mildly calcareous, whereas the sub-soils are moderately to highly calcareous. With a wide range of adoption, the fertility levels and organic matter can be readily built up.
3.	Buchiana: Medium (Loam, Silt Loam and Silt)	These soils have also been derived primarily from the older sediments. Being moderately permeable, they have well to high water holding capacities that make them the most favorable soils for farming. Kankar Zones are frequent in the upper substratum, particularly in areas where the water table has fluctuated within the soils crust.
4.	Nokhar: Fine (Sandy Clay, Silty Clay and Clay)	The substratum of these soils is commonly of moderate fine texture. The internal drainage is highly restricted and

[10] City District Government Faisalabad, 2019
[11] Commission on Engineering Geological Maps of the International Association of Engineering Geology - CEGM-IAEGC, No. 15, 1976.
[12] The Rechna includes all the area between the Chenab and Ravi Rivers, all the way from the Jammu Division of Jammu and Kashmir in India till their confluence in Punjab, Pakistan.

Sr. No.	Type of Series	Characteristics
		surface drainage features are unfavorable. Extent wise, they constitute only a small fraction of the Rechna Doab.
5.	Chuharkana: Moderately Fine (Silty Clay Loam, Sandy Clay Loam and Clay Loam)	This type of soil occurs across depressional or semi depressional areas, and has compact substrata that support a rather narrow range of crop adoption. Because of limited drainability, the salinity hazard for these soils is much more pronounced, especially when accompanied by high water tables. For the initial 15 centimeters of the soil strata representing the top root zone, surface soils show much more heterogeneity when compared to the series mentioned above.

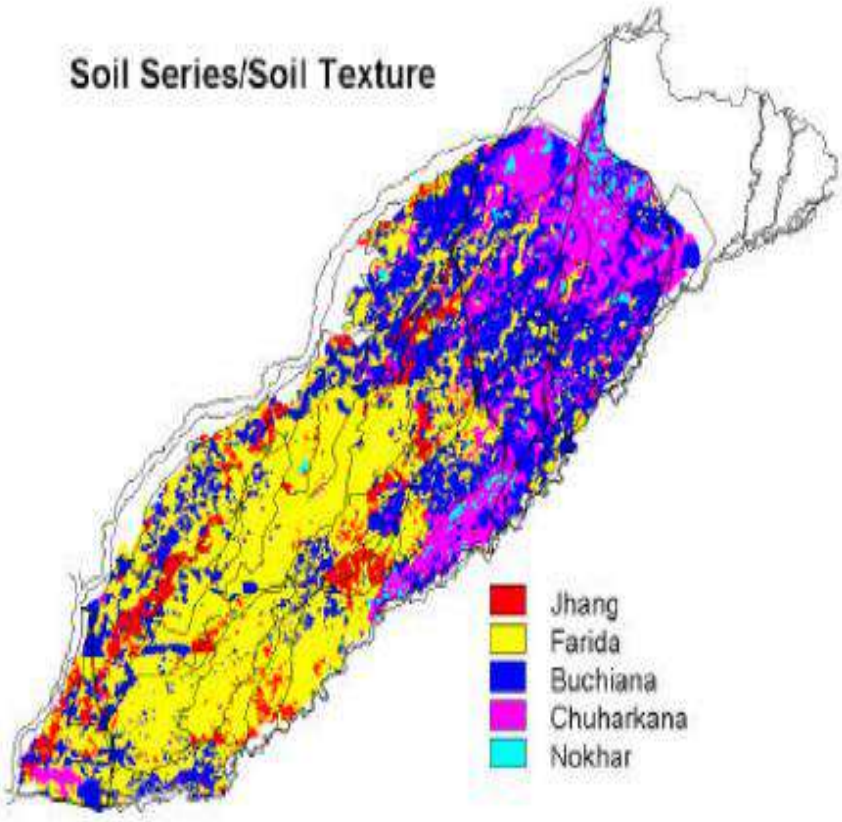


Figure 5.7: Spatial Distribution of different Soil Series in Faisalabad, Sargodha and Chiniot Districts

Study Area

The soil in the study area varies from sandy loam to sandy clay loam, silty and loamy. The soil map of the study area is shown in **Figure 5.8.**

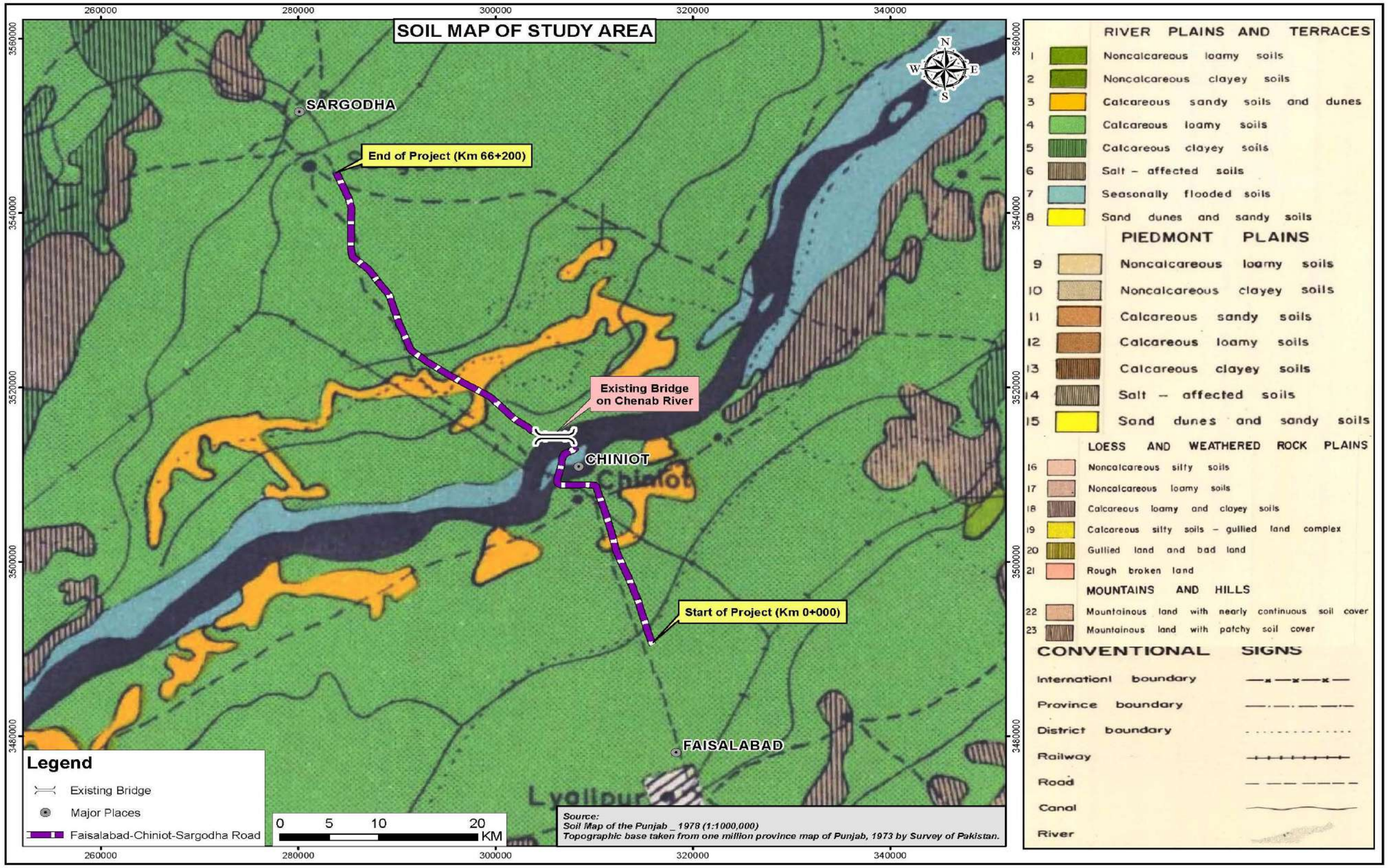


Figure 5.8: A Soil Map of the Study Area

5.2.4 Seismology

The Project site falls in the Punjab plain, which has low to moderate level of seismicity. The Project region has been subjected to severe shaking in the past due to earthquakes in the Himalayas. The known main active fault of the Himalayas is the Main Boundary Thrust (MBT). The epicenters of low to moderate magnitude earthquakes, recorded in the Punjab plain are associated with the subsurface fractures in the basement rocks, which are concealed by thick alluvial deposits. The basement high, depicted by outcrops of basement rocks near Sargodha, Chiniot, Shahkot, and extending from Sargodha to Faisalabad and further southeast towards Indian border, shows a concentration of earthquakes with magnitude up to 5.5 on the Richter scale.

According to Building code of Pakistan, 2007, the Project Area (Faisalabad-Chiniot-Sargodha) falls in Seismic Zone 2A of Pakistan (low to moderate damage), and peak ground acceleration (PGA) from 0.08 to 0.16 gram[13]. **Figure 5.9** shows the seismic zoning map of the study area.

5.2.5 Climate and Meteorology

The seasonal climatic conditions must be considered for the design and execution of the developmental projects. The climate including air, temperature, precipitation, humidity and wind speed and wind direction are an influencing factor, affecting the construction of engineering structures. However, to determine the overall effect of the climatic stresses, daily and seasonal temperature changes, site altitude, direct solar radiation, and precipitation must be considered.

The Project area (Faisalabad-Chiniot-Sargodha) has moderate to extreme climate conditions, with hot summers and cold winters. The summer starts from April and lasts till September, with mean minimum and maximum temperature ranges from 28^0C to 42^0C. The winter seasons lasts from November to March, with mean minimum and mean maximum temperature ranges from 3^0C to 18 ^{0}C.[14]

The project area receives rains in all the seasons but monsoon rain is pronounced and constitutes a definite rainy season between the month of July and September. The average rainfall in Faisalabad is about 615 millimeters per year, in Chiniot 399 millimeters per year and in Sargodha 400 millimeters per year

Based on climatic elements, five seasons are recognized in the Project area i.e.:

i) Pre-monsoon Season

Pre-monsoon refers to the period from April to June prior to the setting in of the monsoon. This is the hottest and the driest season, with persistent dry and hot winds. Day time temperature rises to 42^0C. The flows in the rivers begin to rise simultaneously due to snow-melt water in the high mountains. The water table falls to the maximum depth.

[13] Building Code of Pakistan-Seismic Provisions, Ministry of Housing and Works, Government of Pakistan, 2008
[14] Meteorological Data for Faisalabad Chiniot-Sargodha (1981-2010)

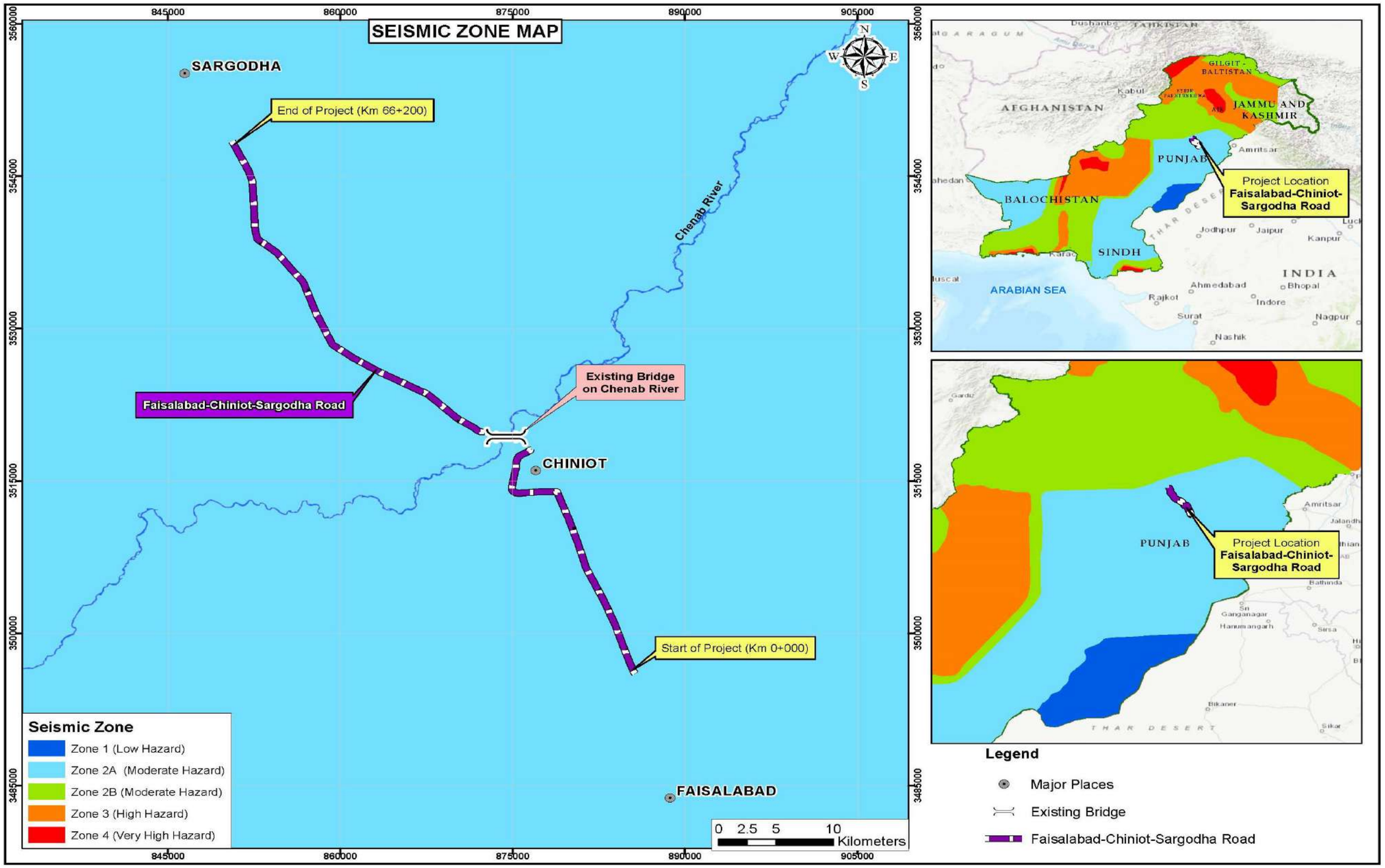


Figure 5.9: Seismic Zoning Map of the Study Area

ii) Monsoon Season

Monsoon is the main rainy period, which starts at the beginning of July, reaches its climax in August and gradually, subsides in September. The intense rainfall events cause soil erosion, which is a function of erosivity and erodibility. The cool monsoon winds followed by heavy showers lower the temperature to great extent. The part of rain percolates into the soil and is conserved in the subsoil, and adds to the groundwater. The conserved moisture in the soils is generally sufficient to rejuvenate the vegetation. All plants grow rapidly and mature towards the end of the season. With the start of monsoon season, the rivers flow at their peak level. The groundwater level is improved toward the end of the season in September and October.

iii) Post-Monsoon Season

Post monsoon season refers to autumn (October-November). The temperature starts falling but the extreme aridity prevents plants to flower early and set seed toward mid-seasons. Groundwater level rises as a result of infiltration from rainfall.

iv) Winter Season

Winter refers to the period from December to January. The lowest temperature is less than 2^0C, and cold winds characterize this season. The plants become dormant and most of them dry out. Most of the trees shed their leaves and few remain green or partly green. Sometimes this season becomes severe due to cold Siberian winds. Groundwater level declines in this season due to low flows in the rivers, and no or little rains which usually fall in light showers causing little soil erosion.

v) Spring Season

Spring refers to the period from February to March. Temperatures become pleasant. The mean maximum temperature is 24.5^0C with the highest precipitation of 92.4 millimeter. Some light showers of rain may also fall without generating run off. The vegetation sprouts again because of conserved moisture from winter and spring rains (if any), and the water table starts falling.

Temperature, precipitation, relative humidity, wind speed and wind gust of the study area (Faisalabad-Chiniot-Sargodha) is discussed below.

a) Faisalabad

Temperature

Table 5.2 and **5.3** shows mean minimal and maximal temperatures observed for each month between 2009 and 2019 in the Study Area. The highest temperature measured between 2009 and 2019 was 46°C in June, 2014, and the lowest temperatures were measured in January, 2011 and January, 2012 i.e. 6°C.

Table 5-2: Mean Maximum Temperature from 2009 to 2019[15]

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
2009	21	23	30	36	43	45	45	43	40	35	27	22
2010	22	23	33	40	43	45	43	39	38	35	29	23
2011	21	22	30	35	43	44	41	38	36	33	29	22
2012	19	20	27	34	40	45	44	39	37	34	28	22
2013	21	21	30	36	42	45	43	39	40	35	27	23
2014	21	22	28	34	39	46	43	41	37	34	28	22
2015	21	25	28	36	41	41	39	39	38	35	28	23
2016	22	27	30	36	42	44	42	40	40	37	31	27
2017	21	27	31	39	42	43	41	41	40	37	29	24
2018	24	26	32	36	41	43	41	41	39	35	29	23
2019	21	22	28	39	42	46	44	41	41	37	28	23

Table 5-3: Mean Minimal Temperatures from 2009 to 2019[16]

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
2009	8	10	15	20	27	29	32	31	25	19	14	9
2010	7	9	16	23	26	29	31	28	25	21	14	8
2011	6	9	14	19	29	33	32	29	26	21	17	10
2012	6	7	12	21	27	32	34	30	27	21	16	11
2013	7	10	14	21	28	32	34	30	27	23	15	11
2014	8	8	14	21	27	33	33	31	26	21	15	10
2015	8	12	15	23	29	33	33	32	27	23	17	11
2016	9	11	17	23	30	33	31	28	28	22	16	12
2017	9	11	14	23	29	32	33	32	28	23	17	13
2018	10	13	17	23	30	34	33	32	28	22	18	12
2019	11	12	15	25	30	34	34	32	29	25	19	13

Figure 5.10 shows the graphical presentation of mean wise temperature in the Study Area for the year 2009-2019.

[15] Pakistan Meteorological Data for Faisalabad (2009-2019)
[16] Pakistan Meteorological Data for Faisalabad (2009-2019)

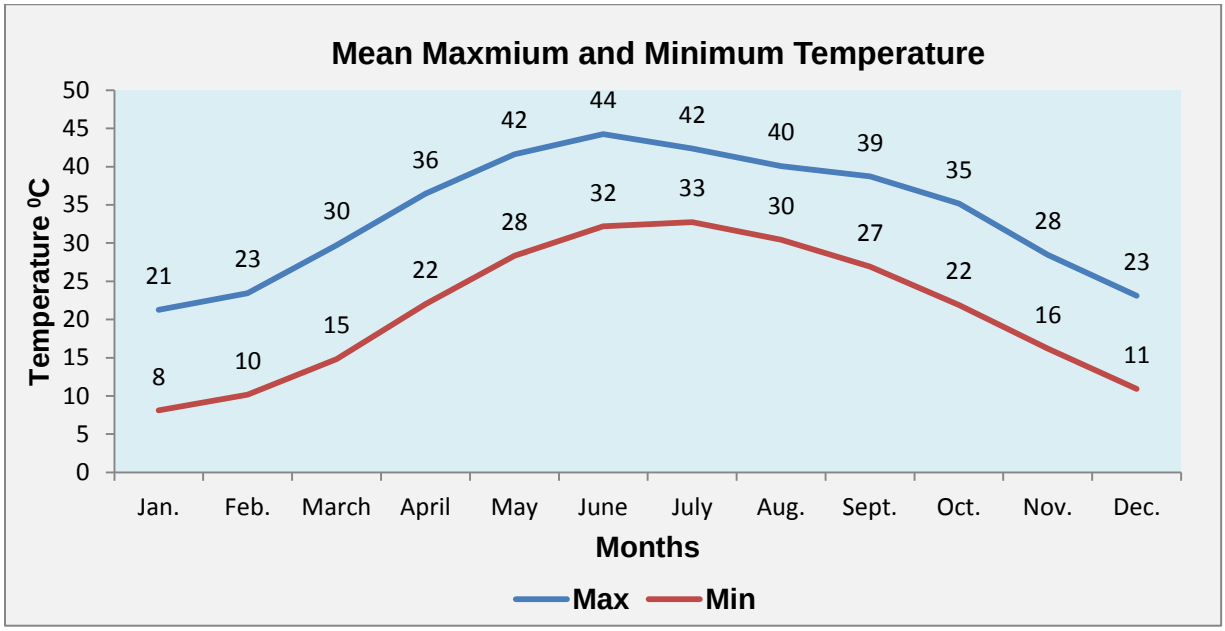


Figure 5.10: Mean Minimum and Maximum Temperature in the Study Area (2009-2019)

Precipitation (Rainfall)

Table 5.4 shows mean monthly precipitation observed in the Study Area from 2009 to 2019 with an annual average rainfall of 132 mm.

Table 5-4: Mean Monthly Precipitation (2009-2019)[17]

Month	Precipitation (millimeters)
January	5
February	17
March	12
April	15
May	9
June	10
July	18
August	22
September	16
October	3
November	2
December	2
Annual	**132**

Figure 5.11 shows the graphical presentation of mean monthly precipitation in the Study Area for the year 2009-2019.

[17] Meteorological Data for Faisalabad (2009-2019)

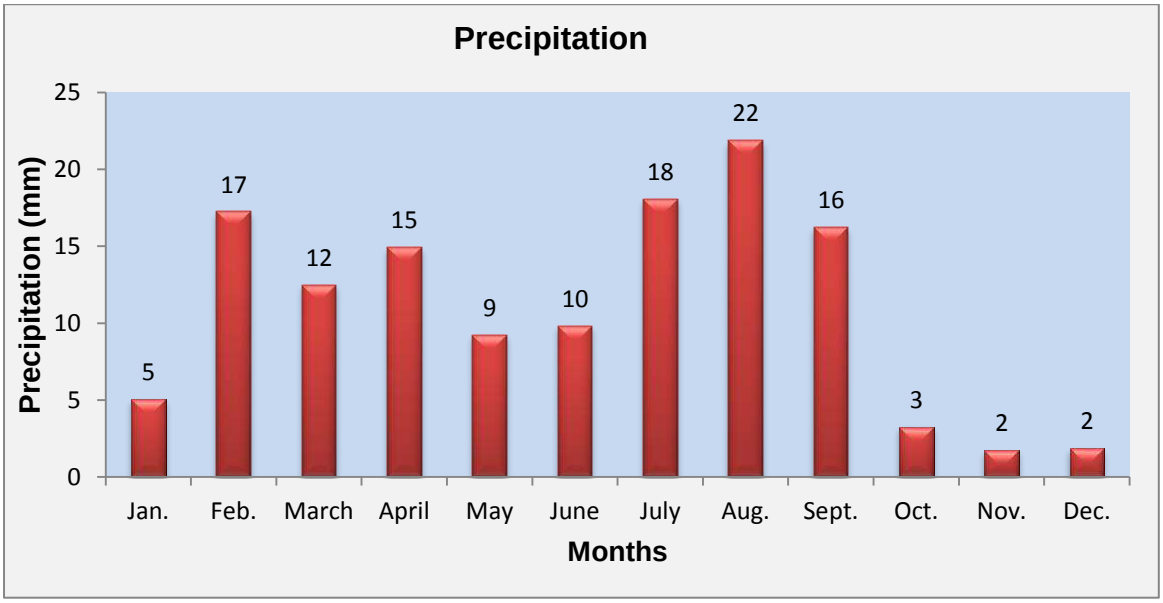


Figure 5.11: Average Precipitation in the Study Area (2009-2019)

Relative Humidity

Table 5.5 and Figure 5.12 shows mean relative monthly humidity observed in the Study Area from 2009 to 2019.

Table 5-5: Mean Relative Humidity (2009-2019)[18]

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
2009	61	56	44	26	15	15	30	35	37	27	33	46
2010	55	56	44	21	20	20	38	54	49	39	28	34
2011	53	64	50	36	22	27	39	55	57	38	38	33
2012	55	56	49	41	21	18	29	47	47	34	32	40
2013	40	66	49	29	16	23	33	47	35	37	32	36
2014	48	55	50	34	25	20	30	36	47	36	30	32
2015	44	45	51	31	15	24	40	40	32	29	26	26
2016	38	32	42	23	20	23	36	38	30	19	18	25
2017	50	34	35	22	19	28	35	34	26	17	23	24
2018	26	35	33	27	18	28	37	38	35	22	24	25
2019	39	54	44	27	20	19	36	41	38	29	38	30

[18] Meteorological Data for Faisalabad (2009-2019)

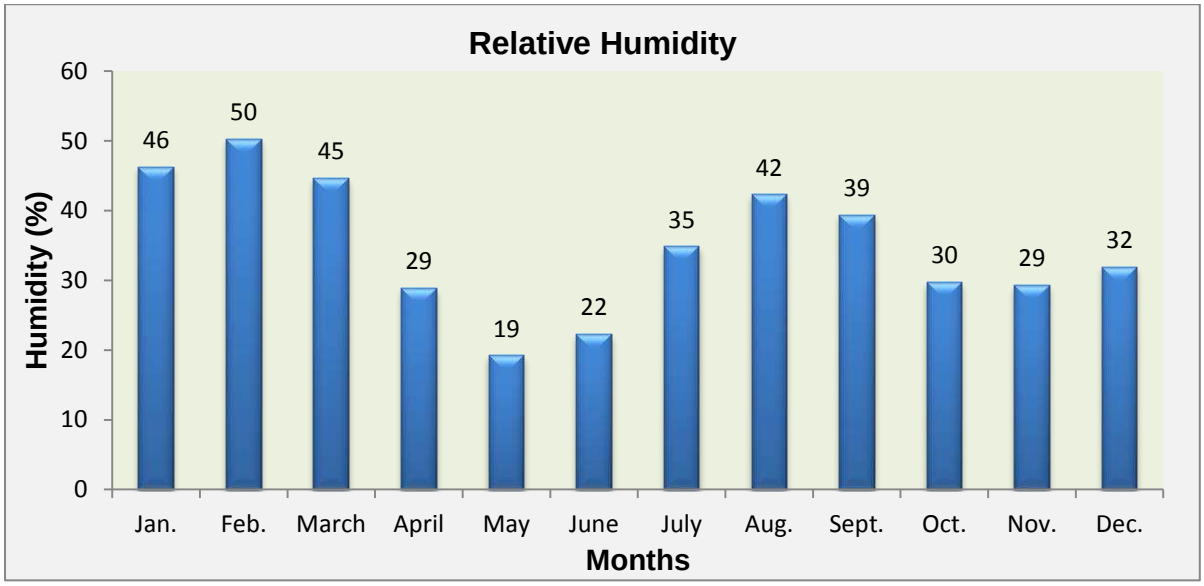


Figure 5.12: Relative Humidity in the Study Area (2009-2019)

Wind Speed and Wind Gust

Table 5.6 and **5.7** depicts average wind speed and gust on a monthly basis in the Study Area from 2009 to 2019.

Table 5-6: Average Wind Speed (Km/h) in the Study Area (2009-2019)[19]

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
2009	7	7.2	7.9	9.4	8.3	7.7	7.1	7	5.8	5.6	5.6	6.4
2010	5.7	8.2	7	8.6	8.7	7	8	6.4	6.4	5.4	5.5	5.4
2011	6.1	8	7.2	8	7.5	7.9	6.6	7.4	5.9	5.7	6.2	6.2
2012	6.9	9	8.6	7.8	8.2	6.9	6.5	7.8	6	5.2	6	8.1
2013	7.8	9.2	8.2	8.2	9.1	7	8.1	7.9	5.7	5.5	6.6	6.7
2014	6.9	7.8	8.8	8.4	7.8	8.6	7.6	6.4	8	5.8	6.1	6
2015	7.5	10.4	8.6	10.4	9.5	9.1	10.1	8.9	7.3	6.5	7.9	7.2
2016	6.6	8.8	10.3	11.1	9.3	8.8	7.4	7.1	7.3	5.3	6.8	6.7
2017	8.2	8.7	8.2	9.7	8.2	8.3	8.9	9.7	6.3	5.2	5.6	7.3
2018	6.5	7.9	8.4	10.1	11.2	9.7	9.6	10.1	8.5	6.3	7.7	5.8
2019	8	8.1	9.5	10.6	10.5	11	11.3	10.5	10.9	7.7	6.7	5.2

Table 5-7: Average Gust (Km/h) in the Study Area (2009-2019)[20]

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
2009	12.2	12.4	13.2	14.6	12.6	11.5	9.6	9.6	8.7	9.3	11.1	10.7
2010	10.4	14.3	11.6	13.7	13	10.4	11	9.4	9.7	9.1	9.6	9.7
2011	11.1	14.1	11.9	13.1	11	10.3	8.5	9.9	8.5	9.2	10.5	10.9
2012	12.1	15.4	14.7	12.6	12.4	9.6	8.1	10.2	8.8	8.3	10.3	13.9
2013	14.1	15.7	13.6	13.3	13.2	9.3	10.4	10.4	8.4	8.6	11.2	11.6
2014	12.3	13.5	14.6	13.2	10.9	11.4	9.6	8.5	11.4	9.1	10.3	10.6

[19] Meteorological Data for Faisalabad (2009-2019)
[20] Meteorological Data for Faisalabad (2009-2019)

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
2015	13.4	17.7	14.2	15.6	13.5	11.6	12.4	11.8	10.6	9.9	13.3	12.5
2016	11.7	15.1	17	17.3	12.8	11.8	9.3	9.7	10.9	9	12	12
2017	14.4	15	13.5	5.1	12.1	11	11	12.1	8.2	6.8	8.1	11
2018	10	12.9	13.2	14.8	14.8	11.7	11.6	14.1	12.5	9.6	11.6	8.5
2019	12.7	12.7	14.9	17.2	16.5	9.2	17.5	16	16.1	12.5	10.2	8.3

Figure 5.13 shows average wind speed and gust in the Study Area from 2009 to 2019.

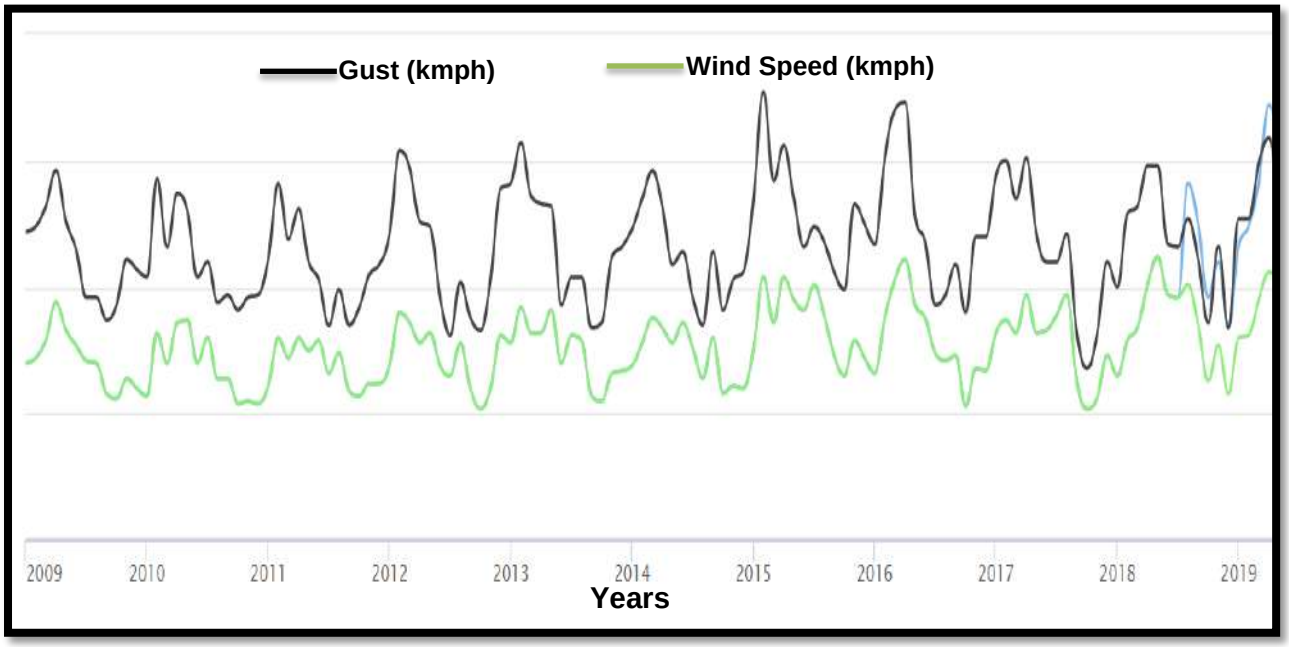


Figure 5.13: Average Wind Speed and Gust in the Study Area (2009-2019)

b) Chiniot

Temperature

Table 5.8 and **5.9** shows mean minimal and maximal temperatures observed for each month between 2009 and 2019 in the Study Area. The highest temperature measured between 2009 and 2019 was 45°C in the month of June and July in 2009, 2010, 2014 and 2019, and the lowest temperature was measured in January, 2011 i.e. 6°C.

Table 5-8: Mean Maximum Temperature from 2009 to 2019[21]

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
2009	21	23	30	36	43	45	45	44	40	35	28	23
2010	22	23	33	40	43	45	43	39	38	35	28	22
2011	20	22	29	35	43	43	41	38	36	33	28	22
2012	18	19	27	33	40	44	44	40	37	33	27	22
2013	21	21	29	35	42	44	43	39	40	35	27	22
2014	21	22	27	34	39	45	43	42	37	33	27	22

[21] Pakistan Meteorological Data for Chiniot (2009-2019)

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
2015	21	25	27	35	41	41	39	39	38	34	28	23
2016	22	27	30	36	42	44	42	40	40	36	31	27
2017	20	26	30	38	42	43	41	41	39	36	29	24
2018	24	26	32	36	41	43	41	41	39	35	29	23
2019	20	21	27	37	41	45	43	41	37	32	24	18

Table 5-9: Mean Minimal Temperatures from 2009 to 2019[22]

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
2009	9	10	15	20	27	29	32	31	26	19	14	9
2010	7	10	16	23	26	29	31	28	25	21	14	8
2011	6	9	14	19	28	32	32	29	26	21	17	10
2012	7	7	12	21	27	32	34	30	27	21	16	11
2013	7	10	14	21	28	32	34	30	27	23	15	10
2014	8	8	13	20	27	33	33	31	26	21	15	10
2015	8	12	15	22	29	32	33	32	27	23	17	11
2016	9	10	16	22	29	33	33	31	28	22	16	12
2017	9	11	14	23	29	32	33	32	28	23	17	13
2018	10	12	17	22	29	33	33	32	28	22	17	12
2019	10	11	14	24	29	33	33	31	29	23	17	12

Figure 5.14 shows the graphical presentation of mean wise temperature in the Study Area for the year 2009-2019.

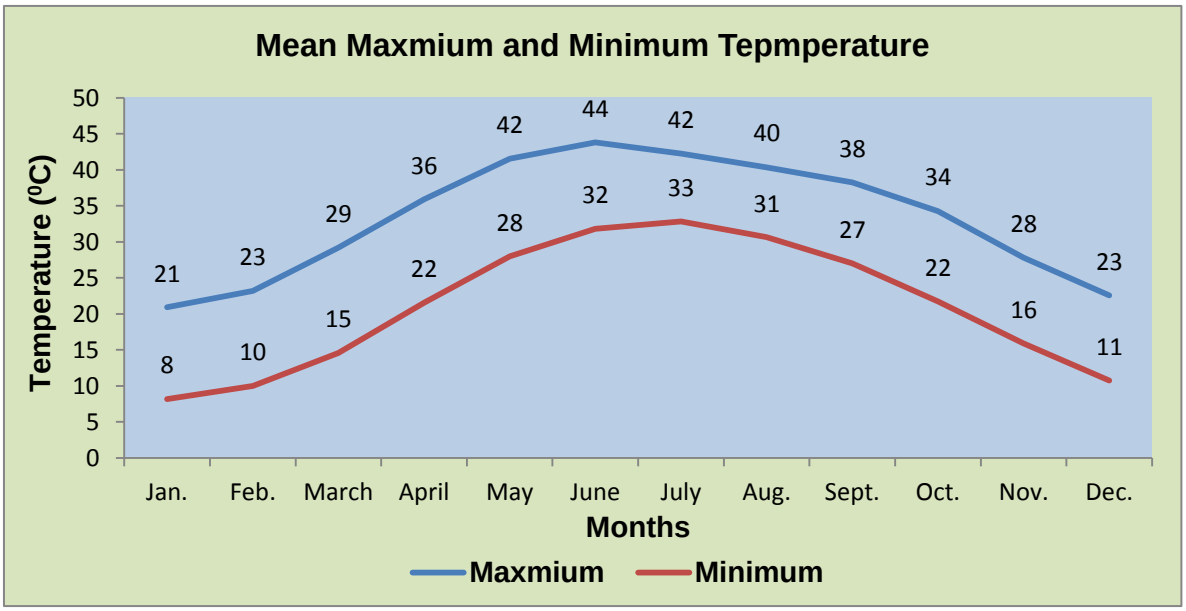


Figure 5.14: Mean Minimum and Maximum Temperature in the Study Area (2009-2019)

[22] Pakistan Meteorological Data for Chiniot (2009-2019)

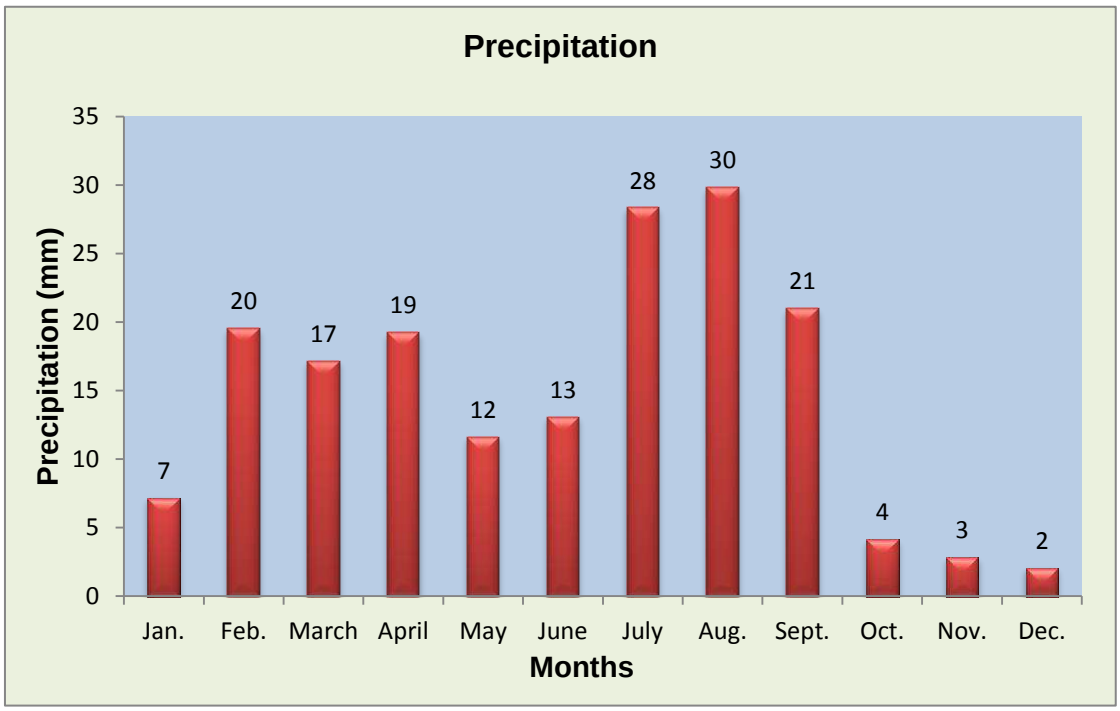
Precipitation (Rainfall)

Table 5.10 shows mean monthly precipitation observed in the Study Area from 2009 to 2019 with an annual average rainfall of 176 mm.

Table 5-10: Mean Monthly Precipitation (2009-2019)[23]

Month	Precipitation (millimeters)
January	7
February	20
March	17
April	19
May	12
June	13
July	28
August	30
September	21
October	4
November	3
December	2
Annual	**176**

Figure 5.15 shows the graphical presentation of mean monthly precipitation in the Study Area for the year 2009-2019.



[23] Meteorological Data for Chiniot (2009-2019)

Figure 5.15: Average Precipitation in the Study Area (2009-2019)

Relative Humidity

Table 5.11 and Figure 5.16 shows mean relative monthly humidity observed in the Study Area from 2009 to 2019.

Table 5-11: Mean Relative Humidity (2009-2019)[24]

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
2009	60	56	45	27	15	15	29	35	36	26	32	45
2010	53	56	44	22	20	20	38	53	48	40	28	33
2011	51	65	51	37	23	28	39	53	54	38	37	32
2012	53	54	49	42	22	18	29	45	46	33	31	39
2013	38	66	50	29	16	23	34	46	36	37	31	34
2014	46	54	52	34	25	20	31	36	48	37	29	30
2015	42	47	52	32	15	24	39	41	33	30	27	25
2016	38	33	44	25	20	23	36	37	30	19	18	24
2017	51	36	36	23	20	27	35	33	26	17	23	25
2018	26	36	35	28	19	28	38	38	35	22	24	24
2019	40	55	46	28	20	20	36	41	38	30	38	30

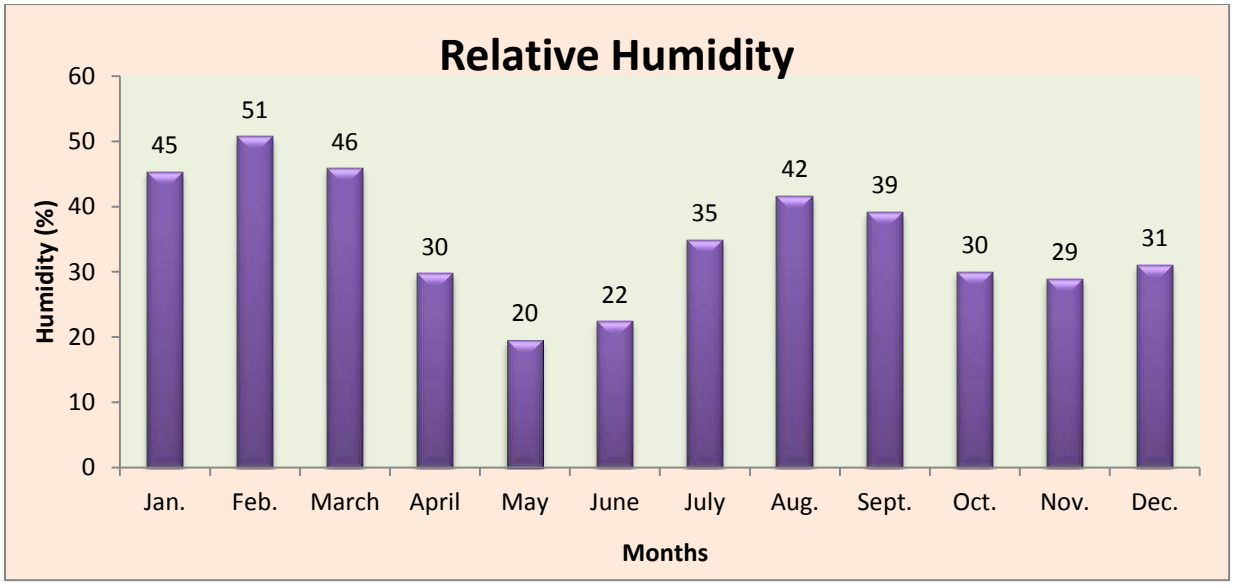


Figure 5.16: Relative Humidity in the Study Area (2009-2019)

Wind Speed and Wind Gust

Table 5.12 and **5.13** depicts average wind speed and gust on a monthly basis in the Study Area from 2009 to 2019.

[24] Meteorological Data for Chiniot (2009-2019)

Table 5-12: Average Wind Speed (Km/h) in the Study Area (2009-2019)[25]

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
2009	7.1	7.2	7.6	9.3	8	7.5	6.8	6.5	5.6	5.4	6.2	6.1
2010	5.6	8.2	7	8.5	8.4	6.9	7.6	6	5.9	5	5.5	5.4
2011	6.3	8.1	7.3	7.9	7.5	7.7	6.1	6.7	5.4	5.3	6.2	6.3
2012	7.1	9.1	8.3	7.7	8.4	6.4	5.5	6.8	5.8	5.3	6.4	8.2
2013	8.1	9.4	8.4	8.5	9.2	6.6	7.4	7.1	5.1	4.9	6.8	6.8
2014	7.1	8	8.8	8.5	7.9	7.9	6.5	5	7.7	5.4	6.2	6.4
2015	7.4	9.6	8.7	10.1	9.3	8.4	9	8	6.5	6	7.4	7
2016	6.2	8.3	9.8	10.7	9	8	6.9	6.7	6.7	5.4	6.7	6.6
2017	7.8	8.2	8	9.4	7.9	7.8	8.3	9	5.9	5	5.5	7
2018	6.2	7.8	8.2	9.9	10.9	9.2	9.3	9.2	7.6	6.4	7.5	5.6
2019	8.1	8.3	9.6	10.6	10.4	11.2	11.5	10.9	11.1	8.2	7.2	5.5

Table 5-13: Average Gust (Km/h) in the Study Area (2009-2019)[26]

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
2009	13	13.1	13.3	14.9	12.8	11.9	10	9.7	8.9	9.3	11.2	11.2
2010	10.5	14.9	12.2	14	13.3	10.9	11.4	9.3	9.6	8.7	10.1	10.2
2011	11.8	14.6	12.7	13.4	12.1	11	8.3	9.5	8.4	9.3	11.3	11.8
2012	13	16.3	14.8	13	13.8	10	7.5	9.4	8.9	9.2	11.5	15
2013	15.2	16.7	14.7	14.4	14.8	9.8	10	9.8	8.2	8.3	12.4	12.7
2014	13.1	14.5	15.2	14.2	12.5	11.9	8.9	7.2	11.9	9.2	11.3	11.9
2015	13.4	17.1	15	16.1	14.8	11.8	11.7	11.4	10.6	10.1	13.4	12.8
2016	11.4	15	16.9	17.2	13.7	11.9	9.2	9.8	11.1	9.5	12.2	12.1
2017	14.2	14.9	13.6	15.3	12.7	11.5	10.9	12	8.7	8.2	9.5	12.1
2018	11.1	13.7	13.7	15.8	16.3	12.1	11.8	12.2	11	10.7	12.9	9.7
2019	14.3	14.1	16	17.2	15.9	16.4	16.2	15.6	16.9	13.3	12.2	9.3

Figure 5.17 shows average wind speed and gust in the Study Area from 2009 to 2019.

[25] Meteorological Data for Chiniot (2009-2019)
[26] Meteorological Data for Chiniot (2009-2019)

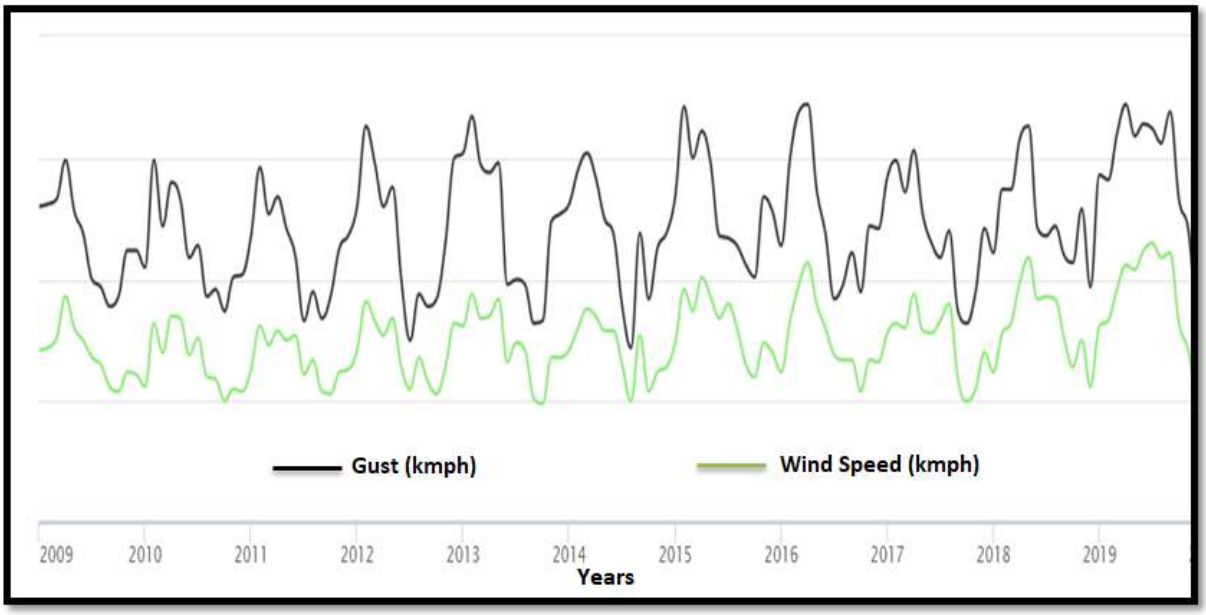


Figure 5.17: Average Wind Speed and Gust in the Study Area from 2009 to 2019

c) Sargodha

Temperature

Table 5.14 and **5.15** shows mean minimal and maximal temperatures observed for each month between 2009 and 2019 in the Study Area. The highest temperature measured between 2009 and 2019 was 45°C in the month of June and July in 2009, 2014 and 2019, and the lowest temperature was measured in January, 2011 and 2012 i.e. 6°C.

Table 5-14: Mean Maximum Temperature from 2009 to 2019[27]

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
2009	20	23	29	35	42	45	45	43	40	34	27	22
2010	22	22	32	39	42	45	43	39	38	35	28	22
2011	20	21	29	34	42	43	41	39	37	33	28	22
2012	18	19	27	32	39	44	44	40	37	33	27	22
2013	20	21	29	35	41	44	43	40	39	35	26	22
2014	20	21	26	33	38	45	43	42	37	33	27	22
2015	21	24	27	34	40	41	39	39	38	34	28	23
2016	22	26	29	35	41	44	41	40	40	36	30	26
2017	19	25	30	38	41	42	41	41	39	36	28	24
2018	23	25	31	35	40	42	40	40	38	34	29	23
2019	21	21	27	37	41	45	44	41	40	36	28	23

[27] Pakistan Meteorological Data for Sargodha (2009-2019)

Table 5-15: Mean Minimal Temperatures from 2009 to 2019[28]

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
2009	9	10	15	20	26	29	32	31	26	19	13	9
2010	7	9	16	22	26	29	30	28	25	21	13	8
2011	6	9	14	19	28	32	32	30	27	22	17	10
2012	6	7	12	21	27	32	34	31	27	21	16	11
2013	8	10	15	21	28	32	33	30	28	23	15	10
2014	8	9	13	20	26	33	33	31	27	22	15	10
2015	8	11	15	22	28	32	33	32	27	23	16	11
2016	9	10	16	22	29	33	33	31	28	22	16	12
2017	9	11	15	23	29	32	33	32	28	24	17	13
2018	10	13	17	22	28	33	33	32	28	22	17	12
2019	11	12	15	24	29	33	34	32	29	25	18	13

Figure 5.18 shows the graphical presentation of mean wise temperature in the Study Area for the year 2009-2019.

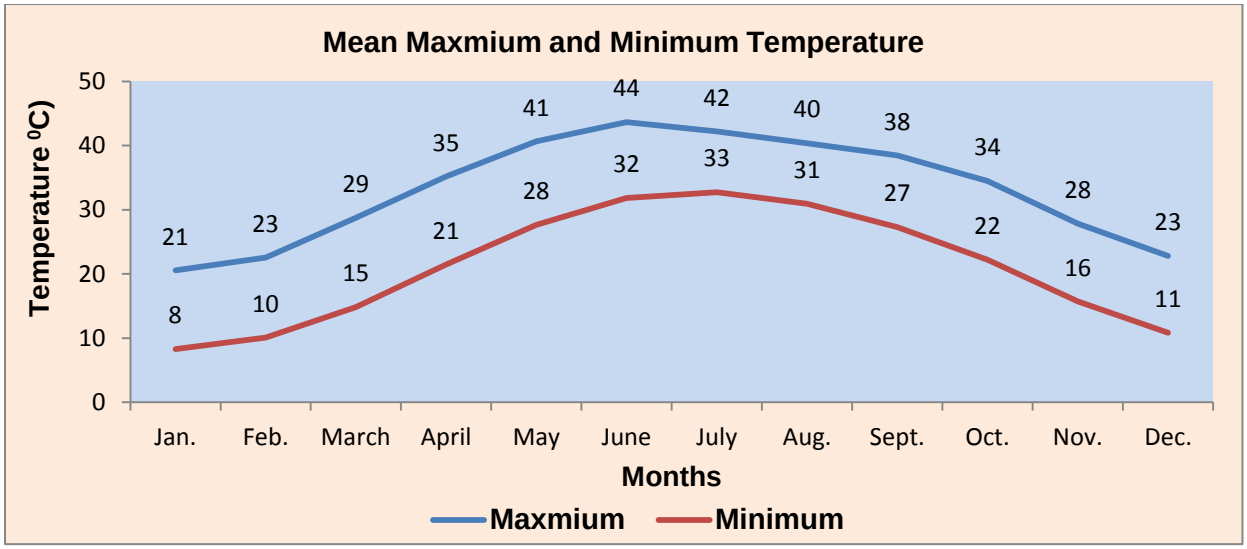


Figure 5.18: Mean Minimum and Maximum Temperature in the Study Area (2009-2019)

Precipitation (Rainfall)

Table 5.16 shows mean monthly precipitation observed in the Study Area from 2009 to 2019 with an annual average rainfall of 127 mm.

Table 5-16: Mean Monthly Precipitation (2009-2019)[29]

Month	Precipitation (millimeters)
January	5
February	13
March	15
April	15
May	8

[28] Pakistan Meteorological Data for Sargodha (2009-2019)
[29] Meteorological Data for Sargodha (2009-2019)

Month	Precipitation (millimeters)
June	9
July	26
August	20
September	10
October	3
November	1
December	1
Annual	**127**

Figure 5.19 shows the graphical presentation of mean monthly precipitation in the Study Area for the year 2009-2019.

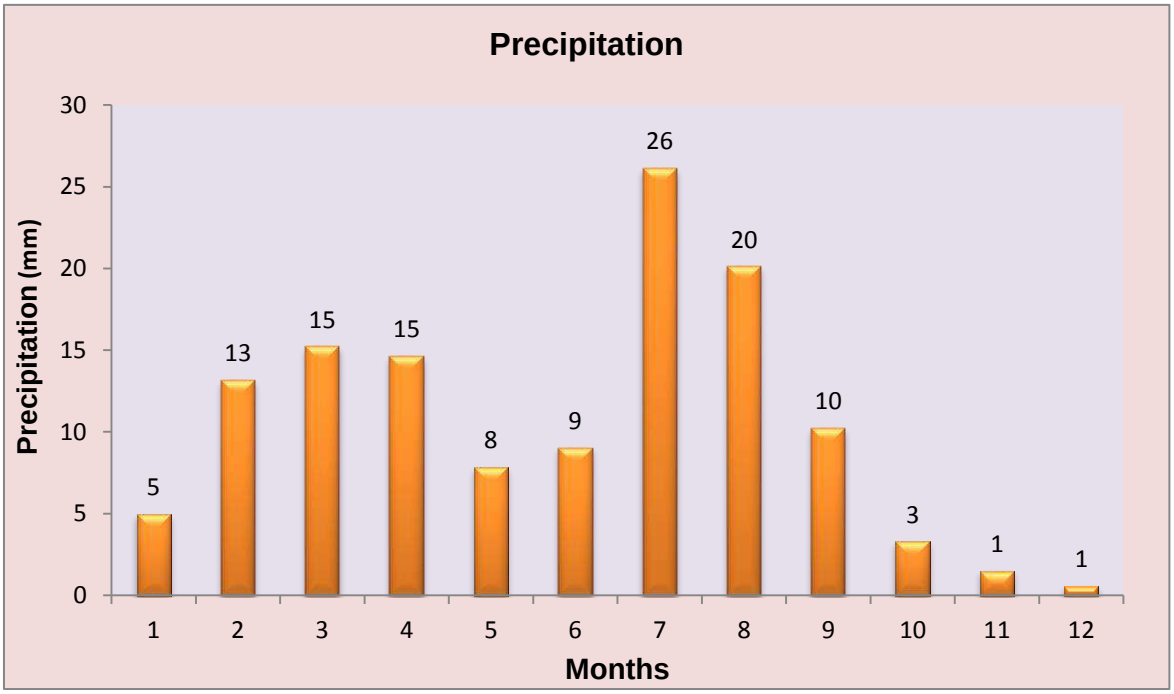


Figure 5.19: Average Precipitation in the Study Area (2009-2019)

Relative Humidity

Table 5.17 and Figure 5.20 shows mean relative monthly humidity observed in the Study Area from 2009 to 2019.

Table 5-17: Mean Relative Humidity (2009-2019)[30]

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
2009	60	56	46	30	15	15	28	34	34	25	33	45
2010	52	56	45	24	21	20	38	53	46	39	29	32
2011	50	65	50	39	24	27	39	50	50	36	36	30
2012	50	52	47	43	23	18	28	44	44	33	31	37

[30] Meteorological Data for Sargodha (2009-2019)

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
2013	36	63	48	30	17	23	34	45	36	36	30	33
2014	42	51	51	35	27	19	31	35	46	36	29	27
2015	41	47	52	34	16	24	39	41	32	31	27	24
2016	38	33	44	26	21	23	36	37	30	19	17	24
2017	51	38	36	24	20	27	35	33	27	18	23	24
2018	26	36	36	30	20	28	38	39	36	23	24	23
2019	39	52	45	30	22	20	36	41	38	30	38	31

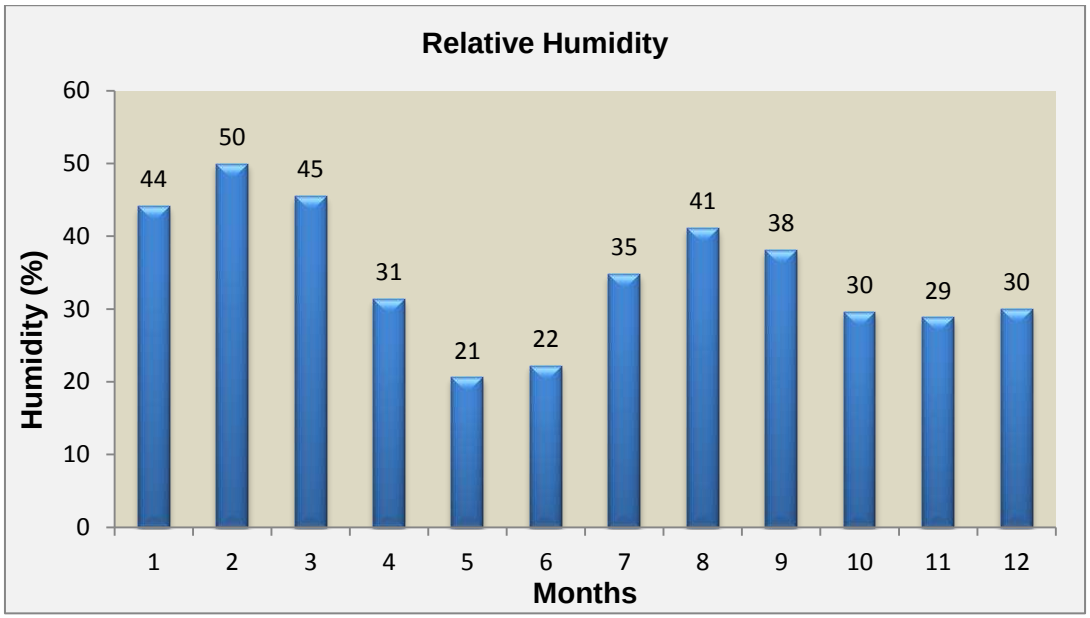


Figure 5.20: Relative Humidity in the Study Area (2009-2019)

Wind Speed and Wind Gust

Table 5.18 and **5.19** depicts average wind speed and gust on a monthly basis in the Study Area from 2009 to 2019.

Table 5-18: Average Wind Speed (Km/h) in the Study Area (2009-2019)[31]

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
2009	6.9	7.2	7.2	8.7	7.6	7.3	6.8	6.7	5.8	5.1	5.8	5.8
2010	5.7	7.9	7	8	8.1	7.1	7.6	5.8	5.9	5	5.4	5.5
2011	6.2	8.1	7.1	7.7	7.5	7.8	6.2	7.1	5.3	5.7	6.4	6.6
2012	7	8.7	8	7.7	8.1	6.7	6.5	7	6	5.1	6.3	8.6
2013	8.2	9.5	8.3	8.3	9.1	7	7.5	7.4	5.8	4.5	6.5	6.7
2014	7.2	8	8.7	8.1	7.9	8.6	6.5	5.8	7.6	5.5	6.1	6.7
2015	6.8	8.7	8.4	9.7	9.2	7.9	8	7	6.4	5.6	7.1	6.4
2016	5.8	7.6	9.2	10.2	8.7	7.3	6.6	5.9	5.6	5.1	6.3	6.2
2017	7.3	7.5	7.8	9.3	7.8	7.2	7.4	8.1	5.5	5	5.5	6.4
2018	5.8	7.5	7.8	9.6	11	8.7	8.8	8.3	7.3	6.6	7.3	5.4
2019	7.8	8.2	9.7	10.4	10.5	11.2	10.5	9.4	9.7	7.2	7.2	5.2

[31] Meteorological Data for Sargodha (2009-2019)

Table 5-19: Average Gust (Km/h) in the Study Area (2009-2019)[32]

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
2009	12.5	12.7	12.1	13.7	11.9	11.1	9.4	9.3	8.8	8.4	10.2	10.6
2010	10.6	14	11.6	12.6	12.2	10.6	10.7	8.6	9.2	8.3	9.7	10.3
2011	11.5	14.2	12	12.5	11.5	10.1	7.7	9.1	7.4	9.1	11.1	12.1
2012	12.6	15.2	13.6	12.4	12.6	9.5	8.1	8.8	8.3	8.2	11	15.3
2013	15.2	16.5	14.2	13.7	14	9.3	9.3	9.5	8.3	7.1	11.3	12.2
2014	13.3	14	14.5	13.2	11.6	11.7	8.1	7.4	10.5	8.5	10.7	12.2
2015	12.3	15.2	14.2	15.2	13.8	10.1	9.9	9.1	9.3	8.4	12.2	11.7
2016	10.5	13.3	15.6	16.2	12.7	9.9	8.4	8	8.6	8.7	11.2	11.4
2017	13.1	13.4	13.1	15	11.9	9.8	9.3	10.1	7.1	6.8	8.4	10.2
2018	9.4	12.4	12.6	14.6	15.4	10.6	10.7	10.4	9.4	9.5	11.4	8.4
2019	13	13.4	15.6	16.4	15.3	15.1	13.9	12.6	13.4	10.2	10.9	7.8

Figure 5.21 shows average wind speed and gust in the Study Area from 2009 to 2019.

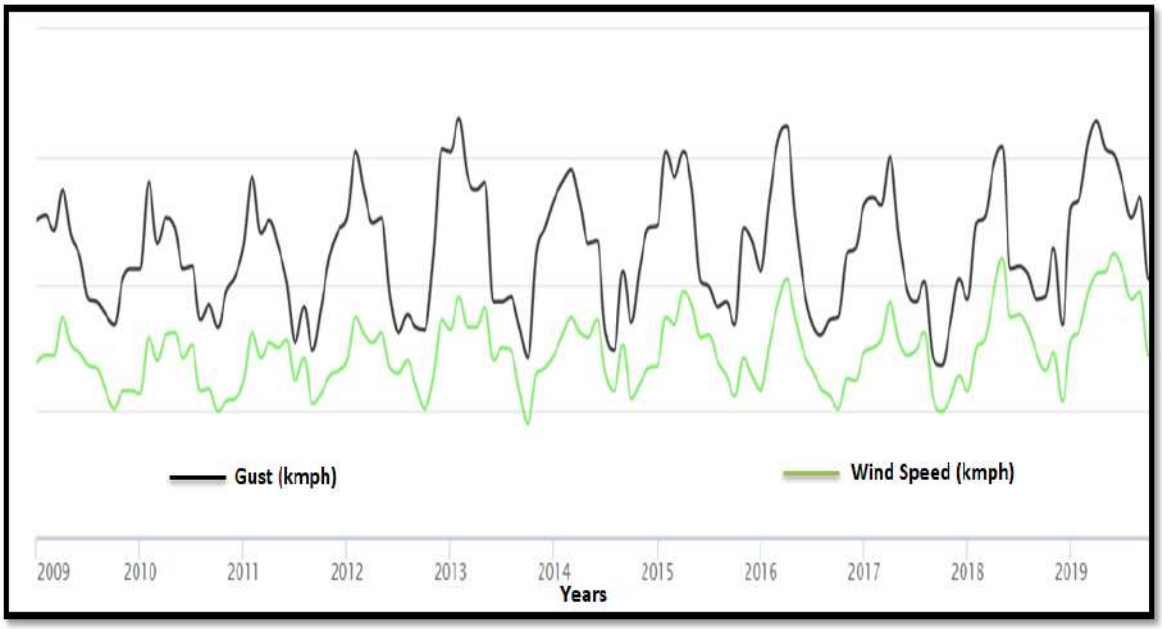


Figure 5.21: Average Wind Speed and Gust in the Study Area from 2009 to 2019

5.2.6 Ground Water

a) Faisalabad

Groundwater is the main source of water supply in Faisalabad city and is managed by Water and Sanitation Agency-Faisalabad (WASA-F) and Public Health and Engineering Department (PHED). Unfortunately, groundwater is quite saline making it unfit for human consumption. Therefore, to meet the city's water demand, WASA-F draws water from different well-fields

[32] Meteorological Data for Sargodha (2009-2019)

(Chiniot well-field: 120 m to 140 m, and Jhang Branch Canal: 133 m to 165 m)[33] along with other small water works in the city which together produce around 110 MGD of water supplied to consumers by WASA-F. These are discussed as below:

i. Chenab (Chiniot) Well-Field

Chiniot Well-Field is located near Chenab River in Chiniot district. A total of twenty nine (29) tube wells are installed in Chiniot well-field and design discharge capacity of one tube well is 400 m^3/hour with 20 hours working capacity per day with a maximum discharge capacity of 224,000 m^3/day (about 49 MGD). However, the maximum discharge has reduced to 160,000-170,000 m^3/day or even less because some of the tube wells are not functional or the average working hours are reduced to about 18 hours or 20 hours per day. The main reasons for non-functionality or reduced operational hours of tube-wells are delay in necessary repair and maintenance and/or budget limitations on the payment of electricity bills requisite for operation. The static ground water level ranged between 2 to 5 m from ground level at the time of installation.

ii. Jhang Branch Canal (JBC) Well-Field

Tube wells installed along the Jhang Branch Canal are known as the JBC Well-Field, located 13 km from Faisalabad city's terminal reservoir. A total of 25 tube wells were installed in the JBC Well-Field in 2011, adding 91,000 m^3/day (about 20 MGD) to the water system in accordance with the design criteria. To keep the ground water level stable, the discharge design of each tube well was set at about 200 m^3/hour with working capacity of about 20 hours per day for each tube well. The static ground water level ranged between 3 m to 8 m from ground level at the time of installation.

iii. Tube wells along the Rakh Branch Canal (RBC)

Rakh Branch Canal (RBC) passes through the center of Faisalabad city where the old tube wells (16 numbers) were installed along RBC. These were the only tube wells situated near Faisalabad city until 2007. New tube wells (22 numbers) were constructed in 2008 and 2016 respectively in upstream of RBC to avoid contamination from pollution occurring in the urban areas. Therefore, the target water supply flow rate from old and new tube wells along RBC was 82,000 m^3/day (about 18 MGD). But, the actual discharge in the present situation from RBC tube wells is about 60,000 m^3/day (about 13 MGD). Static water level at the time of tube well installation was within the range of 6-10 m from ground level.

iv. Jhal Khanuana (JK), Millat Town (MT) and Gulfishan Colony Water Works

Jhal Khanuana (JK) water works is situated on the left bank of RBC and is used to withdraw water from the canal. Water from JK is subjected to treatment through slow filtration process and flows into the main water channels of the city.

Similar to the JK water works, another slow filtration water plant was installed at Millat Town that draws raw water from one of the main tributaries of JBC. Design capacity of the installed water works is approximately 5,000 m^3/day (about 1.0 MGD) and provides water to new

[33] Water and Sanitation Agency, 2017. Water Supply, Sewerage and Drainage Master Plan for Faisalabad, Interim Report.

residential area of Millat Town independently. Additionally, about 7,500 m^3/day (1.5 MGD) of the water is added to the system by water works plant installed at Gulfishan Colony, Faisalabad city.

Location of the above-mentioned water supply sources are shown in the **Figure 5.22**.

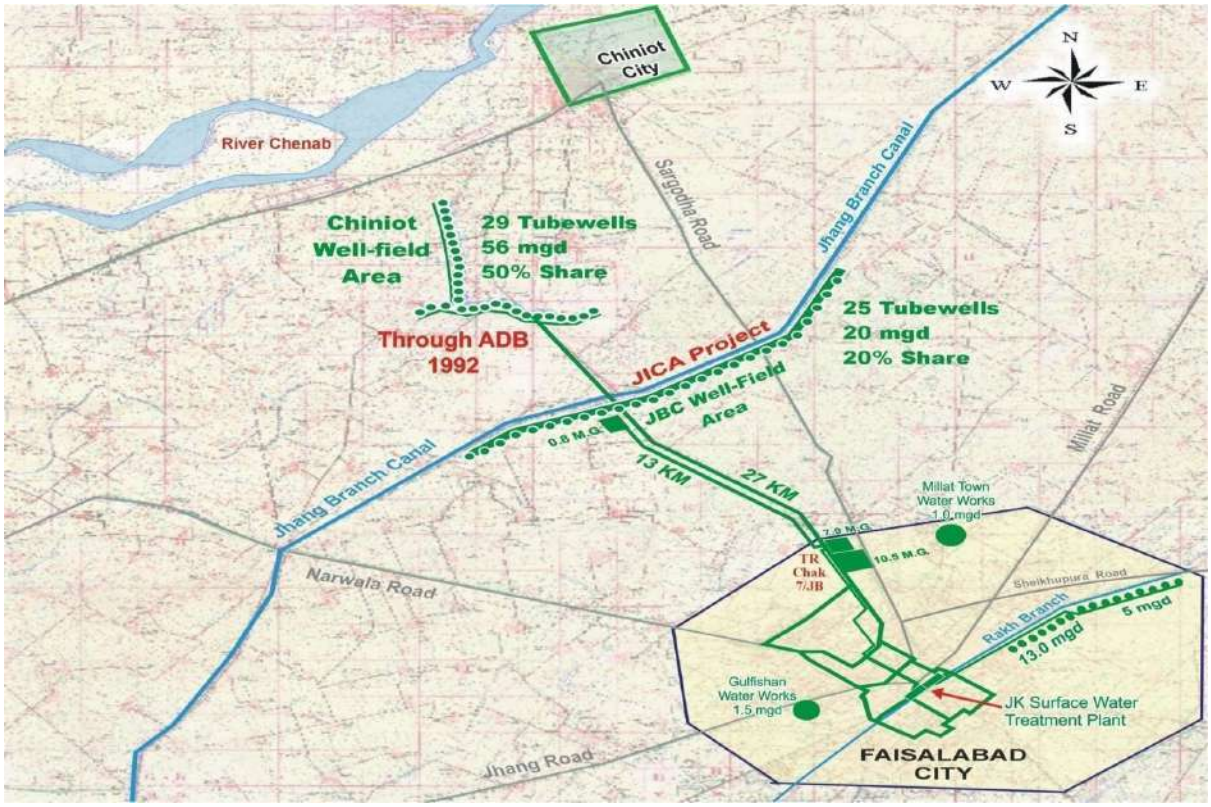


Figure 5.22: Overview of Ground Water Sources in WASA- Faisalabad[34]

WASA-Faisalabad administers approximately 501,000 m^3/day (about 110 MGD) of water supply from existing ground and surface water resources. Summary of existing (2017) water resources under WASA-Faisalabad with current water capacity, demand and shortfall is given in the **Table 5.20**.

Table 5-20: Overview of Water Source Facilities for Water Supply in Faisalabad

Sr. No.	Water Source	Capacity (MGD)	Number of Tube Wells
1.	Chiniot Well Field Area	56	29
2.	JBC Well Field Area	20	25
3.	RBC Wells Tube Wells along RB Canal	13	38
4.	Jhal Khanuana Water Works	3.5	--
5.	Millat Town Water Works	1	--
6.	Gulfishan Colony WTP	1.5	--

[34] Source: JICA Office, WASA-Faisalabad

Sr. No.	Water Source	Capacity (MGD)	Number of Tube Wells
7.	French Project	15	--
Total Water Produced		***110***	***---***
Total Current Water Demand @ 40 GPCD		***160***	***---***
Shortfall		***50***	***---***

Groundwater Usage in Faisalabad City

According to WASA-Faisalabad, Water Supply, Sewerage and Drainage Master Plan of Faisalabad Interim Report (2017), the usage ratio of WASA-Faisalabad water to private groundwater wells in each household is about 1:3. At present, the total capacity of WASA-Faisalabad to supply water is about 501,000 m^3/day (110 MGD). Assuming that the discharge from private wells is three times as that of WASA-Faisalabad, the total groundwater consumption of Faisalabad city can be 1,500,000 m^3/day (330 MGD) excluding the groundwater discharge from industrial /commercial areas.

Ground water level in Faisalabad region ranges between 20 to 50 feet and generally shows a decreasing trend in the entire region[35], as the recharge of groundwater aquifer is negligible because most of the urban areas in Faisalabad city are covered by paved roads and buildings and there are relatively less annual rainfalls. Moreover; continuous decline in ground water level not only raises the hydraulic gradient on the banks of the depression cone, but also results in saline water movement from adjacent areas increasing salinity level in the aquifer.

b) Chiniot

The ground water is sweet in taste and is being recharged from river Chenab, which is flowing at western end of the city. The water supply is based on ground water and tube wells which are 7 in number, and depth of water table is determined at the range of about 20 m to 60 m[36]. The water supply network covers 60% of the town and serves 75% of the total population. The distribution system consists of 2 overhead reservoirs of 50,000 gallon capacity each and 2 hilltop reservoirs of 100,000 gallon capacity each. The total capacity is 300,000 gallons[37]. The existing water supply services of Chiniot City are shown in **Figure 5.23.**

Hand pumps are also used to obtain drinking water in the nearby villages. Irrigation water comes from a network of irrigation canals and/or tube wells. Locals informed the environmental team that canal water is not available throughout the year for agriculture; therefore, most of the farmers who have more than 0.8 hector of land have installed their own tube wells. Those unable to afford tube-well, take water from canals for irrigation at an additional cost of Rs. 400 to 500 per hour. Some small land holders collectively established tube-wells to meet the irrigation demands.

[35] Groundwater Monitoring Report, June 2009, Volume 1: Time-rate changes in groundwater levels and quality.
[36] Delineation of Groundwater Aquifers and Subsurface Geological Variations Using Electrical Resistivity Survey, Chenab Nagar, Chiniot, Pakistan, July 2017
[37] Chiniot City Profile Service Delivery Baseline Data, Punjab Cities Improvement Investment Program, 2018 (Report by The Urban Unit)

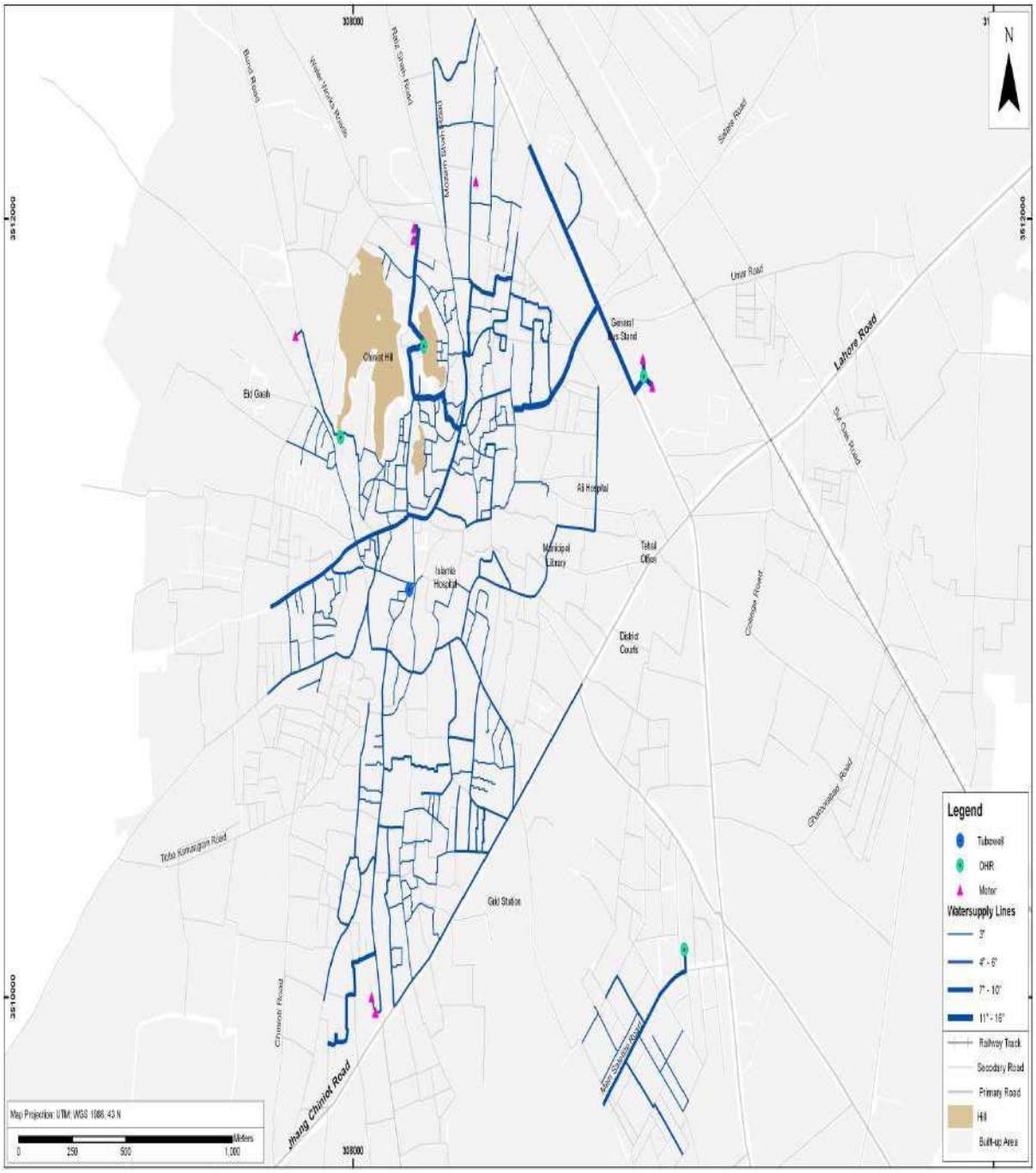


Figure 5.23: Existing Water Supply System in Chiniot City

c) Sargodha

The sub soil water of the Sargodha city is brackish and unfit for human consumption. Water table is 25 feet below the ground level. However; underground water near Lower Jhelum Canal is fit for drinking purpose. The ground water investigation[38] has revealed that recharge is adequate to operate tube wells up to 37 meters depth and capacity of 14 liters per second along the canal for 20 hours per day. The existing Water Supply is based on tube wells and

[38] Sargodha City Profile Service Delivery Baseline Data, Punjab Cities Improvement Investment Program, 2018 (Report by The Urban Unit)

partially on canal water treatment. The total water consumption of Sargodha city is 6 MGD, and total number of operational tube wells are 36 having capacity of 16 cusec.

All the tube of Sargodha city water supply scheme is installed along the canal. The treatment plants are constructed at: (i) main water works Muhammad Colony (ii) New satellite Town and (iii) Johar Colony.

Approximately 70 % of the entire town is served with existing water supply system whereas rest of the area is without it and people have their own sources of water mostly hand pumps / power pumps. The quality of water from this shallow source is not so good and is mostly contaminated and saline in nature.

The existing water supply services of Chiniot City are shown in **Figure 5.24.**

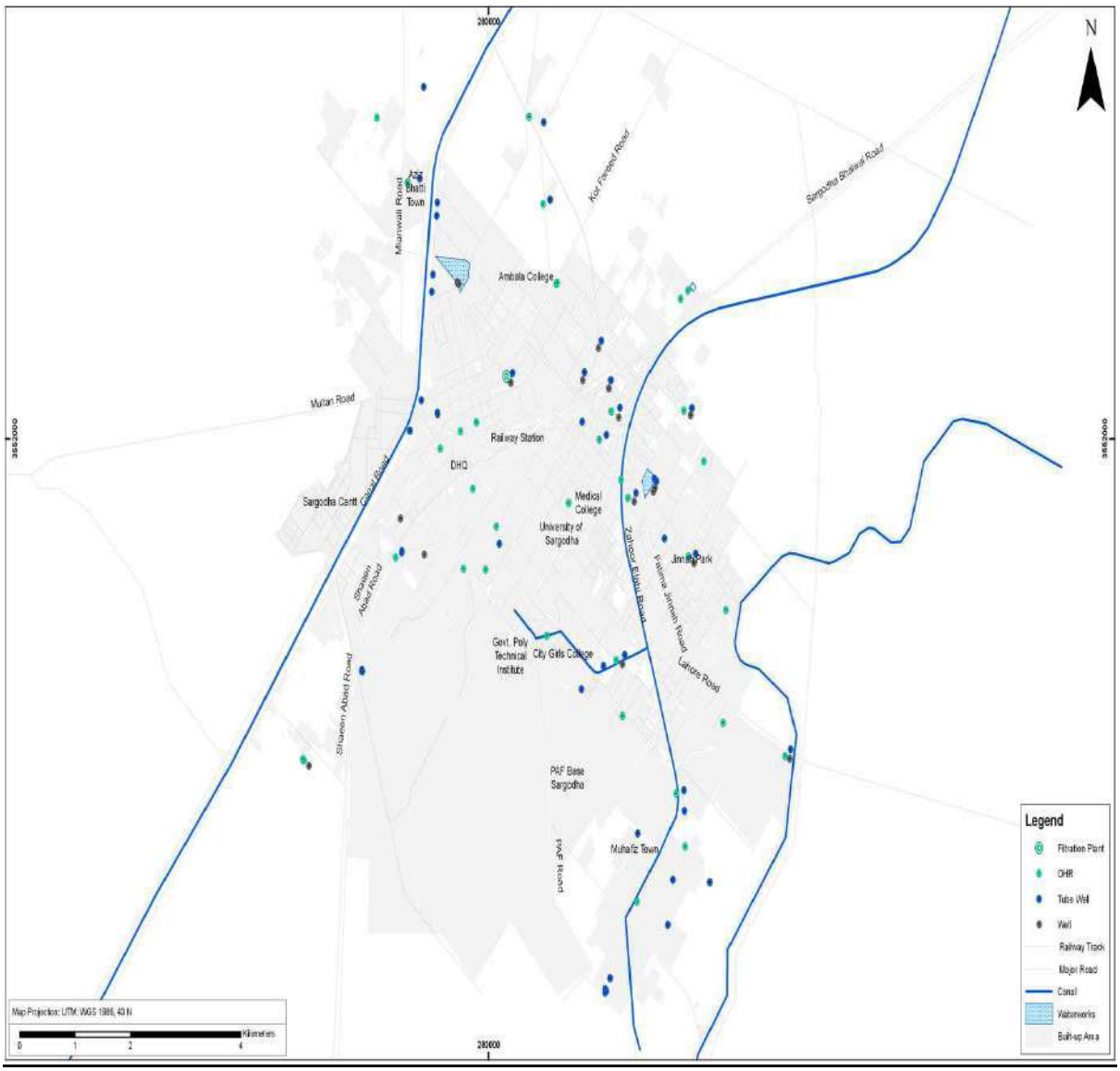


Figure 5.24: Existing Water Supply System in Sargodha City

Study Area

The municipal water supply, motor pumps, hand pumps and private tubewells are the main source of water supply in the study area (Faisalabad-Chiniot-Sargodha Road).

5.2.7 Surface Water Hydrology and Drainage

a) Faisalabad

Faisalabad region is surrounded by the two main rivers of Punjab; Chenab River towards the north and Ravi River towards the south. The entire district lies in the Rechna Doab (the area between Ravi River and Chenab). The Rechna irrigation system comprises of Upper Chenab Canal (UCC), Lower Chenab Canal (LCC), Marala-Ravi Link canal, Bomban–Wala Ravi Badian Depalpur (BRBD) Canal, and Trimu-Sidhnai Link canal. The surface water resources present in the Faisalabad are discussed below in detail.

- **Chenab River**

The Chenab River originates from the upper Himalayas in India. The river flows from the north-east to the south-west direction of national borders between Pakistan and India, and then finally joins the River Indus. Chenab River flows almost 30 km away to the north of Faisalabad city[39]. Discharge of the Chenab River is monitored upstream and downstream of the Khanki Head and the Qadirabad Barrage Works as shown in **Figure 5.25.** The Qadirabad Barrage is built about 100 km upstream of Chiniot city which is located along Chenab River (north of Faisalabad city). The Khanki Head Works is installed about 30 km upstream of the Qadirabad Barrage.

[39] https://punjab.gov.pk/faisalabad_geography

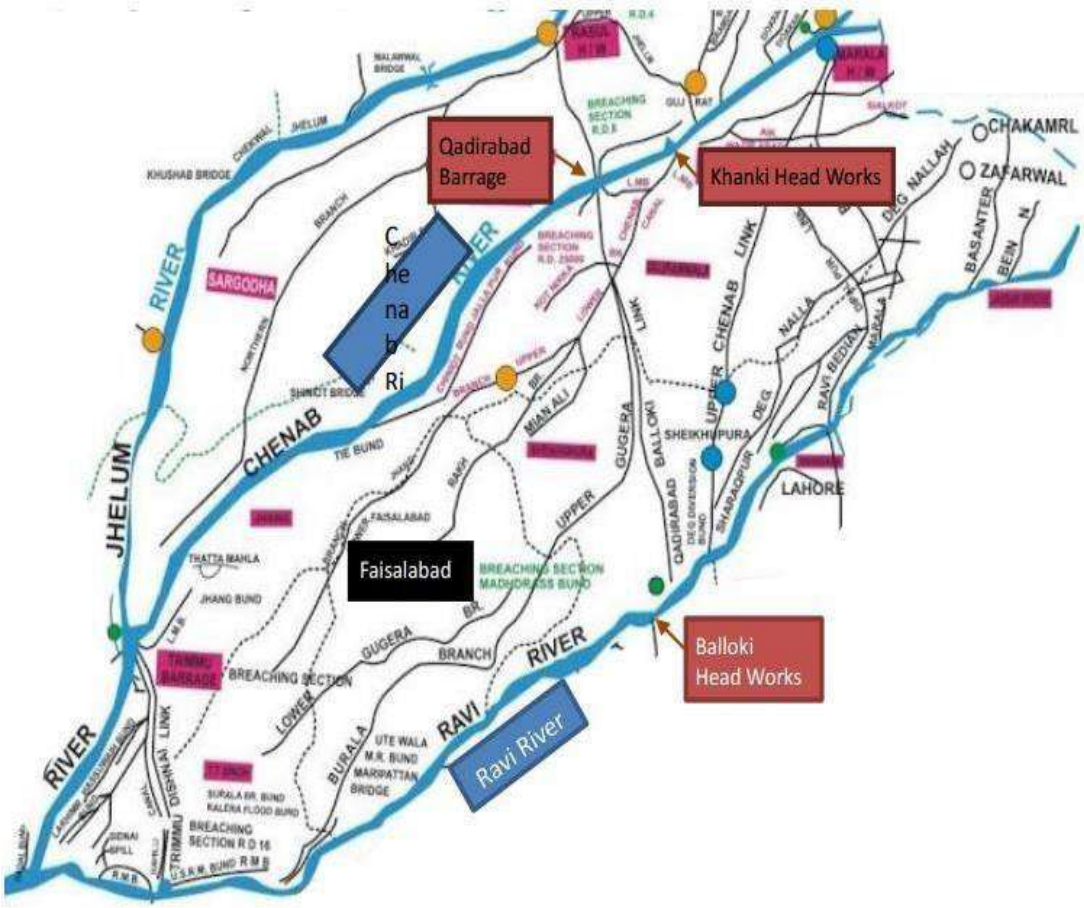


Figure 5.25: Rivers and Irrigation Canals around Faisalabad District

- **Jhang Branch Canal (JBC)**

Jhang Branch Canal (JBC) is located about 20 km north-west of Faisalabad city as shown in **Figure 5.26**. The JBC joins tail of Lower Chenab Canal (LCC) Feeder upstream of the canal, whereas LCC Feeder connects with Qadirabad-Balloki (QB) Link Canal that originates from upstream of Qadirabad Barrage. The Jhang Branch Upper Canal further divides into Jhang Branch Lower Canal and Bhowana Branch Canal downstream. As per the design of Jhang Branch Canal, the "authorized head discharge" (maximum daily discharge to be supplied from the upstream end of the canal) is 88.77 m^3/sec and "authorized tail discharge" (actual discharge that flows out the canal at the downstream end) is 51.93 m^3/sec[40].

- **Rakh Branch Canal (RBC)**

Rakh Branch Canal (RBC) starts from the same point as that of the Jhang Branch Upper Canal, which is the tail of the LCC Feeder. The RBC flows through Faisalabad city and then connects to Dijkot city. According to WASA-Faisalabad interim report (2017), canal water intake from RBC is 17,000m^3/day (about 3.5 MGD) for Jhal Khanuana Water Works and 46,000 m^3/day (about 10 MGD) for Jhal Water Works (French Project Phase I), managed by WASA-Faisalabad downstream of Rakh Branch Canal. In addition, recent development by WASA-Faisalabad has added another 30,000 m^3/day (6.5 MGD) by improving the rapid sand

[40] Faisalabad Canal Division, Irrigation Department and Official Website of Irrigation Department

filtration method in Jhal Khanuana water treatment plant, and 23,000 m^3/day (5 MGD) by expanding the New Jhal Khanuana water treatment plant.

The total capacity adds up to 114,000 m^3/day (25 MGD), which is equivalent to about 15 per cent of 8.81 $m^{3/}$s of authorized full supply discharge upstream near Dijkot City. RBC irrigation water can be further utilized in the area along the Rakh Branch Canal when necessary as per water demand. According to the design criteria of RBC, the authorized head discharge is 38.34 m^3/sec and the tail discharge is 11.27 m^3/sec.

- **Gugera Branch Canal (GBC)**

Gugera Branch Canal (GBC) is located about 25 km south-east of Faisalabad city as shown in **Figure 5.26**. The proposed water intake of 91,000 m^3/day (20 MGD) from the Gugera Branch Canal, as a new water supply source for Faisalabad city is planned under the "Extension of Water Resources for Faisalabad City Phase II (French Project Phase II)". In addition to this, GBC can produce 63.71 m^3/sec of water at the authorized discharge head and 14.58 m^3/sec of water at tail of the canal.

- **Ravi River**

Ravi River originates from the Himalayas in Himachal Pradesh, India. The river flows from the north-east to the south-west of the national border, and finally connects with the Indus River. Ravi River flows about 50 km away to the south of Faisalabad city as shown in **Figure 5.25.** Discharge of Ravi River is monitored upstream and downstream of Balloki Head Works. The Balloki Head Works is situated 80 km from Faisalabad city. The water from Chenab River is inflowing at about 15 km upstream of Balloki Head Works through QB Link Canal.

Discharge from the Ravi River is far higher as compared to the discharge of canals originating from it. However, both Chenab River and the Ravi River discharges are controlled by barrages and other water works upstream. Both barrage and water works are located about 80-100 km upstream of Faisalabad city.

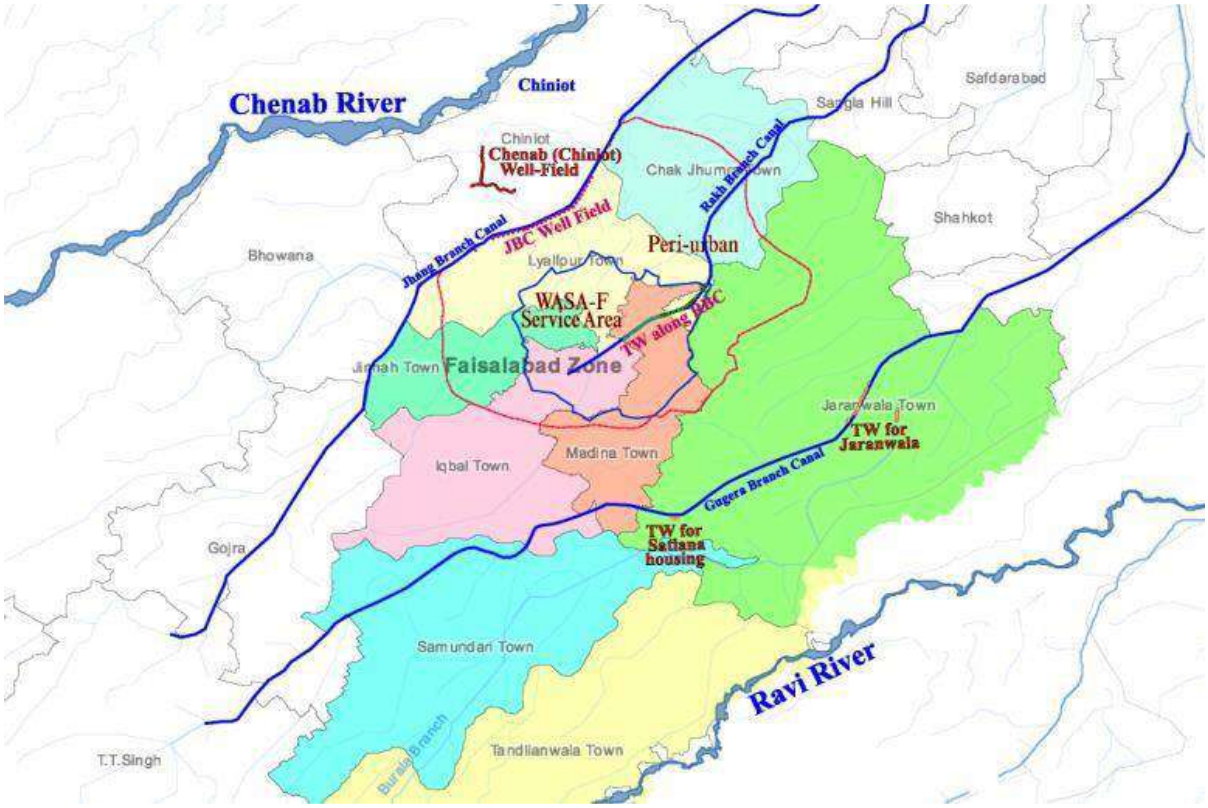


Figure 5.26: Location Map of Branch Canals

b) Chiniot

The primary surface water sources present in the Chiniot are the Jhelum and Chenab Rivers, and Marh Chiniot Drain. However, the Chenab River, and the Jhang Branch Canal and Link Canal and distribution system from these two sources is the main source of irrigation system in the Chiniot.

The Marh drain (a man-made drain) originates from Marh village in Faisalabad and discharges into the Chenab River. The drain carries all the storm water runoff generated in the area during rainfall events. All the industrial effluent and village sewage is also discharged into this drain.

c) Sargodha

The main surface water sources of Sargodha like Chiniot are Jhelum and Chenab Rivers. The main canals / channels that are used for irrigation purposes for agricultural lands in and around Sargodha are given in **Table 5.21.**

Table 5-21: Salient Features of Existing Canals / Channels in and around Sargodha

Name of System	Off-Taking Point	Discharge (Cusec)	Length of Channels (Miles)			G.C.A (M. Acres)	C.C.A (M. Acres)	No. of Outlets
			MC + Branches	Distributary + Minors	Total			
Upper Jhelum Canal (UJC)	Mangla	8975	151.15	626.37	777.52	0.565	0.535	1427

Name of System	Off-Taking Point	Discharge (Cusec)	Length of Channels (Miles)			G.C.A (M. Acres)	C.C.A (M. Acres)	No. of Outlets
			MC + Branches	Distributary + Minors	Total			
Lower Jhelum Canal (LJC)	Rasul Barrage	5280	259.51	1276.84	1536.35	1.639	1.453	3049
Thal Canal	Jinnah Barrage	9000	247.09	2066.30	2313.39	2.490	2.123	4570
Total		***23255***	***657.75***	***3969.51***	***4627.26***	***4.694***	***4.111***	***9046***

Source: Punjab Irrigation Department (https://irrigation.punjab.gov.pk/page/1025)

Study Area

As per hydrological study conducted by NESPAK in 2020 on the subject Project, it is analyzed that the three (03) types of channels are crossing the road alignment (Faisalabad-Chiniot-Sargodha Road) i.e.: (i) irrigation channel crossings; (ii) drain crossings and (iii) natural channels/sheet flow crossings.

(i) Irrigation Channel Crossings

The major irrigation channels crossing along the project road alignment is as follows:

- Khai Canal (RD 00+028);
- Jhang Canal (LCC) (RD 06+000);
- Rajoa Canal (RD 13+850);
- Chiniot Canal (RD 18+765);
- Pillowal Canal (RD 34+772);
- Khadir Canal (RD 38+310);
- Lalian Canal (RD 46+450);
- Lalian Distributary (RD 47+415);
- Wasauna Canal (RD 54+865);
- Kirana Canal (RD 56+290); and
- Malkana Canal (RD 62+675).

(ii) Drain Crossings

Beside Irrigation network, some drains are also crossing the existing road alignment. These drains carry sewage of the area and also accommodate drainable surplus water of agricultural fields to some extent. The names of these drains are as follows:

- Thatha Gilotran Drain (RD 12+293);
- Marh Chiniot Drain (RD 19+200);
- Hadda Branch Drain (RD 50+020); and
- 7L FS BR Drain (58+927).

(iii) Abandoned Natural cum Flood Channel Crossings

In addition to irrigation and drainage channel crossings, certain natural channel crossing structures over existing road have been identified during strip survey. No perennial flow is seen in these crossing structures. While investigating these points with the help of satellite data, it has been revealed that in past, sheet flow was generated at these points as natural

channel formation is visible at certain points. However, due to increase in cultural command area and settlements, these natural channels became abandoned. These structures are now serving as crossing of rain water collected at these depressed points and can travel to and from either side of the channel crossings. The catchment delineation maps of these smaller crossings are shown in **Figure 5.27**.

Figure 5.28 and Plate 5.1 shows the surface water resources present in and around the study area.

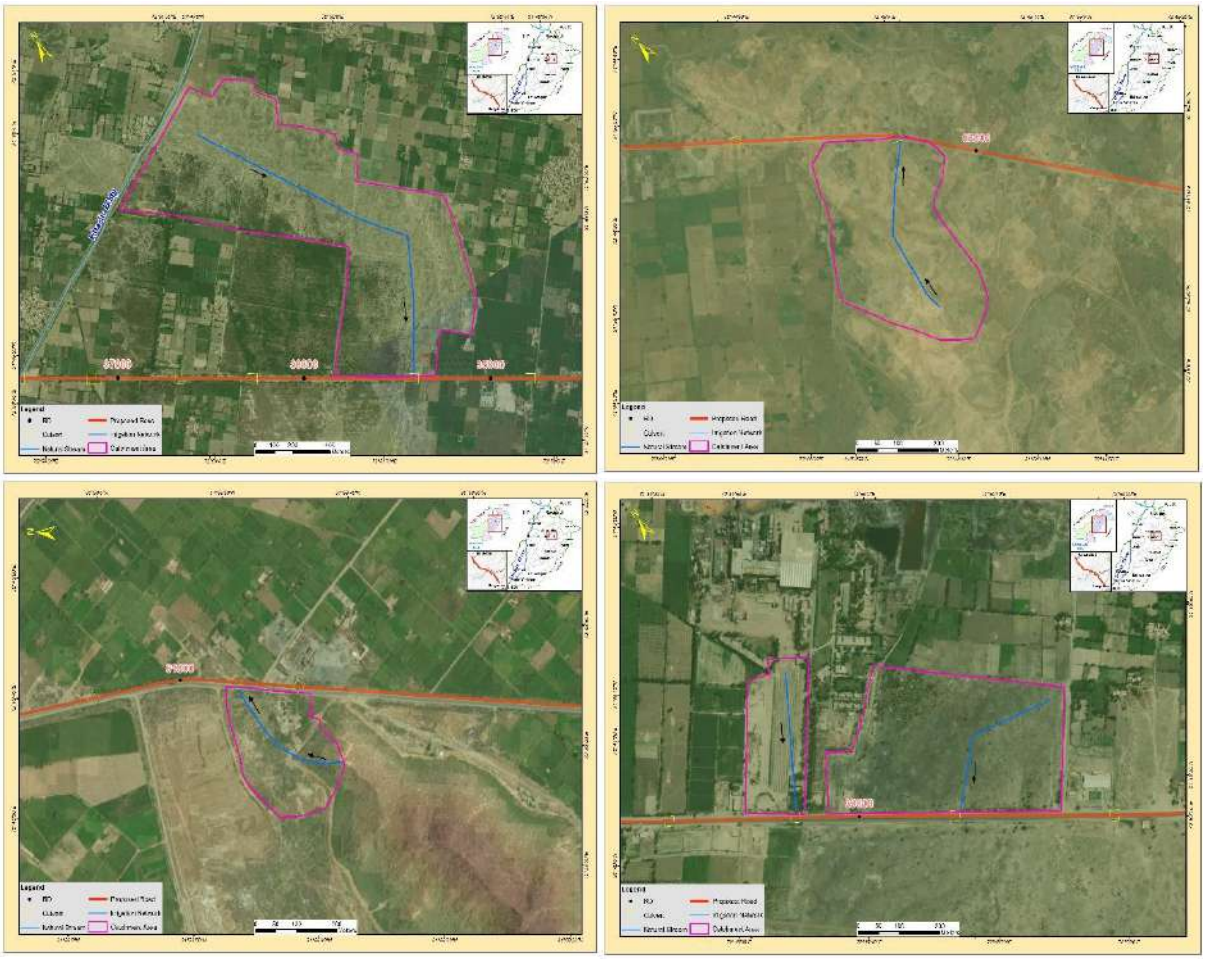


Figure 5.27: Delineation of Smaller Catchment Crossing in Study Area

A view of Jhang Branch Canal

A view of Chiniot Distributary Canal

A view of Natural Crossing near Kal Market Pull 111

A view of Chenab River

Plate 5.1: A view of Surface Water Bodies in the Study Area

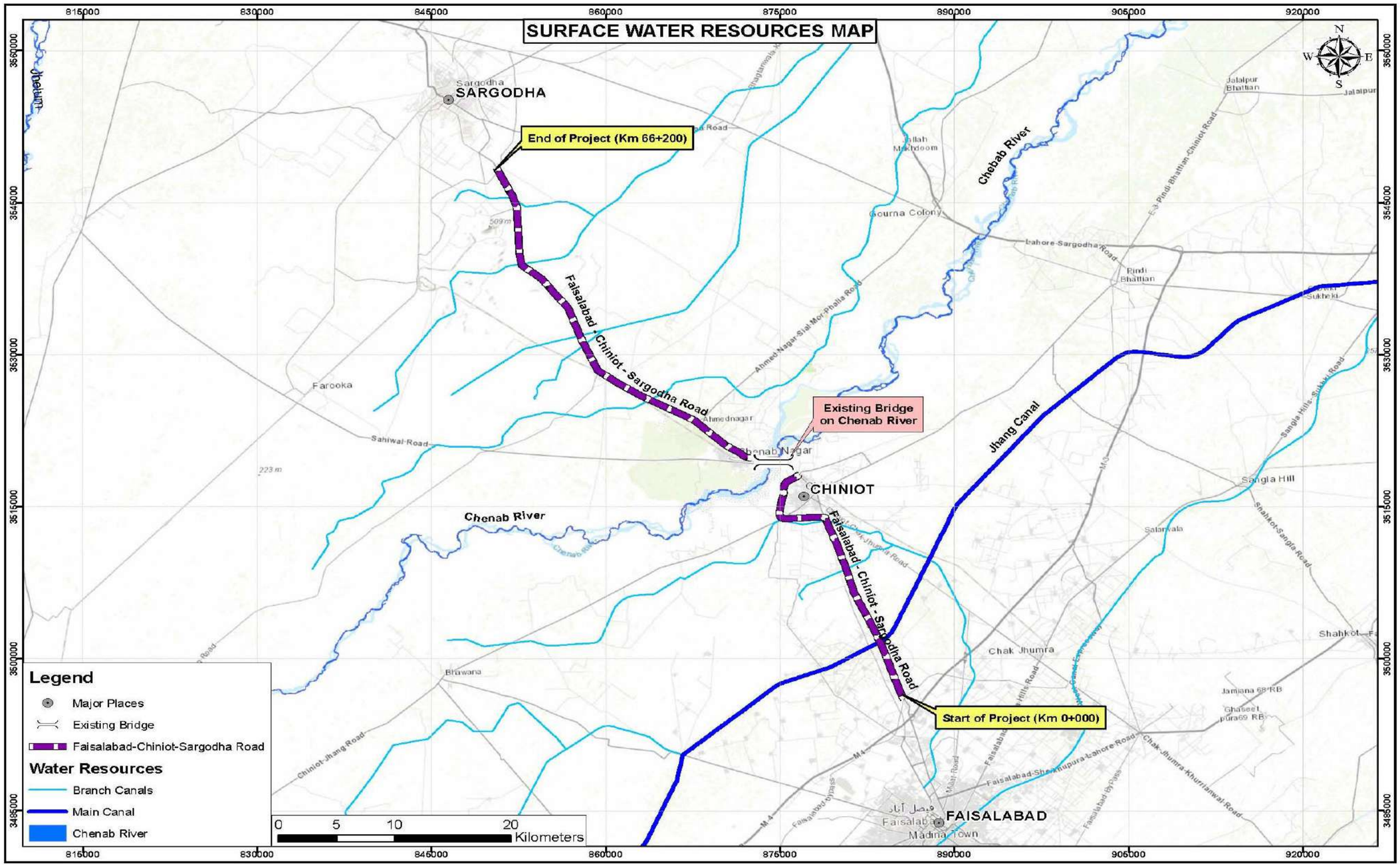


Figure 5.28: Surface Water Resources Map of the Study Area

5.2.8 Solid Waste

a) Faisalabad

Faisalabad Waste Management Company (FWMC) is responsible authority to ensure efficient collection, transportation, recovery, treatment and disposal of waste generation in Faisalabad. The total waste generation of Faisalabad is approximately 1,300-1,600 tons[41] per day and per capita waste generation is 0.48 kg/capita/day. Only 1,250[42] out of 1,600 tons/day of waste is being collected and dumped by FWMC, and remaining waste is being dumped at road side and in nearby canals / drains / nullahs by residents. Machinery used for collection of waste is container, arm roll, trolley, dumper and loaders.

b) Chiniot

The existing solid waste management system of Chiniot is being managed by the Tehsil Municipal Administration (TMA). The existing solid waste collection in general is divided into primary and secondary collection system. However, there is no proper solid waste disposal system in the Town. The total waste generation of Chiniot is approximately 94.9[43] tons/day and per capita waste generation is 0.4 kg/capita/day. The waste collected by TMA (80 tons / day) is being disposed in temporary disposal sites that are located at Sargodha road Bund River Chenab, 3Km from city Centre. **Figure 5.29** shows existing Solid Waste Management System in Chiniot.

Figure 5.29: Existing Solid Waste Management System in Chiniot

[41] Hafsa Yasin and Muhammad Usman, 2017. Site investigation of open dumping site of Municipal Solid Waste in Faisalabad. Earth Science Pakistan (ESP) 1(1) (2017) 23-2

[42] https://www.fwmc.com.pk/

[43] Chiniot City Profile Service Delivery Baseline Data, Punjab Cities Improvement Investment Program, 2018 (Report by The Urban Unit)

c) Sargodha

The existing solid waste management system of Sargodha is being managed by the Tehsil Municipal Administration (TMA). The existing solid waste collection in general is divided into primary and secondary collection system. However, there is no proper solid waste disposal system in the Town and no sanitary land fill site exists. The total waste generation of Sargodha is approximately 277 tons/day[44] and per capita waste generation is 0.4 kg/capita/day. The waste collected by TMA (200 tons / day) is being disposed in temporary disposal site that is Jahl Cheekia, which is government owned land. **Figure 5.30** shows existing Solid Waste Management System in Sargodha.

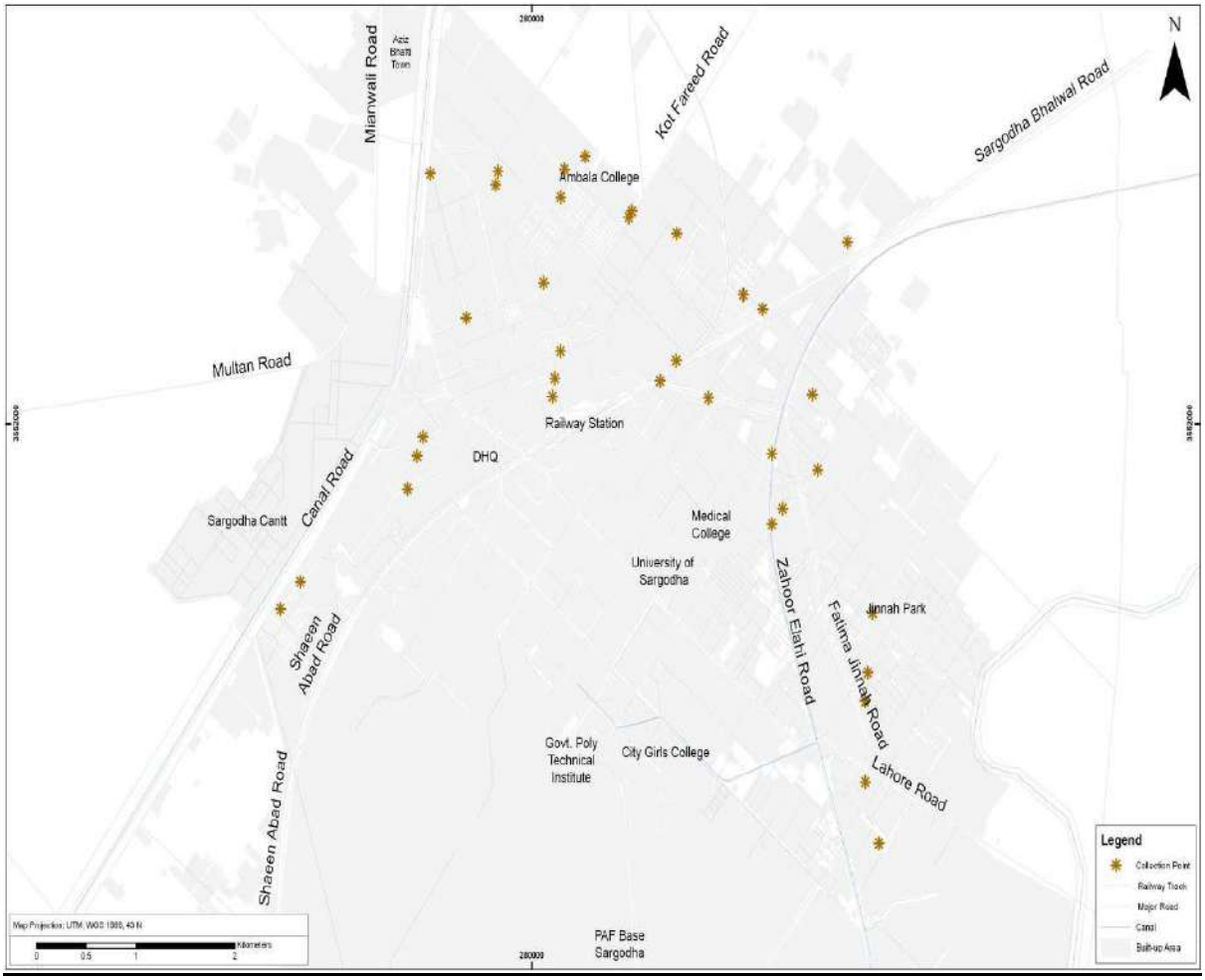


Figure 5.30: Existing Solid Waste Management System in Sargodha

Study Area

FWMC, TMA Chiniot and TMA Sargodha are responsible authorities for the collection and management of municipal waste generated on Faisalabad-Chiniot-Sargodha Road. However, from the field survey, it was observed that there is no facility of waste collection and

[44] Chiniot City Profile Service Delivery Baseline Data, Punjab Cities Improvement Investment Program, 2018 (Report by The Urban Unit)

management on existing road alignment, as waste was seen dumped as open heaps at road sides, and in nearby canals / nullahs by residents and road users (as shown in **Plate 5.2**).

Dumping of Waste along Roadside

Dumping of Waste in Nullahs

Plate 5.2: A view of Waste Dumping along the proposed Route Alignment

5.3 ENVIRONMENTAL PARAMETERS FOR MONITORING

The environmental monitoring of parameters like ambient air quality, noise level, surface water and groundwater help us to analyze the prevailing environment conditions in and around the study area, and to protect it from any adverse activities due to the proposed Project implementation.

The environmental monitoring for ambient air, noise level, surface water and groundwater were monitored at the proposed Project site from December 08, 2020 to December 11, 2020 for establishing the baseline profile of the Study Area.

The sampling locations of the above mentioned parameters are shown in **Figure 5.31** while **Table 5.22** represents the coordinates of sampling and monitoring points.

Table 5-22: Coordinates of Environmental Monitoring Points

Sr. No.	Location/Description	Coordinates	
		North	East
Ambient Air Quality and Noise Level			
1.	Sargodha Pull-11, Sargodha District	31°55'02.9"	72°44'51.7"
2.	Near Punjab College, Chiniot District	31°41'56.1"	72°58'51.1"
3.	Ditu Lune Wala, Faisalabad District	31°35'47.3"	73°02'10.8"

Sr. No.	Location/Description	Coordinates	
		North	East
Groundwater / Drinking Water Quality			
1.	Near Pull Dungra, Faisalabad District	31°58’76.30”	73°04’09.87”
2.	Chenab Nagar, Chiniot District	31°75’34.08”	72°93’37.60”
3.	Laliyan, Sargodha District	31°82’81.43”	72°80’34.78”
Surface Water Quality			
1.	Jhang Branch Canal near Pull Dongra, Faisalabad District	31°58’64.25”	73°04’18.45”
2.	Nullah near Punjab Collage, Chiniot District	31°69’85.94”	72°98’26.60”
3.	Chenab River near Chenab Nagar, Chiniot District	31°74’82.31”	72°94’82.82”

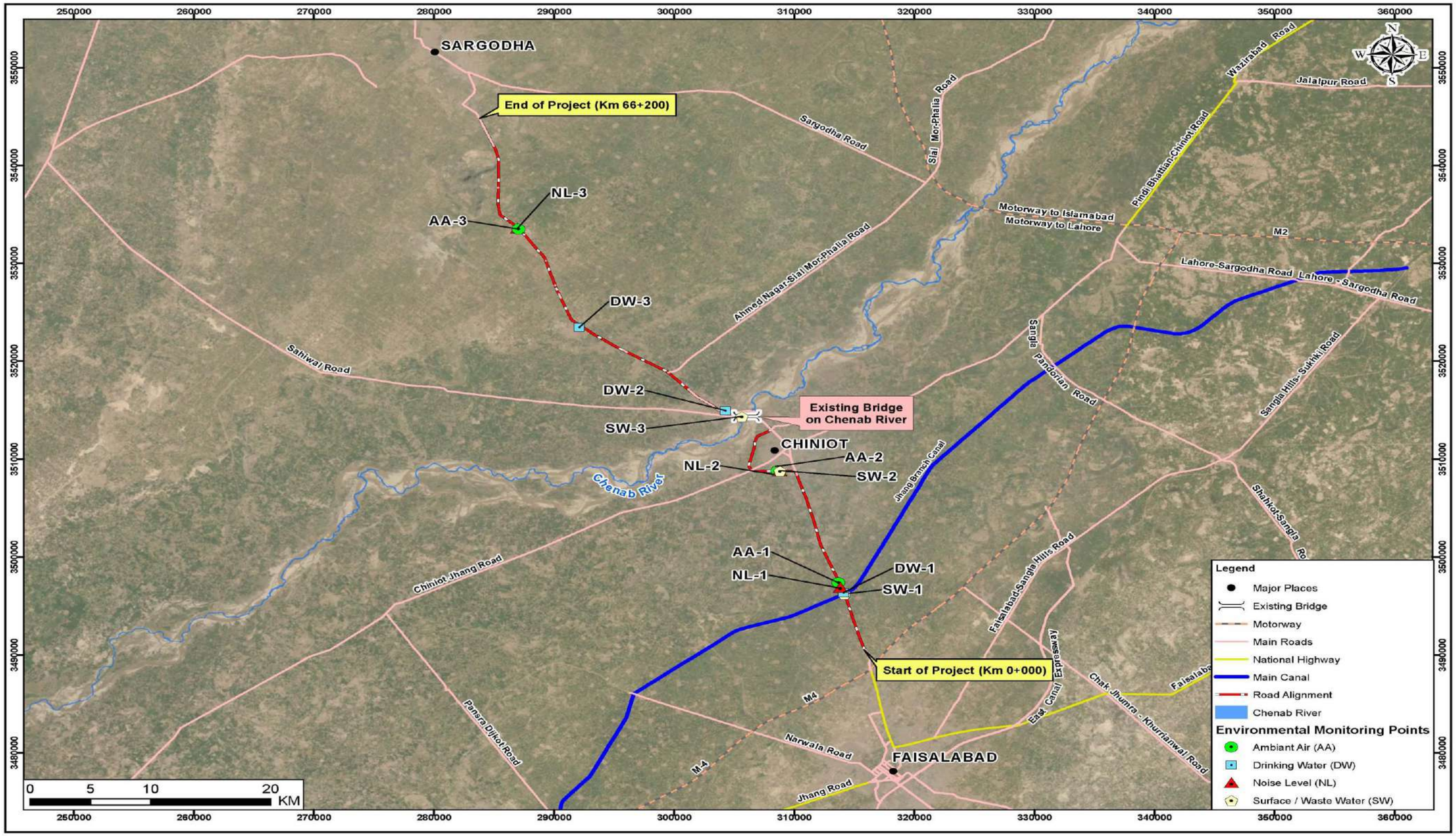


Figure 5.31: Sampling Location Map of Monitoring Parameters

5.3.1 Air Quality

The ambient air quality monitoring for Nitrogen Dioxide (NO_2), Nitrogen Oxide (NO), Sulfur Dioxide (SO_2), Carbon Monoxide (CO), Ozone (O_3), Particulate Matter ($PM_{2.5}$), Particulate Matter (PM_{10}), Suspended Particulate Matter (SPM) and Lead was carried at the proposed Project Site (Sargodha Pull-11, Punjab College, Chiniot and Ditu Lune Wala, Faisalabad). The sampling was conducted for 24 hours duration for NO_2, NO, SO_2, Lead, $PM_{2.5}$, PM_{10} and SPM, 1 hour for O_3 and 8 hours for CO.

The detailed results of ambient air quality monitoring have been attached in **Annex-II**, while the average concentrations of ambient air pollutants are given in **Table 5.23**. A pictorial view of ambient air monitoring is shown in **Plate 5.3**.

Table 5-23: Average Concentration of Ambient Air Pollutants

Parameter	Unit	Monitoring Duration	Average Concentration of Pollutants			Limits as Per PEQS, 2016
			Point 1	Point 2	Point 3	
Nitrogen Dioxide (NO_2)	µg/m^3	24 Hours	18.12	17.21	20.14	80 µg/m^3 for 24 Hours
Nitrogen Oxide (NO)	µg/m^3	24 Hours	13.47	12.66	14.30	40 µg/m^3 for 24 Hours
NO_x	µg/m^3	24 Hours	31.59	29.87	34.44	120 µg/m^3 for 24 Hours
Sulfur Dioxide (SO_2)	µg/m^3	24 Hours	16.49	14.35	15.06	120 µg/m^3 for 24 Hours
Carbon Monoxide (CO)	mg/m^3	08 Hours	0.96	0.92	0.98	5.0 µg/m^3 for 8 Hours
Ozone (O_3)	µg/m^3	01 Hours	18.31	16.11	17.56	130 µg/m^3 for 01 Hours
Particulate Matter ($PM_{2.5}$)	µg/m^3	24 Hours	39.71	37.17	43.13	35 µg/m^3 for 24 Hours
Particulate Matter (PM_{10})	µg/m^3	24 Hours	141.67	138.51	146.31	150 µg/m^3 for 24 Hours
Suspended Particulates Matter (SPM)	µg/m^3	24 Hours	216.38	210.68	224.44	500 µg/m^3 for 24 Hours
Lead (Pb) Airborne Particles	µg/m^3	24 Hours	0.057	0.049	0.063	1.5 µg/m^3 for 24 Hours

µg/m^3: micrograms per cubic meter
PEQS: Punjab Environmental Quality Standards

Table 4.23 indicates that all parameters are well within the permissible limits of Punjab Environmental Quality Standards (PEQS), 2016, except Particulate Matter ($PM_{2.5}$) at all three (03) locations, due to the emissions of particulate matter from vehicles, and from stone crushing plants located on both sides at the study area.

5.3.2 Noise Level

Noise level monitoring was carried out at three (03) different locations in the study area. Major sources of noise observed at the site were vehicular traffic, stone crushing plants and commercial activities in and around the study area.

The detailed results of noise monitoring have been attached in **Annex-II**, while the average concentrations of noise level are given in **Table 5.24**.

Table 5-24: Average Concentration of Noise Level

Averaging Time	PEQS, 2016				Unit	Average Value in dB (A)		
						Average Concentration of Noise Level at Point 1	Average Concentration of Noise Level at Point 2	Average Concentration of Noise Level at Point 3
	Category				dB (A)	Commercial (B)	Silence Zone (D)	Commercial (B)
	A	B	C	D				
Day-time	55	65	75	50		62.27	60.15	63.13
Night-time	45	55	65	45		53.76	51.63	56.07

A Study area is a mix of commercial, residential, industrial, health and educational land use, so the Noise levels measured during the monitoring are compared with Category A (Residential Area), Category B (Commercial Area), Category C (Industrial Area) and Category D (Silence Zone) as specified under PEQS, 2016 for Noise in reference to point taken from specified land use.

The above results shows that the average noise values at Point 2 and 3 during night time are exceeding the limits due to the movement of heavy vehicular traffic. Moreover, at Point 2 the average noise values at day time is also beyond the limits due to the movement of heavy vehicular traffic.

Ambient Air Monitoring near Sargodha Pull-11

Ambient Air Monitoring near Punjab College, Chiniot

Plate 5.3: A view of Ambient Air & Noise Level Monitoring at Project Site

5.3.3 Drinking / Ground Water Quality

Drinking water samples were collected from Pull Dungra, Chenab Nagar and Laliyan along the alignment and were analyzed for physical, chemical and microbiological parameters. **Table 5.25** shows the results of ground water analysis. A pictorial view of groundwater monitoring is shown in **Plate 5.4**

Collection of Drinking Water Sample from Chenab Nagar

Collection of Drinking Water Sample from Laliyan

Plate 5.4 A view of Ground Water Sampling in the Project Area

Table 5-25: Results of Ground Water Analysis

Sr. No.	Parameter	Unit	Results of Ground Water Sample at Point 1	Results of Ground Water Sample at Point 2	Results of Ground Water Sample at Point 3	Punjab Standards for Drinking Water Quality, 2016
A) Physical and Chemical Analysis						
1.	pH	-	7.15	7.68	7.39	6.5-8.5
2.	Odor	-	Odorless	Odorless	Odorless	Non-Objectionable
3.	Taste	-	Sweet	Salty	Salty	Non-Objectionable
4.	Color	Pt-Co	<1.0	<1.0	<1.0	≤ 15 TCU
5.	Turbidity	NTU	<0.1	<0.1	<0.1	< 5 NTU
6.	Total Hardness	mg/l	90.16	209.06	339.73	< 500 mg/l
7.	Total Dissolved Solids	mg/l	145.0	1516	1530	< 1000
8.	Chloride	mg/l	5.95	349.39	377.18	< 250
9.	Cyanide (Cn)	mg/l	<0.01	<0.01	<0.01	≤ 0.05
10.	Fluoride (F)	mg/l	<0.01	<0.01	<0.01	≤ 1.5
11.	Nitrite	mg/l	<0.01	<0.01	<0.01	≤ 3
12.	Nitrate	mg/l	<1.0	1.1	1.2	≤ 50

Sr. No.	Parameter	Unit	Results of Ground Water Sample at Point 1	Results of Ground Water Sample at Point 2	Results of Ground Water Sample at Point 3	Punjab Standards for Drinking Water Quality, 2016
13.	Phenolic Compound	mg/l	<0.01	<0.01	<0.01	-
14.	Chlorine	mg/l	<0.1	<0.1	<0.1	0.2-0.5
15.	Aluminum (Al)	mg/l	<0.028	<0.028	<0.028	≤ 0.2
16.	Cadmium	mg/l	<0.0028	<0.0028	<0.0028	0.01
17.	Copper	mg/l	<0.0045	<0.0045	<0.0045	2
18.	Chromium	mg/l	<0.0054	<0.0054	<0.0054	≤ 0.05
19.	Mercury	mg/l	<0.0008	<0.0008	<0.0008	≤ 0.001
20.	Antimony (Sb)	mg/l	ND	ND	ND	≤ 0.005
21.	Nickel	mg/l	<0.008	<0.008	<0.008	≤ 0.02
22.	Zinc	mg/l	<0.0033	0.0038	<0.0041	5.0
23.	Arsenic	mg/l	<0.01	0.03	0.03	≤ 0.05
24.	Barium	mg/l	<0.031	<0.031	<0.031	0.7
25.	Boron	mg/l	<0.1	<0.1	<0.1	0.3
26.	Manganese	mg/l	<0.0016	0.0019	0.0020	≤ 0.5
27.	Lead	mg/l	<0.013	0.015	0.017	≤ 0.05
28.	Selenium	mg/l	ND	ND	ND	0.01
B) Microbiological Analysis						
1.	Total Coliforms	CFU/ 100ml	Absent	15	18	Must not be detectable in any 100ml Sample
2.	Fecal Coliforms	CFU/ 100ml	Absent	14	6	

mg/l: Milligram per Liter **ND:** Not Detectable

The above table illustrates that all physical, chemical and microbiological parameters are well within permissible limits of Punjab Standards for Drinking Water Quality, 2016, except at point 2 and 3, where Total Coliforms, Fecal Coliforms, Total Dissolved Solids and Chloride exceeding the permissible limits due to the percolation of chemical effluents/sewerage in groundwater through surface water sources, and surface runoff of sediments from nearby roads and land.

5.3.4 Surface/Wastewater Quality

The wastewater quality was measured at three (03) different locations. The water samples were analyzed for the parameters specified in PEQS, 2016. The detailed wastewater results are given in **Table 5.26**. A pictorial view of surface water monitoring is shown in **Plate 5.5**

A view Wastewater Collection Sample from Jhang Branch Canal

A view Wastewater Collection Sample from Chenab River

Plate 5.5 A view of Wastewater Sampling in the Project Area

Table 5-26: Wastewater Quality Monitoring

Sr. No.	Parameters	Unit	Test Results (Surface Water)			PEQS, 2016
			Point 1	Point 2	Point 3	
1.	Temperature	Celsius	24.5	24.5	24.5	≤ 3^0C
2.	pH	--	7.95	8.12	8.15	6-9
3.	Biochemical Oxygen Demand	mg/l	<1.0	3	<1.0	80
4.	Chemical Oxygen Demand	mg/l	6	16	7	150
5.	Total Dissolved Solids	mg/l	155	1223	238	3,500
6.	Total Suspended Solids	mg/l	35	101	11	200
7.	Grease & Oil	mg/l	<0.2	<0.2	<0.2	10
8.	Phenolic compounds	mg/l	<0.01	<0.01	<0.01	0.1
9.	Chloride	mg/l	7.94	136.97	15.88	1,000
10.	Fluoride	mg/l	<0.01	<0.01	<0.01	10
11.	Cyanide	mg/l	<0.01	<0.01	<0.01	1.0
12.	An-ionic Detergents	mg/l	ND	ND	ND	20
13.	Sulphate	mg/l	30.87	154.35	61.74	600
14.	Sulphide	mg/l	<0.4	<0.4	<0.4	1.0
15.	Ammonia	mg/l	<0.002	<0.002	<0.002	40
16.	Cadmium	mg/l	<0.0028	<0.0028	<0.0028	0.1
17.	Chromium	mg/l	<0.0054	<0.0054	<0.0054	1.0
18.	Copper	mg/l	<0.0045	<0.0045	<0.0045	1.0
19.	Lead	mg/l	<0.013	<0.013	<0.013	0.5
20.	Mercury	mg/l	<0.0008	<0.0008	<0.0008	0.01
21.	Selenium	mg/l	ND	ND	ND	0.5
22.	Nickel	mg/l	<0.008	<0.008	<0.008	1.0
23.	Silver	mg/l	<0.0032	<0.0032	<0.0032	1.0
24.	Zinc	mg/l	<0.0033	<0.0033	<0.0033	5.0
25.	Arsenic	mg/l	0.01	0.03	0.01	1.0
26.	Barium	mg/l	<0.031	<0.031	<0.031	1.5
27.	Iron	mg/l	0.14	<0.1	<0.1	8.0
28.	Manganese	mg/l	<0.0016	<0.0016	<0.0016	1.5
29.	Boron	mg/l	<0.1	<0.1	<0.1	6.0
30.	Residual Chlorine	mg/l	<0.1	<0.1	<0.1	1.0
31.	Total Toxic Metal	mg/l	0.01	0.03	0.02	--

mg/l: Milligram per Liter **ND:** Not Detectable

The above table illustrates that all physical, chemical and microbiological parameters are well within permissible limits of Punjab Standards for Wastewater Quality (Municipal and Liquid Industrial Effluents), 2016.

5.4 LAND USE PATTERN

The land use of the study area is a mix of industrial, residential and commercial area covered by educational institutions, health facilities, religious site (mosques and churches), shrines, graveyards, recreational amenities (parks and playgrounds), agricultural land, mountains, valleys, government and private offices, river, channels / canals, drains and road side green belt. The land use index map of the proposed Project is shown in **Figure 5.32**, whereas **Annex-III** shows pictorial view of land use and **Annex-IV** Land Use Maps of the Study Area. **Table 5.27** depicts land use cover of the study area.

Table 5-27: Land Use Cover of the Study Area

Land Use Type	Area (Acres)
Barren / Open Area	196.16
Built-up Area	95.36
Canal	10.22
Cultivated Land	370.21
Filling Station	13.01
Graveyard	3.95
Kilin	8.94
Orchard	7.12
Park / Playground	3.99
Road / Track	187.10
Stream / Nullah	0.43
Trees / Bushes	44.02
Water Pond	0.12
Grand Total	**940.63**

5.5 ENVIRONMENTAL SENSITIVE RECEPTORS

Sensitive receptors are mainly people or other organisms that may have a significantly increased sensitivity and exposure to the pollutants and social disturbance, due to the developmental projects. Thus, sensitive receptors are necessary to be identified, to evaluate the potential impacts of the proposed project on public health and the surrounding environment.

The sensitive receptors identified for the proposed project within COI are: residential areas; educational institutions; health facilities; and religious places (mosques, shrines, churches and graveyards) as shown in **Figure 5.33(a) to Figure 5.33(b)**. They are prone to sensitivity during construction phase, due to emission of air pollutants, noise and vibration, temporary edifice of construction camps and mobilization issues.

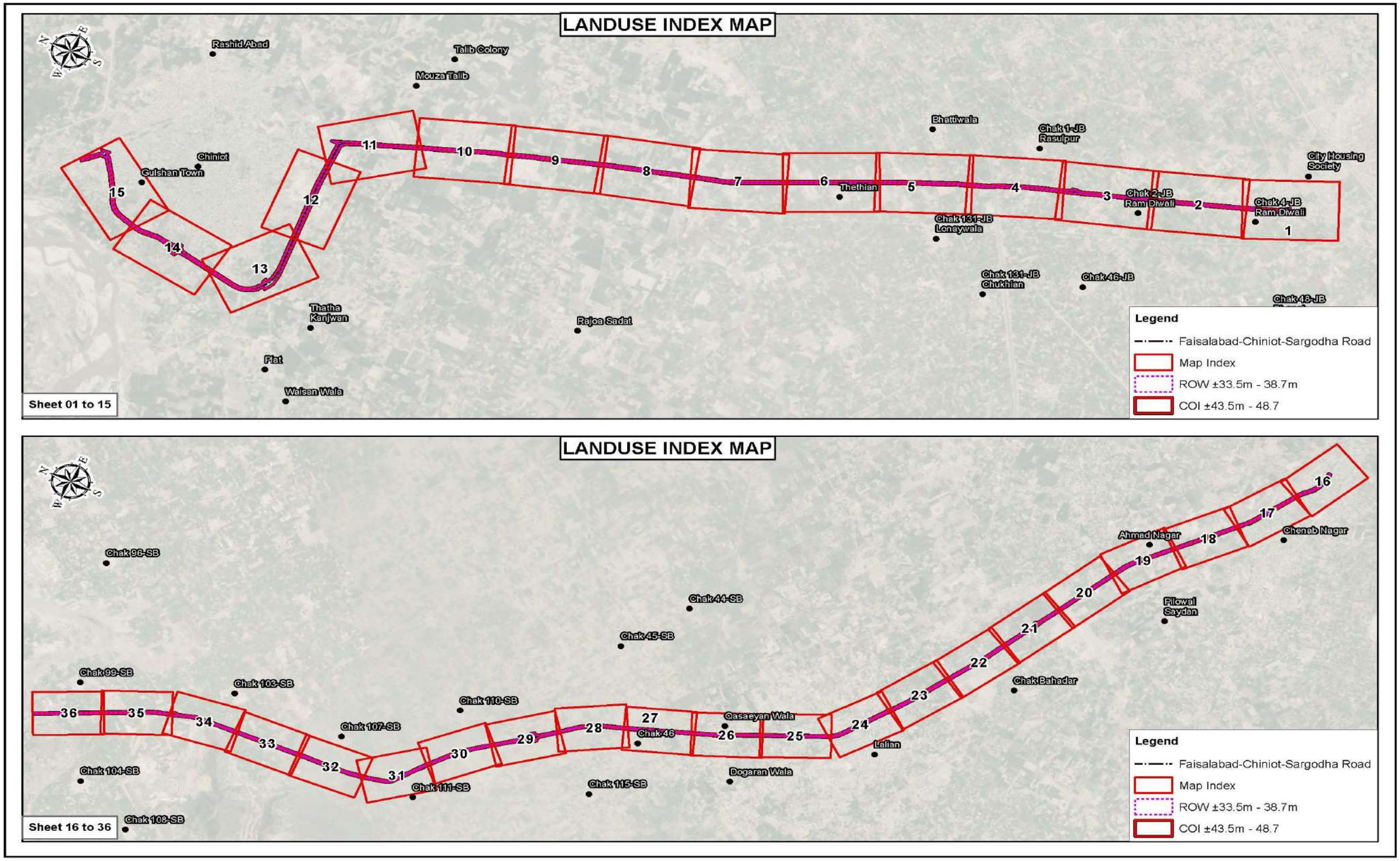


Figure 5.32: Land Use Index Map of the Study Area

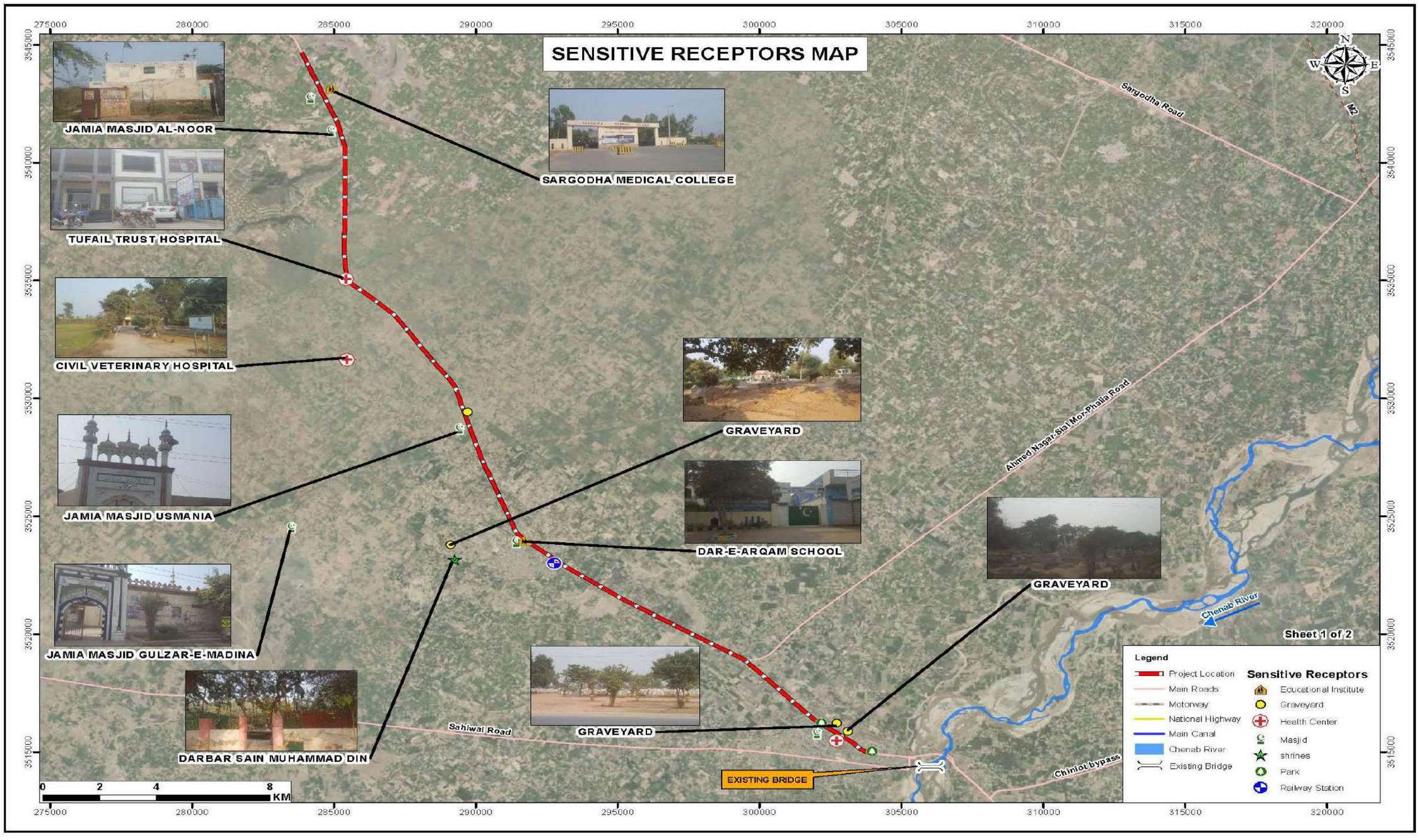


Figure 5.33(a): Sensitive Receptor Map of the Study Area

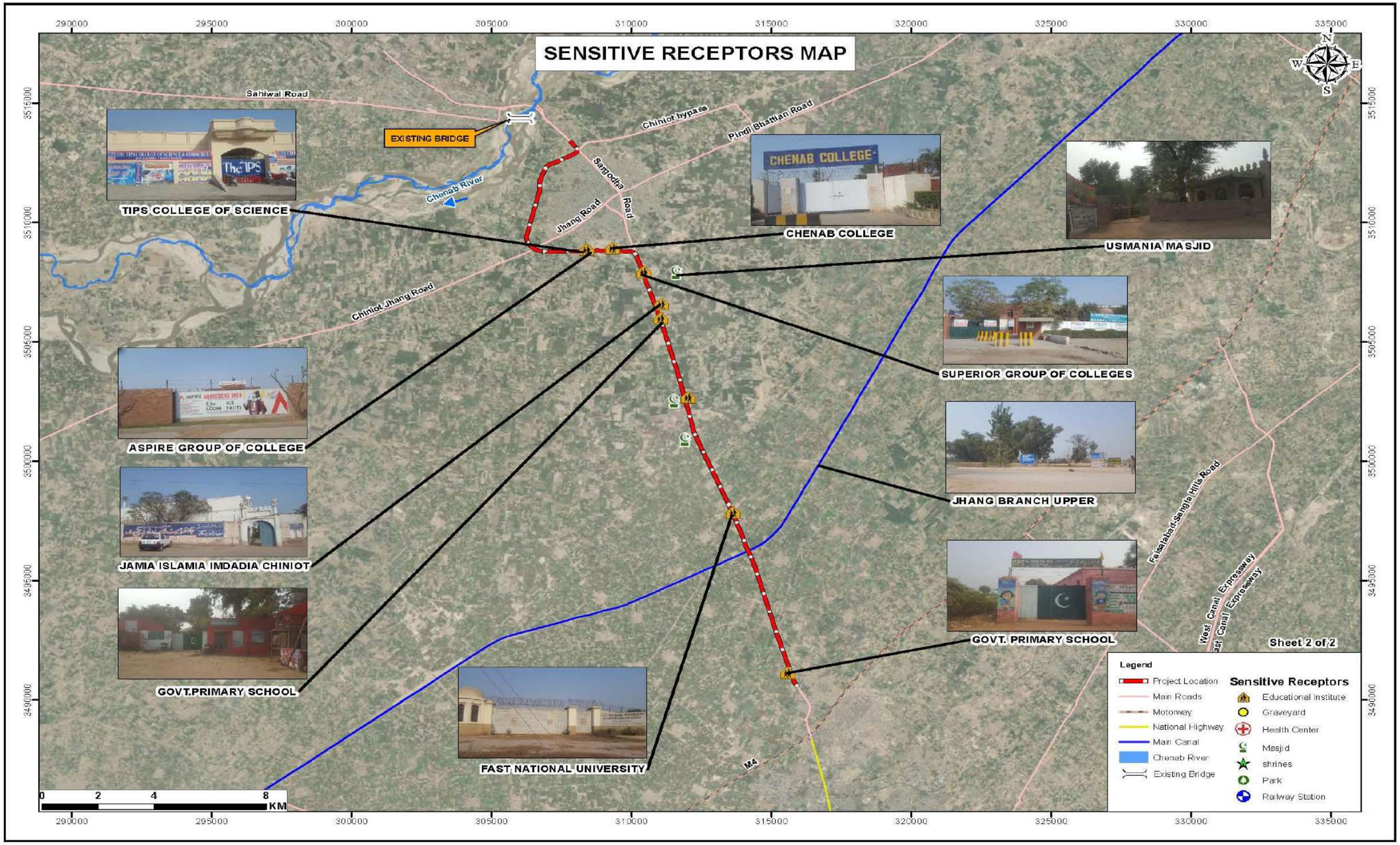


Figure 5.33(b): Sensitive Receptor Map of the Study Area

5.6 BIOLOGICAL ENVIRONMENT

The Study Area is situated in semi-arid region of Pakistan. The region is characterized by dry climate both in summer and winter season. The precipitation is in the form of occasional seasonal rains, during rainy season (July– September). On the basis of climax vegetation, the whole Indus basin plain with the exception of parts of the districts of Sialkot, Gujarat and Jhelum, consists of tropical thorn forests prior to development of irrigation, agriculture and urbanization.

5.6.1 Flora

Forest found in the region is Tropical thorn forests. These are low, open and pronouncedly xerophytic forests in which thorny leguminous species are predominate. Vegetation of the area shows that it is suitable for plantation of native species along the agriculture fields. Variation in diversity is caused due to climate, heterogeneity, biotic interaction and habitat. In the past, the area was covered with huge amount of ground vegetation and dominated by trees but now the conditions are at the adverse side because the original or natural habitat has been modified and converted into barren land for construction and for agricultural purposes. This particular area has been accessible to humans for a long time resulting in low diversity and wildlife abundance.

The major tree species are Prosopis ineraria (Jhand), Capparis decidua (Karir, Karil), Zizyphus mauritiana (Ber), Tamarix aphylla (Farash) and Salvadora oleoides (Pilu, wan). Natural flora of the Project Area enriched with shrubs, trees, medicinal plants, forbs, herbs, weeds, and grasses as listed in **Table 5.28** and **Plate 5.6**.

Table 5-28: Flora in the Study Area

S. No.	Common Name	Scientific Name
1.	Kikar	*Acacia nilotica*
2.	Shisham	*Dalbergia sissoo*
3.	Ber	*Zizyphus sp.*
4.	Sufeda	*Eucalyptus camaldulensis*
5.	Mulberry	*Morus alba*
6.	Neem	*Azadirachta indica*
7.	Sirris	*Albizia lebbek*
8.	Dherek	*Melia azedarach*
9.	Bakain	*Melia azadirachta*
10.	Sumbal	*Bombax ceiba*

Plate 5.6: Floral Species along the Project Alignment

5.6.2 Fauna

The Study Area being agricultural land and is not very rich in wildlife Mammals. However, common mammals are Jackal (*Canis aurecus*), Squirrel (*Funambulus*), Fox (*Vulpus vulpus*), Rats (*Mus musculus*) and Mangoose (*Herpestes auropunctatus*). Wild bear (Sus scrofa) is also reported in the area (**Table 5.29**), but its number has been reduced to a bare minimum as a result of extensive hunting and shootingFauna and flora are an essential part of the environments and depend on each other in many ways and as the flora is not only plentiful, but also enriched with lush green crops. The fauna of the area comprises mammals, reptiles and birds etc. A View of Agriculture in the Study Area is shown in **Plate 5.7**.

Table 5-29: Mammals in the Study Area

S. No.	Common Name	Scientific Name
1.	Jackal	*Canis aureus*
2.	Fox	*Vulpus bengalensis*
3.	Porcupine	*Hystrix indica*
4.	Squirrel	*Sciuridae*
5.	Mouse	*Funambulus pennanti*
6.	Mongoose	*Herpestes javanicus*
7.	Wild Boar	*Sus scrofa*

Plate 5.7: A View of Faunal Species and Avi-Fauna in the Study Area

5.6.3 Reptiles and Amphibians

Amphibians and reptiles collectively called Herps, are very important animals among the vertebrates and important components of any living system. They may act as excellent biological indicators of any ecosystem. Their position in the ecological niche is so vulnerable that the survival and collapse of the whole energy cycle depends upon the presence and absence of the amphibians and reptiles. The main species found are brown cobra, Indian krtait, spiny and finger toad lizards.

5.6.4 Birds

House sparrow (Passer domesticus), House crow (Corvussplendens) and Mynah (Acredotherestristis) are the most common in the area. In addition, some birds have also been observed in the area like Nightingale (Pycnontuscafer), Parrot (Psittaculakrameri), Pigeon (Columba livia) and Hoopoe (Upupaepops).

5.6.5 Endangered

There is no endangered species of flora and fauna in the study area.

5.6.6 Wildlife Sanctuaries and Game Reserves

No wildlife sanctuary or game reserve is located in the vicinity of the study area.

5.6.7 Critical Habitats

No reserve, protected forests, national parks wild life sanctuary, game reserve and critical habitats, exists near the project area and therefore it can be stated that this project does not affect any critical habitat.

5.6.8 Agriculture

Agriculture in the study area is predominantly irrigated agriculture. The project area depends upon a number of tube wells installed in the area for its irrigation, as canal water is not available here. As a result of ground water availability, lush green crops of wheat, sugarcane, fodder and vegetables give a substantial yield. Vegetables grown in the project area and the study area include, tomato, sweet pepper, brinjal, cucumber, okra, bitter gourd, potato, turmeric, ginger, cabbage, carrot, onion, radish, turnip, peas, spinach, etc. A view of agriculture in the Study Area is shown in **Plate 5.8.**

Plate 5.8: A View of Agriculture in the Study Area

5.7 SOCIO- ECONOMIC CHARACTERISTICS

The socio-economic baseline provides an overview of the social and economic conditions of the Project Area based on primary and secondary data sources. This overview helps in understanding the socio-economic importance of the Project Area and contributes towards identification of any social risks that the project proponents must be aware of during the project design phase. The baseline data presented here also provides a basis for monitoring project activities during the project implementation and operations phase.

The proposed road is located in three (03) Districts Faisalabad, Chiniot and Sargodha. The social baseline for subject project is based on primary data collected through social survey and stakeholders consultations and secondary data extracted through different sources such District Census Reports (DCRs) and other published materials.

5.7.1 Administrative and Political Settings

Following is the administrative setup of the three districts of the study area;

Faisalabad was re-organized as a City-District, and composes of eight Tehsil Municipal Administrations (TMA) (or towns).

1. Faisalabad
2. Madina Town
3. Jinnah Town
4. Iqbal Town
5. Chak Jhumra Town
6. Jaranwala Town
7. Samundri Town
8. Tandlianwala Town

Previously, **Chiniot** was Tehsil[45] of district Jhang and it was declared as a separate district in February 2009. Chiniot District is divided into three tehsils:

1. Chiniot
2. Bhawana
3. Laliyan

Sargodha city is the administrative headquarter of Sargodha Division and handles the population of about 8.1 million. Sargodha District is administratively divided into Seven Tehsils, which contain a total of 161 Union Councils. Following are the seven tehsils of Sargodha district:

1. Sargodha
2. Kot Momin
3. Bhalwal
4. Shahpur
5. Sillanwali
6. Sahiwal
7. Bhera

All the three above mentioned Districts are managed by the Deputy Commissioner who is District Magistrate as well as District Collector. District Magistrate is mainly responsible for law & order and other allied matters of whole District, he is assisted by an Additional District Magistrate (Additional Deputy Commissioner), three Sub-Divisional Magistrates and 10 Ilaqa[46] Magistrates.

In these districts Union Councils (UC) are the lowest tier of the local government and fifth tier of government in Pakistan; in rural areas, UCs are often known as "village councils". The territory represented by a village council usually comprises a large village and surrounding areas, often including nearby small villages. The term "union council" may be used for localities

[45] A tehsil is an administrative sub-division of a district
[46] Magistrate of the relevant area

that are part of cities. A village council is an elected local government body headed by a mayor and a deputy mayor.

Tehsil Council is the next tier of local government. About 04 to 05 UCs fall in the Tehsil Council (TC). Tehsil is a sub-unit of the district, which is the highest tier of the local government system, dealing with the administrative matters at district level.

A district is composed of Tehsils and is governed by the District Coordination Officer (DCO). Like other districts of the Punjab, the local government system comprise UCs consisting of members directly elected by people through an open competition, which is also from the Electoral College for the selection of the members for the next higher tier.

5.7.2 Socio- Economic Characteristics

Methodology Used for Data Collection

Socio-economic survey of the selected households of the Project Area villages was carried out along the road from Faisalabad Bypass to Sargodha Bypass. During the socio-economic survey, 99 respondents from the villages of Project Area (along the road side) were selected as sample size by calculation with 95% confidence level and 10% confidence interval. Theses major villages are chak-03 (Faisalabad By pass), Chak-01, chak-02, pull dengro, dera arain, chak-127, tehthian, bhutto colony, raojaoi sadat, adda lune mor, lalian, qasian wala, adda-46, pull-111, chiniot bypass and chak bahadur. Population of those villages along the road side was estimated based on the village/area profile about 100,000 during the field survey conducted on October, 2020.

These respondents were selected by using systematic random sampling technique in the study area, however, social survey 100% carried out in Project area. Questionnaires were developed to collect the baseline data, based on the demographic and socio-economic indicators. Interviewing technique was used as a tool for data collection. In order to quantify the existing baseline conditions of the Study Area, collected data was analyzed digitally by using SPSS software.

During the socio-economic survey, people were informed about the objective and purpose of the proposed Project. In particular, apprehensions of the locals regarding issues of existing road and the proposed dualization and rehabilitation were discussed. Public Consultations and Focus Group Discussions (FGDs) were held in the villages located in the study area as well as within project boundary, to clarify the Project related works and activities in detail and also to record the concerns and suggestions of the people. The total number of houses in each village was identified either through observatory analysis or the figure quoted by the residents during the questionnaire survey.

a) Sample Population and Family Size

Based on the socio-economic survey of the selected households of the Study Area, the overall population of 99 households was calculated as 663 numbers. Average household size was concluded as about 6.7. The sex ratio (males per 100 females) for the Study Area is found to be 106.9. Detail is given in **Table 5.30** below.

Table 5-30: Sample Population and Family Size

Sr. No	Age Group (Years)	Male		Female		Total	
		No.	Percentage	No.	Percentage	No.	Percentage
1	0-4	38	11.1	29	9.1	67	10.1
2	5-9	48	14.0	31	9.7	79	11.9
3	10-19	66	19.2	75	23.4	141	21.3
4	20-39	90	26.2	88	27.5	178	26.8
5	40-49	75	21.9	62	19.4	137	20.7
6	50-59	18	5.2	22	6.9	40	6.0
7	60 and above	8	2.3	13	4.1	21	3.2
	Total	**343**	**100.00**	**320**	**100**	**663**	**100**

** Men per 100 women*

The sex ratio is an important demographic indicator, which is defined as the "number of males per hundred females". The sex ratio for the district computed in 1998 is 108.4 males per 100 females. The sex ratio based on the household was 107 males per 100 females. The sex ratio depends on the factors such as the sex ratio at birth, differential mortality rates between the sexes at different ages, and losses and gains through migration. In rural areas of Pakistan, sons are preferred because (i) they have a higher wage-earning capacity, (ii) they continue the family line; and (iii) they are generally recipients of inheritance. Girls are often considered an economic burden because of the dowry system and after marriage they typically become members of the husband's family, ceasing to have responsibility for their parents in illness and old age.

b) Age and Marital Status of the Respondents

As per the respondents interviewed during the socio-economic survey, it was identified that majority of them were married i.e.98% of the total respondents. Therefore all of them were identified as key informant of the area. Majority of the respondent 57% fall under the age category is 36-50 years. Details of age of the respondents along percentage is shown in **Figure 5.34**.

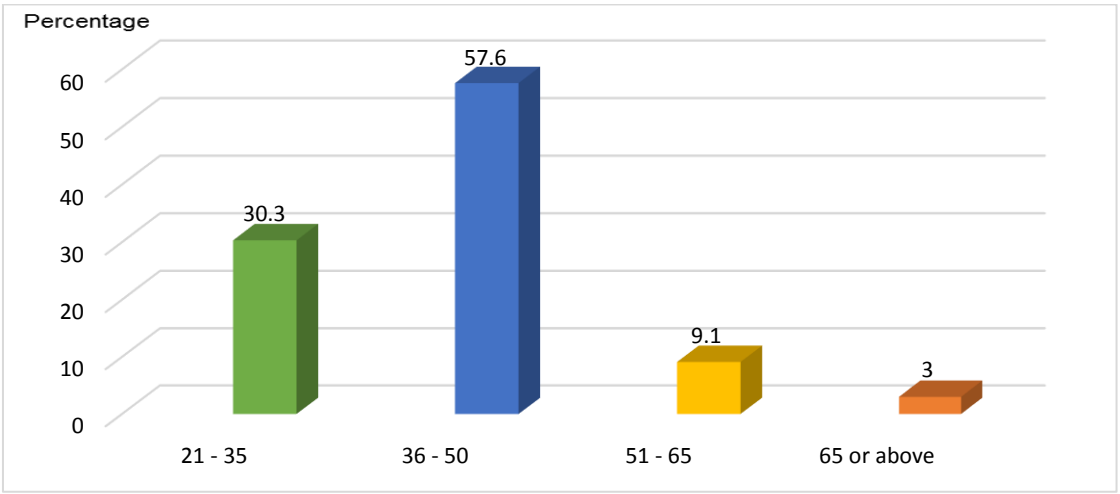


Figure 5.34: Age Distribution of Respondents in the Study Area

Endogamy is the prevalent style of marriage. Most of the people are monogamous as second marriage is expensive. Mothers have very little role in decision-making about marriages of their sons and daughters. Neither the groom nor the bride is allowed to choose his or her life partner in rural areas. The decision of the parents is considered final; however, sometimes the bridegroom is consulted before the final decision.

c) Languages Spoken

Punjabi is the predominant language being spoken in the Study Area along the road from Faisalabad to Sargodha. However Urdu is also understood and spoken at little level.

d) Ethnicity and Minority Groups

The population of the villages in the Study area is predominantly Muslim, Ahmadies and only few number of households were found Christians.

The core unit of social organization is the caste system ("biraderi" in local language) in which groups are either defined on the basis of specific occupation or lineage. Occupationally defined caste groups are considered as lower status in the social setup. For instance occupationally defined biraderi/caste groups are Mochi (cobbler), Machi (fisherman), Nai (barber), Gujjar (dairy and livestock farmers), Julahay (weavers) while lineage based biraderi/caste groups are e.g., Khokar, Sandhu, Sial, Malik, Rajput, Bhatti, Jutt, Kullah, Mian, Khurral, Syed, and Cheema. The social life of the local population is traditionally on rural.
Based on the household survey, the population in the Study has many castes. The major caste/ethnic groups are Arain, Sial, Sipra, Bharwana, Khurral, Bhutta, Sheikh, Khokar, Malik, Rehmani, Bhatti, Syed, Cheema, Mochi Sindhu, Rana and Baloch. Among all the castes mentioned, Bharwana, Arain, Jutt, Syed, Rahmani, Sheikh and Bhatti are the dominant castes of the Study Area.

During the field survey, it became apparent that the major castes were important because they have a key role in decision-making regarding the resolution of social issues of family matters. For instance, landlords (locally named as Chaudry/Mahar) as well as the head/or elder of the respective caste generally make decisions related to the social issues at village level as well as the social development works in their areas. Prior to any Project/ programme to be initiated, it is essential to involve these groups right from start of the Project i.e. planning g, design, implementation and operation of the proposed project, to make the Project successful. In the Study area, local councilors, chairman and deputy chairman are the influential persons while in rural setup Numberdar and councilors have influence.

e) Migration in the AOI

Migration, especially internal migration in Pakistan, is an old phenomenon. It's not only provides opportunities for employment but also improves the socio-economic conditions of migrant households. Lack of employment opportunities coupled with inadequate income from farming are considered the leading cause of migration. Similar is the case with the population residing in the Study Area and they migrate to other areas. Although, there are lot of textile and other industries exists along the road side from Faisalabad to Sargodha and many locals are working in these industries. However, these industries cannot fulfil their jobs requirement therefore, locals are forced to migrate other areas.

During the field visit, locals informed that they are forced to migrate to other areas due to lack of jobs and business opportunities. In the majority of the cases, male members usually migrate to other cities such as Faisalabad and Lahore. Faisalabad is an industrial city and has lot of job opportunities. Being the divisional headquarters, there are many educational institutions which also attract migrants (e.g., Government College University, Agriculture University, Science College, and Faisalabad University). People also migrate to Lahore for similar reasons. If a person moves to another city, he prefers to retain his ties with his native village and his rights are still acknowledged even after his departure. Typically, the migrant sends part of his earnings to the family remaining in villages. Mostly, villagers return to their village for work at peak agricultural seasons. Sometimes married migrants leave their families in the village when they initially migrate. The decision to migrate and bring wife and children to other cities has always been a difficult decision. While a man is away from his family, his wife often assumes responsibility for many day-to-day business transactions that are considered the responsibility of men.

f) Literacy

Primary schools for boys and girls were present in the major villages/areas along the project road such as Chak-03, Chak-02, Chenab Nagar, Chiniot Bypass, and chak-46, while high school level education is only available in chak-02, chiniot bypass, Chenab nagar, lalian and chak-46. Along the road from Faisalabad to Sargodha lot of educational institutions exist including colleges for boys and girls and vocational institutions.

The literacy level of the respondents, identified during the survey, depicts that the majority of the respondents interviewed in the Study Area were illiterate and their percentage is 27.3% followed by 23.3% primary, 17.2% middle, 13.1% secondary level educated. Detail of the education level of the respondents are given in **Table 5.31**.

Table 5-31: Level of Education in the Study Area

Sr. No.	Education Level	Frequency	Percentage (%)
1	Illiterate	27	27.3
2	Primary	23	23.2
3	Middle	17	17.2
4	Secondary	13	13.1
5	Higher Secondary	9	9.1
6	Graduate	8	8.1
7	Post Graduate	1	1
8	Deeni Uloom	1	1
	Total	**99**	**100**

Most of the people in the Study Area are poor and cost of education is another determinant factor for parents to decide whether to send their children to school or not. Therefore, poor people do not send children to school.

Based on the field survey and discussion with the locals, it is noted that female literacy rate is lower as compared to males. Locals give least importance to female education. Few reasons of low literacy rate among women are:

- The major cause of women illiteracy is increase in population, which is playing a negative role in this deprivation of female education. A family having more children and less income will prefer to educate the boys of the family, while the girls will be given embroidery or sewing skills;
- The number of schools and colleges for females are few. Girls have to travel a long distance to reach the schools or colleges in the Study area. For this reason most parents prefer to give them religious education.
- There is also misconception that females have to manage home after marriage whereas males have to earn for livelihood, so education matters only for males and not for females;
- Some families do not like their daughters to study in co-education institutes thus depriving them of higher education; and
- The social setup is male dominated and girls restricted to homes and cannot go out freely thus any male of the family has to take responsibility for grocery purchasing etc. This sometimes seems difficult to them. There is also a sharp division between female oriented work and male oriented work. Females are not allowed to work in all sectors therefore their education is not considered valuable.

g) Family System

Joint family system is the dominant culture in the Study Area. Only one person was found who have two wives. It was observed that the family structure in the area was very strong and members played a pivot role in solving their social and cultural problems.

Most of the families are living in joint family system comprising grandparents, uncles, aunties and lot of cousins, whereas only a small percentage of families are living as a single family (nuclear family system). Although the joint family system is generally undergoing a radical change, with a greater influence of media and education, people of the Study area do not feel good about this change. Because while living in a joint family system a lot of emotional attachments are enhanced and they feel that by separating in nuclear family system, their relationships will be damaged and family ties will be weakened.

As per the locals, joint family system is basically a form of organization. In this organization there are defined norms and values to be followed strictly by all the members. All the members have their defined tasks and responsibilities to perform. There is equal share of each and every member of the family in the available resources in the form of money, food and other requirements and locals feels better in joint family system as compare to nuclear family.

During the discussion with the locals, it was clarified that large family size is also treated as the strength of the family.

h) Occupations

The dominant source of income in the whole Study area is agriculture which is 78.8% (refer **Figure 5.35**). The second major source of income identified in the study area was labour. Only few people were found who use to work in other occupations. However, majority of the respondents are small land holder, therefore they are forced to adopt other source of income such as labour, livestock, small level general stores etc. Details occupational distribution of the respondents are given in below table.

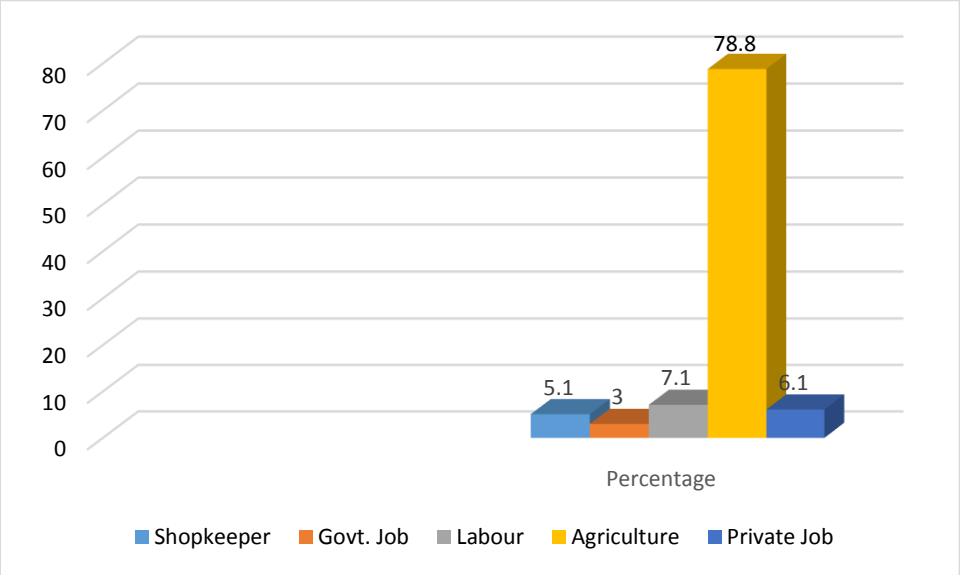


Figure 5.35: Occupation Distribution of Respondents in the Study Area

i) Average Annual Income

The assessment of annual household income is one of the important indicators to measure the well-being / livelihood of the household. During the field surveys, it was observed that in case of farm households, the major sources of income included the income from crops and livestock (dairy products). For non-farm or landless households, the main sources of income are the income from off-farm activities, such as business, Govt. or private employment, labour etc.

Income is an indicator for assessing the livelihood/well-being of the household. As discussed earlier, the majority of the respondents were involved in doing the private jobs, therefore, a major chunk of the respondents, 36.7% earning monthly income in the range of Rs. 17,501/- to Rs. 30,000/-.

Income is an indicator for assessing the livelihood/well-being of the households. The percentage income group 18% has monthly income upto Rs. 17,500. While 28.7% having income from Rs. 30,001/- to Rs. 50,000/- and 16.7% respondents earn more than Rs. 50,000 per month. Details of average income of respondents are given in below **Table 5.32**.

Table 5-32: Average Income

Sr. No.	Monthly Income	Frequency	Percent
1	Less than Rs. 17,500/-	18	18
2	Rs. 17,501/- to Rs. 30,000/-	37	36.7
3	Rs. 30,001/- to Rs. 50,000/-	28	28.7
4	Rs. 50,001/- and above	16	16.7
Total		**99**	**100**

j) Household Expenditure

The annual expenditure and pattern of the expenditure provides an indication for assessing the standard of living of a household. The expenditure on food items includes cereals, pulses, flour, sugar, cooking oil/ ghee, milk etc., while the non-food items consists expenditure on education, medical treatment, clothes, shoes, cosmetics etc.

Table 5.28 shows average monthly expenditure for different income groups. The highest percentage of expenditure i.e. 39.3% is the group which spends Rs. 17,501-30,000. The lowest group in the category spends less than Rs. 17,500 per month. Other category wise expenditure details are shown in below table. While few respondents whose expenditures are more than their income, manage their livelihood on the basis of weekly income. They are mostly labourer who takes loan for grocery from shopkeepers and other sources.

Table 5-33: Household Expenditure

Sr. No.	Monthly Expenditure	Frequency	Percent
1	Less than Rs. 17,500	18	18
2	Rs. 17,501 - 30,000	39	39.3
3	Rs. 30,001 - 50,000	30	30.7
4	Rs. 50,001 +	12	12
	Total	**99**	**100**

k) Money Borrowed

Table 5.34 shows that the significant majority i.e. 92.7% of respondents did not borrow money during the fiscal year 2018-2019. While 7.3% borrowed money during that time.

Table 5-34: Amount Borrowed

Sr. No.	Last Year Borrow Money	Number	Percentage
1	No	97	92.7
2	Yes	7	7.3
	Total	**99**	**100.0**

Generally, the credit is obtained to supplement the income to meet the routine and some extra expenditure of the household including investment, social needs and other unforeseen situations such as illness (medical care), marriage, education, and livestock. Credit is also obtained for agricultural needs (such as equipment, seeds and fertilizers) from both the formal (banks) and informal sources (e.g., friends, relatives, and landowners).

5.7.3 Housing Characteristics

Housing characteristics is one of the major indicator for the assessment of the living standard of the population. Most of the houses are owned by one influential resident of house who is male. However, some joint ownership also exists. Majority of the houses have ordinary construction, with moderate standard buildings made of cement and bricks.

Approximately 78.8% houses are pacca (made from brick, stone, and mortar) and 20.2% are

semi-pacca (made of clay, inferior bricks and palstered with mortar). Types of housing structures in the area are given in **Figure 5.36**

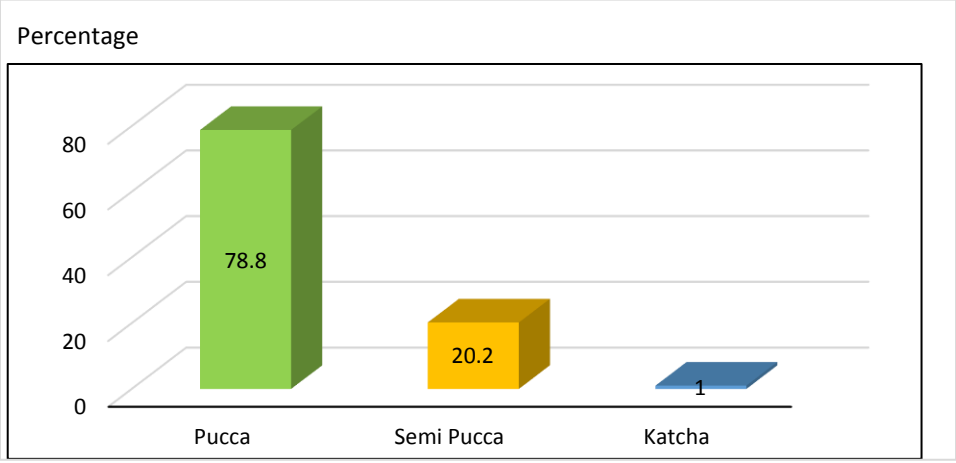


Figure 5.36: Type of Housing Structures

a) Ownership Status

In the Study area, houses are generally owned by a single owner and no respondent was found on rented house.

b) Toilet Facilities

Type of the toilet used by the household indicates the living standard, health and hygienic conditions. Based on the social survey about 100% of the selected households of the Study area use flush type of latrine.

c) Water Supply

Based on the socio-economic survey of the selected households, it was found no water supply is available whole the Study area. However, nearby canal and river bed ground water quality is very good and locals use this water for drinking as well as domestic purpose. In the Study area depth of the ground water is about 100 to 140 ft average. Locals use hand pumps and electric motors.

5.7.4 Agriculture Practice

In the villages of the Study area, canal water is being used as the main source of irrigation. However, local farmers also used groundwater for irrigation purpose due to shortage of canal water. Local farmers use traditional methods for farming (i.e. plowing, tilling etc.) coupled with use of tractors and modern machinery for cultivation and harvesting. They grow crops (e.g. wheat, sugarcane etc.) along with vegetables (Potato and Mutter) and fodder crops for their domestic animals. There are no fruit orchards in Project Study area.

Main crops of the Rabi season are wheat, peas and mustard while Kharif crops consist of sugarcane, cotton, rice, maize and fodder crops. Rabi crops (also called winter/springcrops) are sown during October – December and harvested during March – April. The Kharif crops (also known as Summer/Autumn crops) have generally longer period for sowing which starts

from February (for sugarcane) to July (for maize) and crops are harvested during winter season.

a) Ownership and Tenure System

Agricultural labor in the study area is primarily done by men but women and children are also involved in farming activities. Big land owners employ tenants for agricultural activities or give their land for cultivation on contract basis whereas small land owners cultivate their land by themselves with the help of their family members. The big land owners in the Study Area hire labor on a permanent basis. However, in the project area exist only small land holders and they cultivate their own land. Every farmer and landowner adopts a system according to his own will and resources. Generally landowners hire tenants on equal-share of crop basis. The laborers work throughout the season and after harvest, the crop is distributed as per share between laborers and land owner. Some landowners hire the services of laborers on cash payment.

b) Livestock

A significant percentage of the workforce and households in the area is engaged in livestock rearing in addition to agricultural farming. The livestock is a pillar of economy growth through improvement of breeds, feeding and health facilities; dairy development; commercializing management of range dependent livestock for beef and meat; value addition of livestock products; and taking advantage of Lahore proximity to supply livestock products and develop a livestock market. The importance of livestock as a major source of livelihood has decreased due to growing of agriculture and vegetable cropping with tube wells and canal irrigation. The livestock farming is a traditional activity in the area; it comprises rearing of Cattle, Sheep and Goat. Cattle constitute major portion of the livestock population within the area.

5.7.5 Amenities in the Study Area

The availability of the basic infrastructure and social amenities measures the development of the area and living standard of the people. During the social survey, data regarding the availability of village infrastructure including electricity, road, basic health unit/center, school, drinking water/water supply scheme, telephone, sewerage/drainage, fuel wood and sui gas were collected in order to identify the pressing infrastructural development needs of the villages located in the Study area.

a) Decision-Making Methods and Conflict Resolutions System

The methods for decision-making about social conflicts in the AOI are "*Panchayat"* (an assembly of wise and respected elders), court, "*Jirga"* (traditional assembly of leaders that make decisions by consensus), caste groups and others (method constituted on the spot considering major issues and scope of the conflicts).

People prefer "*Panchayat"* in the AOI compared to court or other legal system because this method is more effective. "*Panchayat"* provide timely justice while other methods are complex and require time as well as money.

The people have a tradition to help each other in the hour of need. Common conflicts arise

from time to time which are solved by the community at the local level. Generally, in case of a conflict between two individuals, only the families or closest friends take sides of the conflicting rivals so there are rare chances that personal conflict will transform into an ethnic dispute.

5.7.6 Infrastructure Facilities

a) Educational Facilities

As per social survey the educational facilities in the AOI. An education facility in any village predicts the highest level of education that can be achieved; some villages have lower level of education as compared to other villages in the AOI that have middle and high schools. Primary schools for boys and girls exist in several villages of the AOI. However, higher secondary level education facilities are poor.

The proposed Project is close to the urban areas of Faisalabad, Chiniot and Sargodha. As discussed, in these districts lot of educational institution exist. Along the road side from Faisalabad to Sargodha, important education institutions are Fast National University, Superior College, Chenab College, Punjab College, Sargodha Medical College etc. Famous educational institutions found in Chiniot are Chenab College (about 1,800 students enrolled), Punjab College (about 500 students enrolled), TIPS College (about 100 students enrolled), Allied School (about 300 students enrolled) and Educator School (about 300 students enrolled). Locals prefer to go to Lahore, Faisalabad and Sargodha for higher education as it is a first class place of learning in Pakistan.

b) Health facilities

Health facilities are generally inadequate in the Study area. People tend to get treatment from indigenous healers, due to the lack of suitable and sufficient health facilities. Bad sanitary conditions, insufficient medical facilities and meager parental care, all contribute to the prevalence of ill health and high rate of mortality in the area.

As per household survey, although health facilities exist in few villages of the AOI but they are not in good condition. In some villages, dispensaries/Basic Health Units (BHUs) are working up to some extent.

In Chiniot City, only one government level hospital is functioning but it was found to be in poor condition during the social survey. Due to lack of staff and inadequate space it is overloaded and unable to accommodate the population. In regard to this, locals have to cover long distances to reach health facilities and go to Faisalabad and Lahore Cities. The situation is even worst for women in need of maternity facilities. The majority of respondents informed that for childbirth cases, people have to move to Faisalabad due to lack of proper maternity facilities in the local hospital. In the AOI, private clinics exists which are run by dispensers with limited services.

5.7.7 Women Emancipation/Empowerment

In the rural set-up women are kept under-educated or un-educated, so is the case in our Study Area. However, there are some households who are pro-education and use to send their girls

to the available educational facilities in the Area.

Women in the Study Area are mainly dependent on male members of their family for economic reasons and cannot take decisions regarding their own lives. They have no opinion in the family matters and are not asked about their preference/acceptance for marriage.

In this rural society, males are dominate members. Cultural tradition, social practices and low female literacy ratio have left women in a vulnerable position. Women are restricted to performing household work and are excluded from decision-making both on the domestic front and at the community level. Women's access to education and health care is limited because such services are not available close to home in the Study area. Women take active part in agricultural activities, collect fuel wood and fetch water, in addition to household work and family duties, but their due status is not given by the society.
Women in the Study area are also vulnerable through economic, social and psychological poverty. Economic poverty is due to lack of assets and low endowment of human capital. Social poverty derives from the inability of the society to accept women's equality and their economic, political and cultural rights, while psychological poverty is a product of the subjugation of women, under the dictates of customs and traditions, which deprives them even of control over their own lives.

Information which was collected through some female consultations (summarized in **Section-6**) and secondary sources and group discussion with locals shows that major problems faced by women in the area are lack of primary health care and the lack of education opportunities. Other problems include laborious work such as woods collection for cooking and heating, working in agricultural fields. These tasks not only affect their health but also take up major portion of their time.

5.7.8 Culture

The cultural aspects of the area are found to be very hospitable. Decisions are mostly taken by head of the village but people also use to resolve their issues on their own first. Common gender sensitivity was found in all the villages. In general people were found humble in consultation except few hardliners.

5.7.9 Awareness Regarding the Proposed Project

A large number of respondents 69% were already aware of the proposed project. Only 31% were those, who had no prior knowledge of the project as shown below in **Table 5.35**.

Table 5-35: Awareness about the Project

Sr. No.	Awareness of the Project	Percentage (%)
1	Yes	69
2	No	31
Total		**100**

5.7.10 Acceptability of the Proposed Project

During the survey 100% respondents favored the construction of the Faisalabad-Sargodha Road Project keeping in view its importance & need. Locals requested that this project should be started as soon as possible due to its poor condition.

5.7.11 Women Issues

During the survey following issues related to the women highlighted by the respondents which are prioritized as under:

- Limited access to and control over benefits;
- Public transport service;
- Availability of drinking water;
- Access to medical treatment;
- Access to educational institution;
- Skill development;
- Toilet facilities; and
- Women's empowerment and participation.

5.7.12 Presence of Indigenous People (IPs)

Indigenous peoples are peoples defined in international or national legislation as having a set of specific rights based on their historical ties to a particular territory, and their cultural or historical distinctiveness from other populations that are often politically dominant. The survey finding shows that no IP groups were found / reported in the project corridor.

6 STAKEHOLDER CONSULTATION

6.1 GENERAL

Stakeholder's, involvement especially the local population, is an important feature of the environmental assessment and can lead to a better and more acceptable decision-making regarding the project design and implementation. Public involvement, undertaken in a positive manner and supported by a real desire to use the information gained to improve the Project design, will lead to better outcomes and lay the basis for on-going positive relationships between the stakeholders. It gives the feeling of an ownership to the local population. Public involvement is necessary for smooth implementation of the project and especially the local community whose support is also required for the success of the project.

Proposed project management and implementation authorities are committed for undertaking public consultation at district and local levels as a part of project planning/design for getting necessary environmental permissions.

6.2 OBJECTIVES

The objectives of stakeholder consultation were to contribute to the openness, transparency and dialogue. Special efforts were made to ensure that the communication with the public should be efficient and well balanced. The concerned stakeholder groups were identified to participate in the assessment process.

The objectives of public involvement include:

- Informing the public about the proposed project;
- Identify and involve all stakeholders, especially local residents, in the consultative and participation process;
- Share information with stakeholders on the design and construction of the proposed project and anticipated impacts on the physical, biological and socio-economic environment of the project area;
- Understand stakeholders' concerns regarding various aspects of the project, including the existing available facilities and problems, construction of the project and the likely impacts (positive & negative) of construction and operation related activities;
- Understand the perceptions, assessment of social impacts and concerns of the communities in the vicinity of the proposed project;
- Provide an opportunity to the public in the public consultation session to provide valuable suggestions for the project design in a positive manner; and
- Reduce the chances of conflict through the early identification of controversial issues, and consult them to find acceptable solutions.

6.3 CONSULTATION AND PARTICIPATION PROCESS

For ascertaining the perceptions of different stakeholders about the project (during construction/operation) consultation meetings were held with them. These meetings were carried out in the vicinity areas of proposed project route. The meetings with stakeholders were carried out from 24th of October to 28th of October, 2020.

6.4 METHODS OF PUBLIC CONSULTATION

Public Consultations were carried out in order to establish stakeholder's opinion regarding project implementation. The following methods were used for public consultations with project stakeholders:

- Scoping Sessions
- Formal Meetings
- Informal Meetings
- Individual Interviews

6.5 IDENTIFICATION OF STAKEHOLDERS

Stakeholders are those who have a direct or indirect interest in project development, and who will be involved in the consultation on process. During the field survey, significant efforts were made to identify the possible categories of stakeholders and their stakes.

Considering the urgency and importance of the project, consultations were carried out at all possible levels i.e. district and village level. The process of consultation is an on-going process which continues during the project life cycle and even after the submission of this report and so on. Therefore, two-tier approach was adopted. Stakeholders were identified, categorized and consulted at district level (EPD, Agriculture Department, Fisheries Department, Wildlife Department, Forest Department, etc.) and at village level (Direct and Indirect Affectees and Locals).

Consultation with the provincial and district level departments were carried out through meetings and presentations while consultations with locals, village people, directly affected people, local NGOs etc. were undertaken during the baseline survey of the Study Area. Consultations were held with the following;

6.5.1 District Level Stakeholders

i) Environment Protection Department, Faisalabad, Chiniot and Sargodha;
ii) Agriculture Department, Faisalabad and Chiniot;
iii) Forest Department, Faisalabad and Chiniot;
iv) Wild life Department, Faisalabad and Chiniot;
v) Social Welfare Department, Faisalabad and Chiniot; and
vi) Education Institutions such as Fast University, Superior College, Punjab College etc.

6.6 CONSULTATION MEETINGS AND FORMAL & INFORMAL GROUP DISCUSSIONS

A series of public consultations were required to get the feedback/concerns of the different categories of stakeholders including, district level departments, potential PAPs, local community and other general public residing in the Study Area.

Consultation meetings regarding project impacts, their magnitude and mitigation measures were held with the, local residents, shopkeepers (owners/renters), customers, pedestrians, students, management/administration of educational institutions, industries and general public to know their concerns regarding proposed project.

Scoping sessions were conducted with the local residents, shop keepers, customers, road users, students and pedestrians. These sessions were carried out at various location of the proposed project.

Generally, it was found that people were already aware of the proposed project. After the meetings, 100% respondents including local residents and other stakeholders showed their full support for the proposed project without any delay for smooth flow of traffic. This project will be beneficial in terms of good infrastructure development, not only for the local residents but also good for the socio-economic development of the area.

6.6.1 Village Level Consultations

Village Level Consultations were conducted at following locations:

i) PAPs and local communities;
ii) Chak-03 Faisalabad Bypass Muhammad;
iii) Pull Dengro;
iv) Lalian;
v) Adda 46;
vi) Thethian;
vii) Pind Araina
viii) Sargodha Bypass; and
ix) Other local communities along the road.

6.7 GENERAL CONCERNS / SUGGESTIONS OF THE STAKEHOLDERS

Brief Introduction about the proposed project, its various components, positive and negative impacts and other technical details related to environment, social and economic considerations are provided before the consultation to stakeholders. The most commonly raised concerns during the meetings are listed below:

The most commonly raised concerns during the meetings are listed below:

- Private land acquisition and physical displacement should be avoided where feasible;
- If land acquisition is unavoidable, Government should compensate the affectees on the basis of current market rates for their loss;

- Construction of road should be completed in time without any delay as per project timeline;
- Exposure of noise and dust pollution will cause disturbance and health & safety issues may arise to the local residents and other stakeholders throughout the construction stage due to the movement of construction machinery and transportation of construction materials. The effects of noise and dust pollution on the local residents should be minimized by making necessary arrangements. Dust pollution should be controlled by water sprinkling on regular basis;
- Due to the movement of loaded trucks during the construction period of proposed project, congestion on the access roads will increase. Proper diversion route rather than access road should be clearly defined to avoid traffic blockage during the entire construction period;
- During construction period local residents, road users and pedestrians will face difficulties while moving to places in the vicinity of proposed project area. Appropriate diversion plan should be developed to avoid the disruption of all the people due to use of heavy machinery in day timings and should avoid disturbance for the local residents living in the project vicinity;
- Local residents should be given priority for jobs during the construction phase;
- Due to the construction of the proposed project, public utilities will be disturbed. Arrangements should be made to minimize the disruption of public utilities or they may be rehabilitated on priority basis to reduce the impacts;
- Increase in traffic and safety hazards will create problems to local population and surrounding communities. Accordingly, a detailed health and safety plan (HSE Plan) must be developed to mitigate the construction and operation risks of the proposed project on the local residents and surrounding communities;
- Solid waste produced during construction should be disposed of timely and properly.
- Construction material and asphalt plant should be located outside the residential area;
- The labor camps should be away from the populated area to avoid privacy issues;
- Local residents should be given priority for unskilled jobs during construction phase;
- Good quality construction machinery may be used to reduce noise and pollution issue.

During public consultations feedback also received related to general pressing needs of the Project Area that includes:

- Electricity related issues;
- Provision of Drinking Water Supply and Sewerage ;
- Availability of Health Facilities;
- Rehabilitation of Road Infrastructures,
- Education,
- Agriculture and Security.

6.8 DETAILS OF MEETINGS WITH THE STAKEHOLDERS

The detailed schedule of meetings at site with the stakeholders and the issues raised by the respondents are given below in **Table 6.1**. **Plate 6.1** shows the pictorial view of consultation meetings held with the different stakeholders.

Table 6-1: Schedule of Meetings with Stakeholders and their Concerns / Apprehensions

Sr. No.	Agency / Department / Stakeholder	Date	Time	Representative	Apprehensions Raised	Suggestions
1.	District Office Environment, Faisalabad	26-10-2020	10:00 AM	Mr. Farhat Abbas Kamoka, Deputy Director Environment (Field)	• Dust emissions due to the construction activities such as deep excavations, transportation of construction materials and use of construction machinery. • Health and safety issues may arise for local community and workers due to construction activities. • Generation and illegal dumping of solid waste into nearby canals and drains. • During construction period, local residents and road users may feel difficulty to move/travel from one place to another due to construction activities. • Due to the construction of the proposed project, public utilities and allied facilities will be disturbed and relocated. • If tree cutting is involved then it should be avoided as much as possible; • Traffic issues will be exaggerated in the project area due to the construction activities.	• Ensure continuous sprinkling of water on daily basis in the Project area to reduce emission of dust particles. • Health and Safety Management Plan should be prepared and implemented to avoid health and safety issues occurring during construction period of the Project. • SOPs related to COVID-19 issued by Government of Punjab should be implemented during construction period to avoid outbreak of COVID-19 among workers and local community. • Solid waste produced should be properly managed and disposed of at identified designated areas. • Construction material should be removed as early as possible on the construction sites. • Alternate routes should be provided in consultation with Traffic Police to the residents and road users for their movement and to avoid the chaotic situation of traffic at this bottleneck. • Ensure minimum disturbance to the public utilities and allied facilities and

Sr. No.	Agency / Department / Stakeholder	Date	Time	Representative	Apprehensions Raised	Suggestions
						they may be rehabilitated on priority basis to reduce the impacts. • Proper barricading shall be provided along excavation sites to avoid accidents and casualties. • All relevant and applicable mitigation measures should be suggested and mentioned in the EIA Report.
2.	FAST University Chiniot	26-10-2020	10:55 AM	Mr. Naveed Ahmed, Administrative Officer	• The proposed Project is a good initiative taken by Govt. of Punjab; as it will facilitates the road users, students, truck drivers and local residents for smooth mobilization and will reduced the traffic accidents, casualties and deaths, which is common on this route due to congested and bumpy roads, and due to the movement of heavy traffic. • Time and vehicular maintenance cost will be saved due to smooth flow of traffic. • Dust emissions due to the construction activities such as deep excavations, transportation of construction materials and use of construction machinery. • Health and safety and noise issues may arise for students and staff due to the construction activities. • Traffic issues will be exaggerated in the project area due to the construction activities.	• Ensure continuous sprinkling of water on daily basis in the Project area to reduce emission of dust particles. • Alternate routes should be provided in consultation with Traffic Police to the students and staff for the mobilization. • Proper barricading shall be provided along excavation sites to avoid accidents and casualties. • Labour should bound to work and stay in the designated area or camp sites to ensure safety and privacy of female students and staff. • Ensure minimum transportation of construction material and use of construction machinery during university opening (8:00 to 9:00 AM) and closing (5:00 to 6:00 PM) times.

Sr. No.	Agency / Department / Stakeholder	Date	Time	Representative	Apprehensions Raised	Suggestions
						• Efforts should be made to complete the construction works on the projected time period.
3.	Superior College Chiniot	26-10-2020	11:35 AM	Mr. Ghulam Mustafa, Principle	• The proposed Project is a good initiative taken by Govt. of Punjab; as it will facilitates the road users, students, truck drivers and local residents for smooth mobilization and will reduced the traffic accidents, casualties and deaths, which is common on this route due to congested and bumpy roads, and due to the movement of heavy traffic. • Time and vehicular maintenance cost will be saved due to smooth flow of traffic. • Dust emissions due to the construction activities such as deep excavations, transportation of construction materials and use of construction machinery. • Health and safety and noise issues may arise for students and staff due to the construction activities. • Traffic issues will be exaggerated in the project area due to the construction activities.	• Ensure continuous sprinkling of water on daily basis in the Project area to reduce emission of dust particles. • SOPs related to COVID-19 issued by Government of Punjab should be implemented during construction period to avoid outbreak of COVID-19 among students and staff. • Alternate routes should be provided in consultation with Traffic Police to the students and staff for the mobilization. • Proper barricading shall be provided along excavation sites to avoid accidents and casualties. • Ensure minimum transportation of construction material and use of construction machinery during college opening (7:30 to 8:30 AM) and closing (12:00 to 1:00 PM) times. • Efforts should be made to complete the construction works on the projected time period.
4.	District Office Environment, Chiniot	26-10-2020	12:15 PM	Mr. Wazir Ali, Field Assistant Environment	• Dust emissions due to the construction activities will create health issues for locals.	• Ensure continuous sprinkling of water on daily basis in the Project area to reduce emission of dust particles.

Sr. No.	Agency / Department / Stakeholder	Date	Time	Representative	Apprehensions Raised	Suggestions
					• Smog is a major problem along the proposed route alignment due to existing industries, brick kilns and crushing plants. Due to the construction activities of the proposed Project, smog issues will be enhanced. • During construction period, local residents and road users may feel difficulty to move/travel from one place to another due to construction activities. • Due to the construction of the proposed project, public utilities and allied facilities will be disturbed and relocated. • Traffic issues will be exaggerated in the project area due to the construction activities.	• Solid waste produced should be properly managed and disposed of in identified designated areas. • Alternate routes should be provided in consultation with Traffic Police to the residents and road users for their movement and to avoid the chaotic situation of traffic at this bottleneck.
5.	District Office Environment, Sargodha	26-10-2020	2:32 PM	Mr. Ali Imran, Assistant Director Environment (Field)	• Dust emissions due to the construction activities such as deep excavations, transportation of construction materials and use of construction machinery. • Smog is a major problem along the proposed route alignment due to existing industries, brick kilns and crushing plants. Due to the construction activities of the proposed Project, smog issues will be elevated. • Generation and illegal dumping of solid waste into nearby canals and drains; • During construction period, local residents and road users may feel difficulty to move/travel from one place to another due to construction activities.	• Ensure continuous sprinkling of water on daily basis in the Project area to reduce emission of dust particles. • Solid waste produced should be properly managed and disposed of in identified designated areas. • Construction material should be removed as early as possible on the construction sites. • Alternate routes should be provided in consultation with Traffic Police to the residents and road users for their movement and to avoid the chaotic situation of traffic at this bottleneck.

Sr. No.	Agency / Department / Stakeholder	Date	Time	Representative	Apprehensions Raised	Suggestions
					• Due to the construction of the proposed project, public utilities and allied facilities will be disturbed and relocated. • If tree cutting is involved then it should be avoided as much as possible. • Traffic issues will be exaggerated in the project area due to the construction activities.	• Ensure minimum distribution to the public utilities and allied facilities or they may be rehabilitated on priority basis to reduce the impacts.
6.	**Forest Department (Faisalabad and Chiniot)**	27-10-2020	2:32 PM	District Forest Officers	• Dust & noise problem during the construction period. • Efforts should be made to avoid the cutting of trees to save the natural environment. • He further recommended that during construction of road attention must be given to minimum loss of crops along the route.	• A feasible provision of budget for horticulture/tree plantation plan in project cost.
7.	**Agriculture Department, Faisalabad**	27-10-2020	12:32 PM	Assistant Engineer	• The proposed Faisalabad-Chiniot-Sargodha Road Project is a good initiative of Govt. of Punjab, it will facilitates the commuters from Faisalabad to Sargodha. • The project should be executed while ensuring that the project will not cause any significant negative impact on the vegetation of the area or the crops.	• Proper diversion routes should be provided to minimize the traffic problems during construction stage.
8.	**Wildlife Department (Faisalabad Division)**	28-10-2020	01:00 PM	Director Wildlife	• Exposure of noise and dust particles will cause disturbance and health issues to the local fauna throughout the construction stage due to the movement of construction machinery and transportation of construction materials.	• Solid waste produced should be properly managed and disposed at designated places. • Efforts should made to complete the construction as soon as possible.

Sr. No.	Agency / Department / Stakeholder	Date	Time	Representative	Apprehensions Raised	Suggestions
					• The project is a good step for the development of the proposed project area. • There is no notified ecological sensitive species in the Project Area	
9.	**Social Welfare Office, Faisalabad**	28-10-2020	10:00 AM	Mr. Tayeb Bhatti (Assistant Director Social Welfare)	• It is the dualization of road which will be beneficial for the country as well as the local communities of chiniot and Sargodha districts. • This road project will reduce the road side accidents; • It is the suggested that human settlements should be fully avoided for the construction of the proposed road alignment. • Living standard of the people particularly in the rural areas will be improved with the completion of the road projects. • Due to the proposed project locals socio-economic condition will improve.	• Proper diversion route rather than access road should be provided to minimize the traffic problems during construction stage. • Project should complete within the given time in order to avoid the movement problems faced by customers. • To avoid the mobility problem of local residents and road users, an appropriate diversion plan should be develop.
10	**Social Welfare Office, Chiniot**	28-10-2020	03:00 PM	Mr. Zaffar (Assistant Director Social Welfare)	• The proposed project will contribute to the economic and social development of the region. • It is the suggested that social related issues should be fully addressed during the construction of the proposed project.	

Consultation with DFO, Chiniot

Consultation with Forest Official, Faisalabad

Consultation with Director Wildlife, Faisalabad

Consultation with Social Welfare Office, Chiniot

Consultation with Assistant Engineer, Agriculture Department, Faisalabad

Consultation with Social Welfare Office, Faisalabad

Consultation with Deputy Director Environment (Field), Faisalabad

Consultation with Field Assistant (Environment), Chiniot

Consultation with Assistant Director Environment (Field), Sargodha

Consultation with Principle of Superior College, Chiniot

Plate 6.1: Consultations with Different Stakeholders

6.9 VILLAGE LEVEL CONSULTATIONS WITH PAPS

A series of public consultations were conducted to get the feedback/concerns of the different category of stakeholders including potential PAPs, local community and other general public residing in the Study Area. Total four (06) consultative meetings were held with about 60 participants in the study area. The major categories participated in these meetings were local population, community groups, landowners, tenants and potential PAPs. Majority of the people who participated in these consultations are mature/elderly persons because as per the local culture, elders have the right regarding any decision. However, young people were participated in the consultations.

These consultations were carried out on from 24 to 28 October, 2020 with the direct and indirect affectees. Major consultation with the PAPs/local community and general public were carried out in Chak-03, Pull Dengro, Pind Arain, Thethian, Lalian, Bhutto Colony, Adda 46 and

Sargodha Bypass. Basti Kora Wala, Basti Rasheed Wala and Kot Kamian. The detail of the participants is given in **Table 6.2** below:

Table 6-2: Village Level Meetings and their Concerns / Apprehensions

Sr. No.	Village	Date	Time	Participants	Apprehensions Raised	Suggestions
1.	**Chak-03**	24-10-2020	1:30 P.M	Azhar Abbas Irshad Hussain, Ghazanfar, Abbas, Ghulam, Muhammad, Muhammad Ilyas, Said Khan, Lal Khan, Abdul Rehman Khan, Ayyub Khan, Yasin Khan	• Privacy issues during construction phase; • Shortage of civic facilities like health & education institutions will not be enough; • Preference to local people for jobs during construction phase; • More development of area and increase in land value.	• Training of labor to take care of social norms and values prevailing in project area during construction phase; • Attention should be drawn at forum of local government for establishment of more schools and health institutions.
2.	**Pull Dengro**	24-10-2020	3:30 P.M	Sarfraz, Javaid Iqbal, Muhamamd Hayat, Mukhtar Ahmed, Safdar Ali, Khadim Hussain, Yasir Sikandar, Akhtar Abbas, Liaqat Ali.	• Preference to local people for job opportunities during construction phase; • Poor road situation and traffic load causes daily road side accidents; • Dust issues or related skin/allergy diseases will increase; • Land value may increase.	• Contractor should be responsible for rehabilitation of existing infrastructure in case of damage; • Water sprinkling during construction phase should be ensured to minimize the dust pollution.
3.	**Thethian**	25-10-2020	3:30 P.M	Malik Hameed Amjad Ali Qaisar Abbas Shamsheer Ali Asif Noor Asif Sher Muhammad Khan Nasir Ali	• Up-gradation of health and educational facilities of the project area; • Dust and noise pollution; • Creation of job opportunities due to the dualization and rehabilitation of the existing road.	• Use of temporary barrier sheets and maintained machinery; • Water sprinkling during construction phase should be ensured to minimize the dust pollution.

Sr. No.	Village	Date	Time	Participants	Apprehensions Raised	Suggestions
				Zafar Abbas Mazhar Abbas		
4.	**Pind Arain**	25-10-2020	12:30 P.M	Ghulam Abbas, Haji Khan, Manzar Hussain, Ghazanfar Abbas, Ulfat Hussain, Nasir Ali Shah, Malik Muhammad Yasin, Mistri Khan, Muhammd, Mistri Muhammad Zafar.	• Dust, noise & vibrations effects; • Difficulty in access to linked village and disruption in routine work; • Industrial development due to the dualization and rehabilitation of the existing road and as a result there may be; • Generation of water borne diseases due to polluted water from industries.	• Use of temporary barrier sheets and maintained machinery. • Implementation of traffic management and diversion plan for commuters. • Pre-treatment by industry and waste water treatment plant should be installed by the industrial owners.
5	**Bhutto Colony**	26-10-2020	11:00 P.M	Muhammad Iqbal Muhammad Mumtaz Zafar, Anwar Ali Muhammad Iqbal Muhamamd Nawaz Sarfraz, Mustafa, Mukhtar Lal Shah, Yar Muhammad Raza Ali Shah, Falak Sher Ibrahim, Iqbal, Zulfiqar Ghulam Sarwar, Haji Umer Hayat, Muhammad Nawaz	• Poor solid waste management and sewerage system in project area; • Project area is deprived of good quality education	• Attention should be drawn at forum of local government for establishment of more schools and promotion of technical education; • Locals should be preferred for job opportunities. • Contractor will be responsible for proper dumping of solid waste generated on site.
6	**Adda 46**	26-10-2020	3:00 P.M	Abdul Rauf Raja Irshad Zahoor Ejaz Ilyas	• Poor sewerage system in project area; • Difficult of access to main road and disruption in routine work during construction phase; • Dust and noise pollution	• Locals should be preferred for job; • Traffic diversion plan should be given and suggested to design consultant for construction of roundabout at a suitable location;

Sr. No.	Village	Date	Time	Participants	Apprehensions Raised	Suggestions
				Mehdi Ramzan Khan Azhar Khan Haji Gulsher		• All possible measures should be taken to minimize the effects of dust and noise pollution like water sprinkling, barriers, etc.
7	**Sargodha Bypas**	27-10-2020	3:00 P.M	Khan Muhammad Haq Nawaz Allah Ditta Ghulam Mustafa Ghazanfar Abbas UmerDaraz MukhtarHussain ZawarHussain Qamar	• Privacy Issues will raised for local residents during the construction of the proposed project due to the movement of labour. • Exposure of noise and dust pollution will cause disturbance and health issues to the local residents throughout the construction stage due to the movement of construction machinery and transportation of construction materials. • Traffic will be congested on the access roads and main road during the construction phase of the proposed project. It will be difficult for all local residents to reach their designations and more time will be consumed. • The project is a good step for the development of the proposed project area.	• As a solution, labour should bound to work and stay in the designated area or camp sites. • The effects of noise and dust pollution on the local residents should be minimized by making necessary arrangements. Dust pollution should be controlled by water smattering on daily basis. • Proper diversion route rather than access road should be provided to minimize the traffic problems during construction stage. • Arrangements should be made to minimize the disruption of public utilities, or they may be rehabilitated on priority basis to reduce the impact.

Consultation with locals, Chak-03

Consultation with Shop Owners, Chiniot

Consultation with Shop Owner, Adda 46

Consultation with locals, Thethian

Consultation with Commuters, Lalian

Consultation with Shop Owners, Pind Arain

Consultation with Shop Owners, Sargodha

Consultation with Shop Owners, Sargodha

Plate 6.1: **Consultations with Different Stakeholders**

6.10 GENDER CONSULTATIONS

The detailed schedule of meetings with the women in the Project Area and the issues raised by the respondents are given below in **Table 6.3**. **Plate 6.3** shows the pictorial view of consultation meetings held with the women.

Table 6-3: Gender Consultations

Sr. No.	Agency / Department / Stakeholder	Date	Time	Representative	Apprehensions Raised	Suggestions
1.	Lalian, Chiniot	25-10-2020	3:00 PM	Local Female Residents	• The proposed Project is a good initiative taken by Govt. of Punjab; as it will facilitates the road users, students, and local residents for smooth mobilization and will reduced the traffic accidents, casualties and deaths, which is common on this route due to the movement of heavy traffic. • Time and vehicular maintenance cost will be saved due to smooth flow of traffic. • Health and safety and noise issues may arise for residents due to the construction activities. • Traffic issues will be exaggerated in the project area due to the construction activities. • Mobilization issues for females in and around the project area due to labor and construction activities. • Issues related to drinking water, sewerage and drainage system and health care facilities also need to be resolves in the Project Area.	• Construction material should be removed as early as possible on the construction sites. • Alternate routes should be provided for the mobilization. • Proper barricading shall be provided along excavation sites to avoid accidents and casualties. • Labour should bound to work and stay in the designated area or camp sites to ensure safety and privacy of females • Efforts should be made to complete the construction works on the projected time period. • Local residents should be given preference for jobs during construction and operation phase. • Government should implement projects related to drinking water, sewerage and drainage system and health care facilities in the proposed Project area to uplift standard of living of local residents.

Sr. No.	Agency / Department / Stakeholder	Date	Time	Representative	Apprehensions Raised	Suggestions
2.	Adda 146 Village, Sargodha	25-10-2020	3:45 PM	Local Female Residents	• The proposed Project is a good initiative taken by Govt. of Punjab; as it will facilitates the road users, students, truck drivers and local residents for smooth mobilization and will reduced the traffic accidents, casualties and deaths, which is common on this route due to congested and bumpy roads, and due to the movement of heavy traffic. • Dust emissions due to the construction activities such as deep excavations, transportation of construction materials and use of construction machinery. • Health and safety and noise issues may arise for residents due to the construction activities. • Mobilization issues for females due to labor and construction activities. • Project should be completed in time. • Provision of drinking water filtration plant, sewerage and drainage system and health care facilities should also be recommended for the Project Area.	• Ensure continuous sprinkling of water on daily basis in the Project area to reduce emission of dust particles. • Alternate routes should be provided for the mobilization. • Proper barricading shall be provided along excavation sites to avoid accidents and casualties. • Labour should bound to work and stay in the designated area or camp sites to ensure safety and privacy of females • Efforts should be made to complete the construction works on the projected time period. • Local residents should be given preference for jobs during construction and operation phase. • Government should implement projects related to drinking water, sewerage and drainage system and health care facilities in the proposed Project area to uplift standard of living of local residents.

Plate 6.3: A view of Gender Consultations in the Project Area

6.11 GRIEVANCE REDRESS MECHANISM

In order to receive and facilitate the resolution of affected people concerns, compliments, and grievances about the project's environmental performance, a Grievance Redress Mechanism (GRM) will be established for the proposed project. GRM will include a proactive component where by at the commencement of construction of project the local community will be formally informed of project implementation details by the client (CWD), the supervision consultant (SC) and the contractor (designs, scheduled activities, access constraints etc.), so that all necessary project information will be communicated effectively to the community and their immediate concerns can be addressed.

The GRM will address the affected people's concerns and complaints proactively and promptly, using an understandable and transparent process that is culturally appropriate, and

readily accessible to all segments of the affected people at no costs. The mechanism will not impede access to the country's judicial or administrative remedies.

CWD will establish a Grievance Redress Committee (GRC) prior to the contractor's mobilization to the site. The function of the GRC is to address the concerns and grievances of the local communities and affected parties as necessary.

GRC will comprise of representatives from local communities, the contractor's Environmental Specialist, SC's Environmental Specialist and CWD Safeguards/ Environmental Specialist. The role of the GRC is to address the project related grievance of the local communities that are unable to be resolved satisfactory through the initial stages of the Grievance Redress Mechanism (GRM). CWD Safeguards/ Environmental Specialist will assist local communities to nominate the representatives for Environmental Committee (EC).

Representatives from the community will be responsible to conduct formal meetings between the project team (contractor, SC, CWD) and communicating community members' grievances and concerns to the contractor during project implementation. The number of representatives to be nominated will depend on the number of communities along the project alignment.

7 ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

7.1 GENERAL

This chapter identifies the beneficial as well as the potentially significant adverse environmental and social impacts during design/pre-construction, construction and operation phases of the proposed project on the physical, ecological and socio-economic domains of the environment. The appropriate mitigation and remedial measures are proposed in this chapter. A project impact evaluation matrix has been developed to evaluate the potential impacts of the proposed Project. A brief qualitative description of each aspect and the affected environment in both RoW and the project's corridor of impact is presented below.

7.2 NOTION OF SIGNIFICANCE

The term ***"Environmental Impact"*** or simply ***"Impact"*** covers the negative, adverse or harmful as well as positive, desirable or beneficial impacts of the project on environmental settings. Prediction of impacts of the proposed activity is based on factual data; however, the significance of these impacts involves a value judgment technique. The nature of the impacts may be categorised in terms of:

Direction	-	Positive or Negative
Intensity	-	Low, Medium & High
Duration	-	Long or Short Term
Extent	-	Wide or Local
Reversibility	-	Reversible / Irreversible

Impact significance depends on both the nature of the impact and on the sensitivity of the receptor. The more sensitive the receptor the greater will be the significance of impact from that proposed activity. For this EIA, activities and nature of impact are combined with the sensitivity of the receptor to evaluate the significance of the impact. The significance of impact is characterized as very low, low, moderate, high and very high. Environmental issues having "moderate", "high" and "very high" significance are provided with mitigation measures.

Following the assessment of magnitude, the quality and sensitivity of the receiving environment or potential receptor has been determined and the significance of each potential impact established using the impact significance criteria matrix as shown below. Most of the potential impacts can be mitigated by implementation of various types of mitigation measures; however some residual environmental impacts may remain after mitigation.

Table 7-1: Notion of Significance

Impact Significance	Positive Impacts Score	Adverse Impacts Score
Very High	> 12	> 12
High	9 – 12	9 – 12
Medium	5 – 8	5 – 8
Low	2 – 4	2 – 4
Negligible	O	O

7.3 METHODOLOGY FOR IMPACT EVALUATION

The methodology adopted for the evaluation of the impacts included the following assessment tools, (i) project impact evaluation matrix and (ii) overlays. These tools were used to identify the significance and magnitude of the impact as well as the nature, reversibility, extent etc.

a) Project Impact Evaluation Matrix

The Impact Evaluation Matrix was developed by placing project activities along one axis (i.e. Y-axis), and on the other axis (i.e. X-axis) the different environmental parameters likely to be affected by the proposed Project actions grouped into categories i.e. physical, ecological and socio-economic environment. For the impact assessment, project impact evaluation matrix was used by dividing the project action into different phases (design/pre-construction, construction and operational phases). A Project Impact Evaluation Matrix is given as **Table 7.1**.

Table 7-2: Project Impact Evaluation Matrix

Environmental Component / Project Component	Physical Environment					Ecological Environment							Socio Economic Environment																	
	Soil (Erosion/Stability/ Contamination)	Air Quality	Noise Level	Surface & Ground Water Quality	Solid Waste Generation	Aquatic Ecosystem	Terrestrial Ecosystem	Endangered Species	Migratory birds	Beneficial Plants	Loss of trees	Loss of Crops/Orchards	Conflict over Resources	Mobility of Locals	Public Infrastructure	Accessibility	Housing Infrastructure	Cultural Properties (Mosque, Shrine, Graveyard	Community Stability	Tourism And Recreation	Grazing Area	Gender Issues	Cultural & Social Issues	Health& Safety	Aesthetic	Security Situation	Living Standards	Employment Opportunities	Restoration of Livelihood	Economic Uplift
A. Planning & Design Phase	1	2	3	4	5	6	8	9	10	11	12	13	14	15	16	17	18	18	20	21	22	23	24	25	26	27	28	29	30	31
Topographic Survey of Bypass	o	o	o	2	o	o	2	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	2	o	o	o	o	o	o
Geotechnical Investigation	o	o	2	3	o	o	o	o	o	o	2	3	o	o	o	o	o	o	o	o	o	o	2	4	o	o	o	o	o	o
Temporary Acquisition of Land	o	o	o	o	o	o	o	o	o	o	4	4	o	o	o	o	o	o	3	o	o	o	3	o	o	o	o	o	o	o
Parmanent Acquisition of Land	o	o	o	o	o	o	o	o	o	4	9	9	6	o	6	o	9	6	9	o	o	o	9	o	o	6	6	o	o	o
B. Construction Phase																														
RoW / Site Clearance	9	9	9	8	8	4	6	o	o	4	9	9	o	6	4	3	6	6	o	o	6	o	8	9	4	4	o	6	o	4
Earthwork in Filling and Excavation	9	9	9	8	8	4	4	o	o	o	o	o	o	6	2	3	o	o	2	o	o	o	6	9	4	4	o	6	o	4
Establishment of Construction Camps & Workshop	2	2	4	o	o	o	4	o	o	o	o	4	8	o	o	o	o	4	4	o	o	4	4	8	4	o	o	6	6	6
Transportation & Storage of Construction Materials	4	6	6	2	4	o	2	o	o	o	o	4	o	4	o	o	o	o	4	o	o	o	4	6	4	o	o	4	o	o
Use of Construction Material and Heavy Machinery	3	8	9	o	4	2	4	o	o	o	o	o	o	2	2	2	o	o	o	o	o	o	2	8	o	4	o	4	o	o
Installation and operation of Batching and Asphalt Plants	4	8	8	2	4	2	2	o	o	o	o	o	2	o	o	o	o	2	o	o	o	o	o	6	4	o	4	4	o	o
Spoil Disposal	3	3	o	6	6	4	6	o	o	o	4	6	o	o	o	o	o	o	2	o	o	o	4	4	6	o	o	o	o	o
Structural & Civil Work	8	8	8	7	7	4	6	o	o	o	o	o	2	o	2	o	o	o	2	o	o	4	6	9	4	4	o	8	o	8
Drainage Work	6	6	6	7	6	6	6	o	o	o	o	o	2	o	2	o	o	o	2	o	o	4	4	9	4	4	o	8	o	8
Miscellaneous Work (Road Ancillaries, Traffic Signs and Signals etc.)	o	4	6	4	4	2	2	o	o	o	o	o	o	o	2	o	o	o	o	o	o	o	o	6	o	o	o	6	o	6
Pavement Work	2	4	6	2	4	2	2	o	o	o	o	o	o	o	o	o	o	o	o	o	o	2	2	8	o	o	o	6	o	6
Finishing and Comissioning	o	2	4	o	4	o	2	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	4	o	o	o	4	o	4
C. Operational Phase																														
Operation of Road	o	2	2	o	o	o	4	o	o	o	6	o	o	6	4	8	o	o	6	4	o	o	8	6	8	4	8	6	6	6
Inspection & Monitoring	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	3	o	o	o	o	o	o	2	4	o	4	o	4	o	o
Road Maintenance	o	4	4	2	o	o	2	o	o	o	o	4	o	4	4	4	o	o	o	o	o	o	o	6	2	o	o	4	o	o
Maintenance of Miscellaneous Work	o	o	2	o		o	o	o	o	o	o	o	o	2	2	2	o	o	o	o	o	o	o	4	o	o	o	4	o	4

Positive Impact Score
0
2 to 4
5 to 8
9 to 12
>12

Impact Significance
Negligible
Low
Medium
High
Very High

Adverse Impact Score
0
2 to 4
5 to 8
9 to 12
>12

b) Overlays

In order to identify spatial based impacts, overlays were used. An overlay is based on a set of transparent maps, each of which represents the spatial distribution of an environmental characteristic (for example, land acquisition). Information for an array of variables such as land use, infrastructure, vegetation etc. was collected for the standard geographical units within the project's CoI, recorded on a series of maps, typically one for each variable. These maps were overlaid to produce a composite map. The resulting composite maps characterize the Project area's land use, physical, social, ecological and other relevant parameters related to proposed intervention. The overlays maps used in this EIA study for the quantification of the landuse categories referred in Chapter 5.

7.4 DELINEATION OF PROJECT CORRIDOR OF IMPACT (COI)

Before proceeding to the environmental analysis of the Project, it is imperative to delineate the CoI. The CoI has already been described in Chapter-1. There are two (02) types of project corridors which have been used for the environmental baseline information, impacts assessment and mitigation purposes and is described briefly below.

7.4.1 Corridor of Impact (CoI)/ Area of Influence

For a linear Project, CoI is a limit that identifies the area where direct and indirect impacts of the project activities are envisaged like existence of crops, orchards, brick kilns, water ponds/ structures, built up structures, public utilities, nullahs etc. The COI /AOI of the proposed project is considered as 43.5m to 48.7m that also includes the RoW (110 to 127 ft). This is limited to 10m on either side of the ROW for collection of baseline information, impacts assessment and mitigation measures of physical, ecological as well as social resources as shown in **Figure 5.1**.

Apart from the CoI, which is along the centerline, some components are non-linear such as the Construction/Contractor camps, vehicle, equipment yard, material quarry areas, while access tracks are also considered part of the CoI for the study and termed as Project Area or Area of Influence. Therefore, in this report CoI the Study Area and Area of Influence are used accordingly.

The location of Construction/Contractor camps, vehicle, equipment yard, material quarry areas and access tracks will be finalized by the Contractor. The assessment for those components is generic in nature and will be updated accordingly as the project information is made available.

7.4.2 Right of Way (RoW) / Project Area

RoW is the corridor where direct impacts of the proposed dualization and rehabilitation of existing Faisalabad - Chiniot - Sargodha Road.

In the RoW there will be direct impact on the environment like relocation of the physical infrastructure, clearing of vegetation, cutting of trees, loss of crops due to the road construction and some indirect impacts on shrubs, ornamental trees etc. are also envisaged. RoW is taken as 110'-127' (feet) from the centerline strip throughout the proposed road. RoW of the proposed project is shown in **Figure 5.1.**

7.5 POTENTIAL POSITIVE IMPACTS

The positive impacts due to the proposed project are mentioned below:

- The Faisalabad - Chiniot - Sargodha Road Section of 67 km, after rehabilitation with improved facilities shall provide an efficient / intelligent transport corridor. Main objective of this road is to provide a safe, congestion free and high speed facility to the commuters of project area and heavy traffic travelling from Faisalabad to Sargodha;
- The corridor will largely contribute to the economic and social development of the region as well as monitory benefits to Provincial Government through tolling. The Project will bring more population into the stream of benefits, which in turn will improve the social complexion of people around this corridor;
- Apart from the usual benefits of time saving, this link will transform the entire pattern of transportation in the surrounding areas resulting in uplift of economic condition of local community;
- Development of businesses during the construction stage will cause socio-economic uplift of the locals along the project corridor. The socio-economic impacts like employment, education, living standards and cultural uplift during the interaction with locals are the indirect benefits due to the Project implementation;
- Recommendations for raising of new trees in both sides of the proposed road shall render a positive impact on the flora of the area and will also cause a positive impact on the landscape of the area, which shall be of permanent in nature;
- Presence of adequate flora will absorb CO_2 emissions, through photosynthesis, emitted from an expected large number of cars, vehicles and public transport, thus purifying air of hazardous particles and also act as a noise barrier;
- During the operation of the proposed project, lesser wear and tear of the vehicles will occur and it will also result in lesser fuel consumption and decrease in operating cost;
- Improved communication infrastructure will promote new business opportunities. In addition, such an activity will also increase the land value that will benefit the local residents; and
- The proposed project is expected to increase the land values, especially in nearby villages. Land owners will have an opportunity to sell their land at increased prices and start new businesses.

7.6 POTENTIAL ADVERSE IMPACTS

Apart from positive impacts, there are some potential significant adverse environmental and social impacts on the local environment. The proposed Project is divided into three (03) phases i.e. Pre-construction / Planning and Design phase, Construction phase and Operation and Maintenance (O&M) phase. The Pre-Construction phase includes all stages before the construction Stage (i.e. site investigation work i.e. topographical, seismic studies, etc.); Construction phase includes all stages from mobilization of Contractor to the completion of

Project; and Operation Stage starts after the Construction Stage which includes the inspection and repair works.

Adverse impacts envisaged at these three (03) stages of the proposed road project along with their proposed remedial or mitigation measures are detailed below:

7.7 ADVERSE IMPACTS DURING PLANNING AND DESIGN PHASE

Potential adverse impacts during the planning and design stage of the Project are given below:

7.7.1 Technical Design and Layout Planning

Incompatible layout plan and engineering design of the project's structures (retaining walls, ramps, bridge, etc.) can undermine the overall aesthetic beauty and ambience of the project area. Also low utilization of the available spaces and designing the structures without considering the prospective and futuristic needs can result in structures with low social acceptability and functionality. This future traffic factor if not considered in the design properly, will also affect the project road and public safety of the Project Area. Similarly, the locals may also face access problems for their land. This impact is temporary and minor negative in nature.

Mitigation Measures

- The technical design of the proposed project must consider all the above mentioned factors for the final design and should meet all the local and international standards;
- The proponent must review and validate all the design parameters considering the possible impacts (as mentioned) before the start of construction of proposed Project; and
- Proposal of pedestrian bridges may also be considered to facilitate the locals especially near institutions i.e. FAST University, Superior University, Aspire College, Punjab College, etc.

7.7.2 Topography

The project area is a plain terrain and excavation of land will be involved for the proposed project. As the proposed project is rehabilitation and extension of existing road, so, there is no significant change in the topography of the project area is expected. This impact is minor negative and permanent in nature.

Mitigation Measures

Mitigation measures will involve adoption of best engineering design measures keeping in view of the aesthetics of the project area and provision of green belts for the landscape in design.

7.7.3 Drainage

Improper design of storm water drainage of the proposed Project may result in stagnant water on the road due to which following impacts are expected to arise:

- Deterioration of road surface and reduction of its bearing capacity;
- Inconvenience for commuters/pedestrians;
- Stagnant water may provide the breeding ground for disease vector; and
- Foul odour may be generated.

This impact is temporary and minor negative in nature.

Mitigation Measures

Mitigation measures will include provision of appropriate drainage structures with appropriate design capacity to avoid urban flooding especially during the rains. Proper slopes shall be incorporated in design to avoid the stagnant water on At-grade road surface.

7.7.4 Seismicity

In Building Code of Pakistan (Seismic Provisions, 2007), the whole region of Pakistan is classified into five main Seismic Hazard zones i.e., i) Zone-1, ii) Zone-2A, iii) Zone-2B, iv) Zone-3, v) Zone-4 based on the peak horizontal ground acceleration and its ultimate tendency to damages during seismic events. The proposed Project Area falls in the seismic zone classified as "**Zone-2A**" with g-value 0.08 to 0.16, and is considered as Moderate Hazard seismicity zone.

In case of an earthquake, the proposed road expected to suffer damages if designed without consideration of seismic activities. This would be permanent and major negative in nature. However, No change (+/-) in the impact of seismology risk of the area is expected during the project construction phase as none of the project activities is expected to be of such a powerful extent to influence the tectonic risk.

Mitigation Measures

- The proposed structure (bridge over canal in particular) should be designed and constructed keeping in consideration high intensity earthquakes. For seismic hazard analysis, updated structural and seismic evaluations should be conducted by the design engineer/consultant. Moreover, geo-technical investigations must be conducted prior to construction phase;
- Seismic Building Code of Pakistan 2007 (SBC-07) should be adopted. This code specifies minimum requirements for seismic safety of buildings and has to be applied and used by engineers in conjunction with the necessary understanding of the concepts of structural, geotechnical and earthquake engineering; and
- The structure of the proposed project should also be studied by the proponent (CWD) to evaluate its durability/strength to withstand moderate to high intensity earthquake.

7.7.5 Permanent Land Acquisition

About 1100 Kanals of land will be acquired for dualization of the existing Faisalabad – Chiniot – Sargodha Road. This may result in loss of land, crops, infrastructure, religious structures, livelihood, commercial activities, disturbance to people and loss of income sources.

The detail of land under the impact and record of ownership status will be prepared by the Revenue Department. The loss of agriculture and orchard production is also a major direct impact due to acquisition of agriculture and orchards areas. This impact will be permanent and high adverse in nature.

Mitigation Measures

The Land Acquisition Act (LAA) of 1894 is the main law regulating land acquisition for public purpose. This impact can be mitigated by ensuring compliance of Land Acquisition Act, 1894, addressing community grievances on priority basis and timely compensation to affectees.

The process of land acquisition and compensation should be followed in a transparent manner to minimize the impacts to provide judicious compensation to the affected persons by providing sufficient budget in the project cost. According to Land Acquisition Act 1894, the following points needs to be considered while determining compensation for the project affectees:

- The market value of land at the date of publication of notification under section 4 sub section (1);
- The damage sustained by the person interested, by reason of the taking of any standing crops, or trees which may be on the land at the time of the collector's taking possession thereof;
- The damage if any sustained by the person interested at the time of the collector's taking possession of the land by reason of acquisition injuriously affecting his other property, moveable, or immoveable, in any other manner, or his earning; and
- As a consequence of the acquisition of the land by the collector, the person affected is compelled to change his residence or place of business, the reasonable expenses incidental to such change.

Therefore, compensation should be made to the affected people as per Land Acquisition Act, 1894 and market value for the loss of assets. Adequate budget will be provided in the Project cost for this compensation.

7.7.6 Temporary Acquisition of Land

The Contractors will require temporary land acquisition for the development of contractor camps and facilities i.e. storage, workshops, equipment parking and washing areas.

The approximate area required for the establishment of one Contractor's camp facilities will be 1500m^2 at the different locations. Land utilization for Project activities and subsequent operation of Project may induce temporary as well as permanent changes in the existing

landuse pattern. This impact can be categorized as direct, low, site-specific, temporary, and reversible.

Mitigation Measures

It is the foremost option to establish the construction camps at the acquired land to eliminate the issues of land leased etc. however, if this option is not feasible than the land for above mentioned facilities should be selected and leased prior to the start of construction phase.

Land for above mentioned facilities will be directly rented from the private landowners by the Contractors. The provisions of the Land Acquisition Act (LAA), 1894 will not be involved as the acquisition of the land will be temporary and will be covered by short-term lease agreements between the landowners and Contractor. Rental terms should be negotiated to the satisfaction of the concerned landowners and the agreement should be in local language to make the process clear.

In addition, these project facilities should be located at a minimum distance of 500 meter from the existing settlements, built-up areas, archaeological and cultural monuments as the case may be. Prior to the commencement of the construction activities, the Contractor should submit a construction camp development/management plan to the Engineer-incharge and the PEPA (if required) for its scrutiny and approval. As far as possible, waste/barren land i.e. areas not under agricultural or residential use and natural areas located at high elevation should be used for setting up the contractor camps.

7.7.7 Resource Conservation

Resources involved in the construction of proposed project would include water, fuel and construction materials.

Excessive water consumption by the construction staff may stress water resources in the project area and in certain cases may disturb the existing water supplies in the project area.

Construction material to be used for construction includes coarse aggregates, fine aggregates, asphalt, cement, lining material, earthworks, reinforced and structural steel etc. Almost all the materials to be used in the construction of proposed project are non-renewable and therefore their efficient use is necessary to make it available for future use.

Fuel will be used to operate construction machinery. Efficient use of energy resources is important to reduce air emissions. For conservation of energy, efficiency of the engines and burning processes is important. The impact is medium negative and permanent in nature.

Mitigation Measures

Following practices shall be adopted to conserve these natural resources:

- Use potable water bowsers for construction works and mineral water bottles/ treated or filtered ground water for drinking purpose;
- Plan for the provision/purchase of adequate insulation to reduce heat loss through batching plants;
- Reduction of wastage of water through training of workers involved in water use;
- Reuse of construction waste materials may be adopted wherever possible;
- Diesel and fuels with low sulphur content should be used to operate construction machinery and equipment;
- Efficient and well maintained equipment and machinery should be used;
- The equipment and machinery should be turned off when not in use;
- Ensure adequate insulation to reduce heat loss through batching plants;
- Regularly monitor CO and CO2 content of the flue gases to verify that combustion systems are using practical excess air volumes;
- Use of solar panels at construction camps may be considered and plan for use of solar panels at operational phase may also be considered; and
- A good camp design and an efficient worksite management plan can help the contractor to reduce the water demand, wastewater and solid waste volumes to the lowest levels.
- Resource Conservation Plan is attached as **Annex-V**

7.7.8 Route (Alignment) Optimization

Improper route selection (in terms of ROW) of proposed project will lead to disturbance to environmental and social issues of resettlement and displacement of people. This impact would be of moderate significance.

Mitigation Measures

Most of the significant environmental, ecological and social impacts of the project have been addressed at the design phase. In order to minimize environmental, ecological and social issues at the detailed design stage, various features have been considered. The route alignment (with due consideration to RoW) has been finalized and efforts have been made to avoid or minimize impacts on habitat, resettlement and relocation issues and disturbance to sensitive receptors.

By considering the optimization of route, the impact of route alignment has been reduced to low significance.

7.7.9 Change in Hydrologic Regime

The proposed road will cross Jhang Branch Canal and minor distributaries. There might be change in water flow pattern and disturbance to water flow occurred which will cause adverse impacts on communities that rely on these water bodies. Moreover, when flood flows encounter a restriction in the natural stream, adjustments take place in the vicinity of the restrictions. The portion of flow not directly approaching the bridge opening is redirected towards the opening by the embankment. This impact is moderate in nature.

Mitigation Measures

For the crossing of the canal and other similar structures bridges will be constructed and / widened. While culverts and other possible arrangement will be accomplished in design for the crossing of nullahs/ drains. Bridges on water channels shall be properly designed to accommodate design flows. Provision of culverts to control flood damages and provision of safety of embankments will be considered during the design of these arrangements.

7.7.10 Public Utilities

Due to the proposed project, public utilities will be affected creating disruption of public services and inconvenience to the local residents. This impact is temporary and may be considered as moderately negative in nature.

Mitigation Measures

Mitigation measures will include:

- The provision in the design and budget for the relocation of the existing utility infrastructures wherever required shall be finalized in consultation with the concerned department; and
- All public utilities (e.g. electric lines, water pipes, power/ telephone lines, etc.) likely to be affected by the proposed project will be relocated well ahead of time before the actual commencement of the construction works.

7.7.11 Flora

During the pre-construction phase, activities such as installation of construction camps, construction of temporary roads and mobility of construction staff may damage the local vegetation/trees. As the heavy machinery and camps will be moved and installed, which require significant space due to which available vegetation is expected to be removed. This impact is site-specific, temporary, medium significant and needs to be encountered prior to the start of construction stage.

Mitigation Measures

- The camps, mobility of machinery and construction of temporary road should be properly planned and well designed to avoid any loss to local green cover;
- It is recommended to establish the construction camps where minimum or no vegetation exists;
- Similarly, the alternate routes for roads and points for camps are recommended where no loss of vegetation is expected; and
- The location of construction camp(s) will be selected so, as to have limited environmental effect during construction phase and to reduce the cost and land requirement.

7.7.12 Fauna

As movement and installations of machinery and vehicles will take place during this pre-construction phase so noise and habitat loss is expected. The routes of the available wildlife and other habitats may be affected due to camps set-up and machinery movements and installations. Temporary road may also affect the habitat of locally available fauna. This impact is site-specific, temporary, irreversible and low significant.

Mitigation Measures

- The standard measures must be considered prior to construction phase to minimize noise due to machinery movements and installations;
- The alternate routes and points are recommended to avoid any damage to locally available fauna;
- The construction camp management plan during the planning stage must consider fencing and gating to check the entry of animals in search of eatable goods;
- Similarly, waste management plan of the camps must be considered at the planning stage to prevent wild animals and birds.

7.7.13 Socio-economic Environment

During the planning and design phase of the project, it is anticipated that there will not be any potentially significant adverse impact on the socio-economic environment. Locals may be temporarily disturbed due to the field investigations and drilling activities. This impact can be categorized as indirect, low, site-specific, short term, temporary, low probable and irreversible.

Mitigation Measures

No mitigations measures are required except good engineering practices to avoid and reduce these low adverse impacts.

7.8 ADVERSE IMPACTS DURING CONSTRUCTION STAGE

7.8.1 Soil Erosion

Construction activities such as clearing of earth, levelling, piling, compaction, carpeting, pavement finishing will affect the existing soil condition in the CoI. The clearing of vegetation can also loosen the soil and make it more susceptible to erosion due to wind and rain. There is also a possibility of silt runoff during rainy season causing soil erosion. During the rain, the eroded soil mix with stagnant water to transform into slush, which can affect movement of vehicles and machinery and construction work as well as limit the movements of local people.

Soil erosion may also occur in the workshop areas as a result of improper drainage system of equipment washing-yards and improper management of construction activities. This impact can be categorized as site-specific, long term, moderate negative and irreversible.

Mitigation Measures

Good engineering practices will help to control or minimize the soil erosion both at the construction sites and in peripheral areas. All the disturbed areas need to be protected against soil erosion by stripping and stockpiling of all the available topsoil for later re-vegetation. Special slope protection measures will be adopted in the sensitive areas and along the shoulders of roads and excavations shall be kept confined to the specified foundation spots as per the approved engineering drawings. Unnecessary excavations should be avoided.

The provision for vegetation with a fast growing crops/trees and a native seed mix immediately after fill placement to prevent scour and to encourage stabilization will be made in the design. Use of stone pitching or riprap will also be provided in the design at appropriate places especially around bridges, culverts. Provision for rip-rap in discharge zones from drainage structures will be made in the design to reduce erosion. Down drains/chutes will be lined with rip-rap/masonry or concrete to prevent erosion. Side slopes will be adjusted to a gradient necessary to reduce erosion potential or, if steeper, stabilized, covered with riprap or other material to prevent soil erosion. Site restoration plan for the Project will be strictly followed.

7.8.2 Soil Contamination

The soil contamination occurs at all construction stages: during the design and survey work, during the construction of road, directly during the work on the construction site. Land may be contaminated due to the spillage of chemicals, fuels, solvents, oils, paints, concrete, solid waste generated at campsites etc. This normally happens when these materials are transported in open or loosely capped containers. Various types of machinery will be used at the construction sites. This machinery will not only pollute the atmosphere at the construction sites and adjacent communities, but also have a negative impact on the soil surface layer.

The possible contamination of soil by oils and chemicals at camp sites, workshop area and equipment washing-yards may limit the future use of land for agricultural purposes. This impact can be categorized as site-specific, long term, moderate negative and irreversible.

Mitigation Measures

The following practice will be adopted to minimize the risk of soil contamination:

- The Contractors will be required to instruct and train their workforce in the storage handling and management of materials and chemicals that can potentially cause soil contamination;
- Material Safety Data Sheets (MSDS) will be strictly followed during handling and storage of chemicals;
- Soil contamination due to concrete transportation will be minimized by placing all containers in casings;
- Solid waste generated at the camp sites will be properly treated and safely disposed only in the demarcated waste disposal sites/areas;
- If any contaminated soils are found, they shall be removed and deposited in a sealed pit in an area agreed with the concerned; and

- Use of modern, well-maintained machinery and vehicles by the contractor to avoid emissions and leakages;
- Soils removed during construction would be stockpiled for reuse where possible; and
- Runoff from washing of equipment and gadgets should be drained into either a septic tank or a sand-gravel bed for removal of the grit and contaminants.

7.8.3 Borrow/ Open Pits

Borrow/ open pits and associated excavation activities may result in land disputes, soil erosion, loss of potential cropland, loss of vegetation, landscape degradation, and damage to road embankments. Borrow/ Open pits may also become potential sources of mosquito breeding and may prove hazardous to humans, livestock and wildlife. This will also degrade hygienic condition of the Project Area. This impact is permanent and moderate negative in nature.

Mitigation Measures

Mitigation measures will include:

- Necessary permits will be obtained for any borrow pits from the competent authorities;
- In borrow pits, the depth of the pits will be regulated so that the sides of the excavation will have a slope not steeper than 1: 4;
- Soil erosion along the borrow pit will be regularly checked to prevent/ mitigate impacts on adjacent lands;
- In case borrow pits are filled with water, measures have to be taken to prevent the creation of mosquito-breeding sites; and
- Borrow pits will be used for construction waste, but during the excavation, top 20 cm soil cover will be preserved for vegetation after the filling of the pits. This is the best way to restore the flora of that area.

Quarry Management Plan is attached as **Annex-VI.**

7.8.4 Air Quality

Air quality will be affected by fugitive dust emissions from construction machinery; dust from the unpaved surface and construction vehicles. Emissions may be carried over longer distances depending upon the wind speed, direction, temperature of surrounding air and atmospheric stability. The operation of an asphalt plant causes the emission of many different pollutants. The most common pollutants emitted from hot mix asphalt plants are particulate matter (PM_{10}), sulfur dioxide (SO_2), nitrogen oxides (NO_x), volatile organic compounds (VOCs), and carbon monoxides (CO).

Potential impacts on the air quality during the construction stage will be due to the fugitive dust and the exhaust gases generated in and around the construction site. Dust is a major component of air pollution during road construction. Emissions are generated mainly from the following construction activities:

- Site clearance and use of heavy vehicles and machinery/equipment etc. at construction site;
- Procurement and transport of construction materials such as sand, cement, etc. to the construction site;
- Other Gaseous emissions during construction result from operating of construction vehicles, plant and equipment;
- Increase in air pollution levels without project and with project during construction period (for mobile & stationary sources) is predicted from construction machinery, equipment, which reveals that there shall not be significant contribution towards pollution due to the construction activity of the project if mitigation plan will be implemented and monitored in proper sense; and
- Asphalt heating.

The construction activities will also result in increased air pollution in the area. The overall impact on the quality of air during the construction phase will be temporary, moderate negative and limited to the project's implementation phase only.

Mitigation Measures

The impacts associated with the construction phase of the proposed project could be effectively mitigated by the implementation of simple procedures by the Contractor including but not limited to the following:

- All vehicles, machinery, equipment and generators used during construction activities should be kept in good working condition and be properly tuned and maintained in order to minimize the exhaust emissions;
- Open burning of solid waste from the Contractor's camps and at construction site should be strictly banned;
- Preventive measures against dust should be adopted for on-site mixing and unloading operations;
- Construction materials (sand, gravel, and rocks) and spoil materials will be transported trucks covered with tarpaulins and all vehicles (e.g., trucks, equipment, and other vehicles that support construction works) will comply with the PEQS (as amended) for carbon emissions and noise;
- Regular water sprinkling of the site or use of chemical dust suppressants should be carried out to suppress excessive dust emission(s);
- Emissions from power generators and construction machinery are important point sources at the construction sites. Proper maintenance and repair is needed to minimize the hazardous emissions;
- Emissions from batching / asphalt plants can be controlled efficiently by the installation of cyclone / scrubbers. Diesel operated equipment should be equipped with well-maintained fuel filter and may be replaced timely (if required). In addition to that, regular maintenance activities comprising changing of lubricating oil, changing the air and fuel filter, cleaning the fuel system, draining the water separators and proper tuning may also help in reducing the emissions from diesel generators;
- Construction equipment is generally left idling while the operators are on break or waiting for the completion of another task. Emissions from idling equipment tend to be high. Existing idling control technologies, which automatically shut the engine off after a pre-set time can reduce emissions, without intervention of the operators;

- PEQS applicable to gaseous emissions generated by construction vehicles, equipment and machinery should be enforced during construction works;
- Service roads (used for earthmoving equipment and general transport) should be regularly sprayed with water during dry weather;
- All excavation work should be sprinkled with water;
- Construction workers should be provided with masks for protection against the inhalation of dust;
- Vehicles used for construction should be tuned properly and regularly to control emission of exhaust gases;
- Ensure precautions to reduce the level of dust emissions from hot mix plants, crushers and batching plants; e.g. providing them as applicable, with protection canvasses and dust extraction units. Mixing equipment should be well sealed and equipped as per existing standards. Moreover, ensure that the batching and asphalt plants are equipped with emission control devices like scrubbers, electrostatic precipitators or bag filters; and
- Regular monitoring of air quality in accordance with PEQS.

7.8.5 Noise/Vibration

The noise and vibration will be produced due to the operation of construction machinery and equipment (refer **Table 3.7**: Machinery and Equipment Requirement for the Proposed Project). Sources of noise and vibration during construction are heavy machinery such as bulldozers, excavators, stabilizers, concrete mixing plant, pneumatic drills, stone crushers, asphalt plants and other equipment's. Noise and vibration are perceived as one of the most undesirable consequences of construction activities. The above machinery is expected to generate noise levels that would be severe in the project area.

The cumulative effects from several machines can be significant and may cause significant nuisances. However, these increased noise levels will prevail only for a short duration during the pre-construction and construction phase.

The likely impacts due to noise are:

- Psychological effects of distraction of attention, irritation and short temperedness in the exposed persons due to persistently higher noise levels; and
- Noisy settings and higher background levels can cause temporary threshold shift and the consequent habit of speaking loud, which may cause damage to vocal cords in the persons exposed.

Though the construction method that has not been determined yet, however it is believed that the adopted method of construction shall produce less noise and vibration if the suggested mitigation measures are adopted.

Mitigation Measures

There are a variety of ways by which construction equipment and worksite noise can be controlled. The following is a list of ways to control noise level at the worksite of the proposed project:

Quieter Equipment

A cost-effective way to reduce noise at a construction worksite is to buy quiet equipment. In addition, equipment in use should be the most suitable for the job. Avoid using equipment that is over-powered and, conversely, avoid using under powered equipment. Whenever possible the quietest equipment alternative should be used. In general, electronic powered equipment is quieter than diesel powered equipment and hydraulically powered equipment is quieter than pneumatic power.

Modifying Existing Old Equipment

The most common way to reduce the noise levels of common construction equipment is through worksite modifications. Some common worksite modifications consist of retro-fitting existing equipment with damping materials and mufflers.

Barrier Protection

An effective way of reducing noise is to locate noisy equipment behind purpose-built barriers. The barriers can be constructed on the work site from common construction building material (plywood, block, stacks or spoils) or the barriers can be constructed from commercial panels which are lined with sound absorbing material to achieve the maximum shielding effect possible. To be effective, the length of the barrier should be greater than its height. The noise source should not be visible and barrier should be located as close as possible to either the noise source or the receiver.

Work Activity Scheduling

Work activity scheduling are administrative means to control noise exposure. Planning how noise sources are sited and organized on a work site can reduce noise hazards. Jobs can be rotated so that exposure time is limited. Transferring workers from a high exposure task to a lower exposure task could make the employee's daily noise exposure acceptable. Administrative controls include activity planning, for example, scheduling pavement breaking operations so as to reduce the number of work site workers exposed. In addition, noisy equipment should not be run for periods longer than necessary and should be switched off when not in use.

Maintenance

Increased attention to maintenance of tools and equipment will reduce worksite noise levels. Maintaining plant and equipment in good order not only increases its life, but makes it safer to use and quieter. Loose and worn parts should be fixed as soon as possible. Ideally, the worksite should have a system in place for checking and servicing the various machines and power tools.

Noise Perimeter Zones

Noise Perimeter Zones (NPZ) are another administrative control to limit exposure to noisy processes or equipment to as few workers as possible. NPZ are areas where noise levels of 90 dB (A) or more are roped off and marked to keep out all workers who don't have to be there. NPZ can be set up using a sound level meter to find the safe distance from the source (90 dB (A)) and the NPZ can be set up at that distance. Noise does not radiate from the source

at the same level in all directions. Noise from machinery can be higher in one direction than another because the noise can also be either absorbed or reflected from surfaces it contacts, such as the ground or a wall. Therefore, measurements should be taken at several points in an area where people might be working. Once noise levels that are 90 dB (A) or more are determined, rope off this area as the Noise Perimeter Zone. Exclude all workers who do not need to be in that zone. All workers who need to work within the zone must wear hearing protection.

7.8.6 Construction Camps/Camp Sites

Due to the construction camps[47], loss of vegetation and dis-satisfaction of rehabilitation measures during and after completion of construction phase may occur. These impacts may include waste, soil pollution, groundwater pollution, dust, etc. However, the impact will be temporary and moderate adverse in nature. For these impacts, mitigation measures have been developed to minimize the likelihood, extent or duration of their occurrence and any associated adverse effects. **Table 7.3** summarizes potential impacts and proposed mitigation measures associated with construction camps.

Table 7-3: Summary of Workers Camp Impacts & Mitigation Measures

Potential Impact	Proposed Avoidance and Mitigation Measures
Environmental ▪ Temporary habitat loss or disturbance ▪ Temporary visual intrusion ▪ Noise emissions at a single location ▪ Waste generation ▪ Discharge of sanitary effluents and rainwater run-off to nearby water bodies	***Environmental*** ▪ Reinstate any temporary facilities to pre-existing conditions in ecologically sensitive areas. ▪ Implement landscaping plan for all facilities in areas where high landscape value and visual vulnerability to the proposed activities warrants site-specific landscape restoration measures. ▪ Operate equipment in a manner sympathetic to the ambient noise environment. Do not leave equipment idling unnecessary. ▪ Provide adequate warnings of impeding works to all potential receptors within a 1 km corridor surrounding the RoW via public notices and local news.
Social ▪ Worker camp site: consultation surrounding potential construction camp sites revealed concerns regarding the location of proposed sites for Worker Camps.	***Social*** State land will be a second preference for worker camp locations, followed by land where there is a willing lessee. Employment policies which aim to maximize job opportunities for local people will help to minimize tensions caused by different socio-cultural values. Training will be provided to all staff on camp management rules and overall discipline and

[47] The location of construction camps will be provided by the Contractor in coordination with the CWD before mobilization.

Potential Impact	Proposed Avoidance and Mitigation Measures
	cultural awareness. This will include, in appropriate languages: ▪ A briefing on camp rules ▪ A community relations orientation to increase awareness about the local area, cultural sensitivities and the project Code of Conduct ▪ Awareness-raising on health considerations, including sexually transmitted diseases (STDs). The construction contractor is required to develop a Construction Camp Management Plan to address: ▪ Discipline; ▪ Community liaison; ▪ Ethnic tensions and; ▪ Communicable diseases. A Code of Conduct and Camp Rules will be required within the Construction Camp Management Plan, which provides policies and a disciplinary framework with respect to worker behavior.
Camp Location The final location will be determined by the construction contractors and agreed with the CWD.	***Camp Location*** The construction contractor will be required to assess the environmental/social sensitivity of any additional or alternative sites prior to their approval for adoption.

Some additional mitigation measures should include:

- The contractor(s) should provide plan to CWD for removal & rehabilitation of site upon completion;
- Photographical and botanical inventory of vegetation before clearing the site; and
- Compensatory plantation to be scheduled when construction works near end.

A sanitation plan for the construction camp has been proposed which is attached as **Annex-VII.**

7.8.7 Wastewater Generation at Construction Camps

The locations of construction camps will be selected by the contractor before mobilization as per guidelines given in **Section 4**.

Wastewater will be generated at the construction camps and from construction activities. If the generated wastewater is not properly treated or disposed of, this may contaminate the surface water sources such as nullahs, drains, water channels i.e. Jhang Branch Canal, small distributaries etc. apart from soil contamination. Water from dewatering activities (during rainy season) has the potential to contain suspended solids and oil and grease and if disposed of

untreated may affect the soil quality. The below **Table 7.4** shows anticipated composition and estimate of the wastewater to be generated during the course of the construction phase of the project assuming that on average the water demand per person is 40 liters per day and that 80% of the water demand will become wastewater.

Table 7-4: Estimated Wastewater Generated by Workers in Construction Camps

Sr. No.	No. of Workers*	Estimated Total Water Demand** (liters/day)	Estimated Wastewater Generated (liters/day)***
1	250	10,000	8,000

* "Tentative Work Force Requirements Including Client and Contractor Staff"
** = (250) x (40) = 10,000 liters/day
*** = (250) x (80%) =8,000 liters/day

This impact can be categorized as direct, moderate negative, site-specific, temporary and reversible.

Mitigation Measures

To dispose the liquid waste generated from the construction activities, the following steps will be taken by the Contractor:

- Domestic and chemical effluents from the construction camp will be disposed by the development of on-site sanitation systems i.e. septic tanks (as shown in **Figure 7.1**).
- Proper monitoring to check the compliance of PEQS will be carried out; and
- Sewage from construction camps will be disposed of after proper pre-treatment and processes such as soakage pit.
- The Contractor(s) will be responsible to submit details of site-specific wastewater management plan along with details of wastewater collection, transportation and its disposal.

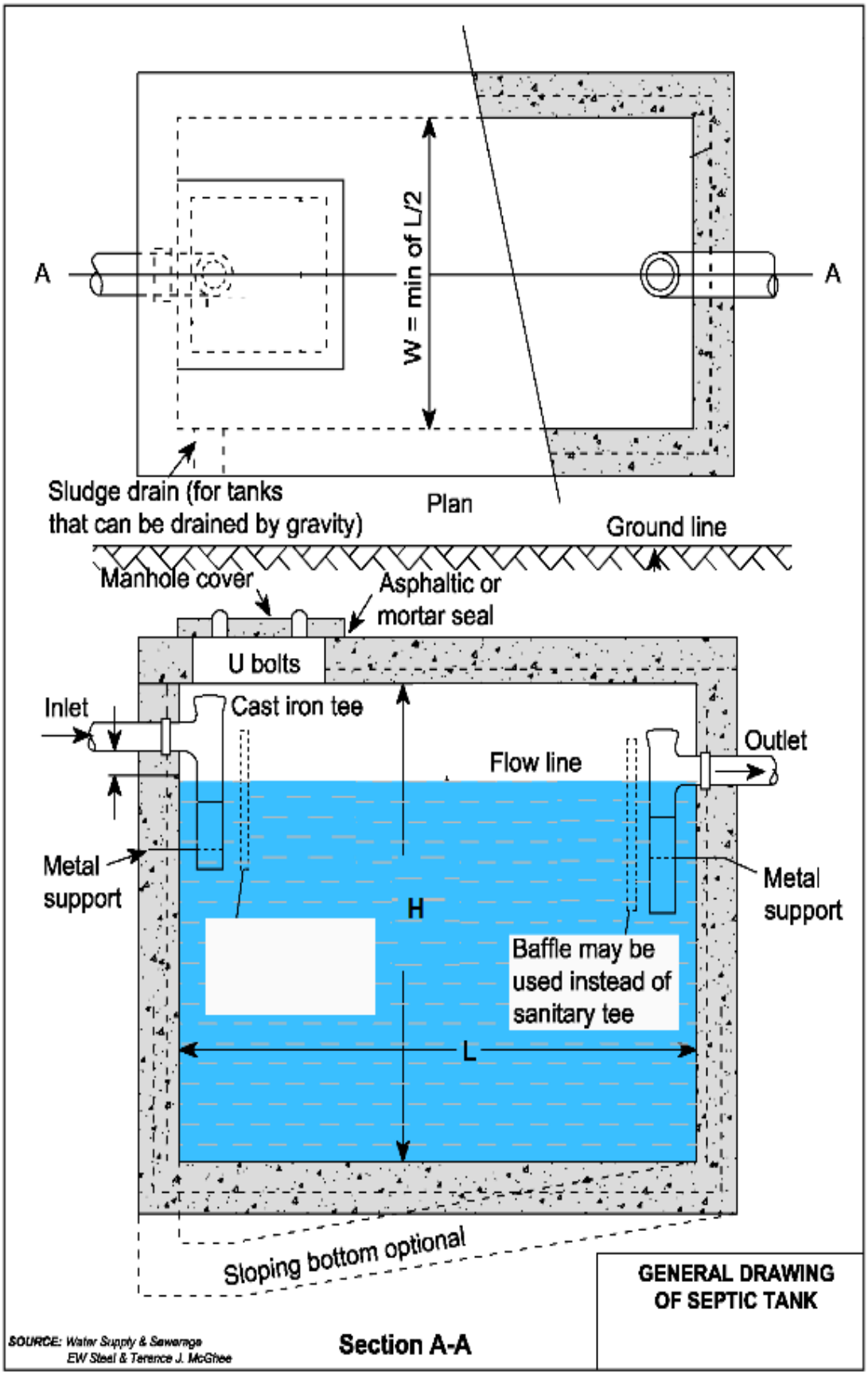


Figure 7.1: General Drawing of Septic Tank

7.8.8 Solid Waste Generation at Construction Camps

Considering the labourers (about 250 in numbers) residing in the construction camp and the locally available labour, an average solid waste generation rate of 0.5 kg/capita/day[48] is adopted for the estimation of solid waste generation. Based on this assumption, a total of about 125 kg of solid waste will be generated from construction camps on daily basis. The major components of the labour camp waste will be garbage, putrescible waste, rubbish and small portion of ashes and residues. Other type of wastes may include inorganic construction wastes including hazardous waste. This waste would require proper disposal to minimize land and water contamination. This impact can be categorized as moderate, site-specific, temporary and irreversible.

Mitigation Measures

- All the solid waste from the camps will be properly collected at source by placing containers and disposed of through proper solid waste management system. The Contractor will coordinate with local representatives and administration of the concerned solid waste management department for the disposal of solid waste;
- The Contractor must develop a plan of action with the help of concerned solid waste management department for transporting the waste to the disposal site;
- Toxic waste will be handled, stored, transported and disposed-off separately; and
- The waste will be properly sealed in containers with proper labels indicating the nature of the waste.

7.8.9 Waste Generation at Construction Site

The construction waste will include wastewater, oil spillage from machinery and solid waste (damaged or spoiled materials, temporary and expendable construction materials etc.). The handling and storage of oil and other hazardous waste will be a source of environmental pollution during the excavation, foundation, levelling, carpeting and pavement activities. The quantification of construction material waste is not available but it is anticipated that less amount of such waste will be generated along the route length.

Improper disposal of construction waste can lead to nuisance and hazards towards environment and local population. The unspent materials and debris produced from consumed up materials, if left as such and allowed to mix with soil underneath, can degrade the quality of receiving soils and render them unfit for plantation. Leakages of oils, lubricants, chemicals, and other similar substances from their storage sites can spoil the receiving soils and may undermine ability of the spoiled soils to support growth of vegetation and plants.

The estimated quantity of excavation material for ROW clearance cannot be provided at design stage. The contractor will provide the estimated quantity of excavation material during the construction phase. These wastes will be generated due to the construction activities and

Source: The World Bank Report 2012 – What a Waste: A global review of solid waste management. Based on UNEP estimates for waste generation in the Asia Pacific. Average is 0.45 kg/capita/day.

the materials used for construction. This waste would also require proper disposal to minimize any contamination of land and water resources. This impact can be categorized as direct, moderate, site-specific, short term, temporary, high probability and reversible.

Mitigation Measures

Mitigation measures will include:

- Waste Management Plan will be developed to implement an efficient and responsive solid waste management system during construction phase. Recyclable wastes e.g. steel bars will be sold to waste vendors;
- Reusable material will be used as a filling material during ground levelling;
- Solid waste generated during construction will be safely disposed in demarcated waste disposal sites and the contractor will provide a proper waste management plan; and
- The site will be restored back to its original conditions after construction completion.

A comprehensive plan for construction waste management (Flow chart of Construction Waste Management Plan is shown in **Figure 7.2**) attached as **Annex-VIII** should be adopted.

7.8.10 Waste Management from Asphalt and Batching Plants

Concrete and asphalt have limited usable life, after which they become waste. If not used within the time span, their waste will have major financial implications. Further, their disposal will become very difficult because of the large quantities involved. This impact can be categorized as direct, moderate, site-specific, short term, and reversible.

Mitigation Measures

- The contractor will develop specific environmental management plans for asphalt plants and concrete batching plants. These plans shallincorporate the general measures as applicable to the entire project, but shallalso have focused mitigations for solid waste from these plants.

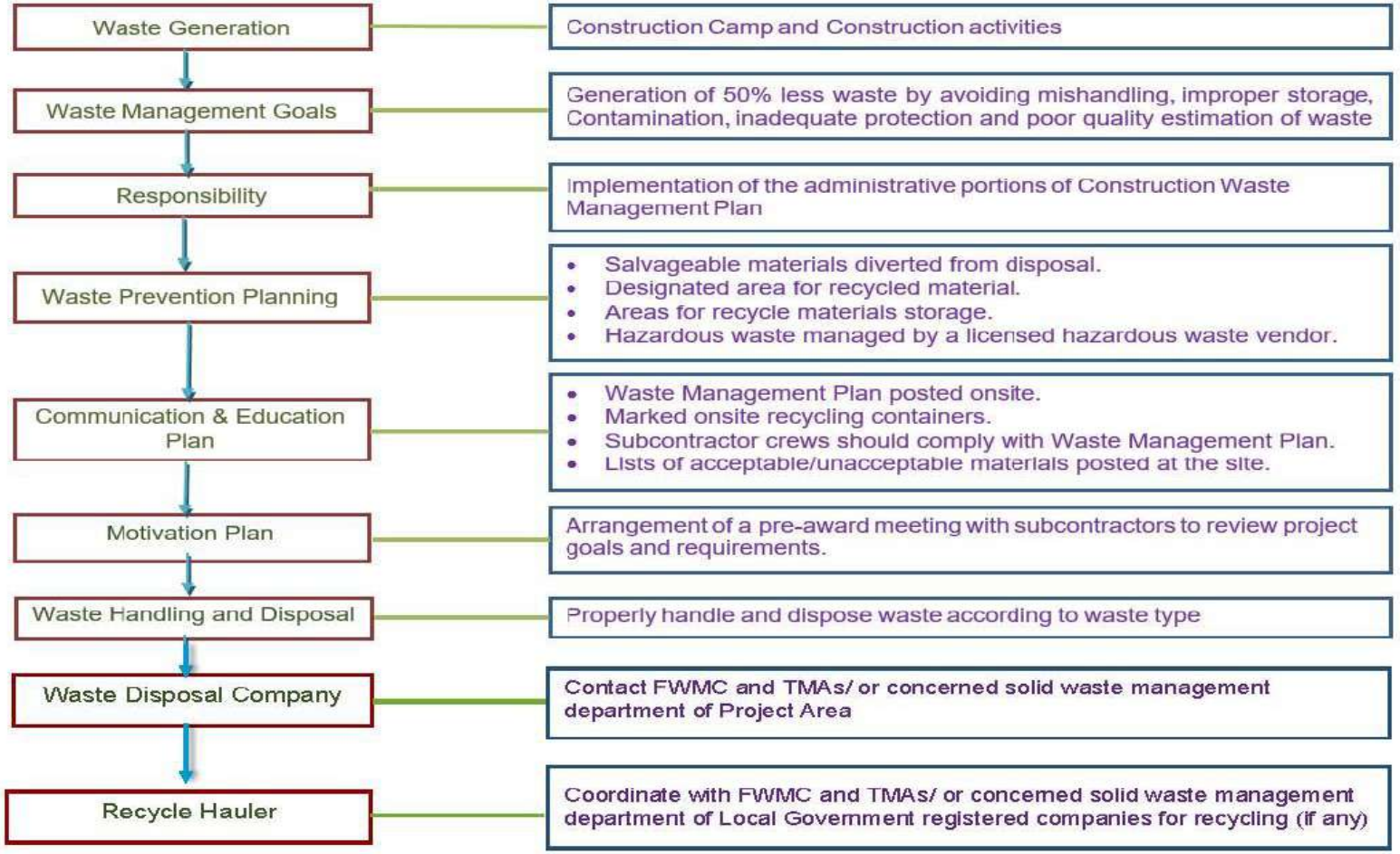


Figure 7.2: Flow Chart of Construction Waste Management Plan

7.8.11 Impact on Water Resources (Surface and Groundwater Contamination)

The proposed project will cross the Jhang Branch Canal, numbers of water channels/distributaries and nullahs/ drains at different locations. These surface water resources may get contaminated by the fuel and chemical spills, or by solid waste and effluents generated by the kitchens and toilets at the construction camp sites. Moreover, runoff from the chemical storage areas may also contaminate the surface water bodies.

Surface water might get contaminated due to the disposal of construction waste generated due to the Project activities and also result in jeopardizing the health of natives that use this water for domestic purposes. The impact on these water bodies will be only for the period of construction phase. In addition to that, construction waste, if left un-attended will result in leachate formation, which will percolate through the soil strata and reach to groundwater table and will contaminate it. This impact can be categorized as local, temporary, moderate negative and reversible.

Mitigation Measures

As a mandatory step, all the effluents will be disposed as per the requirements of PEQS. Moreover, to reduce the risk of surface and groundwater contamination, good management practices will be adopted to ensure that fuels, chemicals, raw sewage and wastewater effluent are disposed of in a controlled manner. These measures are described below:

- Construction camps will be established in areas with adequate natural drainage channels in order to facilitate the flow of the treated effluents after ensuring that PEQS are met;
- The surface and groundwater reserves will be adequately protected by installing screens and barriers to protect the source of contamination such as construction and oily waste that will degrade its potable quality;
- The proponent will ensure that the construction work is confined within the RoW and water bodies are prevented from pollution during construction;
- The solid waste will be disposed of at designated landfill sites to sustain the water quality for domestic requirements;
- Regular water quality monitoring according to determined sampling schedule;
- The contractor will ensure that construction debris do not find their way into the drainage or irrigation canals which may get clogged;
- Work near the Jhang Branch Canal area will be kept to a minimum and protective walls will also be constructed;
- To maintain the surface water flow/drainage, proper mitigation measures will be taken along the road, like drainage structures in urban areas;
- Prohibit washing of machinery and vehicles in surface waters, provide sealed washing basins and collect wastewater in sedimentation/retention pond;
- Construction work close to the distributaries or other water bodies will be avoided, especially during monsoon period;
- Wastewater effluent from the Contractors' workshops and equipment washing-yards will be passed through gravel/sand beds to remove oil/grease contaminants before discharging into the natural streams. According to the PEQS, the BOD concentration in sewage must be brought down to less or equal to 80 mg/l before being discharged

into a natural stream having capacity to dilute the effluent. For wastewater apart from BOD, COD of 150 mg/l will also be checked; and

- Similarly, if the sewage after treatment is to be discharged on to the land it will meet the requirements of the PEQS for disposal of wastewater.

7.8.12 Blockage of Water Channels and Natural Drainage

The alignment crosses water channels, nullahs, drains as mentioned above. These water channels and drains may get blocked and the catchment of the downstream may be disturbed during construction phase. This impact can be categorized as local, temporary and irreversible.

Mitigation Measures

To minimize the impact of the project on the geophysical environment, a number of measures have been included in the design that will need to be taken into account when constructing the project facilities. A second class of measures is related to the day-to-day management of the project during construction phase.

Following specific measures are required to minimize potential impacts:

- Unnecessary widening beyond the proposed design of the road shall be avoided at straight portions and on bends;
- The natural drainage pattern will not be disturbed, culverts and bridges will be constructed where required;
- Surplus soil and cleared vegetation will be disposed-off properly so as to avoid disturbance and blockage of natural drainage; and
- The Project Director (PD) of CWD in consultation with Irrigation Department allow local re-adjustments in foundation treatment or any other small changes, wherever required.

7.8.13 Site Accessibility

The proposed Faisalabad – Chiniot – Sargodha Road can be approached through various major roads. The construction material, equipment and machinery will be arrived at proposed workshop area and construction camps sites by using this road network. From these camps, the material, equipment and machinery will be transferred to work site. Detail of major approach roads are provided in the **Table 7.5**.

Table 7-5: Major Approach Roads for the Proposed Project

Sr. No.	RD Stretch	Road Name
1.	0+200	Faisalabad Bypass
2.	21+000	Rajoa Sadat Road
3.	22+770	Jhang-Chiniot Road
4.	23+800	Chiniot Bypass

Sr. No.	RD Stretch	Road Name
5.	24+150	Baraf Khana Road
6.	27+800	Sargodha Faisalabad Road
7.	29+420	Kot Ammer Shah road
8.	34+000	Kaloowal Road
9.	47+500	Faisalabad Road - NH 60 Link

Apart from above existing road, few accessibility tracks needs be developed which may cause damage to trees and crops, soil erosion, soil contamination, air and noise problems. This impact is medium and temporary in nature.

Mitigation Measures

According to usual practices during the construction of road, the access road will be developed within the RoW of the proposed road. This will limit and reduce the additional impact of the establishment of the access roads for the proposed project. For the development of access roads/tracks, contractor will be bound to consider the following mitigations to further reduce the severity of this impact:

- Selection of access roads/tracks should be based upon certain criteria to ensure high stability, no or minimum tree cutting and crop damage, minimum disturbance to nearby settlements and other social amenities;
- The approach roads should be selected to avoid any soil degradation and erosion impacts;
- Special care should be taken for known sensitive area to ensure that all interested parties are aware of the type and location of working. Measures should be taken where necessary to protect such areas physically;
- Mitigations for the loss of trees and crops, soil erosion, soil contamination, air and noise pollution, waste generation, and loss of agricultural land provided in below sections will be adopted; and
- Rehabilitation of access roads after completion of construction phase.

7.8.14 Traffic Issues

The proposed Road will be approached through various major roads as mentioned in *sub-section 7.8.13.* These roads serve as main approach roads to the proposed Project Area and due to the proposed construction activities and movement of heavy project vehicles for construction material supply, traffic problems may arise for the commuters and transporters travelling to the Project Area. The problems will include traffic jams and inconvenience to the public passing through the Project Area. It will also increase traffic load on the existing road network or access roads ultimately deteriorating the existing condition of the roads. The movement of vehicles along the haulage routes will cause soil erosion, debris flow, dust emissions, vibrational impacts, etc. Considering these consequences, this impact can be

categorized as direct, moderate, site-specific, medium term, temporary, medium probability and irreversible.

Mitigation Measures

To minimize traffic problems in the proposed project area, following measures will be considered:

- Movement of vehicles carrying construction materials and equipment/machinery will be restricted during the daytime to reduce traffic load and inconvenience to the local population;
- Construction vehicles, machinery and equipment will be parked at designated areas (at construction camps site) to avoid un-necessary congestions along the major roads;
- The speed of the vehicles will be controlled (at 30 to 40 km/hr) to reduce the probability of severe accidents, soil erosion, debris flows due to vibrations and dust emission;
- Damages of roads due to construction vehicles will be instantly repaired and/or compensated after the completion of work;
- Proper sign boards will be provided for smooth flow of traffic;
- Period of construction and area / location of construction site shall be informed to public in general and specifically to local residents; and
- Any closure of the roads (especially main roads) and deviations / diversions proposed should be informed to the riders through standard signs and displays.

Traffic Management Plan (TMP) will be implemented by the contractor to avoid traffic accidents, jams/public inconvenience. A TMP framework is attached as **Annex-IX** for contractor guidance, whereas site specific TMP will be submitted by the contractor.

7.8.15 Occupational Health and Safety

Occupational Health and Safety (OHS) related impacts will arise during construction activities including clearing of earth, levelling, compaction, carpeting, pavement finishing and testing & commissioning. The falls during inspection or maintaining pile rigs, erection of framework and other related activities may also occur. Eye injury can be caused by stone or metal particles. Hazard of being hit by falling objects, major hand-arm and whole body vibration hazards, skin and respiratory tract irritation from exposure to cement dust, overexertion and awkward postures etc. will be another impact. Welding hazards include electric shock, fumes and gases, fire and explosions, falls from height, eye and head injuries etc.

Other impacts will be fall from height, contact with heavy electrical and mechanical equipment, equipment failure, uncontrolled movement, unguarded moving mechanical equipment parts, fatigue, unbalanced load, falling objects, hand injury, slip and trip hazards, wind / storm activity, injury from releasing load too soon etc. Operating mechanical and electrical equipment will trigger the H&S issues e.g. struck by moving vehicles or other equipment, slips or trips, struck by flying objects, such as dirt or splashed fluids, caught in pinch points, shear points, crush points, falling from machine etc. The proposed project area is also sensitive from the law and order point of view and the security as well as the safety of the Contractor and

Consultant staff will be a major issue. Considering these consequences, this impact can be categorized as site-specific, medium negative, and irreversible.

Mitigation Measures

Following mitigation is given to avoid the accidental risks:

- Punjab Occupational Safety and Health Act 2019 ensures the compliance of occupational safety and health of the persons at workplace and to protect them against risks arising out of the occupational hazards;
- Compliance with the safety precautions for the construction workers as per International Labour Organization (ILO) Convention No. 62, as far as applicable to the Project Contract;
- Training of workers in construction safety procedures, environmental awareness, equipping all construction workers with safety boots, helmets, gloves and protective masks, goggles, shields and monitoring their proper and sustained usage;
- Contractor will ensure the provision of medicines, first aid kits, ambulance etc. at the camp site;
- Work areas will be cordoned off where necessary;
- Contractors will instruct their staff to use Personnel Protective Equipment (PPE) (e.g., wire containment, displaying warning signs along the work site, communicating advance warnings to mats) to enhance the safety; and
- Safety lookouts will be built to prevent people and vehicles from passing at the time of hot or cold work; and
- An emergency management plan must be devised by the contactor in close coordination with the provincial emergency services (Rescue 1122).
- Construction Safety checklist is attached as **Annex-X**.

7.8.16 Utilities (Power Transmission Lines, Telephone Lines, etc.)

Various utilities such as electrical poles and transmission lines, telephone lines, nullahs/ drains are situated within the RoW of the proposed project. These utilities will be relocated if there is any hindrance before the start of construction activities. These utilities if not handled properly will cause difficulties to the people of Project Area.

Mitigation Measures

To handle this problem following mitigation measures will be taken:

- Strengthening of utilities, wherever required;
- Close coordination with the concerned departments to curtail inconvenience to the residents of the Project area.
- Timely public notification of unexpected disruption of services.

7.8.17 Disposal of Mucking Material

Inevitable cut and fill earthwork operations will open up scars on the land around the project area. This impact is temporary and minor adverse in nature.

Mitigation Measures

The excavated materials that are unsuitable for use will need to be stored, transported and disposed of appropriately at designated sites by construction contractor.

7.8.18 Green House Gas (GHG) Abatement

The main sources of greenhouse gases (CO_2, CH_4, NO_x etc.) during the construction activities of the proposed project will include both mobile and stationary sources. The mobile source will be the construction and transportation vehicles while the stationary source will be the batching and asphalt plants. Emission of greenhouse gases from project activities will contribute in global warming and other climatic changes on regional and global scale.

Mitigation Measures

- Regular motioning of the equipment and vehicles for engine efficiency;
- Avoid idling of construction vehicles;
- Alternative energy resources shall be considered where possible;
- PEQS applicable to gaseous emissions generated by construction vehicles, equipment and machinery shall be enforced during construction works.

7.8.19 Discovery of Heritage Sites and Structures during Excavation

During excavation, there is a chance of finding artifacts. In case of finding any artifact, the contractor shall immediately report through Supervision Consultant/Client to Directorate of Archeology and Museums Punjab to take further suitable action to preserve those antiques or sensitive remains. Chance find procedure (attached as **Annex-XI**) shall be adopted in case of any accidental discovery of cultural heritage.

7.8.20 Natural and Man-Made Disasters

Natural disasters (earthquakes) and accidents such as fire, falls, slips and trips may result in injuries, financial losses and may even lead to deaths. The workers shall be trained and facilitated to cope with such disasters.

Mitigation Measures

Mitigation measures include the following:

- An Emergency Response Plan (ERP) for earthquakes and manmade disasters should be developed by contractor in coordination with SC and CWD and implemented in close consultation with the RESCUE Services and other concerned departments;
- Training of the Contractor and CWD staff and employees regarding the emergency procedures and plans should be regularly conducted;
- Emergency numbers should be clearly posted at all disposal stations; and

- Minor incidents and near misses should be reported, and preventive measures should be formulated accordingly by the CWD Management.

An ERP is attached as **Annex-XII**.

7.8.21 Emergency Response

The construction of the proposed project may encounter emergencies. In addition, disasters such as earthquakes and fires may occur. Lack of Emergency Response Plan (ERP) or an inefficient response plan may lead to an accident or critical injury. This impact is negative, temporary and moderate in nature.

Mitigation Measures

An ERP is attached as **Annex-XII** should be adopted in case of any emergency.

7.8.22 Flora

The project will involve destruction of vegetation cover particularly along the RoW. It is initially examined that approximately 1,800 trees will be affected along the RoW by implementation of proposed dualization. The provided number of trees is approximate and tentative which needs to be verified with the help of forest and agriculture departments as the EIA scope is limited. The number of possibly impacted trees is provided by field surveys complemented by GIS mapping. Moreover, trees of small and medium sizes will be removed due the layout of the project for which compensation will be made to concerned parties (Local community, forest and other relevant departments.)

Exhaust of noxious gases from movement of heavy machinery and dust will pollute ambient air which will adversely affect health and vigor of the plants. During construction activities the Contractor's workers may also damage the vegetation and trees (for use as fire-wood to fulfill the camps requirements). This impact is direct, regional, irreversible and high significant.

Mitigation Measures

- Incorporate technical design measures to minimize removal of trees, if possible;
- Cutting of trees and disturbance shall be avoided, as far as possible so, that negative effects on the process of natural regeneration of species are minimized and possible alternate route must be considered for proposed road, in which minimum ecological and environmental losses are expected;
- A Tree Plantation Plan has been formulated (**Annex-XIII**) that shall be implemented with the technical support of concerned Agriculture and Forest Department;
- As a principal, ten trees shall be planted in place of felling of one tree (i.e.1:10) in consideration of mortality. Moreover, due consideration should be given to invasive/non-invasive species factor while replantation process ;
- The Forest Department and agriculture department shall involve the local communities to carry out plantation;
- Open fires should be banned in the Project Area to avoid fire hazards;

- Clearing of vegetation cannot be avoided at the areas specified for project structures, but damage to the natural vegetation may be minimized by establishing camp sites, workshops and batching plants on waste/barren land rather than on forested or agriculturally productive land;
- However, if such type of land is not available, it shall be ensured that minimum clearing of the vegetation will be carried out and minimum damage will be caused to trees and undergrowth;
- Construction vehicles, machinery and equipment will remain confined within their designated areas of movement;
- The Contractor's staff and labor shall be strictly directed not to damage any vegetation such as trees or bushes. The contractor' workforce shall use the paths and roads for movement and shall not be allowed to trespass through farmlands or forest areas; and
- Contractor shall provide gas cylinders at the camps for cooking purposes and cutting of trees/bushes for fuel shall not be allowed.

7.8.23 Fauna

During construction phase the existing population of mammals and reptiles of the construction areas will be affected due to disturbance arising from construction activities involving excavation, blasting, movement of machinery and vehicular traffic, movement of labor, camping, etc. The existing animals will leave the directly affected areas due to construction activities and human intervention. Some animals particularly reptiles may get killed during the earthworks operations. Moreover, the movements of the mammals and reptiles will be restricted during the construction phase.

Birds as well will tend to move away from the construction areas and find shelter and food elsewhere due to the activities mentioned above for fear of being hunted / trapped.

Noise generated from construction machinery particularly during the night hours will even scare the wildlife residing in habitats located at some distance from the construction areas. Food and refuse at the Contractor's camps may attract animals that might in turn be hunted by the workers. This impact is site-specific, temporary and medium significant.

Mitigation Measures

- Care shall be taken during construction activities to avoid purposely or chance killing of animals;
- If found any wild species and habitat during construction that must deal carefully and local wildlife department officials should be called;
- Hunting, poaching and harassing of wild animals shall be strictly prohibited, and Contractor shall be required to instruct and supervise its labour force accordingly and clear orders should be given in this regard;
- The Contractor must be held responsible for instructing his work force accordingly and for enforcing this restriction. In addition, this shall have to be controlled by the Wildlife Department;
- Provision of culvert/tunnel for the movement of different faunal species across the project road present in the project area;

- Special measures shall be adopted to minimize impacts on the wild birds, such as avoiding noise generating activities during the critical periods of breeding;
- Noise generating activities shall not be carried out during the night by the work force, clear orders should be given by the contractor;
- Similarly, wastes of the camps shall be properly disposed of to prevent it being eaten by animals, as it may be hazardous to them; and
- Efforts should be made to keep noise levels at acceptable levels (as per PEQS) produced by the construction activities.

7.8.24 Agriculture, Orchards and Trees

Mostly the alignment of the proposed project fall in the very rich agricultural area and damages of crops, orchards and tree are expected during construction activities, which may cause loss of income to affectees.

The areas used for the construction of haul routes and construction camps will result only in temporary loss of cultivable land, as the land can be again brought under cultivation following completion of the construction works. However, standing crops in RoW of the road may result in permanent loss of cultivatable land. The impact on agriculture in the project area is major adverse and permanent.

Mitigation Measures

- The budget for the proposed project will include provision for payment of compensation to farmers for the loss of any standing crops, or crops already sowed. It will be applicable for all standing crops within the acquisition area at the time of possession;
- The compensation value shall be calculated based on market value of the crops and average yields in the project area;
- In order to reduce the loss of agricultural land during the construction stage, existing haul routes will be preferred by the contractor, and the width of any new haul route shall be limited to the bare minimum required and approved by the engineer;
- Removal of all contractors' facilities from the project area shall be a contractual requirement, and land used for the construction camps can be restored to facilitate agriculture and the land used for the construction camp shall become cultivatable.
- Compensation for the loss of crops to the land owners and cultivators as the case may be will be paid, in accordance with the prevailing market prices and uniformity in rates will be ensured; and
- As far as possible, land within the RoW (which will be acquired) or otherwise barren land without any crop outside the RoW will be selected for the camp sites and disturbance to the crops and natural vegetation will be avoided as much as possible.

7.8.25 Community Health and Safety

The construction activities and vehicular movement at construction sites may result in road side accidents particularly inflicting local communities who are not familiar with presence of heavy equipment. Quality of groundwater and surface water resources available in the nearby local communities may be affected due to the construction activities, oil spillage and leakage, etc. The proposed project will also have potential of air (dust pollution), noise and vibrational

impacts on nearby communities. The labour works with different transmittable diseases may cause spread of these diseases in the local residents. The construction areas located near the residential, settlements, may cause accident for the people moving near to those areas. Institutions along the route may also suffer during construction period due to air, noise and road accidents. Conflicts may arise between the local community and the construction workers, which may be related to religious, cultural or ethnic differences, or based on competition for local resources. Tensions may also arise between different groups within the labor force, and pre-existing conflicts in the local community may be exacerbated. Ethnic and regional conflicts may also be aggravated if workers from one group are moving into the territory of the other.

There are many schools and colleges exist along the Faisalabad to Sargodha road in which major education institutions are High School Chak-02, Fast National University Chiniot Campus, Superior College, Chenab College Chiniot, Punjab College Chiniot etc. Students and staff in these educational institutions will be adversely affected during construction activities due to noise, air pollution and vibration. During the construction activities, elevated air and noise levels may create short term and long term health issues such as respiratory diseases by air pollution and hearing impairment, hypertension, annoyance, and sleep disturbance by noise pollution for the students and staff as well as local population residing along the RoW. Other than these educational institutions, there are number of industries also exist along the road such as tayeb textile, Amir Textile, Tayeb sugar mill, Ayesha rice mill, Nayab Aatta etc. Employees of these industries adversely affected during the construction stage, which needs special measures.

Indirect effects on public health can include increased incidence of tuberculosis, asthma, chronic bronchitis, and gastrointestinal diseases. Considering these consequences, this impact can be categorized as site-specific, temporary, medium negative and irreversible.

Mitigation Measures

- There will be proper control on construction activities and oil spillage leakage of vehicles;
- The labourers with different transmittable diseases will be restricted within the construction site;
- Ensure that the site is restricted for the entry of irrelevant people particularly children;
- Efforts will be made to create awareness about road safety among the drivers operating construction vehicles;
- Timely public notification on planned construction works;
- Close consultation with local communities to identify optimal solutions for diversions to maintain community integrity and social links;
- Seeking cooperation with local educational facilities (school teachers, university management, students) at each village along the route for road safety campaigns;
- Provision of proper safety and diversion signage, particularly at urban areas and at sensitive/accident-prone spots;
- Setting up speed limits in close consultation with the local stakeholders;
- If identified, consider additional guard rails at accident-prone stretches and sensitive locations (near City, Dar-e-Arqam school, Tips College, Punjab and Aspire college, near FAST and Superior University, etc.).

- Construction Camp Management Plan (CCMP) and effective implementation of GRM may reduce this impact;
- The communicable disease of most concern during construction phase, like Sexually-Transmitted Disease (STDs) such as HIV/AIDS, will be prevented by successful initiative typically involving health awareness; education initiatives; training heath workers in disease treatment; immunization program and providing health service;
- Reducing the impacts of vector borne diseases will be accomplished through implementation of diverse interventions aimed at eliminating the factors that lead to disease, which include prevention of larval and adult propagation of vectors through sanitary improvements and elimination of breeding habitat close to human settlements and by eliminating any unusable impounding of water;
- The Contractor will prepare the construction camp management plan which, in addition to other components, will include the labor influx management plan. This will be reviewed and approved by CWD ;
- Contractor will take due care of the local community and observe sanctity of local customs and traditions by his staff. Contractor will warn the staff strictly not to involve in any unethical activities and to obey the local norms and cultural restrictions; and
- A Traffic Management Plan (TMP) will be prepared by the contractor in consultation with C&W department and existing schools/colleges on Chiniot-Sargodha road. TMP should be developed and implement through concerned government departments, surrounding industries representatives & officials and surrounding communities of the project route.

7.8.26 Impact on Shrines

Two (02) Shrines (Grave of the Saien Abdul Majeed Khokar and Pir Malan Shah) exist on the foothill on the mine mouth and processing area, outside the mine mouth limits. Two (02) shrines (Mai Jevan and Baba Bakht Shah) exist in RoW of project route. During construction and operation stage any possibility of destruction, damage, and intrusion may cause serious issues. Moderate impact is foreseen on the shrines structures and the visitors/followers who will come to attend religious events.

Mitigation

The Contractor should made efforts to avoid the shrines through re-design the proposed route at design stage. If the realignment of the road is not possible, then amicable measures such as community consultation and consultation with relevant department should be carried out to relocate the shrines. Moreover, proper steps should be taken to control dust and noise emissions in the area to save the nearby shrines.

7.8.27 COVID-19 Scenario

The COVID-19 belongs to a family of viruses known as the Coronaviruses, which can cause illnesses ranging from the common cold to more severe diseases, such as the Severe Acute Respiratory Syndrome (SARS) and Middle East Respiratory Syndrome (MERS). Infected people can spread COVID-19 through their respiratory secretions via droplets produced when an infected person coughs or sneezes, etc.

To avoid the risk of exposure to COVID-19 Contractor must consider the physical well-being and safety of all the persons entitled to be on the Site and follow reasonable guidelines and recommendations of Government authorities and healthcare professionals.

Mitigations

Since, the vaccine of COVID-19 is only available for health care workers and elderly people, therefore, transmission can be prevented through following measures:

- Cover your mouth while cough or sneeze;
- Avoid close contact with people who are sick;
- Avoid the use of hard soap;
- Wash your hands often with liquid soap and water for at least 20 seconds;
- All the employees should ensure sanitization of hands at appropriate time;
- Avoid touching your eyes, nose, and mouth with unwashed hands;
- Use of Personal Protective Equipment (PPE) according to risk (a surgical or N95 mask);
- Do not spit, wrap your oral and nasal secretion with tissue and throw it in a covered dustbin;
- Balance your nutrition and exercise moderately; and
- Sterilization / disinfection of medical devices at Site dispensaries.

Guidelines to combat with COVID-19 are attached as **Annex-XIV.**

7.8.28 Gender Issues

Gender-based violence: Construction workers are predominantly younger males. Those who are away from home on the construction job are typically separated from their family and act outside their normal sphere of social control. This can lead to inappropriate and criminal behavior, such as sexual harassment of women and girls and illicit sexual relations with minors from the local community. A large influx of male labor may also lead to an increase in human trafficking whereby women and girls will face safety and security issues.

Child labor and school dropout: Increased opportunities for the host community to sell goods and services to the incoming workers can lead to child labor to produce and deliver these goods and services, which in turn can lead to enhanced school dropout.

Positive Impact

The project area is rural in nature and there is no possibility of inclusion of females in employment opportunities (labour works) due to cultural and religious norms. However, the project will have positive impacts on the females of the Project Area due to smooth traffic flow and ease in travelling to hospitals, schools, markets, etc.

Mitigation Measures

- The contractor will be required to provide qualified key personnel to address the specific risks identified in the project. Contractors will specify key staff with the technical skill and experience to implement the mitigation measures;
- The bidding documents will include specific requirements that minimize the use of expatriate workers and encourage hiring of local workers, thereby minimizing labor influx;
- The bidders will be required to submit Codes of Conduct (CoCs) with their bids. The CoCs will set clear boundaries for acceptable and unacceptable behaviours of all individuals and companies and will be signed by companies, managers and individuals;
- All project consulting firms will also be required to submit Codes of Conduct with their proposals;
- The contractor will be required to establish anti-sexual harassment policies that governs conduct in the workplace;
- The contractor will be required to provide mandatory and repeated training to workers on sexual exploitation and abuse and HIV/AIDS prevention and on the content and obligations derived from the code of conduct; and
- Provisions will be set in contracts for dedicated payments to contractors for SEA prevention activities (e.g. training) against evidence of completion. The portion of the contract price will be guaranteed by a performance security linked to environmental and social contractor performance.

7.8.29 Loss of Income

During the construction activities, people will suffer loss in their annual income due to the loss of crops, orchards, trees etc. This impact can be categorized as indirect, moderate, local, medium term, permanent, highly probable and irreversible.

Mitigation Measures

- Fair, prompt and negotiated compensation for the crops and trees on private land will be provided to the affectees along with the land value; and
- Affectees will be involved in the valuation process of the Project.

7.9 Anticipated Impacts during Operational Phase

The anticipated impacts related to the proposed project have been studied for the operational phase and discussed hereunder:

7.9.1 Landscape

During the operation stage, new saplings of different plants and trees would be planted to enhance the aesthetics and compensate the loss of affected trees. This will have a positive impact of permanent nature. The presence of adequate flora at available spaces along the proposed alignment will help in absorbing flue gases emitting from a large number of vehicles and public transport passing through the project area, which shall help to improve the air quality.

Mitigation Measures

The saplings planted in the project area against the trees affected should be properly maintained throughout their growth.

7.9.2 Air Quality

Improvement in road condition will help to reduce traffic related emissions in the short term by allowing a smoother traffic flow. However, in the longer run, increased traffic levels may lead to higher values of emissions. The impact is permanent. It is positive in case of improvement of road conditions; and minor negative, when traffic volume increases.

Mitigation Measures

Following mitigating measures are needed to be suggested:

- CWD with the help of PEPA may set up system to monitor air quality along project area at important intersections/sensitive receptors in accordance with PEQS for a specific period to record the quality of air during the operation phase. This may help in comparing the baseline conditions with the operation phase of the project;
- Setting up to system to monitor air quality along the project area in accordance with acceptable International Standards; Monitoring emissions of vehicle as per PEQS;
- Helping the owners and occupants of the affected premises/settlements to identify and implement special measure such as hedges and vegetation to reduce air pollution; and
- Increasing vegetation in the form of greenbelt is one of the preferred methods to mitigate air pollution. Plants generate oxygen, serve as a sink for pollutants, reduce the flow of dust and reduce the noise pollution too alongside the proposed project.

7.9.3 Noise and Vibration

The movement of vehicles and usage of horns will create noise which will be a hazard for the nearby residents/built-up areas. Impact of noise generated from the vehicles moving on the proposed road will be permanent and moderate adverse in nature.

Mitigation Measures

- Provision of adequate noise barriers such as hedges and indigenous tree species will reduce the noise. Further Improvement can be made by enforcing the laws and getting the vehicles tested, regularly after a specific time period, by some reputable vehicle testing laboratory and obtaining a certificate. Noise measurements should be carried out at locations with respect to the schedule specified in the Environmental Monitoring Plan (EMMP) to ensure the effectiveness of mitigation measures;
- Use of horn should be strictly prohibited in the close proximity of the built-up areas;
- Proper signboards should be installed to ensure reduce noise levels in the project area;
- Enforcement and penalties against traffic rules violators; and
- Noise barriers may be installed/constructed near the built-up areas.

7.9.4 Road Safety

Enhanced vehicular movement and speed in the long run may result in road safety issues like traffic accidents. This impact is permanent but moderately adverse in nature, since the frequency of accidents may be lowered, but their intensity may be quite severe due to enhanced speeds at which vehicles will move. The impact may be considered permanent and high adverse in nature.

Mitigation Measures

Strict enforcement of speed limits, installation of speed guns and channelization of traffic with respect to categories (heavy vehicle traffic and light vehicle traffic), should be ensured for the smooth flow of traffic moving from major road crossings. Enforcement of penalties for the violators will reduce the significance of this impact.

7.9.5 Road Maintenance

During the operation phase, related road maintenance works will be conducted time to time which may lead to social and environmental issues like traffic management, inconvenience to local residents, public safety, vehicular emissions, dust and increase in noise. This is a temporary and moderate negative impact.

Mitigation Measures

- Best Management Practices should be used for all the maintenance works;
- Timely completion of all the maintenance works according to the agreed schedule;
- Traffic management plan should be devised and implemented; and
- HSE protocols should be strictly followed and implemented to avoid any incident/accident.

7.9.6 Drainage

During the operational phase, poor maintenance of the road drainage system, particularly during the monsoon season can cause nuisance to the travellers and public due to flooding in the existing drainage line. In case of chocking of road drainage, the increased surface runoff due to heavy rains will accumulate at the surface and can cause traffic jams. The impact may consider to be moderate adverse in nature.

Mitigation Measures

- The impact can be controlled/reduced by timely and continuous maintenance/ cleaning of the drainage system; and
- Placement of sign boards instructing not to dispose of solid waste to avoid chocking of drain along the road alignment.

7.9.7 Flora

During Operational stage, the Project will not affect flora (trees and agricultural crops) or release any significant pressure detrimental to flora. Low level impact is expected at operational phase on vegetation due to the Operational and Maintenance activities. This impact is site-specific, temporary, irreversible and low significant.

Mitigation Measures

- The implementation of tree plantation plan recommended in compensation for cutting of trees should start working during operational stage, to ensure the ecological balance and to avoid any impact on local Environment;
- Large scale planting with suitable indigenous fruit and forest trees, shrubs and ornamental plants in the form of Tree Groves, and Linear plantation will be carried out in accordance with the Tree Plantation Plan to improve aesthetic value and offset the effect of removal of vegetation. It will help in absorbing flue gases, emitting from a large number of vehicles and public transport passing through the project area, which shall improve the air quality;
- The saplings planted in the project area against the trees affected should be properly maintained throughout their initial growth period in terms of water requirement and necessary nutrients by CWD or relevant department;
- Proper check and balance for above activities is highly recommended. Plantations raised, must be maintained according to the Silvicultural practices, which include proper irrigation, cleaning, pruning, thinning at prescribed intensity, Silt clearance and Trench-opening, etc.
- Maintenance and security of the plantation should be done for at-least five years (in consultation with the forest department). Measures such as fencing, watch guards and fire protection should be considered; and
- All activities must be done under the technical supervision of Forest Department.

7.9.8 Fauna

There is no protected area, Game reserve, Game sanctuary or national park in the project area so no major impact on Wildlife & Livestock in the area is expected through, noise, vibration and any type of normal activity in the project area, thus will have no effect on productivity.
This impact is site-specific, permanent, irreversible, and medium significant.

Mitigation Measures

- The pathways of locally available wildlife and livestock for food, Shelter and other normal activities must be compensated with proper alternative routes/pathways & water points must be provided to minimize the impact and movement of available wild and domesticated animals.;
- In proper consultations with Forest and Wildlife department, permanent water points for available fauna must be provided to conserve local ecosystems and biodiversity.
- Strict control must be exercised for stoppage of killing/poaching of available wildlife species by enhancing protection practices and deploying effective watch and ward system;

- The precautionary measures described for future shall also be applicable during operation phase as relevant for the conservation of wildlife species in the Study Area; and
- Proper fence must be provided along the roadside to avoid road killing of wildlife, livestock and most importantly any inconvenient for local inhabitants.

7.9.9 Socio-economic Impacts

The change in land use (residential to commercial) may pose privacy issues and accident hazards. The socio-economic impacts due to traffic congestion, air pollution and traffic delays may include loss of work time, waste of fuel, reduced efficiency of people due to adverse impacts on human health and resultant increase on health expenditures.

Mitigation Measures

- Redefining basic land use allocation standards;
- Improvements in the design considerations of proposed road alignment so as to promote sustainable development of commercial areas; and
- Land use policies such as development restrictions and zoning codes (residential or commercial) and implementation of related By-Laws.

8 ENVIRONMENTAL MANAGEMENT PLAN

8.1 GENERAL

Environmental Management Plan (EMP) is a tool for the implementation of the all the suggested measures to make the project environmentally sustainable. It provides an overall approach for managing and monitoring the environmental, ecological and socio-economic issues of the proposed Project, and describes the institutional framework and reporting mechanism to implement EMP for the Project.

This section provides brief description of environmental issues, mitigation measures to eliminate or reduce environmental and social impacts to an acceptable level, institutional framework for the implementation of the mitigation measures and environmental monitoring plan for air quality, water quality, and noise pollution parameters during construction and operational phase. A budgetary plan is also developed, indicating estimated costs to be incurred to mitigate potential adverse impacts of the proposed Project.

8.2 EMP Components

The EMP comprises of following main components:

- EMP Objectives;
- Scope of the EMP;
- Environmental Policy, Legislation and Framework;
- Institutional Requirements;
- Environmental Mitigation and Management Matrix;
- Environmental Monitoring Plan;
- Planning for EMP Implementation;
- Training and Capacity Building;
- Communication & Documentation;
- Management Plans;
- Chance Find Procedure;
- Public Disclosure;
- EMP Cost; and
- Summary of Environmental Cost.

8.3 OBJECTIVES OF ENVIRONMENTAL MANAGEMENT PLAN (EMP)

The main objectives of the EMP are to:

- Provide the details of the Project impacts along with the proposed mitigation measures, and the corresponding implementation activities;
- To ensure that all necessary corrective actions are carried out and monitored in time to counter any adverse environmental impact under a systematic monitoring approach;

- Provide a procedure for timely action in the face of unanticipated environmental situation;
- Define the role and responsibilities of the Project Proponent (Communication & Works Department (CWD)), Contractor(s), Supervisory Consultant(s) and other key players in order to effectively communicate environmental and social issues among them;
- Define a monitoring mechanism, reporting frequency and identify monitoring parameters to ensure that all the mitigation measures are completely and effectively implemented;
- Design the training and capacity building plan for enhancing the capacities of the Project Proponent (Communication & Works Department (CWD)), Contractor(s), Supervisory Consultant(s) on environmental and social management;
- Identify the resources required to implement the EMP and outline the corresponding financing arrangements; and
- Define the requirements necessary for documenting compliance with EMP and communicating it to all the concerned regulatory agencies.

8.4 INSTITUTIONAL REQUIREMENTS

The institutional requirements for the Construction and Operation & Maintenance (O&M) phases of the proposed Project are provided in below sections.

8.4.1 Institutional Setup for Implementation and Management of EMP

The key players involved during construction phase of the proposed Project are the CWD as employer/proponent, PEPA, the Supervisory Consultant (SC) and the Contractor. The roles and responsibilities of these organizations are outlined below.
The following staff will be involved in the implementation of EMP:

- CWD/Proponent/Employer;
- SC's; and
- Contractor's Environmental Manager.

The employer/ proponent (CWD) will make Contractor bond through contract documents to implement the EIA including EMP and other terms and conditions of the Environmental Permit. The whole EMP will be included as a clause of the contract documents. Construction camps will be established after necessary approvals and submission of Site-Specific EMPs to be developed in the light of the relevant agencies requirements, before commencement of construction works. The organizational setup for implementation of EMP during construction phase is provided in **Figure 8.1**.

8.4.2 Overall Oversight Arrangements

A Project Steering Committee comprising of Chairman CWD, Project Director (dualization and rehabilitation of existing Faisalabad-Chiniot-Sargodha Road) and Deputy Director, CWD will provide overall guidance and oversight and will be responsible for ensuring effective implementation of the project.

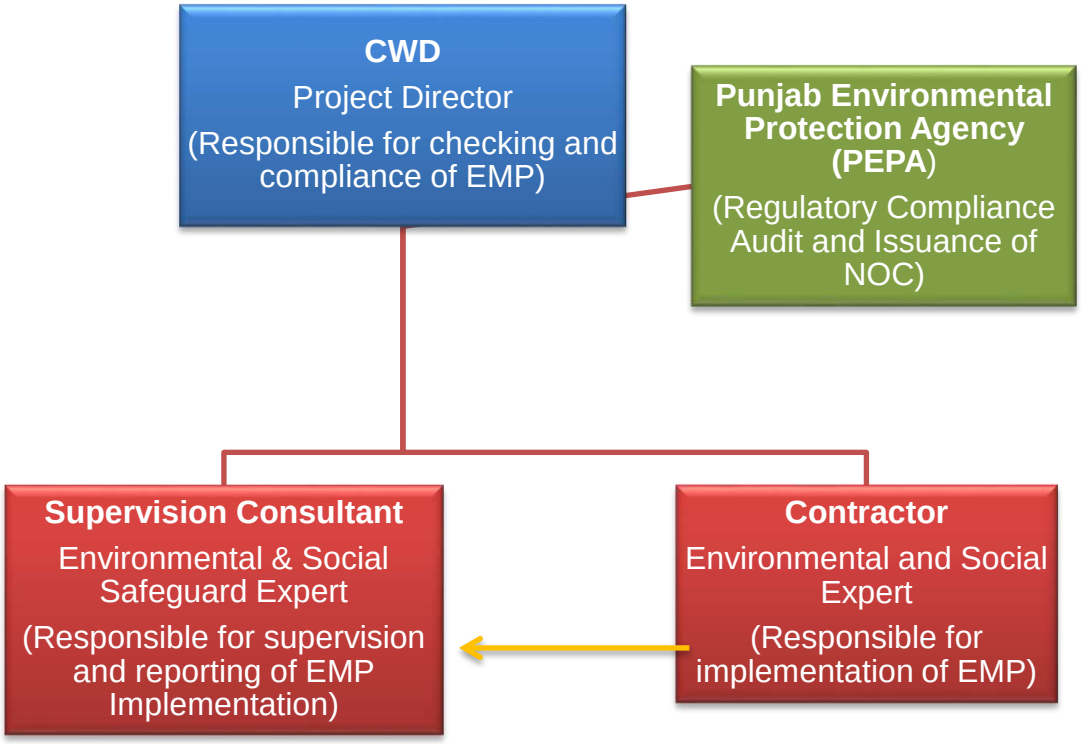


Figure 8.1: Organizational Setup for the Implementation of EMP at Construction Stage

8.4.3 Roles and Responsibilities for EMP Implementation during construction Phase

a. CWD/ Employer Concerned Staff

The specific responsibilities are as follows:

- Setting up systems for environmental management;
- Ensuring that the Contractor(s) develop and carry out environmental implementation plans that are consistent with the EMP;
- Liaising between the Project staff and the Supervisory Consultant's staff to monitor environmental and social compliance during construction phase;
- Ensuring that the required environmental and social training is provided to the concerned staff;
- Responsible for carrying out random site visits to the construction sites to review the environmental performance of the contractors;
- Monitoring the progress of environment and social related activities;
- Make sure that the contractor is implementing the additional measures, suggested by the Supervisory Consultant in monthly environmental monitoring reports;
- Assessment of the crops, orchards, valuation of property (if any), public utilities and negotiation with the affectees for fixation of compensation to be paid for temporary as well as permanent acquisition of the land;
- To estimate the crop compensation;
- Assist in checking genuine ownerships of the claimants, in consultation with the Revenue staff for prompt payment to the affectees;

- To ensure that the tenants get their rightful compensation as per prevailing law especially in case of loss of crops;
- To assist Contractor for obtaining necessary approvals from the concerned departments;
- Maintaining interface with the other lined departments/stakeholders; and
- Reporting to the EPA-Punjab on status of EMP implementation.

b. Supervision Consultant (SC)

A professional consulting firm will be hired by CWD and responsible for Contract Administration and Construction Supervision. The firm will be fully empowered as the 'Engineer' in accordance with International Federation of Consulting Engineers (FIDIC) stipulations. The Consultant will administer the civil work's contracts, make engineering decisions, be responsible for quality assurance, provide general guidance and furnish timely responses to the Contractors in all matters relating to the civil works, and ensure that all clauses of the Contract Agreement including environmental and social clauses between the civil works Contractors' and CWD are respected. The Project Engineer will have a full-time field based environmental and social specialist to ensure the implementation of EMP. Two separate experts, one for environment and one for social aspects, will be hired. The environmental and social specialist of SC will also develop training modules, conduct environmental and social trainings for the contractor's staff, and ensure social issues are properly addressed and mitigated during the project life.

Environmental and Social Safeguard Experts (ESSEs) of SC will oversee the performance of contractor to make sure that the contractor is carrying out the work in accordance with EMP as mentioned in the contract documents. He will provide guidance to the contractor's ESE for implementing each of the activity as given in EMP. ESSEs will be responsible for record keeping, providing instruction through the Resident Engineer (RE) for corrective actions and will ensure the compliance of various statutory and legislative requirements.

However, overall responsibilities of ESSEs are as follows:

- To oversee the performance of the Contractor to make sure that the Contractor is complying with EMP;
- Discussing various environmental and social issues and environmental mitigation, enhancement and monitoring actions with all concerned personnel's;
- Inspect, supervise and monitor all the construction and allied activities related to the EMP for the project and oversee the performance of the Contractor to make sure that the Contractor is complying with EMP;
- Visiting construction sites including incomplete construction work sites, where there is no contractor's activities, active construction work sites, completed areas of work sites as well as ancillary sites such as borrow areas, quarries, asphalt and crusher sites, hot mix plant sites, construction camps and work shop areas to ensure contractors compliance with EMP stipulations and conditions of statutory bodies;
- Assisting contractor in all matters related to public contacts including public consultation pertaining to environmental and community issues;
- To organize periodic environmental training programs and workshops for the consultant's and contractor's staff;

- Periodic reporting as mentioned in EMP; and
- Suggest any additional mitigation measures (if required).

c. Responsibilities of Contractor

Site Environmental and Social Expert of contractor will carry out the implementation of the mitigation measures at construction site. Contractor will be bound through contract documents to appoint the Site Environmental and Social Expert with relevant educational background and experience. The responsibilities of ESE of Contractor are as follows:

- ESE of contractor will prepare Site Specific Environmental and Management Plan (SSEMP) including Evacuation Plan, HSE Management Plan, Material Transportation Plan, Traffic Management Plan, Emergency Response Plan, Monitoring Plan, and asphalt and batching plant area plans, and will submit all the plans to the SC.
- ESE of contractor will be responsible for the implementation of EMP and to take effective measures against corrective actions plan;
- ESE will prepare the monthly compliance and monitoring reports as per schedule and will submit it to the SC;
- Provision of proper Personal Protective Equipment's (PPEs) to the workers and train them for their proper use;
- ESE will conduct the environmental, health and safety trainings for the staff and labors; and
- The Contractor shall submit the Code of Conduct that will apply to all of the contractor's staff. The contractor shall submit an outline of how the Code of Conduct will be implemented. The aspects to be addressed include:

    - Ensure compliance with applicable environment, health and safety standards and procedures associated with risks of Project activities;
    - Ensure compliance with all acquired approvals, applicable to the proposed Project;
    - Ensure protection of local community (including vulnerable and disable assemblies), and the Contractor's staff, sub-contractors and daily wage workers;
    - Ensure employment of fulltime security guards, and necessary security measures and instruments (CCTV) at site;
    - Ensure provision of adequately stocked first aid kit at site for dealing with accidental injuries, and natural hazards;
    - Prohibit use of illegal items such as weapons, alcohol and drugs at site;
    - Ensure that Project property is protected against vandalism, theft, and noxious activity;
    - Ensure that positive attitude of respect and warmth is given to staff and community members;
    - Ensure good housekeeping practices shall be adopted at site;
    - Ensure that employment decisions are not made on the basis of personal characteristics unrelated to inherent job requirements, including race, gender, nationality, religion or belief, disability, age, sexual orientation, or ethnic, social and indigenous origin;
    - Ensure establishment and strictly enforcement of "No Sexual Harassment Policy";
    - Ensure provision of necessary sanitation requirements for site workers (both for men and women);
    - Ensure workers only use specified sanitary facilities provided by their employer and not in open areas;

- Restriction on burning solid waste;
- Restriction on dumping solid and liquid waste into nearby water bodies;
- Prohibition for cutting trees, and clearing vegetative areas for construction camps, and for cooking purpose as a source of fuel; and
- Prohibition on illegal hunting of local fauna.

The Code of Conduct should be written in local and simple language (Urdu and English) and signed by each site staff to specify that they have received a copy of the code; code explained and clarified to them; acknowledged adherence to this Code of Conduct as a condition of employment; and understood that violations of the Code can result in serious consequences. A copy of the code shall be displayed at strategic location of the site, and mainly in the contractor's site office.

d. Punjab Environmental Protection Department (PEPA)

EPA is the regulatory authority for issuance of NOC for the proposed Project. As part of its mandate, protection of environment is their responsibility. Therefore, the agency will undertake an audit (as and when required) of the activities of the Project (both phases i.e. Construction and Operation) with respect to the protocols as defined in EMP and in NOC. The specific responsibilities are as follows:

- Liaison with the Environmental Committee of CWD on the proposed Project to ensure compliance of measures as given in the EMP and in NOC issued by them for the construction activities of the proposed Project;
- Environmental Audit of the activities being undertaken by the Environmental Committee of CWD and all other relevant stakeholders as provided in the EMP and NOC through random site visits and meetings.

8.4.4 Institutional Arrangement for Implementation of EMP during O&M Phase

The proposed Project will be administrated by CWD during the O&M phase. CWD has established District Support & Monitoring Department to monitor the development works of every district and for technical support for District Government. Therefore; it is suggested that the Project Director of the proposed Project shall depute / hire Environment and Social Expert through District Support & Monitoring Department to monitor and implement EMP during operation phase.

The specific responsibilities of Environment and Social Expert are as follows:

- Coordinating with the operational staff working under the Regional General Manager and Project Director to monitor environmental compliance during operation phase;
- Advising on, and monitoring tree plantations along the road alignment as suggested in EMP;
- Reporting on the progress of environmental compliance to the Project Director and EPA-Punjab;

- Assess and propose mitigation measures for unforeseen long-term environmental and social impacts of operation; and
- Sustaining a working partnership among the CWD, EPA-Punjab, Agriculture, Irrigation, Forest and Wildlife departments of Faisalabad, Chiniot and Sargodha to ensure compliance of EMP during operation phase.

8.5 ENVIRONMENTAL MITIGATION AND MANAGEMENT MATRIX

Environmental Mitigation and Management Matrix (EMMM) is considered as one of the main elements of EMP. The EMMM provides the framework for the implementation of the mitigating measures against each identified potential adverse impacts, and management and monitoring of the same during the design, construction and operation phases of the proposed Project. **Table 8.1** shows impacts, mitigations and the responsible authority and organization for the implementation of the same during design, construction and operation phase.

The Contractor(s) will be responsible for the preparation of Site Specific EMP (SSEMP) on the same format of this EMMP along with the site specific plans based on the guidelines provided in this Section.

Table 8-1: Environmental Mitigation and Management Plan during Design Phase

Sr. No.	Parameters	Target	Impact	Mitigation Measures	Responsibility	
					Implementation	Supervision / Monitoring
Design Phase						
1.	Technical Design and Layout Planning	To ensure compatible layout plan and engineering design of the project's structures to safeguard overall aesthetic beauty and ambience of the project area.	▪ Incompatible layout plan and engineering design of the project's structures (retaining walls, ramps, bridge, etc.) can undermine the overall aesthetic beauty and ambience of the project area. ▪ Also low utilization of the available spaces and designing the structures without considering the prospective and futuristic needs can result in structures with low social acceptability and functionality.	▪ The technical design of the proposed project must consider all the mentioned factors for the final design and should meet all the local and international standards; ▪ The proponent must review and validate all the design parameters considering the possible impacts (as mentioned) before the start of construction of proposed Project; and ▪ Proposal of pedestrian bridges may also be considered to facilitate the locals especially near institutions i.e. FAST University, Superior University, Aspire College, Punjab College, etc.	DC	CWD
2.	Topography	To avoid adverse permanent changes in the topography of the proposed Project site.	▪ As the proposed project is rehabilitation and extension of existing road, so, there is no significant change in the topography of the project area is expected.	▪ Mitigation measures will involve adoption of best engineering design measures keeping in view of the aesthetics of the project area and provision of green belts for the landscape in design.	DC	CWD

Sr. No.	Parameters	Target	Impact	Mitigation Measures	Responsibility	
					Implementation	Supervision / Monitoring
3.	Storm Water Drainage	Proper designing of storm water drainage system that withstand heavy rainfall events.	Improper design of storm water drainage, following impacts are expected to arise: ▪ Deterioration of road surface and reduction of its bearing capacity; ▪ Inconvenience for commuters/pedestrians; ▪ Stagnant water may provide the breeding ground for disease vector; and ▪ Foul odour may be generated.	▪ Mitigation measures will include provision of appropriate drainage structures with appropriate design capacity to avoid urban flooding especially during the rains. Proper slopes shall be incorporated in design to avoid the stagnant water on At-grade road surface.	DC	CWD
4.	Seismic Hazard	To keep the structures safe and intact in case of earthquake.	▪ The proposed Project Area falls in the seismic zone classified as “Zone-2A” with g-value 0.08 to 0.16, and is considered as Moderate Hazard seismicity zone. ▪ In case of an earthquake, the proposed road expected to suffer damages if designed without consideration of seismic activities.	▪ The proposed structure should be designed and constructed keeping in consideration high intensity earthquakes. For seismic hazard analysis, updated structural and seismic evaluations should be conducted by the design engineer/consultant. Moreover, geo-technical investigations must be conducted prior to construction phase; ▪ Seismic Building Code of Pakistan 2007 (SBC-07) should be adopted. This code specifies minimum requirements for seismic safety of buildings and has to be applied and used by engineers in conjunction with the necessary	DC	CWD

Sr. No.	Parameters	Target	Impact	Mitigation Measures	Responsibility	
					Implementation	Supervision / Monitoring
				understanding of the concepts of structural, geotechnical and earthquake engineering; and ▪ The structure of the proposed project should also be studied by the proponent (CWD) to evaluate its durability/strength to withstand moderate to high intensity earthquake.		
5.	Permanent Land Acquisition	To avoid or minimize permanent land acquisition to the extent possible.	▪ About 1100 Kanals of land will be acquired for dualization of the existing Faisalabad – Chiniot – Sargodha Road. This may result in loss of land, crops, infrastructure, religious structures, livelihood, commercial activities, disturbance to people and loss of income sources.	▪ The process of land acquisition and compensation should be followed in a transparent manner to minimize the impacts to provide judicious compensation to the affected persons by providing sufficient budget in the project cost. ▪ According to Land Acquisition Act 1894, the following points needs to be considered while determining compensation for the project affectees: ▪ The market value of land at the date of publication of notification under section 4 sub section (1); ▪ The damage sustained by the person interested, by reason of the taking of any standing crops, or trees which may be on the land at the time of the collector's taking possession thereof; ▪ The damage if any sustained by the person interested at the time of the collector's taking possession of the land by reason of acquisition injuriously affecting his other property,	DC	CWD

Sr. No.	Parameters	Target	Impact	Mitigation Measures	Responsibility	
					Implementation	Supervision / Monitoring
				moveable, or immoveable, in any other manner, or his earning; and ▪ As a consequence of the acquisition of the land by the collector, the person affected is compelled to change his residence or place of business, the reasonable expenses incidental to such change. ▪ Therefore, compensation should be made to the affected people as per Land Acquisition Act, 1894 and market value for the loss of assets. Adequate budget will be provided in the Project cost for this compensation.		
6.	Temporary Acquisition of Land	To avoid or minimize temporary land acquisition to the extent possible for construction of construction camps.	▪ The Contractors will require temporary land acquisition for the development of contractor camps and facilities i.e. storage, workshops, equipment parking and washing areas. ▪ Land utilization for Project activities and subsequent operation of Project may induce temporary as well as permanent changes in the existing landuse pattern. This impact can be categorized as direct, low,	▪ To establish the construction camps at the acquired land to eliminate the issues of land leased etc. however, if this option is not feasible than the land for mentioned facilities should be selected and leased prior to the start of construction phase. ▪ Land for mentioned facilities will be directly rented from the private landowners by the Contractors. The provisions of the Land Acquisition Act (LAA), 1894 will not be involved as the acquisition of the land will be temporary and will be covered by short-term lease agreements between the landowners and Contractor. Rental terms should be negotiated to the satisfaction of the concerned landowners	DC	CWD

Sr. No.	Parameters	Target	Impact	Mitigation Measures	Responsibility	
					Implementation	Supervision / Monitoring
			site-specific, temporary, and reversible.	and the agreement should be in local language to make the process clear. ▪ In addition, these project facilities should be located at a minimum distance of 500 meter from the existing settlements, built-up areas, archaeological and cultural monuments as the case may be. Prior to the commencement of the construction activities, the Contractor should submit a construction camp development/management plan to the Engineer-in charge and the PEPA (if required) for its scrutiny and approval. As far as possible, waste/barren land i.e. areas not under agricultural or residential use and natural areas located at high elevation should be used for setting up the contractor camps.		
7.	Resource Conservation	To minimize unnecessary and excessive use of resources.	▪ Excessive water consumption by the construction staff may stress water resources in the project area and in certain cases may disturb the existing water supplies in the project area. ▪ Almost all the materials to be used in the construction of proposed project are non-renewable and	▪ Use potable water bowsers for construction works and mineral water bottles/ treated or filtered ground water for drinking purpose; ▪ Plan for the provision/purchase of adequate insulation to reduce heat loss through batching plants; ▪ Reduction of wastage of water through training of workers involved in water use; ▪ Reuse of construction waste materials may be adopted wherever possible;	DC	CWD

Sr. No.	Parameters	Target	Impact	Mitigation Measures	Responsibility	
					Implementation	Supervision / Monitoring
			therefore their efficient use is necessary to make it available for future use.	▪ Diesel and fuels with low sulphur content should be used to operate construction machinery and equipment; ▪ Efficient and well maintained equipment and machinery should be used; ▪ The equipment and machinery should be turned off when not in use; ▪ Ensure adequate insulation to reduce heat loss through batching plants; ▪ Regularly monitor CO and CO2 content of the flue gases to verify that combustion systems are using practical excess air volumes; ▪ Use of solar panels at construction camps may be considered and plan for use of solar panels at operational phase may also be considered; and ▪ A good camp design and an efficient worksite management plan can help the contractor to reduce the water demand, wastewater and solid waste volumes to the lowest levels.		
8.	Route (Alignment) Optimization	To avoid disturbance to environmental and social issues of resettlement and displacement of people.	▪ Improper route selection (in terms of ROW) of proposed project will lead to disturbance to environmental and social issues of resettlement and displacement of people.	▪ Most of the significant environmental, ecological and social impacts of the project have been addressed at the design phase. In order to minimize environmental, ecological and social issues at the detailed design stage, various features have been considered. The route alignment (with due consideration to RoW) has been finalized and efforts have been	DC	CWD

Sr. No.	Parameters	Target	Impact	Mitigation Measures	Responsibility	
					Implementation	Supervision / Monitoring
				made to avoid or minimize impacts on habitat, resettlement and relocation issues and disturbance to sensitive receptors. ▪ By considering the optimization of route, the impact of route alignment has been reduced to low significance.		
9.	Change in Hydrologic Regime	To avoid or minimize change in water flow pattern and disturbance to water flow (as the proposed road will cross Jhang Branch Canal and minor distributaries), which will cause adverse impacts on communities that rely on these water bodies.	▪ There might be change in water flow pattern and disturbance to water flow occurred which will cause adverse impacts on communities that rely on these water bodies.	▪ For the crossing of the canal and other similar structures bridges will be constructed and / widened. While culverts and other possible arrangement will be accomplished in design for the crossing of nullahs/ drains. Bridges on water channels shall be properly designed to accommodate design flows. Provision of culverts to control flood damages and provision of safety of embankments will be considered during the design of these arrangements.	DC	CWD
10.	Utilities	Minimize disruption to utilities as much as possible.	▪ Due to the proposed project, public utilities will be affected creating disruption of public services and inconvenience to the local residents.	▪ The provision in the design and budget for the relocation of the existing utility infrastructures wherever required shall be finalized in consultation with the concerned department; and ▪ All public utilities (e.g. electric lines, water pipes, power/ telephone lines, etc.) likely to be affected by the proposed project will be	DC	CWD

Sr. No.	Parameters	Target	Impact	Mitigation Measures	Responsibility	
					Implementation	Supervision / Monitoring
				relocated well ahead of time before the actual commencement of the construction works.		
11.	Flora	Evade tree / vegetation cutting as much as possible.	▪ During the pre-construction phase, activities such as installation of construction camps, construction of temporary roads and mobility of construction staff may damage the local vegetation/trees.	▪ The camps, mobility of machinery and construction of temporary road should be properly planned and well designed to avoid any loss to local green cover; ▪ It is recommended to establish the construction camps where minimum or no vegetation exists; ▪ Similarly, the alternate routes for roads and points for camps are recommended where no loss of vegetation is expected; and ▪ The location of construction camp(s) will be selected so, as to have limited environmental effect during construction phase and to reduce the cost and land requirement.	DC	CWD
12.	Fauna	To avoid disturbance / damage to the habitat of the wildlife.	▪ As movement and installations of machinery and vehicles will take place during this pre-construction phase so noise and habitat loss is expected. ▪ The routes of the available wildlife and other habitats may be affected due to camps set-up and machinery movements and installations.	▪ The standard measures must be considered prior to construction phase to minimize noise due to machinery movements and installations; ▪ The alternate routes and points are recommended to avoid any damage to locally available fauna; ▪ The construction camp management plan during the planning stage must consider fencing and gating to check the entry of animals in search of eatable goods; and	DC	CWD

Sr. No.	Parameters	Target	Impact	Mitigation Measures	Responsibility	
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			▪ Temporary road may also affect the habitat of locally available fauna.	▪ Similarly, waste management plan of the camps must be considered at the planning stage to prevent wild animals and birds.		
Construction Phase						
A.			**B. Physical Environment**			
1.	Soil	To minimize soil erosion, contamination, deep excavation and seepage runoff.	▪ Construction activities such as clearing of earth, levelling, piling, compaction, carpeting, pavement finishing will affect the existing soil condition in the CoI. ▪ The clearing of vegetation can also loosen the soil and make it more susceptible to erosion due to wind and rain. ▪ There is also a possibility of silt runoff during rainy season causing soil erosion. ▪ The soil contamination occurs at all construction stages: during the design and survey work, during the construction of road, directly during the work on the construction site. Land	▪ Good engineering practices will help to control or minimize the soil erosion both at the construction sites and in peripheral areas. All the disturbed areas need to be protected against soil erosion by stripping and stockpiling of all the available topsoil for later re-vegetation. Special slope protection measures will be adopted in the sensitive areas and along the shoulders of roads and excavations shall be kept confined to the specified foundation spots as per the approved engineering drawings. Unnecessary excavations should be avoided; ▪ The provision for vegetation with a fast growing crops/trees and a native seed mix immediately after fill placement to prevent scour and to encourage stabilization will be made in the design. Use of stone pitching or riprap will also be provided in the design at appropriate places especially around bridges, culverts. Provision for rip-rap in discharge zones from drainage structures will be made in the design to reduce erosion. Down drains/chutes will be lined with	Construction Contractor	Supervisory Consultant / CWD

Sr. No.	Parameters	Target	Impact	Mitigation Measures	Responsibility	
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			may be contaminated due to the spillage of chemicals, fuels, solvents, oils, paints, concrete, solid waste generated at campsites etc.	rip-rap/masonry or concrete to prevent erosion. Side slopes will be adjusted to a gradient necessary to reduce erosion potential or, if steeper, stabilized, covered with riprap or other material to prevent soil erosion. Site restoration plan for the Project will be strictly followed; ▪ The Contractors will be required to instruct and train their workforce in the storage handling and management of materials and chemicals that can potentially cause soil contamination; ▪ Material Safety Data Sheets (MSDS) will be strictly followed during handling and storage of chemicals; ▪ Soil contamination due to concrete transportation will be minimized by placing all containers in casings; ▪ Solid waste generated at the camp sites will be properly treated and safely disposed only in the demarcated waste disposal sites/areas; ▪ If any contaminated soils are found, they shall be removed and deposited in a sealed pit in an area agreed with the concerned; and ▪ Use of modern, well-maintained machinery and vehicles by the contractor to avoid emissions and leakages; ▪ Soils removed during construction would be stockpiled for reuse where possible; and		

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				▪ Runoff from washing of equipment and gadgets should be drained into either a septic tank or a sand-gravel bed for removal of the grit and contaminants.		
2.	Borrow/ Open Pits	To avoid land disputes, soil erosion, loss of potential cropland, loss of vegetation, landscape degradation, and damage to road embankments.	▪ Borrow/ open pits and associated excavation activities may result in land disputes, soil erosion, loss of potential cropland, loss of vegetation, landscape degradation, and damage to road embankments. Borrow/ Open pits may also become potential sources of mosquito breeding and may prove hazardous to humans, livestock and wildlife.	▪ Necessary permits will be obtained for any borrow pits from the competent authorities; ▪ In borrow pits, the depth of the pits will be regulated so that the sides of the excavation will have a slope not steeper than 1: 4; ▪ Soil erosion along the borrow pit will be regularly checked to prevent/ mitigate impacts on adjacent lands; ▪ In case borrow pits are filled with water, measures have to be taken to prevent the creation of mosquito-breeding sites; and ▪ Borrow pits will be used for construction waste, but during the excavation, top 20 cm soil cover will be preserved for vegetation after the filling of the pits. This is the best way to restore the flora of that area.	Construction Contractor	Supervisory Consultant / CWD
3.	Air Quality	To minimize air pollution and maintain the air quality.	▪ Potential impacts on the air quality during the construction stage will be due to the fugitive dust and the exhaust gases generated in and around the construction site. Dust is a major component of air	▪ All vehicles, machinery, equipment and generators used during construction activities should be kept in good working condition and be properly tuned and maintained in order to minimize the exhaust emissions;	Construction Contractor	Supervisory Consultant / CWD

Sr. No.	Parameters	Target	Impact	Mitigation Measures	Responsibility	
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			pollution during road construction. Emissions are generated mainly from the following construction activities: ▪ Site clearance and use of heavy vehicles and machinery/equipment etc. at construction site; ▪ Procurement and transport of construction materials such as sand, cement, etc. to the construction site; ▪ Other Gaseous emissions during construction result from operating of construction vehicles, plant and equipment; ▪ Increase in air pollution levels without project and with project during construction period (for mobile & stationary sources) is predicted from construction machinery, equipment, which reveals that there shall not be significant contribution	▪ Open burning of solid waste from the Contractor's camps and at construction site should be strictly banned; ▪ Preventive measures against dust should be adopted for on-site mixing and unloading operations; ▪ Construction materials (sand, gravel, and rocks) and spoil materials will be transported trucks covered with tarpaulins and all vehicles (e.g., trucks, equipment, and other vehicles that support construction works) will comply with the PEQS (as amended) for carbon emissions and noise; ▪ Regular water sprinkling of the site should be carried out to suppress excessive dust emission(s); ▪ Emissions from power generators and construction machinery are important point sources at the construction sites. Proper maintenance and repair is needed to minimize the hazardous emissions; ▪ Emissions from batching / asphalt plants can be controlled efficiently by the installation of cyclone / scrubbers. Diesel operated equipment should be equipped with well-maintained fuel filter and may be replaced timely (if required). In addition to that, regular maintenance activities comprising changing of		

Sr. No.	Parameters	Target	Impact	Mitigation Measures	Responsibility	
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			towards pollution due to the construction activity of the project if mitigation plan will be implemented and monitored in proper sense; and ▪ Asphalt heating.	lubricating oil, changing the air and fuel filter, cleaning the fuel system, draining the water separators and proper tuning may also help in reducing the emissions from diesel generators; ▪ Construction equipment is generally left idling while the operators are on break or waiting for the completion of another task. Emissions from idling equipment tend to be high. Existing idling control technologies, which automatically shut the engine off after a pre-set time can reduce emissions, without intervention of the operators; ▪ PEQS applicable to gaseous emissions generated by construction vehicles, equipment and machinery should be enforced during construction works; ▪ Service roads (used for earthmoving equipment and general transport) should be regularly sprayed with water during dry weather; ▪ All excavation work should be sprinkled with water; ▪ Construction workers should be provided with masks for protection against the inhalation of dust; ▪ Vehicles used for construction should be tuned properly and regularly to control emission of exhaust gases;		

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				▪ Ensure precautions to reduce the level of dust emissions from hot mix plants, crushers and batching plants should be taken up; e.g. providing them as applicable, with protection canvasses and dust extraction units. Mixing equipment should be well sealed and equipped as per existing standards; and ▪ Regular monitoring of air quality in accordance with PEQS.		
4.	Noise and Vibration	To minimize the impact of noise on workers and on nearby communities.	▪ The noise and vibration will be produced due to the operation of construction machinery and equipment. ▪ The likely impacts due to noise are: ▪ Psychological effects of distraction of attention, irritation and short temperedness in the exposed persons due to persistently higher noise levels; and ▪ Noisy settings and higher background levels can cause temporary threshold shift and the consequent habit of speaking loud, which may cause damage	***Quieter Equipment*** A cost-effective way to reduce noise at a construction worksite is to buy quiet equipment. In addition, equipment in use should be the most suitable for the job. Avoid using equipment that is over-powered and, conversely, avoid using under powered equipment. Whenever possible the quietest equipment alternative should be used. In general, electronic powered equipment is quieter than diesel powered equipment and hydraulically powered equipment is quieter than pneumatic power. ***Modifying Existing Old Equipment*** The most common way to reduce the noise levels of common construction equipment is through worksite modifications. Some common worksite modifications consist of retro-fitting existing equipment with damping materials and mufflers. ***Barrier Protection***	Construction Contractor	Supervisory Consultant / CWD

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			to vocal cords in the persons exposed.	An effective way of reducing noise is to locate noisy equipment behind purpose-built barriers. The barriers can be constructed on the work site from common construction building material (plywood, block, stacks or spoils) or the barriers can be constructed from commercial panels which are lined with sound absorbing material to achieve the maximum shielding effect possible. To be effective, the length of the barrier should be greater than its height. The noise source should not be visible and barrier should be located as close as possible to either the noise source or the receiver. ***Work Activity Scheduling*** Work activity scheduling are administrative means to control noise exposure. Planning how noise sources are sited and organized on a work site can reduce noise hazards. Jobs can be rotated so that exposure time is limited. Transferring workers from a high exposure task to a lower exposure task could make the employee's daily noise exposure acceptable. Administrative controls include activity planning, for example, scheduling pavement breaking operations so as to reduce the number of work site workers exposed. In addition, noisy equipment should not be run for periods longer than necessary and should be switched off when not in use. ***Maintenance***		

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				Increased attention to maintenance of tools and equipment will reduce worksite noise levels. Maintaining plant and equipment in good order not only increases its life, but makes it safer to use and quieter. Loose and worn parts should be fixed as soon as possible. Ideally, the worksite should have a system in place for checking and servicing the various machines and power tools. ***Noise Perimeter Zones*** Noise Perimeter Zones (NPZ) are another administrative control to limit exposure to noisy processes or equipment to as few workers as possible. NPZ are areas where noise levels of 90 dB (A) or more are roped off and marked to keep out all workers who don't have to be there. NPZ can be set up using a sound level meter to find the safe distance from the source (90 dB (A)) and the NPZ can be set up at that distance. Noise does not radiate from the source at the same level in all directions. Noise from machinery can be higher in one direction than another because the noise can also be either absorbed or reflected from surfaces it contacts, such as the ground or a wall. Therefore, measurements should be taken at several points in an area where people might be working. Once noise levels that are 90 dB (A) or more are determined, rope off this area as the Noise Perimeter Zone. Exclude all workers who do not		

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				need to be in that zone. All workers who need to work within the zone must wear hearing protection.		
5.	Construction Camps Sites	Minimize disturbance to local people and local ecology.	▪ Due to the construction camps, loss of vegetation and dis-satisfaction of rehabilitation measures during and after completion of construction phase may occur. These impacts may include waste, soil pollution, groundwater pollution, dust, etc.	***Environmental*** ▪ Reinstate any temporary facilities to pre-existing conditions in ecologically sensitive areas. ▪ Implement landscaping plan for all facilities in areas where high landscape value and visual vulnerability to the proposed activities warrants site-specific landscape restoration measures. ▪ Operate equipment in a manner sympathetic to the ambient noise environment. Do not leave equipment idling unnecessary. ▪ Provide adequate warnings of impeding works to all potential receptors within a 1 km corridor surrounding the ROW via public notices and local news. ***Social*** State land will be a second preference for worker camp locations, followed by land where there is a willing lessee. Employment policies which aim to maximize job opportunities for local people will help to minimize tensions caused by different socio-cultural values. Training will be provided to all staff on camp management rules and overall discipline and cultural awareness. This will include, in appropriate languages: ▪ A briefing on camp rules	Construction Contractor	Supervisory Consultant / CWD

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				▪ A community relations orientation to increase awareness about the local area, cultural sensitivities and the project Code of Conduct ▪ Awareness-raising on health considerations, including sexually transmitted diseases (STDs). The construction contractor is required to develop a Construction Camp Management Plan to address: ▪ Discipline; ▪ Community liaison; ▪ Ethnic tensions and; ▪ Communicable diseases. A Code of Conduct and Camp Rules will be required within the Construction Camp Management Plan, which provides policies and a disciplinary framework with respect to worker behavior. ***Camp Location*** ▪ The construction contractor will be required to assess the environmental/social sensitivity of any additional or alternative sites prior to their approval for adoption; ▪ The contractor(s) should provide plan to CWD for removal & rehabilitation of site upon completion; ▪ Photographical and botanical inventory of vegetation before clearing the site; and ▪ Compensatory plantation to be scheduled when construction works near end.		

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6.	Wastewater Generation at Construction Camps	To minimize Wastewater generation at construction camps to the extent possible.	▪ Wastewater will be generated at the construction camps and from construction activities. ▪ If the generated wastewater is not properly treated or disposed of, this may contaminate the surface water sources such as nullahs, drains, water channels i.e. Jhang Branch Canal, small distributaries etc. apart from soil contamination.	▪ Domestic and chemical effluents from the construction camp will be disposed by the development of on-site sanitation systems i.e. septic tanks (as shown in Figure 7.1); ▪ Proper monitoring to check the compliance of PEQS will be carried out; and ▪ Sewage from construction camps will be disposed of after proper pre-treatment and processes such as soakage pit. ▪ The Contractor(s) will be responsible to submit details of site-specific wastewater management plan along with details of wastewater collection, transportation and its disposal.	Construction Contractor	Supervisory Consultant / CWD
7.	Solid Waste (Construction, Municipal and Hazardous Waste)	To avoid and minimize nuisance and environmental pollution at construction site, and at construction camps due to solid waste.	▪ Considering the labourers (about 250 in numbers) residing in the construction camp and the locally available labour, an average solid waste generation rate of 0.5 kg/capita/day is adopted for the estimation of solid waste generation. ▪ The major components of the labour camp waste will be garbage, putrescible waste, rubbish and small	▪ All the solid waste from the camps will be properly collected at source by placing containers and disposed of through proper solid waste management system. The Contractor will coordinate with local representatives and administration of the concerned solid waste management department for the disposal of solid waste; ▪ The Contractor must develop a plan of action with the help of concerned solid waste management department for transporting the waste to the disposal site; ▪ Toxic waste will be handled, stored, transported and disposed-off separately;	Construction Contractor	Supervisory Consultant / CWD

Sr. No.	Parameters	Target	Impact	Mitigation Measures	Responsibility	
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			portion of ashes and residues. ▪ Other type of wastes may include inorganic construction wastes including hazardous waste.	▪ The waste will be properly sealed in containers with proper labels indicating the nature of the waste; ▪ Waste Management Plan will be developed to implement an efficient and responsive solid waste management system during construction phase. Recyclable wastes e.g. steel bars will be sold to waste vendors; ▪ Reusable material will be used as a filling material during ground levelling; ▪ Solid waste generated during construction will be safely disposed in demarcated waste disposal sites and the contractor will provide a proper waste management plan; ▪ The site will be restored back to its original conditions after construction completion; ▪ The excavated materials that are unsuitable for use will need to be stored, transported and disposed of appropriately at designated sites by construction contractor; ▪ The contractor will develop specific environmental management plans for asphalt plants and concrete batching plants. These plans will incorporate the general measures as applicable to the entire project, but will also have focused mitigations for solid waste from these plants; and		

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				▪ The plan will be reviewed and approved by Supervision Consultants.		
8.	Water Quality (Surface and Groundwater Contamination)	To avoid or minimize deteriorating the quality of water.	▪ The proposed project will cross the Jhang Branch Canal, numbers of water channels/distributaries and nullahs/ drains at different locations. These surface water resources may get contaminated by the fuel and chemical spills, or by solid waste and effluents generated by the kitchens and toilets at the construction camp sites. ▪ Moreover, runoff from the chemical storage areas may also contaminate the surface water bodies. ▪ Surface water might get contaminated due to the disposal of construction waste generated due to the Project activities and also result in jeopardizing the health of natives that use this water for domestic purposes.	▪ Construction camps will be established in areas with adequate natural drainage channels in order to facilitate the flow of the treated effluents after ensuring that PEQS are met; ▪ The surface and groundwater reserves will be adequately protected by installing screens and barriers to protect the source of contamination such as construction and oily waste that will degrade its potable quality; ▪ The proponent will ensure that the construction work is confined within the ROW and water bodies are prevented from pollution during construction; ▪ The solid waste will be disposed of at designated landfill sites to sustain the water quality for domestic requirements; ▪ Regular water quality monitoring according to determined sampling schedule; ▪ The contractor will ensure that construction debris do not find their way into the drainage or irrigation canals which may get clogged; ▪ Work near the Jhang Branch canal area will be kept to a minimum and protective walls will also be constructed;	Construction Contractor	Supervisory Consultant / CWD

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				▪ To maintain the surface water flow/drainage, proper mitigation measures will be taken along the road, like drainage structures in urban areas; ▪ Prohibit washing of machinery and vehicles in surface waters, provide sealed washing basins and collect wastewater in sedimentation/retention pond; ▪ Construction work close to the distributaries or other water bodies will be avoided, especially during monsoon period; ▪ Wastewater effluent from the Contractors' workshops and equipment washing-yards will be passed through gravel/sand beds to remove oil/grease contaminants before discharging into the natural streams. According to the PEQS, the BOD concentration in sewage must be brought down to less or equal to 80 mg/l before being discharged into a natural stream having capacity to dilute the effluent. For wastewater apart from BOD, COD of 150 mg/l will also be checked; and ▪ Similarly, if the sewage after treatment is to be discharged on to the land it will meet the requirements of the PEQS for disposal of wastewater.		
9.	Water Channels and Natural Drainage	To avoid blockage of water channels and natural drainage due	▪ The alignment crosses water channels, nullahs, drains as mentioned above. These water channels and drains	▪ Unnecessary widening beyond the proposed design of the road shall be avoided at straight portions and on bends;	Construction Contractor	Supervisory Consultant / CWD

Sr. No.	Parameters	Target	Impact	Mitigation Measures	Responsibility	
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		to construction activities.	may get blocked and the catchment of the downstream may be disturbed during construction phase.	▪ The natural drainage pattern will not be disturbed, culverts and bridges will be constructed where required; ▪ Surplus soil and cleared vegetation will be disposed-off properly so as to avoid disturbance and blockage of natural drainage; and ▪ The Project Director (PD) of CWD in consultation with Irrigation Department allow local re-adjustments in foundation treatment or any other small changes, wherever required.		
10.	Impacts of Heavy Traffic	To avoid traffic jams and congestions.	▪ Due to the proposed construction activities and movement of heavy project vehicles for construction material supply, traffic problems may arise for the commuters and transporters travelling to the Project Area. ▪ The problems will include traffic jams and inconvenience to the public passing through the Project Area. ▪ It will also increase traffic load on the existing road network or access roads ultimately deteriorating the	▪ Movement of vehicles carrying construction materials and equipment/machinery will be restricted during the daytime to reduce traffic load and inconvenience to the local population; ▪ Construction vehicles, machinery and equipment will be parked at designated areas (at construction camps site) to avoid un-necessary congestions along the major roads; ▪ The speed of the vehicles will be controlled (at 30 to 40 km/hr) to reduce the probability of severe accidents, soil erosion, debris flows due to vibrations and dust emission; ▪ Damages of roads due to construction vehicles will be instantly repaired and/or compensated after the completion of work; ▪ Proper sign boards will be provided for smooth flow of traffic;	Construction Contractor	Supervisory Consultant / CWD

Sr. No.	Parameters	Target	Impact	Mitigation Measures	Responsibility	
					Implementation	Supervision / Monitoring
			existing condition of the roads. ▪ The movement of vehicles along the haulage routes will cause soil erosion, debris flow, dust emissions, vibrational impacts, etc.	▪ Period of construction and area / location of construction site shall be informed to public in general and specifically to local residents; and ▪ Any closure of the roads (especially main roads) and deviations / diversions proposed should be informed to the riders through standard signs and displays.		
11.	Greenhouse Gases and Climate Change	To avoid emissions of greenhouse gases.	▪ The main sources of greenhouse gases (CO2, CH4, NOx etc.) during the construction activities will include both mobile and stationary sources. ▪ The mobile source will be the construction and transportation vehicles while the stationary source will be the batching and asphalt plants. ▪ Emission of greenhouse gases from project activities will contribute in global warming and other climatic changes on regional and global scale.	▪ Regular motioning of the equipment and vehicles for engine efficiency; ▪ Avoid idling of construction vehicles; ▪ Alternative energy resources shall be considered where possible; and ▪ PEQS applicable to gaseous emissions generated by construction vehicles, equipment and machinery shall be enforced during construction works.	Construction Contractor	Supervisory Consultant / CWD
12.	Natural and Man-Made Disasters	To avoid or minimize damages occurring due to earthquake,	▪ Natural disasters (earthquakes) and accidents such as fire, falls, slips and	▪ An Emergency Response Plan (ERP) for earthquakes and manmade disasters should be developed by contractor in coordination with SC	Construction Contractor	Supervisory Consultant / CWD

Sr. No.	Parameters	Target	Impact	Mitigation Measures	Responsibility	
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		fire, falls, slips and trips.	trips may result in injuries, financial losses and may even lead to deaths. The workers shall be trained and facilitated to cope with such disasters.	and CWD and implemented in close consultation with the RESCUE Services and other concerned departments; ▪ Training of the Contractor and CWD staff and employees regarding the emergency procedures and plans should be regularly conducted; ▪ Emergency numbers should be clearly posted at all disposal stations; ▪ Minor incidents and near misses should be reported, and preventive measures should be formulated accordingly by the CWD Management; ▪ Contractor should designate one of the staff members to act as lead person for emergency response and safety issues; ▪ Contractor should be responsible to provide first aid facilities at construction site as well as camp; ▪ Contractor should provide safety equipment such as helmets, goggles, ear plugs, gloves, safety shoes etc. to the workers; ▪ Safety signage should be erected at potentially dangerous working areas; ▪ Proper lighting arrangements should be ensured for night shift working, if required; ▪ Contractor should be responsible to provide insurance against accidental death and injuries to workers and public; and		

Sr. No.	Parameters	Target	Impact	Mitigation Measures	Responsibility	
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				▪ Public and animal access to construction site should be restricted by providing fences.		
C. Ecological Environment						
13.	Flora	Avoid tree cutting and protection of floral species from disturbance and impairment	▪ The project will involve destruction of vegetation cover particularly along the RoW. It is initially examined that approximately 1,800 trees will be affected along the RoW by implementation of proposed dualization.	▪ Incorporate technical design measures to minimize removal of trees, if possible; ▪ Cutting of trees and disturbance shall be avoided, as far as possible so, that negative effects on the process of natural regeneration of species are minimized and possible alternate route must be considered for proposed road, in which minimum ecological and environmental losses are expected; ▪ A Tree Plantation Plan has been formulated (**Annex-XIII**) that shall be implemented with the technical support of concerned Agriculture and Forest Department; ▪ As a principal, ten trees shall be planted in place of felling of one tree in consideration of mortality; ▪ The Forest Department and agriculture department shall involve the local communities to carrying out plantation; ▪ Open fires should be banned in the Project Area to avoid fire hazards; ▪ Clearing of vegetation cannot be avoided at the areas specified for project structures, but damage to the natural vegetation may be minimized by establishing camp sites,	Construction Contractor	Supervisory Consultant / CWD

Sr. No.	Parameters	Target	Impact	Mitigation Measures	Responsibility	
					Implementation	Supervision / Monitoring
				workshops and batching plants on waste/barren land rather than on forested or agriculturally productive land; ▪ However, if such type of land is not available, it shall be ensured that minimum clearing of the vegetation will be carried out and minimum damage will be caused to trees and undergrowth; ▪ Construction vehicles, machinery and equipment will remain confined within their designated areas of movement; ▪ The Contractor's staff and labor shall be strictly directed not to damage any vegetation such as trees or bushes. The contractor' workforce shall use the paths and roads for movement and shall not be allowed to trespass through farmlands or forest areas; and ▪ Contractor shall provide gas cylinders at the camps for cooking purposes and cutting of trees/bushes for fuel shall not be allowed.		
14.	Fauna	Protection of floral species from disturbance and hunting	▪ During construction phase the existing population of mammals and reptiles of the construction areas will be affected due to disturbance arising from construction activities involving excavation, blasting, movement of machinery and	▪ Care shall be taken during construction activities to avoid purposely or chance killing of animals; ▪ If found any wild species and habitat during construction that must deal carefully and local wildlife department officials should be called; ▪ Hunting, poaching and harassing of wild animals shall be strictly prohibited, and Contractor shall be required to instruct and supervise its labour	Construction Contractor	Supervisory Consultant / CWD

Sr. No.	Parameters	Target	Impact	Mitigation Measures	Responsibility	
					Implementation	Supervision / Monitoring
			vehicular traffic, movement of labor, camping, etc. ▪ The existing animals will leave the directly affected areas due to construction activities and human intervention. ▪ Some animals particularly reptiles may get killed during the earthworks operations. ▪ Moreover, the movements of the mammals and reptiles will be restricted during the construction phase.	force accordingly and clear orders should be given in this regard; ▪ The Contractor must be held responsible for instructing his work force accordingly and for enforcing this restriction. In addition, this shall have to be controlled by the Wildlife Department; ▪ Provision of culvert/tunnel for the movement of different faunal species across the project road present in the project area; ▪ Special measures shall be adopted to minimize impacts on the wild birds, such as avoiding noise generating activities during the critical periods of breeding; ▪ Noise generating activities shall not be carried out during the night by the work force, clear orders should be given by the contractor; ▪ Similarly, wastes of the camps shall be properly disposed of to prevent it being eaten by animals, as it may be hazardous to them; and ▪ Efforts should be made to keep noise levels at acceptable levels (as per PEQS) produced by the construction activities.		
15.	Agriculture, Orchards and Trees	Avoid cutting / damage to agricultural area, crops, orchards and tree to the extent possible.	▪ Mostly the alignment of the proposed project fall in the very rich agricultural area and damages of crops, orchards and tree are expected during construction	▪ The budget for the proposed project will include provision for payment of compensation to farmers for the loss of any standing crops, or crops already sowed. It will be applicable for all standing crops within the acquisition area at the time of possession;	Construction Contractor	Supervisory Consultant / CWD

Sr. No.	Parameters	Target	Impact	Mitigation Measures	Responsibility	
					Implementation	Supervision / Monitoring
			activities, which may cause loss of income to affectees.	▪ The compensation value shall be calculated based on market value of the crops and average yields in the project area; ▪ In order to reduce the loss of agricultural land during the construction stage, existing haul routes will be preferred by the contractor, and the width of any new haul route shall be limited to the bare minimum required and approved by the engineer; ▪ Removal of all contractors' facilities from the project area shall be a contractual requirement, and land used for the construction camps can be restored to facilitate agriculture and the land used for the construction camp shall become cultivatable. ▪ Compensation for the loss of crops to the land owners and cultivators as the case may be will be paid, in accordance with the prevailing market prices and uniformity in rates will be ensured; and ▪ As far as possible, land within the ROW (which will be acquired) or otherwise barren land without any crop outside the ROW will be selected for the camp sites and disturbance to the crops and natural vegetation will be avoided as much as possible.		
D.			**E. Socioeconomic Environment**			

Sr. No.	Parameters	Target	Impact	Mitigation Measures	Responsibility	
					Implementation	Supervision / Monitoring
16.	Interference with other Utilities	Minimize disturbance to existing utilities	▪ Various utilities such as electrical poles and transmission lines, telephone lines, nullahs/ drains are situated within the RoW of the proposed project. ▪ These utilities will be relocated if there is any hindrance before the start of construction activities.	▪ Strengthening of utilities, wherever required; ▪ Close coordination with the concerned departments to curtail inconvenience to the residents of the Project area; and ▪ Timely public notification of unexpected disruption of services.	Construction Contractor	Supervisory Consultant / CWD
17.	Health and Safety	To avoid or minimize occupational and health hazards, community hazards, accidental risks and man-made disasters	▪ Occupational Health and Safety (OHS) related impacts will arise during construction activities including clearing of earth, levelling, compaction, carpeting, pavement finishing and testing & commissioning. ▪ The falls during inspection or maintaining pile rigs, erection of framework and other related activities may also occur. ▪ Eye injury can be caused by stone or metal particles.	▪ There will be proper control on construction activities and oil spillage leakage of vehicles; ▪ The labourers with different transmittable diseases will be restricted within the construction site; ▪ Ensure that the site is restricted for the entry of irrelevant people particularly children; ▪ Efforts will be made to create awareness about road safety among the drivers operating construction vehicles; ▪ Timely public notification on planned construction works; ▪ Close consultation with local communities to identify optimal solutions for diversions to maintain community integrity and social links;	Construction Contractor	Supervisory Consultant / CWD

Sr. No.	Parameters	Target	Impact	Mitigation Measures	Responsibility	
					Implementation	Supervision / Monitoring
			▪ Hazard of being hit by falling objects, major hand-arm and whole body vibration hazards, skin and respiratory tract irritation from exposure to cement dust, overexertion and awkward postures etc. will be another impact. ▪ Welding hazards include electric shock, fumes and gases, fire and explosions, falls from height, eye and head injuries etc. ▪ The construction areas located near the residential, settlements, may cause accident for the people moving near to those areas. ▪ Conflicts may arise between the local community and the construction workers, which may be related to religious, cultural or ethnic differences, or based on competition for local resources.	▪ Seeking cooperation with local educational facilities (school teachers, university management, students) at each village along the route for road safety campaigns; ▪ Provision of proper safety and diversion signage, particularly at urban areas and at sensitive/accident-prone spots; ▪ Setting up speed limits in close consultation with the local stakeholders; ▪ If identified, consider additional guard rails at accident-prone stretches and sensitive locations (near City, Dar-e-Arqam school, Tips College, Punjab and Aspire College, near FAST and Superior University, etc.). ▪ Construction Camp Management Plan (CCMP) and effective implementation of GRM may reduce this impact; ▪ The communicable disease of most concern during construction phase, like Sexually-Transmitted Disease (STDs) such as HIV/AIDS, will be prevented by successful initiative typically involving health awareness; education initiatives; training heath workers in disease treatment; immunization program and providing health service; ▪ Reducing the impacts of vector borne diseases will be accomplished through implementation of diverse interventions aimed at eliminating the		

Sr. No.	Parameters	Target	Impact	Mitigation Measures	Responsibility	
					Implementation	Supervision / Monitoring
				factors that lead to disease, which include prevention of larval and adult propagation of vectors through sanitary improvements and elimination of breeding habitat close to human settlements and by eliminating any unusable impounding of water; ▪ The Contractor will prepare the construction camp management plan which, in addition to other components, will include the labor influx management plan. This will be reviewed and approved by CWD; ▪ Contractor will take due care of the local community and observe sanctity of local customs and traditions by his staff. Contractor will warn the staff strictly not to involve in any unethical activities and to obey the local norms and cultural restrictions; ▪ Punjab Occupational Safety and Health Act 2019 ensures the compliance of occupational safety and health of the persons at workplace and to protect them against risks arising out of the occupational hazards; ▪ Compliance with the safety precautions for the construction workers as per International Labour Organization (ILO) Convention No. 62, as far as applicable to the Project Contract; ▪ Training of workers in construction safety procedures, environmental awareness,		

Sr. No.	Parameters	Target	Impact	Mitigation Measures	Responsibility	
					Implementation	Supervision / Monitoring
				equipping all construction workers with safety boots, helmets, gloves and protective masks, goggles, shields and monitoring their proper and sustained usage; ▪ Contractor will ensure the provision of medicines, first aid kits, ambulance etc. at the camp site; ▪ Work areas will be cordoned off where necessary; ▪ Contractors will instruct their staff to use Personnel Protective Equipment (PPE) (e.g., wire containment, displaying warning signs along the work site, communicating advance warnings to mats) to enhance the safety; ▪ Safety lookouts will be built to prevent people and vehicles from passing at the time of hot or cold work; and ▪ An emergency management plan must be devised by the contactor in close coordination with the provincial emergency services (Rescue 1122).		
18.	Health Impacts (Diseases)	Avoid spread of communicable diseases between workers and maintaining hygiene	▪ The labour works with different transmittable diseases may cause spread of these diseases in the local residents. ▪ COVID-19 Infected people can spread COVID-19 through their respiratory	▪ Arrange to run an active campaign, in the labour camp, to make people aware of the cause, mode of transmission and consequences of HIV/AIDS; ▪ SOPs related to the construction industry to control spreading of COVID-19, should be implemented by the contractor and should be strictly monitored;	Construction Contractor	Supervisory Consultant / CWD

Sr. No.	Parameters	Target	Impact	Mitigation Measures	Responsibility	
					Implementation	Supervision / Monitoring
			secretions via droplets produced when an infected person coughs or sneezes, etc.	▪ Strengthen the existing local health & medical services for the benefit of labour as well as the surrounding villages; ▪ Ensure cleanliness and hygienic conditions at the labour camp by ensuring proper drainage and suitable disposal of solid waste. Inoculation against Cholera will be arranged at intervals recommended by the Health Department; ▪ Locating a labour camp at least away from the villages (local settlement), and ▪ Keep all the camps, offices, material depots, machinery yards and work sites open for the inspection of health and safety measures and related documents.		
19.	Gender Issues	To avoid gender discrimination and harassment.	▪ A large influx of male labor may lead to an increase in human trafficking whereby women and girls will face safety and security issues. ▪ Increased opportunities for the host community to sell goods and services to the incoming workers can lead to child labor to produce and deliver these goods and services, which in turn can lead to enhanced school dropout.	▪ The contractor will be required to provide qualified key personnel to address the specific risks identified in the project. Contractors will specify key staff with the technical skill and experience to implement the mitigation measures; ▪ The bidding documents will include specific requirements that minimize the use of expatriate workers and encourage hiring of local workers, thereby minimizing labor influx; ▪ The bidders will be required to submit Codes of Conduct (CoCs) with their bids. The CoCs will set clear boundaries for acceptable and unacceptable behaviours of all individuals and	Construction Contractor	Supervisory Consultant / CWD

Sr. No.	Parameters	Target	Impact	Mitigation Measures	Responsibility	
					Implementation	Supervision / Monitoring
				companies and will be signed by companies, managers and individuals; ▪ All project consulting firms will also be required to submit Codes of Conduct with their proposals; ▪ The contractor will be required to establish anti-sexual harassment policies that governs conduct in the workplace; ▪ The contractor will be required to provide mandatory and repeated training to workers on sexual exploitation and abuse and HIV/AIDS prevention and on the content and obligations derived from the code of conduct; and ▪ Provisions will be set in contracts for dedicated payments to contractors for SEA prevention activities (e.g. training) against evidence of completion. The portion of the contract price will be guaranteed by a performance security linked to environmental and social contractor performance.		
20.	Loss of Income	To provide fair compensation to the affectees.	▪ During the construction activities, people will suffer loss in their annual income due to the loss of crops, orchards, trees etc.	▪ Fair, prompt and negotiated compensation for the crops and trees on private land will be provided to the affectees along with the land value; and ▪ Affectees will be involved in the valuation process of the Project.	Construction Contractor	Supervisory Consultant / CWD
Operational Phase						
A. Physical Environment						

Sr. No.	Parameters	Target	Impact	Mitigation Measures	Responsibility	
					Implementation	Supervision / Monitoring
1.	Ambient Air Quality	To avoid air pollution and emission of greenhouse gases	▪ Improvement in road condition will help to reduce traffic related emissions in the short term by allowing a smoother traffic flow. ▪ However, in the longer run, increased traffic levels may lead to higher values of emissions.	▪ CWD with the help of PEPA may set up system to monitor air quality along project area in accordance with PEQS for a specific period to record the quality of air during the operation phase; ▪ Setting up to system to monitor air quality along the project area in accordance with acceptable International Standards; Monitoring emissions of vehicle as per PEQS; ▪ Helping the owners and occupants of the affected premises to identify and implement special measure such as hedges and vegetation to reduce air pollution; and ▪ Increasing vegetation in the form of greenbelt is one of the preferred methods to mitigate air pollution. Plants generate oxygen, serve as a sink for pollutants, reduce the flow of dust and reduce the noise pollution too alongside the proposed project.	Environmental Representative of CWD	CWD
2.	Noise and Vibration	To avoid noise pollution	▪ The movement of vehicles and usage of horns will create noise which will be a hazard for the nearby residents/built-up areas.	▪ Provision of adequate noise barriers such as hedges and indigenous tree species will reduce the noise. Further Improvement can be made by enforcing the laws and getting the vehicles tested, regularly after a specific time period, by some reputable vehicle testing laboratory and obtaining a certificate. Noise measurements should be carried out at locations with respect to the schedule specified in the Environmental	Environmental Representative of CWD	CWD

Sr. No.	Parameters	Target	Impact	Mitigation Measures	Responsibility	
					Implementation	Supervision / Monitoring
				Monitoring Plan (EMMP) to ensure the effectiveness of mitigation measures; ▪ Use of horn should be strictly prohibited in the close proximity of the built-up areas; ▪ Proper signboards should be installed to ensure reduce noise levels in the project area; ▪ Enforcement and penalties against traffic rules violators; and ▪ Noise barriers may be installed / constructed near the built-up areas.		
3.	Road Safety and Maintenance	To ensure road safety and maintenance during the entire design life	▪ Enhanced vehicular movement and speed in the long run may result in road safety issues like traffic accidents. ▪ During the operation phase, related road maintenance works will be conducted time to time which may lead to social and environmental issues like traffic management, inconvenience to local residents, public safety, vehicular emissions, dust and increase in noise.	▪ Strict enforcement of speed limits, installation of speed guns and channelization of traffic with respect to categories (heavy vehicle traffic and light vehicle traffic), should be ensured for the smooth flow of traffic moving from major road crossings. Enforcement of penalties for the violators will reduce the significance of this impact; ▪ Best Management Practices should be used for all the maintenance works; ▪ Timely completion of all the maintenance works according to the agreed schedule; ▪ Traffic management plan should be devised and implemented; and ▪ HSE protocols should be strictly followed and implemented to avoid any incident/accident.	Environmental Representative of CWD	CWD

Sr. No.	Parameters	Target	Impact	Mitigation Measures	Responsibility	
					Implementation	Supervision / Monitoring
4.	Drainage	To ensure maintenance of the road drainage system.	▪ During the operational phase, poor maintenance of the road drainage system, particularly during the monsoon season can cause nuisance to the travellers and public due to flooding in the existing drainage line. ▪ In case of chocking of road drainage, the increased surface runoff due to heavy rains will accumulate at the surface and can cause traffic jams.	▪ The impact can be controlled/reduced by timely and continuous maintenance/ cleaning of the drainage system; and ▪ Placement of sign boards instructing not to dispose of solid waste to avoid chocking of drain along the road alignment.	Environmental Representative of CWD	CWD
B. Ecological Environment						
5.	Flora and Fauna	Avoid damage and impairment to local flora and fauna	▪ Low level impact is expected at operational phase on flora and fauna due to the Operational and Maintenance activities.	▪ The implementation of tree plantation plan recommended in compensation for cutting of trees should start working during operational stage, to ensure the ecological balance and to avoid any impact on local Environment; ▪ Large scale planting with suitable indigenous fruit and forest trees, shrubs and ornamental plants in the form of Tree Groves, and Linear plantation will be carried out in accordance with the Tree Plantation Plan to improve aesthetic value and offset the effect of removal of vegetation. It will help in absorbing flue gases, emitting from a large number of vehicles and public transport	Environmental Representative of CWD	CWD

Sr. No.	Parameters	Target	Impact	Mitigation Measures	Responsibility	
					Implementation	Supervision / Monitoring
				passing through the project area, which shall improve the air quality; ▪ The saplings planted in the project area against the trees affected should be properly maintained throughout their initial growth period in terms of water requirement and necessary nutrients by CWD or relevant department; ▪ Proper check and balance for above activities is highly recommended. Plantations raised, must be maintained according to the Silvicultural practices, which include proper irrigation, cleaning, pruning, thinning at prescribed intensity, Silt clearance and Trench-opening, etc. ▪ Maintenance and security of the plantation should be done for at-least five years (in consultation with the forest department). Measures such as fencing, watch guards and fire protection should be considered; ▪ All activities must be done under the technical supervision of Forest Department; ▪ The pathways of locally available wildlife and livestock for food, Shelter and other normal activities must be compensated with proper alternative routes/pathways & water points must be provided to minimize the impact and movement of available wild and domesticated animals.;		

Sr. No.	Parameters	Target	Impact	Mitigation Measures	Responsibility	
					Implementation	Supervision / Monitoring
				▪ In proper consultations with Forest and Wildlife department, permanent water points for available fauna must be provided to conserve local ecosystems and biodiversity. ▪ Strict control must be exercised for stoppage of killing/poaching of available wildlife species by enhancing protection practices and deploying effective watch and ward system; ▪ The precautionary measures described for future shall also be applicable during operation phase as relevant for the conservation of wildlife species in the Study Area; and ▪ Proper fence must be provided along the roadside to avoid road killing of wildlife, livestock and most importantly any inconvenient for local inhabitants.		
C. Socioeconomic Environment						
6.	Health and Safety	Ensure healthy and safe environment for community members and workers	▪ The change in land use (residential to commercial) may pose privacy issues and accident hazards. The socio-economic impacts due to traffic congestion, air pollution and traffic delays may include loss of work time, waste of fuel, reduced efficiency of people due to adverse impacts on human	▪ Redefining basic land use allocation standards; ▪ Improvements in the design considerations of proposed road alignment so as to promote sustainable development of commercial areas; and ▪ Land use policies such as development restrictions and zoning codes (residential or commercial) and implementation of related By-Laws.	Environmental Representative of CWD	CWD

Sr. No.	Parameters	Target	Impact	Mitigation Measures	Responsibility	
					Implementation	Supervision / Monitoring
			health and resultant increase on health expenditures.			

KEY

DC	Design Consultant
CC	Construction Contractor
SC	Supervision Consultant
CWD	Communication and Works Department

8.6 ENVIRONMENTAL MONITORING

Environmental Monitoring is undertaken during both the construction and operational phases, to ensure the effectiveness of the proposed mitigation measures against identified adverse environmental impacts in the EIA report.

The main objectives of the construction phase monitoring plan will be to:

- Monitor the actual impact of the works on the project site physical, biological and socio-economic receptors;
- Recommend mitigation measures for any unexpected impact or where the impact level exceeds the anticipated impact;
- Ensure compliance with legal obligations including safety on construction site; and
- Monitor the rehabilitation of borrow areas and the restoration of construction campsites as described in the EMMP; and
- Ensure the safe disposal of excess construction materials.

The main objectives of monitoring during the operational phase will be to:

- Appraise the adequacy of the EIA with respect to the Project's predicted long term impacts of operation on physical, biological and socio-economic environment;
- Evaluate the effectiveness of the mitigation measures proposed in the EMMP and recommend improvements, if and when necessary; and
- Compile periodic Environmental Monitoring reports on the basis of recommendations in EMMP.

Table 8.2 provides environmental monitoring schedule for construction and operational phases of the proposed Project.

Table 8-2: Environmental Monitoring Schedule

Sr. No.	Receptors	Monitoring Parameters / Performance Indicator	Location	Monitoring Mechanism	Monitoring and Reporting Frequency	Duration
1.	Water Resources/ Water Quality	Monitoring of Physical, Chemical and Biological parameters and its compliance with PEQS, 2016 for surface water and drinking water.	• Major receptors are Jhang Branch Canal, Saim Nullah, Chenab River, and commercial / residential areas and educational and health institutes within the ROW of the proposed project alignment. • Other proposed effluent discharge points are: ▪ Contractors camps; ▪ Concrete preparation plants; ▪ Fuel (Petrol. Oil and Grease) products storages; and ▪ Vehicle and machines repairing and servicing yards.	• Visual checks of laboratory activities; and • Discrete grab sampling and laboratory testing of water samples by EPA-Punjab Certified Laboratory for monitoring.	• Once before the start of construction activities; • On quarterly basis during the construction phase; • Bi-annually for at least one year during O&M phase; and • Visual inspection daily.	• As per PEQS, 2016.
	Soil Contamination	Soil contamination due to effluent / surface runoff and uncontrolled solid waste disposal activities at sites.	• Along Faisalabad-Chiniot-Sargodha Road; and • Other proposed sampling sites are: ▪ Construction camps;	• Visual observations and checking of laboratory activities; • Sampling and laboratory testing for soil samples.	• Once before the start of construction activities; • On quarterly basis during the construction phase;	

Sr. No.	Receptors	Monitoring Parameters / Performance Indicator	Location	Monitoring Mechanism	Monitoring and Reporting Frequency	Duration
			▪ Equipment washing yards; ▪ Spillage points of fuel, chemicals and lubricants.		• Bi-annually for at least one year during O&M phase; and • Visual inspection daily.	
	Land Resources	Land use changes on agriculture, residential and commercial areas due to the construction of proposed project alignment.	Faisalabad-Chiniot-Sargodha Road.	• Random visits and visual observations of land use changes.	• Once before the start of construction activities; • On monthly basis during the construction phase; and • Bi-annually for at least one year during O&M phase.	
	Dust Emissions	Monitoring of PM_{10} and $PM_{2.5}$ and its compliance with PEQS, 2016 for Ambient Air.	Sensitive receptors (residential area, educational and health institutions, religious places and construction camps) within the ROW of the proposed road alignment. However; estimated sampling points are three (3) which will be verified during construction stage.	• Visual checks of laboratory activities; • Onsite Ambient Air Monitoring Equipment; and • Daily visual monitoring of dust emissions at construction route.	• Once before the start of construction activities; • On quarterly basis during the construction phase; and • Bi-annually for at least one year during O&M phase.	

Sr. No.	Receptors	Monitoring Parameters / Performance Indicator	Location	Monitoring Mechanism	Monitoring and Reporting Frequency	Duration
	Noise Pollution	Monitoring of Noise Level and its compliance with PEQS 2016 for Noise.	Sensitive receptors (residential area, educational and health institutions, religious places and construction camps) within the ROW of the proposed road alignment. However; estimated sampling points are three (3) which will be verified during construction stage.	• Visual checks of laboratory activities; and • Onsite Noise Monitoring using Sound Meter.	• Once before the start of construction activities; • On quarterly basis during the construction phase; and • Bi-annually for at least one year during O&M phase.	
	Fumes and gases	Monitoring of CO, CO_2, SOx, NO_x, Lead and $PM_{2.5}$ PM_{10}, Vehicular emissions and its compliance with PEQS 2016.	Sensitive receptors (concrete plants, construction camps and vehicular emissions) within the ROW of the proposed road alignment. However; estimated sampling points are three (3) which will be verified during construction stage.	• Visual checks of laboratory activities; • Onsite Ambient Air Monitoring Equipment; and • Daily visual monitoring of dust emissions at construction route.	• Once before the start of construction activities; • On quarterly basis during the construction phase; and • Bi-annually for at least one year during O&M phase.	
	Ecological Resources	Disturbance to natural habitat and uncontrolled floral cutting which can be avoidable.	Natural habitats within the ROW / COI of the proposed alignment.	• Visual checks to ensure that only marked trees are cut within the Project corridor; and • Monitoring of Wildlife / birds hunting.	• Once before the start of construction activities; and • Visual inspection daily / weekly during construction and O&M phase.	

Sr. No.	Receptors	Monitoring Parameters / Performance Indicator	Location	Monitoring Mechanism	Monitoring and Reporting Frequency	Duration
	Public Infrastructure	Disturbance or damage to public infrastructure (if any).	Public infrastructures within the ROW/COI of the proposed alignment. These structures will be verified prior to the start of construction activities.	• Random visits; and • Consultations with AP's.	• Once before the start of construction activities; and • On quarterly basis during the construction phase.	
	Community around the Project corridor	• Use of common resources; • Hindrance to mobility; and • Community health and safety.	Communities within the ROW/COI of the proposed alignment.	• Community consultations.	• Once before the start of construction activities; and • On quarterly / monthly basis during the construction phase.	

8.6.1 Responsibilities for Environmental Testing and Reporting

The Construction Contractor (CC) will be responsible for environmental monitoring and reporting throughout the construction phase under the supervision of Environmental Engineer of Supervision Consultant (SC); in coordination with Project Director, CWD. During construction phase, environmental testing reports will be prepared on quarterly basis and one comprehensive report will be prepared at the end of the construction phase and will be submitted to each of the following authorities and institutions: (i) CWD and (ii) EPA- Punjab.

During the first year of the project operation, concessionaire will be responsible to conduct environmental testing and monitoring along with its cost through a third party contractor and EPA-Punjab certified lab. The reports will be prepared biannually and one comprehensive report will be prepared annually and submitted to the EPA-Punjab. Contents of the final report will include results of environmental monitoring in comparison to the standards for the various parameters, location and sampling time along with recommendations for the future environmental testing and monitoring.

8.6.2 Budget Estimate for Environmental Monitoring and Compliance

Budget Estimate for Environmental Monitoring and Compliance during the Construction and Operation Phase has been summarized in **Table 8.3**.

Table 8-3: Budget Estimate for Environmental Monitoring and Compliance during the Construction and Operation Phase

Components	Parameters	Quantity (No. of samples x No. of Locations x Frequency)	Frequency	Responsibility	Duration	Cost (Rs.)
A) Construction Phase (24 Months)						
Ambient Air Quality	CO, NO_2, SO_2, Lead, SPM, $PM_{2.5}$ and PM_{10}	1x3x6= 18	Quarterly @ Rs. 30,000 per sample	CC and SC	24 hours	540,000/-
Noise Level	Day and night time levels on dB (A) Scale (min-max)	1x3x6= 18	Quarterly @ Rs. 2,000 per point	CC and SC	24 hours	36,000/-
Drinking Water Quality	**Physical Parameters:** Color, pH, Taste, Odour, Turbidity, Total Hardness as Calcium Carbonate and Total Dissolved Solids **Biological Parameters:** E. Coliform, Fecal Coliform and Total Coliform **Chemical Parameters:** Aluminum, Antimony, Arsenic, Barium, Cadmium, Chloride, Chromium, Copper, Cyanide, Fluoride, Lead, Manganese, Mercury, Nickel, Nitrate, Nitrite, Selenium, Residual Chlorine, Zinc and Phenolic Compounds	1x3x6=18	Quarterly @ Rs. 20,000 per sample	CC and SC	-	360,000/-
Surface Water Quality	**Physical Parameters:** Temperature, pH, Color, Total Dissolved Solids, and Total Suspended Solids	1x3x6= 18	Quarterly @ Rs. 20,000 per sample	CC and SC	-	360,000/-

Components	Parameters	Quantity (No. of samples x No. of Locations x Frequency)	Frequency	Responsibility	Duration	Cost (Rs.)
	Biological Parameters: Biochemical Oxygen Demand, Chemical Oxygen Demand, and Fecal Coli **Chemical Parameters:** Grease and Oil, Lead, Phenolic compounds, Cyanide, Chloride, Fluoride, Anionic Detergents, Sulphate, Sulphide, Ammonia, Calcium, Cadmium, Chromium, Copper, Mercury, Selenium, Nickel, Silver, Zinc, Arsenic, Barium, Iron, Manganese, Boron and Total chloride					
					TOTAL (A) =	***1,296,000/-***
B) Operation Phase (12 Months)						
Ambient Air Quality	CO, NO_2, SO_2, Lead, SPM, $PM_{2.5}$ and PM_{10}	1x3x2 = 6	Biannually @ Rs. 30,000 per sample	C&WD	24 hours	180,000/-
Noise Level	Day and night time levels on dB (A) Scale (min-max)	1x3x2 = 6	Biannually @ Rs. 2,000 per point	C&WD	24 hours	12,000/-
Drinking Water Quality	**Physical Parameters:** Color, pH, Taste, Odour, Turbidity, Total Hardness as Calcium Carbonate and Total Dissolved Solids	1x3x2 = 6	Biannually @ Rs. 20,000 per point	C&WD	-	120,000/-

Components	Parameters	Quantity (No. of samples x No. of Locations x Frequency)	Frequency	Responsibility	Duration	Cost (Rs.)
	Biological Parameters: E. Coliform, Fecal Coliform and Total Coliform **Chemical Parameters:** Aluminum, Antimony, Arsenic, Barium, Cadmium, Chloride, Chromium, Copper, Cyanide, Fluoride, Lead, Manganese, Mercury, Nickel, Nitrate, Nitrite, Selenium, Residual Chlorine, Zinc and Phenolic Compounds					
Surface Water Quality	**Physical Parameters:** Temperature, pH, Color, Total Dissolved Solids, and Total Suspended Solids **Biological Parameters:** Biochemical Oxygen Demand, Chemical Oxygen Demand, and Fecal Coli **Chemical Parameters:** Grease and Oil, Lead, Phenolic compounds, Cyanide, Chloride, Fluoride, Anionic Detergents, Sulphate, Sulphide, Ammonia, Calcium, Cadmium, Chromium, Copper, Mercury, Selenium, Nickel, Silver, Zinc, Arsenic,	1x3x2 = 6	Biannually @ Rs. 20,000 per point	C&WD	-	120,000/-

Components	Parameters	Quantity (No. of samples x No. of Locations x Frequency)	Frequency	Responsibility	Duration	Cost (Rs.)
	Barium, Iron, Manganese, Boron and Total chloride					
					TOTAL (B) =	***432,000/-***
					GRAND TOTAL (A+B) =	***1,728,000/-***

KEY

CC Construction Contractor SC Supervision Consultant

CWD Communication & Works Department

Notes:

- Provision must be given in annual budget of operation phase for environmental monitoring. For this, the cost of operation phase (i.e. Rs. 432,000/-) must be considered with an annual increment of 10%.
- All the environmental parameters will be analyzed as per Punjab Environmental Quality Standards (PEQS), 2016.

8.7 Tree Plantation

To minimize the negative impacts arising due to tree cutting (1800 No.), increased vehicular activity on the Faisalabad-Chiniot-Sargodha Road and to enhance the landscape of the project area, plantation at available spaces may be carried out especially along sides and at the median.

Plantation Plan shall be carried out by the Client in coordination with Forest Department, which has the requisite expertise and experience for such tasks.

Trees recommended for planting are Chir, Alstonia, Phulai and Ber. The tentative cost for the plantation is about Rs. 2,773,950/-. Detailed Tree Plantation Plan is attached as **Annex-XIII**.

8.8 TRAINING AND CAPACITY BUILDING

An environmental and social training and technical assistance (TA) program is to be carried out before the implementation of the proposed project as it strengthens the institutional capacity required to manage the environmental and social issues. Contractor's environmental awareness and appropriate knowledge of environmental protection is critical to the successful implementation of the EMMP because without appropriate environmental awareness, knowledge, and skills required for the implementation of the mitigation measures, it would be difficult for the Contractor(s) workforce to implement effective environmental protection measures.

CWD will be responsible to engage TA consultant to conduct environmental and social training programs. The objective of the TA will be as follows:

- To help in establishment of appropriate systems;
- To train senior CWD staff, Contractor and Sub-Contractor workers and Supervision Consultant employees, responsible for managing environment and social tasks and planning during construction and post construction phase; and
- Training courses on specialized areas such as air, water and noise pollution monitoring.

Table 8.4 provides brief detail of the capacity building and training plan for the proposed project.

Table 8-4: Capacity Building Programs and Technical Assistance Services

Provided by	Contents	Trainees	Duration
TA Individuals, Consultants and Organizations specializing in Environmental Management and Monitoring	Short Seminars and Courses on: • Environmental laws and regulations; • Environmental Sustainability; and • Environmental Management and Monitoring Plan (EMMP)	Members of Environmental Committee, CWD Staff and Contractor Workers	3 Days

Provided by	Contents	Trainees	Duration
TA Individuals, Consultants and Organizations specializing in Social Management and Monitoring, and Occupational Health and Safety	Short Seminars and Courses on: • Occupational Health and Safety Plan (OHS); • Basic First Aid; • Occupational and Community Health and Safety Management; • Labour Camp Management; • Traffic Management; • COVID-19 Protection and Control; • Use and Importance of Personal Protective Equipment's (PPEs); and • Fire Safety and Emergency Response Measures.	Members of Environmental Committee, CWD Staff and Contractor Workers	3 Days
TA Individuals, Consultants and Organizations specializing in Environmental and Social Management and Monitoring	Short Seminars and Courses on: • Environmental Management Plan (EMP); • Environment Health and Safety Management; • Occupational Health and Safety; • Basic First Aid; • Waste Management; • Fire Safety and Emergency Response Measures; • Electrical Safety; and • Use and Importance of Personal Protective Equipment's (PPEs)	Operation and Maintenance Staff of CWD	3 Days

8.9 COMMUNICATION & DOCUMENTATION

Communication and documentation is an essential feature of EMP. The key features of such mechanism are:

8.9.1 Data Recording and Maintenance

All forms to be used for recording information during the environmental monitoring will follow a standard format which will correspond to the data base in to which all the gathered information will be placed. Check boxes will be used as much as possible to facilitate data entry. Tracking system will be developed for each form.

8.9.2 Database

The database may include the following information:

- Training programs;
- Staff deployment;
- Non-compliances;
- Corrective actions

- List of environmental data; and
- List of environmental data to be maintained:
  - Soil and land pollution;
  - Disposal of waste;
  - Water resources;
  - Fuel oil and chemical spills;
  - Vegetation record;
  - Noise pollution;
  - Air and dust pollution;
  - Socio-economic data; and
  - Ecological sensitivities.

8.9.3 Meetings and Reporting

Monthly meetings will be held at site during the construction phase. The purpose of these meetings will be to discuss the routine activities, non-compliances and their remedial measures. Various reports will also be produced at periodic time intervals, as provided in **Table 8.3** along with information regarding persons responsible for report preparation and review process. Additionally, minutes of meeting will also be submitted as part of routine environmental reports.

Table 8-5: Periodic Reporting Mechanism

Sr. No.	Report Category	Prepared by	Reviewed by
1	Monthly	Contractors' environmental staff	CWD / SC
2	Quarterly	Contractors' environmental staff	CWD / SC
3	Semi-Annual Environmental Monitoring Report (SAEMR)	Construction Supervision Consultant (CSC)	CWD / SC
4	Annual Report	Contractors' environmental staff	CWD / SC
5	Completion Report	Contractors' environmental staff	CWD / SC

8.9.4 Social Complaint Register

The Contractor will maintain a register of complaints record from local communities and measures taken to mitigate these concerns.

8.9.5 Photographic Records

Contractors will maintain photographic records during the implementation of the proposed Project. As a minimum, the photographic records will include the site photographs, all the roads, camp sites and monitoring activities, etc.

8.9.6 Non-Compliance of the EMP

The implementation of the proposed EMP involves inputs from various functionaries. The Contractor will be primarily responsible for ensuring implementation of the mitigation measures proposed in the EMP, which will be part of the contract documents. The provision of the

environmental mitigation cost will be made in the total cost of Project, for which the Contractor will be paid on the basis of monthly compliance reports. However, if the Contractor fails to comply with the implementation of EMP and submission of the monthly compliance reports, deductions will be made from the payments to the Contractor claimed under the heads of environmental components.

8.9.7 Review of Recorded Data

All the data and communication recorded and maintained by the Contractor will be periodically reviewed and checked by SC and CWD and necessary action will be recommended to Contractor to improve the recording and documentation.

8.10 MANAGEMENT PLANS

Various site-specific management plans will be prepared by Contractor as a part of EMP for the better management and implementation of EMP during all phases of the proposed Project. However, approval of these site-specific plans from CWD should be sought before start of construction activities. These site-specific plans are listed below but not limited to these:

- Tree Plantation / Reforestation Plan;
- Health, Safety and Environment (HSE) Management Plan;
- Emergency Preparedness and Response Plan;
- Site Restoration and Rehabilitation Plan;
- Waste Management Plan;
- Disaster Management Plan;
- Drinking Water Supply and Sanitation Plan
- Traffic Management Plan;
- Change Management Plan
- Quarry Management Plan; and
- Resource Conservation Plan.

8.11 PUBLIC DISCLOSURE

CWD will disclose this EIA to all the stakeholders prior to the start of the construction. This report will be made available to the stakeholders at places as designated by the PEPA. In addition, executive summary of the Report will be translated into Urdu language and made available to the affected communities and locals. The copies will also be kept at construction site for ease in accessibility of the locals. This will ensure the locals to be aware of the Project impacts, its mitigation, responsible staff and mode of implementation. In addition, the executive summary will also be published on CWD website.

8.12 EMP COST

The contractor will be responsible for implementation of mitigation measures and environmental Monitoring during construction phase, whereas CWD will be responsible for implementation of mitigation measures and environmental Monitoring during operation phase. For an effective implementation of environmental mitigation measures during construction and

operational phase, it is very important to provide sufficient funds for the implementation of environmental and social mitigation measures, monitoring and training. The estimated cost of environmental and social mitigation measures, monitoring and training is given in the **Table 8.6**.

The cost for EMP will be part of the contract document with the Contractor. The same may also be included in the total project cost for the implementation of EMP. It must be noted that environmental cost will not be a separate entity because all of its components will be addressed in the bidding document under various heads of account.

Table 8-6: Environmental and Social Testing, Mitigation and Training Cost

Sr. No.	Activity	Description	Cost (Rs.)	Rationale
1.	Medical screening for workers	Rs. 5,000 per person for 250 employees *Pre-Construction Phase:* 250 x 5,000 x 1 = 1,250,000 *Construction Phase:* 250 x 5,000 x 4 = 5,000,000	6,250,000/-	Medical screening of the workers before deployment on site and twice a year during whole construction period.
2.	Material Storage, handling and use	Four Number of tarpaulins of Rs. 20,000 each	80,000/-	Four tarpaulins are proposed during the whole construction phase for the protection of material and dust control.
3.	Water Sprinkling	Sprinkling of water to control dust at site on alternate day 30,000 x 24 = 1,350,000	720,000/-	Sprinkling of water to control dust emissions at site during whole construction period.
4.	Handling of solid waste	Includes the cost of collection, segregation, transportation, disposal and management of domestic, commercial and construction wastes	1,200,000/-	Rs. 50,000 per month for 24 months to collect construction waste from all the active sites on daily basis.
5.	Health and Safety of Workers	For 250 employees for the provision of dust masks, safety shoes, gloves, first aid box, ear plugs, safety helmets and safety jackets (Hi Vis) and provision of dust bins, warning tap, safety cones and safety sign boards.	4,094,000/-	For detail, please refer to **Annex–XV**.
6.	HSE Expert	HSE Expert to monitor / conduct all HSE related activities e.g. TBTs, PPEs, housekeeping, safety signage, emergency	5,400,000/-	Cost for hiring HSE Experts along with their monthly logistics during construction and operational phase.

Sr. No.	Activity	Description	Cost (Rs.)	Rationale
		preparedness, etc. during construction and operational phase *Construction Phase:* 1 x 24 x 150,000 = 3,600,000 *Operational Phase:* 1 x 12 x 150,000 = 1,800,000		
7.	Environmental Testing Cost	Ambient air, drinking water, surface water and noise	1,728,000/-	Refer to **Table 8.2** for detailed schedule and cost of environmental testing during construction and operation phase.
8.	Cost of environmental and social training	Short Seminars, Courses, Trainings and Lectures on Environment, Social and Occupational, Health and Safety constituents and components (Rs. 75,000/- per session twice a year during construction phase). *Construction Phase:* 4 x 75,000 = 300,000	300,000/-	Refer to **Table 8.3** for details.
9.	Environmental Audit	Environmental Auditing through third party twice a year during construction and operational phase 4 x 400,000 = 1,600,000 *Operational Phase:* 2 x 400,000 = 800,000	2,400,000/-	Cost for at least two auditors along with logistics, travels and accommodation charges.
10.	Tree Plantation	Approximately 1,800 numbers (based on GIS and field trothing for species identification) of different trees may be cut down during construction phase. Therefore, Compensatory planting of ten trees against each fallen tree of similar floral function should be planned which is 18,000 to enhance the landscape of the project area. Plantation at available spaces may be carried out especially at the median.	2,773,950/-	For detail, please refer to **Annex–XIII**.

Sr. No.	Activity	Description	Cost (Rs.)	Rationale
		Total =	***24,945,950/-***	

The total estimated cost for the environmental management, monitoring and auditing during construction and O&M (annual cost will be updated for next upcoming years accordingly) comes to about **PKR 24.94 Million**.

9 CONCLUSION AND RECOMMENDATIONS

9.1 GENERAL

This section depicts the conclusion and recommendations of the EIA study for the proposed Project i.e. Transaction Advisory Services for Dualization of Faisalabad-Chiniot-Sargodha Road (Length =67km).

The EIA report has been prepared in accordance with the requirements of the Punjab Environmental Protection Act, 2012 (Amended) and 2017 (Amended); Pak-EPA Regulations, 2000 for review of IEE and EIA; Pakistan EIA procedures; and sectoral guidelines for environmental reports: Major Roads.

9.2 CONCLUSION

The existing road from Faisalabad-Chiniot-Sargodha is very important inter District Highway Link of 67 km in length running between the Faisalabad, Chiniot and Sargodha districts of Punjab Province. The proposed dualization and rehabilitation of subject road starts from Faisalabad city at Faisalabad Bypass Chowk and ends at Sargodha Bypass in district Sargodha. Due to high population growth and main route for transporting construction materials from crushing plants to various cities of Pakistan, tremendous traffic problems i.e. time delays, extra fuel consumption, accidents, environmental degradation, wear and tear of roads and vehicles etc. has been observed at the existing Faisalabad-Chiniot-Sargodha Road. Thus, traffic loads has become a major concern in the project area. At present, the capacity of this road is insufficient to handle existing/future traffic volume and unable to provide safe and smooth travelling.

After rehabilitation of project road along with improved facilities, it will provide an efficient transport corridor in the project area. Main objective of the proposed project is to provide a safe, congestion free and high speed facility to the commuters of project area and heavy traffic travelling from Faisalabad to Sargodha. The corridor will largely contribute to the economic and social development of the project area and it's near vicinity.

Significant efforts were made to identify the main physical, ecological, social, cultural and environmental issues related to the construction and operation of the proposed road. Various stakeholders including government departments and agencies were also contacted for obtaining salient information in this regard along with that from area residents.

During the pre-construction, construction and operational phases, following are the main issues and concerns:

- Dualization will be done in available ROW; however, at certain locations land acquisition will be required;
- Cutting of trees/bushes/crops falling within the proposed ROW;
- Disturbance to infrastructure and public utilities;

- Disturbance to the public movement and cultural norms during construction;
- Reduction in the daily routine activities of local residents during construction;
- Noise and air pollution due to the working of construction machinery during construction and traffic operation phases of the Project;
- Solid waste and wastewater generation during construction;
- Oil spillages from construction machinery, resulting in soil and groundwater contamination;
- Surface water bodies contamination due to soil erosion and construction activities; and
- Occupational and community health and safety issues.

Project is socio-economically viable and environment friendly, if EMP is implemented in true letter and spirit. Results of the EIA Study have shown that there are no critical environmental impacts associated with the project. However, several concerns / impacts with regard to physical, ecological and social environment have been identified in report which needs to be mitigated by strict implementation of Environmental Management Plan. These impacts could also be reduced by proper and judicious compensation to the affectees and well planned meticulous design of the facility and by implementing an appropriate tree plantation plan. In fact, in times of diminishing economic and natural resources, using sustainable approaches in transportation infrastructure will help us to enhance quality of life and serve the transportation needs of the present leaving provision for future generations to meet their needs.

9.3 RECOMMENDATIONS

An Environmental Management Plan (EMP) for both the phases (construction and operation) has been developed as part of the report which provides a detailed mitigation matrix that covers impacts, mitigation measures, roles and responsibilities and timings to avoid, minimize or mitigate the adverse impacts of the proposed project.

Based on the field visit, environmental monitoring and analysis of primary and secondary data, the following recommendations have been conferred so that the Proponent gets the necessary direction and clarity to ensure efficient environment friendly and compliant operation:

- The proposed road should be designed and constructed to withstand high magnitude earthquakes as per Seismic Building Code of Pakistan, 2007;
- Proper location(s) for construction camps should be selected by contractor in close coordination with CWD that cause minimal/no damage to the prevailing environmental conditions of the project area;
- Formulation and implementation of a comprehensive safety and security plan by contractor before the start of the construction activities for the camps which should be comprised of a training manual, use of safety equipment, emergency preparedness and code of ethics;
- Wearing of Personal Protective Equipment (PPEs) such as helmet, masks, adequate footwear for bituminous pavement works, protective goggles and gloves should be made compulsory during construction activities and formulation and implementation of Health and Safety Plan (HSP) for construction workers;
- Preparation and implementation of Solid Waste Management Plan during construction stage by contractor in close coordination with concerned authorities for collection, reuse, recycling and disposal of waste;

- Employment opportunities should be provided to local people for skilled and unskilled works during construction stage;
- A provision of adequate budget in the overall cost of the Project and on-site space for plantation as per guidelines of the concerned departments should be provided in the design of proposed road to compensate tree cutting and to eradicate air pollution. Moreover, tree plantation must be considered along the road side to create a buffer zone for the noise pollution arising from the road traffic;
- Soil contamination should be controlled by proper storage of chemicals;
- Surface runoff and wastewater generated during construction stage should be controlled and collected in septic tanks and soakage pits;
- Dust and fugitive emissions should be controlled by maintenance of equipment, fine tuning of the vehicles and regular sprinkling of water on soil;
- Noise and vibration should be controlled by equipment maintenance, by providing noise barrier and by scheduling the construction activities to avoid peak activity hours in the area;
- Adequate budget should be provided in the project cost for the compensation to the affected people's as per Land Acquisition Act, 1894; and
- For effective implementation of suggested mitigation measures, the environmental mitigation and monitoring cost must be the part of the bidding document of the Contractor.