# Environmental and Social Impact Assessment (ESIA) Report
(Including ESMP)

**MODERNISATION OF SONE WESTERN MAIN CANAL FROM KM 0.00 TO 32.50**

***under***

**Bihar Water Security and Irrigation Modernization Project. (BWSIMP)**

*(Funded by The World Bank)*

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**ABBREVIATIONS**

| | |
|---|---|
| BC & EBC | Backward & Extremely Backward Class |
| BKBDP | Bihar Kosi Basin Development Project |
| BKFRP | Bihar Kosi Flood Recovery Project |
| BSDMA | Bihar State Disaster Management Authority |
| BSPCB | Bihar State Pollution Control Board |
| BWSIMP | Bihar Water Security & Irrigation Modernization Project |
| CCA | Cultural Command Area |
| CEMP | Construction Environmental Management Plan |
| CGWB | Central Ground Water Board |
| CPCB | Central Pollution Control Board |
| CPGRAM | Centralised Public Grievance Redress and Monitoring |
| CTE | Consent to Establish |
| CTO | Consent to Operate |
| Cum | Cubic Meter |
| DG | Diesel Generator |
| DPR | Detailed Project Report |
| EAP | Emergency Action Plan |
| E & S | Environmental & Social |
| EC | Environmental Clearance |
| EHS | Environmental Health & Safety |
| EIA | Environmental Impact Assessment |
| EMP | Environmental Management Plan |
| ERM | Environmental Risk Management |
| ESF | Environmental & Social Framework |
| ESIA | Environmental & Social Impact Assessment |
| ESMF | Environmental & Social Management Framework |
| ESMP | Environmental & Social Management Plan |
| ESS | Environmental & Social Standard |
| FGD | Focus Group Discussion |
| FMISC | Flood Management Improvement Support Centre |
| GBV | Gender Base Violence |
| GRM | Grievance Redressal Mechanism |
| HIRA | Hazard Identification and Risk Assessment |
| ICC | Internal Complaints Committee |
| ID | Identification |
| IFC | International Finance Corporation |
| IRC | Indian Roads Congress |
| KVA | Kilo-volt-amperes |
| LPG | Liquid Petroleum Gas |
| LMP | Labor Management Procedures |
| MCM | Million Cubic Meters |
| MIS | Management Information System |
| MoEF&CC | Ministry of Environment, Forest and Climate Change |

| | |
|---|---|
| MPL | Maximum Permissible Limit |
| MT | Metric Ton |
| NDWI | Normalized Difference Water Index |
| OBC | Other Backward Class |
| OHS | Occupational Health & Safety |
| PAF | Project Affected Family |
| PAP | Project Affected People |
| PCB | Pollution Control Board |
| PCC | Plain Cement Concrete |
| PIU | Project Implementation Unit |
| PMTC | Project Management & Technical Coordinator |
| PMU | Project Monitoring Unit |
| PRI | Panchayati Raj Institutions |
| PUC | Pollution under control Certificate |
| R&R | Rehabilitation and Resettlement |
| RAP | Resettlement Action Plan |
| RPF | Resettlement Planning Framework |
| SC | Scheduled Caste |
| SEA | Sexual Exploitation & Abuse |
| SEP | Stakeholder Engagement Plan |
| SH | Sexual Harassment |
| SPM | Suspended Particulate Matter |
| Sq Ft | Square Feet |
| ST | Scheduled Tribe |
| STP | Sexually Transmitted Diseases |
| TPP | Thermal Power Plant |
| WHO | World Health Organisation |
| WMC | Western Main Canal |
| WRD | Water Resource Department |
| WUA | Water User’s Association |

## EXECUTIVE SUMMARY

The Bihar Water Security and Irrigation Modernization Project (BWSIMP), partly funded by The World Bank as loan, aims to enhance water security and modernize irrigation systems in Bihar, India. One of the sub-projects under this project focuses on the modernization of the "Sone Western Main Canal (Km 0.00 to Km 32.50)", as this stretch is crucial for improving irrigation efficiency and effectiveness in the region.

The Sone Canal System includes two link canals that supply water to a vast network of earthen main canals, distributaries, and minor canals, forming the Sone East and West irrigation systems. This sub-project focuses on improving water availability in the Western Main Canal (WMC) Command, which begins about 10.20 km downstream of the Indrapuri Barrage and Water is off-taken from the Western Link Canal and Western Parallel Link Canal with a total length of 10.20 Km. Western Main Canal starts from 10.20 km downstream of Indrapuri barrage i.e. from the end point of Western Link Canal & Western Parallel Link Canal and runs up to Dehri town which is about 32.50 km downstream and is completely in unlined condition. From 0.00 Km to 10.20 Km, the upstream link canals i.e. Western Link Canal and Western Parallel Link Canal have already been lined with concrete, resulting in improvement in availability of water at offtake point of WMC. Hence lining of WMC in the chosen stretch will further enhance the canal system efficiency. However, the benefits of lining will only be fully realized if the downstream canal systems are also lined.

The sub-project proposes mainly modernization of the Sone Western Main Canal (km 0.00 to km 32.50) to address seepage and other water losses, aiming to restore the lost irrigation potential of up to 24,244 hectares by upgrading the canal system by concrete lining.

The Environmental and Social Impact Assessment (ESIA) report outlines the sub-project's objectives, methodology, and expected outcomes. It includes a detailed analysis of the environmental and social impacts including inputs obtained during public consultations and the proposed Environmental and Social Management Plan (ESMP). The ESMP aims to mitigate any likely adverse impacts during execution as well as completion of the sub-project and ensure sustainable development.

The sub-project is expected to bring significant benefits, including improved agricultural productivity, better water management, and enhanced resilience to weather vageries due to climate change. It will also contribute to the overall economic development of the region by providing reliable irrigation and supporting sustainable agricultural practices.

**1. Project Description**

The Sone Western Main Canal is a key component of the whole Sone Canal System. It is a contour canal being fed from the Western Link canal and Western Parallel Link Canal. From "Dehri fall" the total length of WMC is 32.50 Km and has five distinct reaches. The canal is all along unlined. The design discharge at head is 189.7 Cumecs (6700 Cusecs) with a design bed Width of 71.3 m (234 ft.). The WMC provides irrigation to a vast area of 521,489 hectares (Culturable Command Area, or CCA). This network supplies water to several canals, including the Ara Main Canal (AMC), Chausa Branch Canal (CBC), Buxar Main Canal (BMC), Gara Chowbey Branch Canal and various distributaries. Modernization of WMC with concrete lining will begin at about 10.20 km downstream of the Indrapuri Barrage till up to Dehri town (32.50 km downstream). This will reduce seepage loss of irrigation water. The proposed Canal Modernization of WMC envisages restoration up to 24,244 hectares (CCA 19,442 hect) of lost irrigation potential.

**2. Project Risk**

The project **Environmental risk is classified as "Substantial"** because the nature of construction/intervention proposals will result in large volume of waste/silt and other significant other

OHS and CHS issues. Though the present sub-project components are confined to modernization of existing structures (on government land, owned by WRD), the **Social risk rating is also "Substantial"** as field surveys indicate encroachments for habitation, livelihood, farming and grazing by encroachers or non-title holders, along some parts of the embankments of canals chosen for renovation/modernization.

The tools for E&S risk management have been developed and detailed in the ESMF.

| **Process in the Project Cycle** | **Tools for E&S management and monitoring** |
|---|---|
| 1. FEASIBILITY<br>• Irrigation Potential (IPC & IPU)<br>• Life of Canal System<br>• Flood Proneness Area<br>• Drought Prone Area | E&S Screening Checklist - will be filled and submitted by Environmental and Social Specialist of PMU<br><br>BWSIMP *ESMF, RPF, SEP, LMP* will be prepared for overall project guidance. |
| 2. PREPARATION OF SCHEME BY FIELD ENGINEERS<br>• Identification of Vulnerable reaches for prioritization<br>• Damages to canal structure<br>• Selection of schemes | An Environmental and Social Impact Assessment (ESIA) of these activities proportional to risk of the activity defined will be caried out during that time.<br><br>Prepare ESIAs (including ESMP) under the project.<br><br>ESIA (including ESMP) to be included in the DPR.<br><br>Specialized Mitigation Measures to be prepared: RAP, OHS plan, GBV plan, Dolphin program. |
| 3. REVIEW and APPROVAL<br>• Technical Review and approval of Scheme by SE, CE and recommendation of the scheme to PMU<br>• Approval of Scheme by Project Co-Ordinator | |
| 4. DETAILED DESIGN<br>• Surveys and Preparation of DPRs<br>• Review of DPR<br>• Approval of DPR | |
| 5. **TENDERING**<br>• Preparation of Bid documents by PMTC<br>• Tender Evaluation and Award | Contractor ESMP (C-ESMP) to be included in Bid Documents which covers E&S responsibilities of Contractor including monitoring and reporting and Contractual Remedies |
| **6. IMPLEMENTATION** | Reporting against Contractor-ESMP<br>Reporting against RAP |
| **7. REPORTING AND MONITORING** | Reporting against agreed specific mitigation measures<br>Reporting against Contractor-ESMP |

**3. Environmental and Social Impact Assessment (ESIA)**

The ESIA report provides a comprehensive analysis of the environmental and social impacts of the sub-project. It includes the following key components: -

- **Resource Requirements**

<u>Land Requirement</u>

**Land Requirement and availability**

The intervention is mainly in the form of lining work in Western main canal of Sone, which implies, work will be limited to inside of the canal. Hence, no Land acquisition is required. On both sides of the

canal sufficient land, owned by WRD is available as "Chat Land" and agricultural land (private) is about 10 m away from either side of the canal. Sufficient Govt. land is available for movement of machineries during the work and even temporary acquisition of private land is not required for that purpose. However, the assessment/survey conducted in the sub-project, few squatters on the bank of the canal have been identified at some locations who need to be relocated with appropriate R & R support.

Construction Materials Requirement

The construction materials to be used in lining and modernization of various existing water regulatory structures are shown in a tabular form below: -

**Amount of construction Materials required for lining and modernization of WMC**

| **Western Main Canal (k.m 0.0 to k.m 32.5)** | | | | |
|---|---|---|---|---|
| **Sl. No.** | **Construction Material** | **Quantity** | **Unit** | **Main Carriage station** |
| 1 | Cement | 82420 | MT | Dehri |
| 2 | Coarse Sand | 137761 | $m^3$ | Sone sand |
| 3 | Coarse aggregate | 366548 | $m^3$ | Ahiraura |
| | Stone Filter | 96369 | $m^3$ | Ahiraura |
| 4 | Local Sand | 335948 | $m^3$ | nearest place to worksite |
| 5 | Bitumen | 530 | MT | Gaya |
| 6 | Steel | 248.55 | $m^3$ | Dehri-on-sone |
| 9 | Bricks | 2950333 | No. | nearest place to worksite |
| 10 | Hume pipe | 18190 | m | |
| 11 | Emulsion | 16957.73 | kg | |
| 12 | LDPE | 2055199.86 | $m^2$ | Kolkata |
| 13 | 160 OD-PVC Pipe | 161634.30 | $m^2$ | Kolkata |
| 14 | NCL & NCT | 1317834.03 | M | Ahamadabad |
| 15 | 750 mm long PRV | 10713 | M | Ahamadabad |
| 16 | 430 mm long PRV | 13624 | No. | Ahamadabad |

Labor Requirement

The lining work will take 36 months to complete for the proposed sub project. The requirement of skilled and unskilled labor is summarized in the following table.

**Requirement of labor by type**

(in labour days)

| **Skilled Lab** | **Semi skilled Labour** | **Unskilled Labour** | **Total Labour** |
|---|---|---|---|
| 201600 | 9900 | 5907600 | 6119100 |

**4. Applicable Policy and WB Environmental and Social Standard**

The legal and regulatory requirements for the sub-project's proposed interventions, under applicable acts / rules and policies for social and environment safeguards, have been identified. This includes the environmental legislations related to protection of biodiversity, pollution control, resource

management, waste management, safety of workers and general public while the identified social legislations cover social inclusion, labor welfare, gender equality, land management, resettlement of squatters, citizen engagement, citizen rights, good governance etc. There is requirement of permits / licenses under different rules /regulations for various aspects of interventions proposed in the sub-project. All agencies involved in implementing the sub-project activities, including contractors, shall have to follow applicable state and central government laws and regulations. These include, prior permission (if required) for tree felling from the Department of Forest; NoC for establishment and operation of hot mixing plant, batching plant, etc., from the Bihar Pollution Control Board, approval of local government authority / concerned work division of WRD for sites identified for camp establishment, temporary storage and disposal of waste materials, etc.

An outline of the applicable environmental and social safeguards standards of the World Bank are as follows: -
**ESS 1 -** Assessment and Management of Environmental and Social Risks and Impacts
**ESS 2 -** Labor-and-Working-Conditions
**ESS 3 -** Resource-Efficiency-and-Pollution-Prevention-and-Management
**ESS 4 -** Community-Health-and-Safety
**ESS 5 -** Land-Acquisition-Restrictions-on-Land-Use-and-Involuntary-Resettlement
**ESS 6 -** Biodiversity Conservation and Sustainable Management of Living Natural Resources and
**ESS 10** - Stakeholder-Engagement-and-Information-Disclosure

The Environment Management Framework of the sub- project is based on the above elaborated policies and standards: -

**5. Environmental Baselines**: This section covers the physical and biological environment of the project area, including temperature, rainfall, land use, topography, soil, hydrogeology, air quality, noise pollution, groundwater quality, surface water quality, natural disasters and climate change variability.

**6. Social Baselines**: This section covers the administrative boundaries, demography, socio-economic profile, population growth rate, squatters occupying government land required under the sub-project and the status of Water User Associations.

**7. Public Consultations and Disclosure**: This section outlines the identification of stakeholders, the method and process of consultation, the outcome of the consultation, the disclosure of project information, the grievance redressal mechanism, and the provision for further consultation during the implementation.

**8.Environmental Impact Assessment (EIA)**: This section covers the pre-construction impacts, construction phase impacts and operation phase impacts of the sub-project on the environment. It includes the impact on land use and topography, air quality, drainage, surface water quality, groundwater quality, construction wastes, noise, accessibility, occupational health and safety, community health and safety, construction camps, local ecology and chance finds during execution of the sub-project.

- **Pre-construction impacts**
  - The likely works during the pre-construction phase are i) Shifting of electricity poles II) setting up of Contractor's Camp and Construction yard iii) Planning for sourcing of construction materials etc.
  - Finalization of Work Methodology which would define the activities to be undertaken. These would also determine the risk to the workmen and the communities. Based on the work Methodology and the plan, the various legal permits need to be obtained.

- Site Selection for Construction Work Camps, Stockpile Areas, Storage Areas near the project location. However, if it is deemed necessary to locate these elsewhere, sites to be considered should not lead to unwarranted impacts on air, noise and lead to tensions or conflicts with the local community. The chosen location should also not cause any inconvenience to the local community. Further the planning and layout of the Construction camp and the whole area / use of the equipment should be planned / done in a manner that it should not impact the environment adversely.
- The sub-project would result in an estimated 420183.76 Cum of silt and if it is not properly disposed it can adversely impact the nearby waterbody/land of construction site. Hapazard dumping will also result in unpleasant sighting and also would be a potential health and safety risk for the residents. However, the sub-project has identified that the generated quantity of silt will be used for restoring section of the canal. The filling quantity of earth/silt required to bring the canal in design section is much more than the quantity expected to be obtained during bed clearance.
- For Sourcing of Construction Materials, only those mine & quarries will be used in the project, which have valid mining licenses and Environmental Clearances as permitted by Mines and Geology department, Govt. of Bihar.
- The Plant Machinery and Vehicle to be used in the sub-project must meet the existing emission requirement.

- **Construction Phase Impact**

  <u>Air pollution</u>

  - Deterioration of air quality due to various construction activities along the project site is primarily due to dust generated. The summer season experiences high wind velocity causing accelerated wind erosion resulting heavy suspension of dust. This results in high SPM in the air.
  - Large quantity of dust is likely to be generated during modernization of WMC.
  - Fugitive emissions are from vehicles used for the transportation of construction materials and other heavy mechinaries used during construction. Transportation routes are also likely to face pollution due to spills of debris and construction materials during transportation. Air pollution is also likely due to emission from vehicles and other heavy machineries (batching plant, mixing plant and DG sets to meet the power requirement) during construction period.
  - The construction camp will also be a source of air pollution due to cooking, operation of DG sets for domestic uses etc.

  Since there are habitation adjoining the existing canal these incremental air pollutants can cause inconvenience to the residents and sensitive group of people (elderly, sick, new born etc). The haphazard disposal may lead to loss of productive land. Additionally, during disposal the movement of trucks carrying the debris and silt outside the designated route can cause compaction.

  - The following mitigation measures:
    - The movement of the truck carrying debris or construction material should be limited to the designated tracks
    - The construction waste and debris should be disposed only at site “Fit for Disposal”

  However, significant impact on health is not expected as construction period is short and the above emitted emission and dust will disappear as construction gets completed.

Surface Water pollution

- Impact on surface water quality during the construction phase is anticipated due to surface runoff from construction site containing substantial quantities of suspended impurities, mixing of oil / fuels /lubricants and other hazardous chemical etc.
- Discharge of sewage etc from labour camp/site offices.
- Run-off from stockpiled materials, wastewater during construction.

These pollutants could contaminate downstream surface water quality of the streams/water bodies. However, these potential impacts are temporary and of short-term only. The wash water from the concrete mixer/ batching plant/ miller may degrade the surface water quality therefore it should only be disposed at a pit developed in construction camp.

Ground Water pollution

- During vehicle/heavy machinery and equipment operation, spillage of fuels and lubricants.
- Discharge of sewage etc from labour camp/site offices.
- Run-off from stockpiled materials, wastewater during construction.

These pollutants could contaminate ground water quality of the region. To mitigate this, only fuel pumps will be used for fueling / re-fueling. Oil interceptors will be provided at vehicle parking, wash down and refueling areas as per the design provided. For sewage generated from camp/office site, proper sockpits will be provided at the required places.

Noise pollution

- Operation of heavy machineries; movement of heavy vehicles, concrete mixing activities, operation of DG Set, demolition of existing structure etc generate high level of noise resulting in increase of ambient noise level of the surrounding.

However, most of the construction activities will be confined to the sub-project area (inside the canal systems, embankment site) away from habitation area and mostly would be executed during day time only therefore these risks would be minimum.

- **Operation Phase Impact**
  - The proposed Canal modernization, which involve creating an impermeable layer along the canal section will result in decreasing water losses due to seepage
  - Canal lining targets enhancing water transport efficiency in the canal resulting in decreasing loss, due to evaporation.
  - Reduction in seepage and evaporation loss will result in significant increase in availability of water for irrigation.
  - Modernization of existing water regulatory structures alongwith canal lining will allow the adoption of modern irrigation strategies i.e. drip and sprinkler systems. This will further minimize water wastage and soil degradation.
  - Canal lining will reduce water logging and resultant salinity to a large and significant extent preserving agricultural land and environment. Increase irrigation water availability will allow increase in culturable command area of the system, which will lead to improve agriculture productivity.
  - Increased agricultural productivity will ensure food security and improvement in economic condition of farmers.

- Canal lining may affect the microbial ecology of the irrigation water, existence of aquatic organisms etc doubtlessly downgrading quality of irrigation water.
- To offset the ecological impacts of canal lining, if required, development of artificial wetlands, fish passages and riparian buffer zones could be thought off after consultation and involvement of nearby communities.
- The usage of eco-friendly and locally sourced materials for canal lining whenever feasible will be explored.

9. **Social Impact Assessment (SIA)**: This section covers the findings of the social impact assessment w.r.t. the scope of land acquisition, the socio-economic and demographic profile of affected persons, the labor profile of the workers and required mitigation measures.

- The Project Area falls in 3 blocks of Rohtas district, namely, Akorhigola, Sasaram and Dehri covering 38 villages. A total of 1,03,303 families reside in the project block area and the average family size is 7. The project blocks have a total population of 7,53,442 (Census 2011) out of which 52.3% are males and rest 47.7% are females. The religious composition of population of the project blocks shows that 85.8% of the population are Hindus, while 13.5% are Muslims. The Scheduled Caste population in the project blocks is 16.17%, while the Scheduled Tribe population is significantly lower at 0.84%. The labor force in the project blocks comprises 2,31,326 workers, with majority (63.08%) engaged as main worker and 36.92% are involved in marginal activity according to census, 2011.

- The economy is primarily agrarian.

- The project does not need permanent or temporary acquisition of private land. WRD owns sufficient land along the canal bank in form of Chat Lands to execute the work of strengthening of canal bank, restoring the canal section, lining of canal and construction of service road on right bank of the canal. However, during construction work residential structures of 8 squatters covering 5,175 square feet of WRD/Government land near work zone need to be relocated with appropriate R & R support.

- A total of 4 of these 8 households belong to OBC community, 3 are SC and rest 1 belong to general category. Majority of the Head of the households are illiterate. Their primary occupation is working as daily laborer within their own village. Open defecation is being practiced by 3 households, among the rest either has septic tank with toilet or has sewerage connection. However, 4 households still depend on firewood or coal for fuel and 2 have LPG connection and their source of water is tube well.

- The project will have civil works contracts and employ both direct & contracted workers. The contractor will employ local labor and depending upon the scale and skill requirement, may source migrant labor. Total 61,19,100 no. of labordays will be required for 36 months during construction work. Out of that 2,01,600 will be skilled labordays and 9,900 will be semi skilled labordays. Labor influx increases risks of SEA/SH and also pose infection risk from the community as well as to the community. All workers under the project will be governed by Codes and laws regulating labor in India to cover workers work/service conditions, remuneration, occupational health and safety.

- Labour camps will be established following World Bank's accommodation process and standards.

- Grievance redressal mechanism (GRM) including issues of SEA/SH for workers is based on ESMF provisions which will be accessible to all.

- The Occupational Safety, Health and Working Conditions Code, 2020 of GoI along with the Draft Occupational Safety, Health and Working Conditions (Bihar) Rules, 2021, provides guidelines for ensuring workers' safety during construction activities, which has to be followed by the Employers. Contractors will prepare and implement a Site-Specific Occupational Health and Safety Plan, including measures like community liaison, compliance with the Worker's Code of Conduct, and provision of Personal Protective Equipment (PPE) kits. Additionally, contractors are responsible for training workers in safety procedures, maintaining first aid kits and minimizing potential hazards.

10. **Alternatives**: The modernization of the Western Sone Main canal has limited interventions proposed aimed at the improvement of the performance of the Sone Canal system. Since this is an existing canal without any new construction/extension (within the scope of the World Bank Funded Project) the analysis of alternatives is limited.

**11. Environmental and Social Management Plan (ESMP)**: This section outlines the objectives of the ESMP, the institutional arrangement for ESMP implementation, the environmental monitoring plan, documentation and record-keeping, environment and social monitoring reports, the review mechanism of the ESMP implementation, capacity building and training, and the indicative budget allocation for the ESMP.

**12. Conclusion:** The BWSIMP is a significant initiative that aims to improve water security and irrigation efficiency in Bihar. The project is expected to bring substantial benefits to the region, including enhanced agricultural productivity, better water management, improved irrigation efficiency and increased resilience to climate change.

This sub-project namely "Modernization of Sone Western Main Canal (Km 0.00 to Km 32.50)" is designed to minimize irrigation water loss in the form of seepage and evaporation resulting in increase in availability of additional irrigation water, which could be used for increased agricultural productivity and resultant economic growth of community residing in the project area.

This sub-project has been designed in a way that any environmental impact is minimized. Since the work is restricted to the canal's existing footprint, there is no risk of harming forests, trees, historical monuments or any other sensitive areas. The materials required for the construction, including sand, aggregate, and other resources, will be sourced from approved quarries in Bihar, Jharkhand and Uttar Pradesh, adhering to all environmental regulations.

Water User Association along with the concerned division of WRD are to be jointly responsible for the upkeeping of the irrigation system so that the community continues to get the benefit in sustainable manner.

# CHAPTER 1: INTRODUCTION

## 1.1 Introduction

Bihar, with a population of 10.41 crore making it the third most populous state in India and a geographical area of 94,163 sq. km, is one of the most densely populated states in India. As the population density continues to rise, there has been an increasing focus on agriculture and irrigation to tackle the state's challenges of poverty and slow economic growth. Improving agricultural productivity is crucial for addressing these issues, and to achieve this, expanding irrigation facilities on a large scale is necessary. Significant investments are needed to develop irrigation potential and fully utilize it through the construction of major and medium irrigation projects. Bihar has the capacity to create an ultimate irrigation potential of 117.54 lakh hectares, with 53.53 lakh hectares achievable through major and medium irrigation schemes.

The Sone Canal System has been under development for many years and is now at a stage where upgrading is urgently needed, particularly in the Bhojpur, Rohtas, Buxar and Kaimur districts. Enhancing the existing canal system is vital to improve its efficiency and effectiveness in these regions. The Sone Canal System includes two link canals that supply water to a vast network of earthen main canals, distributaries, and minor canals, forming the Sone East and West systems. These canals irrigate a Gross Command Area (GCA) of 7,96,157 hectares and a Cultural Command Area (CCA) of 6,85,932 hectares.

The upstream link canals, the Western Link Canal and the Western Parallel Link Canal, have already been lined with concrete, resulting in improved canal system efficiency. However, the benefits of lining will only be fully realized if the downstream canal systems are also lined. Lining reduces water losses and facilitates easier maintenance, while also allowing the canals to handle higher discharges without eroding the banks. With a lined canal system, the canal bed width can be adjusted to accommodate higher flows while minimizing water loss during transit.

The effective management of water resources is crucial for agricultural sustainability and environmental conservation. Canal lining plays a significant role in minimizing water losses due to seepage, ensuring equitable water distribution, and enhancing irrigation efficiency. The current project focuses on increasing water productivity in the Western Main Canal Command, which starts about 10.20 km downstream of the Indrapuri Barrage. Water is drawn from the Western Link Canal and the Western Parallel Link Canal, and the unlined Western Main Canal extends up to Dehri town, 32.50 km downstream. This canal feeds one main canal, three branch canals, and five distributaries, serving a GCA of 5,95,722 hectares and a CCA of 5,21,489 hectares.

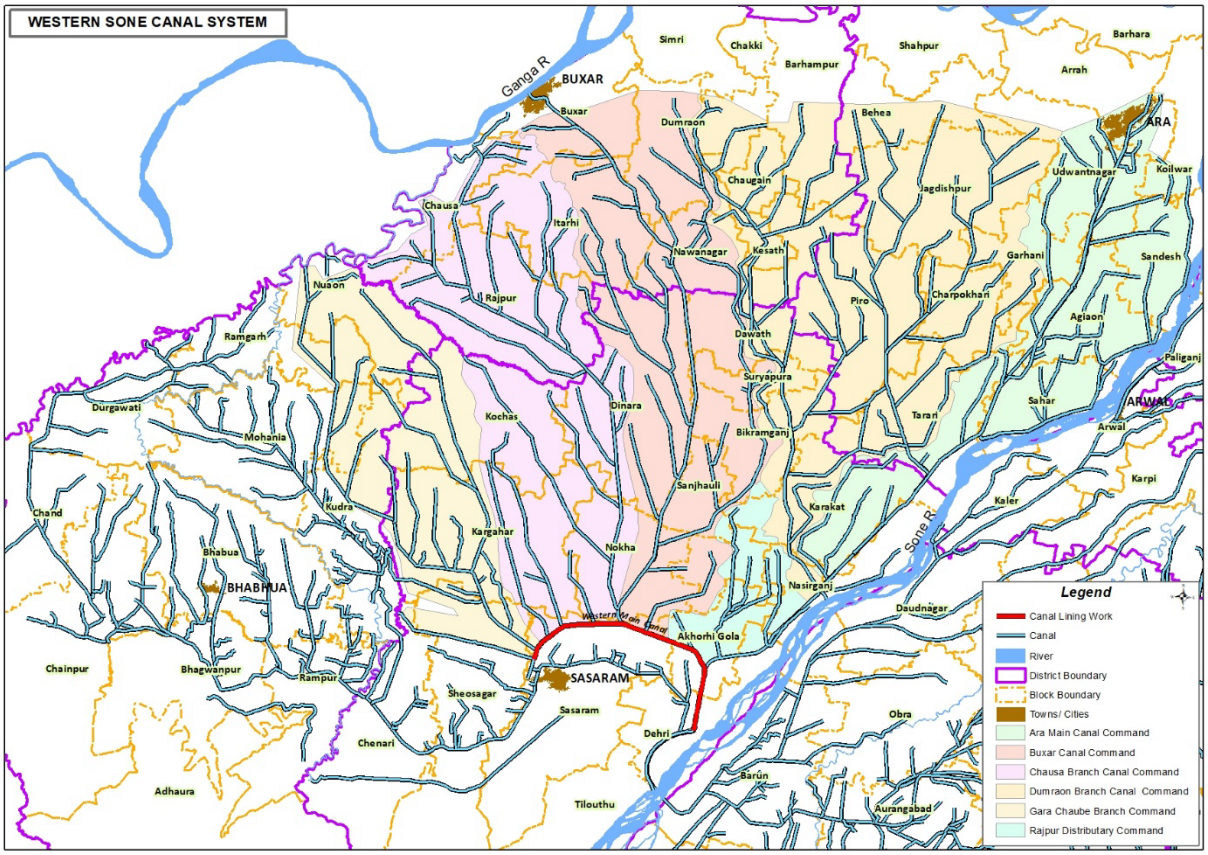
## 1.2 Brief Description of the Project (DPR)

The Water Resources Department, Govt. of Bihar has embarked on an ambitious plan to upgrade the Canal System in Bihar to enhance assured irrigation in the Sone Command Area. This modernization effort aims to increase the canals' carrying capacity, ensuring water reaches the tail-end regions with minimal loss. While the existing canals are operational, drought like conditions make it difficult to supply sufficient water for crop irrigation in the command area. The Sone command area has a dense canal network, with most canals functioning as designed. However, some canals underperform due to significant water loss during transit, primarily because they are unlined. To improve efficiency and reduce water loss, it has been decided to line the canals with plain cement and concrete.

The Water Resources Department has submitted a project proposal to the World Bank for assistance through the "Bihar Integrated Water Resources Management Project (BIWRMP) ". This proposal includes the modernization of the Sone Western Main Canal (km 0.0 to km 32.50) under Component 1 i.e. Climate Resilient Irrigation. The scheme is now renamed the "Modernisation of Western Main Canal from km 0.0 to km 32.50 of Sone Canal System" under the Bihar Water Security and Irrigation Modernisation Project (BWSIMP).

The Modernization of the Western Main Canal (WMC) project aims to address seepage and other water losses, aiming to restore the lost irrigation potential up to 24,244 hectares by upgrading the canal system with advanced concrete lining technology. The Western Main Canal, a crucial part of the Sone canal system, commands an extensive area of 521,489 hectares (CCA). This network supplies water to the Ara Main Canal (AMC), Chausa Branch Canal (CBC), Buxar Main Canal (BMC), Garah Chowbey Branch Canal, and various distributary systems. District and Block wise command area of Western Main Canal is shown in following Figure 1.1.

**Figure 1.1: District and Block wise Command Area of WMC**




Currently, many of these canals remain unlined and suffer from deterioration due to factors such as rain cuts, cattle movement, local encroachment, and other disturbances. The shift in monsoon patterns from sustained drizzles to heavy cloudbursts has led to significant rain splash damage. Additionally, animal grazing and movement on the canal slopes contribute to bank erosion, while burrowing animals present a significant threat to earthen embankments. The growth and subsequent falling of trees also result in soil loss from the canal embankments.

Water loss due to seepage and evaporation significantly impacts the operational lifespan of the canal system. Modernization efforts, including concrete lining, aim to mitigate these issues, thereby enhancing the canal network's efficiency and effectiveness. Currently, the upstream feeder canals, Western Link Canal and Western Parallel Link Canal, have been upgraded with concrete lining and are operating at full efficiency. These improvements will only be fully realized, if the downstream Western

Main Canal system is also lined. Lining will reduce water losses, increase flow velocity, and address maintenance issues. Lined canals can handle high discharge without the risk of bank erosion, carry more water without altering the canal section, and reduce transit water loss.

Regular maintenance and periodic upgrades are essential for efficient water distribution and addressing challenges such as siltation and infrastructure aging. Despite these efforts, the system still faces issues that require ongoing improvements and modernization to meet evolving irrigation demands and support sustainable agricultural practices.

The Modernization of the Western Main Canal (WMC) project aims to address seepage and other water losses to restore up to 24,244 hectares (CCA 19,442 hect) of lost irrigation potential. This will be achieved by upgrading the canal system with advanced concrete lining technology. The Western Main Canal, a key component of the Sone canal system, serves an area of 521,489 hectares (CCA). The proposed engineering works under the project include:-

I. De-silting and re-sectioning of the canal, with strengthening of existing banks over a length of 35.20 km (32.5 km of the WMC and 2.70 km from 18.70 km of WMC to Jaynagar lock).
II. Installation of 100 mm/ 75 mm thick concrete lining along 32.5 km of the WMC and 2.70 km from 18.70 km of WMC to Jaynagar lock, total length 35.20 km.
III. Remodeling outlets 268 number to replace the old ones.
IV. Renovation of existing outlets 2388 numbers.
V. Construction of a 390 m (both sides) retaining wall at Dehri Fall.
VI. Construction of Service Road in 22.50 Km with Bituminous.
VII. 19 numbers of new Puja Ghats/Stairs are proposed to be constructed under the project on the interval of 2.00 km each.

## 1.3 Objective of the ESIA Study

The main objectives for ESIA & ESMP of the "Bihar Water Security and Irrigation Modernization Project (BWSIMP) includes the following: -

- To ensure that the project is implemented in an environmentally sustainable manner.
- To identify the environmental and social sensitivities in the project areas and assessing the level of environmental and social impacts.
- To mitigate potential negative environmental and social impacts that may arise during the construction and operation of the project.
- Ensuring appropriate compensation for the Project Affected Persons (PAP) / Project Affected Families (PAF) irrespective of legal status with a view to provide suitable options that enable the affected people to improve or at least restore their standard of living in the post impact
- To establish systems and procedures for ensure that the mitigation planned, process suggested for preventing environment and social impacts during various stages of the project – pre-construction, construction and operation phase are implemented.

## 1.4 Approach and Methodology

The EIA Notification 2006 and the subsequent amendments list categories of infrastructure investment/ industries which would require prior environmental clearance. As the project involved renovation or modernization of the existing irrigation canal system including desilting, rehabilitation etc without increase in the command area the project does not fall in the under the preview of the EIA notification. However, for the study has been conducted in the spirit of the standard Terms of

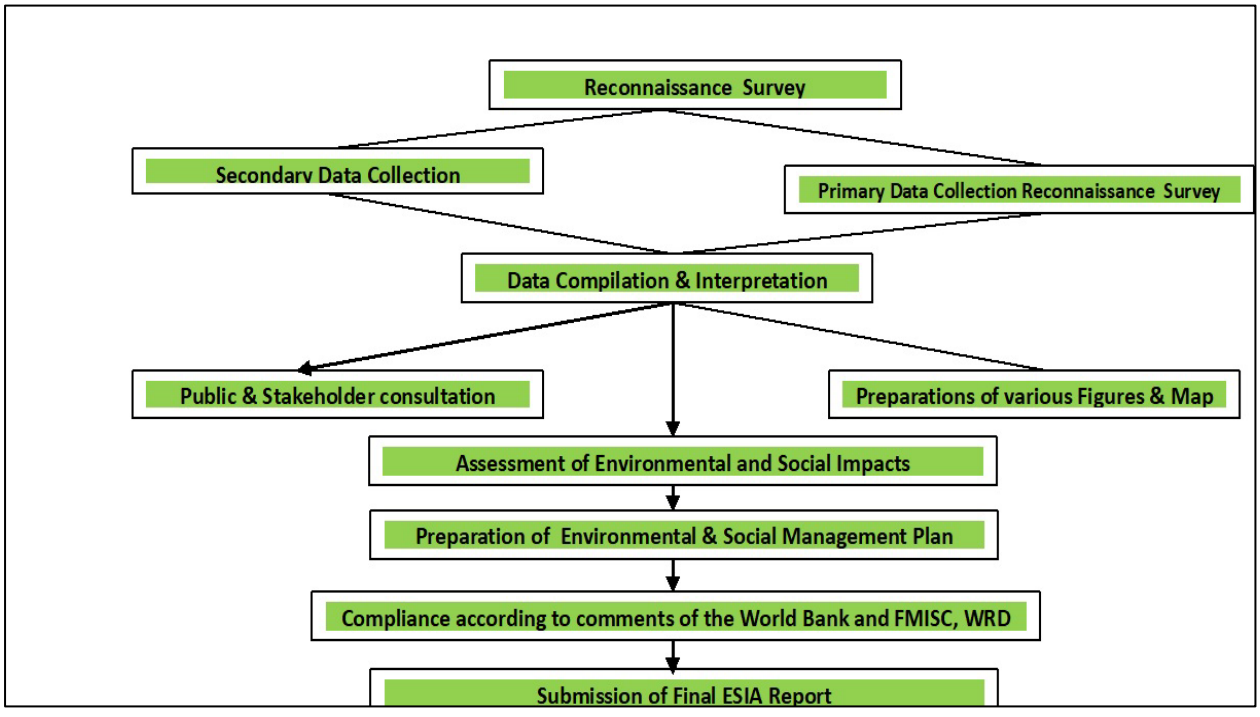
Reference proposed by MoEF&CC the World Bank ESF. The ESIA has further been refined based on the discussion held with FMISC, WRD, Patna, field unit of WRD and World Bank in accordance with the ESF requirements.

The approach and the methodology for the preparation of this report is: -

- Site Reconnaissance: Inspection of the site to assess the availability of land, type of assets to be impacted, etc.
- Desktop scoping conducted within the area of 5 km on either side of the stretch.
- Review of project documents and other relevant literature related to the water resource and irrigation sector in Bihar.
- Assessment of secondary data related to the socio-economic profile of the proposed project areas and collection of primary data required for establishing the project E&S baseline i.e. physio-chemical, biological and socio-economic aspects.
- Focused Group Discussions & Public Consultations were conducted during study to understand the views and perceptions of villagers within project area.
- Mapping of the national and state legal policy framework relevant to the project to assess gaps and additional requirements.
- Identification of potential impacts on various environmental and social attributes due to activities envisaged during the construction.
- Drafting the Environmental and Social Management Plan (ESMP), outlining measures to minimize adverse impacts anticipated during the pre-construction, construction and operation phase.
- Formulation of Environmental & Social Monitoring Programs.
- Estimation of cost for implementation of Environmental and Social Management Plan including both Environmental & Social Monitoring.

The proposed methodology for the Study is mentioned in the following Figure 1.2.

**Figure 1.2: Flow Chart of proposed activity under ESIA Study**



## 1.5 Layout of the Report

The layout of the ESIA Study is presented below:

- **Chapter 1**- This chapter provides a brief description of the project, the objectives of the ESIA study along with the methodology adopted for the ESIA Study.
- **Chapter 2**- This chapter discusses Resource Requirement for the proposed Project such as Land Requirement and availability, power requirement, requirement of raw material, labor requirement (local, migrant- number, accommodation), waste water disposal and Waste Generation and Disposal of Sludge etc.
- **Chapter 3**- This chapter discusses policy, legal and administrative framework applicable to this Project, World Bank Safeguard Policies etc.
- **Chapter 4**- This chapter deals with the analysis on alternatives available for the proposed project.
- **Chapter 5**- This chapter deals with the environmental baseline status of the Project area. It also described the details of the surveys/ field studies carried out during study.
- **Chapter 6**- This chapter deals with social baseline status of the Project area. It also described the details of the surveys/ field studies carried out during study.
- **Chapter 7**- This chapter deals with public consultation conducted under the project and its disclosure.
- **Chapter 8**- This chapter describes the impacts of project on the environmental components.
- **Chapter 9**- This chapter describes the impacts of project on the social components.
- **Chapter 10**- ESMP is presented in this chapter which includes proposed measures needed to prevent, minimize & mitigate the adverse impacts and improve environmental and social performance, along with the proposed Implementation Mechanism for the ESMP and financial estimates for the implementation of environmental and social measures proposed in the ESMP.

## CHAPTER 2: PROJECT DESCRIPTION

### 2.1 General

After the Sone canal became operational in the year 1874, certain difficulties such as, siltation of under sluices and canals, difficulties in the operation of headworks and damages to anicut were encountered from time to time. By the year 1931, the excessive siltation in the upstream, structural damages and reduced efficiencies due to difficulties in operation of sluices and weir gates, prompted the authorities to think in term of replacing the anicut at Dehri, on the River Sone. Subsequently, electricai analogy tests were also carried out, which confirmed the presence of voids in the Dehri anicut. Thereupon, detailed investigations were conducted for construction of a new barrage to replace the old anicut and also for remodel ling the existing canal system. Based on these investigations and after obtaining clearance from the Central Water Commission and approval of the Planning Commission, Government of India a new barrage was constructed in the year 1968 at lndrapuri, on the river sone, 8 km upstream of the old Dehri anicut. The new lndrapuri Barrage is 1410 m long and it consists of 60 bays, with a clear span of 18.3m (60 ft), between the abutments for the Spillways and 9 under sluice bays having a clear span of 18.3m (60 ft.). Five of the under-sluice bays have been located on the left side and four on the right side.

The following canals are emanating from the Indrapuri barrage from both sides:

1. Two link canals, one on either side, where also constructed in the year 1968, to connect the old sone canal system with the Indrapuri barrage.
2. The canal head regulators contain 7 gates on the Western Sone Link Canal and 4 gates on the Eastern Sone link Canal, each with a Clear span of 7.62 m (25ft.). Under the sub-project as such no activity on the gates of Barrage is included.
3. Extra head regulation constructed at western side to feeding the canal name as western parallel link canal. By this canal water transfer to sone high level canal and WMC.

The Dehri Fall, located at the mouth of the Western Main Canal, serves as the existing cross regulator cum fall. This canal system draws water from the Western Link Canal, which has a capacity of 8,738 cusecs, and the Western ·Parallel Link Canal, with a capacity of 3,247 cusecs. Positioned approximately 2 kilometers from the town of Dehri-On-Sone, the project channel is situated at the tail end (Dehri Out-fall) of these canals.

The Western Link Canal, off taking from the Sone barrage at lndrapuri, joins the old Main Western canal, at Dehri on Sone, about km. downstream of the old Dehri anicut and feeds the Western Low-level canal. The junction of the Western Link canal and the Main Western canal has been negotiated with the help of a 3.66m (12 ft.) free-fall, which is being utilized for generation of power. A navigation lock was provided at the fall to permit through navigation from lndrapuri downwards. The Western Link canal is 10.20 Km long. lt has a maximum discharging capacity of 226.56 Cumecs (8000 Cusecs) and a bed width of 62.50m (205ft.) at its head.

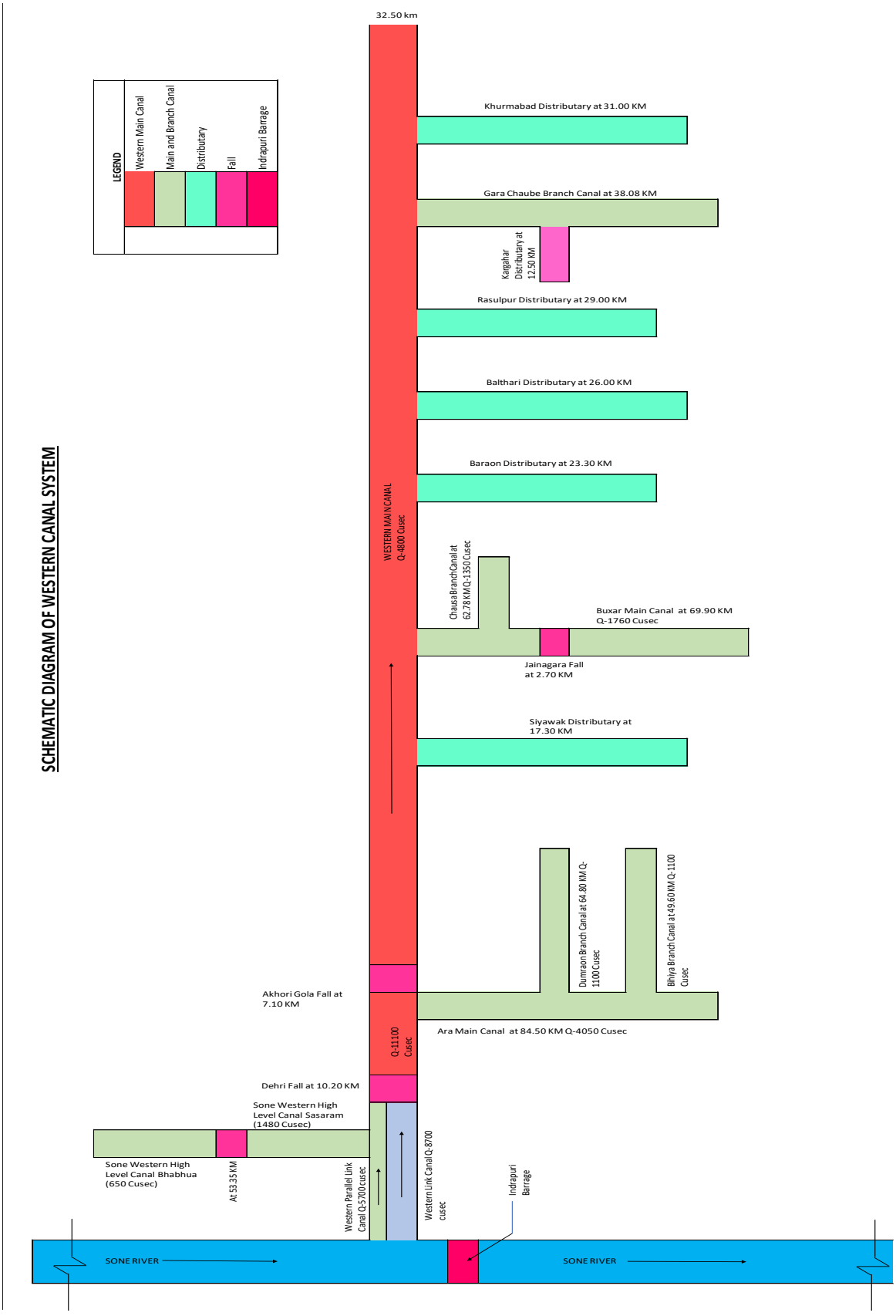
The Main Western Canal is a contour canal, which is now fed from the Western Link canal. Total length of MWC is 32.50 Km from Dehri fall and has five distinct reaches. The MWC has been aligned in such a way as to avoid deep cutting beyond 9.15 m (30 ft). it Curves round in a northerly direction for a short distance near the starting point and then turns to the West, crossing the river Kao over a siphon aqueduct at Muranpur at 14.18 Km and finally ends at Beda 3.22 km West of Sasaram. The canal all

along is unlined. The design discharge at head is 189.7 Cumecs (6700 Cusecs) with a bed Width of 71.3 m (234 ft.).

The upstream link canals, the Western Link Canal and the Western Parallel Link Canal, have already been lined with concrete, resulting in improved canal system efficiency. However, the benefits of lining will only be fully realized if the downstream canal systems are also lined. Lining reduces water losses and facilitates easier maintenance, while also allowing the canals to handle higher discharges without eroding the banks. With a lined canal system, the canal bed width can be adjusted to accommodate higher flows while minimizing water loss during transit. There is a plan to modernize the Western Main Canal under World Bank funded BWSIMP.

The Modernization of the Western Main Canal (WMC) project aims to address seepage and water losses, with the goal of restoring irrigation potential for up to 24,244 hectares by upgrading the canal system using advanced concrete lining technology. The WMC is a key component of the Sone Canal system, covering a vast area of 521,489 hectares (Culturable Command Area, or CCA). This network supplies water to several canals, including the Aral Main Canal (AMC), Chausa Branch Canal (CBC), Buxar Main Canal (BMC), Garah Chowbey Branch Canal, and various distributaries. Schemetic Diagram of Western Canal System is provided below in **Figure 2.1.**

## Figure 2.1: Schemetic Diagram of Western Canal System



## 2.2 Regional Setting

The Sone River, an interstate river, originates from the Amarkantak Plateau in Madhya Pradesh. It flows through Madhya Pradesh for about 510 km and Uttar Pradesh for 82 km before entering Bihar. In Bihar, it traverses the districts of Palamu, Rohtas, Bhojpur, Aurangabad, and Patna, eventually covering a total length of 839 km before merging with the Ganges River about 32 km upstream of Patna. The Sone River's catchment area spans 71,259 sq. km, with 17,651 sq. km located within Bihar.

The modernization efforts for the Sone Canal system, which is the central focus of this ESIA report, pertain specifically to the Sone Western Main Canal system, which provides irrigation to this agriculturally significant region.

The project area encompasses the Western Main Canal (WMC) command region, which spans a Cultivable Command Area (CCA) of 5.21 lakh hectares and a Gross Command Area (GCA) of 5.95 lakh hectares, with a total canal length of 32.50 km. The WMC originates from the Dehri outfall, situated 10.20 km downstream on the western side of the lndrapuri Barrage. It is primarily fed by the Western Link Canal (WLC) and the Western Parallel Link Canal (WPLC).

The command area is located in the southwestern part of Bihar and extends across four districts as detailed below:-

| Sl. No. | Name of the District | Reporting Area (in ha.) | Culturable Command area (In ha.) | | |
|---|---|---|---|---|---|
| | | | Whole district | WMC | Percentage |
| 1 | Bhojpur | 2,37,339 | 1,97,125 | 1,77,429 | 90.01 |
| 2 | Buxar | 1,66,900 | 1,46,721 | 140041 | 95.45 |
| 3 | Rohtas | 3,90,722 | 2,53,542 | 180951 | 71.37 |
| 4 | Kaimur (Bhabua) | 3,42,447 | 1,74,243 | 23068 | 13.24 |
| **Total** | | **11,37,507** | **7,71,631** | **5,21,489** | **67.52** |

## 2.3 Existing Condition of the Scheme

The Sone Canal System consists of two link canals that feed a vast network of earthen main canals, distributaries, and minor canals, forming the Sone East and West systems. These canals irrigate a Gross Command Area (GCA) of 7,96,157 hectares and a Culturable Command Area (CCA) of 6,85,932 hectares.

The current Detailed Project Report focuses on improving water productivity in the Western Main Canal (WMC) Command, which begins about 10.20 km downstream of the lndrapuri Barrage and Water is off-taken from the Western Link Canal and Western Parallel Link Canal with a toal length of 10.20 Km. Western Main Canal starts from 10.20 km downstream of Indrapuri barrage i.e. from the end point of Western Link Canal & Western Parallel Link Canal and runs up to Dehri town which is about 32.50 km downstream and completely in unlined condition. From 0.00 Km to 10.20 Km, the upstream link canals i.e. Western Link Canal and Western Parallel Link Canal have already been lined with concrete, resulting in improved canal system efficiency.

However, the benefits of lining will only be fully realized if the downstream canal systems are also lined. Lining will reduce water losses and easier maintenance of facilities, while also allowing the canals to handle higher discharges without eroding the banks. With a lined canal system, the canal bed width can be adjusted to accommodate higher flows while minimizing water loss during transit. Presently unlined WMC is in poor condition due to rain damage, cattle movement, local encroachments, and

other disturbances. Changing monsoon patterns have shifted from steady drizzle to torrential downpours, causing rain splash damage. Additionally, grazing animals and burrowing creatures erode canal banks, while the growth and collapse of trees further degrade the earthen structures. These issues collectively shorten the working lifespan of the canal system.

Present status of WMC is depicted below:

| **Particulars of Reach** | **Actual Design Discharge (in cumecs)** | **Present Status (in cumecs)** | **Remarks** |
|---|---|---|---|
| From 0.00 Km to 7.10 Km | 314.31 | 282.94 | Due to 16.19 cumecs Seepage losses & Transmission Losses |
| From 7.10 Km to 18.70 Km | 152.91 | 138.98 | |
| From 18.70 Km to 30.50 Km | 48.39 | 46.86 | |
| From 30.50 Km to 32.50 Km | 7.08 | 6.55 | |

## 2.4 Need of The Project

The performance of the major part of the WMC's system was assessed using the FAO Rapid Appraisal Process. The findings reflected a low level of water delivery services and below average performance, with the system's overall irrigation efficiency estimated at just 32-39%. Canal water reaches only about half of the command area. To meet crop water demands, supplementing or replacing canal supply, there are about 25,000 shallow tube wells (STWs), mostly diesel, in the command area.

The Sone Canal Project was originally conceived for Rabi wheat but it subsequently started catering for Kharif paddy which ultimately became a principal crop. Remodeling works executed in 1967-68 did not meet therequirements fully. The revised capacities of the various canals were not adequate to meet the ever-increasing demand of modern agricultural practices over the years, where sufficient supply of water was needed at the right time, necessitating the Project Authorities to encroach into free boards. The canals had been put to more and more stress every year as more and more areas were brought under irrigation. This has resulted in severe damage to the canals in the absence of corresponding improvements and proper maintenance. Consequently, the system had developed many deficiencies, which can be categorized as Engineering Deficiencies, Agronomical Deftciencies and Administrative and legislative deficiencies.

The Engineering Deficiencies occurring in the existing canal system are: -

- Low values of Critical Velocity Ratio
- Very flat canal bed slopes in certain reaches and steep slopes in other reach
- Deterioration of design parameters resulting in generation of lesser velocities
- Deterioration of canal structures
- lnadequatenumber ofcrossregulators
- lnadequate number of escapes
- Unsatisfactory functioning of cross drainage structures
- lmproper functioning of outlets

The Agronomical Deficiencies in the command area are:

- Lack of scientific estimation of crop water requirements
- Defective crop calendar
- Arbitrary cropping pattern
- Absence of water management
- Deep submergence of paddy crops

The Administrative and legislative Deficiencies

- Fragmentation of land holdings
- Unauthorized irrigation
- Lack of research studies
- lnadequate number of Agriculture Extension Centres
- Lack of Pilot Projects for demonstration
- lnadequate demonstration in farmer's fields
- Lack of efficient and quick communication facilities

In view of the deficiencies narrated above, the existing canal system is unable to supply adequate and timely water needed by the crops. The efficiency of the system is low and the crop yields per ha are poor. It is high time and extremely essential to remove these deficiencies. All these deficiencies could be removed by thoroughly modernizing the system. Herein lays the necessity and requirement for modernization. Apart from achieving significant improvement in overall irrigation efficiency, modernization will enable more intensive cropping and extension of irrigated area, leading to substantial increase in the yield of various crops per unit of land. Hence much improvement in the Environmental Quality (EQ) along with economic development can be made by modernization of the Western Sone Main Canal Project.

2.5 Description of the Proposed Scheme

The objective of proposed Modernization of the Western Main Canal (WMC) project is to address seepage and other water losses to restore up to 24,244 hetares (CCA 19,442 hect) of lost irrigation potential and maximize the irrigation intensity during both Kharif and Rabi seasons in Sone command area. This will be achieved by upgrading the canal system with advanced concrete lining technology. This project intends to undertake lining and modernization of Western Main Canal (WMC) from Km 0.00 to 32.50 and @ 18.70 Km to Jaynagara lock in length of 2.70 Km under Irrigation Division Dehri of WRD as per following details:

| S. No. | Description of the Item | Work |
|---|---|---|
| 1. | **Earth Work:** De-silting and Re-sectioning with strengthening the existing banks of Western main canal (WMC) and from 18.70 Km of WMC to Jaynagara lock. | 35.20 Km |
| 2. | **Lining:** a) Providing of 100/75 mm thick concrete lining work of WMC | 35.20 Km |
| | b) From Western Main Canal's @ 18.70 Km to Jaynagara lock in length 2.70 Km | |
| 3. | **Construction Outlets in place of old/ dilapidated at different locations:** | |
| | a) Western Main Canal | 06 Nos. |
| | b) Gara Chaube Branch Canal (GCBC) and its systems | 07 Nos |
| | c) Karghar Distry from Km 12.50 to Km 37.50 | 52 Nos. |
| | d) Buxar Branch Canal | 113 Nos. |
| | e) Chausa Branch Canal | 90 Nos. |
| | **Total** | **268 Nos.** |
| 4. | **Restoration of Outlets at different location of entire system of WMC** | |

| | | |
|---|---|---|
| | a) Western Main Canal | 55 Nos. |
| | b) Gara Chaube Branch Canal (GCBC) and its systems | 66 Nos. |
| | c) Karghar Distry from km 12.50 to 37.50 km | 472 Nos. |
| | d) Buxar Branch Canal | 990 Nos. |
| | e) Chausa Branch Canal | 805 Nos. |
| | **Total** | **2388 Nos.** |
| 5. | Retaining Wall:<br>Construction of Retaining wall 0.240 Km left side and 0.150 Km right side at Dehri fall of Western Main Canal. | 390 m |
| 6. | Construction of Service Road with Bituminous | 22.50 Km |
| 7. | **Puja Ghats /Stairs** | **19 Nos.** |

The above mentioned works majorily includes the following: -

- The Restoration includes re-sectioning of damaged portion of existing canal in a length of 32.50km.
- PCC lining with 100 mm thickness over the low-density polythene specification of 250 micron over the 230 mm thick local sand.
- Provision of sleepers in 3m x 3m grid along and across the canal has been made.
- Provision for longitudinal drain and transverse drain at approx. 10 m interval has been proposed.
- Provision of PRV'S (Pressure Release Valve):
  a) In bed –1 no. at every 100 square metre at the inter section of drain.
  b) In slope –1 no. at every 40 square metre. PRV'S are provided at 1m below the FSD and 0.5 above the toe of slope in staggered form @ of 5m interval (horizontally).

- Provision for laying of LDPE in bed and damaged portion of canal has been made.
- Provision for 100 mm thick M15 grade concrete lining in bed and slope has been made.
- Dowel bank has been proposed at the both side of the lining with brick masonry 300 mm width and height 750 mm with 50 mm thick PCC lamination.
- Retaining wall with Nominal reinforcement has been proposed at both side of Downstream of Dehri Fall upto FSL+FreeBoard.
- Restoration of existing structures: Outlets 4no.s, CR/Fall–2no.s, Headregulators–4No.s.

Before commencement, the Contractor shall submit a detailed work programme and method statements for all major activities (dismantling, earthwork, lining, structure construction, etc.) for approval. All work shall be planned considering the seasonal irrigation schedule and weather conditions; construction in the canal bed shall preferably be done in the dry season or during canal closure periods. The Contractor shall make necessary provisions to manage water during construction - including diversion channels, cofferdams or pumping to keep the work areas dry. The site conditions include existing agricultural land and villages adjacent to the canal; the Contractor shall ensure minimal disturbance to existing embankments, crops, and structures, and take all necessary safety and erosion control measures. Access to the site, including any required temporary roads or ramps, shall be the Contractor's responsibility. Any utilities or obstructions encountered (if applicable) shall be safeguarded or relocated in coordination with authorities.

## 2.6 Design Basis and Period

The lining of canals plays a crucial role in irrigation systems by enhancing water flow and reducing losses from seepage. The water conserved through lining can be redirected for expanding and improving irrigation coverage. This is especially important for areas irrigated by tube wells, where pumped water

is more expensive. Lining also reduces seepage, preventing the rise of the subsoil water table, which can lead to water logging and potential damage to surrounding areas. Additionally, by allowing higher velocities in the canal, lining reduces the canal's cross-sectional area and the required land width, leading to cost savings in excavation and construction. It also helps maintain the canal's shape. Designing a lined canal in India involves several considerations, both technical and environmental, to ensure the efficient conveyance of water for irrigation or other purposes while minimizing losses.

**Function Canal Lining:**

1. Control of seepage
2. Prevention of waterlogging
3. Enhanced hydraulic efficiency
4. Increased resistance to erosion and abrasion
5. Reduced operational and maintenance costs

Damage to irrigation infrastructure can have a cascading effect, disrupting agricultural productivity, harming the environment, and imposing significant financial costs. The service road on a canal embankment is vital for ensuring the canal system's smooth operation, supporting maintenance, enhancing safety, and enabling efficient responses to any issues that arise.

For the Ara canal systems higher flows are required to be discharged. For conveying the increased discharge in the Ara Main Canal, the flow carrying capacity of the Western Main Canal (7.0 km length) upstream of the Ara iain Canal offtake is also required to be increased to carry a duty of 0.89 L/s/ha. The present capacity of Western main Canal is about 273 $m^3$/s (0.62 L/s/Ha). The existing capacity of WMC is fixed as 11,100 cusecs with 124.70% irrigation intensity operated in rotation system (Tatil). The present reported CCA of WMC Project is 5,21,489 Ha.
For the purpose of economic analysis, the life expectancy of concrete, brick/tile and stone pitched lining is taken as **60 years** as per IS 10430:2000.

2.7 Sustainability of the Project

Western Main canal modernization sub-project will be considered sustainable when it effectively conserves water by minimizing seepage and evaporation, leading to increased irrigation efficiency in the adjoining areas, reduced maintenance needs, and improved agricultural productivity, while also minimizing environmental impacts through the choice of materials and construction practices, ultimately contributing to long-term water resource management and ecological health.

**Key aspects of sustainable WMC modernization sub-project: -**

Water Conservation: The primary benefit of WMC lining is significantly reducing water loss through seepage, allowing more water to reach the intended irrigation areas, thus promoting water conservation and sustainable agricultural practices.

Improved Irrigation Efficiency: By minimizing water losses, WMC lining will enable better water distribution and allows for the adoption of modern irrigation techniques like drip and sprinkler systems, further enhancing water use efficiency.

Reduced Maintenance Costs : Proper lining and modernization of WMC will require less frequent cleaning and repairs due to reduced sediment deposition and vegetation growth, leading to long-term cost savings.

**Environmental Considerations:**

Material Selection: Choosing eco-friendly lining materials like geomembranes made from recycled materials can minimize the environmental footprint of the project.

Habitat Preservation: Incorporating vegetation along canal banks can provide wildlife habitats while stabilizing soil and improving water quality.

Minimizing Disruption: Careful construction techniques can minimize disturbance to existing ecosystems.

2.8 Resource Requirement for the Project

## Land Requirement and availability

The intervention is mainly lining work on the main canal of Sone, which implies work will be limited inside the canal, hence, no Land acquisition is required. On both sides of the canals sufficient land, owned by WRD is available, details of that are given in the Table 2.1. Agricultural land is about 15 m to 20 m far from either side of the canal. Further, necessary land is available at the bank of the canal for movement of machineries during the work, acquisition of private land is not required for that. However, in some places, squatters at the bank of the canal have been identified, who need to be relocated with appropriate R & R support.

**Table 2.1: Details of WRD Land available on each side of embankment of WMC**

| S.No. | Chainage | Government Land from Centre line of Canal Embankment | | Name of Block | Name of Village |
|---|---|---|---|---|---|
| | | Left | Right | | |
| 1. | Km 0.00 to Km 7.10 | 48.125 m | 55.74 m | Dehri, Akorhigola, Sasaram | Dehri Mathuripur Mor Dalmianagar, Bishun Bigha Bihari Bigha, Akorhigola, Akorhi, Barhari, Chhapra, Chapra Garh, Khapra, Semradih, Mahadevganj, Manger Tola, Bhajea, Bisunpura, Bhainsahi, Inaihia, Paisara, Gobina, Babhanpura, Garura, Sumbha, Jhalkhoria, Rakasia, Akasi, Agrer, Mokar, Kothara, Nimia, Semra, Bhikhanpura, Baradih, Turki, Chaukhnda Chitauli, Lodhi |
| 2. | Km 7.10 to Km 18.70 | 40.35 m | 45.20 m | | |
| 3. | Km 18.70 to Km 30.50 | 29.08 m | 33.30 m | | |
| 4. | Km 30.50 to Km 32.50 | 17.45 m | 21.67 m | | |

Source: Concerned divisions of WRD

## Requirement of Raw material

The construction materials used in lining and modernization of WMC tabulated in Table 2.1

**Table 2.1: Amount of construction Materials required for lining and modernization of WMC**

| Western Main Canal (k.m 0.0 to k.m 32.5) | | | | |
|---|---|---|---|---|
| **Sl. No.** | **Construction Material** | **Quantity** | **Unit** | **Main Carriage station** |
| 1 | Cement | 82420 | MT | Dehri |
| 2 | Coarse Sand | 137761 | Cum | Sone sand |
| 3 | Coarse aggregate | 366548 | Cum | Ahiraura |
| | Stone Filter | 96369 | Cum | Ahiraura |
| 4 | Local Sand | 335948 | Cum | nearest place to worksite |
| 5 | Bitumen | 530 | MT | Gaya |
| 6 | Steel | 248.55 | Cum | Dehri-on-sone |
| 9 | Bricks | 2950333 | Nos. | nearest place to worksite |

| Western Main Canal (k.m 0.0 to k.m 32.5) | | | | |
|---|---|---|---|---|
| **Sl. No.** | **Construction Material** | **Quantity** | **Unit** | **Main Carriage station** |
| | | | | |
| 10 | Hume pipe | 18190 | m | |
| 11 | Emulsion | 16957.73 | kg | |
| 12 | LDPE | 2055199.86 | $m^2$ | Kolkata |
| 13 | 160 OD-PVC Pipe | 161634.30 | m2 | Kolkata |
| 14 | NCL & NCT | 1317834.03 | m | Ahamadabad |
| 15 | 750 mm long PRV | 10713 | m | Ahamadabad |
| 16 | 430 mm long PRV | 13624 | Nos | Ahamadabad |

Source: Concerned Divisions of WRD

### Labor Requirement (local, migrant- number, accommodation)

The lining work will take 36 months to complete for the proposed sub project. The requirement of skilled and unskilled labour is given in Table 2.2.

**Table 2.2: Requirement of labour by type**

| Skilled Lab | Semi skilled Lab. | Unskilled Lab. | Total Lab. |
|---|---|---|---|
| 201600 | 9900 | 5907600 | 6119100 |

Source: Concerned Divisions of WRD

The unskilled workers will be primarily sourced form the local areas but the skilled workers would be part of the Contractors own workforce and would need to be housed in construction camps or rented accommodation.

### Wastewater Disposal

Waste water from the construction area charged with cement slurry, Grease and oils etc. are likely to flow to the nearest water body causing contamination of water. The water contamination may be caused due to waste discharge from construction camps and labour camps. These short-term impacts will be mitigated with the adoption of precautionary measures as detailed in Chapter 10.

### Waste Generation and Disposal

The Wesern Main Canal is unlined at present so there is no need of dismantling in the bed and slopes, while lining is proposed on the bed and side slopes. In areas where the slopes have collapsed, resectioning of the canal is proposed.

In addition, estimated quantity of excavated materials to be generated due to desilting of WMC under the project is estimated to be 420183.76 Cum. This quantity will be used for sectioning of canal. The filling quantity required to bring the canal in section is much more than the quantity obtained during bed clearance of the Sone western main canal. This cutting quantity will be used during filling of the damaged embankment of canal to bring the canal in section. Desilted material will temporarily be stored in alongside available chat land belonging to Water Resources Department (WRD). There are approx. 20-50-meter-wide chat land is available alongside of Western Sone Main Canal (WMC). As per discussions held with official of concerned division of WRD, the construction/debris waste and desilted material generated during the construction will also be temporarily stored in alongside available chat land area of WRD.

## CHAPTER 3: LAWS, POLICIES AND PERMITS

This chapter deals with the laws, regulations and policies, of Government of India, Government of Bihar and the World Bank, related to environmental and social issues. Only the laws, regulations and policies which are in vogue and relevant to the project are discussed here. This section needs to be updated as and when new laws, regulations and policies are made and enforced or the existing ones are revised.

### 3.1 National and State Laws- Environment and Social

**Table 3.1: Applicable Laws and Policies**

| S. No. | National/ State Legislation | Description on provisions related to the Project | Relevance to the Project |
|---|---|---|---|
| **1** | Constitution of India (Article 15, 16, 46) | The Indian Constitution prohibits any discrimination based on religion, race, caste, sex, and place of birth and contains a clause allowing the union and state governments to make special provision for the advancement of socially and educationally vulnerable classes of citizens or for the Scheduled Castes and Scheduled Tribes. Article 16 refers to the equality of opportunity in matters of public employment and directs the state to protect them from social injustice and all forms of exploitation | The provisions under the Constitution ensure the access, equity, and inclusiveness of the vulnerable groups in the Program. |
| 2 | The Bihar Irrigation Act, 1997 | The Act consolidates the law relating to irrigation embankment, drainage, levy and assessment of water rates. It provides the State government all rights in the water of any river, natural stream or natural drainage, channel, natural lake or other natural collection of water. | The Act guides the project activity for carrying out repair work related to irrigation.<br>It gives direction in remedial measures in ESIA and ESMP. |
| 3 | Bihar Irrigation and Drainage Rules, 2003 | The rules include some of the relevant laws and regulations that govern Water Users Associations (WUA)s in Bihar. It implements the provisions of the Bihar Irrigation Act, 19.97. The rules also outline an action plan for the state in the event of floods. | It gives direction in strengthening of Water Users Association (WUA) wrt Standard operation procedure of WUA, Irrigation work forms, in ESIA and ESMP. |
| 4 | The Right to Information Act, 2005 | Empowers citizens to demand information on functioning of public systems if it impacts their lives or is of public interest. Designates a Public | Ensures transparency and accountability in the govt |

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| | | Information Officer in all public offices to provide info; creates State /Central Information Commissions (statutory) to look into appeals regarding unsatisfactory information provided to citizens or unclear interest in demanding information. | operations and citizen's access to public information. |
| 5 | Bihar Right to Public Services Act, 2011 | To provide for the delivery of notified public services to the people of the State within the stipulated time limit | Timely, transparent, and easy-to-access public services. |
| 6 | Panchayati Raj Act, 73rd constitutional amendment act, 1992 | The act strengthens the decentralized governance system and promotes bottom-up planning. The most critical part are that it strengthens the structure of representative democracy and political representation at the local level. | The Act empowers the local self-government to prepare GP level plans at Gram sabha, to execute and monitor the same. In ESIA and ESMP it gives direction for managing and monitoring irrigation work, flood protection work. |
| 7 | Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act (RFCT in LARR), 2013<br><br>and Bihar Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Rules, 2014 | To ensure, in consultation with institutions of local self-government and Gram Sabhas established under the constitution of India, a humane, participative, informed and transparent process for land acquisition for industrialization, development of essential infrastructural facilities and urbanization with the least disturbance to the owners of the land and other affected families; provide just and fair compensation to the affected families whose land has been acquired or proposed to be acquired or are affected by such acquisition. | Make adequate provisions for such affected persons for their rehabilitation and resettlement; (iv) ensure that the affected persons become partners in development leading to an improvement in their post-acquisition social and economic status and for matters connected therewith. |
| 8 | The Equal Remuneration Act, 1976; Employee Compensation Act, 1923; and<br><br>Personal Injuries (Compensation Insurance) Act, 1963; The Minimum Wages | Provide equal remuneration to men & women workers, prevent discrimination against women in matters of employment, employers to compensate workman's spouse / dependent sons, daughter in case of injury at workplace and mandatory worker insurance by employers against such liability. | Prevents gender discrimination in employment and provides for employee welfare, including social assistance against any incident/ accident. |

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| | Act, 1948, Payment of Wages Act, Maternity Benefit Act, 1961 | | |
| 9 | The Child Labour (Prohibition and Regulation) Act 1986, and Rules 1988; Children (Pledging of Labour) Act, 1933 (as amended in 2002); Contract Labour Act 1970; The Bonded Labour System (Abolition) Act, 1976 | These Acts mandate the employers of any establishment employing construction workers to provide basic amenities and welfare facilities. The laws also prohibit employment of child and bonded labour. | Ensures safety, welfare, and other conditions of service to construction workers employed |
| 10 | Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 | To regulate the employment and conditions of service of building and other construction workers. | Safe and healthy working environment.<br>Responsiveness in case of mishaps and accidents. |
| 11 | Inter-State Migrant Workmen's (Regulation of Employment and Conditions of Service) Act, 1979 | To regulate the employment of inter-State migrant workmen and to provide for their conditions of service | Protects migrant and seasonal agricultural workers by establishing employment standards related to wages, housing, transportation, disclosures and record keeping |
| 12. | EIA Notification 2006 and its amendement vide Ministry of Enironment, Forest and Climate Change, New Delhi Notification dated 17th March, 2025. | Supreme Court *vide* its judgment dated the 21st March 2024 in Civil Appeal Nos. 1628-1629 of 2021 titled Noble M. Paikada Vs Union of India has struck down item 6 of the Appendix-IX to the said notification, on the grounds that the term "linear projects" is not defined and is very vague and the process to be adopted for excavation has not been set out, thus, item 6 is a case of completely unguided and blanket exemption which is, *per se*, arbitrary and violative of article 14 of the Constitution of India; In order to address all the issues and concerns raised by the Supreme Court, MoEFCC issued notification dated 17.03.2025 and amended the said notification of 2006. As per amendment "Extraction | The Expert Appraisal Committee shall, while granting prior environment clearance for the projects requiring extraction or sourcing or borrowing of ordinary earth, include the environmental safeguards prescribed in this Appendix as part of the prior environmental clearance granted to them. |

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| | | or sourcing or borrowing of ordinary earth for the linear projects subject to the compliance of the conditions set out in Appendix XIV[1]" of MoEFCC notification dated 17.03.2025. | |
| 13 | National Policy on Safety, Health, and Environment at Workplace 2009: | The policy provides an action program that includes enforcement, national standards, compliance, awareness, occupational safety and health development. | It emphasizes that awareness generation on occupational safety needs to be done by suitably incorporating teaching inputs on safety, health, and environment at workplace in schools, technical and vocational courses. |
| 14 | Code on Occupational Safety, Health, and Working Conditions Bill, 2019 | This code on occupational safety, health and working conditions applies to all establishments with 10 or more workers and includes building and construction workers. | |
| 15 | Public Liability and Insurance Act, 1991 | Enacted for the purpose of providing immediate relief to persons affected by accidents while handling hazardous substances and other incidents. | The project is being carried out in mainly urban areas where there are already existing vessel movements as well as several other human activities at the jetty locations (vendors, locals moving around, etc.). Protection to general public from the accidents due to hazardous material (especially if any used at the vessel yards, gangway/pontoon manufacturing units) is essential. |
| 16 | The Sexual Harassment of Women at Workplace (Prevention, Prohibition, and Redressal) Act 2013 | Protects women workers from sexual harassment and abuse of power at their workplace and provides for constituting an Internal Complaints Committee in every organization employing 10 or more workers, including women, to look into complaints of sexual harassment. Provides guidance on redressal against | Recognizes the need for legal protection of women workers against abuse, exploitation in all government institutions. |

[1] https://parivesh.nic.in/publicdocument/UPLOAD_OM_NOTIFICATION/IA_DOCS/1001_19032025024958.pdf

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| | | such complaints, including its internal investigation in a time bound manner. | |
| 17 | National Policy for Women, 2016 | The policy articulates various mandates for the holistic empowerment of women in the country. It includes various areas such as health, education, livelihoods, access to social protection, and protection from violence and discrimination at the core of its provisions. The policy's mandate seeks to guide governance and policy making practices across departments at the national and state level. | Guides inclusion and accessibility provisions and overall women's empowerment and SEA relevant to the program. |
| 18 | Plastic Waste Management 2016 | The plastic waste like polythene, plastic bags, plastic bottles etc. during project construction and operation phases. | Applicable, during operation phase, project proponent will implement the provision of this Act for disposal of Plastic waste. |
| 19 | Air (Prevention and Control of Pollution) Act, 1981, amended 1987 and it's Rules, 1982. | For prevention, control and abatement of air pollution activities.<br>Establishes ambient air quality standards. | Applicable for equipment and machinery's potential to emit air pollution (including hot mix/ batching plants/ stone crushers/ diesel generators and vehicles etc.). The project involves digging, spoil dumping, etc., which will generate fugitive dust. |
| 20 | Water Prevention and Control of Pollution) Act, 1974, Amendment there of | To prevent and control water pollution. | Applicable. Effluents are expected to be generated during construction of the project. The effluents should meet the discharge standards specified in the Rules. |
| 21 | Environmental (Protection) Act, 1986 amended 1991 and associated rules / notifications | ▪ To protect and improve overall environment, this is an umbrella legislation for protecting the environment.<br>▪ It seeks to supplement existing laws on pollution control and also lays down standards for air quality and noise.<br>▪ Many rules/ notifications are formed under this act. | ▪ Relevant to sub-projects to be taken up, viz., Canal lining, dredging of silt, embankments, etc. activities.<br>▪ Preservation of air and water quality.<br>▪ Control of pesticides & insecticide runoff. |

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| | | | ▪ Control dust pollution due to quarrying, which might harm the vegetation. |
| 22 | Construction and Demolition Waste Management Rules, 2016 | The rules shall apply to everyone who generates construction and demolition waste such as building materials, debris, rubble waste resulting from construction, re-modeling, repair and demolition of any civil structure of individual or organisation or authority. | Not Relevant. Construction and demolition waste will not be generated from the project works as WMC is not lined at present. |
| 23 | Hazardous Waste Management Rules, 2016 | Rules defines and classifies hazardous waste, and procedures for handling and storage. | Applicable: Used engine oil, gear oil, hydraulic oil, spent oil, lubricants etc. will be generated during construction and desiltation operation as well as operation of diesel generator at camp site. The desilted sediments will be tested for toxicity (presence of heavy metals, pesticide residues, etc.) and disposed as per the provisions of the applicable Rules. |
| 24 | Solid Waste Management Rules, 2016 | The provisions of the Act prevent littering and mandate proper segregation, collection, storage and disposal of municipal solid waste. | Applicable. The project will have provisions to manage and dispose solid wastes generated during project construction and operation phases. |
| 25 | Noise Pollution (Regulation and Control) Act, 1990 and Rules, 2000. | Standards for permitted level of noise during the day and night have been promulgated by the MoEFCC for various uses. In case of any violation in silence zone area, complaints to be made to authority and power to prohibit continuance of music sound or noise also falls under within these rules. | Noise will be generated during project implementation stage due to different activities like construction, operation and movement of vehicle, heavy equipment and machinery. |
| 26 | Notification for use of fly ash, 2003 and subsequent amendment, 2016 | ▪ Reuse large quantity of fly ash discharged from thermal power plant to minimize land use for disposal.<br>▪ The 2016 amendment requires the mandatory use of fly ash in the construction of roads and flyover | Presence of TPPs within 300 km radius of proposed project activities are observed. Project activity involves construction activity like PCC lining, rehabilitation |

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| | | embankments within a 300 km radius of a thermal power plant.<br>▪ Fly ash shall mandatorily be utilized in asset creation programmes of the Govt. involving construction of building, road, dams and embankment.<br>▪ Fly ash shall be used in soil conditioner.<br>▪ Fly ash-based bricks or product shall be used in construction under all Govt. scheme or programme. | of regulating structure, flood wall construction. Possibility of using fly ash in different construction related activities will be planned as part of the EMPs of the project works. |
| 27 | Insecticides Act, 1968, Rule 1971 | Use of registered and recommended insecticides and non-use of banned insecticides. | No insecticides will be procured under the project |
| 28 | Central Motor Vehicle Act, 1988 and Central Motor Vehicle Rules, 1989 | To check vehicular air and noise pollution. Empowers State Transport Authority to enforce standards for vehicular pollution. From August 1997 the "Pollution Under Control Certificate is issued to reduce vehicular emissions. | Applicable, as the proposed development activities will engage several vehicles (transport of materials, worker movements, etc.). |
| 29 | The Gas Cylinder Rules 2004 | To regulate the storage of gas / possession of gas cylinder more than the exempted quantity | Applicable if contractor store more than the exempted quantity of gas cylinder. |
| 30 | National Framework for Sediment Management issued by the MoJS[2] | To adhere with the environmental safeguards during dredging and desilting of canal as outlined in the National Framework for Sediment Management (SOP) | The Ministry of Environment, Forests and Climate Change (MoEF&CC) has issued notifications related to sediment management (S. O. 1224 (E), dated 28th March 2020), particularly focusing on dredging and desilting of dams, reservoirs, weirs, barrages, rivers, and canals. Said notification exempts these activities from requiring environmental clearance, provided they adhere to the environmental safeguards outlined in the National Framework for |

[2]https://nmcg.nic.in/writereaddata/fileupload/52_National%20Framework%20for%20Sediment%20Management%20-%20English%20(1).pdf

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|---|---|---|---|
| | | | Sediment Management (NFSM). |
| 31. | The Mines and Minerals (Development and Regulation) Act, 1957 as amended | Legal framework for regulating mines and developing minerals. | The contractors will procure aggregates and other building materials from quarries and borrow areas approved under such Acts. In the event if the contractors open any new quarry and/or borrow areas, appropriate prior permission from the State Departments of Minerals and Geology will need to be obtained. Contractors will also need to ensure full compliance with these rules and any conditions imposed in the permit. |

**Other Acts and Regulations that may be applicable**:

- Untouchability Offences Act, 1955
- The Scheduled Castes and the Scheduled Tribes (Prevention of Atrocities) Act, 1989 and The Scheduled Castes and the Scheduled Tribes (Prevention of Atrocities) Rules, 1995
- Bihar Public Land Encroachment Act, 1956
- Kosi Calamity Rehabilitation and Reconstruction Policy, 2008
- Panchayats Extension to Scheduled Areas (PESA) Act, 1996
- The Rights of Persons with Disabilities Act, 2016
- Mahatma Gandhi National Rural Employment Guarantee Act, 2005 (MGNREGA)
- Forest Rights Act, 2006
- Bihar Reservation of Vacancies in Posts and Services Act, 1991 (Bihar Act 03, 1992)
- Bihar Reservation of Vacancies in Posts and Services (for Scheduled Castes, Scheduled Tribes and other Backward Classes) (Amendment) Act, 2023

<u>Earlier Approval</u>

The Sone Canal Modernisation Project, for all the 8 nos. of Main and Branch canals of the Sone Canal System was first formulated in the Year 1982. It underwent a series of changes and modifications in course of compliance of comments of the Central Water Conunission. The scheme was finalised in the year 1984. This Project was considered by the Advisory Committee to the Planning Commission, in this meeting held on 24.09.1984 and was found acceptable in principle, vide Planning Commission letter No. 16 (25)/28/84-1 & CAD dt. 31.10.1984. It was also recommended to take up the proposed remodelling work in pilot areas, in four main and branch canals in the first phase, with provision of lining, limited to only the head reaches of canals.

The Environmental clearance to the Project was also accorded by the Department of Environment, Government of India, vide letter No. J-11016(125)/85-Env-5 dated the 3rd September 1984. Modernisation of Sone Canal System Phase-I, Bihar was approved by Planning Commission for an estimated cost of Rs.235.93 crore (at price level 1991) in its 56th meeting of the Advisory Committee if irrigation and Flood Control & Multi-purpose project held on 10Novermber, 1993 vide letter No.2(234)/93-98 CAO dt.01.12.1993. The environmental clearance given by Ministry of Environmental and Forests vide letter no. J 11616/125/83-Env.5 dated the 6th June 1998. After that, Investment Clearance obtained from Planning commission, GoI vide letter 02(234)/ 98-I & CAD dt. 7" July 1998.

3.2 World Bank Environmental and Social Standards

The project will be governed by the Environment and Social Framework of the World Bank. The World Bank's Environmental and Social Framework (ESF) promotes sustainable solutions in its operations and in the work environment. The focus is to prevent and mitigate undue harm to people and their environment during the development process. They strive for positive impact on the environment and on Indigenous Peoples and local communities — whose perspectives we seek through meaningful consultation, by prioritizing projects that tackle issues of climate change, environmental and social sustainability, fragility, and gender-based violence. All World Bank Projects should adhere to these standards. The Environmental and Social Framework (ESMF) prepared for the project, which would guide the E&S actions in the project has identified the following policies as relevant:

- **ESS 1 -** Assessment and Management of Environmental and Social Risks and Impacts: ESS1 is relevant to ensure that such investments are planned and designed to be sound and sustainable by integrating environmental dimension into the overall decision-making process. The ESIA is prepared in compliance to the requirements
- **ESS 2 -** Labor-and-Working-Conditions: The labour to be employed under Sone Western Main Canal will be governed by the national regulations and shall also comply with the requirement of the ESS2
- **ESS 3 -** Resource-Efficiency-and-Pollution-Prevention-and-Management: It improves resource efficiency. The project is aiming to use the excavated material. There are also measures being planned to control pollution during construction
- **ESS 4 -** Community-Health-and-Safety: Community Health Safety and Occupational Health and Safety concerns are being taken care of during the design, construction and operations
- **ESS 5 -** Land-Acquisition-Restrictions-on-Land-Use-and-Involuntary-Resettlement: Proposed sub project involves resettlement of non-title holders/ encroachers/ squatters along the existing canal RoWs. Site specific RAPs will be prepared and implemented in line with ESS5 guidance to address the impacts of of permanent and temporary resettlement
- **ESS 6 -** Biodiversity Conservation and Sustainable Management of Living Natural Resources: It recognizes protection and conservation of biodiversity and habitats. Western Sone Main canal does not have as such important habitats. If any such habitats are identified specific mitigation measures proportional to the risk will be taken up as per ESS 6 guidance
- **ESS 7** - Indigenous Peoples/Sub-Saharan African Historically Underserved Traditional Local Communities: Not relevant as the project does not have footprint in tribal areas
- **ESS 8** - Cultural Heritage: The project will not encroach into any archeological site but may be in proximity and the ESMF lays down the guidance for handling these situations. However, 19 Nos. of Pujaghat / Stairs are proposed under the subject therefore its applicability will be assessed.
- **ESS 9** - Financial-Intermediaries: Not relevant as there are no financial intermediaries involved.
- **ESS 10** - Stakeholder-Engagement-and-Information-Disclosure: Stakeholder remains at the center of the development process and a Stakeholder Engagement Plan has been put in place for effective communication and handling grievance if any

The Environment Management Framework is based on the policies and standards elaborated on the above. The ESMF has been prepared and approved by the Bank and disclosed. The ESIA and ESMP have been prepared in compliance with this framework.

3.3 IFC EHS Guideline

The International Finance Corporation (IFC) Environmental, Health, and Safety (EHS) Guidelines are technical references with general and Good International Industry Practice (GIIP). The EHS Guidelines contain the performance levels and measures that are normally acceptable to the World Bank Group, and that are generally considered to be achievable at reasonable costs by existing technology. The Contractors are expected to apply the relevant levels or measures of the EHS Guidelines. The guidelines which are relevant are:

- ***IFC General EHS Guidelines***: The (EHS) guidelines contain performance level and measures on environmental, occupational health and safety for construction, community health and safety to be followed during the construction, operation and decommissioning phases. Since the project contains construction activities the Contractor will adhere to the performance level and measures provided in the IFC general EHS guidelines.
- **World Bank's Guideline note on Labour Influx, 2016**: The influx of workers can lead to adverse social and environmental impacts on local communities, especially if the communities are rural, remote or small. The objective of the guideline note is to identify risks and impacts on local communities associated with the temporary influx of labourers that typically results from construction works, and to advising Borrowers accordingly on how to best manage such risks. The Project will engage maximum local labours as far as possible; Labour camps will be established by the contractor as per the guidelines given in Annexure-I. Toilet facilities and other recreational activities will be provided at the camp. Adequate supply of potable drinking water will be ensured in the labour camp and site.

3.4 E & S permits required

Relevant permissions, clearances and authorizations need to be obtained from competent authorities during the design, planning and implementation of the project as indicated in the following Table:

**Table 3.2: Clearances required**

| S. No. | Clearance/ Authorization | Relevant Act | Competent Authority | Responsibility |
|---|---|---|---|---|
| 1. | Tree Cutting Permission | Forest Conservation Act, 1980 | State Forest Department, MoEF & CC, Govt. of India | PMU & Concerned division of WRD |
| 2. | Hot mix plants, Wet Mix Macadam plants, Crushers, Batching Plants | Air (Prevention and Control of Pollution) Act, 1981 and Noise Pollution (Regulation and Control) Rules, *2000* | Bihar State Pollution Control Board | Concerned Contractor |

| S. No. | Clearance/ Authorization | Relevant Act | Competent Authority | Responsibility |
|---|---|---|---|---|
| 3. | Storage, handling and transport of hazardous materials and waste | Hazardous Waste (Management and Handling) Rules, 1989 and Manufacturing, Storage and Import of Hazardous Chemicals Rules, 1989 | Bihar State Pollution Control Board | Concerned Contractor |
| 4. | Location/ layout of workers camp, equipment and storage yards | Environment Protection Act, 1986 and Manufacturing, Storage and Import of Hazardous Chemicals Rules, 1989 | Bihar State Pollution Control Board | Concerned Contractor |
| 5. | Discharges from Labor Camp | Water (Prevention and Control of Pollution) Act, 1974 | Bihar State Pollution Control Board | Concerned Contractor |
| 6. | Permission for sand mining from river bed | Environment Protection Act, 1986 | Bihar State PCB, Mining Department, GoB | Concerned Contractor |
| 7. | Obtaining Labour license | Contract Labour (Regulation and Abolition) Act. 1970 | State Labour Department | Concerned Contractor |
| 8 | Dredging and desilting of Canal | Environmental Safeguards as proposed in the National Framework for Sediment Management (SoP)[3] issued by the MoJS, Department of Water Resources. There is a requirement to intimate SPCB as per the MoEF&CC Notification 21st August 2023. State pollution control board shall independently monitor the compliance status of the above-mentioned | Bihar State PCB and Department of Water Resources | Concerned Contractor |

[3]https://nmcg.nic.in/writereaddata/fileupload/52_National%20Framework%20for%20Sediment%20Management%20-%20English%20(1).pdf

| S. No. | Clearance/ Authorization | Relevant Act | Competent Authority | Responsibility |
|---|---|---|---|---|
| | | SOP. Further in case of noncompliance SPCB shall initiate legal action against the project proponent under the relevant provisions of Environment (Protection) Act, 1986. | | |
| 9. | Borrow Area | EIA Notification 2006 and its amendement vide Ministry of Enironment, Forest and Climate Change, New Delhi Notification dated 17th March, 2025 | Bihar State PCB | Concerned contractor shall ensure that extraction or sourcing or borrowing of ordinary earth for the sub-project is in line with the compliance of the conditions set out in Appendix XIV[4] of MoEFCC notification dated 17.03.2025 |

The Contractor will also be responsible for meeting the requirement specified under these permits and also filing reports/ returns as is applicable under the respective regulations.

[4] https://parivesh.nic.in/publicdocument/UPLOAD_OM_NOTIFICATION/IA_DOCS/1001_19032025024958.pdf

# CHAPTER 4: ANALYSIS OF ALTERNATIVES

The modernization of the Western Sone Main canal has limited interventions aimed at the improvement of the performance of the system. Since this is an existing canal without any new construction/extension (within the scope of the World Bank Funded Project) the analysis of alternatives is limited to the options describe below.

## 4.1 Project or No Project scenario

As is evident form the description above the WMC is not performing as expected. The primary reasons for this poor performance are reduction in the carrying capacity of the canal due to the siltation, water losses due to the canal lining not being maintained etc. If this "Business-as-Usual" scenario continues, water losses will continue and the potential for increasing the irrigated area will not be achieved.

The implementation of the project would improve the irrigation networks, reduce water losses and thus improve resource efficiency.

## 4.2 Alternative Material

There are roads adjoining the canal. These roads are essential for the movement of the machinery during the construction as well as the maintenance of the canal. Since there are some settlements along the canal, road also acts as an access for the population in the area. The renovation of the canal will result in excavation of silt. The estimated quantity is 420183.76 cum. Based on the discussion with divisional engineer; it is anticipated that this quantity will be used for sectioning of canal. The filling quantity required to bring the canal in section is much more than the quantity obtained during bed clearance of the Sone western main canal. This excavated material will be used during filling of the damaged embankment of canal to bring the canal in section. This reuse of material will have dual benefits. It would a) reduce the quantity of borrow area and b) reduce the amount of land required for the dumping of the excavated material.

# CHAPTER 5: ENVIRONMENTAL BASELINES

The objective of conducting baseline survey of the existing environmental and social status in the study area i.e. in the adjoining area of WMC is to provide a data base for assessing the likely changes that are expected in implementation of the project. This chapter deals with the approach for data collection, environmental scoping / identification of social and environmental attributes and baseline survey details. As the project activities are limited to the river and canal systems of Rohtas district, surrounding environments of project activity zones were also considered for baseline study.

## 5.1 Project Location and Delineation of study area

The Modernization of Western Main Canal Scheme is part of the World Bank funded "Bihar Water Security and Irrigation Modernization Project (BWSIMP)". The current Detailed Project Report focuses on improving water productivity in the Western Main Canal Command, which begins about 10.20 km downstream of the Indrapuri Barrage. Water is off-taken from the Western Link Canal and Western Parallel Link Canal, and the unlined Western Main Canal (WMC) runs up to Dehri town, 32.50 km downstream. From this canal, one main canal, three branch canals, and five distributaries branch off, serving a GCA of 5,95,722 hectares and a CCA of 5,21,489 hectares.

Canal Modernization of the Western Main Canal project aims to address seepage and other water losses to restore up to 24,244 hectares (CCA 19,442 hect) of lost irrigation potential. The entire canal system depends on WMC water, therefore environmental baseline data and cropping pattern have been taken up for the whole command area of Western Main canal which includes mainly four districts of Rohtas, Bhojpur, Buxar, and Kaimur.

The major part of the Western Main Canal System's CCA is covered by the Ara Main Canal and its system. These works are proposed for a subsequent phase and are being implemented with the assistance of ADB funding. The Ara Main Canal System covers approximately 202,000 hectares. In this ESIA report, some of the required data, which has already been measured & analyzed by the WRD, is used as a reference.

## 5.2 Physical Environment

Rohtas district is where proposed project is located and Command area of proposed project (after taking consideration of Gara Chaube Branch Canal, Karghar Distry from Km 12.50 to Km 37.50, Buxar Branch Canal and Chausa Branch Canal) includes Bhojpur, Buxar and Kaimur districts are in the southern part of Bihar. Map of project area is provided in Figure 1.1. The Project area is characterized by its rich cultural heritage, dynamic environmental conditions and diverse socio-economic structures. An environmental study encompasses physical, biological, and social components. The physical environment includes vital elements such as, land use, air quality, water quality, and soil conditions each affected by both natural and anthropogenic factor.

### Temperature and Relative Humidity

**Temperature:** The highest recorded temperature at Dehri was 49.5°C on May 11, 1988 and the lowest was -1°C on January 18, 1977. These districts experience a similar climate pattern characterized by hot summers with extreme temperatures, significant monsoon effects and cold winters with potential cold waves, emphasizing the need for careful agricultural planning and resource management.

### (a) Rohtas District

There is one meteorological observatory in the district at Dehri. The meteorological data and climatological conditions prevailing at this station may be taken as representative of weather conditions of the whole district. The summer season starts from March with appreciable rise in day and night temperature. May is the hottest month of the season with the mean maximum temperature at 40.5°C and mean minimum temperature at 23.5°C. During May and early June, the maximum temperature may go upto 47C on individual days. There is a fall in day temperature after the onset of the monsoon in second week of June. The night temperature however, continues to be high. The temperature falls appreciably after the withdrawal of the monsoon by mid October. Generally, January is the coldest month of the season with the mean maximum temperature at 23.8°C and the mean minimum temperature at 8.6°C. In association with western disturbances which move across the state during winter season, cold wave conditions prevail in the district and the minimum temperature may fall below freezing point.

**(b) Buxar District**

In March, days become warmer while nights remain cool. Day and night temperatures start rising rapidly from March to early June. May is the hottest month of the year, with a mean maximum temperature of about 38°C and a mean minimum temperature of around 25°C. During May and June, maximum temperatures can sometimes exceed 44°C on certain days. With the onset of the southwest monsoon in the second week of June, day temperatures drop, but the weather remains uncomfortable due to increased humidity and high night temperatures similar to summer. In October, while daytime temperatures remain as high as in the monsoon months, nights are cooler. The highest maximum temperature ever recorded at Dehri was 49.5°C on May 11, 1988, and the lowest minimum temperature ever recorded was -1.0°C on January 18, 1977

**(c) Bhojpur District**

In the later part of summer season i.e. May and June the maximum temperatures may sometimes go above 44°C on individual days. There is drop in day temperature with the advance of the south west monsoon into the district towards the second week of June, however, there is little relief as the weather is uncomfortable on account of increase in moisture and heat. In October while day temperature remains as high as in the monsoon months the nights are however cooler.

The summer season starts from March with appreciable rise in day and night temperature. May is the hottest month of theseason with the mean maximum temperature at about 40°C and mean minimum temperature at about 23°C. During May and early June the maximum temperature may go upto 47C°C on individual days. There is a fall in day temperature after the onset of the monsoon in second week of June. The night temperature however, continues to be high. The temperature falls appreciably after the withdrawal of the monsoon by mid October. Generally, January is the coldest month of the season with the mean maximum temperature at about 24°C and the mean minimum temperature at about 9C. In association with western disturbances which move across the state during winter season, cold wave conditions prevail in the district and the minimum temperature may fall below freezing point.

**Relative Humidity:** Humidity levels remain high during the monsoon months, ranging from 70% to 83%, while winter months experience lower humidity levels of around 40%-50%. Overall, the district's climate is shaped by distinct seasonal variations, with the monsoon being a dominant influence on both agriculture and water resources. The mean daily maximum Relative Humidity (Rhmax) was high during most of the months except during summer and it was lowest in April.

**Rainfall**

In continuation to the hydrological analysis during DPR preparation by M/s Aymans Infra, the weighted average of the 46 rainfall stations (including 9 self recording) has been worked out to obtain complete

observed 10-daily rainfall series for Western Main Canal command area. Sone is a rainfed river and 90% of the rainfall occurs during the monsoon period from June to October. The monthly mean rainfall during four monsoon months is 280.7mm. The maximum rainfall recorded in the month of August is about 725 mm and minimum in months of June or September is around 25mm only. The central-northern part and northern lowermost reach of the basin, covering mostly Bihar areas, are the zones of comparatively low rainfall. The average monthly contribution to the average annual rainfall for the entire Sone basin is as follows:-

| | | | | | |
|---|---|---|---|---|---|
| June | : | 16.1% | December | : | 0.8% |
| July | : | 30.1% | January | : | 2.6% |
| August | : | 25.5% | February | : | 0.7% |
| September | : | 16.0% | March | : | 1.3% |
| October | : | 4.0% | April | : | 0.6% |
| November | : | 1.0% | May | : | 1.4% |

The Rohtas and its adjoing districts gets easterly wind from June to September, whereas westerly wind blows from October till May. The district gets maximum rainfall during the months of July and August. Some winter rains occur in January and February. About 90 % of rainfall is received during the monsoon months between June to September. The average annual rainfall is 1144.2 mm.

The 10-daily Rainfall of WMC command area is given in the following ***Table 5.1***:-

**Table 5.1: 10-daily normal rainfall for WMC Command districts**

| 10 Daily | Bhojpur District | Rohtas District | Buxar District | Kaimur District |
|---|---|---|---|---|
| JAN-I | 5.42 | 4.99 | 5.73 | 4.59 |
| JAN-II | 3.39 | 3.09 | 5.60 | 1.84 |
| JAN-III | 5.39 | 8.01 | 3.77 | 4.14 |
| FEB-I | 9.62 | 6.80 | 13.36 | 10.90 |
| FEB-II | 8.71 | 6.39 | 6.47 | 10.64 |
| FEB-III | 3.52 | 2.54 | 3.44 | 1.48 |
| MAR-I | 25.28 | 18.72 | 23.78 | 20.59 |
| MAR-II | 45.53 | 50.57 | 57.19 | 30.99 |
| MAR-III | 11.39 | 16.69 | 19.68 | 20.57 |
| APR-I | 5.19 | 6.93 | 6.34 | 3.81 |
| APR-II | 10.83 | 11.55 | 7.91 | 7.12 |
| APR-III | 3.60 | 3.15 | 9.60 | 1.73 |
| MAY-I | 21.32 | 18.38 | 22.02 | 10.29 |
| MAY-II | 43.73 | 28.92 | 24.19 | 27.09 |
| MAY-III | 38.25 | 40.36 | 21.73 | 11.02 |
| JUNE-I | 34.23 | 47.19 | 43.16 | 26.84 |
| JUNE-II | 47.34 | 35.30 | 37.97 | 32.95 |
| JUNE-III | 55.17 | 63.67 | 57.63 | 48.43 |
| JULY-I | 76.33 | 64.33 | 68.20 | 95.12 |
| JULY-II | 86.18 | 63.47 | 70.09 | 59.89 |
| JULY-III | 77.14 | 61.58 | 72.42 | 74.36 |
| AUG-I | 56.03 | 58.85 | 58.53 | 64.28 |
| AUG-II | 69.47 | 72.78 | 63.77 | 76.26 |
| AUG-III | 66.05 | 53.56 | 43.21 | 51.04 |
| SEP-I | 58.30 | 60.64 | 62.01 | 57.56 |
| SEP-II | 50.04 | 38.56 | 51.91 | 46.50 |
| SEP-III | 55.13 | 42.91 | 51.78 | 46.92 |

| | | | | |
|---|---|---|---|---|
| OCT-I | 60.96 | 54.17 | 48.56 | 31.51 |
| OCT-II | 20.62 | 9.53 | 13.52 | 11.33 |
| OCT-III | 11.05 | 7.64 | 6.78 | 4.54 |
| NOV-I | 53.74 | 39.00 | 43.06 | 32.94 |
| NOV-II | 38.34 | 20.96 | 37.29 | 26.50 |
| NOV-III | 21.88 | 10.34 | 19.59 | 54.12 |
| DEC -I | 7.00 | 5.96 | 9.76 | 9.29 |
| DEC -II | 4.16 | 2.29 | 3.66 | 2.92 |
| DEC -III | 2.73 | 2.98 | 4.55 | 2.73 |

The majority of rainfall occurs during the monsoon season, spanning from June to September, with July and August typically receiving the highest rainfall.

While overall monsoon rainfall has exhibited variability, there has been a slight declining trend in rainfall over the past three decades. This trend may reflect changing monsoon dynamics influenced by factors such as climate change, regional weather patterns, and human activities.

**Analysis of Monthly Variation of Rainfall during monsoon:** The analysis of monthly rainfall trends from 1993 to 2022 across June, July, August, and September reveals distinct seasonal patterns and shifts. June exhibits relatively stable rainfall with minor fluctuations, although recent years, particularly 2020, show higher values, suggested a consistent early monsoon. In contrast, August show concerning declines, with a pronounced downward trend, particularly after the early 2000s.

**Conclusion:** The analysis indicates that the WMC command area receives a significant portion of its annual rainfall during the monsoon season. The significant variability is observed in certain years suggests that the monsoon system is becoming increasingly unpredictable, characterized by both extreme dry and wet years. Such fluctuation could have critical implications for water availability, agriculture, and flood management, particularly in regions that rely heavily on the monsoon. Although there has been a slight decrease in average monsoon rainfall compared to earlier historical records, this highlights the necessity for improvements in the irrigation systems within the WMC command area

**Land Use**

As per the record of Department of Agriculture, Government of Bihar, the land use pattern of project district of Rohtas is given in following Table 5.2-

**Table 5.2: District wise Land Use pattern of WMC Command Area**

<table>
<tr><td colspan="3">Forest Area</td><td>1</td><td>66723</td></tr>
<tr><td rowspan="4">Land put to non-agriculturable use</td><td colspan="2">Land Area</td><td>2</td><td>38489</td></tr>
<tr><td rowspan="2">Water</td><td>Parenial</td><td>3</td><td>8961</td></tr>
<tr><td>Temporary</td><td>4</td><td>309</td></tr>
<tr><td colspan="2">Total of rows 2, 3 & 4</td><td>5</td><td>47759</td></tr>
<tr><td colspan="3">Barren Uncultur-able Area</td><td>6</td><td>16831</td></tr>
<tr><td colspan="3">Permanent Pastures & Grazing Land</td><td>7</td><td>99</td></tr>
<tr><td colspan="3">Land under Misc. Tree crop& Groves not included in net area sown</td><td>8</td><td>2879</td></tr>
<tr><td colspan="3">Culturable Waste Land</td><td>9</td><td>1102</td></tr>
</table>

| | | | |
|---|---|---|---|
| Fallow Land | Other Fallow Land | 10 | 789 |
| | Current Fallow land | 11 | 15870 |
| | Total | 12 | 16659 |
| Total Non-Agricultural Land | | 13 | 152052 |
| Net Sown Area | | 14 | 238670 |
| Total Cropped Area | | 15 | 281796 |
| Area Sown more than once | | 16 | 43126 |

*Source: Ground Water information Booklet of CGWB*

Land use details of other WMC command area districts are as follows:-

Bhojpur

As per the record of Directorate of Statistics & Evaluation, Bihar, the net and gross area cropped in the district of Bhojpur are 1910 sq km and 2200 sq km respectively. It has no forest cover. The other fallow land and the current fallow land are 30 sq km and 100 sq km respectively. The district has 10 sq km as cultivable waste land.

Agriculture is the main liveliehood of more than 80% population in the district. The agriculture calender starts from July and continues up to June of the succeeding year, before the onset of the monsoon every year. Thus, a calender year is divided into four agricultural seasons, viz., Bhadai, Aghani, Rabi and Garma as given below

**Agricultural Seasons in Bhojpur, Bihar**

| **Kharif** | | **Rabi** | |
|---|---|---|---|
| Bhadai (AprilAug/Sept) | Aghani (June-Oct) | Rabi (NovMarch/Apr) | Garma (MarchApr/June) |
| Paddy, maize | Paddy, pulses | Wheat, pulses, maize, spices and oilseeds | Paddy, maize, pulses, vegetables, millet |

The district is provided with a well-developed unlined canal network (Sone canal command area) in the form of surface water availability together with readily and easily available ground water within shallow depth. The flood zone of Barhara, Shahpur and Koilwar is well cropped with Rabi crop only.

Kaimur

From district agricultural recordsit has been found that the total geographical area of Kaimur district is 3339.31 Sq. Km out of which 1673.01 Sq. Km area is net sown area. The net sown area constitutes 50% of the total area of the district. The cropping intensity in the district is 129% with Rampur block accounting for 182% cropping intensity. 27% of total geographical area is covered by forest. Adhaura block with forest area of 641.68 Sq. Km covers 73% of total forest area of the district.

**Cropping Pattern**

Agriculture is the main livehood of the population of project district. The agriculture calendar starts from the month of July and continued to the month of June of the succeeding year before the onset of monsoon every year. Thus, a calendar year is divided into four agriculture seasons viz., Bhadai, Aghani Rabi and Garma. Rohtas is called the "Bowl of Rice" (Dhan ka Katora) in Bihar due to its significant agricultural production, particularly of rice (paddy) and wheat. The district is a major source of rice in Bihar and is known for its fertile land and extensive irrigation systems, making it a key agricultural region.

Irrigation plays a vital role in the agriculture in this district and irrigation is practiced from both surface and groundwater. The surface water is the major source of irrigation in the district. Total 192365 hactare areas of the district are irrigated, out of which 163686 hactare area is irrigated by the canals. The Sone River is the main source of canal system. The groundwater is used for agriculture purpose by boring and about 22069 hactare area is irrigated by the tubewells and only 6610 hactare area is irrigated by the other sources. As per the record of Department of Agriculture, Government of Bihar (2010-11) the total production of rice, wheat & barley and Maize is 286533, 1312, and 289 M.T. respectively.

**Cropping pattern in Rohtas District**

| Kharif | | Rabi | |
|---|---|---|---|
| Bhadai (AprilAug/Sept) | Aghani (June-Oct) | Rabi (NovMarch/Apr) | Garma (MarchApr/June) |
| Paddy, maize | Paddy, pulses | Wheat, pulses, maize, spices and oilseeds | Paddy, maize, pulses, vegetables, millet |

*Source: Aquifer mapping and management of ground water resources, Rohtas district*

## Topography

Rohtas district features a diverse topography with both plain and hilly areas, while Bhojpur is characterized by low-lying, fertile plains. Rohtas is divided into the Sasaram Plain and the Rohtas Plateau, with the later being an eastern flank of the Vindhya Plateau. Bhojpur's terrain is largely flat, with the Ganges forming its northern boundary and the Sone River running along its eastern and southern edges.

The project district district can be divided into two major natural areas. In the north and northeast is the Sasaram Plain, an alluvial plain sloping gently downward toward the northeast. Its average height ranges from 72m above sea level in the north to 153m above sea level in the south. The plains cover all of Dinara, Dawath, Bikramganj, Nasriganj, Nokha, and Dehri Blocks, as well as parts of Sasaram, Sheosagar, and Rohtas Blocks. There are scattered woodlands in the east, in Sasaram Block. In the southern part of the district is the Rohtas Plateau, which is an eastern flank of the Vindhya plateau with an average elevation of 300m above sea level. It covers parts of Nauhatta, Rohtas, Sheosagar, Sasaram, and Chenari Blocks. This area is hilly, with occasional forests throughout. Several streams flow toward the north, including the Durgawati, the Bajari, the Koel, and the Sura. The Rohtas Plateau is less well suited for agriculture due to the uneven, rocky and gravelly soils as well as the forest cover. A variety of long grasses grow naturally on the plateau, including pear grass, kus, and khas khas.

## Soil

The upper portion of the Sone basin, including Kanhar and North Koel basins in Bihar, comprise mainly laterite soils while lower portion contains alluvial soil. About half the area of the basin is covered with exposed consolidated rocks of igneous and metamorphic origin and those of the consolidated and Semi-consolidated sedimentary rocks.

The soils in the Sone basin have been divided into eight different types, as shown in the following table:-

**Table 5.3 Classification of Soils in Sone Basin**

| S. No. | Soil Type | Approximate percentage of Soil in the Basin |
|---|---|---|

| | | |
|---|---|---|
| 1. | Red & Yellow Soil | 45.8 |
| 2. | Medium Black Soil | 21.2 |
| 3. | Red Loam Soil | 15.4 |
| 4. | Mix Red & Black Soil | 5.5 |
| 5. | Alluvial Soil | 5.1 |
| 6. | Sketeral Soil | 4.5 |
| 7. | Forest and Hill Soil | 1.9 |
| 8. | Grey & Brown Soil | 0.6 |

*Source: Comprehensive Plan for Water Resources Development of Sone Basin, Volume - I, Chapter - IV*

## Physiography and Drainage Pattern

The districts of Rohtas, Bhojpur, Kaimur and Buxar exhibit a diverse physiography and drainage patterns. They are characterized by alluvial plains in the north and the Rohtas Plateau/Kaimur Plateau in the south. The main drainage pattern is dendritic, with rivers like the Ganga, Son, and their tributaries shaping the landscape.

**Physiography**

- **Alluvial Plains:**

  The northern parts of above-mentioned districts are characterized by low-lying, fertile alluvial plains, formed by the deposition of sediments from the Ganga and its tributaries.

- **Rohtas/Kaimur Plateau:**
  The southern part is dominated by the Rohtas Plateau, an extension of the Vindhyan ranges, with undulating terrain and higher elevations.

**Existing Drainage Pattern**

The drainage pattern of Rohtas, Bhojpur, Kaimur, and Buxar districts in Bihar is primarily influenced by the Ganga and Sone rivers. These districts are part of the Middle Ganga Plain and are characterized by alluvial plains formed by the rivers. The Ganga flows through the northern part, while the Sone forms the eastern boundary. Kaimur and Rohtas have additional drainage influenced by the Karamnasa and Durgawati rivers.

## Hydrogeology

The hydrogeology of poject districts of Rohtas, Bhojpur, Buxar, and Kaimur in Bihar is characterized by the "Middle Ganga Plain" and its alluvial formations, underlain by the Vindhyan rocks. These districts rely heavily on groundwater for various uses, including excessive pumping for irrigation, domestic, and industrial purposes due to which there's a noticeable trend of groundwater level decline in some areas. Over-extraction of groundwater, especially for agriculture, is a major driver of depletion. Since these area falls under the CCA of proposed project thus the enhanced irrigation facility after lining of WMC will decrease the dependency of irrigation on ground water.

Geologically the area is occupied by the principal hard rock units of Vindhyan system comprising limestone, shale, sandstone and unconsolidated alluvial sediments of Quaternary age. The Vindhyans crop out in the southern and southweastern parts by moderately prominent hillocks and flat-topped plateaus and often showing conspicuous scarp faces to the plains of the north which is underlain by alluvium of varying thickness. The alluvial basin thickness towards the north almost uniformly. The area to the east and south east of the Kaimur hills forms a second strip of alluvium between the

Vindhyans and the Sone River. The Quaternary alluvium is restricted to areas near Ganga River in north, Sone River in east and Karmnasa in west.
*(Source: Central Ground Water Board, Mid Eastern Region, Patna; November 2019)*

## Air Environment

Air quality in the project area varies significantly among different seasons, at present the sources of air pollution are the vehicles plying on the existing roads, burning of crop residue and domestic fuel burning. In some places small factory and brick kilns are also the sources of air pollution. The air quality in Rohtas, Bhojpur, Buxar, and Kaimur is generally poor, with some areas experiencing unhealthy levels of air pollution. Rohtas and Kaimur are considered moderately to unhealthy, while Buxar and Bhojpur are in the moderate to poor range.

Based on the data of Dehri AQI monitoring station, in general, project area ambient air quality is good and within maximum permissible limit for NOx, SOx and SPM, however in some places in urban areas Average PM2.5 levels is upto 82 µg/m³, with levels exceeding the national permissible limit of 60 µg/m³ during winter months (CPCB 2020).
It is expected that, during construction of lining of canal and desiltation work, the air quality may be deteriorated temporarily due to increase in pollutant in the ambient air, but very limited within the local areas. Monitoring of air quality during construction period will be carried out against the ambient air quality standards set by CPCB.

## Noise Quality

The existing noise sources are mainly from crowds, machineries used in agricultural field, pumps, two-wheeler, three-wheeler, motor vehicles plying on the roads. Ambient noise level at different project location site is found in the range of 47-55 dB (A) in day time - within the Maximum Permissible Limit (MPL) at residential area. Moreover, the noise level during construction period of canal ling and embankment road construction may be increased and to be monitored near sensitive receptors against the Ambient Noise Quality Standards set by CPCB.

### Ground Water Quality and its Monitoring

The ground water in the area is suitable for drinking and irrigation purposes except at some places with high magnesium and salinity hazards. The ground water in the blocks of Shahpur, Behea, Koilwar and Ara in the district, adjoining to the river course of Ganga has been reported to be contaminated with unusual concentration of Arsenic. The Central Ground Water Board has taken up special exploratory programme to decipher the extent and range of arsenic contamination in deeper aquifers and the organization is finding out ways to get fresh and arsenic free water in the highly polluted areas. In addition, Bihar government is implementing the "Har Ghar Nal Ka Jal" scheme to provide safe drinking water to rural areas and address the issue.

**Water Table Depth:** The depth of the water table in project districts of Rohtas, Bhojpur, Buxar, and Kaimur districts, the water table depth typically ranges from 2 to 10 meters below ground level (bgl). However, in some areas, especially in the southern part of Kaimur and Rohtas, water levels can be deeper, exceeding 10 m bgl.

**Groundwater Quality:** Groundwater quality in Rohtas, Bhojpur, Buxar, and Kaimur districts of Bihar is a concern, with reports of contamination from arsenic, fluoride, and iron. Arsenic contamination, in

particular, has been found in several areas, with levels exceeding permissible limits. The Bihar Public Health Engineering Department (PHED) has identified affected wards in these districts and is working on initiatives to provide safe drinking water, according to a report from The Deccan Herald.

### Surface Water Quality Monitoring

Surface water quality monitoring in Rohtas, Bhojpur, Buxar, and Kaimur districts in Bihar involves a variety of approaches, including routine water quality testing of drinking water sources and government efforts to improve water quality and management**.**

**Major Rivers**: The major rivers in Rohtas, Bhojpur, Buxar, and Kaimur districts in Bihar are the Ganga and Karmanasa. The Ganga flows through the northern parts of these districts, and the Karmanasa, originating from the Kaimur range, also flows through these areas before joining the Ganga. Additionally, the Durgawati and Kudra rivers are also notable, particularly in the Kaimur and Rohtas districts, where they serve as boundaries and provide water resources. These rivers not only provide irrigation but also support fisheries and contribute to groundwater recharge.

**Canal Systems:** The canal system in project district and its CCA includes main canals, branch canals, and distributaries, forming a network for distributing water to various agricultural areas. The canal system in Rohtas, Bhojpur, Buxar, and Kaimur districts primarily relies on the Durgavati and Sone rivers, with the Durgavati Canal (also known as Kudra Wier Canal). The Sone River also played a significant role in the canal system, with an anicut constructed across the river at Dehri. This anicut diverted water to canal systems on both sides of the river, irrigating large areas.

**Ponds and Chaur Lands:** In addition to Rivers, project CCA have numerous ponds and chaur lands - low-lying areas that act as natural reservoirs during the monsoon. These water bodies, known locally as pokhars, are integral to local water storage, especially for non-monsoon agricultural use and flood management. These areas, along with the major rivers like the Ganga, Son, and Karmanasa, provide water resources, support diverse ecosystems, and contribute to the region's agricultural and socio-economic landscape.

## 5.3 Natural Disaster

[Rohtas, Bhojpur, Buxar, and Kaimur districts are particularly vulnerable to both floods and droughts. These districts, along with others in southern and southwestern Bihar, are susceptible to droughts due to the dependence of agriculture on monsoon rainfall and variations in rainfall distribution. Additionally, these districts have experienced significant flooding, with the 2007 floods being particularly severe.

## 5.4 Climate Change Variability

South Bihar where the proposed project is located is experiencing increased climate variability, particularly in rainfall patterns and temperatures, leading to more frequent and severe droughts. This is impacting agriculture and water resources, with higher temperatures, erratic monsoon rainfall, and increased water deficits being observed.

Key aspects of climate variability in project area:

- **Erratic rainfall:** Monsoon rainfall has become increasingly unpredictable since the 1990s.

- **Rising temperatures:** Average temperatures have increased by 0.5°C over the years.
- **Water deficits:** Surface and groundwater deficits are high, with significant regional variations.
- **Drought vulnerability:** Large parts of South Bihar, including the south and southwest regions, are increasingly vulnerable to drought.
- **Impact on agriculture:** Erractic rainfall and rising temperatures are impacting agriculture, affecting crop yields and water availability.
- **Groundwater scarcity:** The over-extraction of groundwater, driven by increased irrigation demands, is leading to a decline in water tables, further exacerbating water scarcity.

## 5.5 Biological Environment

The biological environment studies the natural landscape, forest cover, and profile of flora and fauna including agricultural and riverine ecosystems. Biological environment of the proposed project area can mainly be defined into agroforestry systems, riverine ecosystems, and patches of deciduous forests.

**Forest Types, Forest Area, Agriculture and Ecological Sensitivity**

The forest cover in the Rohtas district is 672.23 km2 which is 17.32% of the total geographical area of the state. On the basis of density classes 352.52 km2 comes under moderately dense forests and 319.71 km2 under open forest. There is no very dense forest in the district. Rohtas, Bhojpur, Kaimur and Buxar districts (CCA of proposed project) in Bihar have a mix of forest types, with a significant portion under agricultural land. The primary forest types include Sal forests (in Kaimur and Rohtas), dry deciduous forests, and mixed deciduous forests. Forest area in these districts is relatively limited compared to the vast agricultural landscape, but efforts are underway to improve forest cover and quality.

In the project district Rohtas and its adjoining area, agriculture and horticulture play a central role in the local economy, with a variety of crops cultivated due to favourable climatic and soil conditions. The main **agricultural crops** include paddy (*Oryza sativa*), wheat (Triticum aestivum), maize (*Zea mays*), and pulses such as lentils (*Lens culinaris*) and gram (*Cicer arietinum*). Additionally, oilseeds like mustard (*Brassica juncea*) and linseed (*Linum usitatissimum*) are prominent in the region.

In horticulture, project districts are known for fruits such as mango (Mangifera indica), banana (Musa spp.), guava (Psidium guajava), and papaya (Carica papaya). Key vegetables grown include tomato (Solanum lycopersicum), onion (Allium cepa), cauliflower (Brassica oleracea), and potato (Solanum tuberosum). Spices like chili (Capsicum annuum) and ginger (Zingiber officinale) are also cultivated.

**Ecological Sensitivity:** The proposed irrigation channel restoration work area is not falling in the ecological protected area or WLS. However CAA of proposed project is the southernmost section of the state, which lies south to the Gangetic plain in the eastern part of Vindhyan range. This region is represented by unique ecological systems. River ‘Sone’ is most important to this region. The forests in the region are restricted to the hilly tracts of the Kaimur hills, Rajgir hills, and Kharagpur hills. Rohtas district is high ecological sensitivity due to its diverse geological formations, particularly the Kaimur Wildlife Sanctuary, which is considered an ecologically sensitive area. This Wildlife Sanctuary is located about 70 Km from the project area. The district's sub-tropical monsoon climate, with hot summers, high humidity, and dry winters, also contributes to its unique ecological landscape. Map of nearest Wildlife Sanctuary mentioning distance from project area is shown below in **Figure 5.1.**

**Figure 5.1: Map showing distance between project location and nearest ESZ**


## Flora and Fauna

**Flora:** The Project area is devoid of forests, grasslands or climax vegetation. Wild herbs, bushy shrubs and scattered trees dominate the area.

The dominant tree species in the project area and on the both side of Western Main Canal are Sheesham (Dalbergia Sissoo), Gamhar (Gmelina Arborea), Babul (Acacia Arabica), Arjun (Terminalia Arjuna), Bael (Aegle Marmelos) and Guava (Psidium Guajava).

The dominant shrubs are Aak (Calotropis Procera), Sage (Lantana Camara), Jangal Jalebi (Pithecolobium Dulce), Jhau (Tamarix Dioica Roxb), Doob (Cynodondactylon), Nut Grass (Cyperus rotundus), Dhatura (Datura alba), Madar (Calotropis Procera Lantana Camara), Bara dudhi (Euphorbia Hirta), etc.

The vegetation reported in the project area is wild and common as in other sub-tropical regions. The area was dominated by wild herbs, bushy shrubs and scattered trees.

Most of the herbs are of common type and have economical and medicinal value for the villagers. No rare or endangered species were reported from the project area and most of the species fall in NE category of IUCN. Trees reported in the area are also common and used for flowers, fruits and vegetables. No forest area is reported in the project area or its vicinity. Following **Table No. 5.4** presents the recorded Floral Species in the Project area:-

**Table 5.4: Floral Species in Project Area**

| Botanical Name | Local Name | Botanical Name | Local Name |
|---|---|---|---|
| ***Aquatic Macrophytes*** | | ***Shrubs*** | |

| | | | |
|---|---|---|---|
| *Alternanthera philoxeroides Mart* | Danta | *Adhatoda Vasica Nees* | Basak |
| *Eichhornia crassipes (Mart) Solmns* | Jalkumbhi | *Calotropis Procera (Ait) R. Br* | Akwan |
| *Ipomoea Aquatica Forsk* | Karmi | *Cannabis Sativa* | Bhang |
| *Ipomoea fistulosa Mart* | Behaya | *Hiptage Benghalensis Linn* | Gulphrosh |
| *Nelumbo nucifera Gaertn* | Kamal | *Lantana Camera Linn* | Putus |
| *Nymphaea stellataWilld* | Bhent | *Solanum Torvum Siu* | Bab baigan |
| ***Herbs*** | | *Tamarix DioicaRoxb* | Jhau |
| *Acalypha Indica Linn* | Copper leaf | *Vitex Negundo* | Shiwali |
| *Aloe Vera* | Dhrit Kumari | **Cereals, Pulses & Vegetables** | |
| *Amaranthus Spinosus Linn* | Ktaiyasag | *Amaranthus Tricolor* | Lal saag |
| *Argemone Mexicana* | Kataiya | *Amaranthus Virdis Linn* | Genhari saag |
| *CentellaAsiatica Linn* | Brahmi Buti | *Momordica charantia* | Karela |
| *Cyperus Rotundus* | Motha | *Oryza sativa* | Rice |
| *EcliptaAlba Linn* | Bhangaiya | *Spinacia oleracea* | Palak |
| *Euphorbia Hirta Linn* | Dudhi | *Vigna mungo* | Urd |
| *EvolvulusAlsinoides Linn* | Shankhpushpi | *Vigna radiata Linn* | Moong |
| *HeliotropiumIndicum Linn* | Hathisur | **Grasses** | |
| *Mirabilis Jalpa* | 4 ‘O clock | *Commelinabenghalensis* | Kanchara |
| *Oxalis Corniculata Linn* | Khattimithi | *Cynodondactylon* | Dub |
| *Physalis Minima Linn* | Makoi | *Cyperus rotundus* | Motha |
| *Ranunculus Sceleratus Linn* | Jaldhania | *Imperata cylindrical* | Khans |
| *Solanum Nigrum Linn* | Bhatkoi | *SetariaInterrupta* | Latpatwa |
| *Vernonia Cinerea Linn* | Sahajai | **Trees** | |
| *Vigna Radiata Linn* | Moong | *Acacia Arabica* | Babool |
| *ZeaMays* | Maize | *Aegle marmelos* | Bel |
| **Climbers** | | | *Annona squamosa Linn.* |
| *Cayratiatrifolia* | Amalbel | *Azadirachta indica A. Zuss.* | Neem |

| | | | |
|---|---|---|---|
| *Basella alba* | Poi | *Bombax malbaricum* | Shimal |
| *Cuscutareflexa* | Amarbell | *Citrus × Limon* | Lemon |
| *Atylosiascarabaeoides* | Ban kulatha | *Cocos nucifera* | Coconut |
| *Coccinia indica* | Kundari | *Derris pinnata* | Karuini |
| *Dolichos lablab* | Bean | *DulbergiadissoRoxb.* | Shisham |
| *Luffa cylindrical* | Nenua | *Ficus benghalensis* | Gamhaar |
| **Trees** | | *Syzygiumcuminii* | Jamun |
| *Ficus religiosa* | Peepal | *Terminalia arjuna* | Arjun |
| *Litchi chinensis* | Litchi | *Thevetia peruviana* | Yellow Kaner |
| *Mangifera indica* | Mango | *Ziziphus jujube* | Ber |
| *Neolamarckiacadamba* | Kadam | *Tamarindus indica* | Tamarind |
| *Odinawodier* | Jihal | *Syzygiumsalicifolium* | Kath Jamun |
| *Pithecellobium dulce Roxb* | Jalebi | *Ficus glomerate* | Gular |
| *Phyllanthus Emblica* | Amala | | |
| *Psidium guajava* | Amrood | | |

**Fauna:** The faunal species reported from the area within 5 km envelope on both the sides of embankment of existing canal of WMC are presented in **Table No. 5.5**.

**Table No. 5.5: Faunal Species in Project Area**

| ***Zoological Name of Species*** | ***English Name*** | ***Zoological Name of Species*** | ***English Name*** |
|---|---|---|---|
| **MAMMALS** | | ***BIRDS*** | |
| *Canis aureus* | Jackal | *Ardea cinereal* | Grey Heron |
| *Canis familiaris* | Dog | *Bulbulcus ibis* | Cattle Egret |
| *Felis domesticus* | Cat | *Casmerodius albus* | Great Egret |
| *FunambulusBalmarum* | Squirrel | *Columba livia* | Blue rock pigeon |
| *HerpestesEdwardsii* | Indian Mongoose, Indian grey Mongoose | *Corvus splendens* | House crow |
| *Mus Booduga* | Indian Fieldmouse | *Ardea cinereal* | Grey Heron |
| *Mus musculus* | House Mouse | *Gyps indicus* | *Grey Vultures/ Indian long-billed vulture* |
| ***REPTILES*** | | *Leptoptilosjavanicus* | Lesser Adjutant (Garud) |

| | | | |
|---|---|---|---|
| *Agama tuberculate* | Common lizard | *Milvus migrans* | Cheel |
| *Bungarus caeruleus* | Common Krait | *Mycteria leucocephala* | Painted storks and grey storks |
| *Chamaleonzeylanicus* | Chameleon | *Pavocristatus* | Common peacock |
| *Naga naja* | Indian cobra | *Phalacrocorax fuscicolis* | Cormorant or Indian Shag |
| *Viperarusselli* | Russel's viper | *Pyenonotusjacosus* | Bulbul |

Rats, mice, and rabbits are main burrowing animals likely to be found, along with other rodents in the project area which present a significant threat to earthen embankments. In addtion, common grazing animals include cattle, sheep, and goats are found in the project area which are frequently found grazing in embankment of canal. After when the embankment is made, it can indirectly benefit grazing animals through improved water availability and quality, leading to enhanced grazing land and livestock productivity. By reducing seepage and evaporation, canal lining will ensure more water reaches agricultural areas, potentially boosting forage production and improving the quality of grazing lands.

**Aquatic Ecology**

The phytoplankton and macrophytes represent the primary producers in the Sone River. Zooplankton, benthos and fish represent the secondary producers.

**Fish Species:** The Sone River in Bihar exhibits a rich aquatic ecology, characterized by diverse fish populations and a variety of aquatic habitats. The river's fish diversity is a key component of its ecosystem, with studies revealing over 80 species in various stretches of the river. The Sone River also plays a crucial role in the overall fish biodiversity of the region by providing migration corridors and supporting diverse habitats. The list of fish species observed during field visits after discussion with local people is presented in Table No 5.6.

**Table 5.6: Fish Species in Project Area**

| ***Zoological Name of Species*** | ***Local Name*** | ***Zoological Name of Species*** | ***Local Name*** |
|---|---|---|---|
| *Puntius sophore* | *Pool Barb* | *Cirrhinus mrigala* | *Mrigal* |
| *Puntius chola* | Durhie | *Cyprinus carpio* | *Masuri* |
| *Labeo rohita* | *Rohu* | *Oreochromis niloticus* | *Nile tilapia* |
| *Catla* | *Catla* | *Hypophthalmichthys nobilis* | *Bighead Carp* |

**Sacred Trees and sacred groves**

Trees like the banyan (Ficus benghalensis) and peepal (Ficus religiosa) are often considered sacred in Hindu and other religious contexts in Bihar, and they may be found in project district as well. Sacred trees and groves in Rohtas, like elsewhere in Bihar, reflect a deep connection between nature, religion, and community. These spaces are often important for rituals, ceremonies, and community gatherings.

**Cultural aspects of the Puja ghats**

As part of ERM, puja ghat is proposed under the sub-project at 2km interval on canal bank for Performing Chhat Puja as per requirement. Although this was not the part of ERM to provide the puja ghat but on demand of local public and social welfare it is included in the sub-project to construct Puja Ghtas on the sone western main canal. The puja ghat consist of staircase, landing and platform. Chhath Puja, highlight the importance of nature worship, emphasizing the connection between humans and the environment. Exact location of Puja ghat will be finalized after consultation with local community during execution of sub-project.

At present there are 3 Nos. of Puja Ghats/ Stairs exist at Km 0.57, Km 2.16 and Km 3.13 of WMC.

## CHAPTER: SOCIAL BASELINE

### 6.1 Administrative boundaries of the project area and downstream impacted areas

The Project Area lies in Rohtas district located at South-Western part of Bihar. In the north and northeast part of the district is the alluvial plain and the southern part of it is an eastern flank of the Vindhya plateau. The southern area is hilly, with occasional forests throughout and several streams flow towards the north. The River Sone enters Bihar in the Rohtas district. The Sone Canal system is crucial for irrigation in the region. The Sone Barrage located on the River in Dehri of Rohtas district.

Rohtas district have 19 blocks, out of which the project work area falls in the following 3 blocks, Akorhigola, Sasaram and Dehri covering 38 villages: -

The proposed work area covers following villages under mentioned blocks.

| Sl. No. | Name of Sub-Project | Block | Village |
|---|---|---|---|
| 1. | Modernisation of Sone Western Main Canal from km 0.00 to 32.50 | Akorigola | Akorhigola, Akorhi, Barhari, Chhapra, Chapra garh, Khapra, Semradih, Mahadevganj, Manger tola, Bhajea, Bisunpura, Bishun bigha, Bihari bigha, Bhainsahi, Inaihia, Paisara, Gobina |
| 2. | | Sasaram | Babhanpura, Mor, Garura, Sumbha, Jhalkhoria, Rakasia, Akasi, Agrer, Mokar, Kothara, Nimia, Semra, Bhikhanpura, Baradih, Turki, Chaukhnda Chitauli, Lodhi |
| 3. | | Dehri | Dehri, Mathuripur, Dalmianagar |

### 6.2 Demography of areas directly and indirectly impacted

As per Census 2011, total 103,303 families reside in the project area blocks and the average family size is 7. Block wise population of above mentioned three blocks is mentioned in the following Table 6.1.

**Table 6.1: Block wise Population Distribution**

| Block | Population | | | Sex Ratio |
|---|---|---|---|---|
| | Total | Male | Female | |
| Dehri | 275014 | 143965 | 131049 | 910 |
| Akorhigola | 120145 | 62634 | 57511 | 918 |
| Sasaram | 358283 | 187456 | 170827 | 911 |
| Total | 753442 | 394055 (52.3%) | 359387 (47.7%) | |

The project blocks have a total population of 753,442 as per the Census 2011. Out of which 3, 94,055 (52.3%) are male while 359,387 (47.7%) are female. The block wise average Sex Ratio is given in the above table which shows Akorhigola has the highest sex ratio with 918 females per 1000 male, same as the state figure whereas, Dehri has the lowest sex ratio - 910 among the project blocks.

### 6.3 Socio Economic Profile

The project blocks are predominated by Hindu population, 85.8% and followed by Muslim population - 13.5%. Among these three project blocks maximum Hindu population lives in Akorhigola, 89.27% and maximum Muslim population inhabits in Sasaram, 16.20%.

Schedule Caste (SC) constitutes 16.71% while Schedule Tribe (ST) is meagerly 0.84 % of total population in project blocks. Following Table 6.2 shows SC & ST population distribution.

**Table 6.2: SC & ST population distribution**

| Block | Total | Male | Female |
|---|---|---|---|
| Dehri SC | 38885 | 20385 | 18500 |
| Dehri ST | 636 | 327 | 309 |
| Akorhigola SC | 27952 | 14539 | 13413 |
| Akorhigola ST | 69 | 32 | 37 |
| Sasaram SC | 59031 | 30589 | 28442 |
| Sasaram ST | 5636 | 2905 | 2731 |
| **Total SC** | **125868 (16.71%)** | | |
| **Total ST** | **6341 (0.84%)** | | |

The literacy rate in Rohtas district is 73.37%, highest in the state of Bihar, (61.8% percentage in state) as per 2011 census. Average literacy rate of the referred blocks as per census 2011 is 71.08%, in which, male and female literacy is 70.53% and 54.82% respectively. Around 16 % disparity exists in literacy rate in fvour of male in the project blocks. Gender wise distribution of literacy rate is given in the following Table 6.3 and gender wise distribution of workforce is shown in Table 6.4.

**Table 6.3: Distribution of Literacy rate by gender**

| Block | Literacy | | |
|---|---|---|---|
| | Total | Male | Female |
| Dehri | 65.78% | 73.07% | 57.76% |
| Akorhigola | 72.33% | 69.36% | 50.36% |
| Sasaram | 75.13% | 69.16% | 56.35% |
| **Average** | **71.08%** | **70.53%** | **54.82%** |

**Table 6.4: Distribution of Workforce by gender**

| Block | Main Workers | | | Cultivators | | | Agriculture Labourer | | | Household Industries | | | Other Workers | | | Marginal Workers | | | Non Working | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total | Male | Female | Total | Male | Female | Total | Male | Female | Total | Male | Female | Total | Male | Female | Total | Male | Female | Total | Male | Female |
| Akorhigola | 19,738 | 16,940 | 2,798 | 6,640 | 6,098 | 542 | 6,227 | 5,521 | 706 | 930 | 417 | 513 | 5,941 | 4,904 | 1,037 | 19,800 | 12,873 | 6,927 | 80,607 | 32,821 | 47,786 |
| Sasaram | 67,597 | 59,171 | 8,426 | 10,877 | 9,790 | 1,087 | 13,202 | 11,101 | 2,101 | 3,730 | 3,213 | 517 | 39,788 | 35,067 | 4,721 | 35,211 | 24,275 | 10,936 | 255,475 | 104,010 | 151,465 |
| Sheosagar | 28,328 | 24,657 | 3,671 | 9,910 | 9,187 | 723 | 10,145 | 8,751 | 1,394 | 795 | 580 | 215 | 7,478 | 6,139 | 1,339 | 31,743 | 18,027 | 13,716 | 116,009 | 48,584 | 67,425 |
| **Total** | **115,663** | **100,768** | **14,895** | **27,427** | **25,075** | **2,352** | **29,574** | **25,373** | **4,201** | **5,455** | **4,210** | **1,245** | **53,207** | **46,110** | **7,097** | **86,754** | **55,175** | **31,579** | **452,091** | **185,415** | **266,676** |
| **Percentage on Total workforce** | **63.08** | **55.88** | **7.19** | **11.85** | **10.87** | **0.98** | **12.25** | **10.60** | **1.65** | **3.25** | **2.60** | **0.65** | **35.72** | **31.81** | **3.92** | **36.92** | **25.29** | **11.64** | **69.07** | **28.33** | **40.74** |

In the referred project blocks out of the total population, 231,326 are engaged in work activities. 63.08% of workers describe their work as Main Work (Employment or Earning more than 6 Months) while 36.92% are involved in Marginal activity providing livelihood for less than 6 months. Of 1, 15,663 workers engaged in Main Work, 27,427 are cultivators (owner or co-owner) while 29,574 are Agricultural labourers.

6.4 Population Growth Rate

The population growth rate of Rohtas district from 2001 to 2011 is 20.78% as per census 2011 (25.42 % for the State), while sex ratio is 944 females per 1000 male, which is far higher than the state sex ratio, 918.

6.5 Land related adverse impacts under the project

In preliminary survey 15 structures and 2500 encroachers were identified in the adjacent land of project site. Those structures belong to non-title holders who have occupied WRD land in the project zone for residential purpose. However, under the present proposed intervention in addition to construction of service road in 22.50 km, the work majorly will be taken up within the canal area. Hence, all of the encroachers in the area are not required to be displaced. It is likely 8 of the encroached structures will be affected. The information of the 8 Project affected households are detailed in chapter 9.

6.6 Status of Water User Association

The existing Water Users Associations (WUA)s in Bihar are formed and governed by the Bihar Irrigation, Flood Management and Drainage Rules, 2003 which implements the provisions of the Bihar Irrigation Act, 1997. As per the rule the operation and maintenance of the distribution systems of the completed irrigation schemes are handed over, in phases, to the canal system level WUAs formed and registered under Societies Registration Act 1860. Till now 64 canal systems has been transferred to WUAs. The WUAs besides being responsible for operation and maintenance, collection of water charges/revenue and paying 30 percent of such collections to the department and spending the remaining 70 percent on the operation and maintenance works of the canal system under their jurisdiction. The water is charged on crop area basis. If the irrigated area is low the water charge collection is also low. Department controls the works of Canal and water supplies as well as bears the responsibility of major repairs and provides any technical assistance required. However, over the years, due to serious resource constraints the performances of irrigation systems and distributory network have increasingly deteriorated. Consequently, farmers' participation / contribution turned low so as the role of WUAs. It appears that significant improvements are necessary in the present form of PIM system.

Under such circumstances, the survey observed that in the project area only 3 WUAs, named i) Garachaube shakha nahar khand -3 krishak samiti, ii) Garachaube shakha nahar khand -4 krishak samiti and iii) Raghunathpur vitarni krishak samiti have been found functional. It was formed 20-23 years back, in 2002/2005. At present it comprises a total of 33 male members. The association mainly regulates the canal system, takes care of maintenance work, collects revenue and holds meeting with the WRD officers and farmers regarding the referred works.

**Table 6.5: Status of Water user association**

| No. of functional WUA | Division | Name of WUA | No. of Members | Year of formation | Activities performed |
|---|---|---|---|---|---|
| 3 out of 10 | Dehri for Garachaube branch canal and associated | 1. Garachaube shakha nahar khand -3 krishak samiti<br>2. Garachaube shakha nahar | 33, all male | 08-06-2002 | The societies besides being responsible for operation and maintenance also collect water charges and pay 30 percent of such collections to the department and spend the remaining 70 percent on |

| | | | | | |
|---|---|---|---|---|---|
| | distributory | khand -4 krishak samiti<br>3. Raghunathpur vitarni krishak samiti | | | the operation and maintenance works of the canal system under their jurisdiction. The WUAs are given additional benefits under various programs of government of India and government of Bihar like functional grant for trainings, demonstrations under command area development and water management program. |
| **Non-functioning WUA** | | 1. Badhupar vitarni krishak samiti<br>2. Gorsara vitararni krishak samiti<br>3. Garachaube shakha nahar khand -8 krishak samiti<br>4. Loknathpur vitarni krishak samiti<br>5. Goghara vitarni krishak samiti<br>**6.** Dangri vitarni krishak samiti | | 1. 08-06-2002<br>2. 05-12-2005<br><br>Do | |

# CHAPTER 7: PUBLIC CONSULTATIONS AND DISCLOSURE

## 7.1 Identification of Stakeholders

Based on the current set of proposed interventions, the following potential stakeholders were identified and categorized as Affected Stakeholders, Other Interested Stakeholders, and Disadvantaged & Vulnerable Stakeholder.

**Affected Persons:** There are 8 squatter households who shall be directly or indirectly adversely affected by the proposed interventions.

**Other Interested persons**: In relation to structural interventions, these are contractors, project management consultants, regulatory bodies/institutional stakeholders such as Pollution Control Board, Gram Panchayat, Electricity Department and WUA. In relation to non-structural interventions, communities living downstream who are key stakeholders to be involved in the implementation of Emergency Action Plan (EAP). To finalize the location of 19 Nos. of proposed Puja Ghat or stairs under the sub-project, public consultation will be done during execution of the sub-project.

**Disadvantaged and Vulnerable Stakeholders**: Illiterate persons, physically challenged, landless farmers, women and elderly who are living adjacent to the intervention sites are the key vulnerable stakeholders. Public meeting was organized and during the project cycle more interaction with them through meeting will be held to ensure that they are well informed about the provisions of the EAP.

## 7.2 Method and Process of Consultation

Stakeholder consultation is an integral part of the environmental and social assessment which provides inputs for the preparation of Social and Environment Management Plan (ESMP). The overall objective of such consultations was to document the concerns of the stakeholders with specific reference to the project planned interventions. The consultation meetings were organized basically for two important purposes, i.e., (1) to share project objectives and proposed project interventions with the identified stakeholder groups and (2) to consult with the stakeholders and document their concern, with particular reference to social and environmental impacts of the proposed project interventions. During the field assessment, community consultations were taken up as an integral part of social and environmental assessment process of the project. Public participation has been viewed as a continuous two-way process, i.e., developing people's understanding on the project, activities and process of ESIA and capturing their opinion on expected environmental and social concerns / issues.

To understand the expected project benefits / risks and people's perception on the project, field visits were conducted to different places within the planned project jurisdiction. In the process of assessment, mapping of stakeholders was done in the visited areas to understand how the project is going to impact upon the stakeholders. The field visit and stakeholder consultations were conducted in Sone Western Main Canal project sites of Rohtas district. The interaction with different stakeholders covered farmers of different social and economic categories, *Sarpanch* of the related project villages, leaders of the concerned communities, people / households expected to be affected due to the project, local service providers etc. in project districts to understand their concerns.

*Consultation with Potential PAFs / PAPs:*

The consultation meetings were conducted with the squatters / encroachers who have the establishment near the project site of Sone Western Main Canal. Discussion was primarily on project's planned improvement and strengthening measures and its anticipated impact on their livelihood, accessibility to utilities and services. At each intervention site / sub project level meetings were conducted. Environmental and social concerns of each project activities were thoroughly discussed to find out suitable project alternatives. Generic environmental and social concerns of each alternative were disseminated among all stakeholders to bring out baseline environmental and social concerns.

*Focus Group Discussion:*

A number of Focused Group Discussions (FGD) were conducted with the villagers residing adjacent to Sone Western Main Canal to understand their opinion on the project dimensions. Opinion of WUA operating under WRD was also noted during FGD. The discussions were primarily related to the project and its activities, people's current livelihood engagement and expected environmental and social implications of the project. Project activity wise generic environmental and social issues were discussed with different people and locations as well as activity specific environmental concerns were captured. However, people/ community were much more interested about project activities without enough environmental and social concern. The details of community consultations/ FGD held are given in the below Table 7.1 and Figure 7.1.

**Figure 7.1: Community Consultations/ FGD**


**Table 7.1: Focus Group Discussion with stakeholder community**

| Sl. no. | Subproject name | Date | Place | No. of Participant | Participants |
|---|---|---|---|---|---|
| 1 | Modernization of Sone Western Main Canal From km 0.00 to km 32.50 | 09/12/2024 to 12/12/2024 | Akhorigola | 40 | Villagers -40<br>Male -4<br>Female – 3<br>Pradhan - 3 |
| 2 | | | Sasaram | 123 | Community people - 123<br>Male -112<br>Female - 11<br>Pradhan – 4<br>Nagar Nigam Adhyachh Krishi Samiti - 1 |
| 3 | | | Dehri | 16 | Villagers -16<br>Male -12<br>Female– 4<br>Pradhan – 1 |

| | | | | | |
|---|---|---|---|---|---|
| 4 | | 10/07/2025 | Ankhorigola Section | 21 | Villagers -21<br>Male -12<br>Female– 9<br>Pradhan – 2 |

Consultation meetings were organized with local officials of different departments to make them aware about nature of BWSIMP intervention, thereon anticipated impacts, positive as well as negative, the cooperation required from them to mitigate negative impact, also to understand their views on different aspects of the project. Stakeholder departments who have specific interest / stake in proposed project from environmental and social dimensions are listed below.

| **Stateholder Department** | **Issues** | **Issues addressed in ESMP** |
|---|---|---|
| District/Local Administration | Nature of work to be executed, expected duration of work, area of work, impact anticipated during implementation, future scope, maintenance of law and order | Creating awareness about the project, needs active involvement of district/ local administration for resettlement and rehabilitation of project affected people/families |
| Dept. of Agriculture | Nature of work to be executed, impact anticipated during implementation, scope of increase of production in future due to land reclamation, many agri-labours are migrating to other districts, other industry | Creating awareness about the project<br><br>Modernization of canal will reduce seepage from canal and improve irrigation efficiency in the adjoining area.<br>This may attract agri-labour to work in local region. Further construction of service road will provide an alternate option to main road to the community. |
| Department of Electricity | Nature of work to be executed, impact anticipated during implementation, Public utilities like lamp post, electric pole located on either side of embankment may be affected. These should either be shifted before construction activity or re-established after construction activity.<br><br>Electric supply will be discontinued during shifting of electric pole. | Creating awareness about the project<br><br>Lamp/ electric post will be shifted by concerned electric department before or during construction work, if required. Impact will be temporary in nature. |

| | | |
|---|---|---|
| Pollution Control Board | Nature of work to be executed, impact on environment anticipated during implementation, obtain required permission for storage and handling of any hazardous material, management of construction and demolition waste etc. | Creating awareness about the project.<br>Adverse environmental impact will be mitigated. |

7.3 Outcome of the Consultation

The ESMP addresses all such issues that are identified to have potential for adverse impact. The plan takes care of encroachment issues building upon avoidance principles. Involvement of small and marginal holders is ensured through inclusion and equity norms in different project activities. Further, women participation and their safety and security are addressed in the camp (labour camp) establishment and management plan. Pollution and environment related issues are taken care in the ESMP under environment management plan.

Local communities are much more concerned about project activities and infrastructure facilities to be provided under this project. Communities focus was mainly concentrated on encroachment related issues, loss of agricultural land and pollution on agricultural land due to stocking of construction material on agricultural land. Majority of local people are expecting improvement of flood management and irrigation modernization. Very negligible percentage of people are concerned about environmental pollution during project implementation. Stakeholder wise environmental and social issues and are tabulated below in Table 7.2.

**Table 7.2: Environmental and social concern by different stakeholders**

| Stakeholders | Issues | Issue Addressed in ESMP Stakeholders |
|---|---|---|
| Community | Re-use of desilted material generated due to desiltation may be a problem. People suggested following reuse practice: | Desilted materials are mainly having sand, which can be used for backfilling of road, filling of low laying area. Silt test carried out by River Research Institute (RRI) has recommended safe use of desilted material in other similar study. |
| | Village roads may be elevated by using excavated earth which comes from river/ canal bed.<br><br>Contruction of the service road to ease communication of the villagers | Desilted material will be used in filling of low lying area, if need arises it may be sold directly to different end users.<br>Service road construction is a part of proposed project activities |
| | Disposed silt may be used to raise the elevation of a selected area of village so that villagers can be re-located at the time of flood. | Majority of the silt will be deposited in the chat land area of WRD on both side of canal embankment. In addition, raising low land area using desilted material will not be a problem. It will reduce burden of desilted material disposal. Possibility will be explored before commencement of desiltation. |

| | | |
|---|---|---|
| | Farmers may object to dump river/ canal silt in their land since the silt from the river /canal may reduce the fertility of soil. | Possibility shall be explored during desiltation operation and primarily will be dumped on chart land only. After quality testing of silt and analyzing its impact on soil, based on the result it may be used in agriculture field on the willingness of farmers. |
| | Farm land located across the chat land of WRD may be affected due to deposition of excavated material. | Desilted material will temporarily be stored on Chat land of WRD available on both side of canal embankment and unused desilted material (if any) will be sold directly from there. |
| | Contractor shall not store construction material and demolition waste in nearby agricultural field. | Construction material will be stored on side of embankment keeping enough space for local commuters. Haul road will be provided for material transfer. Contractor shall obtain consent of land owner before stocking construction or demolition material for temporary period on agricultural land. Crop compensation will be provided in case of crop damage. |
| | Construction labour shall not throw away any plastic bag/ materials to nearby agricultural field. | Waste bin will be provided in each work site for collection of plastic waste. These bins will be emptied and waste materials will be dumped to nearby sanitary landfill side on regular basis. |
| | There are planted tree on left side embankment in chat land Area. Compensation shall be paid against any such tree felling. | Canal lining and desiltation activity is proposed for Sone western Whirlo J Canal lining and desiltation activity will not affect tree located on embankment of canal. |
| | No private land shall be acquired | Project is not intended to acquire any private land. However, RAP is proposed for encroachment related issues, limiting to 8 households on the sides of the main canal where lining work is planned. |
| | Contractor shall employ local labour during construction and operation | Contractor will be appropriately oriented to engage local labour force in the work to the extent possible, based on the required skill base. It will be a part of the contractor's obligation. |
| | 8 residential structures of temporary /semi temporary type are situated at the bank of canal. Dwellers will vacate required land for construction work. However, compensation shall be provided. Being landless, the project affected squatters shall be linked with housing programme of Govt. | Eviction of squatters is minimised. However, compensation for Rehabilitation & Resettlement will be provided to all squatters.<br><br>The Division will forward the list of the project-affected squatters to the appropriate authority of Govt. housing programme to ensure that the affected households receive priority consideration. |

| | | |
|---|---|---|
| | Provision of access points along the canal for animals as well as humans, including: | In the civil work there is provision for<br>- constructing steps for animals to access drinking water<br>- building entry structures (ghats) or stairs to facilitate human use |
| | Canal lining might reduce groundwater levels in nearby areas, making it difficult to obtain drinking water through tube wells. | Canal lining, by reducing seepage will increase water availability within the canal, enabling irrigation over a larger area and gradually recharging ground water. Consequently, the overall impact on the ground water table will be positive and any decrease in ground water level in the areas adjacent to the canal will be minimal and short-lived.<br><br>Public awareness on this issue will be created through various programmes referred in the SEP. |
| Women | Contractor shall engage woman workers from nearby community. | Inclusion principles are incorporated in the ESMP. |
| | Contractor shall provide equal wage for women workers and shall not force them to work during night time. | Equal wage for equal work will be followed and included in the plan. |
| | Separate toilet shall be provided for women at camp as well as work site. | Included in ESMP as a part of labour camp and work site management plan. |
| | There may be social issues like women trafficking, sexual harassment in the work place during project implementation. Management planned to consider this, such activities in advance. | Workers camp site is proposed at least 500 meters away from nearby habitation. Although considering the social and cultural practices of this place there is minimum chance that woman labour will work in the project. However, if there are women workers the Contractor will provide separate toilet facility for women workers. Security guard will be posted at each camp site to restrict movement of local people within campsite. |
| **Overall Opinion** | **General agreement was observed among the participants when benefit of this project was explained to them.** | |

All the 8 PAPs have given their consent to vacate the land and welcomed the project. Signed attendance sheet and consent note is attached in the Annexure-III.

After ESIA report has been prepared a stakeholder consultation on the draft ESIA has been conducted by the Western Sone Main Canal, Irrigation division, WRD at the sub- project site on 10th July, 2025 to gather feedback and suggestions from the concerned stakeholders on the draft ESIA. The details of the consultation have been attached in Annexure VI.

7.4 Disclosure of project Information

*State Level*: WRD shall disclose the entire ESMF/ESMP at their website. The summary of the ESMF needs to be translated into local language (Hindi) and placed on the website. The Resettlement Policy Framework

will be disclosed along with the entitlement framework, though this is a part of the ESMF, these documents shall be separately identified and disclosed in the WRD website. These two documents shall also be translated into Hindi and made available at the WRD's website.

District Level: WRD must arrange to disclose the final versions of the ESMF and Resettlement Policy Framework and Entitlement Matrix in all the District Collectors Offices and the local offices of WRD. These would be in place once the final versions are ready. When this document is updated, then the copies in the different locations would also be updated.

Disclosure by The World Bank: The World Bank will disclose the ESMF and ESIA along with ESMP/ RAP for downloading and reference by interested parties. Following information shall be displayed / disclosed / disseminated, wherever applicable: -

Project specific information needs to be made available at each project site (hard/soft/display);
Project information brochures shall be made available at all the construction sites as well as the office of PMU and the office of Engineer in charge.
Reports and publications, as deemed fit, shall be expressly prepared for public dissemination e.g., English versions of the ESIA, ESMP and RAP and Executive Summary of ESIA, ESMP and RAP in local language.
Wherever civil work will be carried out a board will be put up for public information which will disclose all desired information to the public, as a part of pro-active and Suo-motto disclosure, transparency and accountability. All information will be translated into local language and will be disclosed

Table below lists the different types of information, relevant target audience depending on the nature of information, modes and frequency of engagement with these stakeholders.

**Table 7.3: Stakeholder engagement strategy**

| Information to be disclosed | Target stakeholders | Tools of engagement & mode of disclosure | Frequency | Responsibility |
|---|---|---|---|---|
| Provisions related to Canal | Contractor<br>PMU staff<br>Pollution control Board<br>Farmers, Communities (affected/ other interested) at downstream of the Canal | Consultation meetings related ESIA and ESMP<br>Minutes of the Consultation Meetings<br><br>Web disclosure of related ESIAs and ESMP | Multiple,<br>Must before work start,<br>During implementation,<br><br>ESMP, ESIA to remain on the WRD & WB websites and other disclosure locations through out the project period. | PMU |
| Work opportunities for Structural works | Contractors<br>Consultants | Website notifications<br>Tender advertisements in newspaper | Multiple | PMU |

| | | | | |
|---|---|---|---|---|
| | | | Continuous | |
| Work opportunities for Petty contracts Labor | Communities (including disadvantaged persons)<br>Petty contractor | Website notifications<br>Meetings to inform Village heads or community representatives | Multiple<br><br>Continuous | PMU and Contractor |
| GBV related provisions | WRD officials<br>Contractor personnel<br>Consultant personnel | Office circular and training events<br>Website notifications<br>Bid documents and Contract provisions | Multiple<br><br>Continuous | PMU |
| Labor management procedure | WRD officials<br>Contractor personnel<br>Consultant personnel | Website notifications<br>Bid documents and Contract provisions | Multiple<br><br>Continuous | PMU |
| Grievance mechanisms | Communities (affected/ other interested)<br>Contractors (for procurement related) | Phone number or Toll free Helpline<br>Display boards at site with GRM information<br>Consultative meetings<br><br>Website notifications<br>Meetings to inform Village heads or community representatives | Continuous, Multiple,<br>To be disclosed at WRD & WB websites.<br><br>Hard copies in local language at WRD district office, DM's office | PMU |

7.5 Grievance Redressal Mechanism

Effective grievance redressal mechanism gives an opportunity to the organization to implement a set of specific measures to ensure good governance, accountability and transparency in managing and mitigation of environmental and social issue of a particular project. This consists of defining the process for recording/receiving complaints and their redressal in respect of environmental and social matters.

## Current System

The existing GRM for Government services are summarized in the table below.

**Table 7.4: Existing GRM for Government services**

| Level | Name | How to access | Link to the project Implementing Agency |
|---|---|---|---|
| 1 | National | CPGRAMs | Accessible to all citizens. Citizens can register their grievances online and through Mobile App. Complainants track the status of the complaints with the |

| | | | |
|---|---|---|---|
| | | | unique registration ID generated at the time of complaint registration. |
| 2 | State | CM Portal/Helpline | Anyone can fill online form at any time by giving their personal details/contacts and feedback. Thus Project beneficiaries can access the portal to register their grievances. |
| 3 | Department | Departmental Grievance cell | At present WRD has public information officer and Grievance Redressal officer at state level to him complainants can register their complaints. |
| 4 | Department | Internal Complaint committee | At present WRD has an ICC but its role and functionality needs improvement. |

**Lessons from existing systems**

A similar World Bank supported project, Bihar Kosi Basin Development Project (BKBDP) due to close in March 2025 has followed three-tire grievance redressal mechanism, Tier I at the project site level, Tier II at District level and Tier III at State level (PMU level). In first-tier Sarpanch of local Gram Panchayat or a designated Project staff at project site is the focal point to record the complaint and address the issue or escalate to district level for mediation within 15 days of the submission of the compliant. The second tier at district level comprises a Grievance Redressal Committee (GRC) chaired by the District Collector and here GRC provides their view within 30 days of receiving the grievance. The aggrieved person if not satisfied with the verdict given by district level grievance cell, moves to the third tier, i.e. State level grievance committee which works under the Chairmanship of Secretary of concerned Department to get the complaint resolved within 45 days after receiving it. However, the major challenge of Grievance redressal system of BKBDP is that each tier being led by high powered officials of Govt. administration, the redressal process becomes time consuming due to their busy schedule. Hence, sometime purpose of the GRM of the project gets defeated. Based on this learning, an alternative system has been proposed for BWSMIP.

## GRM under BWSIMP to be developed

For the BWSMIP, a unique system will be developed for general stakeholders, individual beneficiary, PAPs, laborers and complainants of GBV/SEASH. Though they may access all the existing grievance redressal platforms mentioned above to express their grievances and seek solutions too.

The grievance redress mechanism would be in place since the inception of the project till its life. It is proposed to establish a dedicated Grievance Redress Mechanism (GRM) for receiving and handling grievances related to the project including for resettlement, labor complaints and SEA/SH. PMU at the state level will be responsible for tracking, managing and analyzing complaints received on a periodic basis and to make their status available for internal reporting as well as select information in public domain. In addition, systems will also be developed for communication on existing mechanisms as well as periodic training on grievance handling.

Emphasis in the GRM under the current program will be on enhancing transparency and accountability through wide-spread awareness creation and complementing it by creating multiple access points for

registering grievance, for ensuring easy access to these mechanisms. These access points could be telephone-based helpline, drop-boxes as well as web-based grievance filing systems.

Citizen/groups would be able to submit through various mediums - **i) Web-based, ii) Telephonic, iii) Mail Post iv) in person to concerned official/s**. At the PMU level, all grievances will be recorded and tracked through the project MIS. One Operator will be hired, and trained to receive, record, categorize and forward all the grievances daily. He/She will do that based on a charter which contains a list of designated Officials who will be alerted, about their responsibility. In case of grievances received through web- based system or in person too, screening and resolution of the same or communicating with the divisions/ department for resolution of the same will be done. There will be an internal escalation mechanism - alert generation, response and closure protocol will be developed for the same. A receipt or a unique number will be generated for all such complaints and communicated to the complainant within 24 hours. The complainant will follow up based on that unique number. If response is not received within 5 working days, the complaint will be escalated to the concerned superior officials. The project MIS dashboard will display this information for follow up and analysis. The number of grievances received and resolved will be disclosed.

Some key features will include:

- Investments on creating public awareness about the available GRM systems
- Easy system for filing complaints
- Charter of responsibilities and response protocols
- Availability of multiple options for filing grievance (including ICC based protocol)
- Provision for registering offline grievances either in-house or through an independent /third-party
- Generation of unique complaint ID for individuals to help them track their grievances
- Development of redress protocols (including timelines) based on nature and complexity of grievances
- Hierarchical system of escalation of unresolved complaints from sub-district upto the state
- Accessibility of GRM data to program managers at all levels for periodic monitoring and review
- Random back-checks after closure of complaints to ensure quality of grievance handling.

**For SEA/ SH Related Grievances:** An Internal Complaints Committee (ICC) for addressing any SEA/SH-related complaints at the workplace will be set up by the WRD under BWSMIP. The committee will be constituted as per the requirements of the Sexual Harassment of Women at Workplace (Prevention, Prohibition and Redressal) Act, 2013. The PMU will put in place necessary mechanisms and procedures for confidential reporting with safe and ethical documentation of SEA/SH issues at the project level. All employers including contractors as per the Act must ensure that the contact information of ICC is displayed in their respective offices and that regular trainings/orientation programs are organised for project staff and the workers of contractors. SEA/SH related processes will be overseen by the Social Development & Management Specialist within the PMU and monitored on the ground by the Environmental and Social experts within the PIU.

**Building Awareness about the Grievance Redress Mechanism:** The Social Development & Management Specialist of PMU will initially brief all staff, PMU, consultants, and contractors on the grievance mechanism and GBV/SEA/SH complaints mechanism of the project and explain to them the procedures for filing, reporting and documentation of public grievances. Awareness campaigns will be conducted

targeting project stakeholders to inform them of the availability of the mechanism through various mediums. The GRM will also be published on the WRD website. Construction sites under the project will also display the phone number, email, and address for filing public grievances.

There will be a State level GR Committee to review the functioning of the above on a six-monthly basis. ESS10 requires the development and implementation of a GRM that allows project-affected parties and others to raise concerns and provide feedback related to the environmental and social performance of the project and to have those concerns addressed in a timely manner. The SRC will be established under the chairmanship of Secretary, Department of Water Resources. Project Director will be convener of this committee. The composition of the committee will be with the following members:

Chief Engineer
Heads of Participating Departments
A senior representative, one each from BC & EBC Welfare and SC & ST Welfare
A senior representative of the Revenue Department
A representative of the PRIs
State level Environmental Officer of project
State level Social Officer of project
A representative of PAPs

**District level Grievance Management**

At the district, nodal department will be responsible for collecting off-line grievances, undertaking a preliminary assessment on the relevance of grievances, digitization offline grievances, their categorization according to nature of complaint, updating complainants about status of their grievance and routing them to concerned duty- bearers. The district level focal point will also be responsible for generating and submitting state monthly or quarterly reports on status of grievance management.

Legal Options to PAPs: If the aggrieved person is not satisfied with the verdict given by district level grievance cell, he or she will have the right to approach the Judiciary. Project will help the aggrieved person in all respect if person wants to approach the judiciary. These options will be disclosed to the PAPs during the public consultation process.

### 7.6 Provision of further consultation at Implementation Stage

Consultations with stakeholders across the spectrum are needed early and continuously in the project. Project should be geared up to carry out consultations from the Identification stage, through project planning and design, as well as during implementation to nurture trust among the stakeholders. The purpose of consultations is to give information about the project to the stakeholders and to clarify misconceptions if any. This process helps in enhancing local ownership and ensures smooth project implementation in the long run.

Through periodic consultations with the local community including WUA, PMU will engage them in project implementation, and monitoring. Consultations will be conducted in an atmosphere that is conducive to the project development and beneficial to the community and local population. The PMU will ensure that the consultations are free of coercion and intimidation, are gender-inclusive, and tailored to the needs of vulnerable groups. All relevant stakeholders will be informed in advance about the timing and format of the consultations.

During project implementation, safeguard experts will have informal discussions with the locals residing in the vicinity of the proposed project activity sites. They will note the grievances, if any, due to construction.

A variety of approaches can be adopted, for stakeholder consultation. At minimum, the following consultation activities as mentioned in Table 7.5 should be conducted. This is indicative and PIU can also adopt more effective methods and approaches, which are locally appropriate.

**Table 7.5: Consultations required for Implementation**

| **Consultation activity during implementation** | **Remarks** |
|---|---|
| 1. Focus group discussions with the concerned WUA/people residing/working near the project sites | During the ESMP monitoring at work sites |
| 2. Informal discussions with the construction workers and construction supervision staff (contractor, consultants and PIU) | During the ESMP monitoring at work sites |
| 3. Informal discussions with commuters and general public along the Sone WMC where works are implemented | During the ESMP monitoring at work sites |
| 4. Formal Discussion with PAPs about RAP implementation | During the RAP implementation and monitoring |

## CHAPTER 8: ENVIRONMENTAL IMPACT ASSESSMENT

The upstream link canals, the Western Link Canal and the Western Parallel Link Canal, have already been lined with concrete, resulting in improved canal system efficiency. However, the benefits of lining will only be fully realized if the downstream canal systems are also lined. Lining reduces water losses and facilitates easier maintenance, while also allowing the canals to handle higher discharges without eroding the banks. With a lined canal system, the canal bed width can be adjusted to accommodate higher flows while minimizing water loss during transit.

Under World Bank funded "Bihar Water Security and Irrigation Modernization Project (BWSIMP)" Modernization of Western Main Canal (WMC) scheme is proposed. This sub-project. seeks to address seepage and other water losses, aiming to restore the lost irrigation potential of up to 24,244 hectares by upgrading and modernizing the canal system with advanced concrete lining technology. The Western Main Canal, a crucial part of the Sone canal system, commands an extensive area of 521,489 hectares (CCA). This network supplies water to the Ara Main Canal (AMC), Chausa Branch Canal (CBC), Buxar Main Canal (BMC), Garah Chowbey Branch Canal and various distributary systems.

As per DPR, the proposed engineering works under the project include: -

I. De-silting and re-sectioning of the canal, with strengthening of existing banks over a length of 35.20 km.
II. Installation of 100 mm/ 75 mm thick concrete lining along 32.5 km of the WMC and 2.70 km from 18.70 km of WMC to Jaynagar lock, total length 35.20 km.
III. Remodeling outlets 268 number to replace the old ones.
IV. Renovation of existing outlets 2388 numbers.
V. Construction of a 390 m (both sides) retaining wall at Dehri Fall.
VI. Construction of Service Road in 22.50 Km with Bituminous.
VII. Puja Ghats/stairs in 19 numbers at each 2.00 km

### 8.1 Design Phase Impacts

The design for the WMC has been completed and the alternative which has been considered in the design are presented in Chapter 4. During the construction phase the design is not expected to change. If there are any major changes in the design the ESIA will be updated.

### 8.2 Pre-Construction Impacts –Location and Design

The work likely during the pre-construction period are i) Shifting of electricity poles, II) setting up of Contractor's Camp and Construction yard, iii) Planning for sourcing of material etc.

### Finalization of Work Methodology

The work methodology would define the activities undertaken. These would also determine the risk to the workmen and the communities. Based on the work Methodology and the plan the legal permits need to be obtained. It is thus important to identify the risk and plan mitigation for both these aspects: -

**Mitigation Measures:**

**To address the OHS issues**

- A Hazard Identification and Risk Assessment (HIRA) for all tasks presented in the Method Statement will be carried out.
- Safety standards will be applied during all phase of project activities. The personnel should be periodically undergoing medical check to identify anybody suffering from occupational health hazard.
- OHS plan for construction work site safety will be prepared
- The contractor shall effective arrangements to provide sufficient supply of wholesome drinking water with minimum quantity of 5 litres per workman per day. Quality of the drinking water shall conform to the requirements of national standards on Public Health.

**To address the community Health safety issues**

- Traffic management plan for working along the Canalroad/Inspection Road and hauling of material during the construction period will be prepared by the contractor.
- Community Health Safety Plan will be prepared to ensure that the commuters are segregated from the work site.

The OHS Plan, Community Health Safety Plan and Traffic Safety Plan must be submitted along with the Work methodology. The PMU/PMTC shall review this comprehensively (within one week), address any comments, and resubmit for approval. The work methodology should not be approved without the approval of these plans.

## Site Selection of Construction Work Camps, Stockpile Areas, Storage Areas

Priority is to locate these near the project location. However, if it is deemed necessary to locate elsewhere, sites to be considered should not lead to unwarranted impacts on air, noise and tensions or conflicts with the local community. The location should not also cause any inconvenience to the local community. Further the planning of the Construction camp and the Layout of the equipment can also adversely impact he environment.

**Mitigation Measures:**

- The guidelines to be followed by Contractor for site selection for the Camp is presented in Annexure - I. It should conform to the World Bank Group Guidance on Labour Accommodation (Workers' accommodation: processes and standards (https://www.ifc.org/content/dam/ifc/doc/mgrt/workers-accomodation.pdf) and local laws which ever is stringent
- The layout of the Camp shall be reviewed and approved after full compliance of one round of comprehensive review by the Environment Officer of PMTC. The construction of the camp should be carried out after the clearance from Environment Officer, PMTC

## Selection of the Disposal Areas

The project has estimated 420183.76 Cum of silt will be generated and if they are not properly disposed it can adversely impact the receiving waterbody due to erosion. These excavated silts are difficult to re-vegetate. However, if no attempts to vegetate the slopes are made, the silt could slide lower down during rain It can also affect the adjoining agricultural lands and affect their productivity. Hapazard dumping can also be a source of visual pollution and also a health and safety risk for the residents. The project has identified that the generated quantity of silt will be used for sectioning of canal. The filling quantity required to bring the canal in section is much more than the quantity obtained during bed clearance of

the Sone western main canal. This cutting quantity will be used during filling of the damaged embankment of canal to bring the canal in section.

**Mitigation Measures:**

The following needs to be kept in mind during disposal:

- Clear the debris (if any) from construction and demolition sites. Unusable Debris's (if any) are to be carried by trucks/dumpers to the identified dumping yards.
- The selected dumping site should be approved by the dedicated Focal Person for E & S at concerned divisional office of WRD, E & S Specialist of the PMU or Environmental & Social experts of PMTC.
- The locations of dumping sites should be selected with following considerations.
    - Unproductive/wastelands shall be selected for dumping sites.
    - These should be away from residential areas and located at least 1km downwind side of these locations,
    - These sites shall be finalized such that they do not lie within any designed forest or other eco-sensitive areas, do not affect natural drainage courses and no endangered/rare flora is impacted by such disposal.
    - The lowlands, natural depressions which are natural sinks will not be used for dumping as these are natural sinks.
    - Drainage channels should not be used for dumping
    - Local Authorities should be consulted about the location of debris disposal sites before finalizing the locations.
- Dumping sites should not contaminate water sources.
- Dumping sites should have adequate capacity for the amount of debris generated.
- The Ministry of Environment, Forests and Climate Change (MoEF&CC) has issued notifications related to sediment management, particularly focusing on dredging and desilting of water bodies and sand/soil mining. These notifications outline the need for Environment Clearance (EC) for such activities, with some exemptions for maintenance dredging and desilting, subject to environmental safeguards as per the National Framework for Sediment Management (NFSM). During construction phase sediment managment will be done in line with the said framework.

## Shifting of Utilities

The baseline study has revealed the electricity distribution line is present and would get affected. No other amenities/ utilities, which are going to be affected by the project as all of them are situated at a safe distance beyond the proposed construction (protection & strengthening). These infrastructures and utilities will need to be relocated from their present position due to the proposed alignment. Unplanned shifting can lead to power disruption causing inconvenience to people.

**Mitigation Measures:**

- Shifting and relocating utilities like electric poles to a safe place before the commencement of the construction / strengthening/lining work. Concerned department such as electricity department will be consulted before hand for this purpose and the project.

- The scheduling of the construction works will be shared with the line department (electricity supply, Road & transport) for ensuring uninterrupted services during construction.
- The Community should be made aware by WRD about any disruption to the electricity.
- Power disruption should be planned only during daytime so that there is no safety security issues at night during the night time

### Selection of Plant Machinery and Vehicle

The Plant Machinery and Vehicle should be selected that they meet the existing emission requirement else they would be a source of pollution. The Ministry of Road Transport and Highways has notified that emission standards[5] for construction equipment.

**Mitigation Measures:**

The following process should be applied: -

- All construction machinery, equipment should comply with the emission norms. The Contractor needs to provide a Certification to that effect.
- All vehicles involved in the project should have a Pollution under control Certificate (PUC) at all times.
- The Environmental Officer (PMTC) should verify that all vehicle has PUC certification as a process of verification of the bill of the contractor

### Sourcing of Construction Materials

Extraction of materials can disrupt natural land contours and vegetation resulting in accelerated erosion, disturbance in natural drainage patterns, ponding and water logging, and water pollution. The existing system of environmental clearance for the quarry site for aggregate and sand has inbuilt safety mechanism to safeguard against these. To prevent similar impacts from borrow areas (for loose material other than stones) MoEF&CC has provided Standard Operating procedures (305_OM_08_08_2022 Borrow Area.pdf). To ensure that the process is instituionalised in the project the following has procedures have been developed:

- Only mine, quarries which have valid mining licenses and Environmental Clearance are permitted by Mines and Geology Department will be used in the project.
    - The Contractor will finalise the stone quarry /sand mine / borrow area for procurement of construction materials after assessment of the availability of sufficient materials and other logistic arrangements.
    - The Contractor will provide a copy of the Environmental Clearance Certificate of the quarry/sand mine and the Consent to Establish and Operate along with the recent compliance report to the PMU before any such quarry is engaged.
- In case of Borrow areas
    - identified areas will be verified by the Environmental Specialist (PMU) / Env Officer (PMTC) for adherence to the SoP provided by MoEF&CC
    - The request for approval of the borrow area shall be accompanied by Borrow area Rehabilitation Plan

[5] https://morth.nic.in/sites/default/files/notifications_document/GSR%20598%20%28E%29%20dated%2030%20September%202020%20Seperate%20emission%20norms%20for%20agriculture%20tractors%20and%20CEV.pdf

    - The Final Payment to the Contractor shall be released only after the redevelopment of Borrow area is completed.
- The Environmental Specialist (PMU)/ Environmental Officer (PMTC) will inspect every site and suggest measures as is required to prevent deterioration of environment or safety of the people before they are considered “Fit for dumping”

### Sourcing of Water for construction

The construction water would be required for the concreting (incase of in-situ concrete mixing), other construction activities and for domestic purpose. Even though the groundwater resources are not deficient unscrupulous abstraction can lead to shortages in the local area.

**Mitigation Measures:**

- The contractor needs to obtain permission for borewell from Bihar Ground Waterboard / Central Groundwater Board. A copy of the application needs to be submitted with the Method Statement.
- In case the water is procured from third party the copy of the permit should be provided to the Env Specialist of PMU / Env Officer of PMTC.

8.3 Construction Phase Impacts

The construction activities would primarily involve i) excavation, transport and disposal of silt, ii) lining of the canal and construction of embankment road will involve: a) transportation storage and of construction material, b) transportation, storage and laying of liner, iii) mixing and laying of concrete. Iii) construction activities at the gates

### Impact on Land Use and Topography

All the suitable materials will be reused as fill materials, aggregates, embankment, etc. to minimize the disposable quantity. The unsuitable and unutilized excavated material will be disposed-off. Unless the same is done in a scientific manner it has potential to cause water pollution, affect the fertility of the adjoin land and also cause visual pollution. The guidance for the disposal is presented in:

**Mitigation Measures:**

- During the dumping the following should be maintained:
    - The height of the dump at any location shall not exceed 3m
    - The 1:2 slopes of the dump should be maintained and the slopes should be maintained
    - The slopes and top should be covered with vegetation e.g. local variety of grasses to prevent erosion.
    - Peripheral drains should be developed to top and bottom of dump to collect the water. Chute drains should be developed along the sides at regular intervals to collect the water.

### Impact on Air Quality

Deterioration of air quality due to various construction activities along the project site is primarily due to dust. The summer season experiences high wind velocity causing accelerated wind erosion, resuspension of dustwhich contributes to the high SPM in the ambient air quality. Fugitive emissions are from vehicles used for the transportation of construction materials. Large quantity of dust is likely to be generated on the WMC and the proposed transportation routes for debris and spoils disposal and construction

materials. Another source of air pollution is construction emission form movement of vehicles and machineries, running of batching plant, mixing plant and the operation of DG sets to meet the power requirements during construction period. The construction camp will have some sources of pollution from domestic sources such as cooking, DG sets for domestic uses.

Since there are habitation adjoining the canal these incremental air pollutants can cause inconvenience to the residents and sensitive group of people. Significant impact on health is not considered because the construction period is short and the emission and dust will co-terminate with the construction. However, to mitigate the temporary impacts the following should be carried out:

**Mitigation Measures:**

- All vehicles delivering fine materials to the site will be covered to avoid spillage of materials or being blown away during the transportation.
- Contractor will arrange for regular water sprinkling for dust suppression of all roads and surfaces. The records of sprinkling shall be maintained
- The unloading of materials at construction sites in/close to settlements will be done with proper barricade made by the contractor.
- All stockpiles will be covered/protected to prevent dust generation
- The contractor will take every precaution to reduce the level of dust construction sites involving earthwork by a sprinkling of water, encapsulation of dust source and by the erection of screens/barriers.
- The contractor will provide necessary certificates to confirm that all Plants, equipment, machinery, and vehicle used in construction conform to relevant dust emission control legislation.
- No burning of firewood is allowed in the construction camp. The Contractor must make provisions for LPG cylinders.
- The Contractor will submit PUC certificates for all vehicles/ equipment/machinery used for the project.
- Location of DG sets and other emission generating equipment should be decided keeping in view the predominant wind direction so that emissions do not affect nearby residential areas.
- Stack height of DG sets to be kept in accordance with CPCB norms, which prescribes the minimum height of stack to be provided with each generator set to be calculated using the following formula:

  $H = h+0.2x \sqrt{KVA}$

  H = Total height of stack in meter

  h = Height of the building in meters where the generator set is installed

  KVA = Total generator capacity of the set in KVA

- Obtain, CTE and CTO for batching plant, crushers and DG set etc. if specifically established for this project.
- If contractor procures any material (such as ready-mix concrete, asphalt/macadam, aggregates etc.), from third party agencies, contractor shall ensure that such agencies have all necessary clearances/permissions as required under the law; these include CTE/CTO from BSPCB,

environmental clearance, etc.; contractor shall collect the copy of these certificates and submit to PIU; PIU will approve the source only after all the certificates are submitted; and`

- Conduct air quality monitoring according to the EMP.

### Impact on Drainage

The area has a history of flooding and drought both, but the works will be carried out within the existing canal, thus no natural drainage is likely to be affected. The selection criteria for the dumping sites have ensured that low lying areas / depressions, natural channels are not used for dumping because they would hamper the natural flow of water, cause stagnation or water. The project areas are also vulnerable to vector-borne diseases e.g. malaria, Kala-azar and dengu. Thus, the stagnation of water can also lead to health concerns

**Mitigation Measures:**

The following mitigation measures should be implemented:

- Prioritize re-use of excess spoils and materials in the construction works.
- Spoils will be disposed, at site which has been identified as "Fit for Dumping" only after the completion of all mitigation measures suggested by the Environmental Specialist (PMU)/ Environmental Specialist (PMTC).
- Inspect all the drainage at construction site/construction camp/labor camp/ dumping site etc. and clear all the drainage lines so that no water stagnation/flooding may occur during heavy rainfall.

### Impact on Surface Water Quality

Impact on surface water quality during the construction phase are anticipated due to surface runoff from construction site containing substantial quantities of suspended impurities, mixing of oil and other hazardous chemical, discharge of sewage from labour camp etc. Run-off from stockpiled materials construction wastewater, construction camps and chemical contamination from fuels and lubricants during construction works can contaminate downstream surface water quality of the streams. These potential impacts are temporary and short-term duration only.

**Mitigation Measures:**

The presumptive source of surface water pollution due to construction activities and their suggested mitigation measures are discussed below.

**Material storage beside the Canal**

- The contractor will ensure that no construction materials shall disposed off or block the flow of water of any water course and cross drainage channels.
- The stockpiled material must be prevented from erosion and deposition in the drainage channel from sites where these are stocked for construction. Since the project site is congested, an additional construction/fabrication yard can be proposed away from the construction site.

- The runoff from the construction material storage yard must be channelized through peripheral drains connected to sedimentation tanks (holding tanks excavated in the ground) of adequate capacity
- All sedimentation tanks and peripheral drains must be cleaned before the monsoon.

**Water pollution from Fuel and Lubricant**

- Contractor will ensure that all vehicle/machinery and equipment operation, maintenance and refuelling will be carried out in such a way that spillage of fuels and lubricants does not contaminate the ground. Only fuel pumps will be used for the transfer of fuel during refuelling.
- Oil interceptors will be provided for vehicle parking, wash down and refuelling areas as per the design provided.

**Pollution from sewage disposal**

- The Contractor will take all precautionary measures to prevent the wastewater generated during construction from entering into river or any other nearby water bodies by passing wastewater to sedimentation tank to be considered as part of the EM plan and Contractor's responsibility.
- Stagnation of water should not be allowed at any place near the camp site as a precaution against vector-borne disease.
- Provision of STP/septic tank should be provided at site/labour camp for onsite treatment of sewage.
- No Solid waste should be discharged into any waterbody

**Pollution from Construction activities**

- The wash water from the concrete mixer/ batching plant/ miller should only be disposed at a pit developed in construction camp

### Impact on Groundwater Quality

Groundwater resources are not scarce in the project area. It is anticipated that there will not be major adverse impacts on the ground water quality during construction phase of canal lining project The potential of temporal scarcity, affecting nearby wells and ecosystems is also considered to be low.

Contamination of groundwater quality may happen during the construction phase occur due to oil spillage and other chemical contaminants from vehicle parking and washing/ servicing area, fuel/ chemical storage area etc.

Discharge of untreated sewage are potential source of groundwater contamination. Following mitigation measures are suggested to avoid any negative impact.

**Mitigation Measures:**

- Ensure all equipment, vehicles and other sources of fuels and lubricants will be collected and contained to avoid soil/ groundwater contamination.
- Fuel must be stored in proper bounded and covered areas.

- All spills and collected petroleum products must be disposed of in accordance with standard protocols
- Maintenance and refuelling of vehicles, machinery and other construction equipment must be carried out on an impervious surface so that spillage of fuels and lubricants does not contaminate the ground.
- The runoff from the maintenance yard must lead to a peripheral drain and pass through an oil-water separator
- In case the contractor is using groundwater for construction he needs to obtain permission from the Central Ground Water Authority as the case may be. In case he obtains/ purchases the water from a third party, the permission of the third party to supply water for construction purpose should be obtained.
- Septic tanks / STP / Modular Bio-toilets constructed / placed at Contractor Camp and work sites to treat human waste

### Impacts from Construction Wastes

The issues related to construction waste e.g. silt, dilapidated brick tile was had been discussed previously specifically water. In addition, the haphazard disposal may lead to loss of productive land. Additionally, during disposal the movement of trucks carrying the debris and silt outside the designated route can cause compaction. The following mitigation measures:

- The movement of the truck carrying debris or construction material should be limited to the designated tracks
- The construction waste and debris should be disposed only at site “Fit for Disposal”.

### Impact due to Noise

Operation of heavy machineries; movement of heavy vehicles, concrete mixing activities, operation of DG Set, demolition of existing structure, bullah piling generates high noise increasing the ambient noise level in the surrounding. Typical noise leaves are provided in Table 8.1. However, most of the construction activities will be confined to the project area (inside the canal systems, embankment site) away from habitation area.

**Table 8.1: Average noise levels generated by the operation of various construction equipment**

| Equipment | Noise level (dB (A)) |
|---|---|
| Batching Plant | 90 |
| Transit mixer | 75 |
| Winch-7.5 t capacity | 75 |
| Generator | 85 |
| Hydraulic Rig | 85 |
| Compressor | 80 |
| Hydra 12/15t | 80 |
| Vibro hammer | 80 |
| Concrete mixer | 75 |
| JCB-3D | 85 |
| Trailor | 85 |

| Equipment | Noise level (dB (A)) |
|---|---|
| Excavator | 80 |
| Dumper | 85 |
| EoT cranes | 80 |
| Ordinary cranes | 75 |

Modelling studies were conducted to assess the increase in noise level due to operation of various construction equipment's, and the results of this exercise are given in Table 8.2.

**Table 8.2: Predicted noise levels due to the operation of various construction equipment**

| Distance (m) | Ambient noise level (dB (A)) | Increase in noise level due to construction activities (dB (A)) | Resultant Noise Level | Increase in ambient noise level due to construction activities (dB (A)) |
|---|---|---|---|---|
| 30 | 45 | 70 | 70 | 25 |
| 50 | 45 | 66 | 66 | 21 |
| 100 | 45 | 60 | 60 | 15 |
| 200 | 45 | 54 | 55 | 10 |
| 500 | 45 | 46 | 49 | 4 |
| 1000 | 45 | 36 | 46 | 1 |
| 1500 | 45 | 36 | 45.5 | 0.5 |
| 2000 | 45 | 34 | 45 | - |

It is clear from the above table, that at a distance of 1 km from the construction site, the increase in noise levels will be only 1 dB (A). The WMC is located in a rural setting, at most place receptors are located beyond 1km. At few locations the settlement or sentitive receptors would in proximity of the worksite. Since the worksite would keep on shifting along the length of the canal at no location the works would be carried out for more than a couple of days. Hence, no adverse impacts are anticipated on ambient noise levels during construction phase of the proposed project. Attenuation will also occur due to sound waves traversing over vegetation, atmospheric absorption or any other obstacles

However, to minimise the Impacts to the noise environment the following mitigations measures are considered:

**Mitigation Measures:**

- Staging of construction equipment and unnecessary idling of equipment within noise sensitive areas to be avoided whenever possible.
- All plants and equipment used in construction (including third-party plants and equipment) must conform to the MoEF&CC/ CPCB noise standards.
- All vehicles and equipment used in construction will be fitted with exhaust silencers.
- Servicing of all construction vehicles and machinery will be done regularly and during routine servicing operations, the effectiveness of exhaust silencers will be checked, and if found defective will be replaced.

- The activities must be carried out during the daytime. Night-time activities may be carried out in an emergency, but all measures mentioned in the mitigation measures for night work must be strictly adhered to.
- Restriction on unnecessary honking at the project site
- Barricading (Temporary noise barrier) around the construction site to minimize the noise level
- Monitoring must be carried out at the construction sites as per the monitoring schedule, and results will be submitted to PMC and PMU.

The following **Noise Standards for DG sets** are recommended for the running of DG sets during the construction:

- The contractor must use silent DG sets prescribed by CPCB; if not then noise from the DG set should be controlled by providing an acoustic enclosure or by treating the enclosure acoustically.
- The Acoustic Enclosure should be made of material of appropriate thickness and structural/ sheet metal base. The walls of the enclosure should be insulated with fire retardant foam.
- The acoustic enclosure/acoustic treatment of the room should be designed for minimum 25 dB (A) Insertion Loss or for meeting the ambient noise standards, whichever is on the higher side.
- The DG set should also be provided with proper exhaust muffler.
- Proper efforts to be made to bring down the noise levels due to the DG set, outside its premises, within the ambient noise requirements by proper siting and control measures.
- A proper routine and preventive maintenance procedure for the DG set should be set and followed in consultation with the DG set manufacturer which would help prevent noise levels of the DG set from deteriorating with use.

### Impact on Local Ecology

The project activities are not located in any ecological sensitive areas e.g. wild life sanctuary, national park or interfere with any wildlife corridor. No tree felling is also envisaged. The project withdraws water from the River Sone where aquatic life may be disturbed. As the modernization happens more land would be converted into double cropped areas requiring additional water. As described in the ESMF there will be reduction in flow in the river but that would not be substantial.

In WMC since there are no interventions directly in the river there no standalone plans are proposed to be implemented.

### Accessibility

The Canal inspection road/ canal bank road is presently used the local people for commuting. The same will be used during the construction. Deterioration of the conditions / damage to the structure due to construction. This will inconvenience the people.

The following mitigation are proposed

### Occupational Health and Safety

The project activities will include operation of heavy machinery, movement of heavy vehicle etc. it is also expected to have around 1600 plus labours working in the project. The various OHS risk in the different activities these have been identified and presented in Annexure- III. The OHS mitigation and control point are also highlighted in the same.

## Community Health and Safety.

The work site is primarily located in rural areas with a few habitations detailed in Table 9.1. In addition, the Canal Side Road / Inspection Road is used by people for their commuting. During construction there will be chances of interaction between machinery and the local population especially near settlements. Since the canal road/inspection road would also be used for staging the machinery thus there will be chances of pedestrian or road user being struck by the machinery.

In addition, there will be movement of project vehicles along the canal road/ inspection road. Since this road is also used by local population and other commuter to access their agriculture field. There are chances of collision but the probability of occurrence of such collisions are low because of the low traffic during the non-agricultural season. Majority of the civil works will also be scheduled during the non-agricultural season when the canal will not be used. However, there are a few mitigations which are envisaged.

**Mitigation Measures:**

- Since the worksites are mostly in rural areas with not much traffic hard barricading may not be possible. It is thus suggested that work site be demarcated with barricading tapes outside settlement areas. Inside settlement areas the barricading should done by waterfilled New Jersy Barriers.
- The Work zone safety signages shall be placed as per IRC: SP 55.
- The Project Board shall be presented at the beginning /start of the package. The Project Board should provide the critical information about the project include the grievance mechanism.
- The construction zone must be access controlled, and the workers must be provided valid identification cards to allow entry.
- Construction material must be stored in the barricaded area. If temporary storage is required (for 1-2 days) outside the demarcated construction area, the same must be discussed with the community.
- Retro reflective tapes shall be fitted on all sides of equipment
- Reverse horns must be placed on all vehicle and equipment. In case of rotating equipment rotation alarm must also be fixed on the equipment.
- If machineries are parked on / beside the canal road the area should be barricaded ater filled New Jersey barrier. Retrorefletive tape must be fixed on the barrier for easy visibility. Solar LED blinkers shall be placed on the machinery for easy visibility.

To prevent the dust from the construction area affecting the sensitive receptor/ commuters' green screens may be used as per advice of safety officer.

## Chance Finds

The project involves excavation of soil. Most of the excavation are within the canal areas so there is a less likelihood of the excavating archeological remains and artifacts. However, a Chance find procedure has been adopted for the project which is detailed in Annexure- IV

## 8.4 Operation Phase Impact

Modernization and lining of Western Main Canal will be instrumental in maintaining agriculture activity in the vicinity of project area i.e. in the district of Rohtas, Bhojpur, Buxar and Kaimur. Yet, the unchecked glide of water through these earthen channels often ends in seepage, evaporation, and waterlogging, diminishing their efficiency. To address those challenges, canal lining emerges as a capability solution. However, like any intervention in a complex atmosphere, it contains its own set of implications. This exploration delves into the multifaceted environmental impacts of canal lining, inspecting both its blessings and drawbacks.

Following is the anticipated major operation phase impact of proposed renovation and modernization of WMC project:-

- The proposed Canal modernization, which involve creating an impermeable layer in the canal mattress and banks will itself as a viable approach by decreasing water losses through seepage and evaporation, canal lining targets enhancing water transport efficiency in agricultural fields.
- Canal lining will present water losses, notably lowering seepage and evaporation. This translates to a tremendous growth in the quantity of water reaching the fields, improving agricultural productivity and ensuring food security, particularly in regions grappling with water scarcity.
- With an extra-controlled water flow, canal lining will allow the adoption of contemporary irrigation strategies, together with drip and sprinkler systems. This will minimize water wastage and maximizes crop yields, optimizing resource utilization.
- By stopping water logging and salinity, canal lining allows for the preservation of agricultural land. This, in turn, contributes to the general fitness of the atmosphere and supports sustainable agricultural practices.
- Increased agricultural output, coupled with reduced water wastage, leads to stepped-forward economic conditions for farmers and the vicinity as a whole. The proposed project can contribute to poverty comfort and rural improvement by enhancing agricultural livelihoods.
- While canal lining offers several benefits, it's critical to remember its potential environmental impacts from a nuanced and comprehensive angle.
- After operation, the proposed canal lining & modernization project will enhance agricultural productivity. Small-scale farmers and marginalised groups may additionally face demanding situations in having access to and utilising the improved water sources. Furthermore, the initial investment and renovation charges related to canal lining can be sizeable, probably affecting the affordability and accessibility of this generation for positive groups.
- Canal lining can affect the microbial ecology of the water, doubtlessly affecting the pleasantness of the water and the fitness of aquatic organisms.
- Implement measures to offset the ecological impacts of canal lining, consisting of developing artificial wetlands, fish passages, or riparian buffer zones.
- Involve nearby communities in the choice-making method and make certain they benefit from the assignment.
- Explore the usage of eco-friendly and locally sourced materials for canal lining whenever feasible.
- Canal-lining initiatives ought to be aligned with the United Nations Sustainable Development Goals (SDGs), particularly those related to water and sanitation, food protection, and sustainable ecosystems. By integrating these dreams into undertaking planning and implementation, it is viable to gain both environmental and social benefits.

**Community Benefit**

Overall, canal lining and modernization of WMC can have a significant positive impact on the economic growth of local community by improving water supply, reducing flood risk, and enhancing agricultural productivity. Canal lining will contribute to the economic growth of community residing in project area in several ways: -

**Increased Water Supply:** Canal lining will help in reduction of water losses due to seepage, ensuring a more reliable and consistent water supply for irrigation, drinking water, and industrial purposes.

**Prevention from water logging:** Water logging is caused due to rise in the water table by the seepage losses from the canals. Water logging affects the groundwater table and makes the land unfit for irrigation. This problem of water logging in the project area can be prevented by canal lining.

**Improved Agricultural Productivity:** By the process of canal lining, the seepage losses of the water for irrigation from the canals are reduced and this helps increase the extent of irrigation of a field. With a reliable water supply, farmers of local community can increase crop yields, leading to higher incomes and improved food security.

**Enhanced Food Security:** Increased agricultural productivity and improved water supply contribute to enhanced food security, reducing the risk of famine and malnutrition.

**Job Creation:** Canal lining and modernization of WMC will create employment opportunities for local communities, both during construction and in the long-term maintenance and operation of the canal.

**Increased Property Values:** Improved water supply and reduced flood risk will increase property values, making local community more attractive for investment and development.

**Safety against floods:** The bed and sides of lined canals can withstand flooding conditions while the unlined canals cannot. In the case of unlined canals, the bed and sides can easily erode away with water during flood conditions, while the bed and sides of lined canals are protected with a hard stratum, which prevents its weathering. So, canal lining will help to reduce the risk of flooding, protecting homes, businesses, and infrastructure from damage.

**Improved Water Quality:** By reducing seepage and preventing contamination, canal lining will improve water quality, making it safer for human consumption and other uses.

**Increased Industrial Activity:** A reliable water supply and reduced flood risk can attract industries that rely on water, such as manufacturing, textiles, and food processing.

**Enhanced Tourism:** Improved water supply and reduced flood risk can make the area more attractive for tourism, generating revenue and creating jobs.

**Long-term Sustainability**: Canal lining is a long-term investment in the community's infrastructure, providing benefits for generations to come.

## CHAPTER 9: SOCIAL IMPACT ASSESSMENT (SIA)

### 9.1 Findings of Social Impact Assessment

The assessment revealed that the sub project will have both positive as well as negative social impact on the people of the area.

**Resettlement**

There are few structures at the bank of the canal of the work zone. These structures may be affected due to the project intervention i.e. lining work on canal, strengthening of canal banks and construction of service road. The structures anticipated to be affected is mainly residential structures. These structures are expected to be fully or partially affected and temporary or permanent relocation is required for these structures. These structures are encroached on the land of WRD.

These households predominantly belong to OBC and SC community. Majority of the Head of the households are illiterate. Firewood is being used for fuel by majority. Open defecation is being practiced by significant section. Their source of water is tube well.

**Employment**

As the proposed project work will require skilled and unskilled workers, some people will get employment opportunities in this project and there will not be necessity for them to go out of their villages for livelihood. Hence, there is a positive impact on employment and income. It will also increase the economic activities in the nearby villages.

**Agriculture land**

Agricultural land is about 5 m to 10 m away from the side of the canal. Hence the impact on agriculture land adjacent to canal is not expected. However, during construction phase, minor impacts on agriculture field in some parts may occur due to the proposed intervention, but the benefits to the farmers with the implementation of the project will be high, as it will provide necessary irrigation water and enhance agricultural productivity.

**Amenities**

There are no such amenities/ utilities, which are going to be affected by the project as all of them are situated at a safe distance from the canal bank. The information gathered through stakeholder consultation, public meeting and FGD with the possible project affected squatters along project area found that people are in favour of the intervention/ works of canal.

### 9.2 Scope of Land related impacts

The intervention is mainly lining work, desiltation on the main canal of Sone, restoration & construction of outlet, construction of retaining wall at Dehri fall and for all of which no Land acquisition is required. On both sides of the canals sufficient land, owned by WRD is available, detail of that is given in the Annexure V. Further, necessary land is available at the bank of the canal for movement of machineries during the work, acquisition of private land is not required for that. However, in some place squatters at the bank of the canal have been identified, who need to be relocated with appropriate R & R support.

The assessment conducted in the project locations observed that the proposed sub project is likely to affect 8 households who have encroached on WRD land. All of 8 identified encroachers, have residential structures in the identified work zone. The structures are mostly temporary in nature – Semi Kuccha and Kuccha. Two pucca structures will also be affected. Details of household distributions are provided in the following tables.

**Table 9.1: Distribution of Household by Village anticipated to be impacted**

| Village Name | No. of Households |
|---|---|
| Dehri | 5 (1 Kuccha, 3 Semi Kuccha, 1 Pucca) |
| Akorigola | 2 (Semi Kuccha) |
| Ambedkar chauk | 1 (Pucca) |
| **Total** | **8** |

Out of 8 identified residential structures 1 is *kachha* and 5 is semi *kaccha* structure, 2 of the structure is of concrete as detailed in Table 9.2.

**Table 9.2: Type of Residential structures to be impacted**

| Type of structure | HH No. |
|---|---|
| Kuccha | 1 |
| Semi Kuccha | 5 |
| Pucca | 2 |
| Total | 8 |

Area of these identified residential structures cover 5175 sq ft, with minimum 225 square to maximum 1200 sq ft. as elaborated in the Table 9.3 below.

**Table 9.3: Area covered by impacted (to be) structure (residential)**

| Area of Residential structures | HH No. |
|---|---|
| Less than 500 sqft | 2 |
| 500 -1000 sqft | 4 |
| 1000-1200 sqft | 2 |
| **Total** | 8 |

9.3 Socio-economic and Demographic profile of affected persons

**Household Profile**

All of the 8 households whose residential structures are likely to be impacted are Hindu. Their average family size is 9.

These 8 households who own the residential structure primarily belong to OBC and SC category. Distribution of Household by caste in provided in the following Table 9.4.

**Table 9.4: Distribution of Household by Caste**

| Caste | HH No. |
|---|---|
| SC | 3 |
| OBC | 4 |
| General | 1 |
| **Total** | **8** |

None of the family member is disable for these identified projects affected households. All the 8 households possess ration card as mentioned in the following Table 9.5.

**Table 9.5: Distribution of Household owns Ration card**

| Ration card holder | HH No. |
|---|---|
| Yes | 8 |
| No | 0 |
| **Total** | **8** |

Primary occupation of these 8 households' is mainly daily labour. They work within their villages and the monthly income of the households varies from Rs.8000/- to Rs.12000/-. Household distribution by Primary occupation whose residential structure expected to be impacted is given in the following Table 9.6.

**Table 9.6: Household distribution by Primary occupation whose residential structure expected to be impacted**

| Primary Occupation | HH No. |
|---|---|
| Daily Labour | 6 |
| Business | 1 |
| NA (Age above 70 years) | 1 |
| **Total** | **8** |

*A Resettlement Action Plan (RAP) is under preparation for the sub-project which will assess the compensation and other entitlements to be made available to the PAPs based on the nature and duration of impacts as well as ownership status.*

**Amenities**

All of these households have connectivity to electricity.

Main source of drinking water is tubewell/hand pump. For bathing and other domestic purposes also water from tube well is used.

Open defecation is being practiced in 3 households among the 8 households. 4 households of them have septic tank with toilet and the toilet of the other household has sewerage connection. Arrangement of sanitation is mentioned in the following Table 9.7.

**Table 9.7: Arrangement for Sanitation**

| Sanitation | HH No. |
|---|---|
| Open Defecation | 3 |
| Toilet with Septik Tank | 4 |
| Toilet with Sewerage connection | 1 |
| Total | 8 |

4 out of 8 households use firewood for cooking and among the remaining 2 households have LPG connection. Details are provided in Table 9.8.

**Table 9.8: Type of Fuel in use**

| Fuel used for cooking | HH No. |
|---|---|
| LPG | 2 |
| Coal | 2 |
| Firewood | 4 |
| Total | 8 |

None of these households own any significant movable asset.

**Profile of Head of the households (HoH)**

The average age of the Head of 8 Households is 51 years as detailed below in Table 9.9.

**Table 9.9: Age distribution of Head of the household**

| Age of HoH | HH No. |
|---|---|
| 20 to 30 | 2 |
| 30 to 50 | 1 |
| 50 to 60 | 2 |
| Above 60 | 3 |
| Total | 8 |

It is noteworthy that only 1 out of the 8 households is headed by man. Further, the women heads of these women-headed-affected-households are senior citizen and widow, further 2 of them are making a living by working as daily wage labourers.

**Table 9.10: Gender distribution of Head of the household**

| Gender of HoH | HH No. |
|---|---|
| Male | 1 |
| Female | 7 |
| Total | 8 |

Among these head of the households those under the age of sixty went to school. And of them young members have attended school upto upper primary or higher grades. Table 9.11 provides the details.

**Table 9.11: Educational status of Head of the household whose residential structure is expected to be impacted**

| Education of HoH | HH No. |
|---|---|
| Illiterate | 5 |
| Primary | 1 |
| Upper Primary | 1 |
| Higher Secondary | 1 |
| Total | 8 |

9.4 Labor profile for the works

The lining work will take 36 months to complete for the proposed sub project. The requirement of skilled and unskilled labour is given in the Table 9.18 below: -

**Table 9.12: Requirement of labour by type**

| Skilled Lab days | Semi skilled Lab. days | Unskilled Lab. days | Total Lab. days. |
|---|---|---|---|
| **201600** | **9900** | **5907600** | **6119100** |
| 224 per day x 36 months | 11 per day for 36 months | 6564 per day for 36 months | |

The labourers will be provided by the contractor. Hence as per WB's guidance i.e. as per ESS2 for such workers, Contractor needs to prepare detailed profile of Workforce.

**Influx of Labour and Conflict with Local people during Construction phase**

During the construction period, 61,19,100 labour will be required for construction work. Reportedly, the man power requirement for the construction phase is labour days (25 days per month for 36 months) who will be mobilized for the construction work. These include unskilled, semi-skilled and skilled workers. Reportedly, 2,11,500 labourdays are for skilled and semi skilled labour, who are expected to be sourced from outside the district and rest can be sourced locally. The intra state migration of labour may affect the project area in terms of additional burden on public infrastructure such as water supply, electricity, and other social dynamics, which may potentially have an impact on local communities. Moreover, there is a possibility of conflict with local people residing near the project footprint. The conflict can also arise with shop owners and business entities operating their businesses near the project footprint due to access disruption. Moreover, the influx of labour may potentially lead to conflict with local people residing near the project footprint due to cultural differences. As during construction phase larger number of labourers will be working on the project site there is risk of occurance of GBV and SEA, incidence.

The contractor would need to take necessary measures to prevent GBV & SEA risks.

**Labour Accommodation**

Approximate 32, 39,039 labour days (for 19 months) will be required during the construction phase of the project. The demand for workers will keep on changing depending on the requirement of the work to be undertaken. Around 1, 06,522 labourdays minimum will be sourced outside the locality. As a result, a labour camp will be required during the different construction periods. As observed during the site visit, the alignment of the proposed work zone passes through inhabitant areas, thus random establishment of the camp will create hindrance to the inhabitants. Improper sanitation facilities in the construction labour camps can also trigger vector borne diseases and impact the health and safety of the workers and the nearby community.

9.5 Mitigation Measures for social impact

The Sone Western Main Canal sub project is not causing any displacement due to acquisition of private land. There are few numbers of squatters who will be temporarily / permanently relocated or their economic activities will be affected during the construction period. The project will take steps for relocation of Project affected people/ families before the beginning of the construction work. If feasible the project may shift/ relocate the affected people temporarily, without compromising with the overall objective of the project.

Proposed lining work on canal, strengthening of canal banks and construction of service road will directly benefit people inhabiting along the Sone Western Main canal, and it will benefit directly and indirectly to the dewellers of the command area of the canal across Rotas, Bhojpur, Buxur and Kaimur districts socio-economicaly. By improving irrigation facility, it will favour growth of cash crops and commercialization of agricultural activities also leading to enhancement of income as well as quality of life.

**Resettlement**

The Sone Western Main Canal sub project is causing displacement of 8 squatters who will be temporarily / permanently relocated or their economic activities will be affected during the construction period. The project will take steps for relocation of Project affected people/ families before the beginning of the construction work. In whichever case it is feasible the project may shift/ relocate the affected people temporarily, without compromising with the overall objective of the project.

In accordance with the principles of the resettlement policy framework, all of the 8 affected households will be entitled for compensation depending upon the nature and the ownership rights on the affected assets.

The affected families/ persons will be entitled to the following types of compensation/ assistance as provided in entitlement matrix.

- Compensation for structures (residential / commercial) and other immovable assets
- Compensation for the loss of crops
- R & R assistance for loss of livelihood/ restoration of income
- R & R assistance to vulnerable people
- Rebuilding and or restoration of community resources / facilities, in case these structures are affected due to execution of works
- Permission to take away material salvaged from the demolished assets

**Labour Influx**

Although the construction work will be within closed premises and the labour camp will also be situated within the site, measures such as proper orientation to workers on gender and cultural sensitivity and prior information dissemination before construction starts is necessary. The required mitigation measures as per LAP is mentioned below.

- Communication to local community, shops and vendors prior to the start of the construction;
- Labours would be provided training on local culture and traditions through daily tool box talk;
- Local community to be made aware of the grievance mechanism and to be provided access to the grievance redressal mechanism for the project, (both, local community and labourers);
- The contractors are responsible for providing adequate, appropriate accommodation facilities for the labourers;
- The contractor would be required to develop labour management procedures and mitigation measures before the start of works and monitor and update the Labour Management Plan (LMP), as necessary during the course of the project.
- For preventative and mitigatory measures in case GBV & SEA issues the help of key government and non-government stakeholders have to be taken as mentioned in ESMF. Ref. Annexure VI
- Contractor should introduce/get signed by a Worker Code of Conduct as part of the employment contract including sanctions for non-compliance, manual scavenging, engagement with local residents, child labour, non discrimination, harassment of co-workers including women and those belonging to SC and STs and other minority social groups. Time to time orientation programme on Code of conduct to be organized with the workers by the contractor.

**Table 9.13: Social Impact mitigation measures**

| **Mitigation Measures during Planning / Pre-construction Phase** | |
|---|---|
| **Social issues/ Activities** | **Mitigation Measures** |
| Relocation of Utility and Common Property Resources | Utility and common property resources are at safe distance from the bank of the canal, so no impact due to the project.<br>Measure would be taken to avoid any restriction in access to these properties. If any displacement is required, they will be relocated with prior approval of the concerned agencies. The relocation site identification will be in accordance with the choice of the community. |
| Compensation and R&R Assistance to the affected families | WRD will endorse the list of affected encroacher families eligible to get appropriate compensation and assistance.<br>Squatters will be notified and given one month time to remove their assets or harvest their crops.<br>They will be provided compensation for loss of structure at replacement cost and shifting assistance of Rs. 10,000/-<br>For the vulnerable PAPs one time assistance of Rs. 25,000/- in addition will be provided. |

| | |
|---|---|
| | The Squatters will be allowed to take away salvage material from the demolished structure and a notice will be issued to that effect intimating that PAPs can take away the materials. |
| Site clearance | WRD will have to give notice to the affected families to shift from the proposed site at least one month prior to start of construction work and hand it over to the contractor. |
| **Mitigation Measures during Construction Phase** | |
| Income Generation/ Restoration | Income restoration/ generation facilities will be provided to the affected families.<br>Employment opportunity for PAPS in the sub-project construction work, if available and if so desired by them will be provided.<br>Subsistence allowances and shifting allowances will also be provided.<br>Contractor will be encouraged to involve the vulnerable people in the project activity by providing employment opportunity for them.<br>To provide long-term income restoration, different skill upgrading vocational training shall be provided of their choice at a rate of Rs. 25,000/- per family. |
| Labour influx and related issues | Labour Management Procedure (LMP) including OHS management plan and GBV/SEA/SH will be followed and monitored.<br>Labour camp will be set up as per WB guidance (ESS 2).<br>Worker's consultation will be regular feature.<br>Contractor will provide training to all workers before start of work and thereafter quarterly.<br>WRD will ensure that contractor monitor, keep records and report on terms and conditions related to labour management. |

Contractor needs to prepare and maintain detailed profile of Workforce as per Table 9.14 below:

**Table 9.14: Detailed profile of Workforce**

| **Key work activities** | **Schedule for such activities** | **Duration of contract** | **Rotation** | **Place of residence** | | |
|---|---|---|---|---|---|---|
| | | | | **Workers from community** | **Within local community** | **On site** |
| | | | | | | |
| | | | | | | |
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# CHAPTER 10: ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

## 10.1 Objectives of the ESMP

The main objectives for ESMP of the "Bihar Water Security and Irrigation Modernization Project (BWSIMP)" includes the following:-

- To mitigate potential negative environmental and social impacts that may arise during the construction and operation of the project.
- To establish systems and procedures for protecting environment during various stages of the project – pre-construction, construction and operation phase.
- To ensure that the project is implemented in an environmentally sustainable manner.
- To monitor that the project is implemented in accordance with the design.
- To monitor implementation of mitigation measures and their effectiveness.

## 10.2 The Environment and Social Management Plan

This section describes the mitigation measures of various impacts during project phases. All care has been taken to provide mitigation measures for all expected environmental degradation and social imbalance at various stages

Table 10.1: Environmental and Social Management Plan

**A. Design and Pre-Construction**

| Activities | Potential Impacts | Mitigation Measures | Monitoring Indicator | Responsibility | |
|---|---|---|---|---|---|
| | | | | Frequency | Supervision |
| **A. Design and Pre-Construction** | | | | | |
| Finalization of Work Methodology | Occupational health, safety, and community health impact | • To manage Environmental & Social issues of the project prepare a **Contractor Environment Health Safety Management Plan** (C-ESMP) in line with the ESMP included in the ESIA. The CESMP should be proportionate and align with Work Methodology proposed; define Roles & Responsibilities, Resources available and monitoring & review mechanisms for E & S issues.<br>• Prepare **Occupational Health and Safety Plan** (OHS Plan). OHS plan for construction work site safety will be prepared[6]<br>• Conduct **Hazard Identification and Risk Assessment** (HIRA) for all tasks presented in the Method Statement[7]<br>• **Community Health and Safety (CHS) Plan** will be prepared which includes a **Traffic management plan** for movement of equipment and materials as well as emergency and hauling of material during the | CESMP<br><br>OHS Plan (including HIRA) along with work methodology<br><br>CHS Plan (including traffic safety) along with work methodology | Contractor to submit CESMP, OHS, CHS, Traffic plan along with the construction methodology and Work Plan.<br><br>The PMU/PMTC shall review this comprehensively (within one week), address any comments, and resubmit for approval. | E&S Specialist PMU and WRD Officials / Environmental Expert and Social Expert of PMTC |

[6] See Occupational Safety, Health and Working Conditions Code, 2020 considering EHS General Guidelines https://www.ifc.org/content/dam/ifc/doc/2000/2007-general-ehs-guidelines-en.pdf

[7] Classify work/assessment units or work activities during construction phase (based on generic understanding of works to be carried out); Identify the hazards associated with work activities; List out the Consequence of the hazard involved in the activity; List out controls (preventive and recovery)

| Activities | Potential Impacts | Mitigation Measures | Monitoring Indicator | Responsibility | |
|---|---|---|---|---|---|
| | | | | Frequency | Supervision |
| | | construction period will be prepared by the contractor; Management of distance and safety to ensure that the community members are segregated from the work site. Safety standards will be applied during all phase of project activities. The personnel should be periodically undergoing medical check to identify anybody suffering from occupational health hazard. | Method Statement only to be approved once the CESMP, OHS, CHS, Traffic plan is approved | | |
| Resettlement | Residential and livelihood impact | If any habitants or occupants (squatters/encroachers) are to be displaced, they will be relocated with prior approval of the concerned agencies. | Entitlement matrix, Resettlement Action Plan | Local administration, District administration, District/ Divisional unit, PMU, PMTC | PMU / PMTC, Divisional Office of WRD NGO/Support organization |
| Setting up of Office and Construction Camp, rest places /shed/ Labour Camp | Air pollution, noise levels and vibration | In case workers accommodation (temporary/ permanent) are constructed by the Contractor it should conform to the World Bank Group Guidance on Labour Accommodation (Workers' accommodation: processes and standards (https://www.ifc.org/content/dam/ifc/doc/mgrt/workers-accomodation.pdf) and local laws which ever is stringent. The Contractor needs to obtain CTE and CTO for setting of Camp. No sites should be considered for stockpiling areas that may promote instability and result in damage of property, hindrance to access road, | Labour Accommodation Plan / Rest Areas Plan (as Applicable) submitted and approved<br><br>Site Plan submitted and approved. | Contractor to submit along with the construction methodology and Work Plan<br><br>The PMU/PMTC shall review this comprehensively (within one week), address any comments, and resubmit for | E&S Specialist PMU and WRD Officials / Environmental Expert and Social Expert of PMTC |

| Activities | Potential Impacts | Mitigation Measures | Monitoring Indicator | Responsibility | |
|---|---|---|---|---|---|
| | | | | Frequency | Supervision |
| | | vegetation, nearby land (without written permission of the owner).<br>No spoils disposals or material shall flow into agricultural land adjoining the project areas.<br>No waste, debris/ scrap / unused machinery shall be stored outside the construction areas.<br>A labour accommodation/ rest area, a Labour accommodation / Rest Area Plan and Construction Yard Layout Plan must be submitted along with the work methodology. | | approval. The labor camp cannot be setup without the approval. If done on the contrary the Contractor has to carry out changes suggested by Client to bring the accommodation to satisfactory levels before the same can be used | |
| Selection of Site for Disposal of excavated material, Camp, Storage of Material, Temporary parking | The works would be located in rural areas with rich agricultural land. Unplanned disposal or setting up of construction camp can impact the soil | The locations should be selected with following considerations:<br>• Unproductive/wastelands/Chart land shall be selected.<br>• These should be away from residential areas and located at least 500 m downwind side of these locations,<br>• These sites shall be finalized such that they do not lie within any designed forest or other eco-sensitive areas, do not affect natural drainage courses and no endangered/rare flora is impacted by such disposal.<br>• The lowlands, natural depressions which are natural sinks will not be used for dumping as these are | Approval of the Dumping site by the E&S Specialist, PMU and E&S Officer PMTC. | Contractor before selection of site.<br><br>The selected dumping site should be approved by the dedicated Focal Person for E & S at concerned divisional office of WRD, E & S Specialist of the PMU or Environmental & Social experts of PMTC. | E&S Specialist PMU and WRD Officials / Environmental Expert and Social Expert of PMTC |

| Activities | Potential Impacts | Mitigation Measures | Monitoring Indicator | Responsibility | |
|---|---|---|---|---|---|
| | | | | Frequency | Supervision |
| | | natural sinks.<br>• Drainage channels shall not be used for dumping<br>• Local Authorities such as Gram Panchayat members, Ward member should be consulted about the location of debris disposal sites before finalizing the locations.<br>• Dumping sites should not contaminate water sources.<br>• Dumping sites should have adequate capacity for the amount of debris generated | | | |
| Assessment of Impacts Due to Changes/ Additions/ Final Designs/ Work Methodology in the Project | Additional Impacts or work Methodology related impacts | • In case of any event of changes/ revisions (including addition or deletion) in the project's scope of work or change in the site condition, the impacts as a result of the changes need to be assessed. Site-specific ESMP should be prepared and approved by the Bank before the commencement of construction.<br>• The Contractor will also prepare CESMP for additional impacts. The CESMP must be submitted to the PMU for approval. A comprehensive review of the CESMP will be carried out by PMU/PMTC within one week's time and the rectified document will be submitted for approval before construction. | The Site Specific EMP/ to be submitted along with the Method Statement<br><br>Construction should not be carried out unless the EMP is approved. | PMU<br><br>Contractor, to be submitted along with the revised construction methodology and Work Plan | E&S Specialist PMU and WRD Officials / Environmental Expert and Social Expert of PMTC |

| Activities | Potential Impacts | Mitigation Measures | Monitoring Indicator | Responsibility | |
|---|---|---|---|---|---|
| | | | | Frequency | Supervision |
| Labour Requirements and labour influx | Increased illicit behavior and crime, increased burden on local public services and utilities, the spread of communicable diseases, and GBV/SEA/SH risks | • The contractor will use labour drawn from local communities preferably to avoid any additional stress on resources and communities. In case of non-availability of skilled labour locally, the contractor will bring them from outside the project area<br>• All guidelines in the Labour Management Procedures for labour influx to be followed by the Contractor.<br>• Ensure compliance with Labour laws - national and state<br>• All labour licence, insurance, registrations and compliance with any statutory requirements to date must be complied with.<br>• Screening of age based Aadhar Card.<br>• Display Board (Wages, labour rights etc).<br>• Contractor to maintain recruitment records and employment process of labourer<br>• Job description and employment condition should be clearly communicated to the labourers by the contractor. | • Registers – gender segregated (muster roll)<br>• Labor returns<br>• Approvals<br>• Display Boards<br>• ID Cards<br>• Availability of Model Code of Conduct signed by supervisors and sub-contractors<br>• Availability of Gender specific facilities at labour camp & worksite | Contractor, throughout Construction & operational phase | Divisional Office of WRD and PMTC. |
| Disclosure and Public Display of Information | Stakeholder engagement for ensuring inclusiveness | • Copy of C-ESMP to be kept at project site and on the website of WRD.<br>• Project information boards showing the name of work, project cost, duration, date of commencement, | ESMF/ESMP available to public<br><br>Project Information Board | PMU<br><br>Contractor | PMU, PMTC |

| Activities | Potential Impacts | Mitigation Measures | Monitoring Indicator | Responsibility | |
|---|---|---|---|---|---|
| | | | | Frequency | Supervision |
| | | date of completion, executing agency and contact details (including telephone numbers) shall be displayed both sides of the road packages in both in English and Hindi.<br>• Prior to construction activity, information dissemination will be undertaken by contractor at the project site.<br>• Information boards containing Code of Conduct, SEA/SH plan, GBV plan in local languages, telephone numbers of GRM cell will be setup at the sites of construction camps and labour camps and stockyard site. | Camp Information Board<br><br>Grievance Boards on Site | Contractor<br><br>Contractor<br><br>throughout Construction & operational phase | |
| Site clearance and site preparation | Loss of green cover, Impact on terrestrial ecology | No trees will be felled without the permission of the Forest Department. Provision of project design / bid document to align the Restoration and rehabilitation of all such locations occupied or used for construction purposes immediately after the given task(s) is over.<br>No hunting/trapping/poaching of wildlife, migratory birds by workers shall be permitted while working or residing on-site. The Contractor should provide training to his staff with support from the PMU. | Site inspection through visual survey<br><br>Code of Conduct to be signed by all workers<br><br>Code of Conduct explained to all workers | Contractor | PMTC and PMU |

| Activities | Potential Impacts | Mitigation Measures | Monitoring Indicator | Responsibility | |
|---|---|---|---|---|---|
| | | | | Frequency | Supervision |
| Selection and Deployment of construction vehicles, equipment and machineries | Increase air pollution, noise and vibration | All Construction equipment8 and machinery to be used in the project will conform to standards adopted by the Ministry of Road Transport and Highways. The emission and discharge standards promulgated under the Environment Protection Act, 1986, will be strictly adhered to.<br>Noise limits for construction equipment to be procured, such as compactors, rollers, front loaders, concrete mixers, cranes (moveable), vibrators and saws, will not exceed 75 dB(A)9, measured at one meter from the edge of the equipment in free field, as specified in the Environment (Protection) Rules, 1986.<br>The Contractor will submit a record of PUC for all vehicles and machinery to be mobilized in the project. | Certification by Manufacturer of emission and noise levels/ Pollution under Control Certificates, Insurance and Driving License of the driver to be submitted for all vehicles<br><br>Contractor | Contractor<br>Once before deployment of all vehicles | PMU and PMTC |
| Material sourcing | Unsustainable mining operation | Contractor will finalize the quarry for procurement of construction materials after assessment of the availability of sufficient materials and other logistic | Permission for mining/ quarrying of materials from the Mining Department, District | Contractor Once before the start of construction activities | PMTC and PMU |

- [8] Every agricultural tractor, construction equipment vehicle and combine harvester shall be so manufactured that it complies with the following standards of gaseous pollutants as per rule 115A, after sub-rule (8), of the Central Motor Vehicle Rules, 1989.The Plant Machinery and Vehicle should be selected that they meet the existing emission requirement else they would be a source of pollution. The Ministry of Road Transport and Highways has notified that emission standard for construction equipment:
[8]https://morth.nic.in/sites/default/files/notifications_document/GSR%20598%20%28E%29%20dated%2030%20September%202020%20Seperate%20emission%20norms%20for%20agriculture%20tractors%20and%20CEV.pdf
- [9] As per Noise limits notified under EPA, 1986 and other provisions of Noise Rules, 2000: Noise rules for Domestic Appliances and Construction Equipment at the manufacturing stage.

| Activities | Potential Impacts | Mitigation Measures | Monitoring Indicator | Responsibility | |
|---|---|---|---|---|---|
| | | | | Frequency | Supervision |
| | | arrangements. They will submit a copy of EC/ CTE/ CTO along with the recent compliance report to the PMU before any such quarry is engaged. All consent and permits to remain valid at all times. Borrow area permission should be in line with the MoEFCC notification dated 02.08.2024 (S.O 3099)[10] | Administration and District Level Environment Appraisal Committee | | |
| Compensation, rehabilitation & resettlement (R&R) provisions | Impact on local squatters/ encroachers | Documents will be verified and endorsed for the list of families eligible to get appropriate compensation and assistance as per entitlement matrix. | Prior to inception of construction activity. | Contractor, Divisional Office of WRD, PMU & PMTC | PMU & PMTC |
| Shifting of Utilities | Disruption of Services | Prior permission shall be taken from concerned department officials, for shifting of utility. Utility shifting shall be undertaken by concerned Department and the corresponding Divisional units shall coordinate the same. All Occupational Health Safety and Community Health Safety requirements shall apply to the respective department. | OHS and CHS requirement shall be included in the work Order and shall be communicated to the concerned departments | PMU before awarding the contract. | PMU |
| Identification of water source for construction | Impact on ground and surface water resource | Groundwater will be the most preferred option for construction. In case of abstraction of ground water, permission from CGWB to be obtained and same should be submitted to environment specialist of PMU.<br>The permit conditions shall be implemented and always maintained. | Permission from CGWB for abstraction of water | Contractor<br>Once before the start of construction activities | PMTC and PMU |

- [10] https://parivesh.nic.in/publicdocument/UPLOAD_OM_NOTIFICATION/IA_DOCS/256042.pdf

| Activities | Potential Impacts | Mitigation Measures | Monitoring Indicator | Responsibility | |
|---|---|---|---|---|---|
| | | | | Frequency | Supervision |
| | | Incase Water is procured form Third parties the permission for borewell shall also be maintained by Contractor.<br>Quality of surface & ground water wrt parameters such as, pH, Temperature DO, BOD, COD, Oil & Grease, Total Suspended Solid, turbidity, Total Hardness, Chlorine, Iron, TSS, TDS, Total hardness, Iron, Sulphate, Nitrate, heavy metals, etc. will be monitored on regular basis | Water quality as per IS 10500 | On regular interval | |
| Setting up of Plant and Machinery (Batching Plants or concrete mixer location) | Potential source of pollution (air quality, water quality, soil) | Use of Ready-Mix Concrete will be encouraged by the contractor.<br>In case the concrete is procured from a third party, a valid consent will be submitted to the PMU before the procurement of any material.<br>In case a Batching plant is setup the necessary consents are required from BSPCB.<br>The Wash Water from the Batching Plant shall be collected in settling tanks, and the supernatant shall be reused. No discharge including run off from the Batching Plant is allowed into the river.<br>The waste from the Batching Plant shall be considered as part of the Waste Management Section of the CEMP.<br>Stand-alone mixing machines are not allowed unless they meet the conform to Ministry of Road Transport and Highways stated above. | In case of Batching Plant / Ready mix Concrete the CTO of the Plant shall be submitted to the PMU as part of the CEMP.<br><br>For Standalone Mixing machine the Pollution under control certificate is required. | Contractor<br>Once before functioning/operation of plant & machinery | Divisional Office of WRD, PMU and PMTC |

| Activities | Potential Impacts | Mitigation Measures | Monitoring Indicator | Responsibility | |
|---|---|---|---|---|---|
| | | | | Frequency | Supervision |
| | | Regular monitoring of air quality in line with National Ambient Air Quality Standards for the parameters such as, PM10, PM2.5, SO2, NOX and CO. | | | |
| Restriction in access to religious properties | Impact on religious properties | There are religious properties at the project site. During construction necessary measures to be taken to extend respect to the property. | Prior to inception of construction activity. | A. Contractor PMU, PMTC & Divisional Office | Social & Envt Specialist, PMU and PMTC/ Concern division of WRD |
| Legal compliance | Non-compliance may attract penalty issues; court stay order etc. | Obtain all consents, clearances (CTE/CTO from BSPCB), permits NOCs etc., before start of construction works. Ensure that all necessary approvals for construction to be obtained by contractor are in place before start of construction.<br>In case of any legal noncompliance, resulting in financial penalties or specific remedial actions, the Contractor shall be responsible for getting the remedial actions executed and bear the financial burden of the same. The Half yearly Progress Report to update the information and provide assurance that the conditions are being met. | Copy of the Permit/ Consent to be submitted before the construction activities start. | Contractor Before the start of construction and to be maintained during the course of the contract/ activity, whichever is later. | Divisional Offices of WRD, PMTC and PMU |
| ESMP Implementation Training | Lack of awareness of ESMP can lead to irresponsible behavior resulting in an Irreversible impact to the environment, | Contractor's Project manager and all key workers will be required to undergo training on CESMP implementation, including pollution prevention, spoils management, Standard operating procedures (SOP) for construction works; occupational health and safety | Certificate of Completion (Safeguards Compliance Orientation)<br>Posting of EMP at worksites. | Contractor Induction/ Orientation Once before initiating construction activities | PMC and PMU |

| Activities | Potential Impacts | Mitigation Measures | Monitoring Indicator | Responsibility | |
|---|---|---|---|---|---|
| | | | | Frequency | Supervision |
| | workers, and community. | (OH&S), core labour laws, applicable environmental laws etc. All new personnel joining the work need to undergo induction training on ESMP. All personnel joining work after a break of more than 15 days need to undergo refresher induction training.<br>Based on the observation of the PMTC and the Client refresher training has to be carried out every year (July – August). Skill Based / Job based training to be carried out for personnel involved in special activities as per the instruction of PMTC. | Refresher training every year<br>Skill Based training as request by PMTC/ Client | Refresher Training: As required<br>Skill Based training: As and when required<br><br>Maintaining Records of training, induction, refresher and skill-based training.<br>Submission of the Training records to the PMTC every month | |

**Construction Stage**

| Activities | Potential Impacts | Mitigation Measures | Monitoring Indicators | Responsibility | |
|---|---|---|---|---|---|
| | | | | Frequency | Supervision |
| **B. CONSTRUCTION PHASE** | | | | | |
| Demolition of the Canal Lining | Impact on Land Use from C&D Waste | • The C&D waste (especially Broken Brick Lining) is a reusable resource.<br>• The Excavated material should only be dumped / temporarily stored at the Site certified as “Fit for Dumping”.<br>• The contractor should adopt efficient construction methods and re-use of construction material to minimize the waste to be generated from the construction works in the | Reporting location of Disposal along with site photographs | Contractor | Divisional Office of WRD, PMU & PMTC |

| Activities | Potential Impacts | Mitigation Measures | Monitoring Indicators | Responsibility | |
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| | | | | Frequency | Supervision |
| | | strengthening of the road adjoining the canal.<br>• In the case of the Storage / temporary storing of the C&D debris the following precautions should be maintained:<br>o The height of the dump at any location shall not exceed 3m<br>o The 1:2 slopes of the dump should be maintained<br>o Peripheral drains should be developed to top and bottom of dump to collect the water. Chute drains should be developed along the sides at regular intervals to collect the water.<br>o The Contractor shall have necessary insurance cover to cover for such exigencies e.g. protection against property damage, liability for injuries, and other unforeseen events. | | | |
| Excavation of the Sediment/ Silt | Impact on Land Environment due to dumping of excavated material | The Excavated silt would be disposed on land with the following precautions:<br>o The height of the dump at any location shall not exceed 3m<br>o The 1:2 slopes of the dump should be maintained, and the slopes should be maintained<br>o The slopes and top should be covered with vegetation e.g. local | Reporting location of Disposal along with site photographs | Contractor | Divisional Office of WRD, PMU & PMTC |

| Activities | Potential Impacts | Mitigation Measures | Monitoring Indicators | Responsibility | |
|---|---|---|---|---|---|
| | | | | Frequency | Supervision |
| | | variety of grasses to prevent erosion.<br>○ Peripheral drains should be developed to top and bottom of dump to collect the water. Chute drains should be developed along the sides at regular intervals to collect the water. | | | |
| Transport of Excavated Material, C&D Waste and Construction Material | Impact of Air due to exhaust from vehicles and fugitive emission | • All vehicles delivering fine materials to the site will be covered to avoid spillage of materials or being blown away during the transportation. Empty Vehicle also needs to be covered to prevent dust<br>• Contractor will arrange for regular water sprinkling for dust suppression of all roads and surfaces. The records of sprinkling shall be maintained.<br>• The unloading of materials at construction sites in/close to settlements will be done with proper barricade made by the contractor.<br>• All stockpiles will be covered/protected to prevent dust generation<br>• The contractor will take every precaution to reduce the level of dust construction sites involving earthwork by a sprinkling of water, | Covering of Vehicle transporting material<br>Sprinkling records<br>Records of the Dust pollution along the roads<br>No. of Compliant received form the Public on dust.<br>No. of observation by PMU/PIU / Project staff on Dust<br>Cooking Fuel used<br>Maintenance of Stockpile<br>PUC of the Vehicle, equipment and machinery as per the MoRTH Standards for | Contractor | Divisional Office of WRD & PMTC |

| Activities | Potential Impacts | Mitigation Measures | Monitoring Indicators | Responsibility | |
|---|---|---|---|---|---|
| | | | | Frequency | Supervision |
| | | encapsulation of dust source and by the erection of screens/barriers.<br>• The contractor will provide necessary certificates to confirm that all Plants, equipment, machinery and vehicle used in construction conform to relevant dust emission control legislation.<br>• The Contractor will submit PUC certificates for all vehicles/ equipment/machinery used for the project. | On-Road and Off-Road machinery<br>Visual observation of dust and smoke | | |
| Lining of the Canal<br>a. Grading of sides<br>b. Preparation of subgrade<br>c. Ploughing of Existing Canal<br>d. Lip cutting for Earthwork Excavation<br>e. Laying of Sand Layer under Bed<br>f. Laying of LDPE Film | Impact of Air pollution from Plant and Machinery | • Location of DG sets and other emission generating equipment should be decided keeping in view the predominant wind direction so that emissions do not affect nearby residential areas.<br>• Stack height of DG sets to be kept in accordance with CPCB norms, which prescribes the minimum height of stack to be provided with each generator set to be calculated using the following formula:<br>H = h+0.2x √KVA<br>H = Total height of stack in meter<br>h = Height of the building in meters where the generator set is installed<br>KVA = Total generator capacity of the set in KVA | DG stack height<br>Monitoring of DG sets<br>Maintenance of DG sets<br>CTO/CTE for plant and machinery<br>Maintenance of CTO conditions | Contractor | Divisional Office of WRD & PMTC |

| Activities | Potential Impacts | Mitigation Measures | Monitoring Indicators | Responsibility | |
|---|---|---|---|---|---|
| | | | | Frequency | Supervision |
| above the sand layer<br>g. Under Drainage work | | Obtain, CTE and CTO for batching plant, crushers and DG set etc. if specifically established for this project.<br>If contractor procures any material (such as ready-mix concrete, asphalt/macadam, aggregates etc.), from third party agencies, contractor shall ensure that such agencies have all necessary clearances/permissions as required under the law; these include CTE/CTO from BSPCB, environmental clearance, etc.; contractor shall collect the copy of these certificates and submit to PIU; PIU will approve the source only after all the certificates are submitted;<br>Batching Plant /Concrete equipment should meet the emission standards of Conduct air quality monitoring according to the EMP. | | | |
| | Impact on Surface and Ground water form Wastewater/ Wash Water generated form Plant & Machinery | Pollution from Construction activities<br>The wash water from the concrete mixer/ batching plant/ miller should only be disposed at a pit developed in construction camp. | | Contractor | Divisional Office of WRD, PMU & PMTC |

| Activities | Potential Impacts | Mitigation Measures | Monitoring Indicators | Responsibility | |
|---|---|---|---|---|---|
| | | | | Frequency | Supervision |
| | Deterioration of the Noise quality and impact on sensitive receptors | • Staging of construction equipment and unnecessary idling of equipment within noise sensitive areas to be avoided whenever possible.<br>• All plants and equipment used in construction (including third-party plants and equipment) must conform to the MoEF&CC/ CPCB noise standards.<br>• DG sets should conform to the CPCB standards<br>• All vehicles and equipment used in construction will be fitted with exhaust silencers.<br>• Servicing of all construction vehicles and machinery will be done regularly and during routine servicing operations, the effectiveness of exhaust silencers will be checked, and if found defective will be replaced.<br>• The activities must be carried out during the daytime. Night-time activities may be carried out in an emergency, but all measures mentioned in the mitigation measures for night work must be strictly adhered to.<br>• Restriction on unnecessary honking at the project site | Adherence to measures suggested for:<br>a. Plant and machinery<br>b. Vehicle and equipment<br>c. DG sets<br>d. Sensitive Receptors<br><br>Complaints from Community<br><br>Results of the Noise Monitoring | Contractor | Divisional Office of WRD, PMTC |

| Activities | Potential Impacts | Mitigation Measures | Monitoring Indicators | Responsibility | |
|---|---|---|---|---|---|
| | | | | Frequency | Supervision |
| | | • Barricading (Temporary noise barrier) around sensitive receptors adjacent to the construction site if construction works are carried for more than 7 days to minimize the noise level especially for sensitive receptors. Preferably no construction shall be carried out during the school hours.<br>• The contractor needs to ensure compliance to the rules and adhere to the norms in "Silence Zone[11]" and "residential Zones[12]". This includes adhering to noise level standards and other regulations applicable to these areas.<br>• Monitoring must be carried out at the construction sites as per the monitoring schedule, and results will be submitted to PMTC and PMU. | | | |
| | Community Health and Safety during the operation of machinery | • It is suggested that work site be demarcated with barricading tapes outside settlement areas. Inside settlement areas the barricading should done by waterfilled New Jersy Barriers. | Barricading inside the settlement and outside the settlements | Contractor | Divisional Office of WRD, PMU PMTC |

- [11] These are areas designated for peace and quiet, such as hospitals, schools, and residential areas where heightened noise levels are detrimental to public health and well-being. Contractors need to be aware of these zones and take steps to minimize noise during construction and operations within them.
- [12] These are areas where housing is the primary land use, and noise pollution can disrupt residents' daily lives and negatively impact their health and quality of life. Contractors must comply with noise level regulations and other rules applicable to residential zones to ensure minimal disruption to residents.

| Activities | Potential Impacts | Mitigation Measures | Monitoring Indicators | Responsibility | |
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| | | | | Frequency | Supervision |
| | because of use of shared space | •The Work zone safety signages shall be placed as per IRC: SP 55.<br>•The Project Board shall be presented at the beginning /start of the package. The Project Board should provide the critical information about the project include the grievance mechanism.<br>•The construction zone must be access controlled, and the workers must be provided valid identification cards to allow entry.<br>•Retroreflective tapes shall be fitted on all sides of equipment<br>•Reverse horns must be placed on all vehicle and equipment. In case of rotating equipment rotation alarm must also be fixed on the equipment.<br>•If machineries are parked on / beside the canal road the area should be barricaded with water filled New Jersey barriers. Retroreflective tape must be fixed on the barrier for easy visibility. Solar LED blinkers shall be placed on the machinery for easy visibility. | Safety Signages<br><br>Reverse Horns and Alarms on vehicle, equipment and machinery<br><br>Presence of Retro-reflective tape on Vehicle, Equipment etc | During all construction or civil works stage | |
| Operation of the Labour Camp/ Construction Yard | Impact on Air pollution form domestic sources<br><br>Impact on water form domestic sources | **Air Pollution from domestic sources in Construction Camp**<br>•No burning of firewood is allowed in the construction camp. The Contractor must make provisions for LPG cylinders.<br>• No burning of solid waste or plastic at the Camp site or project site. | As per format provided in Bid Document. | Contractor | Divisional Office of WRD, PMU, PMTC |

| Activities | Potential Impacts | Mitigation Measures | Monitoring Indicators | Responsibility | |
|---|---|---|---|---|---|
| | | | | Frequency | Supervision |
| | | **Pollution from sewage disposal**<br>•The Contractor will take all precautionary measures to prevent the wastewater generated during construction from entering river or any other nearby water bodies by passing waste water to sedimentation tank to be considered as part of the EM plan and Contractor's responsibility.<br>•Stagnation of water should not be allowed at any place near the camp site as a precaution against vector-borne disease.<br>•Provision of STP/septic tank should be provided at site/labour camp for onsite treatment of sewage.<br>•No Solid waste should be discharged into any waterbody<br>•Municipal solid waste generated at the camp should be managed as per the provisions in the law (Municipal Solid Waste management Rules 2016).<br>•Mobile Bio-toilets should be provided at the worksite. | | | |
| Labour management including labour influx | Increased illicit behavior and crime, increased burden on local public services and utilities, the spread of | • Ensure labor camps are away from settlement areas;<br>• Ensure that every worker working in the project has been given an orientation on the Worker's Code of Conduct, especially on GBV and SEA, and has signed the code of conduct. | Reporting against:<br>Labour Management Procedures<br>Labor related grievances | Contractor with support of PIU and PMTC | PMU |

| Activities | Potential Impacts | Mitigation Measures | Monitoring Indicators | Responsibility | |
|---|---|---|---|---|---|
| | | | | Frequency | Supervision |
| | communicable diseases, and GBV/SEA/SH risks | • Maintain updated records of workers and their families living in the labor camps<br>• Conduct periodic awareness programs targeted at women laborers and wives / partners / children of male laborers residing in the labor camps and women and children of communities residing close to the work sites for reporting incidents of GBV / SEA<br>• Ensure complaints of GBV / SEA are recorded and addressed with urgency. Ensure that name(s) of complainant(s) are kept in confidence and enable anonymous reporting of complaints.<br>• Activate GBV Grievance Redressal Committee immediately on receipt of any GBV / SEA complaint. Investigate complaint within 7 calendar days of receipt of complaint. Take action on recommendation of the GBV Grievance Redressal Committee within 24 hours of submission of the report | GBV action plan | | |
| Storage of Material | Impact on Drainage due blocking of drainage channels | The following mitigation measures should be implemented:<br>•Prioritize re-use of excess spoils and materials in the construction works. C&D waste and excavated silt/ soil can | Fugitive measures<br>Blockage of drainage | Contractor | Divisional Office of WRD, PMU, PMTC |

| Activities | Potential Impacts | Mitigation Measures | Monitoring Indicators | Responsibility | |
|---|---|---|---|---|---|
| | | | | Frequency | Supervision |
| | | be used for the strengthening or raising of canal road / Inspection Road embankment.<br>•The contractor will immediately collect any excess excavated soils for backfilling of borrow pits.<br>•Spoils will be disposed, at site which has been identified as" Fit for Dumping" only after the completion of all mitigation measures suggested by the Environmental Specialist (PMU)/ Environmental Expert (PMTC).<br>•Inspect all the drainage at construction site/construction camp/labor camp/ dumping site etc. and clear all the drainage lines so that no water stagnation/flooding may occur during heavy rainfall. | Blockage of Access and encroachment to private property. | | |

| Activities | Potential Impacts | Mitigation Measures | Monitoring Indicators | Responsibility | |
|---|---|---|---|---|---|
| | | | | Frequency | Supervision |
| Storage of Fuel and Waste Oil | Chances of Contamination of groundwater and surface water | **Water pollution from Fuel and Lubricant**<br>•Contractor will ensure that all vehicle/machinery and equipment operation, maintenance and re-fuelling will be carried out in such a way that spillage of fuels and lubricants does not contaminate the ground. Only fuel pumps will be used for the transfer of fuel during re-fuelling.<br>•Oil interceptors will be provided for vehicle parking, wash down and refueling areas as per the design provided.<br>Hazardous waste, including waste oil, must obtain necessary permits, maintain records, and adhere to the | Construction of the Oil storage areas<br><br>Upkeep and Maintenance of the Oil Storage areas<br><br>Maintain records and returns as per the provisions of the Act. | Contractor | Divisional Office of WRD, PMU, PMTC |
| Safety of Workmen | Occupational Health and safety of workmen during the construction period | Please Refer Occupational Health and Safety Plan (including Hazard Risk Identification and Assessment) which is elaborated after ESMP Table. | | | |
| Protection of Agriculture Land near stud and Embankment | Impact on agricultural land | The contractor makes proper adequate mitigation measures like sprinkling of water and provision of dust screen guard around cultivated crop near stud and embankment.<br>If impacted, adequate compensation as per entitlement matrix will be provided. | Prior to inception of construction activity. | Contractor<br><br>PMU, PMTC & Divisional Office | Social Specialist PMU / Social Expert PMTC/ Concern division of WRD |

| Activities | Potential Impacts | Mitigation Measures | Monitoring Indicators | Responsibility | |
|---|---|---|---|---|---|
| | | | | Frequency | Supervision |
| Chance Find | Chance Find of archeological remains[13] | - Stop the construction activities in the area of the chance find;<br>- Notify the Project Environmental Officer and Project Engineer / and the PMU who in turn will notify the responsible Archeological Survey of India / State Department/ Directorate of Archaeology immediately (within 24 hours or less);<br>- Delineate the discovered site or area;<br>- Secure the site to prevent any damage or loss of removable objects. In cases of removable antiquities or sensitive remains, a night guard shall be arranged until the Archeological Survey of India or the State Department/ Directorate of Archeology take over;<br>- Construction work could resume only after permission is given from the responsible Archeological Survey of India or the State Department/ Directorate of Archeology concerning safeguard of the heritage. | Notification of the chance Find | Contractor | - Responsible ASI or the related State Department would oversee protecting and preserving the site before deciding on subsequent appropriate procedures.<br>- Implementation Support for the ASI or the related State Department decision concerning the management of the finding shall be communicated in writing by relevant local authorities |

- [13] The Ancient Monuments and Archaeological Sites And Remains Act, 1958 and the Antiquities And Art Treasures Act, 1972 provides a basis for the development of the Chance find procedures.

**Operation Stage**

| **Activities** | **Potential Impacts** | **Mitigation Measures** | **Monitoring Indicators** | **Responsibility** | |
|---|---|---|---|---|---|
| | | | | **Implementation and Frequency** | **Supervision** |
| Maintenance of canal system | Restoration of irrigation potential / control water loss/seepage | Technical maintenance & repairing works of canal, Controlling water supplies | Bihar irrigation Act/ rule | Concerned Division of WRD , All through the year, specially before monsoon | Concerned Division of WRD, WUA |
| Operation and maintenance of distributory system | Minimize water loss, optimum supply of Irrigation water | Awareness generation of WUA/community, crop planning, Irrigation /water distribution planning, regular collection of water charges, follow up action by implementing agency | Bihar irrigation Act/ rule, WUA operation manual | WUA, During cultivation period, particularly in Ravi, Summer season | Concerned Division of WRD |
| Community Benefit | Agriculture productivity and yield will be enhanced with the sufficient and timely supply of irrigation water. Thus, the income of the farmers will be augmented. Construction of service road will provide an alternate option to main road to the community. In addition. the proposed construction work will generate employment opportunity to the local people. Canal lining will prevent water logging substamtially. Subsequently with the reduction of flood risk and improvement of agriculture, the value of the land property will increase, community will be attracted for investment and development. As a result, the community will gain socio-economically. WUA along with the concerned division of WRD are jointly responsible for the upkeep of the irrigation system so that they get the benefit sustainably. | | | | |

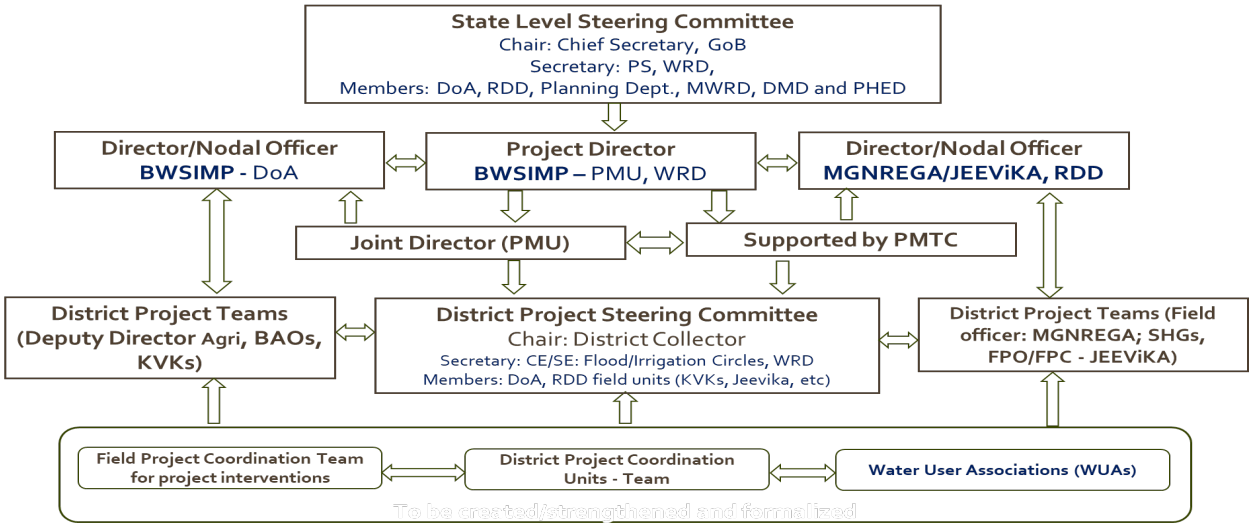
## 10.3 Institutional Arrangements for ESM PImplementation

The Water Resource Department has implemented World Bank-financed projects, such as the Bihar Kosi Basin Development Project (P127725) and Bihar Kosi Flood Recovery Project (P122096) through a PMU-Bihar Aapda Punarwas Evam Punarnirman Society (BAPEPS) that was set up to coordinate activities across all Implementing Agencies. E&S Project staff under BAPEPS were responsible for managing safeguards as per WB safeguard policies. This provided considerable experience to the WRD (Flood Protection Division) on WB procedures especially as the team managed complex issues on resettlement. Therefore, the existing capacities must be leveraged on time such that experienced personnel are on-boarded during the preparation stage and lessons from past projects are duly integrated. The project will now be implemented through the Irrigation Division within WRD. A PMU will be set up in WRD, and respective PIUs will be set up in the Department of Agriculture and Rural Development Department. A Project Management Technical Consultancy (PMTC) will also be formed to backstop the PMU on specific technical, institutional, and monitoring tasks. The PMU, PIUs and PMTC must be adequately staffed with competitively recruited E&S Specialists to support preparing site-specific ESIAs for DPRs and other E&S documents.

**Governance and Overall Institutional structure of the Project**

The implementation arrangements are aligned with the current institutional architecture of the GoB. The WRD, responsible for overall surface water management, including irrigation and flood management, will be the project holder and Project Implementing Agency. The WRD will oversee overall project management and coordination through the Project Management Unit, which has already been established with officers experienced in World Bank procedures. The PMTC, a team of experts and consultants headed by a team leader, will provide technical support for project activities that exceed the skill set of the WRD. Additionally, the PMTC will assist in collating the information to document the achievement of PBCs. The project implementation structure is shown in the following Figure

**Figure 10.1 Project Implementation Structure**




- **Chaired by the Chief Secretary to the GoB, a State Level Steering Committee (SLSC) has been established.** The process of establishing the SLSC has been completed under the Chairmainship of Chief Secretary, Govt. of Bihar and notified through an executive order. The SLSC will meet at least twice a year and will be responsible for overall strategic guidance and oversight and for ensuring collaboration and

resolving inter-department and inter-agency issues**.** The Principal Secretary of the State Water Resources Department will be the Member Secretary of the SLSC. The Additional Chief Secretary, the Principal Secretary, or the Secretaries of the State Ministries/Departments of Agriculture, Rural Development, Minor Water Resources and Finance Department will be the executive members of the SLSC. District Level Project Steering Committees (DLPSCs) will be constituted in all the districts where the Project is implemented, with District Collectors as the chairpersons to provide guidance at the field level.

- **The PMU will be supported by two PIUs represented by DoA and RDD-JEEViKA, in the implementation of the Project.** The DoA is responsible for enhancing agricultural productivity, including climate adaptation, and will lead the implementation of Subcomponent 1.3 on CRA. As a key player in the GoB's JEEViKA program and in alignment with the Command Area Development and Water Management (CADWM), the RDD will spearhead the implementation of OFD in restored command areas. Its responsibilities will include financing field channel formation and O&M in the restored commands, including through accessing MGNREGS funds. The Project will provide technical support for preparation of DPRs, with technical specifications for implementation. The RDD will also support community mobilization and awareness-building processes needed for forming and/or strengthening of WUAs in restored commands. JEEViKA has already organized women's SHGs and FPOs in the state and will complete this process in restored commands, if not already done. Both the DoA and the RDD will support the implementation of PIM under Subcomponent 1.2 in restored commands.

- **The district/circle offices in the project districts will form District Project Teams (DPTs) with deputed staff from the WRD, DoA, and RDD.** The DPTs will report to and provide all necessary field-level information to the nodal officers of respective PIUs[14] and the Project Director of the BWSIMP, who will oversee the overall progress of the project implementation.

- **Implementation will be guided through a Project Operations Manual (POM).** POM will be prepared by the PMU-PMTC, with each implementing entity providing its respective inputs, within three months from the project effectiveness date. All implementing agencies will adopt the POM and follow its guidance on procedures for management, implementation, and M&E. The project's financial management arrangements will follow the extant systems of GoB/WRD.

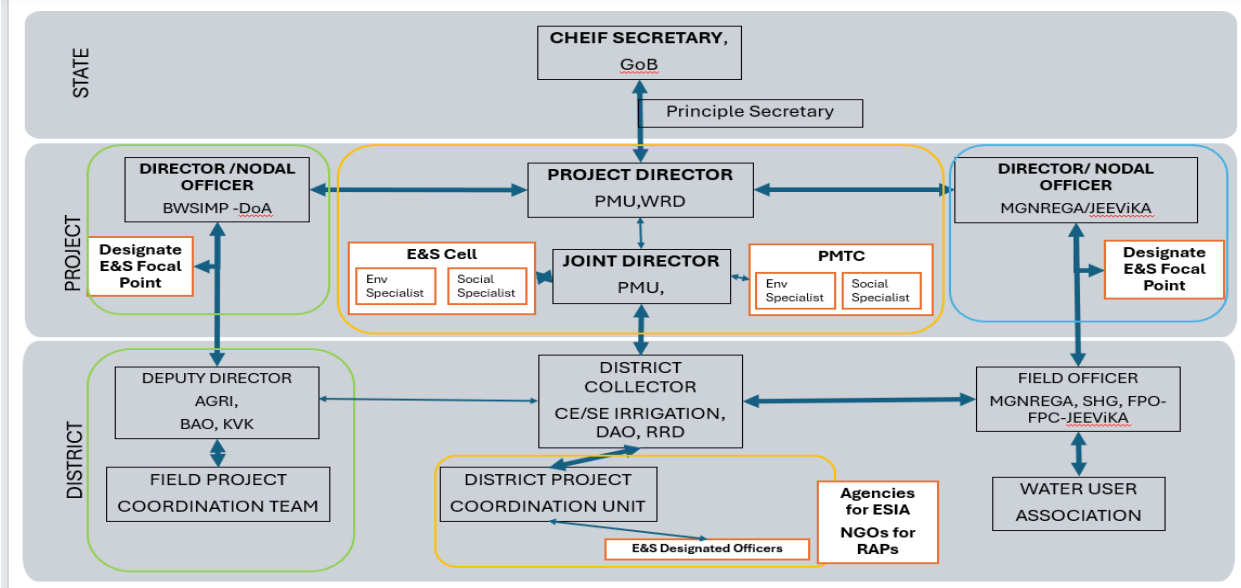
Institutional arrangement for E&S management

- **Project Management Unit (PMU).** WRD has constituted a PMU, drawing from the pool of officers that already have experience with the World Bank procedures. PMU will be is responsible for management and coordination of project implementation. The PMU has a dedicated Environment Specialist (ES) and Social Specialist (SS) responsible for the technical guidance to all PIU, and district level specialists in the projects so that the principle and processes, agreed in the ESMF is implemented. ES and SS would also be responsible for providing input on the environmental and social safeguards and the larger sustainability principles of the ESF.
- **Project Management Technical Consultant (PMTC).** The technical support for implementation of project activities that are beyond skill-set of WRD, will be brought in by the PMTC, with a team of experts/consultants, headed by the Team Leader (TL). PMTC will provide support on verification of the achievement of PBCs to inform the results achieved. The PMTC will have one Environmental and One Social Officer to support the PMU in the implementation of the ESMF for the project and the ESMP for each sub project. The Environment and Social Specialist will verify on site the implementation of the ESMP before each bill is submitted to PMU with recommendation for payment.

[14] The project activities will be implemented through Project Implementation Units (PIU) established in WRD (field level units) each comprising of the Chief Engineer, the Superintendent Engineer and the Executive Engineer. About 20 divisions (out of 158 working divisions) of WRD are expected to be involved in project implementation. DoA and RDD will house the other PIUs

- **Project Implementation Units (PIUs).** WRD will be supported PIU's in the Agriculture Department, GoB and Rural Development Department, GoB. There will be Nodal Officer at E&S at Both the PIUs. The PIU's will have Nodal Officers with assigned charge for E&S. They will not only oversee the implementation of Environmental and Social Codes Practice during the construction but will also support in the integration of the environmental and social aspects into the agricultural interventions.
- **The implementation structure for the environmental and social management has been aligned to the institutional structure of the project.** The E&S institution would help integrate the sustainability principle in the ESMF into the construction of the irrigation and flood management systems, and the use of water in the agriculture, interventions planned under this project. The PMU, PIUs, PMTCs and the organization's supporting this project would ensure the effective engagement of stakeholders and handhold them through the project cycle to ensure that the project makes positive environmental and social benefits. The Institutional structure for implementation of the Environmental and Social Safeguard is presented in **Figure 10.2**.

**Figure 10.2: Organogram for E&S Safeguards Implementation**




**Roles and Responsibilities**

The roles and responsibilities of the different staff members are presented in the section below:

| | |
|---|---|
| **Project Director** | The Project Director / Deputy Project Director is responsible for the overall implementation of the ESMF. They would be supported by the SPMU and DPMU teams. The key responsibilities include:<br>• Oversight of the ESMF process<br>• Ensure staffing as per the Implementation arrangement agree<br>• Review of the finding of the Internal and External Auditing<br>• Reporting to all stakeholders, including the World Bank |

| | |
|---|---|
| **Environment Specialist (SPMU)** | The Environmental Officer at the PMU level will look after environmental issues in line with the ESMF. The Key responsibilities:<br>• Guide the PMU and PIU on the process of Implementation of the ESMF<br>• Guide the project team on the integration of environmental aspects in the project over the project cycle<br>• Undertake screening of projects,<br>• Oversee the process and finalise the Environmental Assessment of the different sub-projects.<br>• Verification of the adequacy of the E&S Assessment and the EMP measures for each scheme<br>• Review the bidding documents and work order to ensure specific environmental measures mentioned in the EMP are integrated into the bid document and work order.<br>• Preparation and implementation of the specific management plans<br>• Guide the PMU and PIU to monitor the works of the Contractor and other agencies involved<br>• Undertake Capacity Building of the team at PMU, PIU, and district-level Environmental Officer.<br>• Guide the District-Level Environmental and Social officers<br>• Coordinate the design and development of the E&S tool for real-time reporting.<br>• Carry out the Reporting for the Implementation of the ESMF.<br>• Coordinate with the social specialist to collate the Environmental and Social Monitoring findings and present it to the Project Director.<br>• Coordinate the development of the Corrective Action Plan with the support of the Social Specialist (Social, Gender and Tribal issues), E&S Officer of Agriculture and Rural Development Department.<br>• Disclosure of the information: ESMF (including SEP and LMP), RPF, ESCP, ESIA, Corrective action plan prepared during project implementation (English), Semi-annual Environmental Monitoring Reports (English))<br>• Preparation of the Report for the World Bank |
| **Social Specialist (SPMU)** | The Social Specialist at the PMU in addition to the roles will be responsible person to:<br>• Guide the overall process related to social and gender aspects.<br>• Provide guidance to the PMU and PIU to plan, execute and monitor the social / gender components<br>• Undertake screening of subprojects for social aspects<br>• Oversee and Finalize the Social Assessment and Resettlement Action Plan of different subprojects and ensure inclusivity with a gender perspective<br>• Oversee the execution of the planned activities and realization of the social / gender inclusion parameters.<br>• Undertake Capacity Building of the team on the Gender and implementation of the social aspects.<br>• Guide the PMU and PIU in ensuring the effective involvement of Women in the functioning of WUA<br>• Carry out the Internal Monitoring and Auditing for the Implementation of the ESMF |

| | |
|---|---|
| | • Support the District Level teams for effective implementation of the plans for social inclusion.<br>• Coordinate with the Environment Specialist on the Disclosure of the documents<br>• Reporting of the Social and gender aspect to the Bank. |
| **Project Team at PMU** | The Project Team at the PMU will be responsible for:<br>• Coordinate with the Environmental and Social Specialist and the Divisions/ district team to upstream the finding so the finding of the E&S Screening into the design<br>• Authentication of the E&S Assessment and the EMP measures for each scheme<br>• Ensure that the environment and social safeguard measures are included in the Tender Document.<br>• Coordinate with the Contractor and ensure the ESMP measures are implemented during the construction by the Contractor.<br>• Coordinate with the Environment and Social expert to collate the Environmental and Social Monitoring findings and work with the Division to address them. |

**Divisional Engineer at WRD**

The Divisional Engineer is responsible for the overall implementation of the ESMF through the District Project Steering Coordination. The team at the PMU would support him at the in these aspects. They would extend all possible technical assistance in this regard. The Key responsibility would include the following:

- Oversight of the ESMF process in the district.
- Coordinate with the Deputy Director (Agri) and the Rural development Department on the ESMF implementation.
- Ensure adequate staffing and capacity as per the Implementation arrangement are present.
- Ensure that the Contractor implements the EMP provisions.
- Review of the finding of the Internal and External Auditing findings.
- Coordinating the development of the Action Plan.

**Engineering Team at the district (WRD)**

The Engineering Team at the district, would be responsible for, preparation of DPR, tendering process, and construction of the irrigation structures. Thus, they would be responsible for

- Authenticate the Screening Questionnaire being prepared at beginning of the DPR preparation
- Authenticate the Scoping questionnaire prepared by the E&S Officer
- Carry out socio-economic surveys and help the E&S officer in carrying out Social Impact Assessment
- Authentication of the E&S Assessment and the EMP measures for each scheme
- Include the environment and social safeguard measures are included in the Tender Document
- Coordinate with the Contractor and ensure the ESMP measures are implemented during the construction by the Contractor
- Help the Environment and Social Specialist to collate the Environmental and Social Monitoring findings and present them to the Divisional Engineer.
- Coordinate the development of the Corrective Action Plan with the support of the Social Specialist (Social, Gender and Tribal issues), Environment Specialist (construction related EMP).

**E&S Officer at WRD**

The Environmental & Social (E&S) Officer at the District level will look after the environmental and social issues, in line with the ESMF. The Key responsibilities:

- Guide the District team on the Implementation of the ESMF
- Guide the engineering teams in the integration of environmental and social aspects in the planning, designing and implementation
- With the assistance of the rest of the team, prepare the E&S Assessment and the EMP measures for each scheme
- Effectively plan the activities to include social / gender inclusion parameters.
- Support in building environmental parameters in the bidding documents.
- Guide the District team to monitor the implementation of the EMP by the Contractor.
- Undertake Capacity Building of the team at the district.
- With the other members of the team at the district ensure that the ESMP is implemented by the contractor.
- Undertake real time Monitoring of the E&S issues during the construction phase of the project.
- With the help of Environmental and Social Specialist of PMTC certify the implementation of the ESMP by Contractor.
- Carry out the Internal Monitoring and Auditing for the Implementation of the ESMF.
- Collate the Environmental and Social Monitoring findings and present them to the Division and also E&S Cell.
- Coordinate the development of the Corrective Action Plan.
- Support in the preparation of the Report for the World Bank.

**PIU at Agriculture Department**

The E&S Officer at PIU in DAO is responsible for coordinating the E&S aspects in the implementation of the interventions in agriculture and horticulture. His key responsibilities during the ESMF implementation would include:

- Ensure that the schemes developed integrate sustainable agricultural practices,
- Ensure that the impacts from agricultural interventions and suitable mitigation measures commensurate with the ESMF are included. Validate these before they are sent to the PMU along with the DPR.
- Motivate the farmers to adopt sustainable agricultural practices. Guide the E&S Officer at the district to help the farmers.
- Providing handholding support to farmers, addressing their queries on sustainable agricultural practices. Finalize the modalities of communicating sustainable agriculture practices.
- Coordinate with the Environmental Specialist (SPMU) for the development of the Real time monitoring tools.
- Assist the E&S Officer at the district in monitoring the implementation of Sustainable Agricultural Practices.
- Assist the E&S Officer in developing a Corrective Action Plan.
- Monitor the implementation of the Corrective Action Plan.

**District Project Team at Agriculture Department**

The Agriculture Department is responsible for implementing the interventions in agriculture and horticulture. His E&S Officer key responsibilities during the ESMF implementation would include:

- Ensure that the schemes developed integrate sustainable agricultural practices.
- Include Sustainable Agricultural/ Horticultural practices in the planning of implementation.
- Provide farmers with a business model to adopt sustainable agricultural practices.

- Providing handholding support to farmers, addressing their queries on agricultural practices
- Assist the Environmental & Social Officer in monitoring the implementation of Sustainable Agricultural Practices.
- Assist the Environment & Social Officer in developing a Corrective Action Plan.

**Contractor**

1. Compliance with Legislation, adhere to national and state legislations, obtain necessary permits (see chapter 2).
    a. The Contractor needs to obtain CTE and CTO for the Camp and establishment of Plant and machinery and ensure that it meets the conditions specified in the permits.
    b. The contractor needs to ensure compliance to the rules and adhere to the norms in "Silence Zone" and "residential Zones"
    c. The Contractor needs to obtain Hazardous waste permits for waste oil and maintain records and returns as per the provisions of the Act.
    d. The Contractor should manage the municipal solid waste generated at the camp as per the provisions in the law
    e. The Contractor shall ensure maximum use of the construction waste and ensure that residual waste is handled as per the provisions of the rules. The Contractor shall have necessary insurance cover for such exigencies
    f. The Contractor needs to obtain labour license, permit and submit returns under the project
    g. The Contractor needs to apply to CGWA or local authority if tubewell are sunk during the construction / Submission of NoC of the source from which water is procured

2. Environmental and Social Management Plan (ESMP):
    a. Requirement of skilled workers is expected to be limited (based on the current estimates provided in the DPRs) and will be staggered across the construction phase
    b. Bidding documents also defines the labour requirements, workers' camp preparation
    c. Approval of the method statement of the contractor has been made contingent to the approval Contractors Environmental and Social Management Plan (CESMP) and OHS plan.
    d. OHS plan would ensure that a risk proportionate hazard identification and risk assessment is carried out which will help in addressing the problem systematically.
    e. General guidance to prevent erosion of stockpiles and spillage of debris outside designated areas.
    f. The worksite safety plan (including traffic management) will be developed alongside the Contractors Method statement and implemented during the construction.
    g. The Ancient Monuments and Archaeological Sites and Remains Act, 1958 and the Antiquities and Art Treasures Act, 1972 provides a basis for the development of the Chance find procedures.
    h. The contractor will immediately collect any excess excavated soils for backfilling of borrow pits.
    i. The contractor will adopt efficient construction methods and re-use of construction material to minimize the waste to be generated from the construction works.
    j. When approved, the Contractor will implement the plan during the project implementation through dedicated staff.

3. GBV prevention: Provide induction and regular training to contract workers on SEA/SH compliances; Ensure CoC are signed and understood by all personnel; Ensure compliance with codes of conduct and timely report violations; Employ or appoint qualified environmental, social, occupational health and safety

expert(s) to manage GBV/SEA/SH issues; Have a system for regular review and reporting on action plan performance and report to the PMU. (See Annexure 5 of ESMF)

4. Occupational Health and Safety (OHS): Develop and implement an OHS plan, including hazard identification, risk assessment, and related provisioning. OHS Plan for Civil works will be developed by the Contractor before the mobilization to site. Contractors must prepare and implement a Site-Specific Occupational Health and Safety Plan, including measures like community liaison, compliance with the Worker's Code of Conduct, and provision of PPEs. Additionally, contractors are responsible for training workers in safety procedures, maintaining first aid kits, and minimizing potential hazards. (See Chapter 6.3 and Annexure 6 of ESMF)

5. Labour Management (See Chapter 8 of ESMF): Employ local and migrant labour, ensure compliance with labour laws, and maintain workers' accommodation standards. Follow the Model Code of Conduct for Contractor's Employees and Sub-contractors on Environmental, Social, Health and Safety (ESHS)**.**
Under civil works, ensure:

a. Complying with the requirements of the national and state legislations, labor management procedures, including those by their sub-contractors.
b. Maintaining records of recruitment and employment process of contracted workers.
c. Clearly communicating the job description and employment conditions to the workers.
d. Employ or appoint qualified environmental, social, occupational health and safety expert(s) to manage ESHS issues.
e. Provide induction and regular training to contract workers on environmental, social and occupational health and safety compliances.
f. Having a system for regular review and reporting on labor, OHS, and ESHS performance Report to the PMU on labor welfare and occupational health and safety performance. The participation of primary supply workers, facilities to be established for female workers and those with families and recommend mitigation are also mentioned. No forced or child labor will be permitted in the project activities.
g. The Contractor shall make available the first aid kit, snake bite kits and bandages at all times and all the sites. Moreover, paramedic staff will be available on-site and the cost of hiring will be a part of the BOQ item.
h. All employers including contractors as per the Act must ensure that the contact information of ICC is displayed in their respective offices and that regular trainings/orientation programs are organized for project staff and the workers of contractors.
i. Worksite Safety: Develop and implement a worksite safety plan, including traffic management and first aid provisions.

6. Training and Reporting: Provide regular training to workers, maintain records, and report on labour, OHS, and ESHS performance.

7. Contractor to hire a E&S Specialist at site to oversee the implementation

*Note: In case of non-compliance of ES requirements, an additional 1% will be retained from each bill and the contractor will be required to comply with the ES requirements within the next two billing cycles. However, if any identified non-compliance is not addressed in the next two billing cycles, then the retained amount will be forfeited. If such incidences of forfeiture due to ES non-compliance happen more than 5*

*times during the contract period, the contract will be terminated, and the ES performance security (ES – Bank Guarantee) will be encashed.*

10.4 Environmental Monitoring Plan

Environmental Monitoring Programme is to ensure that the intended environmental protection goals are achieved and result in desired benefits of the project. The same will be included in tender / bid document. The broad objectives of the environment monitoring program are:

- To monitor impacts on the surrounding environment and the effectiveness of mitigation measures during the construction and operation phase.
- To ensure that the environmental control systems, installed are effective.
- Comply to the provisions of relevant environmental regulations.

The key environmental elements to be monitoried are:

- **Air quality monitoring** with respect to PM10, PM2.5, NOx, $SO_2$ and CO at selected locations to assess the impact.
- **Water quality** with reference to DO, BOD, COD, suspended solids, turbidity, alkalinity, oil and grease at selected water bodies to ensure maintenance of BDU criteria.
- Noise level at settlements zone, Sensitive zones

The parameters to be monitor, frequency of monitoring, number of samples, locations and responsibility of monitoring is given in **Table 10.2**

**Table 10.2: Environmental and Social monitoring during the different activities**

| S. No. | Aspects | Parameters to be Monitored | Frequency of Monitoring | No. of Samples | Location | Responsibility |
|---|---|---|---|---|---|---|
| 1. | Ground water quality | Drinking water parameters specified in IS:10500-2012 | *Construction stage*: Quarterly | 1 location from contractor's camp | Contractor Camp | Contractor |
| | | | *Operational stage*: Quarterly | | | |
| 2. | Soil quality | N, P, K and Heavy metals (Hg, Pb, Fe, Cu, Zn, Cd) | *Construction stage*: Quarterly | 2 locations in each quarter from disposal area | Disposal areas | Contractor |
| 3. | Ambient air quality | $PM_{2.5}$, $PM_{10}$, $SO_2$, NOx, CO | *Construction stage*: Quarterly | 3 locations in each quarter from settlement | 1 location downwind of Contractor Camp (with all plant and machinery running) | Contractor |

| S. No. | Aspects | Parameters to be Monitored | Frequency of Monitoring | No. of Samples | Location | Responsibility |
|---|---|---|---|---|---|---|
| | | | | | 2 Locations to be decided based on the area of work | |
| 4. | Noise quality | Equivalent Noise Level | *Construction stage*: Quarterly | 2 locations in each quarter from each jetty area | 2 location to be decided based on area of work near receptors. | Contractor |
| 5. | Monitoring of the EMP | As defined in the EMP Matrix | *Construction Stage: Daily* | Daily report to PMU | At Construction Camp, Labour Accommodation and Work areas | Contractor |

10.5 Documentation and Record Keeping

The Monitoring of the ESMP Implementation will be carried out through aelectric application or MIS prepared for the purpose. The records of:

- Finding of Monitoring on site
- Corrective Action Plan
- Action Undertaken for Closure of the Observation
- Actions taken to prevent further recurrence of the observations

These will be documented in the electronic format with various levels of accessibility to the different stakeholders involved.

10.6 Environment and Social Monitoring Reports

Effective monitoring and supervision would require regular reporting of the implementation of the E&S aspects to the decision makers. While the Environmental & Social Officers at the District Level and Environmental Specialist and Social Specialists at the PMU and PIU would be operating system the Project Director at PMU and Director/ Nodal Officer at PIU should also be aware of the concerns which are being highlighted. The reporting protocol and the primary focus areas of each of these are presented below:

- Incident reporting within 24 hours (See Annexure 7 on ESIRT)
- ***Daily reporting***: Contractor E&S Officer would report the performance during the construction to the Contractors Management. These will essentially include the progress and performance of the different elements of the EMP. The E&S Officer of the District at WRD would also receive notification of the critical elements which needs attention. Similarly, the daily activities of R&R will be reported by the Division/ District and they will be collated by the E&S Officer to be sent to the E&S Officer at the respective District/ Division. The key parameters will be monitored by the Social Specialist.
- **Weekly Reporting:** The E&S Officer or the officials on the site will visit each site shall provide his observations on of EMP Implementation real-time on an app to designed under the project.
- **Monthly Report:** The Contractor's E&S Officer shall compile the status of implementation activities to the PMU monthly.

- **Six Monthly Report:** The Six Monthly report should highlight a) status of the implementation of the ESMP, b) Status of implementation of RAP c) Key areas of concern which have been identified in the Monthly report d) training carried out, e) outstanding area of concern, f) Accident and incident report, g) key parameters of OHS implementation including number of non-compliances reported f) areas where additional support is required. This report will be compiled and submitted to the Bank before the mission or within 15 days of the closure of six month from the date of effectiveness.
  *All reporting formats will be detailed out in the Project Operational Manual*

10.7 Capacity Building and Training

The training programs will include an orientation on the project concept and components for all the sub project stakeholders, trainings on participatory water governance and on improved agricultural productivity, farming system resilience and improved food security for greater climate resilience targeting the community institutions and farmers to ensure inclusive planning and their active participation in implementation, apart from overall awareness and training on the ESMF of the project to be able to fully manage the E&S risks under the project. Several capacity building approaches will be adopted by BWSIMP for improving the E&S performance, including institutional strengthening of classroom trainings, exposure visits, farmers/ WUA workshops, participatory planning exercises, village / community meetings as well as group discussions with targeted stakeholders.

The capacity building support proposed to be provided to various sub project stakeholders will include, but not limited to the following E&S related key areas/ topics:

- Overall Orientation on the Project objectives and activities.
- Training of the key staff of concered PIM Cell on the World Bank ESF, the project ESMF and the E&S requirements for the project and their role in ESMP implementation.
- Orientation trainings of officials of participating departments in the project district - Rohtas on the ESMF, the E&S documents prepared and their implementation responsibilities.
- Training of WRD staff of Rohtas district on Monitoring and reporting responsibilities.
- Training and exposure visits of farmers, farmers collectives (PACS/FPOs) who are the beneficiaries of the sub project, on overall water governance and climate resilient agriculture practices being promoted under BWSIMP.
- Trainings and exposure visits of beneficiary WUAs and farmers on the concept of PIM, roles and responsibilities of members and executive committees for sustainable management of irrigation systems.
- Trainings of field staff of participating departments and CSOs/NGOs/ Technical agencies engaged by the project in the project district, Rohtas on mobilization of farmers for participation in irrigation management for Rohotas and adoption of resilient farming practices.
- Trainings of field staff and contractor personnel for the sub project on fair working conditions for workers, including Occupational Health and Safety related risk management and incident reporting.
- Orientation of field staff of departments and CSOs/NGOs/ Technical agencies appointed for the proposed sub project on inclusive participation of women and vulnerable and marginalized groups in project activities and their representative in decision making bodies of WUAs/FPOs.

The capacity building strategy of the project will have the following elements:

- **Training of District and Division**: The Rohtas District and sub project related Divisional staff other than the Nodal E&S Officer would be trained on the ESMP implementation, project GRM, monitoring and reporting requirements and other mitigation measures proposed by the different project E&S instruments. Such trainings will be carried out by the E&S Nodal Officers and the Environmental and Social Specialist at the PMU.

- **Training of Contractor Staff**: All the Key personnel of Main Contractors will need to undergo training on the ESMP, the E&S precautions and diligence to be taken, the key actions related to E&S management under the project, the contractual obligations of the contractor related to works and labor management, including the Code of Conduct.

The stakeholder-wise and phase-wise key topics and issues to be taken up as part of capacity building support under BWSIMP are presented in the table 10.3 below:

**Table 10.3: E&S Capacity Development Plan**

| Project Phase | Elected Representatives | WUAs / FPOs/ Other Community Institutions (CIs) | Staff of Support Organizations | Project Functionaries |
|---|---|---|---|---|
| Pre-planning | • Social mobilization (GP)<br>• Orientation on the project & its objectives (ZP / Block /GP)<br>• Roles and responsibilities related to ensuring inclusion and participation (GP level), especially of vulnerable groups, including women and marginal farmers | • Project objectives & key components<br>• Roles & responsibilities related to inclusion & participation in planning, management & monitoring<br>• Elements of participatory Planning: Importance of CRA and judicious irrigation management | • Project objectives & components<br>• Elements of Participatory Planning<br>• Facilitating Participatory Planning<br>Data requirements & simplifying data for use by committee for facilitating inclusive plans | • Social objectives of the Program<br>• Elements of Participatory Planning<br>• Facilitating Participatory Planning<br>• Sustainability practices in Irrigation and Flood<br>• E&S management functions as defined through various E&S instruments- ESCP, ESMF, SEP, ESIA, RPF, LMP, INM/IPM & BMP. |
| Planning | • Process of participatory planning | • Process of participatory | • Supporting the framing of | • Objectives & expected |

| | | | | |
|---|---|---|---|---|
| | • Mobilization of farmers and local communities for developing inclusive plans<br>• Role of GPs in disseminating flood forecasts and other related information to the community<br>• Encouraging farmers to adopt climate resilient practices<br>• Features of the project GRM, GPs role in resolving grievances or escalating them to district GRC | planning and inclusion of marginal groups & women's voices in the plans.<br>• Ensuring decision making roles for women farmers and smallholders in the executive committees of WUA and FPOs.<br>• Use of data by members to develop inclusive plans<br>• Framing of inclusive and gender sensitive rules/ byelaws for groundwater conservation & abstraction for user-group/ WUAs | gender sensitive and inclusive byelaws for the user groups<br>• Devising simple and accessible mechanisms for sharing flood forecasts, irrigation schedules and other information to local community<br>• Handholding of CIs to develop fair rules for water sharing | outcomes of participatory & inclusive planning<br>• Devising simple and accessible mechanisms for sharing flood forecasts, irrigation schedules and other information to local community<br>• Handholding of CIs to develop fair byelaws for equitable water sharing<br>• SEA/ SH prevention and response, steps for setting up ICCs under the POSH Act<br>• Management of critical habitats<br>• Process for implementing site specific RAPs and role in facilitating resettlement of PAPs |
| Implementation and Monitoring | • Role of GPs in ensuring equitable collection of irrigation/ water tariffs, including disincentives to be created by GP for non-payments<br>• Role of GPs in resolving conflicts among water users/ farmers | • Conduct of meetings of WUAs/FPOs, other CIs, ensuring participation<br>• Importance of collective decision making & | • Facilitating the participatory conduct of meetings<br>Tools for community monitoring & its facilitation | • Facilitating committee's and Gram Sabha's meetings on the project<br>• Strategies for public sharing/ dissemination of plans and decisions |

| | | | | |
|---|---|---|---|---|
| | • Role of JP/ ZP in inter-GP coordination and conflict resolution<br>• Importance of community monitoring and communicating emerging issues to senior duty bearers | information sharing<br>• Conflict resolution among members<br>Awareness on access and use of projects GRM | | • Facilitating community monitoring of the project |

10.8 Indicative budget allocation for Environment and Social Management Plan

A draft indicative budget has been provided in ESMF. Based on the unit cost considered for each item in that budget, ESMP budget has been prepared and detailed below in **Table 10.4**:-

**Table 10.4: Indicative Budget for WMC ESMP**

| Sl. No. | Budget Head | Budget Sub Head | Total Amount - INR |
|---|---|---|---|
| **1** | **TRAINING & CAPACITY BUILDING** | | |
| 1.2 | Training of Division/ District workers | Orientation of ESMF and ESMP | 3900 |
| 1.3 | Training of Contractor Staff | Orientation of ESMF and ESMP | 880 |
| 1.4 | Refresher Training | Refresher Training - every year for 3 years | 10500 |
| 1.5 | Specialized Training | i. OHS Training by National Safety Council | 11333 |
| | | ii. GBV, SEA/SH Workshop | 11236 |
| | **Sub Total A** | | **37,849** |
| **2** | **INFORMATION AWARENESS** | | |
| 2.1 | GRM | i. Helpline | 55000 |
| | | ii. Boards/ Poster | 175000 |
| | | iii. Dashboard | 400000 |
| 2.2 | GBV, SEA/SH Program | i. GBV | 221429 |
| | | ii. SEA/SH | 221429 |
| | | iii. IEC material for WRD, DoA, RD | 20000 |
| 2.3 | Stakeholder Engagement | | |
| | i. Public Consultation and Disclosure | Consultation and Disclosure of ESIA | 450000 |
| | ii. Community Health Safety | Campaign | 70000 |
| | **Sub Total B** | | **16,12,857** |
| **3** | **REPORTING** | | |
| 3.1 | R&R | R&R Platform | 250000 |

| | | | |
|---|---|---|---|
| 3.2 | RAP Implementation | RAP Implementation Agency | 864000 |
| | **Sub Total C** | | **11,14,000** |
| | **Total** | | **27,64,707** |
| | **Contingency** | | 138235 |
| | **Grand Total** | | **29,02,942** |

**Annexure- I**

**Guidelines to Contractor for Labour Camp**

1. **Introduction**

The scope of this guideline pertains to the sitting, development, management and restoration of construction and labour camps to avoid or mitigate impacts on the environment. The area requirement for the construction camp shall depend upon the number of labour employed (approx. 150/per camp, where 10-30 Skilled migrant labours) and the extent of machinery deployed. Durig construction period contractor used more than 90% unskilled local labours. The following sections describe the siting, construction, maintenance, provision of facilities in the camps and finally rehabilitation of the construction and labour camps. These are described in three stages i.e., pre-construction, construction and post-construction stage.

2. **Pre-construction stage**

Identification of sites for construction and labour camps is the first task. The Contractor shall identify the site for construction camp in consultation with the individual owners in case of private lands and the concerned department in case of Government lands. The suitable sites shall be selected and finalized in consultation with the Engineer-in-charge. **TableB** gives the lands that could be avoided for construction camps and conversely those that could be preferred.

The contractor will work out with the landowner/concerned department on the arrangements of setting up his facilities for the construction period. These arrangements shall be in the form of written agreement between the contractor and the landowner (private/government) that would specify:

a) Photograph of the proposed campsite in original condition;
b) Agreement of land document acquired for labour camp and compensation amount for the use of specific land for mentioned timeframe.
c) Activities to be carried out on the site;
d) Environmental mitigation measures to be undertaken to prevent land, air, water and noise pollution;
e) Detailed layout plan for development of the construction and labour camp that shall indicate the various structures to be constructed in the camp including temporary drainage and other facilities; and
f) Restoration plan of campsite i.e. to bring the site to the previous campsite conditions.

The arrangements will be verified by the Engineer-in-charge to enable redressal of grievances at a later stage of the project.

**Table B: Selection Criteria for Campsite**

| Avoid the following | Prefer the following |
|---|---|
| ▪ Lands close to habitations<br>▪ Irrigated agricultural lands.<br>▪ Lands belonging to small farmers. | ▪ Wastelands.<br>▪ Waste Lands belonging to owners who look upon the temporary use as a source of income. |

| | |
|---|---|
| ▪ Lands under village forests. Lands within 100 m of community water bodies and water sources as rivers.<br>▪ Lands within 100 m of watercourses.<br>▪ Low-lying lands.<br>▪ Lands supporting dense vegetation.<br>▪ Grazing lands and lands with tenure rights.<br>▪ Lands where there is no willingness of the landowner to permit its use. | ▪ Community lands or government land not used for beneficial purposes.<br>▪ Private non-irrigated lands where the owner is willing.<br>▪ Lands with an existing access road. |

**2.1 Setting Up of Labour Camp**

The contractor shall provide free of cost in the campsite, temporary living accommodation to all the migrant workers employed by him until completion of construction/maintenance work that is in progress. Estimated number of labours at one Labour camp is 150 persons (50 Skilled & 100 unskilled Labours) where more than 90% unskilled labours will be local labours.

- The Contractor agency will setup their camping locations at different places as would be identified.
- Each labour camp may house 20-30 skilled migrated labour.
- These camps should be located away from the existing village or semi-urban households to prevent likely social conflicts.
- Necessary permissions may be obtained from the respective revenue/municipal authorities.
- Temporary house structures should be provided by the contractor agencies to accommodate the labour and their families, with provision of minimum infrastructure facilities, like water supply, sanitation etc.
- A minimum area of 6 $m^2$ per person shall be provided.
- The rooms of labourers shall be well lighted and ventilated.

**The facilities to provide for the labour discussed below:**

**a) Drinking-Water**

Towards the provision and storage of drinking water at the construction camp, the contractor shall ensure the following.

- The contractor shall provide for a continuous and sufficient supply of potable water in the camps, in earthen pots or any other suitable containers.
- If any water storage tank is provided, the bottom of the tank will be kept at least 1 m above the surrounding ground level.
- The contractor shall identify suitable community water sources for drinking. Only in the event of non-availability of other sources of potable water, the Contractor shall obtain water from an unprotected source only after the testing for its portability. Where water has to be drawn from an existing open well, the well shall be properly chlorinated before water is drawn from it for drinking. All such wells shall be entirely closed in and be provided with dustproof trap door.
- Every water supply or storage shall be at a distance of not less than 15 m from any wastewater/sewage drain or another source of pollution. Water sources within 15 m proximity of toilet, drain or any source of pollution will not be used as a source of drinking water in the project.

- A pump shall be fitted to cover the well used as drinking water source; the trap door shall be kept locked and opened only for cleaning or inspection, which shall be done at least once a month.
- Else, a new well can be constructed and a pump will be fitted to the well for drinking water purposes of the labour at the camp.

**b) Washing and Bathing Facilities**

On every site, adequate and suitable facilities for washing clothes and utensils shall be provided and maintained for the use of labourers employed therein. Separate and adequate bathing shall be provided for the use of male and female workers. Such facilities shall be conveniently accessible and shall be kept in clean and hygienic conditions.

**c) Toilets Facilities**

Each labour camp should be provided with community toilets with septic tanks and soak pit arrangement or even bio-toilets could be better. Sanitary arrangements, latrines and urinals shall be provided in every workplace separately for male and female workers. The arrangements shall include:

- A latrine for every 25 labour or part thereof.
- Every latrine shall be undercover and partitioned so as to secure privacy and shall have a proper door and fastenings.
- Where workers of both sexes are employed, there shall be a display board of “For Men Only” or “For Women Only” outside each block of latrine and urinal in the language understood by the majority of the workers.
- The latrines and urinals shall be adequately lighted and shall be maintained in a clean sanitary condition at all times and should have a proper drainage system.
- Water shall be provided in or near the latrines and urinals in suitable containers.

**d) Supply of Fuel**

- These labour forces may adopt unscrupulous methods of cutting trees and bushes for meeting their fuelwood requirement, which would destroy the adjacent green cover and affect the local ecology.
- The project authorities would ensure supply of free fuel to these labours through the contract agencies to prevent such unscrupulous activities.
- Arrangement may be made with the local Civil Supply Authorities for Supply of kerosene oil at a fixed quota.
- Use of LPG gas cylinders should be provided.

The contract specification should include these fuel supplies free of cost to the labour force within the bid value of relevant contract items.

**e) Waste Disposal**

- Disposal of sanitary wastes and excreta shall be into septic tanks. If bio-toilets will be used the excreta could be converted to manure.
- Kitchen wastewater shall be disposed into soak pits/kitchen sump located preferably at least 15 m from any water body. Sump capacity should be at least 1.3 times the

maximum volume of wastewater discharged per day. The bottom of the pit should be filled with coarse gravel and the sides shored up with board, etc. to prevent erosion and collapse of the pit. New soak pits shall be made ready as soon as the earlier one is filled.

- Solid wastes generated in the kitchen shall be reused if recyclable or disposed of in landfill sites.

- Provide segregated garbage bins in the camps and ensure that these are regularly emptied and disposed of hygienically as per the Comprehensive Solid Waste Management Plan approved by the Environmental Expert of Project Authority.
- The camping area should be periodically sprayed with Bleaching powder and other disinfectants.

**f) Medical and First Aid Facilities**

Medical facilities shall be provided to the labour at the construction camp. Visits of doctors shall be arranged twice a month wherein routine checkups would be conducted for every person in the camp including children. A separate room for medical checkups and keeping of first aid facilities should be built. The site medical room should display awareness posters on safety facilitation hygiene and HIV/AIDS/COVID-19 awareness.

First Aid Box will be provided at every construction campsite and under the charge of a responsible person who shall always be readily available during working hours. He shall be adequately trained in administering first aid treatment. Formal arrangements shall be prescribed to carry injured persons or persons suddenly taken ill to the nearest hospital.

The first aid box shall contain the following.

- Six small-sterilized dressings.
- Three medium sizes sterilized dressings.
- Three large sizes sterilized dressings.
- Three large sterilized burns dressings.
- One (30 ml) bottle containing 2 % alcoholic solution of iodine.
- One (30 ml) bottle containing Sal volatile.
- One snakebite lancet.
- One (30g) bottle of potassium permanganate crystals.
- One pair of scissors.
- Ointment for burns.
- A bottle of suitable surgical antiseptic solution.

In case, the number of labour exceeds 50, the items in the first aid box shall be doubled. The contracting agency should arrange to carry out the following anti-malarial measures.

- Supply of mosquito nets.
- Supply of mosquito repellents to the labour.
- Periodic cleaning of the area to destroy stagnant water pockets as well as spraying of disinfectants through health workers.
- Supply of preventative medicines to all labour force-free of cost.
- Ensure imparting free treatment to the affected people through local health centers.

**g) Provision of Shelter during Rest**

The workplace shall provide four suitable sheds, two for meals and two for rest (separately for men and women). The height of the shelter shall not be less than 3 m from the floor level to the lowest part of the roof. These shall be kept clean.

**2.2 Fire Fighting Arrangement**

The following precautions need to be taken:

- Demarcation of area susceptible to fires with cautionary signage;
- Portable fire extinguishers and/or sand baskets shall be provided at easily accessible locations
- In the event of fire, Contractor shall educate the workers on usage of this equipment.

**2.3 Interactions with Host Communities**

To ensure that there is no conflict of the migrant labour with the host communities, the contractor shall issue identity cards to labour and residents of construction camps. A specified code of conduct to be implemented and awareness programe for the labours should also be conducted.

**3. Construction stage**

Construction camps shall be maintained free from litter and in hygienic conditions. It should be kept free from spillage of oil, grease or bitumen. Any spillage should be cleaned immediately to avoid pollution of soil, water stored or adjacent water bodies.

The following precautions need to be taken in construction camps.

- Measures to ensure that no leaching of oil and grease into water bodies or underground water takes place.
- Wastewater should not be disposed into water bodies.
- Regular collection of solid wastes should be undertaken and should be disposed of safely.
- All consumables as the first aid equipment, cleaning equipment for maintaining hygiene and sanitation should be recouped immediately.
- The debris/scrap generated during construction of campsite should be kept in a designated and barricaded area.

The Engineer-in-charge will monitor the cleanliness of construction campsites and ensure that the sites are properly maintained throughout the contract.

**4. Post construction stage**

After construction, all construction camp facilities shall be dismantled and removed from the site. The site shall be restored to a condition in no way inferior to the condition prior to commencement of the works. Various activities to be carried out for site rehabilitation include:

- Oil and fuel contaminated soil shall be removed and transported and buried in waste disposal areas.
- Soak pits, septic tanks shall be covered and effectively sealed off.
- Debris (rejected material) should be disposed of suitably.
- Ramps created should be leveled.
- Underground water tanks in a barren/non-agricultural land can be covered. However, in agricultural land, the tank shall be removed.

- If the construction campsite is on agricultural land, topsoil can be spread to aid faster rejuvenation.
- Proper documentation of rehabilitation site is necessary. This shall include the following:
- Photograph of rehabilitated site;
- Landowner consent letter for satisfaction in measures taken for rehabilitation of site;
- Confirmation regarding receipt of the entire financial lease amount for the use of land.
- Undertaking from contractor; and Certification from Engineer-in-charge.

In cases, where the construction campsite is located on a private landholding, the contractor would still have to restore the campsite as per this guideline. In addition, he would have to obtain a certificate for satisfaction from the landowner.

**Annexure- II**

**List of PAPs, Signed Attendance sheet & Consent note of the PAPs**

**(Attached Seperately)**

**List of Project Affected People (PAP)**

| Sl. No. | Name | Village | Sex |
|---|---|---|---|
| 1 | Mukhna devi | Dehri | F |
| 2 | Sunita devi | Akorigola | F |
| 3 | Rajmuna devi | Dehri | F |
| 4 | Kavita devi | Dehri | F |
| 5 | Taramuni devi | Dehri | F |
| 6 | Ramchandra Chaudhary | Ambedkar chauk | M |
| 7 | Durgawati kuwar | Dehri | F |
| 8 | Shila devi | Akorigola | F |

**Annexure- III**

**OHS Risk in Different Activities**

A generic Hazard Risk Identification and Assessment (HIRA) was carried out for the activities for BWSIMP Project for two major civil works and the sub-activities:

- Renovation and modification of the Irrigation system
- Strengthening and Raising of Embankment

The HIRA does not include the works to be carried out in dams. This would be included as part of the Dam Safety Plan being carried out separately under the program.

The steps undertaken for developing the generic HIRA is based on the typical activities which are undertaken during the construction activities. This HIRA is carried out to develop an understanding of the precautions which need to be planned during the construction. The Proposed Actions are generic in nature. During the Pre-Construction stage the Contractor would prepare a Work Methodology and OHS Plan. As part of the OHS Plan contractor will carry out the HIRA as per the Work Methodology. The Control Action in the HIRA submitted with the Work Methodology will supplement the actions proposed in this Generic HIRA. The present risk identification also does not present the roles and responsibilities for implementation, the control points for monitoring implementation. These will also be included in the HIRA submitted by the Contractor in the OHS Plan developed as part of the method statement. Steps of the generic HIRA review is summarized as follows:

- Classify work/assessment units or work activities during construction phase (based on generic understanding of works to be carried out).
- Identify the hazards associated with work activities.
- List out the Consequence of the hazard involved in the activity.
- List out controls (preventive and recovery).

| SR. NO | SUB-ACTIVITY | ROUTINE ACTIVITY | POTENTIAL HAZARD | CONSEQUENCE | PROPOSED CONTROL |
|---|---|---|---|---|---|
| **A. TRANSPORTATION OF WORKERS** | | | | | |
| 1 | Transportation of workers | R | 1. Accidents | 1. Fatality / severe injury due to accident | 1. Use only vehicle authorized by RTO for transport of workers<br>2. Use Tractors, tractor trolley Excavator, dumpers for the transport of workers is strictly prohibited and lead to contractual consequences.<br>3. Passenger vehicle used for transporting workers should have seat belts as mandated |
| **B. SURVEY AND PREPARATION** | | | | | |
| 2 | Surveying | R | Presence of poisonous reptiles/insp ects/snakes | Loss of consciousness / heart attack / fatal | 1. Ensuring proper supervisor & using safety stick (wooden)<br>2. Ensuring use of appropriate PPE's (high ankle safety shoes) & avoiding loose clothing |

| SR. NO | SUB-ACTIVITY | ROUTINE ACTIVITY | POTENTIAL HAZARD | CONSEQUENCE | PROPOSED CONTROL |
|---|---|---|---|---|---|
| | | | | | 3. Ensure proper housekeeping/ use of protective tools<br>4. Create awareness among the workforce and staff/ monitoring.<br>5. Ensure availability of emergency vehicle and contact details/ tie up with local hospitals<br>6. The Contractor shall make available the first aid kit, snake bite kits and bandages at all times and all the sites. |
| 3 | Surveying | R | Improper Access / working on uneven ground surface; | Slip / trip/ fall may result injury to the personnel. | 1. Ensuring general levelling of surface for vehicle movement<br>2. Deployment of flagman<br>3. Ensuring barricades to the work location at valley / steep access / ramps are existing.<br>4. Ensure proper access to work locations |
| 4 | Surveying | R | Working near to the moving vehicles / construction vehicles | Hit by the vehicles. | 1. Ensuring competent driver.<br>2. Displaying sign boards / caution boards.<br>3. Providing training / awareness & close monitoring<br>4. Using high visibility clothing.<br>5. Provide rigid barricades for defining the vehicle movement & pedestrian walkways separately |
| 5 | Surveying | R | Presence of live electrical cables near survey work. | Cardiac arrest / burns due to electric shock. | 1. Using Insulated tools and keeping minimum distance of 3 meters.<br>2. Using rubber gloves.<br>3. Tie-up with local hospitals.<br>4. Providing Tool Box Talks (explaining HIRA) to the workforce before start of work.<br>5. Use wooden / fibre levelling staffs wherever electrical lines are existing.<br>6. Ensure emergency vehicle availability till the completion of job |
| 6 | Surveying | R | Working in extreme climatic conditions | 1. Sun stroke due to de-hydration.<br>2. Injuries / fell in sick due to adverse weather. | 1. Ensure availability of drinking water<br>2. Provide temporary rest sheds<br>3. Avoiding the work during extreme climatic conditions e.g. Excessive cold/hot. |

| SR. NO | SUB-ACTIVITY | ROUTINE ACTIVITY | POTENTIAL HAZARD | CONSEQUENCE | PROPOSED CONTROL |
|---|---|---|---|---|---|
| 7 | Surveying | R | Manual handling of survey instruments while shifting manually. | Hit by the survey instruments while shifting manually and may receive injury. | 1. Ensuring supervision for safe execution of work.<br>2. Creating awareness on manual material handling by imparting training before start of work.<br>3. Using appropriate PPE in the form of safety shoes & hand gloves. |
| **C. CLEARING AND GRUBBING** | | | | | |
| 8 | Removal / cleaning of Surface encumbrances i.e. Electrical lines, trees, heap of soil, existing structure, existing roads and other encumberances | R | 1. Work near to the moving Vehicles / equipment.<br>2. Manual cutting & material handling<br>3. Fall from height<br>4. Electrocution while using power tools<br>5. Presence of overhead services / utilities;<br>6. Use of sharp hand tools. | 1. Fatality / severe injury due to hit by the moving vehicles / equipment.<br>2. Fall from height and may result into multiple njuries / fatality.<br>3. Cut injuries while doing manual material handling.<br>4. Shifting / pulling / pushing.<br>5. Electrical urn/fatality | 1. Barricading the work area (Hard/ soft as is decided by the Safety Officer)<br>2. Engaging the competent operators.<br>3. Taking approval from relevant authorities and ensure Permit to Work.<br>4. Imparting the Tool Box Talks (explaining the HIRA) before start of work. Recording the messages delivered at the Tool Box Talk<br>5. Avoiding the manual material handling as much as possible and introducing mechanical material handling for the removal of surface encumbrances.<br>6. Engage competent / experienced personnel for handling /operating hand tools / power tools during tree cutting. |
| 9 | Surface levelling (general Cutting /filling) | R | 1. Work near to the moving Vehicles / equipment.<br>2. Topple of vehicle due to uneven ground surface.<br>3. Presence of overhead / underground utilities. | 1. Fatal / severe injury due to hit by the moving vehicles / equipment. | 1. Barricading the vehicle movement area and define pedestrian movement area separately.<br>2. Ensuring that vehicle movement area is levelled and well compacted.<br>3. Prior information to the concern departments of utility services and ensure de-energize / isolation of source.<br>4. Administrative control measures are to be developed for vehicle fitness and engagement of competent operators. |

| SR. NO | SUB-ACTIVITY | ROUTINE ACTIVITY | POTENTIAL HAZARD | CONSEQUENCE | PROPOSED CONTROL |
|---|---|---|---|---|---|
| **D. EXCAVATION** | | | | | |
| 10 | Cutting / digging the soil mechanically (Pit Excavation up to 3.0 M) | | 1. Earth Collapse<br>2. Presence of buried electric cables<br>3. Presence of overhead electrical cables<br>4. Movement / working of equipment in steep access / egress / valley conditions. | 1. Toppling of equipment due to earth collapse and personnel may receive severe injury / fatal. | 1. Screening of workforce before induction training<br>2. Medical examination as per Legal Requirement<br>3. Safety Induction; Issue of ID Card<br>4. Imparting daily Tool Box Talks (explaining HIRA)<br>5. Use of PPE (Both Mandatory and work related)<br>6. Behavioural Safety Training<br>7. If any unsafe act found then - council them & if done knowingly.<br>8. Motivate them by suitably rewarding them.<br>9. Do not allow any unauthorized to person to enter the pit<br>10. Awareness towards safety by displaying safety postures & slogan.<br>11. Relocating/ removing the overhead electrical lines.<br>12. Deploying competent operators for equipment use / operation. |
| 11 | Pit Excavation beyond 3.0m (*During excavation / cutting*) | R | *Same as above plus*<br>1. Flooding due to excessive rain / underground water<br>2. Digging in the vicinity of existing Building / Structure<br>3. Movement of vehicles / equipment's close to the edge of | Injury / fatal due to:<br>1. Drowning<br>2. Building / Structure collapse due to cave- in or slides.<br>3. Electrocution | 1. In addition to the above mentioned in 1.10 follow<br>2. Preventing ingress of water by providing temporary bunds / diverting the catchment water.<br>3. Obtaining prior approval of excavation method from local authorities; if required / needed.<br>4. Relocating / removing the surcharge loads such as buildings / structures from the edge of excavation before mechanical digging / cutting operation.<br>5. Impart training on Excavation to all operators.<br>6. Separate entry & exit path for man and machinery must be maintained |

| SR. NO | SUB-ACTIVITY | ROUTINE ACTIVITY | POTENTIAL HAZARD | CONSEQUENCE | PROPOSED CONTROL |
|---|---|---|---|---|---|
| | | | cut. | | |
| 12 | Working inside deep excavation (*After cutting/excavati on*) | R | 1. Formation of tension cracks on the edge of excavation<br>2. Formation of cave-in on the sides of excavation<br>3. Water seepage<br>4. Rain-cut<br>5. Presence of steep access / egress/ ramp<br>6. Manual shifting of materials / portable | Injury / fatal due to:<br>7. Soil collapse slip/ trip while<br>8. Manual material handling<br>9. Fall of person<br>10. Fall of material<br>11. Fall of equipment | 1. Performing regular inspections as per checklist for tension cracks/cave-ins/dewatering / rain-cut.<br>2. Continuous de-watering system in case of seepge of water<br>3. Provide safe access/ egress by providing gentle ramps / standard ladders / modular stairways.<br>4. Providing Sloping / benching / shoring / sheet piling to restrict the soil collapse as per the type of soil.<br>5. Avoiding vehicle movement near to the excavation.<br>6. Providing rigid barricades, signage's & illumination to avoid fall of person inside excavation.<br>7. Regular Tool Box Talks (explaining HIRA) are being imparted to workforce on daily basis.<br>8. Checking the oxygen levels & other toxic gases with gas detector.<br>9. Develop Standard Operating Procedure for |
| 13 | Heavy Vehicle movement | R | Speed, Hit, slip, trip & fall. | Collision<br>Overturn<br>Topple<br>Fire | Following DOs & DON'Ts as listed below:<br>1. Don't leave the keys in the cabin.<br>2. Don't allow any other person / cleaner to drive the vehicle.<br>3. Don't use Mobile phone while driving the vehicle.<br>4. Parking of vehicles near the excavated area is strictly prohibited and also not in the access path<br>5. Minimum of 3 meters' distance to be maintained from the excavation with parking light and display signage.<br>6. Avoid unnecessary parking.<br>7. Bank man or helper to deploy.<br>8. First aid box and fire extinguisher must bekept inside the cabin.<br>9. Maintenance to be carried out by an experience mechanic. |

| SR. NO | SUB-ACTIVITY | ROUTINE ACTIVITY | POTENTIAL HAZARD | CONSEQUENCE | PROPOSED CONTROL |
|---|---|---|---|---|---|
| | | | | | 10. Other than construction vehicles should not take into the work locations.<br>11. Develop a daily Vehicle Inspection checklist and ensure compliance |
| 14 | Removal of Soil | R | Entanglement, & slip or trip | Hit by bucket | 1. The radius where the Bucket is operated should be barricaded.<br>2. Signal man should be made available to guide the operator<br>3. Ensuring restriction of unauthorized personnel to enter in the excavation area.<br>4. Ensuring all the personnel must wear reflective jacket.<br>5. Ensuring by that JCB / excavator operator must aware of the surrounding area.<br>6. Operator should not use mobile phone or hear music by inserting the head phone in the ear.<br>7. While swinging / reversing - indication horn should be ON.<br>8. Develop Daily Equipment Inspection Checklist and ensure compliance<br>9. Ensure dynamic HIRA precautionary measures are in place |
| 15 | Loading /Unloading of soil | R | Workmen close to the moving equipment / machinery. | Physical injury/fatal due to hit by machinery. | 1. Engaging trained personnel<br>2. Engaging a signal person wherever loading / unloading in progress.<br>3. No personnel should come in the approach / radius of the JCB bucket while loading sand in the truck.<br>4. Ensure that no personnel should stand in the vicinity of loading activity.<br>5. Signal man should communicate once the loading has been completed in the truck & he should simultaneously inform the truck driver & JCB operator.<br>6. Ensure that there must be a clearunderstanding<br>7. /communication between operator & signalmen.<br>8. Not overload the trucks since there |
| 16 | Backfilling, Grading & Dumping | R | Including plying of vehicles on the uneven | Injury to personnel / fatal due to toppling of | 1. Vehicle movement area must be demarcated.<br>2. Soil strengthening of vehicle movement area / road being done.<br>3. Impart Tool Box Talks (explaining HIRA). |

| SR. NO | SUB-ACTIVITY | ROUTINE ACTIVITY | POTENTIAL HAZARD | CONSEQUENCE | PROPOSED CONTROL |
|---|---|---|---|---|---|
| | | | ground surface/ loose soil. | vehicle / equipment / stuck in loose soil. | |
| **E. OPERATION OF BATCHING PLANT** | | | | | |
| 17 | Concreting: Manual / Mechanical Loading or unloading of:<br>a) Raw material at material stack yards of Batching plant/ local concrete plant.<br>b) Mechanical Loading / feeding of cement in silo unit.<br>c) Manual handling of cement bags at cement store | R | 1. Vehicle Movement.<br>2. Stack plies of raw material.<br>3. Men movement on or near to stack piling area & Men movement near to the equipment.<br>4. Auto functioning of material. Grabber to feed the material on feeder unit.<br>5. Men movement or manual material handling near to the conveyor/ rotating parts. | 1. Hit by the moving vehicles/ equipment may result fatality / severe injuries.<br>2. Fall from height / hit by the grabber while working on piling area which may result fatality or severe injuries.<br>3. Injuries due to toppling of vehicles while moving on uneven ground surfaces / heaps.<br>4. Injuries due to collision of vehicles while working at congested / unsafe areas of Batching plant. | 1. Men and vehicle movement area must be separated, and barricades shall be provided.<br>2. Deploy competent and trained operators.<br>3. Avoid manual material handling andinvolve mechanical lading / unloading.<br>4. Stop the movement of vehicles while manual handling is in progress.<br>5. Stack pile separators / retaining structures are designed based on considering all load to withstand the stack piles.<br>6. Daily HIRA Talk talks are to be imparted to bring the awareness amongst all workforce at batching plant.<br>7. Signage and caution boards shall be displayed at vehicle movement area. Engage flagmen's to guide the movement of vehicles.<br>8. Pull card / guarding / covers shall be provided to all rotating parts such as conveyor belts /covers on feeding hoppers.<br>9. All personnel shall be adhered with appropriate PPE.<br>10. Heavy /unwanted vehicle movement shall be restricted in and around batching plant. No parking shall be allowed near the vehicle movement area.<br>11. Ensure dynamic HIRA precautionary measures are in place<br>12. To ensure safety checklist compliance |

| SR. NO | SUB-ACTIVITY | ROUTINE ACTIVITY | POTENTIAL HAZARD | CONSEQUENCE | PROPOSED CONTROL |
|---|---|---|---|---|---|
| | | | 6. Emission of cement particles while feeding the cement.<br>7. Failure / collapse of stack pile separators / retaining walls / structure due to excessive stack of raw material. | 5. Fatality / multiple injuries due to entrapment of body parts in the moving conveyor/rotating parts of batching plant. | 13. Use and maintain filters bags at cement hopper to avoid the emission of cement particles.<br>14. Concern to establish and operate to be obtained from regulatory authorities. |

**Annexure- IV**

**Availability of WRD Land on both sides of Canal**

| S.No. | Chainage, km. | Government Land from. Centre line of Embankment/Canal | |
|---|---|---|---|
| | | Left | Right |
| 1 | 0.100 | 48.125 mtrs. | 55.74 mtrs. |
| 2 | 0.200 | 48.125 mtrs. | 55.74 mtrs. |
| 3 | 0.300 | 48.125 mtrs. | 55.74 mtrs. |
| 4 | 0.400 | 48.125 mtrs. | 55.74 mtrs. |
| 5 | 0.500 | 48.125 mtrs. | 55.74 mtrs. |
| 6 | 0.600 | 48.125 mtrs. | 55.74 mtrs. |
| 7 | 0.700 | 48.125 mtrs. | 55.74 mtrs. |
| 8 | 0.800 | 48.125 mtrs. | 55.74 mtrs. |
| 9 | 0.900 | 48.125 mtrs. | 55.74 mtrs. |
| 10 | 1.000 | 48.125 mtrs. | 55.74 mtrs. |
| 11 | 1.100 | 48.125 mtrs. | 55.74 mtrs. |
| 12 | 1.200 | 48.125 mtrs. | 55.74 mtrs. |
| 13 | 1.300 | 48.125 mtrs. | 55.74 mtrs. |
| 14 | 1.400 | 48.125 mtrs. | 55.74 mtrs. |
| 15 | 1.500 | 48.125 mtrs. | 55.74 mtrs. |
| 16 | 1.600 | 48.125 mtrs. | 55.74 mtrs. |
| 17 | 1.700 | 48.125 mtrs. | 55.74 mtrs. |
| 18 | 1.800 | 48.125 mtrs. | 55.74 mtrs. |
| 19 | 1.900 | 48.125 mtrs. | 55.74 mtrs. |
| 20 | 2.000 | 48.125 mtrs. | 55.74 mtrs. |
| 21 | 2.100 | 48.125 mtrs. | 55.74 mtrs. |
| 22 | 2.200 | 48.125 mtrs. | 55.74 mtrs. |
| 23 | 2.300 | 48.125 mtrs. | 55.74 mtrs. |
| 24 | 2.400 | 48.125 mtrs. | 55.74 mtrs. |
| 25 | 2.500 | 48.125 mtrs. | 55.74 mtrs. |
| 26 | 2.600 | 48.125 mtrs. | 55.74 mtrs. |
| 27 | 2.700 | 48.125 mtrs. | 55.74 mtrs. |
| 28 | 2.800 | 48.125 mtrs. | 55.74 mtrs. |
| 29 | 2.900 | 48.125 mtrs. | 55.74 mtrs. |
| 30 | 3.000 | 48.125 mtrs. | 55.74 mtrs. |
| 31 | 3.100 | 48.125 mtrs. | 55.74 mtrs. |
| 32 | 3.200 | 48.125 mtrs. | 55.74 mtrs. |
| 33 | 3.300 | 48.125 mtrs. | 55.74 mtrs. |
| 34 | 3.400 | 48.125 mtrs. | 55.74 mtrs. |
| 35 | 3.500 | 48.125 mtrs. | 55.74 mtrs. |
| 36 | 3.600 | 48.125 mtrs. | 55.74 mtrs. |
| 37 | 3.700 | 48.125 mtrs. | 55.74 mtrs. |
| 38 | 3.800 | 48.125 mtrs. | 55.74 mtrs. |

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| 39 | 3.900 | 48.125 mtrs. | 55.74 mtrs. |
| 40 | 4.000 | 48.125 mtrs. | 55.74 mtrs. |
| 41 | 4.100 | 48.125 mtrs. | 55.74 mtrs. |
| 42 | 4.200 | 48.125 mtrs. | 55.74 mtrs. |
| 43 | 4.300 | 48.125 mtrs. | 55.74 mtrs. |
| 44 | 4.400 | 48.125 mtrs. | 55.74 mtrs. |
| 45 | 4.500 | 48.125 mtrs. | 55.74 mtrs. |
| 46 | 4.600 | 48.125 mtrs. | 55.74 mtrs. |
| 47 | 4.700 | 48.125 mtrs. | 55.74 mtrs. |
| 48 | 4.800 | 48.125 mtrs. | 55.74 mtrs. |
| 49 | 4.900 | 48.125 mtrs. | 55.74 mtrs. |
| 50 | 5.000 | 48.125 mtrs. | 55.74 mtrs. |
| 51 | 5.100 | 48.125 mtrs. | 55.74 mtrs. |
| 52 | 5.200 | 48.125 mtrs. | 55.74 mtrs. |
| 53 | 5.300 | 48.125 mtrs. | 55.74 mtrs. |
| 54 | 5.400 | 48.125 mtrs. | 55.74 mtrs. |
| 55 | 5.500 | 48.125 mtrs. | 55.74 mtrs. |
| 56 | 5.600 | 48.125 mtrs. | 55.74 mtrs. |
| 57 | 5.700 | 48.125 mtrs. | 55.74 mtrs. |
| 58 | 5.800 | 48.125 mtrs. | 55.74 mtrs. |
| 59 | 5.900 | 48.125 mtrs. | 55.74 mtrs. |
| 60 | 6.000 | 48.125 mtrs. | 55.74 mtrs. |
| 61 | 6.100 | 48.125 mtrs. | 55.74 mtrs. |
| 62 | 6.200 | 48.125 mtrs. | 55.74 mtrs. |
| 63 | 6.300 | 48.125 mtrs. | 55.74 mtrs. |
| 64 | 6.400 | 48.125 mtrs. | 55.74 mtrs. |
| 65 | 6.500 | 48.125 mtrs. | 55.74 mtrs. |
| 66 | 6.600 | 48.125 mtrs. | 55.74 mtrs. |
| 67 | 6.700 | 48.125 mtrs. | 55.74 mtrs. |
| 68 | 6.800 | 48.125 mtrs. | 55.74 mtrs. |
| 69 | 6.900 | 48.125 mtrs. | 55.74 mtrs. |
| 70 | 7.000 | 48.125 mtrs. | 55.74 mtrs. |
| 71 | 7.100 | 48.125 mtrs. | 55.74 mtrs. |
| 72 | 7.200 | 40.35 mtrs. | 45.20 mtrs. |
| 73 | 7.300 | 40.35 mtrs. | 45.20 mtrs. |
| 74 | 7.400 | 40.35 mtrs. | 45.20 mtrs. |
| 75 | 7.500 | 40.35 mtrs. | 45.20 mtrs. |
| 76 | 7.600 | 40.35 mtrs. | 45.20 mtrs. |
| 77 | 7.700 | 40.35 mtrs. | 45.20 mtrs. |
| 78 | 7.800 | 40.35 mtrs. | 45.20 mtrs. |
| 79 | 7.900 | 40.35 mtrs. | 45.20 mtrs. |
| 80 | 8.000 | 40.35 mtrs. | 45.20 mtrs. |
| 81 | 8.100 | 40.35 mtrs. | 45.20 mtrs. |

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| 82 | 8.200 | 40.35 mtrs. | 45.20 mtrs. |
| 83 | 8.300 | 40.35 mtrs. | 45.20 mtrs. |
| 84 | 8.400 | 40.35 mtrs. | 45.20 mtrs. |
| 85 | 8.500 | 40.35 mtrs. | 45.20 mtrs. |
| 86 | 8.600 | 40.35 mtrs. | 45.20 mtrs. |
| 87 | 8.700 | 40.35 mtrs. | 45.20 mtrs. |
| 88 | 8.800 | 40.35 mtrs. | 45.20 mtrs. |
| 89 | 8.900 | 40.35 mtrs. | 45.20 mtrs. |
| 90 | 9.000 | 40.35 mtrs. | 45.20 mtrs. |
| 91 | 9.100 | 40.35 mtrs. | 45.20 mtrs. |
| 92 | 9.200 | 40.35 mtrs. | 45.20 mtrs. |
| 93 | 9.300 | 40.35 mtrs. | 45.20 mtrs. |
| 94 | 9.400 | 40.35 mtrs. | 45.20 mtrs. |
| 95 | 9.500 | 40.35 mtrs. | 45.20 mtrs. |
| 96 | 9.600 | 40.35 mtrs. | 45.20 mtrs. |
| 97 | 9.700 | 40.35 mtrs. | 45.20 mtrs. |
| 98 | 9.800 | 40.35 mtrs. | 45.20 mtrs. |
| 99 | 9.900 | 40.35 mtrs. | 45.20 mtrs. |
| 100 | 10.000 | 40.35 mtrs. | 45.20 mtrs. |
| 101 | 10.100 | 40.35 mtrs. | 45.20 mtrs. |
| 102 | 10.200 | 40.35 mtrs. | 45.20 mtrs. |
| 103 | 10.300 | 40.35 mtrs. | 45.20 mtrs. |
| 104 | 10.400 | 40.35 mtrs. | 45.20 mtrs. |
| 105 | 10.500 | 40.35 mtrs. | 45.20 mtrs. |
| 106 | 10.600 | 40.35 mtrs. | 45.20 mtrs. |
| 107 | 10.700 | 40.35 mtrs. | 45.20 mtrs. |
| 108 | 10.800 | 40.35 mtrs. | 45.20 mtrs. |
| 109 | 10.900 | 40.35 mtrs. | 45.20 mtrs. |
| 110 | 11.000 | 40.35 mtrs. | 45.20 mtrs. |
| 111 | 11.100 | 40.35 mtrs. | 45.20 mtrs. |
| 112 | 11.200 | 40.35 mtrs. | 45.20 mtrs. |
| 113 | 11.300 | 40.35 mtrs. | 45.20 mtrs. |
| 114 | 11.400 | 40.35 mtrs. | 45.20 mtrs. |
| 115 | 11.500 | 40.35 mtrs. | 45.20 mtrs. |
| 116 | 11.600 | 40.35 mtrs. | 45.20 mtrs. |
| 117 | 11.700 | 40.35 mtrs. | 45.20 mtrs. |
| 118 | 11.800 | 40.35 mtrs. | 45.20 mtrs. |
| 119 | 11.900 | 40.35 mtrs. | 45.20 mtrs. |
| 120 | 12.000 | 40.35 mtrs. | 45.20 mtrs. |
| 121 | 12.100 | 40.35 mtrs. | 45.20 mtrs. |
| 122 | 12.200 | 40.35 mtrs. | 45.20 mtrs. |
| 123 | 12.300 | 40.35 mtrs. | 45.20 mtrs. |
| 124 | 12.400 | 40.35 mtrs. | 45.20 mtrs. |

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| 125 | 12.500 | 40.35 mtrs. | 45.20 mtrs. |
| 126 | 12.600 | 40.35 mtrs. | 45.20 mtrs. |
| 127 | 12.700 | 40.35 mtrs. | 45.20 mtrs. |
| 128 | 12.800 | 40.35 mtrs. | 45.20 mtrs. |
| 129 | 12.900 | 40.35 mtrs. | 45.20 mtrs. |
| 130 | 13.000 | 40.35 mtrs. | 45.20 mtrs. |
| 131 | 13.100 | 40.35 mtrs. | 45.20 mtrs. |
| 132 | 13.200 | 40.35 mtrs. | 45.20 mtrs. |
| 133 | 13.300 | 40.35 mtrs. | 45.20 mtrs. |
| 134 | 13.400 | 40.35 mtrs. | 45.20 mtrs. |
| 135 | 13.500 | 40.35 mtrs. | 45.20 mtrs. |
| 136 | 13.600 | 40.35 mtrs. | 45.20 mtrs. |
| 137 | 13.700 | 40.35 mtrs. | 45.20 mtrs. |
| 138 | 13.800 | 40.35 mtrs. | 45.20 mtrs. |
| 139 | 13.900 | 40.35 mtrs. | 45.20 mtrs. |
| 140 | 14.000 | 40.35 mtrs. | 45.20 mtrs. |
| 141 | 14.100 | 40.35 mtrs. | 45.20 mtrs. |
| 142 | 14.200 | 40.35 mtrs. | 45.20 mtrs. |
| 143 | 14.300 | 40.35 mtrs. | 45.20 mtrs. |
| 144 | 14.400 | 40.35 mtrs. | 45.20 mtrs. |
| 145 | 14.500 | 40.35 mtrs. | 45.20 mtrs. |
| 146 | 14.600 | 40.35 mtrs. | 45.20 mtrs. |
| 147 | 14.700 | 40.35 mtrs. | 45.20 mtrs. |
| 148 | 14.800 | 40.35 mtrs. | 45.20 mtrs. |
| 149 | 14.900 | 40.35 mtrs. | 45.20 mtrs. |
| 150 | 15.000 | 40.35 mtrs. | 45.20 mtrs. |
| 151 | 15.100 | 40.35 mtrs. | 45.20 mtrs. |
| 152 | 15.200 | 40.35 mtrs. | 45.20 mtrs. |
| 153 | 15.300 | 40.35 mtrs. | 45.20 mtrs. |
| 154 | 15.400 | 40.35 mtrs. | 45.20 mtrs. |
| 155 | 15.500 | 40.35 mtrs. | 45.20 mtrs. |
| 156 | 15.600 | 40.35 mtrs. | 45.20 mtrs. |
| 157 | 15.700 | 40.35 mtrs. | 45.20 mtrs. |
| 158 | 15.800 | 40.35 mtrs. | 45.20 mtrs. |
| 159 | 15.900 | 40.35 mtrs. | 45.20 mtrs. |
| 160 | 16.000 | 40.35 mtrs. | 45.20 mtrs. |
| 161 | 16.100 | 40.35 mtrs. | 45.20 mtrs. |
| 162 | 16.200 | 40.35 mtrs. | 45.20 mtrs. |
| 163 | 16.300 | 40.35 mtrs. | 45.20 mtrs. |
| 164 | 16.400 | 40.35 mtrs. | 45.20 mtrs. |
| 165 | 16.500 | 40.35 mtrs. | 45.20 mtrs. |
| 166 | 16.600 | 40.35 mtrs. | 45.20 mtrs. |
| 167 | 16.700 | 40.35 mtrs. | 45.20 mtrs. |

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| 168 | 16.800 | 40.35 mtrs. | 45.20 mtrs. |
| 169 | 16.900 | 40.35 mtrs. | 45.20 mtrs. |
| 170 | 17.000 | 40.35 mtrs. | 45.20 mtrs. |
| 171 | 17.100 | 40.35 mtrs. | 45.20 mtrs. |
| 172 | 17.200 | 40.35 mtrs. | 45.20 mtrs. |
| 173 | 17.300 | 40.35 mtrs. | 45.20 mtrs. |
| 174 | 17.400 | 40.35 mtrs. | 45.20 mtrs. |
| 175 | 17.500 | 40.35 mtrs. | 45.20 mtrs. |
| 176 | 17.600 | 40.35 mtrs. | 45.20 mtrs. |
| 177 | 17.700 | 40.35 mtrs. | 45.20 mtrs. |
| 178 | 17.800 | 40.35 mtrs. | 45.20 mtrs. |
| 179 | 17.900 | 40.35 mtrs. | 45.20 mtrs. |
| 180 | 18.000 | 40.35 mtrs. | 45.20 mtrs. |
| 181 | 18.100 | 40.35 mtrs. | 45.20 mtrs. |
| 182 | 18.200 | 40.35 mtrs. | 45.20 mtrs. |
| 183 | 18.300 | 40.35 mtrs. | 45.20 mtrs. |
| 184 | 18.400 | 40.35 mtrs. | 45.20 mtrs. |
| 185 | 18.500 | 40.35 mtrs. | 45.20 mtrs. |
| 186 | 18.600 | 40.35 mtrs. | 45.20 mtrs. |
| 187 | 18.700 | 40.35 mtrs. | 45.20 mtrs. |
| 188 | 18.800 | 29.08 mtrs. | 33.30 mtrs. |
| 189 | 18.900 | 29.08 mtrs. | 33.30 mtrs. |
| 190 | 19.000 | 29.08 mtrs. | 33.30 mtrs. |
| 191 | 19.100 | 29.08 mtrs. | 33.30 mtrs. |
| 192 | 19.200 | 29.08 mtrs. | 33.30 mtrs. |
| 193 | 19.300 | 29.08 mtrs. | 33.30 mtrs. |
| 194 | 19.400 | 29.08 mtrs. | 33.30 mtrs. |
| 195 | 19.500 | 29.08 mtrs. | 33.30 mtrs. |
| 196 | 19.600 | 29.08 mtrs. | 33.30 mtrs. |
| 197 | 19.700 | 29.08 mtrs. | 33.30 mtrs. |
| 198 | 19.800 | 29.08 mtrs. | 33.30 mtrs. |
| 199 | 19.900 | 29.08 mtrs. | 33.30 mtrs. |
| 200 | 20.000 | 29.08 mtrs. | 33.30 mtrs. |
| 201 | 20.100 | 29.08 mtrs. | 33.30 mtrs. |
| 202 | 20.200 | 29.08 mtrs. | 33.30 mtrs. |
| 203 | 20.300 | 29.08 mtrs. | 33.30 mtrs. |
| 204 | 20.400 | 29.08 mtrs. | 33.30 mtrs. |
| 205 | 20.500 | 29.08 mtrs. | 33.30 mtrs. |
| 206 | 20.600 | 29.08 mtrs. | 33.30 mtrs. |
| 207 | 20.700 | 29.08 mtrs. | 33.30 mtrs. |
| 208 | 20.800 | 29.08 mtrs. | 33.30 mtrs. |
| 209 | 20.900 | 29.08 mtrs. | 33.30 mtrs. |
| 210 | 21.000 | 29.08 mtrs. | 33.30 mtrs. |

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| 211 | 21.100 | 29.08 mtrs. | 33.30 mtrs. |
| 212 | 21.200 | 29.08 mtrs. | 33.30 mtrs. |
| 213 | 21.300 | 29.08 mtrs. | 33.30 mtrs. |
| 214 | 21.400 | 29.08 mtrs. | 33.30 mtrs. |
| 215 | 21.500 | 29.08 mtrs. | 33.30 mtrs. |
| 216 | 21.600 | 29.08 mtrs. | 33.30 mtrs. |
| 217 | 21.700 | 29.08 mtrs. | 33.30 mtrs. |
| 218 | 21.800 | 29.08 mtrs. | 33.30 mtrs. |
| 219 | 21.900 | 29.08 mtrs. | 33.30 mtrs. |
| 220 | 22.000 | 29.08 mtrs. | 33.30 mtrs. |
| 221 | 22.100 | 29.08 mtrs. | 33.30 mtrs. |
| 222 | 22.200 | 29.08 mtrs. | 33.30 mtrs. |
| 223 | 22.300 | 29.08 mtrs. | 33.30 mtrs. |
| 224 | 22.400 | 29.08 mtrs. | 33.30 mtrs. |
| 225 | 22.500 | 29.08 mtrs. | 33.30 mtrs. |
| 226 | 22.600 | 29.08 mtrs. | 33.30 mtrs. |
| 227 | 22.700 | 29.08 mtrs. | 33.30 mtrs. |
| 228 | 22.800 | 29.08 mtrs. | 33.30 mtrs. |
| 229 | 22.900 | 29.08 mtrs. | 33.30 mtrs. |
| 230 | 23.000 | 29.08 mtrs. | 33.30 mtrs. |
| 231 | 23.100 | 29.08 mtrs. | 33.30 mtrs. |
| 232 | 23.200 | 29.08 mtrs. | 33.30 mtrs. |
| 233 | 23.300 | 29.08 mtrs. | 33.30 mtrs. |
| 234 | 23.400 | 29.08 mtrs. | 33.30 mtrs. |
| 235 | 23.500 | 29.08 mtrs. | 33.30 mtrs. |
| 236 | 23.600 | 29.08 mtrs. | 33.30 mtrs. |
| 237 | 23.700 | 29.08 mtrs. | 33.30 mtrs. |
| 238 | 23.800 | 29.08 mtrs. | 33.30 mtrs. |
| 239 | 23.900 | 29.08 mtrs. | 33.30 mtrs. |
| 240 | 24.000 | 29.08 mtrs. | 33.30 mtrs. |
| 241 | 24.100 | 29.08 mtrs. | 33.30 mtrs. |
| 242 | 24.200 | 29.08 mtrs. | 33.30 mtrs. |
| 243 | 24.300 | 29.08 mtrs. | 33.30 mtrs. |
| 244 | 24.400 | 29.08 mtrs. | 33.30 mtrs. |
| 245 | 24.500 | 29.08 mtrs. | 33.30 mtrs. |
| 246 | 24.600 | 29.08 mtrs. | 33.30 mtrs. |
| 247 | 24.700 | 29.08 mtrs. | 33.30 mtrs. |
| 248 | 24.800 | 29.08 mtrs. | 33.30 mtrs. |
| 249 | 24.900 | 29.08 mtrs. | 33.30 mtrs. |
| 250 | 25.000 | 29.08 mtrs. | 33.30 mtrs. |
| 251 | 25.100 | 29.08 mtrs. | 33.30 mtrs. |
| 252 | 25.200 | 29.08 mtrs. | 33.30 mtrs. |
| 253 | 25.300 | 29.08 mtrs. | 33.30 mtrs. |

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|---|---|---|---|
| 254 | 25.400 | 29.08 mtrs. | 33.30 mtrs. |
| 255 | 25.500 | 29.08 mtrs. | 33.30 mtrs. |
| 256 | 25.600 | 29.08 mtrs. | 33.30 mtrs. |
| 257 | 25.700 | 29.08 mtrs. | 33.30 mtrs. |
| 258 | 25.800 | 29.08 mtrs. | 33.30 mtrs. |
| 259 | 25.900 | 29.08 mtrs. | 33.30 mtrs. |
| 260 | 26.000 | 29.08 mtrs. | 33.30 mtrs. |
| 261 | 26.100 | 29.08 mtrs. | 33.30 mtrs. |
| 262 | 26.200 | 29.08 mtrs. | 33.30 mtrs. |
| 263 | 26.300 | 29.08 mtrs. | 33.30 mtrs. |
| 264 | 26.400 | 29.08 mtrs. | 33.30 mtrs. |
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| 268 | 26.800 | 29.08 mtrs. | 33.30 mtrs. |
| 269 | 26.900 | 29.08 mtrs. | 33.30 mtrs. |
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| 274 | 27.400 | 29.08 mtrs. | 33.30 mtrs. |
| 275 | 27.500 | 29.08 mtrs. | 33.30 mtrs. |
| 276 | 27.600 | 29.08 mtrs. | 33.30 mtrs. |
| 277 | 27.700 | 29.08 mtrs. | 33.30 mtrs. |
| 278 | 27.800 | 29.08 mtrs. | 33.30 mtrs. |
| 279 | 27.900 | 29.08 mtrs. | 33.30 mtrs. |
| 280 | 28.000 | 29.08 mtrs. | 33.30 mtrs. |
| 281 | 28.100 | 29.08 mtrs. | 33.30 mtrs. |
| 282 | 28.200 | 29.08 mtrs. | 33.30 mtrs. |
| 283 | 28.300 | 29.08 mtrs. | 33.30 mtrs. |
| 284 | 28.400 | 29.08 mtrs. | 33.30 mtrs. |
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| 286 | 28.600 | 29.08 mtrs. | 33.30 mtrs. |
| 287 | 28.700 | 29.08 mtrs. | 33.30 mtrs. |
| 288 | 28.800 | 29.08 mtrs. | 33.30 mtrs. |
| 289 | 28.900 | 29.08 mtrs. | 33.30 mtrs. |
| 290 | 29.000 | 29.08 mtrs. | 33.30 mtrs. |
| 291 | 29.100 | 29.08 mtrs. | 33.30 mtrs. |
| 292 | 29.200 | 29.08 mtrs. | 33.30 mtrs. |
| 293 | 29.300 | 29.08 mtrs. | 33.30 mtrs. |
| 294 | 29.400 | 29.08 mtrs. | 33.30 mtrs. |
| 295 | 29.500 | 29.08 mtrs. | 33.30 mtrs. |
| 296 | 29.600 | 29.08 mtrs. | 33.30 mtrs. |

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| 297 | 29.700 | 29.08 mtrs. | 33.30 mtrs. |
| 298 | 29.800 | 29.08 mtrs. | 33.30 mtrs. |
| 299 | 29.900 | 29.08 mtrs. | 33.30 mtrs. |
| 300 | 30.000 | 29.08 mtrs. | 33.30 mtrs. |
| 301 | 30.100 | 29.08 mtrs. | 33.30 mtrs. |
| 302 | 30.200 | 29.08 mtrs. | 33.30 mtrs. |
| 303 | 30.300 | 29.08 mtrs. | 33.30 mtrs. |
| 304 | 30.400 | 29.08 mtrs. | 33.30 mtrs. |
| 305 | 30.500 | 29.08 mtrs. | 33.30 mtrs. |
| 306 | 30.600 | 17.45 mtrs. | 21.67 mtrs. |
| 307 | 30.700 | 17.45 mtrs. | 21.67 mtrs. |
| 308 | 30.800 | 17.45 mtrs. | 21.67 mtrs. |
| 309 | 30.900 | 17.45 mtrs. | 21.67 mtrs. |
| 310 | 31.000 | 17.45 mtrs. | 21.67 mtrs. |
| 311 | 31.100 | 17.45 mtrs. | 21.67 mtrs. |
| 312 | 31.200 | 17.45 mtrs. | 21.67 mtrs. |
| 313 | 31.300 | 17.45 mtrs. | 21.67 mtrs. |
| 314 | 31.400 | 17.45 mtrs. | 21.67 mtrs. |
| 315 | 31.500 | 17.45 mtrs. | 21.67 mtrs. |
| 316 | 31.600 | 17.45 mtrs. | 21.67 mtrs. |
| 317 | 31.700 | 17.45 mtrs. | 21.67 mtrs. |
| 318 | 31.800 | 17.45 mtrs. | 21.67 mtrs. |
| 319 | 31.900 | 17.45 mtrs. | 21.67 mtrs. |
| 320 | 32.000 | 17.45 mtrs. | 21.67 mtrs. |
| 321 | 32.100 | 17.45 mtrs. | 21.67 mtrs. |
| 322 | 32.200 | 17.45 mtrs. | 21.67 mtrs. |
| 323 | 32.300 | 17.45 mtrs. | 21.67 mtrs. |
| 324 | 32.400 | 17.45 mtrs. | 21.67 mtrs. |
| 325 | 32.5 | 17.45 mtrs. | 21.67 mtrs. |

## Annexure V

### Gender –Based Violence & Sexual Exploitation Abuse Management

The WB Good Practice Note provides a comprehensive understanding of the nature and kinds of GBV. The GPN establishes an approach for identifying risks of GBV, in particularly sexual exploitation and abuse and sexual harassment, that can emerge in a major infrastructure project with civil works contracts. The GPN has been built up on World Bank experience and good international industry practise, including those of other development partners.

- **GBV in Major Infrastructure Projects**

Large infrastructure projects often involve major civil work that require labour forces and associated goods and services that cannot be fully met by local supply. In such cases, workers are often brought in from outside the project area. Construction workers are predominantly young males, typically separated from their families on a construction job for extended periods of time. They can therefore act outside their normal spheres of social control, which can lead to spectrum of unacceptable and illicit behaviours, including sexual exploitation and abuse of woman and girls from the local community.

- Project create changes in the communities in which they operate and can cause shifts in power dynamics between community members and within households. Male jealousy, a key driver of GBV, can be triggered by labour influx on a project when workers are believed to be interaction with community women. Hence, abusive behaviour can occur not only between project-related staff and those living in and around the project site, but also within the homes of those affected by the project.
- Construction workers are predominantly younger males. Those who are away from home on the construction job are typically separated from their family and their normal sphere of social control. This can result is inappropriate behaviour, such as sexual harassment of woman girls and illicit sexual relations with minors form the local community.
- Project with a large influx of workers may increase the demand for sex work – even increase the risk for trafficking of women for the propose of sex work – or the risk of forced early marriage in a community where marriage to an employed man is seen as the best livelihood strategy for an adolescent girl. Furthermore, higher wages for workers in a community can led to an increase in transactional sex. The risk of incidents of sex between labourers and minors, even when it is not transactional, can also increase.
- Women and girls' job opportunities are limited due to a lack of appropriate transportation options. When creating job opportunities for woman within projects, teams should be aware that traveling to and from work in some setting can force women and girls to use unsafe, poorly lit commuter routes, or unsafe public transport. Increased risk of violence is experienced when women are confronted with traveling long distances to access work opportunities or forced to travel at night.
- Increased interactions between the incoming workforce and the local community may result in increasing rates of communicable diseases, including sexually transmitted diseases and HIV/AIDS/COVID-19.

❖ **GBV Risk Assessment**

➢ **Area of Impact**

When considering GBV risks, there are different "areas of impact" that influence both the nature of the risk, and appropriate mitigation measures that a project can implement:

- The project site is the location where the project's activities are being undertaken. This includes both the actual location where civil works are conducted, but also the associated areas such as the locations of workers' camps, quarries, etc.
- The project adjoining communities is generally the broader geographic area around the project. This extends beyond the specific location where civil works are being carried out into wider surroundings. Neighbouring communities are at risk of GBV, particularly when workers are highly mobile.

❖ **Action Plan for Gender Based Violence Prevention and response.**

The GBV action plan outlines the key measures for prevention, mitigation and response for:

The Potential GBV risks to women and adolescent girls (from adjoining communities) as a result of the influx of migrant labour is likely that the workers will come into contact with the community and vice-versa. With varied cultural and economic background, the likely interactions between communities and workers may lead to potential women safety issues, making it pertinent to create awareness on gender issues, gender-based violence and risk mitigation, in particular. If not carefully managed, and influx of labour in the form of rapid migration and settlement of workers or local can negatively impact a project area, especially in contests with high prevalence and social acceptability of violence against women and girls.

The action plan will include, but not be limited to;

i. Mapping of identified Hot Spot, and close monitoring of these areas throughout the project cycle.
ii. Mapping of GBV service provider nearest to the sub project area, including an assessment of the capabilities or the service providers to provide quality survivor cantered services. This should incorporate an assessment of the capabilities of the service providers to provide quality survivor cantered services including GBV case management, acting as a victim advocate, providing referral services to link to other services not provided by the project itself.
iii. Preparation and display of signage on GBV prevention and zero tolerance against GBV at all strategic location/hotspots of the project area; in the local language at identified Hot Spots; against sexual harassment and gender equality in the workplace; zero tolerance for SEA or SH in the project, and GRM committee/ contact persons names and numbers, including help line numbers of police and other response actors, for reporting GBV incidents.
iv. Formation of a GBV committee at project district/divisional zone for GBV grievance.
v. Finalization of the accountability and Response Framework during sub project implementation. This will include at minimum a) GBV allegation procedures and b) a response framework.

vi. Introducing a Worker Code of Conduct as part of the employment contract, and including sanctions for non-compliance (e.g. termination); Inclusion of gender-based violence in safety induction training's; continuous stakeholder consultation and citizen engagement carried out in the adjoining villages of work zone to inform the community about GBV risks and redressal mechanisms.

vii. Stakeholder guidance will be sought to identify existing and potential local GBV risks and on potential interventions and risk mitigation measures. Consultations with those working with adolescent girls, single women and other at-risk groups, will be prioritized to enable understanding of GBV risks and mitigation measures.

❖ **Training on GBV risk**

Training shall include:

- Concept of GBV, particularly SEA and SH; and how the project can exacerbate GBV risks;
- Roles and responsibilities involved in the project (the standards of conduct for project-related staff captured in CoC.);
- GBV incident reporting mechanism, accountability structures, and referral procedures within agencies and for community members to report cases related to project staff;
- Services available for survivors of GBV; and,
- Follow-up activities to reinforce training content.

**Annexure VI**

**Stakeholder consultation meeting on Draft ESIA - Minutes**

**Subject:** Stakeholder Consultation on Draft Environmental and Social Impact Assessment (ESIA) of Modernazation of Sone Western Main Canal from km 0.00 to km 32.50

**Organised by:** Western Sone Main Canal, Irrigation Division, Dehri & Water Resource Department, Govt. of Bihar

**Date & Venue:** 10/07/2025 & Ankhorigola Section office premise

**Attendees:** Prospective stakeholders including, project beneficiaries, project affected people, farmers, representatives of WUA, community leaders, representatives of local government, related line departments and elected representatives. Attendance sheet attached for reference.

**Purpose of meeting:** To present the draft Environmental and Social Impact Assessment (ESIA) of the referred sub-project and obtain final feedback and suggestions from prospective stakeholders.

**Summary of discussion:**

- Participants were briefed on the background, location, and specific activities of the proposed sub-project, along with the mandate of the World Bank.
- The expected outcomes of the sub project intervention were highlighted.
- The process followed for preparing the ESIA report was explained.
- Key findings of the ESIA were discussed.
- The procedure for preparing the Resettlement Action Plan (RAP) was outlined.
- The entitlements for the eight squatters likely to be relocated were explained.
- An overview of Grievance redressal mechanism for the project was shared.

**Stakeholder Feedback/Suggestions:**

- Provision of access points along the canal for animals as well as humans, including:
    - Construction of Animal-friendly steps for accessing drinking water
    - Building of entry structures (ghats) or stairs to facilitate human use
- Linking project-affected squatters with government welfare schemes, such as housing programmes.
- Construction of the service road along the embankment so that communication becomes convenient for them.
- Concerns were raised that canal lining, while beneficial for tail-end farmers, might reduce groundwater levels in nearby areas, making it difficult to obtain drinking water through tube wells.
- Participants express their apprehension that, during construction work of lining, their agricultural land and cultivated crops might be affected by dust.
- After discussing the objective and outcomes of the project, most of the participants have shown their positive interest in the proposed work.

**Clarification provided:**

- In the civil work there is provision for i. constructing steps for animals to access drinking water, ii. building entry structures (ghats) or stairs to facilitate human use.

- The Division will forward the list of the project-affected squatters to the appropriate authority of Govt. housing programme so that the affected households receive priority consideration.

- Construction of 22.50 km service road with Bituminus is one of the project activities.

- Adequate mitigation measures like sprinkling of water and provision of dust screens around material storage areas will do away with such problem.

- It was explained to the participants, that canal lining reduces seepage, which in turn decreases groundwater recharge in the areas adjacent to the canal. However, the reduced seepage will increase water availability within the canal, enabling irrigation over a larger area and reducing reliance on groundwater. This will also lessen the use of borewells for irrigation, and the expansion of irrigated areas will contribute to groundwater recharge over time. Therefore, the overall impact on the groundwater table is expected to be positive. The decrease in ground water level in the areas adjacent to the canal will be minimal and for a short span.

**Conclusions:**

It has been revealed from information gathered from stakeholder consultations and public consultations as well as discussions with project-affected squatters along project area that people are in favour of the proposed Modernization of Sone Canal. Local inhabitants belong to small farmer/ seasonal labour/ skilled or unskilled labour categories are willing to be involved as workforce during execution of the project. Stakeholders and community members voluntarily agreed to join their hands and take part during project implementation.

**FEW SNAPSHOTS OF STAKEHOLDER CONSULTATION MEETING FOR SONE WESTERN MAINCANAL**