Initial Environmental Examination

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Nepal: Irrigation Modernization Enhancement Project

Hill Lift Irrigation System

Prepared by the Department of Water Resource and Irrigation, Government of Nepal for the Asian Development Bank (ADB).

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CURRENCY EQUIVALENTS
(as of 16 September 2024)

Currency unit	–	Nepali Rupee (NR)
NR1.00	=	$0.0075
$1.00	=	NRs134.238

ABBREVIATIONS

AO	–	Association Organizer
ADB	–	Asian Development Bank
AKC	–	Agriculture Knowledge Center
BES	–	Brief Environment Study
BOQ	–	Bill of Quantities
CAMO	–	Central Agriculture Development Office
CBD	–	Convention on Biodiversity
CGF	–	Credit Guarantee Fund
CO	–	Community Organizer
COVID-19	–	Coronavirus disease 2019
CPMO	–	Central project management office
CPR	–	Community Property resources
CSD	–	Central Safeguard Desk
DDR	–	Detail Design Report
DWRI	–	Department of Water Resources and Irrigation
EA	–	Executing Agency
EIA	–	Environmental Impact Assessment
EMP	–	Environmental Management Plan
EPA	–	Environmental Protection Act
EPR	–	Environmental Protection Regulations
ESS	–	Environmental Safeguard Specialist
ESM	–	Environmental Safeguard Monitor
FMIS	–	Farmers-managed irrigation system
GoN	–	Government of Nepal
GRC	–	Grievance Readdress Committee
GRM	–	Grievance Readdress Mechanism
IBAT	–	Integrated Biodiversity Assessment Tool
IEE	–	Initial Environmental Examination

IFC	–	International Finance Corporation
IMEP	–	Irrigation Modernization Enhancement Project
IP	–	Indigenous People
MEWRI	–	Ministry of Energy, Water Resources and Irrigation
MOM	–	Management, operation, and maintenance
NAAQS	–	National Ambient Air Quality Standard
NOENQS	–	National Occupational Exposure Noise Quality Standard
NPHC	–	Nepal Population and Housing Census
O&M	–	Operation and maintenance
OHS	–	Occupational, Health and Safety
PIMS	–	Project Implementation Management and Support
PIU	–	Project implementation unit
PPE	–	Personal Protective Equipment
REA	–	Rapid Environmental Assessment
SEMP	–	Site Specific Environmental Management Plan
SEMRs	–	Semi-Annual Environmental Monitoring Report
SLO	–	Safeguard Liaison Officer
SMU	–	Subproject Management Unit
SPS	–	Safeguard Policy statement
SPPR	–	Subproject Preparation Report
UN	–	United Nation
WUA	–	Water Users' Association
WHO	–	World Health Organization
WUC	–	Water User Cooperatives
WRIDD/SD	–	Water Resources and Irrigation Development Division/Subdivision

WEIGHTS AND MEASURES

%	–	Percentage
°C	–	degree Celsius
µg/m3	–	Microgram per cubic meter
CFS	–	Cubic Feet per Second
dBA	–	decibels audible
ha	–	Hectare
km	–	Kilometer
m^3	–	cubic meter
mm	–	Millimeter

NOTES

In this report, "$" refers to United States dollars.

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EXECUTIVE SUMMARY

The Irrigation Modernization Enhancement Project (IMEP) will (i) improve the productivity, profitability, and climate resilience of 113 farmer-managed irrigation systems (FMIS) across five provinces and (ii) institutionalize irrigation modernization and integrated crop and water management (ICWM).[1] The project will help improve the incomes of approximately 56,000 families. The project will (i) modernize 32,000 hectares (ha) of surface water irrigation systems; (ii) pilot innovative hill lift irrigation systems to irrigate 1,400 ha of dry uplands (Tar); (iii) strengthen the capacity of local government institutions in integrating agriculture, water management and irrigation; and (iv) introduce climate-smart agriculture and support in agriculture value chain services. The project will have the following outcomes: increased productivity, sustainability, and profitability of farms. To meet the project objectives, the project will have three outputs:

(i) Output 1: Irrigation infrastructure will have physical components, such as modernizing the FMIS infrastructure in Bagmati, Koshi, Lumbini, and Madhesh provinces to improve performance and increase resilience to climate change.

(ii) Output 2: Irrigation and Agriculture Agencies and Farmer Organizations Strengthened is designed to develop the management and institutional framework to ensure the project investments meet their irrigation efficiency, productivity, and sustainability targets.

(iii) Output 3: Modern agriculture and value chain facilities introduced will address core weaknesses in agriculture, including the limited uptake of modern agriculture technologies, lack of mechanization and agriculture facilities

HLIP Scope. The Hill Lift Irrigation System (HLIS) provides reliable irrigation to agricultural lands on old river terraces, i.e., the Tar in Nepal's dry uplands. In addition, the project will construct 12 new hill lift subprojects (1,400ha) with modern lifting and high-efficiency piped irrigation in the mid-hill areas of Gandaki and Lumbini Provinces. Hill Lift subprojects that the federal government will implement. Considering the additional needs for technical due diligence and the assessment of farmers' acceptance, the entire hill lift component has been placed under priority 1b. For the hill lift irrigation subprojects, the WUCs will operate as water utilities using metered charging systems and will collect fees to help meet full cost recovery for operating costs. The feasibility study of all the 12 HLIPs is done, whereas the Preliminary detail design has been performed for the three subprojects. The CPMOs and PIUs will perform a detailed design of the remaining nine hill lift subprojects supported by the PIMS.

The Tar lands have relatively flat and mildly rolling topography located along the major rivers, ranging from a few hectares to several hundred hectares in size, and are potential arable lands with the potential of multiple cropping. Still, the availability of year-round irrigation is minimal. A total of 12 hill lift systems have been identified as candidates for project financing. Considering the additional needs for technical due diligence and the farmer's acceptance assessment, the hill lift component has been placed under priority 1b. The scope of work includes tubewell drilling and the construction of reservoir tanks and pipelines from tubewell to reservoir and reservoir to farmer's field. The tubewell will mostly be drilled into the river floodplain area, which is generally free from any use and is owned by the government. Similarly, reservoir tanks are proposed in the public land. Pump systems are also frequently used in storage or diversion schemes to raise water levels for irrigation purposes or to pump groundwater to augment river supplies. Environmental conservation and protection are important factors to consider when designing different systems.

[1] These include Bagmati, Gandaki, Koshi, Lumbini, and Madhesh provinces.

The objective of the IEE is to provide an overview of the environmental issues, viz., legal compliance, environmental impacts, mitigation measures to be employed, monitoring and reporting aspects to be covered during the implementation of HLIP components by the CPMO, Irrigation and River Management Office at Gorkha (for Madi-Marshyandi subprojects) and Butwal (Kaligandaki subprojects), Consultants and Contractors. This ensures that the project is implemented in an environmentally responsible manner, ensuring that all adverse effects are prevented or mitigated and positive impacts are enhanced.

Categorization. The proposed HLIP under the IMEP is classified as Environmental Category "B" as per ADB's Safeguards Policy Statement (SPS), 2009, and accordingly, this Initial Environmental Examination (IEE) is carried out. In particular, the IEE's goal is to find out what impact the project activities might have on the environment and suggest measures to avoid or reduce risks during the planning, construction, and operation stages of the Project. The CPMO shall not award any works contract under the project components until (i) relevant provisions from the EMP are incorporated into the works contract; (ii) this IEE is updated to reflect project components detailed design and CPMO has obtained ADB's clearance of such updated IEE; and (iii) The proposed construction of HLIP subprojects works is limited within the existing canal systems. As per the Environmental Protection Regulation, 2020 (with amendments) of the Government of Nepal, for the implementation of the Hill Lift Irrigation Subprojects, the borrower shall conduct the IEE studies for the subprojects and shall take Environmental clearance from the MoEWRI.

Description of the Environment. The Topography and Land Use of all the twelve subprojects are located in the three river corridors: Kaligandaki, Madi and Marshyangdi. The five subprojects in Madi Tar areas are rapidly urbanizing areas with growing trade and commerce, but the Kaligandaki and Marshayngdi subprojects are rural. The agricultural activities and human settlements in all the subprojects are located on three terraces that run parallel to the Rivers. Sub-categorizing the agricultural land into upper, middle and lower terraces helped capture the topographical differences of the agricultural land, existing cropping system and practice, access to irrigation and the likelihood of flooding/inundation and deficiency of water. Geologically, the proposed Madi subprojects lie on the Lesser Himalaya sequence of the Mid Land Group of the Upper Pre-Cambrian-Late Paleozoic era. The Kaligandaki subprojects lie in the Syangja Formation of Lakharpata Sub Group. All the subprojects have the command area, the cultivable land, and the tube well at the Madi River bank, which is barren land. The reservoir tank locations are on the public land under Municipality/Rural Municipality.

The project site has no protected areas such as national parks, wildlife reserves, hunting reserves, or conservation areas. The proposed project area will not cover any forest areas. The surrounding area community forests involves the major tree species like Sisau *(Dalbergia sissoo),* Sal tree *(Shorea robusta)* Khote Salla *(Pinus roxburghii),* Chilaune *(Schima wallichii),* Katus *(Castonopsis indica),* Teak *(Tectona grandis)*, Mango *(Mangifera indica),* Peepal *(Ficus religiosa),* Bar *(Ficus bengalensis),* Bel *(Aegle marmelos),* Jamun *(Syzygium cumini),* and Kapur *(Cinamomum camphora).* The main non-timber forest species found in the subproject areas are Amala *(Phyllanthus emblica),* Tejpatta *(Cinnamomum tamala),* Neem *(Azadirchta indica),* Tulsi *(Ocimum scantum),* and Bojho *(Acorus calamus).* Similarly, the surrounding subproject area also has a few common wild animal species- Northern Red Muntjac (*Muntiacus vaginalis*), Common Leopard (*Panthera pardus*), Rhesus Monkey (*Macaca mulatta*), Golden Jackal (*Canis aureus*), House Rat (*Rattus rattus*), Wild Boar (*Sus scrofa*), and Greater Short-nosed Fruit Bat (*Cynopterus sphinx*) are the animal species found in the nearby forest in proposed project area. The commonly seen birds in the Subproject area are the House Sparrow (Passer domesticus), Bengal Florican (*Eupodotis bengalensis*), Rose-ringed Parakeet (*Psittacula krameri*), House Crow (*Corvus splendens*), Red Jungle Fowl (*Gallus gallus*), Common Hill Myna (*Gracula religiosa*), Laughing

Dove (*Streptopelia senegalensis*), Cattle Egret (*Bubulcus ibis*) etc.

Caste is a multifaceted status hierarchy composed of all members of the society in Nepal, each of the hereditary classes of Hindu society, distinguished by the relative degree of rituals, purity or pollution, and social status. Also, no historical or cultural sites of national importance are present in the subproject area. People of the project area celebrate more than two dozen festivals. Main festivals are Dashain, Tihar, Ghatu, Chutka, Kaura Parba, Teej, Shreepanchami, Shree Krishna Janma Astami (God Krishna's Birthday), Shivaratri (God Shiva's Birthday) etc. There are a lot of religious, mythological, and historical places in this area. The agricultural system and practices existing in the project area and production enterprise would be worth promoting in the area, considering farmers' willingness to adopt them with the availability of dependable irrigation.

Potential Environmental Impacts and Mitigation Measures. The HLIP is the new irrigation system to be developed in the proposed project areas. The scope of work includes tubewell drilling construction of reservoir tanks and pipelines from tubewell to reservoir and reservoir to farmer's field. The trench works and excavation activities will have significant impacts on the farmland areas of the subproject command areas. The distribution pipeline will be underground and aligned, following both the right of way (ROW) of the local road and individual farmlands. The alignment along farm fields may result in temporary income loss if the standing crops existed along alignments during pipelaying. The potential impacts were identified in the pre-construction, construction, and operation phases. Possible environmental impacts were assessed using secondary data, stakeholder consultations, and field visits. The project will not encroach upon protected areas, their buffer zones, sensitive ecosystems, and ancient heritage sites. The project's key activities that attract environmental concerns are intake rehabilitation for surface water diversion, river bank protection, strengthening irrigation infrastructure, labor camp, and quarry operation. The environmental impacts predicted during implementation are mainly restricted to the construction stage. They will be site-specific, local in extent, temporary, and of low significance, such as dust during construction, sediment flow from construction in the river, noise pollution, and camp operation. Various construction activities will result in various occupational health and safety risks, which need to be mitigated through compliance with the safety protocols. During the operation stage, the use of increased fertilizer, pesticides, and other agricultural chemicals increases the risk of soil contamination and water pollution. Thus, the agriculture unit shall provide awareness activities for the farmers and proper training on sustainable water use and appropriate use of fertilizers and pesticides.

Furthermore, installing large tanks in river floodplains, especially in seismic-sensitive zones, adds another layer of complexity and potential risk. Large tanks can alter natural water flow patterns, potentially leading to increased soil erosion and sedimentation in surrounding areas. This can impact local ecosystems and reduce soil fertility. Also, there is a significant risk of flooding in the event of a tank breach, which can result in the inundation of surrounding land, destruction of habitats, and potential loss of life. On the other hand, the structural stability of large tanks becomes a critical issue, especially in seismic-sensitive zones, since earthquakes can cause tank failures, leading to sudden and severe flooding. Given the impacts mentioned, it is important to conduct geotechnical assessments to ensure that tanks are sited on stable ground, minimizing the risk of subsidence and structural failure risk. Additionally, implementing advanced seismic design standards for tank construction can help ensure their stability during earthquakes. This includes flexible joints, reinforced foundations, and other earthquake-resistant features. Developing comprehensive flood management plans, including constructing levees, drainage systems, and emergency spillways, can help manage and mitigate the impact of potential tank breaches. Educating local communities about risks and preparing them for potential emergencies through drills and information campaigns can reduce the impact of flooding events.

Environmental Management Plan. All impacts identified during the environmental assessment are found to be moderate, and mitigation measures are readily available. Most of these impacts are linked to civil works and predicted to be of moderate significance, short-term, and localized, which can easily be mitigated (through good design and construction planning) or mitigated through the proper implementation of the EMP proposed in this report.

The specific management measures laid down in the IEE will successfully address any adverse environmental impacts due to the subproject. Implementation of appropriate measures during the design, construction, and operation phases will minimize negative impacts to acceptable levels. To ensure that these mitigation measures are implemented and negative impacts mitigated, the measures will be included in the contractor's contract specification. Contractors' conformity with contract procedures and specifications and implementation of the approved Site-specific environmental management plan (SEMP) during civil works will be carefully monitored by the Central Project Management Office (CPMO). Further, the environmental monitoring plans also provide adequate opportunities for course correction to address any residual impacts during construction or operation stages.

In the event of unanticipated environmental impacts not considered significant during implementation and not considered in the IEE and EMP, the CPMO shall prepare a corresponding time-bound and budgeted corrective action plan acceptable to ADB, ensure that the contractor implements it, and report accordingly in environmental monitoring reports to ADB.

Implementation Arrangement. The Ministry of Energy, Water Resources and Irrigation (MEWRI) will be the Executing Agency (EA), and the Department of Water Resources and Irrigation (DWRI) will be the implementing agency of the project. The Central Project Management Office (CPMO) will be responsible for the project's overall implementation and ensuring compliance with ADB's environmental safeguards requirements. The CPMO will establish a "Central Safeguard Desk" (CSD) and comprise a Safeguard Liaison Officer (SLO) supported by an Environmental Safeguard Specialist (ESS) of PIMS. The SLO will ensure full compliance with the overall environmental and social safeguards requirements of the project. The SLO will work closely with the environmental and social development focal points of the Water Resources Irrigation Development Division (WRIDD).

The ESS will support the CPMO and field offices in maintaining overall environmental safeguards and OHS requirements in the project. The ESS will prepare an e-MIS and support the safeguarding of field monitors at field offices in monitoring environmental and OHS activities. The CPMO will mobilize a full-time Environmental Safeguard Monitor (ESM) at the project site. ESM will work under the guidance of ESS of PIMS. The contractor supporting civil works under DWRI shall include the cost for preparing and implementing site-specific environmental management (SEMP) and OHS plan along with mobilizing the Environment Health and Safety (EHS) officer and include the cost in their BOQ. The inclusion of sufficient cost for EMP and safeguard/OHS staff shall be verified and assured by the senior environment specialist at CPMO. The integrated SEMP will be approved by the employer prior to their field mobilization.

Consultation, Information Disclosure, and Grievance Redress Mechanism. Consultations were undertaken in the HLIP subprojects by the local government offices during the feasibility and detailed design study period, with the requirements pertaining to social and environmental considerations. Prior to consultation meetings with local stakeholders, advance notification was circulated, and coordination was established with stakeholders through the project office. Additionally, the consultations focused on seeking stakeholder's opinions, especially the local government's views on potential physical and economic impacts, key risks, mitigation measures,

and many more. The HLIP scope was informed to officials of local government officers. The participants were in complete agreement about the benefits of the subproject and expressed full support for it. The ADB safeguard requirements on environmental assessment, involuntary resettlement, GRM procedures, etc., were shared with Municipal authorities and the Water User Association (WUA).

ADB SPS 2009 also requires establishing a project-specific, responsive, readily accessible, and culturally appropriate grievance redress mechanism (GRM). The GRM is a three-tier arrangement that facilitates time-bound grievance resolution at each level. Responsible persons and agencies/offices are identified to address grievances and seek appropriate advice at each stage, as required. Institutional arrangements, including the constitution of grievance redress committees (GRC) at various levels, will be ensured to function throughout the project duration. The CPMO shall ensure the constitution of these committees and oversee the implementation of grievance redress processes, including adherence to time limits, record keeping, and documentation at each level. The presence of GRM or seeking relief from GRM is not a bar to taking grievances and complaints to the judiciary system of the land. Further, there is an ADB Accountability Mechanism whereby people adversely affected by ADB-financed projects can express their grievances, seek solutions, and report alleged violations of ADB's operational policies and procedures, including safeguard policies.

Monitoring and Reporting. CPMO will monitor the overall progress of EMP implementation of the entire components of IMEP. The CPMO, PIMS, and contractor safeguard team will undertake their respective roles in site inspections and document reviews to verify compliance with the EMP and SEMP and progress toward the final outcome. The contractor will conduct day-to-day implementation of the SEMP and will submit monthly reports to the CPMO.

The PIMS will submit quarterly environmental monitoring reports to CPMO, which will include a summary of the monthly monitoring activities of the contractor and results of any independent monitoring or inspection activities of the project. CPMO, with support from the PIMS, shall accomplish semi-annual environmental monitoring reports (SEMRs) starting from the effectivity date up to the end of the construction phase, which shall be submitted to ADB for review and disclosure on the ADB website. The CPMO shall prepare and submit an annual environmental monitoring report during the operation phase until ADB issues a project completion report.

Conclusions and Recommendations. Department of Water Resources and Irrigation is promoting lift irrigation in the tar areas considering the demand of the medium to marginal farmers of the project area. The proposed lifting irrigation subprojects in Lumbini and Gandaki provinces will benefit the local farmers and people. The magnitude of potential impacts and the presence of environmentally sensitive areas in the subproject influence areas are less significant. According to the ADB Safeguard Policy Statement (SPS-2009), Hill Lift Irrigation is categorized as B, and this IEE report is prepared to comply with ADB's requirements. As per the Environmental Protection Regulation, 2020 (with amendments) of the Government of Nepal, for the implementation of the Hill Lift Irrigation Subprojects, the borrower shall conduct the IEE studies for the subprojects and shall take Environmental clearance from the MoEWRI. The EMPs mentioned in the report are considered sufficient to meet the environmental assessment requirements of ADB for the project. However, it will be reviewed and updated as necessary before and following the detailed design. In case of any unanticipated impact (including a scope or design change) occurring during project implementation, this IEE and EMP must be further updated by DWRI and cleared by ADB before any related works commence or are cleared to continue.

I. INTRODUCTION

A. Background

1. ADB has supported Nepal since the 1980s through five FMIS sector projects consisting of 1,190 subprojects (456 small and 734 medium scale) irrigating a total area of 140,704 ha. Although the projects were evaluated as successful,[1] there are however key issues that need to be addressed to meeting the needs of productivity and climate resilience including; (i) the devolved irrigation and agriculture agencies lack capacities and resources to support the irrigation and agriculture management, issues include slow progress in passing needed legislation, deploying staff, as well as lack of clarity on mandates and responsibilities and coordination among the three tiers of government; (ii) the management performance of the WUA remains weak, with insufficient capacities and resources to meet present needs and future requirement under climate change; (ii) there is a need for a strong nucleus organization at the field level for integrated management of irrigation and agriculture to meet operational requirements including, improved irrigation efficiencies, agriculture productivity and climate resilience; (iii) there is a lack of communications to the dispersed subprojects, effective communication to the to the different subproject stakeholders is critical to meet long term long term needs of irrigation and agriculture including advisories on weather, climate change, water and agriculture management, crop technologies; (iv) farmers face many challenges including climate change, acute labor shortages, low productivity and lack of access to inputs, marketing constraints, food and nutrition security and lack of dissemination of technologies. The government must support the sector in preparing a national strategy to address the increasing risks and understanding of climate change to make the systems resilient and self-sustainable.

2. The project is closely aligned with (i) ADB's Strategy 2030's operational priorities on gender equality, climate resilience, and rural development and food security; (ii) Sustainable Development Goals on economic growth, social inclusion and environmental protection;[2] and (iii) ADB's Water Sector Directional Guide that aims for poverty reduction, gender equality, climate resilience, food security, and capacity building.[3] The project also aims to: (i) empower women farmers, (ii) ensure water security and build climate resilience, and (iii) increase food security and reduce rural poverty.[4]

B. Impact and Outcome

3. The project will be aligned with the following impact: national food security increased. The project will have the following outcome: climate resilient irrigated agricultural productivity and sustainability enhanced. The project beneficiaries will be small and marginal farmers who will benefit through access to water, knowledge of managing modern and resilient infrastructure, increased yields, and incomes. The project will mainstream FMIS investments into the national financing system to reduce the country's reliance on external donor support.

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[1] ADB. 2020. Completion Report: Community Irrigation Project in Nepal. Manila. Covered small scale FMIS in Lumbini, Karnali and Sudurpaschim Provinces. Whereas the (i) ADB. Nepal: Irrigation Sector Project (1988), (ii) ADB. Nepal: Second Irrigation Sector Project (16 May 1996), (iii) ADB. Nepal: Community-Managed Irrigated Agriculture Sector Project (17 Nov. 2004), and (iv) Nepal: Community-Managed Irrigated Agriculture Sector Project–Additional Financing (10 April 2014) were the four medium scale FMIS supported by ADB, which covered Koshi, Madhesh, Bagmati, Gandaki, Lumbini, Karnali and Sudurpaschim Provinces.

[2] SDG 1.5- build resilience of poor, 2.4- resilient agricultural practice, 5.1- gender equality, 10.2- inclusive development, 12.2- sustainable use of natural resources, 13- combat climate change

[3] ADB.2019. *Strategy 2030*. Manila and ADB. 2022. *Strategy 2030 Water Sector Directional Guide*. Manila

[4] Nepal has built an enabling legal and regulatory framework to spur climate action and its climate change commitments are embedded in a Green, Resilient and Inclusive Development (GRID) approach. The government issued the Kathmandu Declaration for the GRID Partnership in 2021.

C. Outputs

4. The project will have the following outcomes: increased productivity, sustainability, and farm profitability. To meet the project objectives, the project will have three outputs, as summarized below.

5. **Output 1: Irrigation Infrastructure Modernized**: This output will modernize FMIS infrastructure in Bagmati, Koshi, Lumbini, and Madhesh provinces to improve performance and increase resilience to climate change. Across those irrigation systems, the project will (i) provide gated intake structures and protect riverbanks and hill slopes to reduce flood and sediment ingress; (ii) improve irrigation efficiency, stability, and equitable management of irrigation water through targeted canal lining and improved control structures and provision of cross drainage; (iii) support on-farm irrigation by upgrading minor canals and expanding use of modern pipe distributions; (iv) introduce hill lift irrigation subprojects in the largely unirrigated mid hill upland areas (Tar). The program will include:

(i) Rehabilitation and upgrading of about 33,000ha of surface water irrigation, including; (i) 66 hill irrigation subprojects (5,889ha), 34 terai irrigation subprojects (11,563ha) in Koshi, Madhesh and Bagmati provinces; and (iii) upgrading for modernization of key infrastructure of the Rajapur Irrigation Project (RIP- 14,500ha) in Lumbini Province. In addition, the project will construct 12 new hill lift subprojects (1,400ha) with modern lifting and high-efficiency piped irrigation in the mid-hill areas of Gandaki and Lumbini Provinces.

(ii) Improved on-farm irrigation will be supported at all the FMIS subprojects and Rajapur. Advanced on-farm irrigation, including piped, micro irrigation and poly houses will be supported at the hill lift sub-projects.

(iii) Pilot community conjunctive groundwater program at three selected terai FMIS locations focusing on the electrification of farmers and other tubewells.

6. **Output 2: Irrigation and Agriculture Agencies and Farmer Organizations Strengthened**. The **output** is designed to develop the management and institutional framework to ensure the project investments meet their irrigation efficiency, productivity, and sustainability targets. The program will be implemented through a new and modernized approach to integrated Crop and Water Management (ICWM) incorporating climate change, sustainable operation and maintenance (O&M) of the irrigation infrastructure, empowered farmer organizations, support the development of agri-enterprises, support in the market chain and access to finance. The output will strengthen the capacity of PIUs, AKCs and the irrigation and agriculture units at the local level in integrating irrigation management and agriculture development in overall FMIS sector development. At the farm level, the project will; (i) strengthen WUAs capacity to operate better and maintain irrigation systems;[5] and (ii) establish in selected irrigation systems Water User Cooperatives (WUCs) at the pilot level who will have integrated irrigation management and agribusiness functions designed to maximize the opportunities of irrigation investments including improved access to government subsidies and rural finance, support for the market chain, facilitate agro-enterprises, and network with private agri-enterprises.[6] For the hill lift irrigation subprojects the WUCs will operate as water utilities using metered charging systems and collect fees to help meet full cost recovery for operating costs. The output will develop new ICWM guidelines including design, management and extension support, climate change risks, and develop a road map for the long-term strategy for investment and

[5] The WUAs will remain as core organization for irrigation management in all subprojects,

[6] The WRIDDs will support farmers in the initial establishment and registration of the WUCs through the cooperative units at the local level. Irrigation management functions will be supported by the WRIDDs and Agribusiness functions supported by the AKCs. The board of directors of the WUCs will initially incorporate the key representatives of the WUA.The twenty pilot WUCs will initially include 12 hill lift, 3 terai FMIS, 2 hill FMS and 3 Rajapur). Subject to the results of the pilots and farmer interest, the WUC program would be upscaled to other subprojects.

management of the FMIS subprojects in Nepal. The guidelines and parallel training modules will support the project programs and wider training of Nepal's irrigation and agriculture extension workers. The program will include:

(i) Training and strengthening of the devolved institutions focusing on the PIUs, AKCs and the irrigation and agriculture units at the local level.

(ii) Strengthening of field level management, including (a) strengthening of WUAs; and (b) exploring for establishment of parallel new WUCs who could enhance support in irrigation management operations and agribusiness functions. The WUCs will be initially piloted in 20 subprojects (12 hill lifts, 3 terai FMIS, 2 hill FMS and 3 Rajapur). Subject to the results of the pilots and farmer interest the WUC program would be upscaled to other subprojects. The farmers will work with the PIUs, who will support them in the initial establishment and registration of the WUCs through the cooperative units at the local level. Irrigation management functions will be supported by the PIUs/hill lift offices, and agribusiness functions will be supported by the AKCs. The WUC management will initially incorporate the key representatives of the WUA.

(iii) Enhanced Access to Rural Finance: The project will review current policies and programs for finance and subsidies for irrigation and agriculture. Based on the review, the project will work with selected local administrations, lending agencies, the private sector, WUA and WUC to train and pilot new and workable models to improve access and better target financial support for farmers to invest in farm enterprises, on-farm irrigation, upgrading of irrigation etc. The program will also address alternative ways to meet financing costs for irrigation maintenance and repairs beyond the farmers' capacities.

7. **Output 3: Modern agriculture and value chain facilities introduced:** The program will **address** core weaknesses in agriculture, including the limited uptake of modern agriculture technologies and lack of mechanization and agriculture facilities. The program will explore upstream and downstream opportunities to promote value addition, including demonstration and training in (i) adopting climate-smart agricultural practices to improve crop yield, quality and production (ii) adopting advanced agricultural technologies, including modern farm machinery and equipment to enhance efficiency, productivity, and address labor shortages; (iii) value adding through agriculture facilities including crop collection and processing, crop storage, and buying and selling of inputs and outputs. The Project will support the establishment of digital advisory services, which, through digital apps and mobile phones, will provide information on weather, marketing and agriculture advisory services, improving farmers' operational efficiency and decision-making. As the farmers and farmer organizations lack access to finance, the project will pilot the provision of partial financing to selected WUAs/WUCs who, based on viable and sustainable business models, want to invest in modern agriculture machinery and construction or rehabilitation of agriculture facilities including marketing, storage and processing. The WUA/WUC will be required to contribute 50% of financing for machinery and 15% for facilities, following the working directives of DOA. The program will include:

(i) Development: of agricultural technologies and enterprise development focusing on the interventions that will make the most impact on the needs of farmers in the subproject areas and will include planning and management of cropping patterns using farmer field school approach, training and demonstrations including seed multiplications, green manuring, zero tillage, nature-based solution for soil conservation, and consolidated farming amongst others. The training will identify potential business opportunities and promote the establishment of agriculture enterprises.

(ii) Demonstrations: of (a) agriculture equipment and machinery to support mechanization to reduce reliance on scarce agricultural labor; (b) agriculture facilities to improve the marketing and processing, including agriculture collection centers, grain storage, WUC

storage facilities and polyhouses. The project will procure equipment for the demonstrations which will be assigned to the WUAs/WUCs for future rental to farmers once the demonstrations are completed.

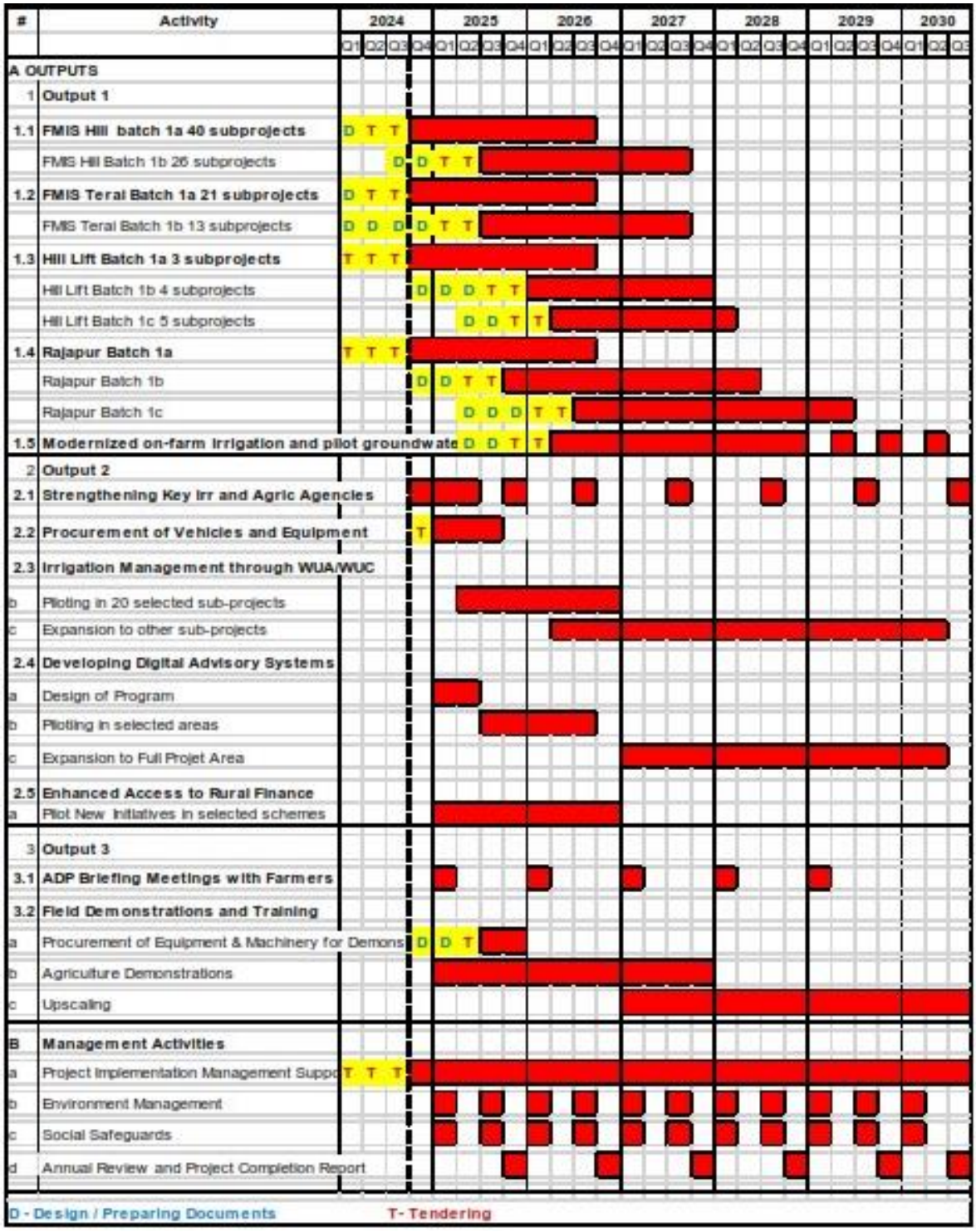
(iii) Upscaling: Following the demonstrations, the project will provide financial support for selected WUAs/WUCs to invest in modern agriculture machinery, polyhouses, and agriculture facilities. Support will be provided to WUA/WUCs to construct or rehabilitate WUA/WUC facilities for crop storage and agro-processing. The aim will be to support selected investments that can demonstrate a viable and sustainable management and business model, be self-financing, and show a significant impact on the viability of the subproject. The project will procure and assign equipment and facilities to the relevant WUA/WUC who will contribute 50% of the costs for machinery and 15% for the WUA/WUC facilities.

(iv) Establishment: of communications through digital advisory services to provide cost-effective access to information to the dispersed and remote irrigation areas and stakeholders. The program will include targeted weather, climate change, marketing, and agricultural advisory services. The system will build on existing social media and include videos, SMS, and apps emphasizing user experience focusing on how to meet the needs of different demographic groups of farmers, government, private sector and small-scale entrepreneurs.

D. Project Implementation Plan

8. The overall project implementation plan of the IMEP is presented in the table below.

Table 1: Implementation Schedule of IMEP



E. Hill Lift Irrigation Project Scope and Locations

9. The objective of the hill lift irrigation system (HLIS) is to provide reliable irrigation to the agricultural lands located on old river terraces, called Tar in Nepal, by installing the tubewell on a river flood plain. The Tar lands have relatively flat and/or mildly rolling topography located along the major rivers, ranging from a few hectares to several hundred hectares in size, and are potentially arable lands with the potential of multiple cropping, but the availability of year-round irrigation is very limited. A total of 12 hill lift systems have been identified as candidates for project financing. Considering the additional needs for technical due diligence, and assessment of farmer's acceptance, the entire hill lift component has been placed under priority 1b (**Figure 1**). Based on the prefeasibility reports, the scope of the hill lift system is as follows.

Table 2: Scope of Work under Hill Lift Irrigation System.

S. N	Scope of Work	Unit	Number	Remark
1	Tubewell	Number	N/A	The location and number have yet to be identified. The number of tubewells in each hill lift scheme will depend on the discharge recorded after the investigation tubewell is installed.
2	Pipe from tubewell to storage tank	Meter	12,412	The pipeline length will be changed after the reassessment of the service area of each system.
3	Storage Tank	M^2	4721	The size of the tank will be finalized after the detailed design and confirmation of the command area
4	Distribution network	KM	123.6	Around four out of 12 systems are getting water from the surface system, the system may need to be revised reducing the length of distribution network

Source: Compilation from subproject feasibility reports, August 2019 & November 2022.

10. The scope of work includes tubewell drilling and the construction of reservoir tanks and pipelines from tubewell to reservoir and reservoir to farmer's field. The tubewell will mostly be drilled into river flood plain area which is generally free from any use and lies in the ownership of government. Similarly, reservoir tanks are proposed in GON land. The tubewell drilling locations are yet to be confirmed. The distribution pipeline will be underground and aligned, following both the right of way (ROW) of the local road and individual farmlands. The alignment along farm fields may result in temporary income loss in case the standing crops existed along alignments during pipelaying.

F. Purpose of Initial Examination

11. The objective of the IEE is to provide an overview of the environmental issues viz., legal compliance, environmental impacts, mitigation measures to be employed, monitoring and reporting aspects to be covered during the implementation of HLIP components by the CPMO, Irrigation and River Management Office at Gorkha (for Madi-Marshyandi subprojects) and Butwal (Kaligandaki subprojects), Consultants and Contractors. This ensures that the project is implemented in an environmentally responsible manner, ensuring that all negative effects are prevented or mitigated and positive impacts are enhanced.

G. Methodology

12. This IEE report was prepared by conducting site visits, conducting stakeholder consultations, collecting primary and secondary data, assessing the existing environmental conditions at the project component locations, identifying the potential environmental impacts that may occur during project implementation, and developing the relevant mitigation measures, including monitoring. Baseline environmental monitoring for air quality, noise level and groundwater quality of the tube well will be done before the start of construction activities.

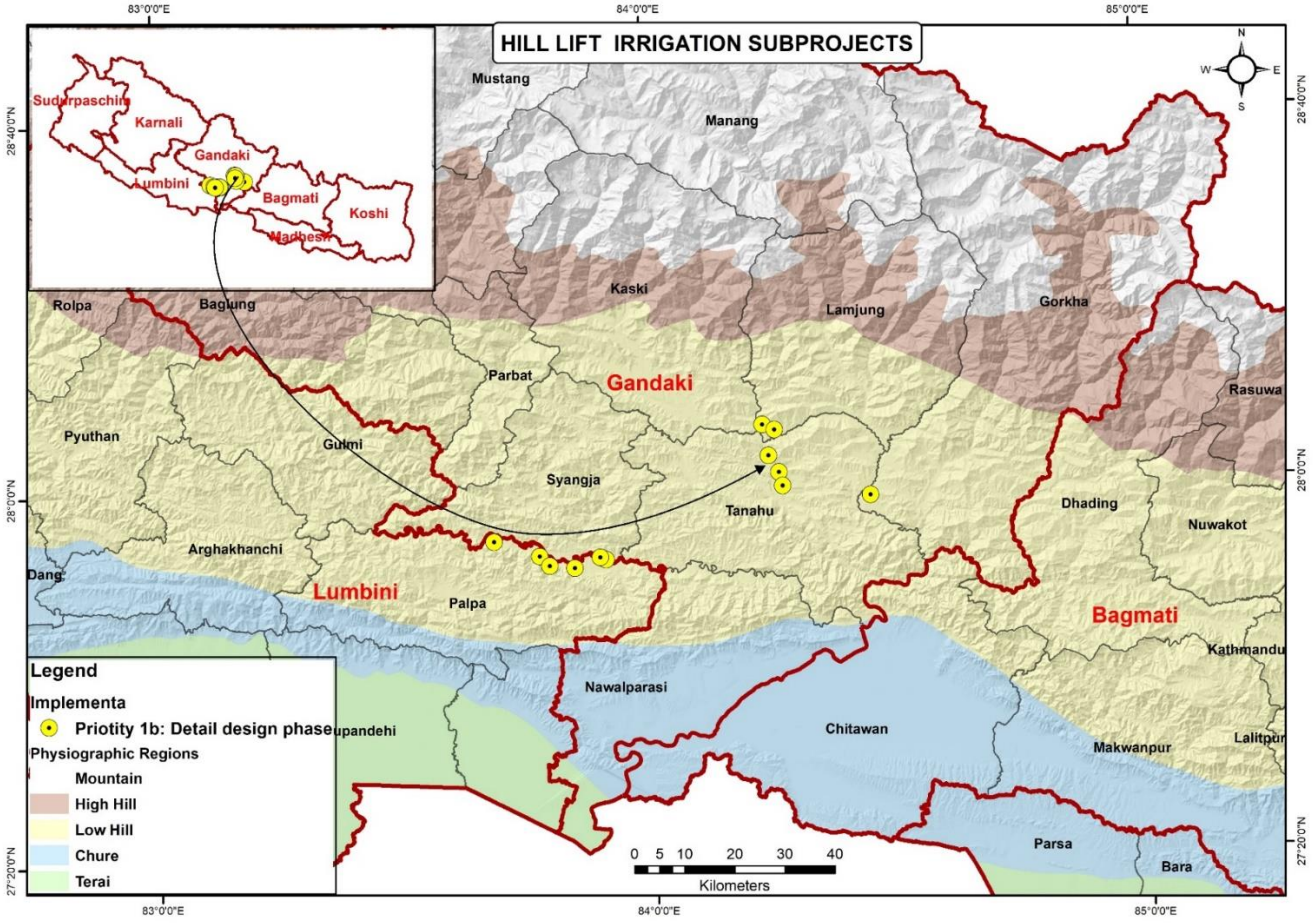
13. During the IEE study, public consultations were conducted with the ward representative, officials of respective municipalities and community people. Their views were incorporated into the IEE and in the planning and development of the project components.

H. Structure of IEE Report

14. The report has been structured to include the following chapters:

(i) Introduction;
(ii) Policy, Legal, and Administrative Framework;
(iii) Description of the Project;
(iv) Description of the Environment;
(v) Anticipated Environmental Impacts and Mitigation Measures;
(vi) Environmental Management Plan;
(vii) Information Disclosure, Consultation, and Participation;
(viii) Institutional Arrangements and Grievance Redress Mechanism;
(ix) Monitoring and Reporting;
(x) Conclusion and Recommendations.

Figure 1: Hill Lift Irrigation Subprojects Location in two Provinces under IMEP



Source: Department of Survey, GoN and Detail Feasibility Report 2022

Table 3: Proposed Hill Lift Irrigation Subprojects in 4 districts

S. N.	Name of ISP	Province	District	Rural/Municipality	Wards	CCA
1	Baireini	Gandaki	Tanahun	Vyas Municipality	10	49.35
2	Dumsi	Gandaki	Tanahun	Vyas Municipality	10	102.2
3	Duipiple	Gandaki	Lamjung	Madhya Nepal	4	124.96
4	Sirshaghat	Gandaki	Lamjung	Madhya Nepal	4	50.4
5	Tilakpur	Lumbini	Palpa	Rampur Municipality	6	105.53
6	Pyakluk	Lumbini	Palpa	Rampur Municipality	6	109.73
7	Alketar	Lumbini	Palpa	Rampur Municipality	8	157.97
8	Ramtar-Kumalgaun	Lumbini	Palpa	Rampur Municipality	10	90.55
9	Majhigaun	Lumbini	Palpa	Rambha Rural Municipality	1	60.93
10	Chyanglitar	Gandaki	Gorkha	Palungtar Municipality	7	415
11	Kalesti	Gandaki	Tanahun	Byas Municipality	7	135
12	Siko Danda	Lumbini	Palpa	Rampur Municipality	10	14

Source: Detail Feasibility Report 2022

II. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

A. ADB Safeguard Policy Statement, 2009

15. ADB requires the consideration of environmental issues in all aspects of ADB's operations, and the requirements for environmental assessment are described in ADB SPS, 2009. ADB environmental safeguards are triggered if a project is likely to have potential environmental risks and impacts. A project is classified based on the most environmentally sensitive component and assigned one of the four environmental categories (A, B, C, or FI) defined in the SPS. These categories are as follows.

(i) **Category A**: Project likely to have significant adverse environmental impacts that are irreversible, diverse, or unprecedented. These impacts may affect areas larger than the sites or facilities subject to physical works. An environmental impact assessment (EIA), including an environmental management plan (EMP), is required.

(ii) **Category B**: Project with potential adverse environmental impacts that are less adverse than those of category A projects. These impacts are site-specific, few if any of them are irreversible, and in most cases mitigation measures can be designed more readily than for category A projects. An initial environmental examination (IEE), including an EMP, is required.

(iii) **Category C:** Project likely to have minimal or no adverse environmental impacts. An EIA or IEE is not required, although environmental implications must be reviewed.

(iv) **Category FI**: The project is classified as category FI if it involves investing ADB funds in or through a financial intermediary.

16. The subproject underwent initial screening using ADB's rapid environmental assessment (REA) checklist. The rapid assessment results show that the project is unlikely to cause significant adverse impacts and, therefore, is classified under Category B per ADB SPS. Thus, this IEE report has been prepared following ADB SPS requirements for projects with Category B classification.

17. **Environmental Assessment**. Environmental assessment shall include a description of environmental and social baseline to provide an understanding of current conditions forming the benchmark against which project components' impacts are assessed. Environmental impacts and risks will be analyzed for all relevant stages of the project cycle, including the design and planning stage, construction, operations, decommissioning, and post-closure activities such as rehabilitation or restoration.

18. **Environmental Planning and Management**. The Central Project Management Office (CPMO) shall prepare an environmental management plan (EMP) to be included in the IEE report. The EMP shall describe and address the potential impacts and risks identified by the environmental assessment. The EMP's level of detail and complexity and the priority of the identified measures and actions will be commensurate with the subproject's impact and risks. The EMP shall include the proposed mitigation measures, environmental monitoring and reporting requirements, emergency response procedures, related institutional or organizational arrangements, capacity development and training measures, implementation schedule, cost estimates, and performance indicators.

19. **Public Disclosure**. The CPMO shall submit the following to ADB for review, clearance and disclosure. ADB will disclose acceptable reports received and endorsed by the DWRI on the ADB website so affected people, other[8] stakeholders and the public can provide meaningful inputs into

[8] Per ADB SPS, 2009, prior to disclosure on ADB website, ADB reviews the "borrower's/client's social and

the subproject design and implementation.

(i) Draft / updated / final IEE upon receipt;

(ii) a new or updated IEE and corrective action plan prepared during subproject implementation, if any, upon receipt; and

(iii) environmental monitoring reports submitted during subproject implementation upon receipt.

20. **Consultation and Participation**. The CPMO shall carry out meaningful consultation[9] with affected people and other concerned stakeholders, including civil society, facilitating their informed participation. The consultation process and its results will be documented and reflected in the environmental assessment report.

21. **Grievance Redress Mechanism**. The CPMO shall establish a mechanism to receive and facilitate the resolution of affected peoples' concerns, complaints, and grievances about the subproject's environmental performance. The grievance mechanism shall be scaled to the risks and adverse impacts of the subproject.

22. **Monitoring and Reporting**. The CPMO shall monitor, measure and document the progress of implementation of the EMP. If necessary, CPMO will identify the necessary corrective actions and reflect them in a corrective action plan. CPMO will prepare and submit to ADB semi-annual environmental monitoring reports that describe progress with the implementation of the EMP and compliance issues and corrective actions, if any. Reporting will continue for subprojects likely to have significant adverse environmental impacts during operation until ADB issues a project completion report.

23. **Unanticipated Environmental Impacts**. Where unanticipated environmental impacts become apparent during subproject implementation, CPMO shall update the environmental assessment and EMP or prepare a new environmental assessment and EMP to assess the potential impacts, evaluate the alternatives, and outline mitigation measures and resources to address those impacts.

24. **Pollution Prevention and Control Technologies**. During the design, construction, and operation of the project component, the CPMO shall apply pollution prevention and control technologies and practices consistent with international good practice, as reflected in internationally recognized standards such as the International Finance Corporation (IFC) World Bank Group's Environmental, Health and Safety Guidelines. These standards contain performance levels and normally acceptable measures applicable to subprojects. When the government regulations differ from these levels and measures, the subproject shall achieve whichever is more stringent. If less stringent levels or measures are appropriate in view of specific project circumstances, DWRI, through CPMO, will provide full and detailed justification for any proposed alternatives that are

environmental assessment and plans to ensure that safeguard measures are in place to avoid, wherever possible, and minimize, mitigate, and compensate for adverse social and environmental impacts in compliance with ADB's safeguard policy principles and Safeguard Requirements 1-4." Upon its receipt of acceptable safeguard documents and endorsement by CPMO, ADB discloses the same on ADB website.

[9] Per ADB SPS, 2009, meaningful consultation means a process that (i) begins early in the project preparation stage and is carried out on an ongoing basis throughout the project cycle;1 (ii) provides timely disclosure of relevant and adequate information that is understandable and readily accessible to affected people; (iii) is undertaken in an atmosphere free of intimidation or coercion; (iv) is gender inclusive and responsive, and tailored to the needs of disadvantaged and vulnerable groups; and (v) enables the incorporation of all relevant views of affected people other stakeholders into decision making, such as project design, mitigation measures, the sharing of development benefits and opportunities, and implementation issues.

consistent with the requirements presented in ADB SPS.

25. **Occupational Health and Safety**. The CPMO shall ensure that workers are provided with a safe and healthy working environment, considering risks inherent to the sector and specific classes of hazards in the subproject work areas, including physical, chemical, biological, and radiological hazards. CPMO shall ensure to take steps to prevent accidents, injury, and disease arising from, associated with, or occurring during the course of work by (i) identifying and minimizing, so far as reasonably practicable, the causes of potential hazards to workers; (ii) providing preventive and protective measures, including modification, substitution, or elimination of hazardous conditions or substances; (iii) providing appropriate equipment to minimize risks and requiring and enforcing its use; (iv) training workers and providing them with appropriate incentives to use and comply with health and safety procedures and protective equipment; (v) documenting and reporting occupational accidents, diseases, and incidents; and (vi) having emergency prevention, preparedness, and response arrangements in place.

26. **Community Health and Safety**. The CPMO shall identify and assess the risks to and potential impacts on the safety of affected communities during the project's design, construction, operation, and decommissioning and will establish preventive measures and plans to address them in a manner commensurate with the identified risks and impacts.

27. CPMO shall apply preventive and protective measures for occupational and community health and safety consistent with international good practice, as reflected in available national standards on Environmental, Health and Safety. Where national standards are not available, internationally recognized standards such as the World Bank Group's Environmental, Health and Safety Guidelines will be adhered to[10]. CPMO shall also adhere to necessary protocols in response to emerging infectious diseases such as coronavirus (COVID-19), consistent with the guidelines of relevant government healthcare agencies and the World Health Organization.

28. **Physical Cultural Resources**. The CPMO is responsible for siting and designing the project components to avoid significant damage to physical and cultural resources. Such resources likely to be affected by the subproject will be identified, and qualified and experienced experts will assess the subproject's potential impacts on these resources using field-based surveys as an integral part of the environmental assessment process. When the proposed location of a subproject component is in areas where physical and cultural resources are expected to be found as determined during the environmental assessment process, chance finds procedures shall be included in the EMP.

29. **Environmental Audit**. When the subproject involves existing activities or facilities, CPMO is responsible for ensuring that relevant external experts perform environmental audits to determine the existence of any areas where the subproject may cause or is causing environmental risks or impacts. If the subproject does not foresee any new major expansion, the audit constitutes the environmental assessment for the subproject.

30. **Bidding and Contract Documents**. IEE, which contains the EMP, shall be included in bidding and contract documents and verified by CPMO. The CPMO shall also ensure that bidding and contract documents include specific provisions requiring contractors to (i) comply with all other conditions required by ADB[11] and (ii) to submit to CPMO, for review and approval, a site-specific

[10] World Bank Group, 2007. Environmental, Health, and Safety General Guidelines. Washington, DC.

[11] Contractors to comply with (i) all applicable labor laws and core labor standards on (a) prohibition of child labor as defined in national legislation for construction and maintenance activities; (b) equal pay for equal work of equal value regardless of gender, ethnicity, or caste; and (c) elimination of forced labor; and with (ii) the requirement to disseminate information on sexually transmitted diseases, including HIV/AIDS, to employees and local communities

environmental management plan (SEMP), including (i) proposed sites/locations for construction work camps, storage areas, hauling roads, lay down areas, disposal areas for solid and hazardous wastes; (ii) specific mitigation measures following the approved EMP; (iii) monitoring program as per SEMP; and (iv) budget for SEMP implementation, among others as may be required. No work can commence prior to the approval of SEMP. A copy of the EMP and/or approved SEMP will always be kept on-site during the construction period. Non-compliance with, or any deviation from, the conditions set out in the EMP and/or SEMP constitutes a failure in compliance and shall require corrective actions.

31. **Conditions for Award of Contract and Commencement of Work**. CPMO shall not award any works contract under the project components until (i) relevant provisions from the EMP are incorporated into the works contract; (ii) this IEE is updated to reflect project components detailed design and CPMO has obtained ADB's clearance of such updated IEE; and (iii) The proposed rehabilitation works of the FMIS are limited within the existing canal systems. There are no construction of new head works and changes in the main canal systems. Thus, for the GoN requirements, the project component does not trigger BES/IEE/EIA.

B. National Environmental Legislations

32. Most of the national policies and laws of GoN are oriented towards achieving environmentally sound economic development and growth, and conservation of natural resources and cultural heritage of the country. The following are the summaries of the relevant policies, acts, regulations, and guidelines.

33. **The Constitution of Nepal, 2015**. This is the fundamental law of the country, and the sections pertaining to environmental protections are as follows:

34. **Article 30 (1)** of the constitution guarantees a "clean environment'' as a fundamental right and elaborates that "every citizen shall have the right to live in a clean and healthy environment".

35. **Article 30 (3)** encourages the state to formulate necessary legal frameworks to balance environment and development.

36. Nepal has enacted comprehensive environmental policies and laws covering various environmental and sector issues. The Environmental Protection Act (EPA) of 2019 and the Environmental Protection Regulations (EPR) of 2020 are two important legal frameworks for environmental protection. According to the EPA and EPR, all development projects should first be screened using criteria that are based on the scale of the project stipulated in Schedules 1, 2 and 3 of EPR to determine the level of environmental assessment required. Projects that could result in some environmental impacts require a brief environment study (BES) BES, projects having moderate environmental impacts require an initial environmental examination (IEE), and large projects that could result in major and adverse environmental impacts are required to go undergo an environmental impact assessment (EIA) process. The EPA makes necessary arrangements to disclose EIA reports to the general public to render opinions and suggestions.

37. **Environment Protection Act 2019 (2076 BS).** The act emphasises new aspects like provisions of BES, IEE and EIA under the jurisdiction of local authority, provincial government, and central government. This act is a pre-requirement for any development project in the country to comply with the environmental safeguards. Article 2 (3) 1 of this act has given provision for environmental assessment. This clearly mentions that the environmental assessment is a prerequisite before the implementation of any project. The detail of the criteria is indicated in

surrounding the project sites.

Environment Protection Rules 2020.

38. **Environment Protection Rules 2020 (2077 BS).** This rule has defined thresholds and equivalent environmental assessments (i.e., BES, IEE and EIA). The proposed HLIP, with all Subprojects, i.e. 12 systems, are the new irrigation systems. Since the proposed irrigation systems are new, with a command area is more than 100 ha. in all three river basins, and an IEE needs to be prepared as per EPR, 2020. Thus, as per EPR 2020, the project component scope triggers IEE for the Hill Lift Irrigation Subprojects. The irrigation projects have the following requirements for environmental assessment as per EPR 2020, listed in Table 4**.** Few HLIS will need to undertake the process of getting IEE as per EPR 2020 due to the size of more than 100 ha. irrigation area.

Table 4. Irrigation Projects Requiring Environment Assessment as per GoN-EPR, 2020

Schedule 1- BES	Schedule 2- IEE	Schedule 3- EIA
Water Resources Sector:		
• Construction of up to 100-hectare irrigation area of lift irrigation project	• *Irrigation with new system* a) Irrigation of 200 to 2000-hectare area in Terai and inner Terai region (d) Construction of more than 100-hectare irrigation area of lift irrigation project • *Rehabilitation of Irrigation system* a) Construction of new headwork or operation of rehabilitation project with the change in the main canal • Water Resource Development Work with the resettlement of 25 to 100 population	• Irrigation with new system a) Irrigation of more than 2000-hectare area in Terai and inner Terai region • Water Resource Development Work with the resettlement of more than 100 population • Construction of Multipurpose water dam • Transfer of water from one water source to another (inter-basin water transfer) for the utilization

Source: Environment Protection Rules 2020

39. Other relevant government laws and regulations. Government environmental acts, rules, policies, and regulations will govern the implementation of project components proposed under the project. The contractors for HLIP will need to comply with all the government laws and regulations stated in Table 5 below.

Table 5: Relevant Government Laws and Regulations

S.N.	Policies, Acts, Regulations, Guidelines	Relevant Provisions
1	**Fifteenth Five Years Plan, 2020−2024, Nepal**	• Requires all projects to be formulated and constructed basedon methods that optimally utilize local skills and resources and generate employment opportunities. • Attention is paid towards minimizing the impacts of climate change and protecting the environment. It aims to minimize adverse impacts on people, property, culture, environment and economy by disasters. • The policy aims to integrate disaster risk management in all development activities in order to reduce the loss of people and property.
2	**Forest Act 2076 (2019)**	• Pertaining to chapter 12, Section 42(1), if there is no other alternative to the use of forest area for the operation of a national priority project, a plan of which the Investment Board approves investment, project of national pride and it appears from the environment examination referred to in the prevailing law that the operation of such plan does not result in significant adverse effects on the environment, the Government of Nepal may approve, as prescribed, to use any part of the national forest for the purpose of operating such plan, • Similarly, in providing the forest area for the operation of a plan pursuant to sub-section (1), to the extent possible, a land that is adjoining to the national forest area near the project site and situated in the same geographical and

S.N.	Policies, Acts, Regulations, Guidelines	Relevant Provisions
		ecological belt and has such landscape where forest can be developed shall be provided for the purpose of planting trees at least in the area equal to the forest area that has to be used.
3	**Forest Regulations, 2079 (2022)**	• Pertaining to Rule 87 (2), in case of a development project related to the use of forest land, coordination with the concerned division forest office during the feasibility study and environmental study must be done. • Rule 88, Application needs to be submitted in case of use of national forest land from the feasibility study, and application needs to be submitted to the Ministry of Forests and Environment through the subjective ministry • Rule 89: Following Rule 88, the Ministry of Forests and Environment directs the Division Forest Office through its respective department for detailed field information, which should also be submitted to the provincial ministry. • Rule 90, following Rule 89, the Division Forest Office should submit the information with field monitoring (if necessary) to the Ministry of Forests and Environment. The ministry will ensure the use of forest land if the applicable information and letters are received and give permission to the respective project by binding the rules stated in the Forest Regulations. • Rule 91, following Rule 90, after the decision made by the government of Nepal for the permission to use the forest land, the development project should make the availability of the applicable land for the forest development as per the Forest Act (2076), Section 42 (2). • Under Rule 92, following Rule 91, if the applicable land is not available, it must be sought through the Land Acquisition Facilitation Committee at the district level. • Rule 93, following Rule 92, states that in case the land acquisition through the Committee fails, the respective department should give permission to the project to Collect amounts in the government fund as per the land purchases for the development project specified in Shedule-51. • Rule 93 (5), the compensation for the loss of 1 tree loss should be made with the plantation of 10 trees with the amount based on the cost of the trees in the ratio of 1:10 and Rule 93 (5), the amount must include bi-annual production or purchase of trees, trees transportation, afforestation of 1600 trees per hectare, fencing and boundary for the protection of trees and require a number of people for look after.
4	**Conservation Area Government Management Area Rules 2001**	• Contains a number of regulatory measures to minimize environmental impacts within the forests, national parks, wildlife reserves and conservation areas. Prior to implementation, the EPA 2076 B.S. (2019 AD) requires a proponent to undertake BES, IEE or EIA for a proposed project and have the report approved by the concerned ministries. The introduction of the exotic species on the specific location may require an IEE before the implementation of the project as per the EPR, 2020 Appendixes 1, 2 and 3 Rule 3 a, b, and c.
5	**Water Resource Act, 1992**	• Water Resource Act, 1992 of clauses 3, 7, 18, 20, 22 and 24 implies state ownership of any surface/stream bodies of Nepal and stresses the utilization of water resources by any individual or organization without causing harm to others. It embodies that the Government of Nepal can fix, monitor and formulate regulations pertaining to water quality standards, pollution tolerance levels and development of water resources. It prohibits any action that may pollute water resources surpassing the threshold value. It has prioritized the use of water resources in successive order: drinking/domestic use, irrigation, fishery, electricity, water transport, and recreation. It urges that utilization of resources should be carried out without causing any considerable damage to the environment such as soil erosion, floods, and other similar natural hazards. The Act fails to address the license mandatory for water extraction even from the land owner.

S.N.	Policies, Acts, Regulations, Guidelines	Relevant Provisions
6	**Water Resource Regulation, 1993**	• The Water Resources Act was published in the Nepal Gazette on (2050/5/1). Persons who are interested in using water resources on an institutionalized basis may form a consumer association consisting of at least Seven persons as officials and members. There shall be a Water Resources Committee in each District for the purpose of issuing licenses pursuant to Sub-section (1) of Section 8 of the Act in order for the utilization of Water Resources contained within Nepal. The government of Nepal, may, giving due consideration to the types, structure, and capacity of the project relating to utilization of wat16 of the Act, prohibit from using the house or land situated within the area of the project specifying the fixed distance for the site for a specified worker resources for the purpose of Sub-section (3)
7	**Irrigation Rules, 2000 (Amendment in 2060)**	• Irrigation Rules, 2000 Chapter 2 provides the formation of the user's association in a format as prescribed in Schedule –1 and the procedure for the transfer of the project. Under Rule 12, the Users' association may plant trees on the side or right of way of a Canal, Branch or Secondary Canal, Minor or Tertiary Canal, Water course or Field Channel after the approval of the community forest work - plan according to the prevailing Forest Act and Rules from the concerned Forest Office. In the course of determining the place for plantation there shall be coordination with concerned Irrigation Office. Until the work plan pursuant to Sub rule (1) is approved, Users' Association may sell the rotten or fallen trees lying on the side of Canal, Branch or Secondary Canal, Minor or Tertiary Canal, Water course or Field Channel and the trees which need pruning may be pruned upon the approval of committee. • Similarly, under the Chapter 6, there is the provision of irrigation project which shall be constituted to implement the large-scale irrigation project as designated by the GoN. It also deals with the function, duties and power of the designated project committee, staff and the establishment of the Project Unit Office.
8	**Irrigation Policy (2013)**	• Irrigation Policy document sets out the rationale for subsector development and policy objectives and approach for project development, water user associations, irrigation service charges and irrigation system operation and maintenance
9	**Soil and Watershed Conservation Act, 2039 BS**	• In order to properly manage the watersheds of Nepal, the Soil and Watershed Conservation Act 1982 was enacted. Section 3 of the Act empowers GoN to declare any area as a protected watershed area. Section 4 of the Act provides that a watershed conservation officer has the authority to implement the following works in protected watershed areas: • Construct and maintain dam, embankment, terrace improvements, diversion channels and retaining walls, • Protect vegetation in landslide-prone areas and undertake afforestation programs, and • Regulate agricultural practices pertinent to soil and watershed conservation. • Under Section 10 of the Act, power is extended to the Watershed Conservation Officer to grant permission to construct dams, drainage ditches, canals, cut privately owned trees, excavate sand, boulders and soil, discharge solid waste, and establish industry or residential areas within any protected watershed. The Act outlines the essential parameters necessary for proper watershed management (including rivers and lakes). The Act is applicable to protected watersheds.
10	**Soil and Watershed Conservation Regulations, 2042 BS**	• In exercise of the powers conferred by Section 25 of the Soil and Watershed Conservation Act 1982, the Government of Nepal has framed Soil and Watershed Conservation Regulations, 2042 BS. Pursuant to sub-rule (1) of rule 10 natural calamity clause (a), (b), (c), (d), (e), (f), (g) of section 10 of the Act and (h) if anyone has to do the work mentioned in the reason to do so. An application has to be submitted to the Watershed Conservation Officer in the format of open schedule 4 (2). After receiving the application as per sub-

S.N.	Policies, Acts, Regulations, Guidelines	Relevant Provisions
		rule (1), the watershed protection officer, in case of any action contrary to the purpose of the Act, in the format of Schedule 5 as per schedule. will allow.
11	**Water Induced Disaster Management Policy 2015 (2072)**	• The latest policy of the Government of Nepal recognizes climate change as one of the main causes of water-induced disasters in Nepal. • This policy is introduced to achieve the objectives of the National Water Resources Strategy and National Water Plan on water-induced disaster management through the participation and coordination of public, cooperative, and private sector institutions. It encourages people to contribute land to flood protection works on a voluntary basis. • It has the main objective of making the infrastructures sustainable and has a policy involving communities, cooperatives and the private sector. It stresses the need for medium and long-term disaster prevention and control programs and makes them climate-resilient and environment-friendly.
12	**Land Acquisition Act, 2034 BS (1978AD)**	• The government can acquire land at any place in any quantity by giving compensation pursuant to the act for any public purposes or the operation of any development project initiated by government institutions.
13	**Labor Act, 2074 (2017 AD)**	• This labor Act was done under the management of parliament under sub-clause 1 of clause 296 of the Constitution of Nepal. Sub-section 3 of Section 2 states that the employees should not be compelled to other work other than they are assigned for. In addition, Sub-section 5 of Section 2 states the prohibition of child labor in any organization and Sub-section 6 of Section 2 states that there should not be any discrimination among the employees regardless of religion, ethnicity, gender, origin, language intelligence or other kind of character.
14	**Child Labor (Prohibition and Regulation) Act, 2056 (2000 AD)**	• As per section 3 of this act, no child who has not attained the age of 14 years shall be engaged in work as a laborer.
15	**Solid Waste Management Act, 2068 (2011 AD)**	• This act has been formulated with the goal of minimizing solid waste production from the target area by setting rules and regulations on solid waste management (SWM) in the country in order to develop a better environment for the systematic and effective management of solid waste and to involve all the concern stakeholders in SWM practice. The main feature of this act is a discussion of the 3R principle (Reduce, Reuse and Recycle). The 3R principle seems very beneficial as it not only increases the life of landfill sites but also saves money, which could be used for other infrastructure development. Section 4 of the act assigns the local body to manage or use the solid waste discharged or dumped in a collection center, transfer station or treatment plant or collected during cleaning.
16	**Solid Waste Management Rules, 2070 (2013 AD)**	• The solid waste management rule was formulated as per the provision made in Article 50 of the Solid Waste Management Act of 2068. This regulation has emphasized the segregation of waste at source and mentioned that the responsibility of proper disposal and management of source belongs to the producers. Section 3 of the rule describes the segregation and management of solid waste. It has been mentioned that it is essential to segregate degradable and non-degradable solid waste at the source.
17	**The National Parks and Wildlife Conservation Act (1973AD)**	• This Act deals with the conservation and management of wildlife and habitat. The Act restricts entry into national parks without prior permission of the concerned authority. Hunting of animals or birds, building or occupying houses, shelters or structures, occupying, clearing, planting or growing in any part, cutting, felling, removing or overshadowing any tree and removing any quarry or any other activities in national parks are banned. • Under the Wildlife Reserve Regulations, 1977, entry, construction of houses or sheds, clearance of forest and forest products, quarrying, and overnight stays in a reserved area are prohibited unless authorized in writing by the relevant GoN authority. • Buffer Zone Management Regulation, 1994, clearance of forests and forest products, acquisition of land, use of quarry sites and hunting in buffer zones

S.N.	Policies, Acts, Regulations, Guidelines	Relevant Provisions
		is restricted unless written approval of the relevant GoN authority is obtained.
18	**Local Self Governance Act (1999AD)**	• This Act gives Local Government the functions, duties and power to, among others; (i) conserve and protect their local environment and natural resources; (ii) plan, implement and / or operate and maintain local water supply projects; (iii) implement and / or arrange for implementation local sanitation/sewerage and drainage projects; (iv) protect cultural heritage and religious sites and / or (v) monitor project activities within their jurisdictions.

C. International Environmental Agreements

40. The table below lists the international environmental agreements that Nepal is party to and their relevance with the WUC Project.

Table 6: International Environmental Agreements ratified by GoN

International Convention	Year*	Relevant Provisions	Remarks
World HeritageConvention	1978	Parties to ensure the protection and conservation of the cultural and natural heritage situated onthe territory of, and primarily belonging to the State. World Heritage sites are identified as per this convention.	The project components will not impact physical and cultural resources and natural heritageduring implementation and operation.
Convention on Wetlands of International Importance, Especially asWaterfowl Habitat (Ramsar Convention)	1987	Parties should conserve and wisely use wetlands (i.e., maintain their ecological character) as a contribution to achieving sustainable development locally and worldwide. This convention will identify the Ramsar areas.	The project components are not located in wetlands as classified as Ramsar sites.
Convention onBiodiversity (CBD)	1992	Parties require the environmental assessment of projects that are likely to have significant adverse effects on biological diversity with a view to avoiding or minimizing such effects. The CBD also identified thebiodiversity identified the hot spot areas.	The project will not impact the country's biodiversity hot spot areas. The project component's scope is the rehabilitation of the existing canal structures.
UN FrameworkConvention on Climate Change	1992	Parties to take precautionary measures to anticipate, prevent or minimize the causes of climate change and mitigate its adverse effects.	The project will help the Government of Nepal comply with this agreement. Theproject will ensure the implementation of the resilience of farmers to climate change.
Basel Conventionon the Control of Transboundary Movements ofHazardous Wastes and their Disposal	1996	Parties to, among others, minimize the amount and toxicity of hazardous waste generated, manage the hazardous and other wastes they generate in an environmentally sound manner and as close as possible to the source of generation.	The project will ensure the implementation of its EMP as a measure to avoid or minimize the generation and disposal ofany hazardous wastes.

*(Year) - Year last amended.

D. Applicable Environmental Standards

41. **National Ambient Air Quality Standards for Nepal, 2003.** As shown in the table below, the air quality standards for Nepal have set standards for 7 parameters: total suspended particles (TSP), PM_{10}, Sulphur Dioxide (SO_2), Nitrogen Oxide (NO_2), Carbon Monoxide (CO), Lead (Pb) and Benzene.

42. **The World Health Organization (WHO) Air Quality Guidelines.** The WHO guideline has set quality standards for four parameters: PM10, PM2.5, SO2, and NO_2. According to ADB SPS 2009, when host country regulations differ from international levels and measures, the project will achieve whichever is more stringent. Both policies provide guidelines and comply with the more stringent standards during the construction period.

Table 7: Standards for Ambient Air Quality for both GoN and WHO

^ Global Air Quality Guidelines. WHO 2021.**Parameter**	**Averaging Period**	**Nepal's Ambient Air Quality Standard (µg.m^3) ***	**WHO Air Quality Guidelines (µg.m^3)**	
			Global Update 2005**	**Second Edition^ 2021**
TSP	Annual	-	-	-
	24-hour	230	-	-
PM_{10}	Annual	-	20	15
	24-hour	120	50	45
$PM_{2.5}$	1-year	-	10	5
	24-hour	-	25	15
SO_2	Annual	50	-	-
	24-hour	70	20	40
	10-minutes	-	500	-
No_2	1-year	40	40	10
	24-hour	80	-	25
	1-hour	-	200	-
CO	8-hour	10,000	-	4 (24-hr)
	15-minutes	100,000	-	-
Pb	1-year	0.5	-	-
Benzene	1-year	20	-	-

Source: *National Ambient Air Quality Standard for Nepal, 2003. Obtained from Environment Statistics of Nepal, 2011, National Planning Commission Secretariat, Central Bureau of Statistics, Nepal.

** WHO Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulfur dioxide. Global update 2005. WHO. 2006.

^ Global Air Quality Guidelines. WHO 2021.

43. **Emission standard for diesel generator EPR-14, 2020**. The emissions standards set for new DG imports are equivalent to Bharat Stage III standards, and for in-use DGs, they are equivalent to Bharat S Inventories and Black Carbon Emissions in Kathmandu Valley, Nepal. Emissions standards are set for four major pollutants: CO, HC, NOx, and PM.

44. **National Noise Standard Guidelines, 2012**. The guidelines set standards for noise levels, measured in dBA, in industrial, commercial, rural, urban, mixed, residential, and quiet areas. They also provide standard values for the noise level generated by water pumps and DG.

45. For international standards, the WHO Noise Level Guidelines have set the noise levels measured in dBA for two areas: residential and commercial. The project will achieve whichever is more stringent. Both policies provide guidelines to follow and comply with the more stringent

standards during the construction period.

Table 8: Standards for noise levels for both GoN and WHO

Receptor/Source	National Noise Standard Guideline 2012 (dBA)		WHO Guidelines Values for Noise Levels Measured Out of Doors*(One Hour LA_q in dBA	
	Day	Night	07:00-22:00	22:00-07:00
Industrial Area	75	70	70	70
Commercial Area	65	55		
Rural Settlement Area	45	40	55	45
Urban Residential Area	55	50		
Mixed Residential Area	63	55		
Quiet Area	50	40	-	-
Water Pump	65		-	
Diesel Generator	90		-	

**Guidelines for Community Noise, WHO, 1999*

46. **Nepal Water Quality Guidelines for Irrigation Water, 2008**. The guidelines set the standards for irrigation water, with the targeted quality range for the different parameters (Table 9). The guideline also shows the acceptable concentration limits for the plant species.

Table 9: Nepal Water Quality Guidelines for Irrigation Water

S.N.	Parameter Name	Target Water Quality Range	Remarks
Microbiological constituents:			
1	Coliforms (fecal)	< 1 count /100 ml	1 – 1000 count / 100 ml could be used for plants for which edible parts are not wetted
Physical Constituents:			
1	pH	6.5 – 8.5	Adverse effect on plants outside this range
2	Suspended Solids	< 50 mg/L	Above the limit problem with sedimentation and irrigation system
3	Electrical Conductivity	< 40 mS/m	Up to 540 mS/m depending upon sensitivity of crops
Chemical Constituents:			
1	Aluminum	< 5 mg/L	Up to 20 mg/L max. acceptable conc.
2	Arsenic	< 0.1 mg/L	> 2 mg/l creates severe problem
3	Beryllium	< 0.1 mg/L	0.1 – 0.5 mg/L max. acceptable conc.
4	Boron	< 0.5 mg/L	Up to 15 mg/L depending upon species.
5	Cadmium	< 0.01 mg/L	0.01 – 0.05 mg/L max. acceptable conc.
6	Chloride	< 100 mg/L	Up to 700 mg/L depending upon species
7	Chromium	< 0.1 mg/L	Up to 1.0 mg/L max. acceptable conc.
8	Cobalt	< 0.05 mg/L	Up to 5.0 mg/L max. acceptable conc.
9	Copper	< 0.2 mg/L	Up to 5.0 mg/L max. acceptable conc.
10	Fluoride	< 2.0 mg/L	Up to 15 mg/L max. acceptable conc.
11	Iron	< 5.0 mg/L (non-toxic)	> 1.5 mg/L creates problem in drip irrigation system
12	Lead	< 0.2 mg/L	Up to 2.0 mg/L max. acceptable conc.
13	Lithium	< 2.5 mg/L	For citrus < 0.75 mg/l
14	Manganese	< 0.02 mg/L	Up to 10 mg/L max. acceptable conc.
15	Molybdenum	< 0.01 mg/L	Up to 10 mg/L max. acceptable conc.
16	Nickel	< 0.2 mg/L	Up to 2.0 mg/L max. acceptable conc.
17	Nitrogen (inorganic)	< 5 mg/L	Higher concentrations may affect sensitive plants and may contaminate groundwater.
18	Selenium	< 0.02 mg/L	Up to 0.05 mg/L max. acceptable conc.

S.N.	Parameter Name	Target Water Quality Range	Remarks
19	Sodium Adsorption Ratio (SAR)	< 2.0	Up to 10 depending upon the sensitivity of crops.
20	Sodium	< 70 mg/L	Up to 460, depending upon the sensitivity of crops
21	Total Dissolved Solids (as EC)	< 40 mS/m	Up to 540 mS/m depending upon the sensitivity of crops
22	Uranium	< 0.01 mg/L	Up to 0.1 mg/L max. acceptable conc.
23	Vanadium	< 0.1 mg/L	Up to 1.0 mg/L max. acceptable conc.
24	Zinc	< 1.0 mg/L	Up to 5 mg/L max. acceptable conc.

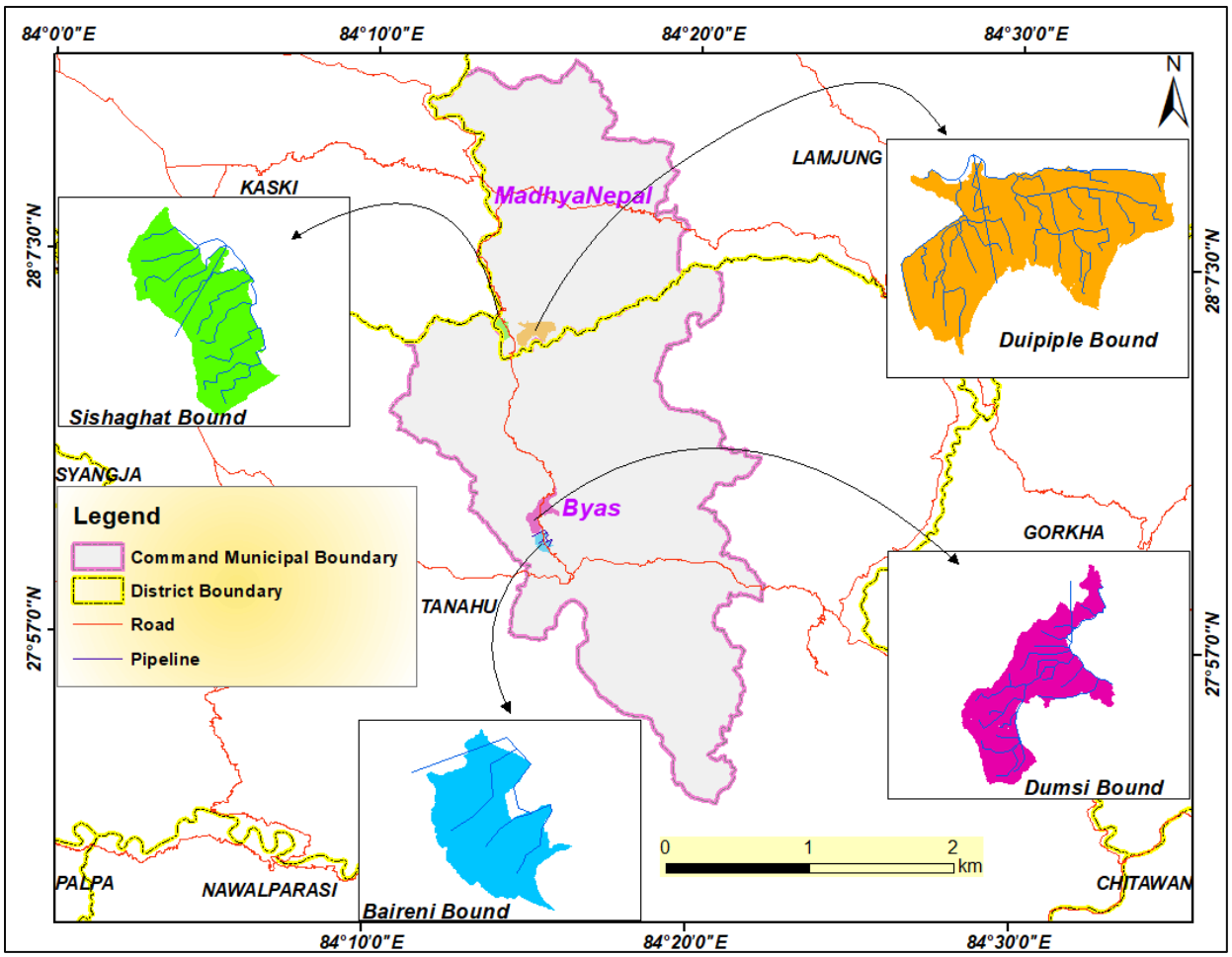
Source: Nepal Water Quality Guidelines for Irrigation, DWRI (Nepal Gazette (Number 10.16 June 2008)

III. PROJECT DESCRIPTION

A. Description of the Subprojects

47. The Hill Lift Irrigation System (HLIS) will provide reliable irrigation to the agricultural lands located on old river terraces, i.e., the dry uplands called Tar in Nepal. In addition, the project will construct 12 new hill lift subprojects (covering 1,400 ha) with modern lifting and high-efficiency piped irrigation in the mid-hill areas of Gandaki and Lumbini Provinces. The federal government will implement the Hill Lift subprojects. Considering the additional need for technical due diligence and an assessment of the farmer's acceptance, the entire hill lift component has been placed under priority 1b. For the hill lift irrigation subprojects, the WUCs will operate as water utilities using metered charging systems and will collect fees to help meet full cost recovery for operating costs. The feasibility study of all 12 HLIPs is done, whereas the preliminary detail design has been performed for the 3 subprojects. The CPMOs and PIUs, with support from the PIMS, will perform the detailed design of the remaining nine hill lift subprojects.

Figure 2: Proposed Hill Lift Irrigation Subprojects in Madi River Cluster



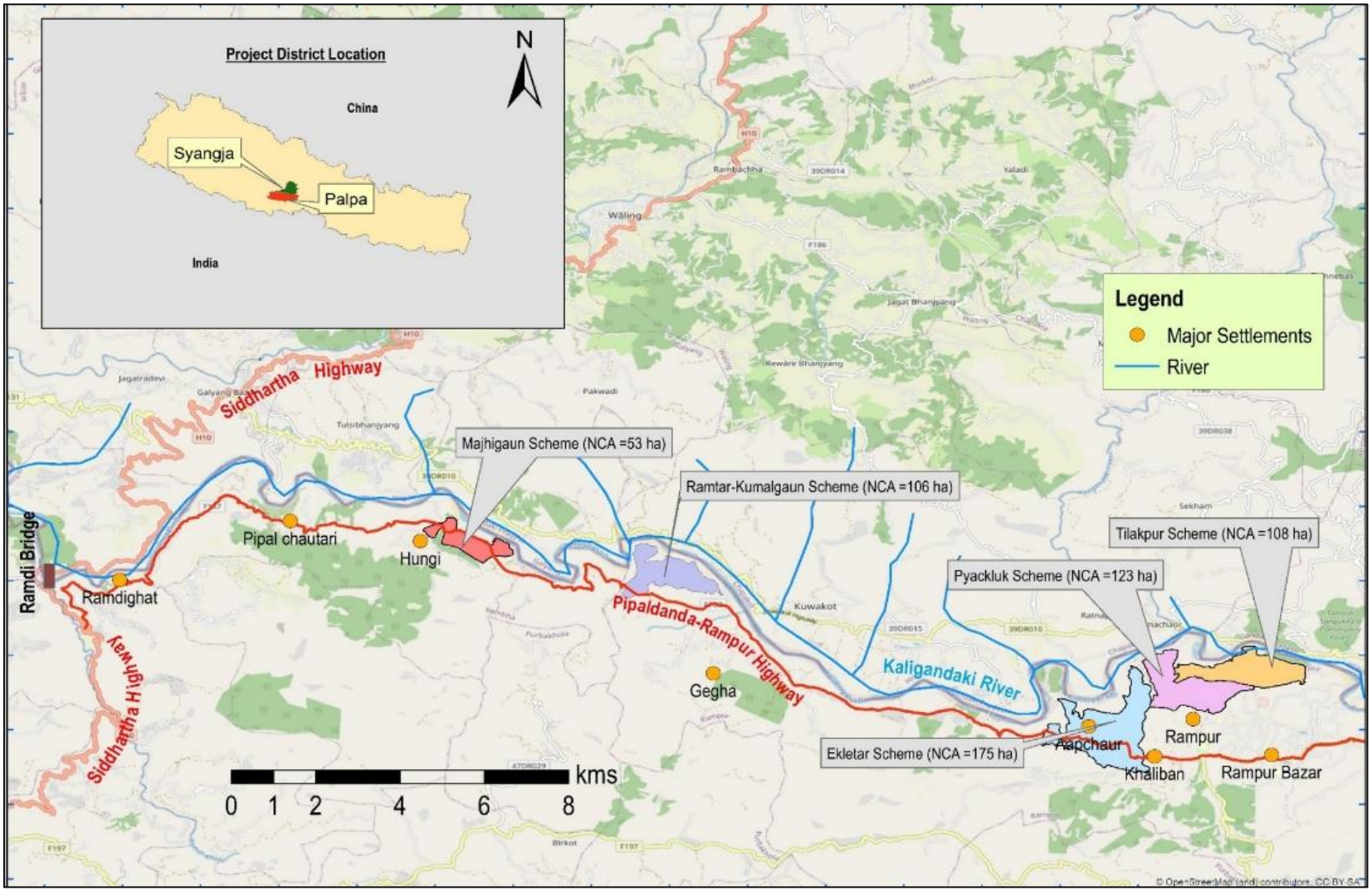
Source: Detail Feasibility Study Report, 2022

Table 10. Salient Features of the HLIP Subprojects in Gandaki Province

River	Madi	Madi	Madi	Madi	Madi	Marsyandgdi
District	Tanahun	Tanahun	Lamjung	Lamjung	Tanahun	Gorka
Name of Subprojects	**Baireni**	**Dumsi**	**Duipiple**	**Sishagat**	**Kalesti**	**Chayanglitar**
Gross Command Area (GCA)	62	145	152	69	180	561
Culturable Command Area (CCA)	49	102	125	50	135	415
Static Head	99	98	96	72	101	140
Current irrigated area	3	29	90	7.5	32	65
Level terrace %					48%	49%
Costs excluding VAT (NPR million 2024 costs)	35	57	73	32	123	317
Cost/ha NPR (2024)	704,335	561,228	580,251	642,137	911,368	763,687
Aquifer thickness (m)	30	8	60	60	20	30-50
Hydrogeology	Gravelly sand with weak bedrock at one side	Bedrock <5m below surface	Gravelly sand	Gravelly sand	Boulder mixed Soil - 10m, Boulder with fine materials - 30m, Below Boulder mixed Soil, Sandy gravel with clay	Gravelly sand with bedrock at side

Source: Detail Feasibility Study Report, 2022

Figure 3: Proposed Hill Lift Irrigation Subprojects in Kaligandaki Clusters



Source: Detail Feasibility Study Report, 2022

Table 11. Salient Features of the HLIP Subprojects in Lumbini Province

River	Kalikandaki	Kalikandaki	Kalikandaki	Kaligandaki	Kalikandaki	Kalikandaki
District	Palpa	Palpa	Palpa	Palpa	Palpa	Palpa
Name of Subprojects	**Ekletar**	**Ramtaar**	**Majihigaun**	**Siko Danda**	**Tilakpur**	**Pyakluk**
GCA	253	133	97	20	151	167
CCA	158	91	61	14	105.5	109
Static Head	136	53	153	106	68	83
Current irrigated area	0	14	0		65	70
Level terrace %				37%		
Costs excluding VAT (NPR million 2024 costs)	130	75	59	11	90	103
Cost/ha NPR (2024)	822,268	825,183	965,863	798,571	855,036	944,169
Aquifer thickness (m)	60	50	50	60	60	50
Hydrogeology	Gravelly sand - 10m, Sandy layer - 20 m, Sandy Gravel - 30m, bedrock at lower layer at side	50m saturated sand layer inclined layer between weak bedrocks	restricted area 10m thick sandy gravel, between conglomerate	Gravelly sand layer between bedrocks	Restricted 10m gravelly sand overlying gravel layer	Restricted 10m gravelly sand (between conglomerate) overlying 30m thick saturated sand

Source: Detail Feasibility Study Report, 2022

B. Design of System and Components of Subprojects

48. **Approach to System Design.** The designs seek to produce technically appropriate and economically viable hill lift irrigation infrastructure to assure irrigation to identified Tars along Madi, Marsyandgdi and Kaligandaki river corridors in the mid-hill landscape. The water for irrigation would be abstracted from tube wells located near the river banks so that it would be fed from influent seepage from the river flow. Submersible pumps of appropriate capacities would be used to pump water from the tubes to be able to lift water to the storage tank located at the high ground in the command area. From the storage tank, the irrigation water will be delivered to the field through piped network to an average unit farm size of 1 ha. The size of the tube wells, filter media and pumps have been designed based on the peak crop water requirement and design pumping needs to meet the peak demand. The crop water requirement has been estimated for the design cropping system using the Food and Agriculture Organization's (FAO) Cropwat-8[12] and Project Design and Supervision Procedures (PDSP) manual volume-3 based on the proposed cropping patterns, long-term climatic data from nearby stations, assessment of 80% reliable rainfall and effective rainfall, and consideration of overall irrigation system efficiency. The climatic stations considered representative of the subproject areas are Damauli (Station no 817) for the subprojects in the Madi River corridor and Chapakot (Station no 810) for the Kaligandaki River corridor.

49. The components of the lift irrigation system comprise tube wells, pump houses, lift pipes, storage tanks, piped distribution networks and outlets. The tube wells would be located on the river bank, while pump houses would be located adjacent to the storage tank. The pump house would be equipped with panel board, switches and safety gears. The pumps will be generally operated in off-peak hours starting from 10 PM and will continue the next day depending upon the operation schedule of the individual scheme. Only daytime irrigation is planned, with up to 17 hours of operation in the peak period. In peak periods, the irrigation schedule may start as early as 4:30 hours and may extend up to 20:00 hours.

50. The pipe distribution network has been developed involving main, sub-main, and laterals. One lateral contains at the most five (5) outlets, which constitutes an operational block of 5 ha. All the outlets under one lateral will be operated at a time. Each unit outlet is equipped with a flowmeter and an on/off valve. The farmers within the block can irrigate their fields with various methods of irrigation based on the choice of crops and the method of application in the crop fields. In addition, consideration of maintaining a minimum residual pressure head at the outlets would allow some farmers to use sprinklers and drip irrigation, where the pressure head at the outlet is 20m – 40m, for vegetable farming. Other farmers will adapt smaller farm plots, broad beds and furrow irrigation for irrigation application to the crops.

51. The proposed design of lift irrigation schemes is different from the conventional design of irrigation systems with open intakes in the river and flow irrigation for water distribution. The proposed design provides relatively silt-free water for irrigation, assures irrigation during lean periods, and also efficiently applies irrigation through a piped distribution network.

52. **Proposed Cropping Pattern**. Cropping systems and practices for the subprojects have been proposed considering the existing cropping systems and practices of farmers in the subproject, farmers' needs, the suitability of the crops and crop sequences introduced to the area and the opportunity to enhance the productivity and income opportunity of farmers. Three

[12] FAO's CROPWAT 8.0 is a decision-support tool developed by the Land and Water Development Division of the FAO. It is designed for the calculation of crop water requirements and irrigation requirements based on soil, climate, and crop data. The program also allows the development of irrigation schedules for different management conditions and calculates scheme water supply for varying crop patterns. Additionally, CROPWAT 8.0 can be used to evaluate farmers' irrigation practices and estimate crop performance under both rainfed and irrigated conditions.

considerations have been considered overriding in proposing the cropping system and practices: i) proposed cropping system providing a fit to irrigation flow regime of hill lift irrigation system, especially the assured year-round irrigation but at a lower flow rate, meaning crops demanding low volume but regular irrigation likely to fit the flow regime, ii) opportunity to shift to market-based production, iii) shift to market-based production and to enhance the income opportunity of the farmers.

Table 12: Changes in the Cropping Intensity with the Development of the Hill Lift Irrigation

S.N.	Name of the subproject	Cropping Intensity (%)		Changes in the cropping intensity (+/- %)
		Existing	With the hill lift irrigation	
1.	Baireni	155	225	+70
2.	Dumsi	165	225	+60
3.	Duipiple	200	210	+10
4.	Sisaghat	190	210	+20
5.	Tilakpur	185	235	+50
6.	Pyakluk	180	235	+55
7.	Ekletar	180	235	+55
8.	Ramtar-Kumalgaun	180	225	+45
9.	Mahigaun	185	240	+55
10.	Kalesti	133	200	+67
11.	Chyanglitar	127	210	+83
12.	SeoDanda	125	200	+75

Source: Detail Feasibility Study Report, 2022

53. The cropping intensity changes with the introduction of hill lift irrigation across various subprojects demonstrate significant improvements in agricultural productivity. The data indicates that the subproject with the highest increase in cropping intensity is Chyanglitar, with an impressive enhancement of +83%. This substantial rise underscores the effectiveness of hill lift irrigation in transforming the agricultural landscape, particularly in areas where traditional methods may have been insufficient to maximize crop yields. On the other hand, Duipiple shows the lowest increase in cropping intensity, with just +10%. This smaller increment suggests that the existing cropping practices in Duipiple were already optimized to a high degree, leaving less room for improvement through additional irrigation. It highlights that while hill lift irrigation is beneficial, its impact may vary depending on the initial conditions and existing agricultural practices of the region.

54. Overall, the average increase in cropping intensity across all subprojects is noteworthy, showcasing the positive impact of hill lift irrigation on agricultural productivity. Most subprojects exhibit a significant increase, ranging from +20% to +83%, illustrating the broad applicability and benefits of this irrigation method. These improvements are crucial for enhancing food security, increasing farmers' incomes, and promoting sustainable agricultural practices in the region. In conclusion, the implementation of hill lift irrigation in these subprojects has led to a marked increase in cropping intensity, indicating a potential rise in agricultural productivity. This intervention not only boosts the overall crop yield but also contributes to the economic well-being of the farming communities. The data supports the continued use and expansion of hill lift irrigation to enhance agricultural output further and improve livelihoods in similar regions.

55. **Crop Water Requirement.** Crop water requirements of the proposed cropping system were estimated based on the area coverage of the crops, crop calendar, reference crop evapotranspiration (ETo) and the climatic data considered representative of the subproject area. FAO developed the software Cropwat-8, and the procedure for the estimation of crop water requirements identified in the PDSP manual was used for the assessment of crop water

requirements. The long-term climatic data used in the estimation of reference crop evapotranspiration for Damauli (station no. 817) was considered representative of the subproject in Madi River Corridor, and Chapakot (station no. 810) was considered representative of the subproject in Kaligandaki river corridor.

56. **Reference Crop Evapotranspiration.** The reference crop evapotranspiration (ET_o) estimate provided by Cropwat-8 is the rate of evapotranspiration of short green grass, 8 to 15 cm tall, with extensive vegetative cover completely shading the ground, based on modified Penman-Monteith equation which combines the evapotranspiration due to heat balance and aerodynamic effects. The calculated monthly ETo of the two stations representative of the subprojects in the Madi and Kaligandaki River Corridor is provided in the Table below.

Table 13: Climatic stations in Madi and Kaligandaki River Corridor

Station	ETo estimates (mm/day) by months											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Damauli (Station no. 817)	1.38	2.18	3.23	4.20	4.47	4.41	3.63	3.73	3.40	3.03	2.06	1.45
Chapakot (Station no. 810)	1.43	2.12	3.15	4.16	4.45	4.30	3.53	3.63	3.31	2.94	2.06	1.51

Source: Detail Feasibility Study Report, 2022

57. **Crop Coefficient.** Crop coefficients (Kc) are experimentally determined ratios of crop evapotranspiration to reference crop evapotranspiration (ETc/ETo), and the values follow the stage of the crop growth in the same climatic condition because the leaf anatomy, stomata characteristics, aerodynamic properties and the albedo of the crop canopy changes over the growing season. In addition, Kc serves as an aggregation of the physical and physiological differences between crops and the reference definition (FAO, 1998). The factors that determine the Kc are crop type, climate, soil evaporation, and crop growth stages, all of which change over the crop growing stages. The Kc values of various crops proposed in this study were derived from PDSP Manual and FAO Irrigation and Drainage Manual No. 56. The crop evapotranspiration has been calculated by multiplying reference crop Evapotranspiration with the crop coefficient values.

58. **Water Requirement for Land Preparation.** Water requirement for land preparation is associated with the creation of an enabling environment for seed germination and plant establishment, hence adding to crop water requirement. The water requirement for land preparation is high for paddy because of the need to create puddled fields for transplanting seedlings under lowland rice culture. For non-paddy crops, the water requirement of land preparation is much lower, which may also depend on the deficiency of moisture stored in the crop root zone to support seed germination. For the non-paddy crops, the farmers in the area generally maintain the seeding/planting schedule when residual soil moisture is high enough to support seed germination and establishment of plant stand, hence not included in the estimate of crop water requirement.

59. **Irrigation Efficiency.** When irrigation is applied to a crop area, considerable water losses occur through evaporation, seepage, and deep percolation. The amount lost depends upon the system's efficiency. In order to calculate the intake water requirements, field irrigation losses, distribution canal losses, and conveyance canal losses must be taken into account. The following three efficiency attributes are considered in estimating the irrigation requirement.

60. **Field efficiency (Fe):** Irrigation field application efficiency is expressed as the ratio of water stored in the root zone to the water applied. In irrigating dry root crops, it is difficult to apply the water evenly over the whole field. To allow for this, a field efficiency of 75% is considered. For

paddy, as the irrigation is based on flooding field efficiency can be assumed to be 75% to 85% to allow for limited run-off and overspill.

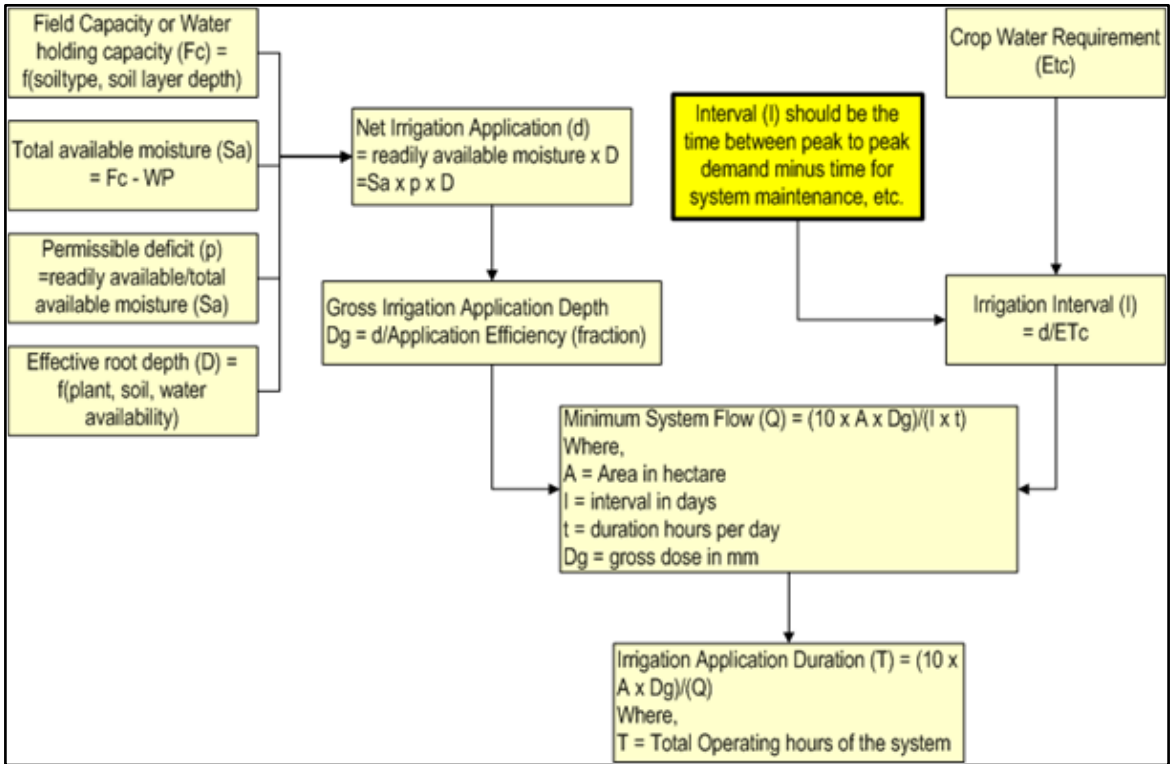
61. **Distribution efficiency (De):** Distribution efficiency is the efficiency of the water distribution conduits supplying water from the conveyance system to individual fields. The proposed water distribution system is piped distribution, so the efficiency will be higher, and for the design purpose, 95% efficiency has been considered.

62. **Conveyance efficiency (Ce):** Irrigation water is also lost along delivery canals or pipes due to seepage, percolation, evaporation, leakage, and/or overdiversion. In this project, the conveyance system shall be a piped system, and hence, conveyance efficiency is considered 95%.

63. **Overall irrigation efficiency (Ep):** This considers the water losses from the point of abstraction (or diversion) to the point of use, which is a product of Fe, De, and Ce. For the purpose of designing the proposed hill lift irrigation project, the overall irrigation efficiency of 68% (90% x 75%) has been considered.

64. **Design Discharge.** The design discharge is based on the present concept of crop-based irrigation demand, water delivery schedules and water allocation to the unit outlets. Information on soil type (water holding capacity), crop type (root zone depth, permissible deficit), and crop water requirement have been used to establish design pumping rates. The concept used in estimating the design pumping rate is provided in the flow chart in the Figure below.

Figure 4: Flow-chart illustrating steps in the estimating design pumping rate



Source: Detail Feasibility Study Report, 2022

65. **Layout of Distribution System.** The layout of the distribution system, as stated above, involves main, sub-main and lateral pipes with outlets. The planning of the distribution network has been based on the consideration that the existing cropped area in the subproject would be brought under irrigation while the storage tank could be located to keep the lift within the economic

limit. While planning for the alignment, existing roads, trails, and property boundaries have been followed to the extent possible extent to avoid land acquisition and crop compensation issues.

66. Each lateral includes 5 outlets: therefore, on average, 5 ha in the irrigation command of each lateral. An outlet area of 1 ha (approx. 20 ropani) has been based on the consideration of the average landholding size of the 3 to 8 ropani in the subprojects, which would mean 3 to 7 farmers served by each outlet. The outlet pipeline was extended up to the highest ground level so that the farmers' plots served by the outlets could be served. The farmers sharing water from each outlet are expected to use either flexible hoses (lay flat pipes) or develop field channels to convey water to their respective farm plots. The rotation was planned by sub-mains and by laterals depending upon the area under irrigation command and peak irrigation demand and the option for rotation that helped optimize the pump and reservoir size was considered.

Table 14: Summary of Details of Pipe Distribution Network in the Subprojects

S.N.	Name of the Subproject	Command Area (ha)	No. of Outlets	Average Area Size of outlets	No. of Laterals and Submains		Average Area Under Lateral
					Lateral	Submains	
1	Sisaghat	50.4	50	1.07 (0.7-1.44)	10	-	5.04
2	Duipiple	126	121	0.975 (0.54-1.41)	25	6	5.00
3	Baireni	49.4	50	0.83 (0.39-1.27)	10	2	4.90
4	Dumsi	102	100	0.945 (1.33-0.56)	20	4	5.07
5	Tilakpur	106	105	0.925 (0.58-1.27)	21	4	5.04
6	Majhigaun	61	60	0.945 (0.64-1.25)	12	-	5.08
7	Pyackluk	110	110	0.88 (0.49-1.27)	22	3	4.99
8	Ramtar	91	90	0.935 (0.62-1.25)	18	3	5.04
9	Ekletar	158	160	0.905 (0.53-1.28)	32	4	4.94
10	Kalesti Phant	14	60	-	-	-	-
11	Siko Danda	135	7	-	-	-	-
12	Chyanglitar	415	173	-	-	-	-

Source: Detail Feasibility Study Report, 2022

67. **Design of Inlet Pipes to Storage Tank.** The lift pipe has to withstand high pressure, and hence, the use of GI pipe has been proposed. Since more than one pump is required to meet irrigation demand, the pipe design discharge is based on the combined total pumping capacity of the pumps. Design involves the computation of head loss for selected pipe diameter, including the minor losses in the pipe fittings (bends, valves, coupling). The design dimensions of the lift pipe, considering the lift head, flow rate and head loss, are summarized in the table below.

Table 15: Summary of Lift Pipe Dimensions and Total Head Loss

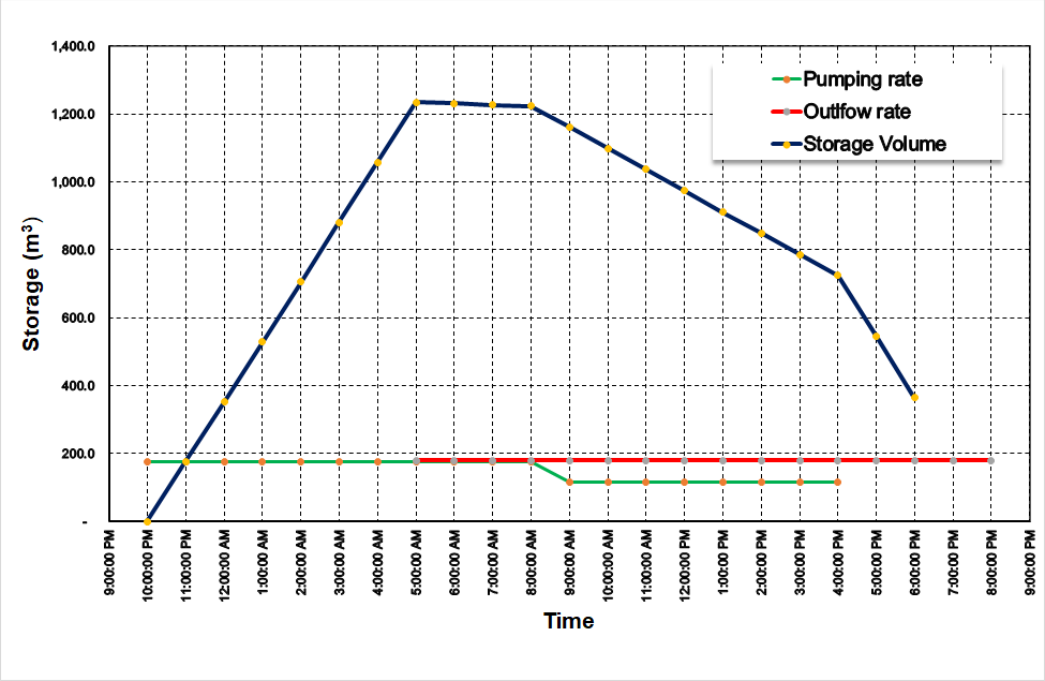
SN	Sub Project	Static head	Flow Rate	Lift Pipe Diameter	Pipe Length	Head loss	Total dynamic head
		m	lps	mm	m	m	m
1	Tilakpur	64.3	49.00	300.00	1195.00	1.80	66.1
2	MajhiGaau	148.2	24.00	250.00	927.00	0.92	149.1
3	Ramtar	44.7	49.00	300.00	652.30	1.08	45.8

4	Pyacluk	73.7	49.00	300.00	1395.00	2.32	76.0
5	Ekletar	133.4	60.00	350.00	1292.00	1.37	134.8
6	Duipiple	91.6	45.00	300.00	1144.00	1.50	93.1
7	Baireni	90.0	24.00	250.00	731.50	0.74	90.7
8	Dumsi	96.8	49.00	300.00	748.00	1.22	98.0
9	Sishaghat	63.0	24.00	250.00	764.50	0.78	63.8
10	Kalesti Phant	101.2	100.00	300	1450	12.8	114.0
11	Siko Danda	106.2	5.00	100	369	8.2	114.4
12	Chyanglitar	140	268.00	450	1269	12.0	152.0

Source: Detail Feasibility Study Report, 2022

68. **Design of Storage Tank**. The key consideration in locating the storage tank is ensuring that all parts of the command area are served through gravity flow from the tank. The availability of public land at suitable locations was another important consideration in addressing the need to procure private land. Therefore, the availability of land free of cost, geological conditions, public safety, and minimum lift length were overriding. The system planning is based on the fact that the pumps are operated at full capacity during the off-peak hours of electricity use, starting from 10 PM. Only daytime irrigation is proposed, but during the peak demand periods, which usually last for two weeks, an early start from 4:00 AM and late closure at 8:00 PM may be required. The optimal capacity of the reservoir has been established based on optimizing the duration of pumping and irrigation schedule. The optimum storage tank capacity worked out for the Tilakpur subproject in the Kaligandaki corridor is provided in the Figure below.

Figure 5: Optimization of Reservoir Capacity in Tilakpur Subproject in Kaligandaki Corridor



Source: Detail Feasibility Study Report, 2022

69. **Determination of the Size of the Storage Tank.** The design dimensions of the storage tank (l*b*h) have been worked out based on the needed storage capacity and the size and shape of the available land at the storage tank's location. The design dimensions of the storage tank are provided in the following table, which are adapted to the local topography and the maximum available strip of land for construction. The ratio of the long wall and the short wall was kept at 2 as far as possible by the local topography.

Table 16: Design Dimensions of the Storage Tank

S. N.	Subproject	Length (m)	Breadth (m)	Height (m)	Freeboard (m)
Madi Corridor					
1	Sishaghat	23.5	10.0	3	0.5
2	Baireni	21.0	10.0	3	0.5
3	Dumsi	34.5	12.0	3	0.5
4	Duipiple	27.0	13.5	3	0.5
5	Kalesti Phant	32.0	16.0	3	0.3
Kaligandaki Corridor					
6	Ekletar	23.0	19.0	3	0.5
7	Tilakpur	33.0	11.0	3.5	0.5
8	Majhigaun	20.0	11.0	3	0.5
9	Pyakluk	28.0	14.0	3	0.5
10	Ramtar	28.0	14.0	3	0.5
11	Siko Danda	10	5.0	2	0.3
Marshyangdi Corridor					
12	Chyanglitar	48.0	24.0	3.5	0.3

Source: Detail Feasibility Study Report, 2022

70. **Design of Intake.** The option of provisioning a tube well located as close as possible, permitted by the suitability of the formation and the risk for flood damage vis-à-vis required flood protection, to abstract and drain influent seepage from the river has been considered as a more practical option. The option of developing a tube well with an infiltration gallery on the river bed has been ruled out, considering the risk of choking in a short period of time due to high sediment concentration in the river water and the higher exposure to flood damages and dynamic nature of river bed in Madi and Kaligandaki rivers producing unpredictable bed scour and/or deposition. The option of a bore well drilled at the river bank was also ruled out, considering the high possibility of hard bedrock in the river bed formation. There have been efforts in the past to develop bore wells at or close to the river bank in some of the drinking water and irrigation projects. However, the results have been mixed- in many projects, the drilling of bore wells failed to tap formation to produce needed discharge. Irrigation pumping demands high discharge; hence, the Consultant did not explore the option of Bore-wells

71. In the subprojects, the intake is proposed to be located on the flood plains of the rivers, consisting of shallow tube wells with filter media envelopes. The tube wells will be drilled along river floodplains in each system. The number of tube wells in each system will depend on the discharge of tubewells, which is essential to providing water to the entire command area and meeting crop water requirements. The number of tubewells and the locations of the drilling points have yet to be determined. However, installing tubewells in river floodplains may entail several environmental, social, and economic impacts. These impacts may include the following; (1) Groundwater depletion; (2) Water quality degradation; (3) River flow alteration; (4) Soil subsidence; (5) Water access inequality; (6) Health issues; (7) Cost of installation and maintenance. Considering these impacts, it is important to integrate mitigating measures to minimize its adverse effects, which may include the following; (1) Sustainable Groundwater Management; (2) Water Quality Monitoring; (3) Integrated Water Resource Management (IWRM);

(4) Community involvement; and (5) Alternative irrigation methods that promote water-saving irrigation techniques to reduce reliance on groundwater.

72. Tubewell intake is selected for pumping irrigation water to the reservoir tank. For each subproject, two to three 50m depth shallow tubewells with 12 lps discharge each are recommended. However, the hydrogeologist needs to confirm the discharge and feasibility of the shallow tubewell in the location together with its detailed design and, if possible, the pilot boring.

73. **Design of Pump and Motors.** The design of pumps and motors to accomplish required pumping has been based on the design discharge of the irrigation system, dynamic head and head loss in the pipes up to the storage tank. The pump and motor selection to produce the required pumping rate at the required head and discharge was made from and based on the information provided by the manufacturer. The capacity of the pump and motors for the subprojects in the two river corridors are provided in the Table below.

Table 17: Capacities of pumps and motors in the subprojects

Sub Project	Design Data		Pump Specification			
	Pumping rate	Dynamic head	Head	Discharge	Power	Number
	m^3/hr	m	m	lpm	kw/HP	
Tilakpur	176.4	66.1	68.0	980.0	18.5 KW/ 25 HP	3
MajhiGaau	86.4	149.1	153.0	720.0	37 KW/50 HP	2
Ramtar	176.4	45.8	53.0	980.0	13 KW/17.5 HP	3
Pyacluk	176.4	76.0	83.0	980.0	22 KW/30 HP	3
Ekletar	126.0	134.8	136.0	900.0	37 KW/50 HP	4
Duipiple	162.0	93.1	96.0	900.0	22 KW/30 HP	3
Baireni	86.4	90.7	99.0	720.0	22 KW/30 HP	2
Dumsi	176.4	98.0	98.0	980.0	26 KW/35 HP	3
Sishaghat	86.4	63.8	72.0	720.0	15Kw/20HP	2
Kalesti Phant	100.0	114	101.2	720.0	67 KW/	4
Siko Danda	86.4	114.4	107.0	720.0	12 KW	1
Chyanglitar	260.0	152	140.0	980.0	112	6

Source: Detail Feasibility Study Report, 2022

74. **Electrical Power Supply in the Project Area.** The electrical power system in Nepal is exclusively managed by the Nepal Electricity Authority (NEA), which is the responsible agency for the generation, transmission and distribution of electric power throughout the country. Location-specific distribution centers under the Pokhara Regional Office of NEA are carrying out the electric power distribution. The possibility of augmenting the subprojects with alternative energy sources, solar, or sustainable local approaches, such as developing micro-hydro projects in the vicinity, was not explored during this study.

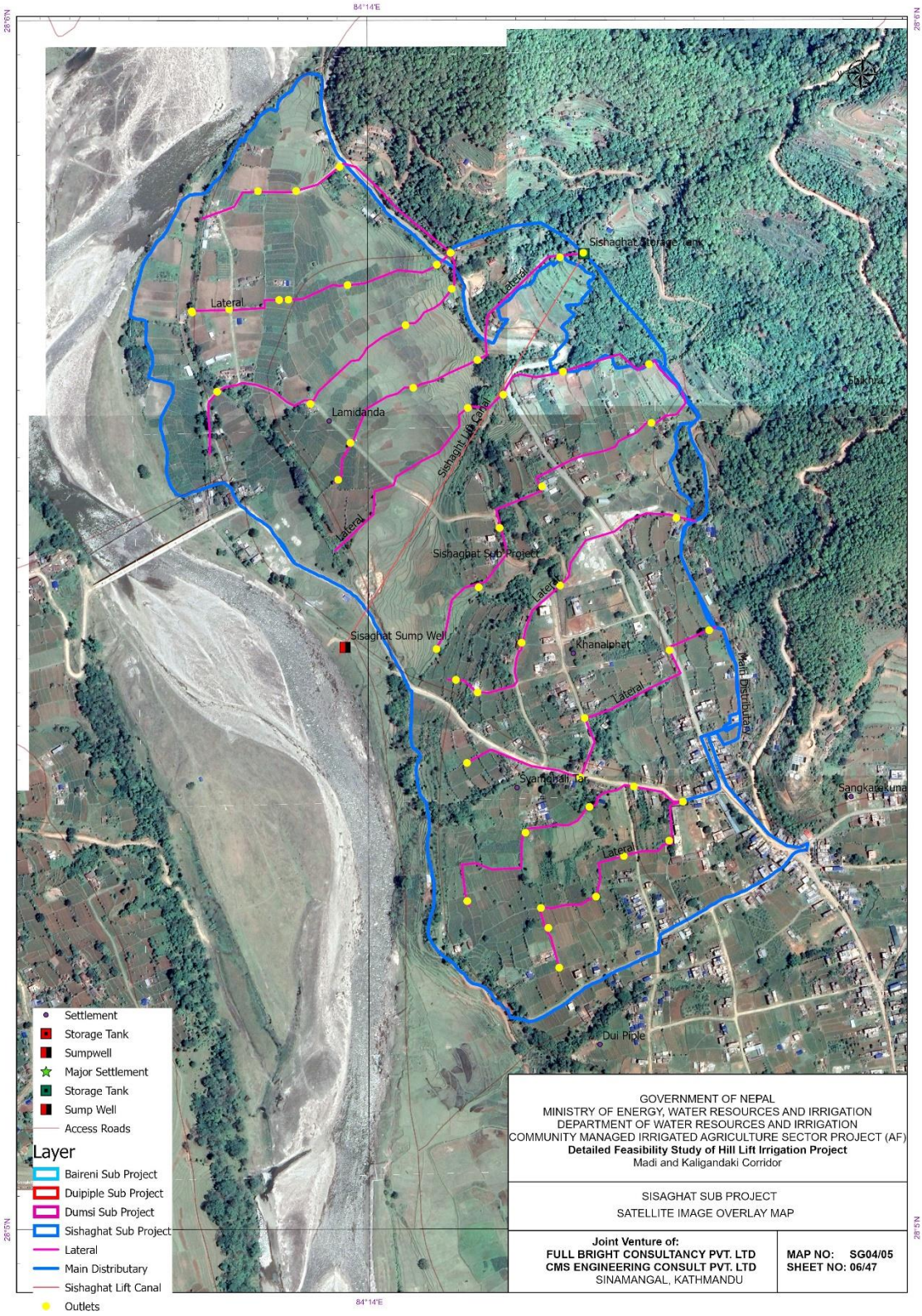
75. **Madi Corridor**. The subprojects in the Madi Corridor shall serve the electric power supply from the Damauli sub-station through the 11 kV Soti feeder line under the purview of the community electricity distribution committee. However, it is to be noted that the 11 kV feeder line comes within the purview of the Damauli distribution center under the Pokhara Regional Office of NEA. The Soti feeder (11 kV power line) passes through the left bank of the Madi River. The required power to the pump house for each subproject can be obtained by adding a transformer of the required capacity. The Damauli sub-station is 6/8 MVA with adequate capacity to supply the power in the corridor and has been reported to be fairly reliable. A new 33 kV transmission line has also been completed along the Madi corridor to evacuate the power from the Midim Hydropower Plant under the Independent Power Purchaser (IPP). Thus, a reliable power supply to the subprojects under consideration along the Madi Corridor can be considered a fair proposition.

76. **Kaligandaki Corridor**. The electrical power supply of the Kaligandaki Corridor comes under the purview of Butwal Power Company (BPC). The BPC distributes electrical energy to four western hill districts: Syangja, Palpa, Pyuthan and Arghakhanchi. The BPC generates power from two hydropower stations: Jhimruk Hydroelectric Plant (12 MW) in Pyuthan and Andhi Khola Hydroelectric Plant (9.4 MW) in Syangja. A 33 kV line passes along the Kaligandaki corridor, which is liable to supply power to the subprojects under consideration under this assignment.

77. **Marshyangdi Corridor**. In Chyanglitar, the electric power supply is provided from the Dumre sub-station through the 11 kV Gorkha feeder line. The power distribution system is under the Gorkha distribution centre of Pokhara Regional Office of NEA. This 11-kV power line passes 50 m upstream of the proposed intake location crossing the Marsyangdi River. The power line has double poles (H pole) on both banks of the river and an H pole on the road from Satighat. The required power to the pump house can be obtained by adding two poles at the site from the H-pole and a transformer of the required capacity. The Dumre sub-station is a 6/8 MVA sub-station that has sufficient capacity to supply power in the Chyanglitar area. In addition, a new sub-station of 6/8 MVA capacity is also under construction in Thanti Pokhari of Palungtar municipality. According to the Assistant Engineer of the Palungtar No-light Section, the sub-station will be completed within a year, and the power supply will be improved in the rural areas of Gorkha, including the Palungtar area.

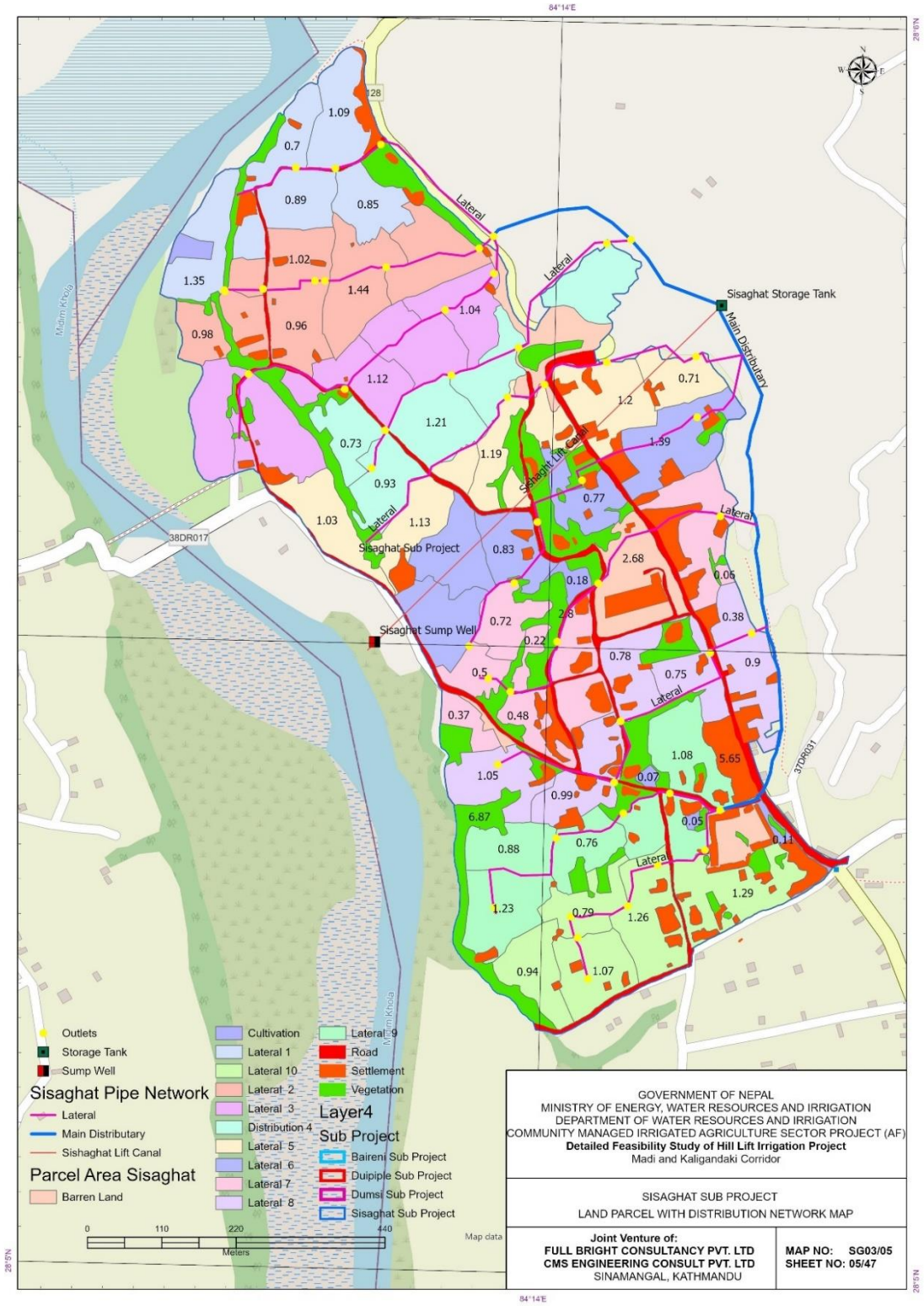
78. **Layout Maps of the Subprojects**. The detailed layouts of all 12 subprojects with distribution pipeline networks, proposed wells and reservoirs are presented in the following figures.

Figure 6: Sishaghat Subproject Satellite Image Overlay



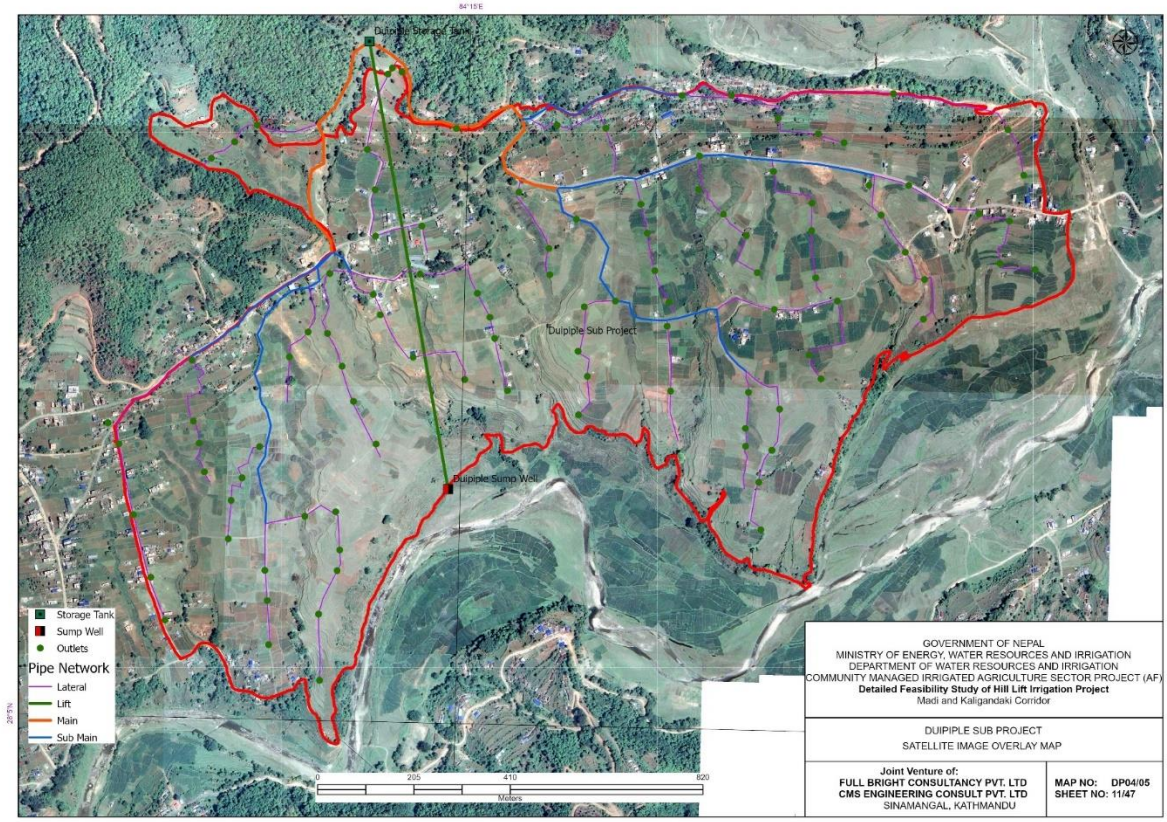
Source: Detail Feasibility Study Report, 2022

Figure 7: Sishaghat Subproject Layout Map



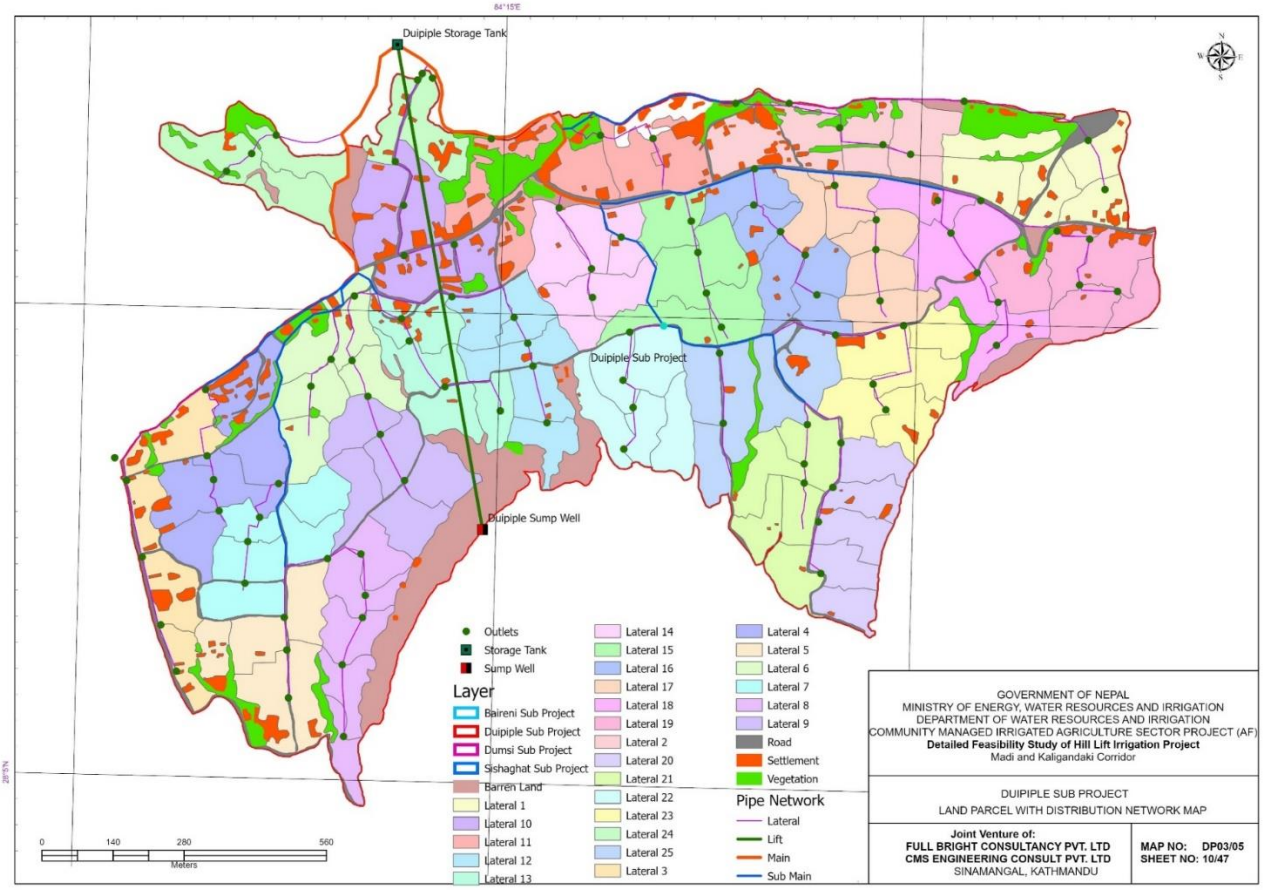
Source: Detail Feasibility Study Report, 2022

Figure 8: Duipiple Subproject Satellite Image Overlay



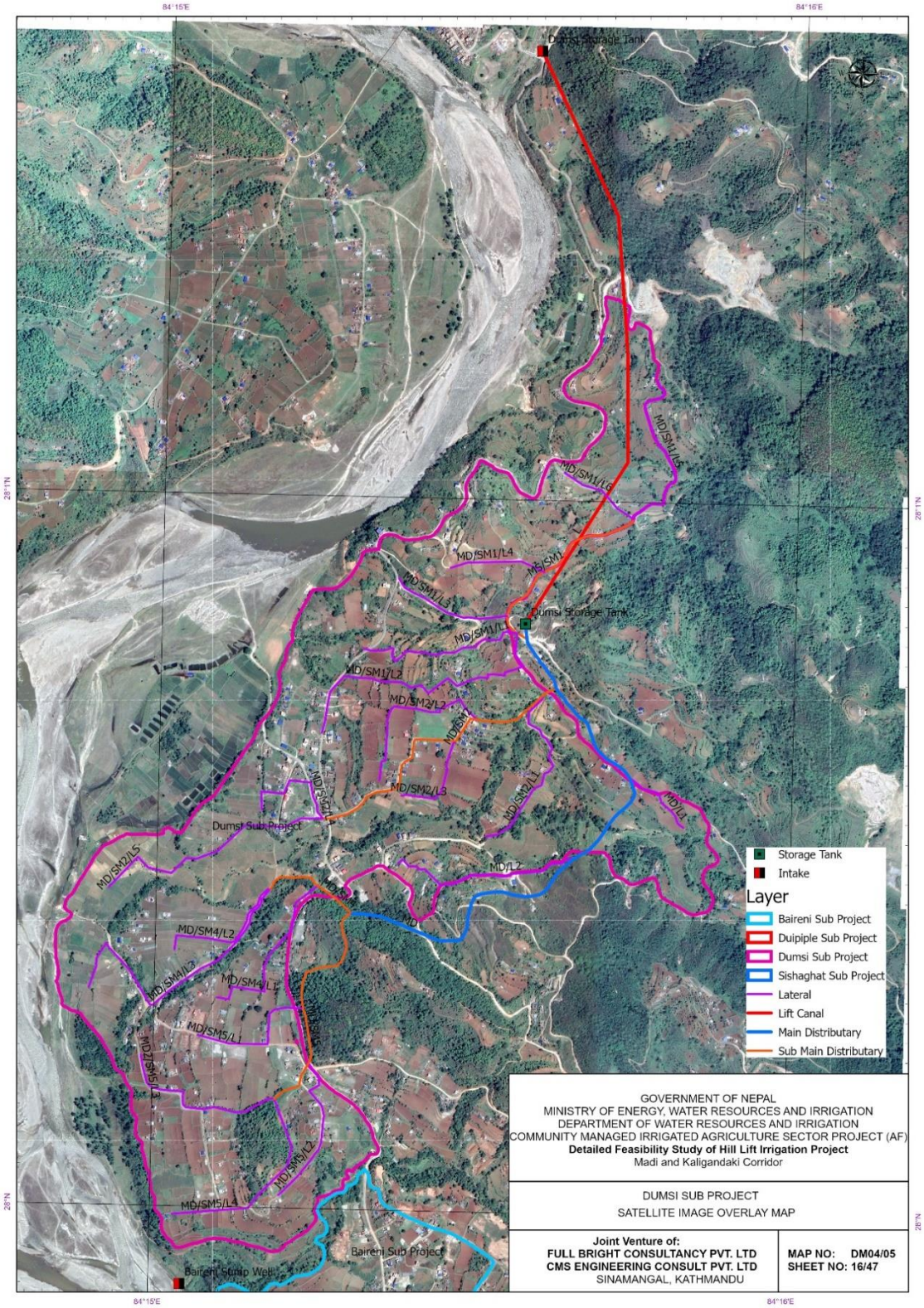
Source: Detail Feasibility Study Report, 2022

Figure 9: Duipiple Subproject Layou Map



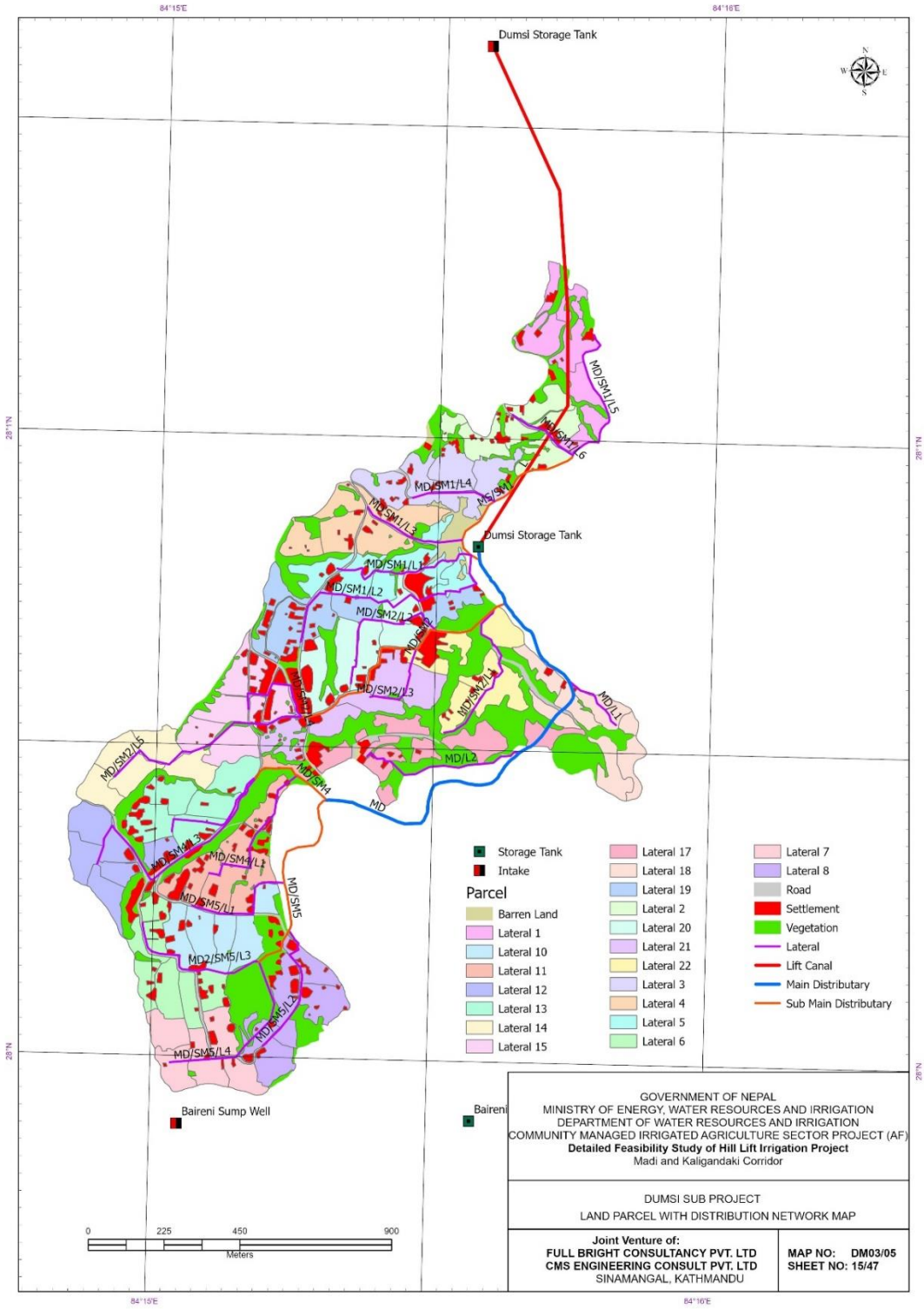
Source: Detail Feasibility Study Report, 2022

Figure 10: Dumsi Subproject Satellite Image Overlay



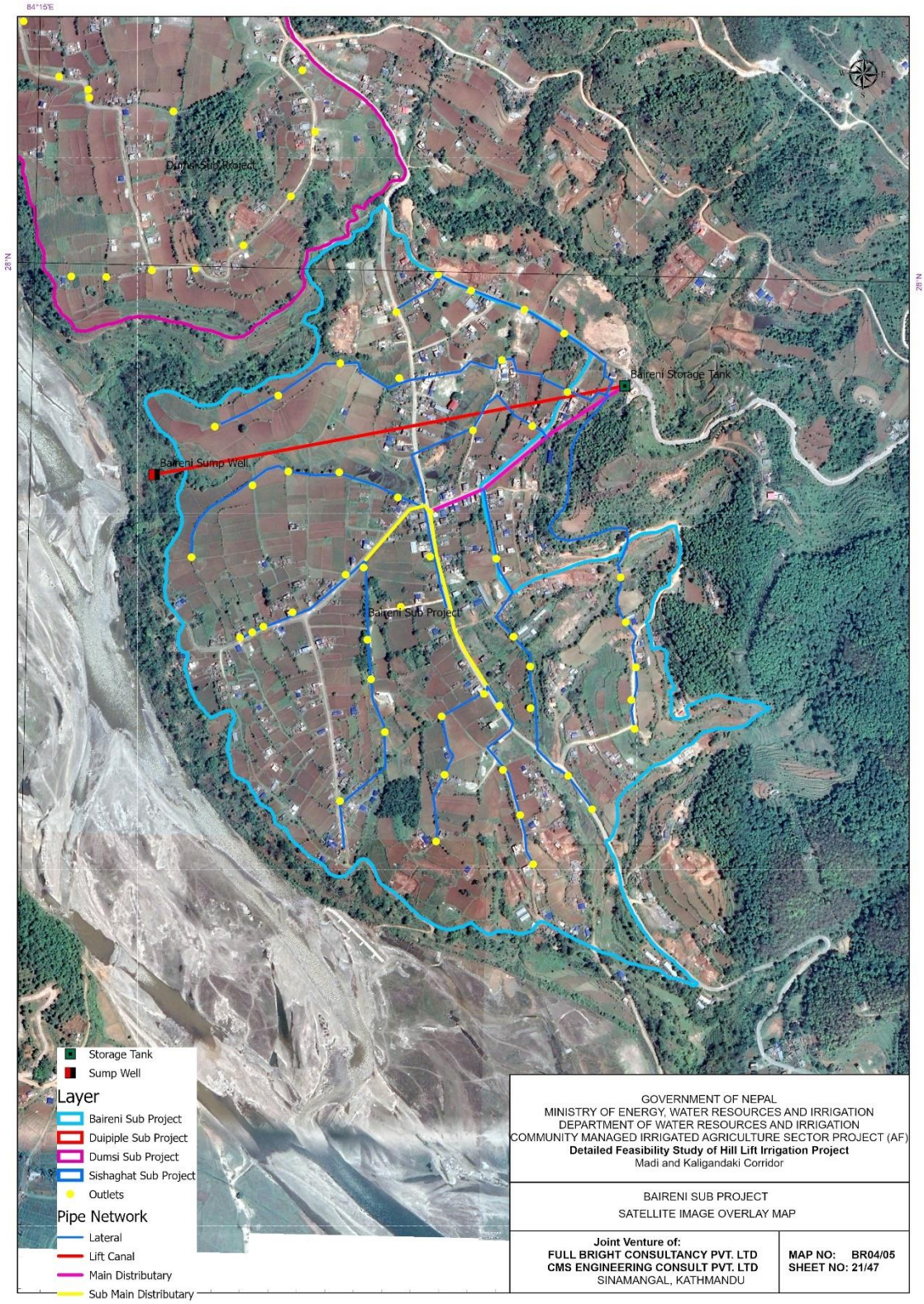
Source: Detail Feasibility Study Report, 2022

Figure 11: Dumsi Subproject Layou Map



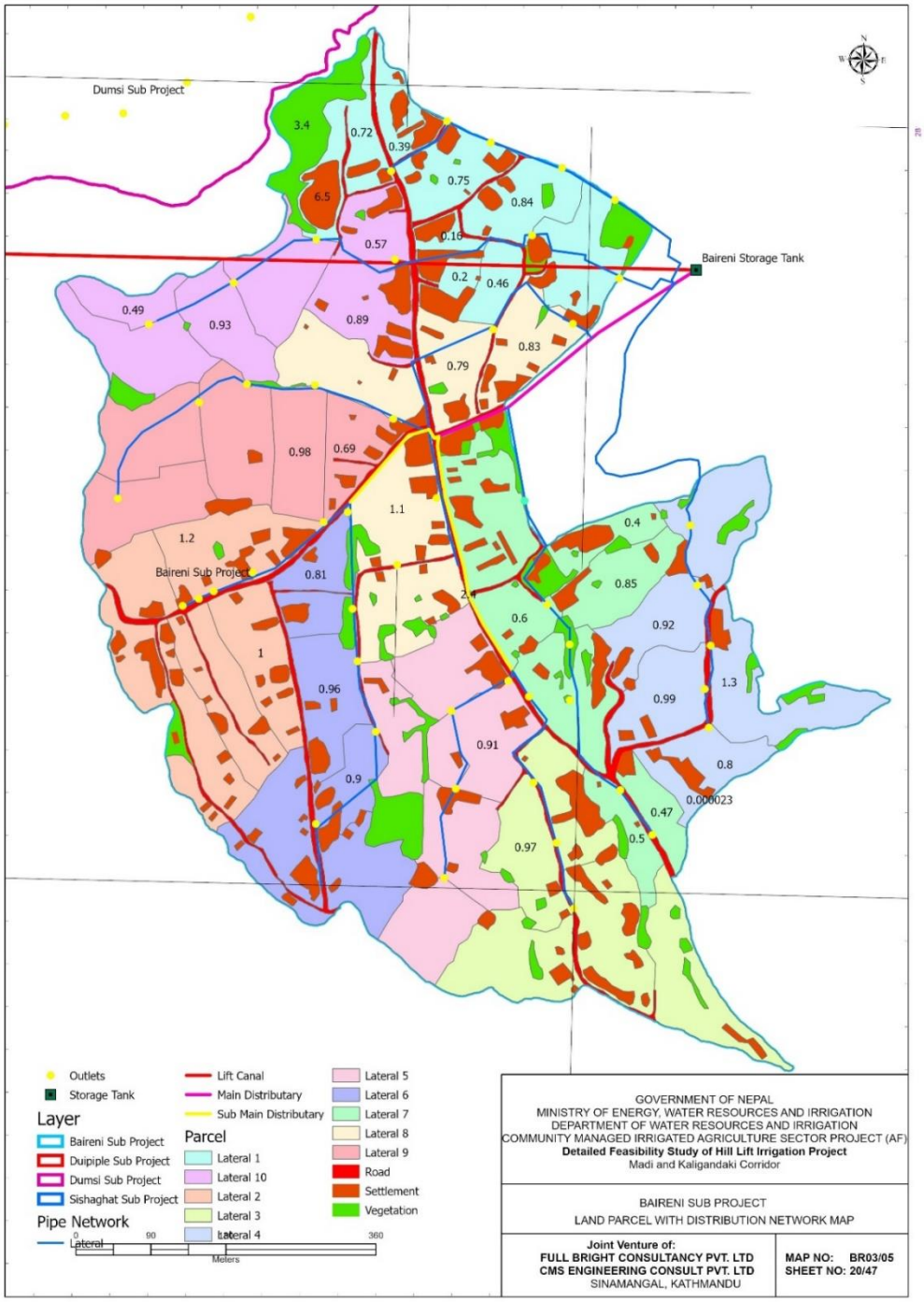
Source: Detail Feasibility Study Report, 2022

Figure 12: Baireni Subproject Satellite Image Overlay



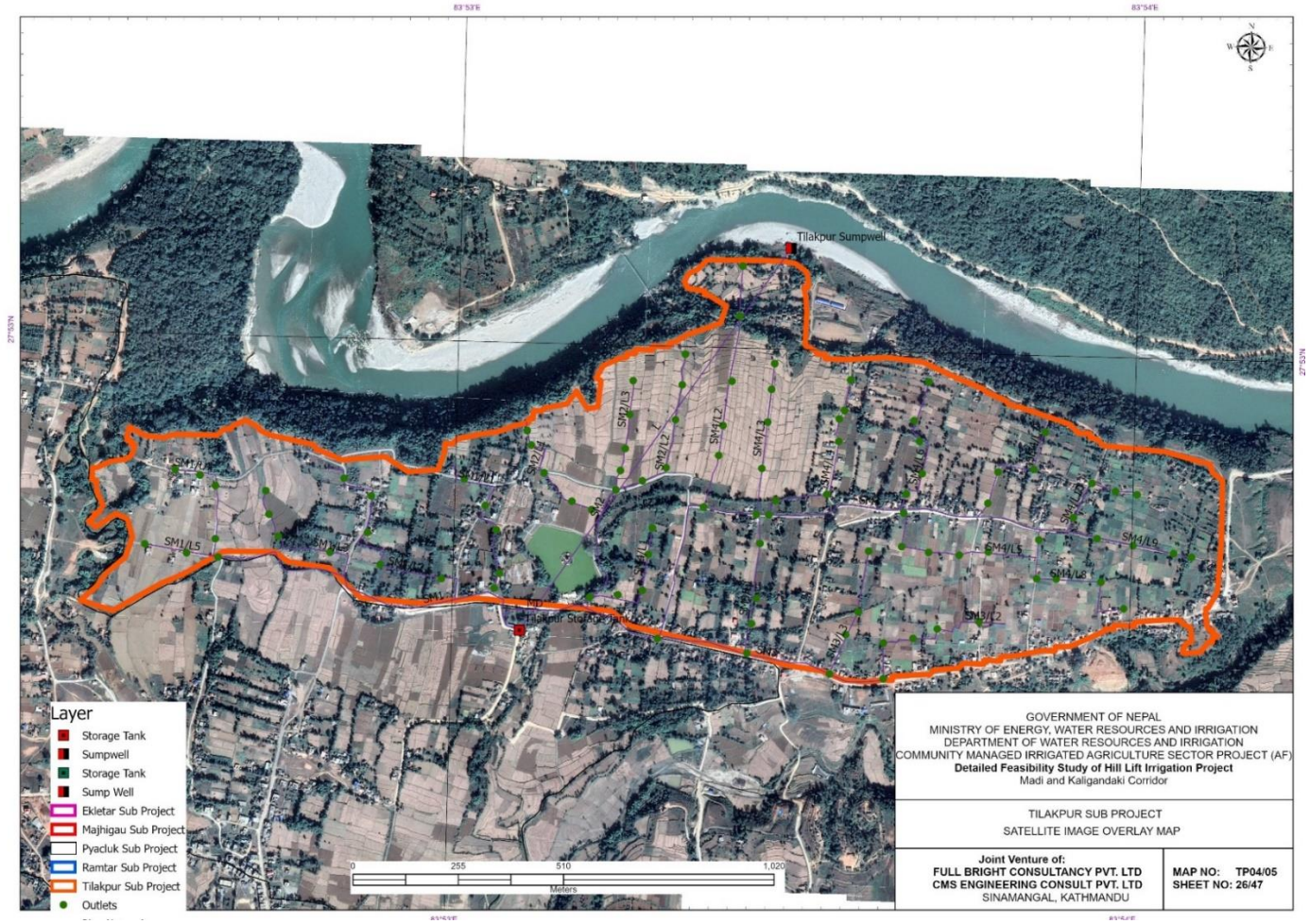
Source: Detail Feasibility Study Report, 2022

Figure 13: Baireni Subproject Layou Map



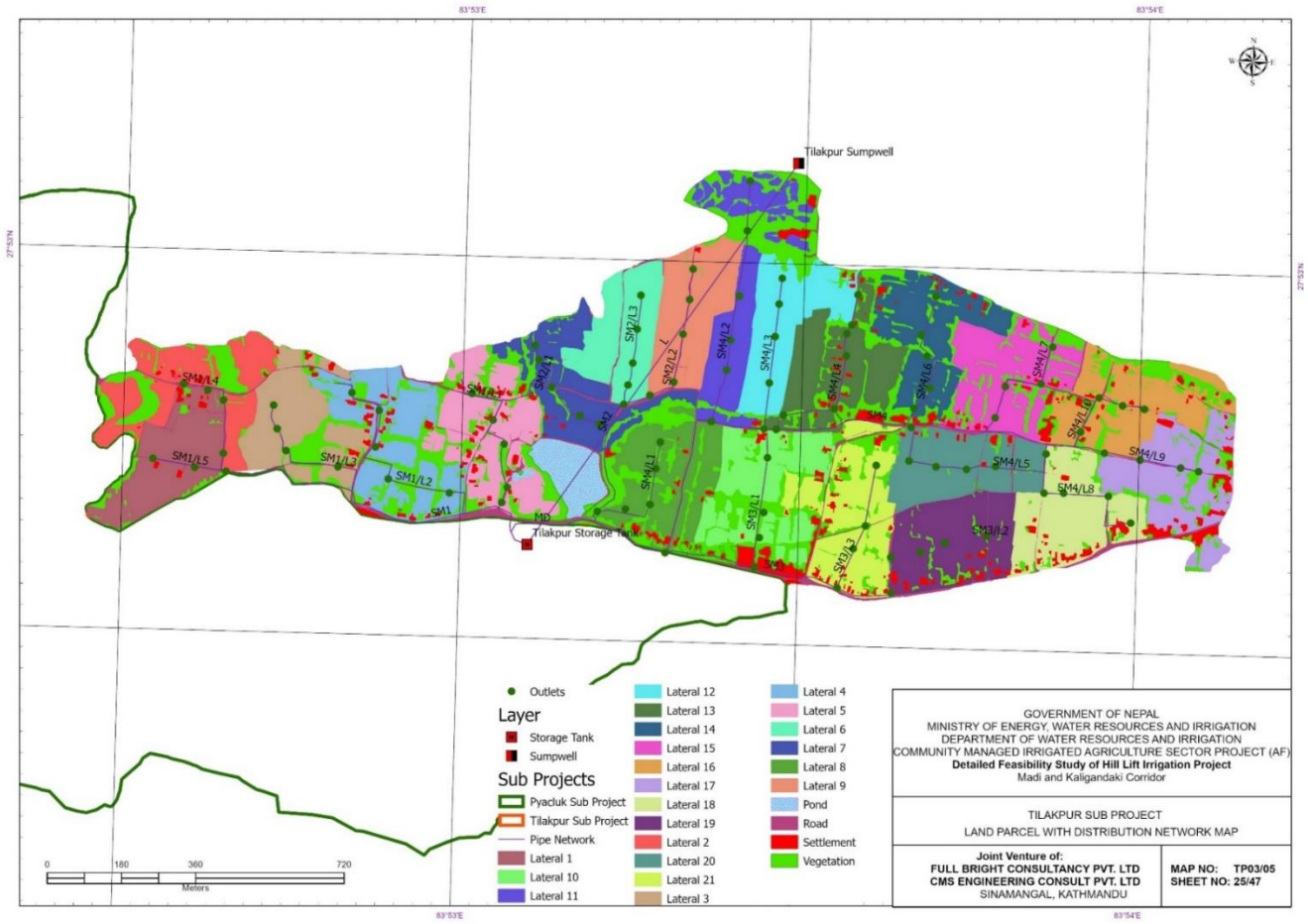
Source: Detail Feasibility Study Report, 2022

Figure 14: Tilakpur Subproject Satellite Image Overlay



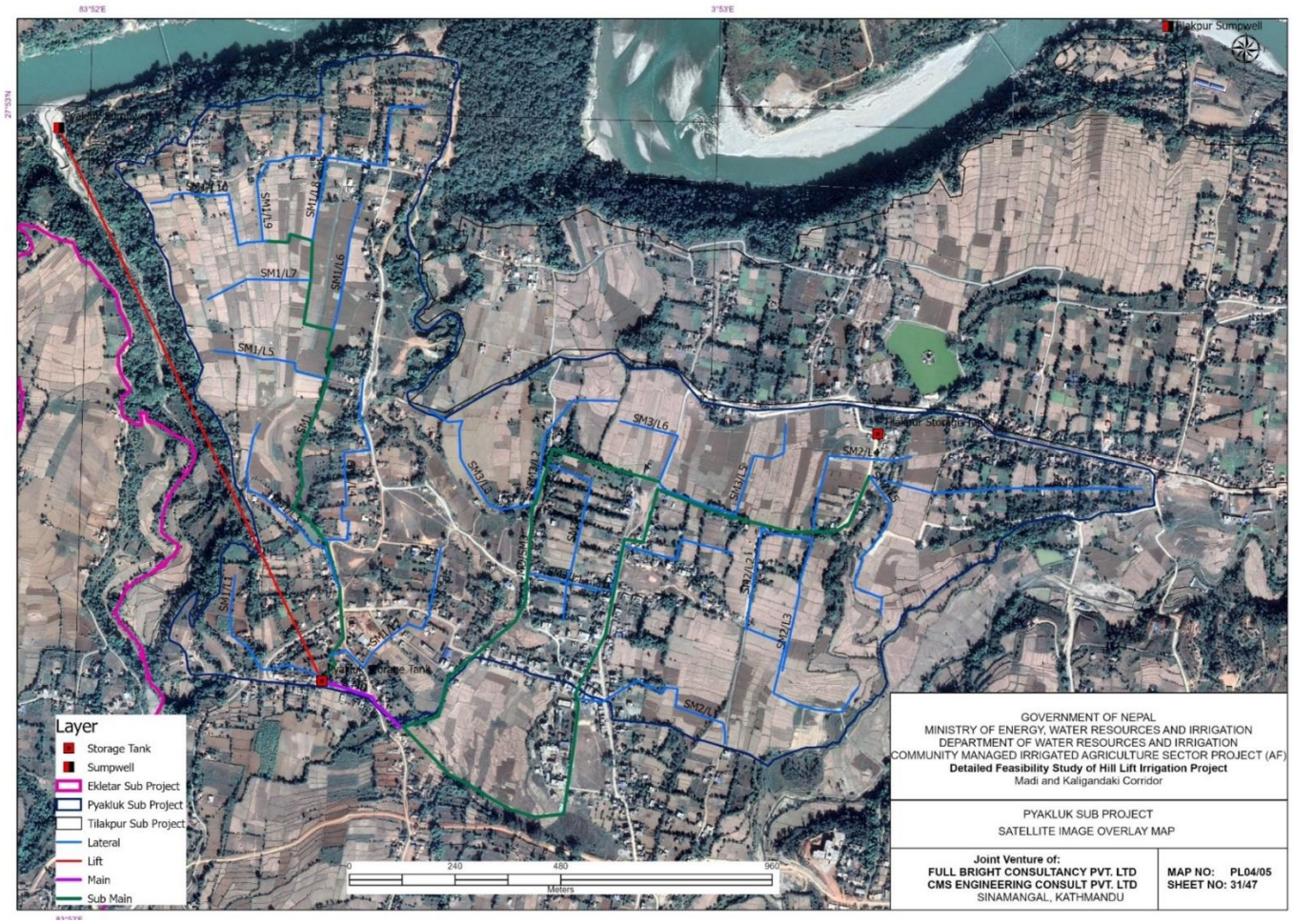
Source: Detail Feasibility Study Report, 2022

Figure 15: Tilakpur Subproject Layou Map



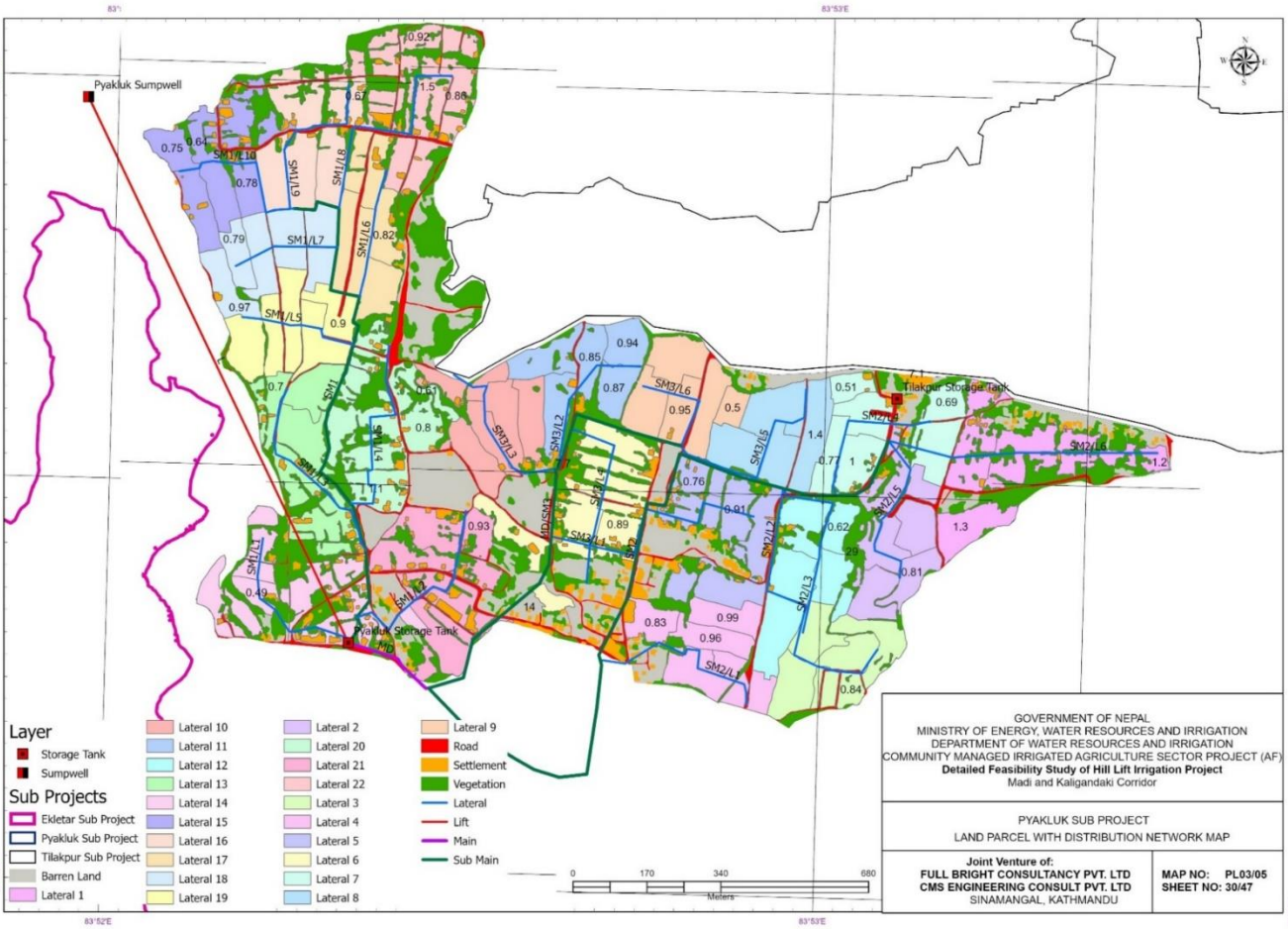
Source: Detail Feasibility Study Report, 2022

Figure 16: Pyakluk Subproject Satellite Image Overlay



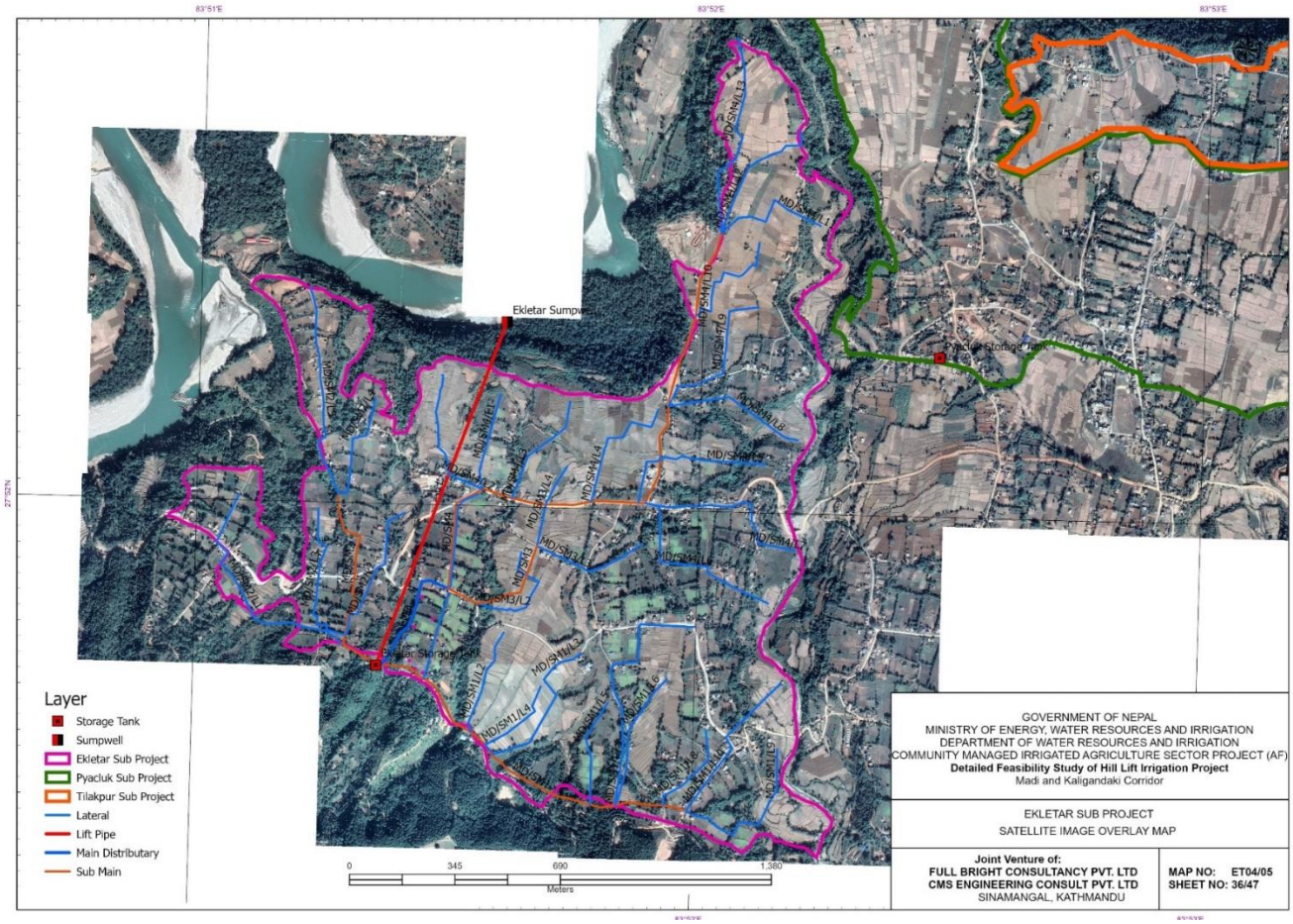
Source: Detail Feasibility Study Report, 2022

Figure 17: Pyakluk Subproject Layou Map



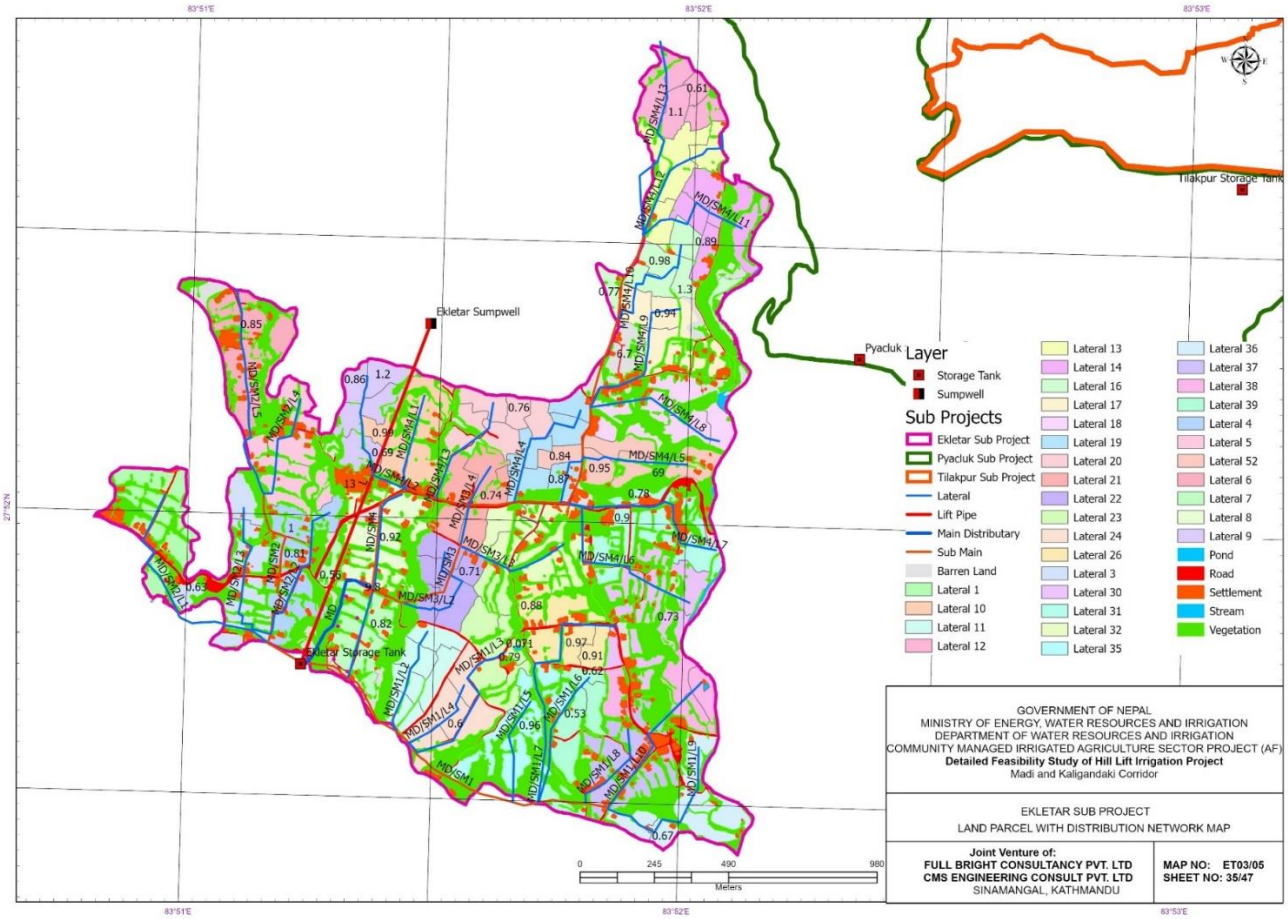
Source: Detail Feasibility Study Report, 2022

Figure 18: Ekletar Subprojects Satellite Image Overlay



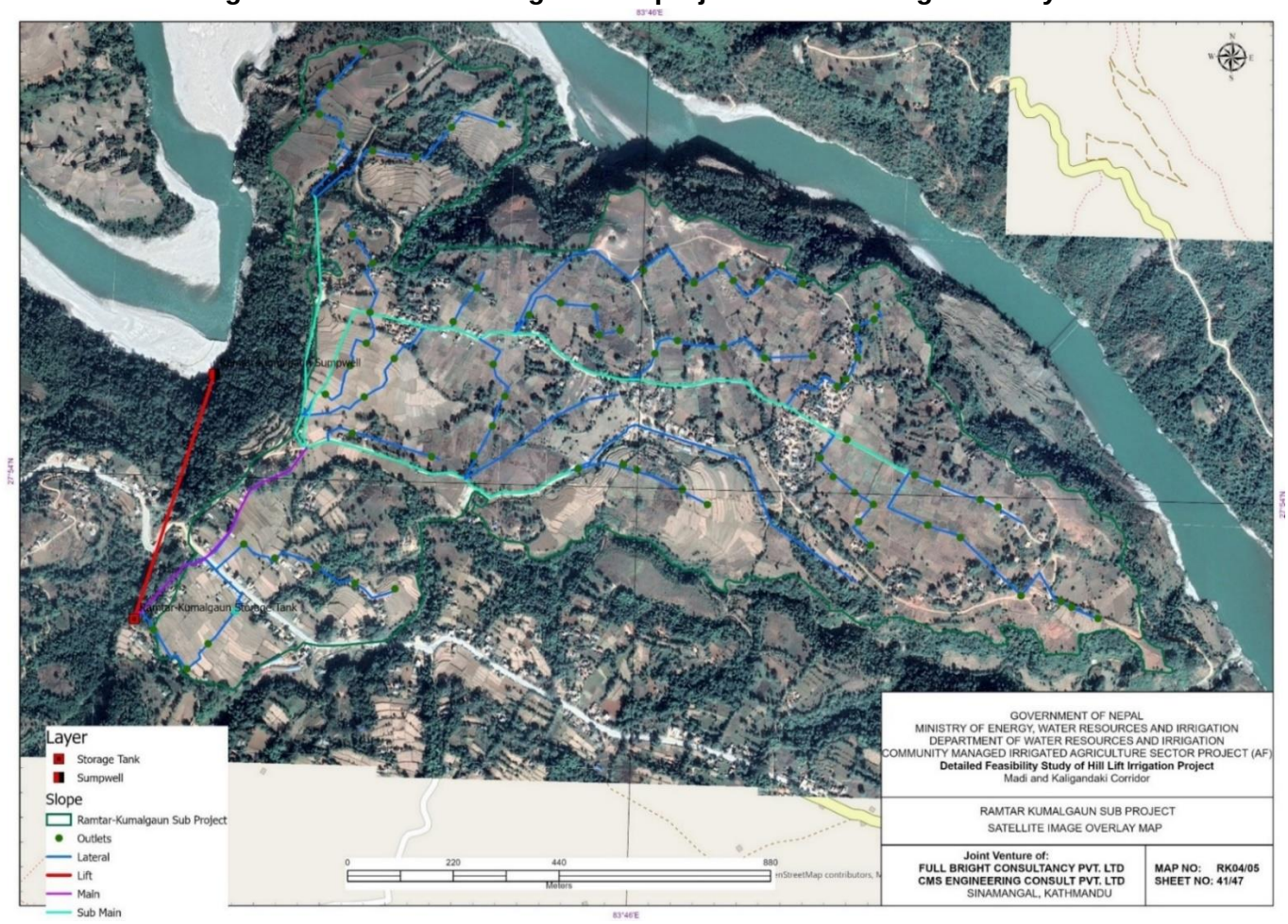
Source: Detail Feasibility Study Report, 2022

Figure 19: Ekletar Subproject Layou Map



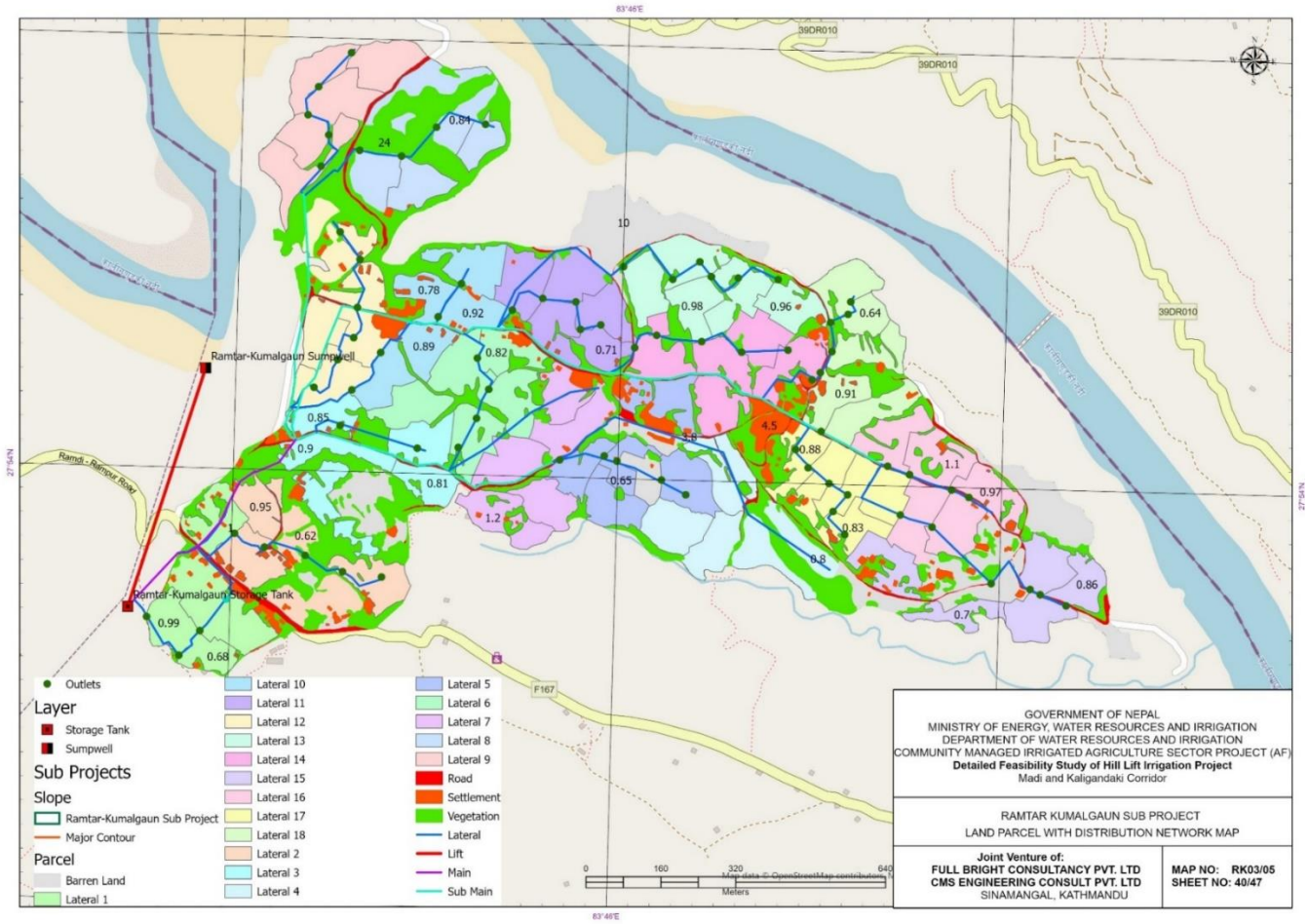
Source: Detail Feasibility Study Report, 2022

Figure 20: Ramtar Kumalgaun Subproject Satellite Image Overlay



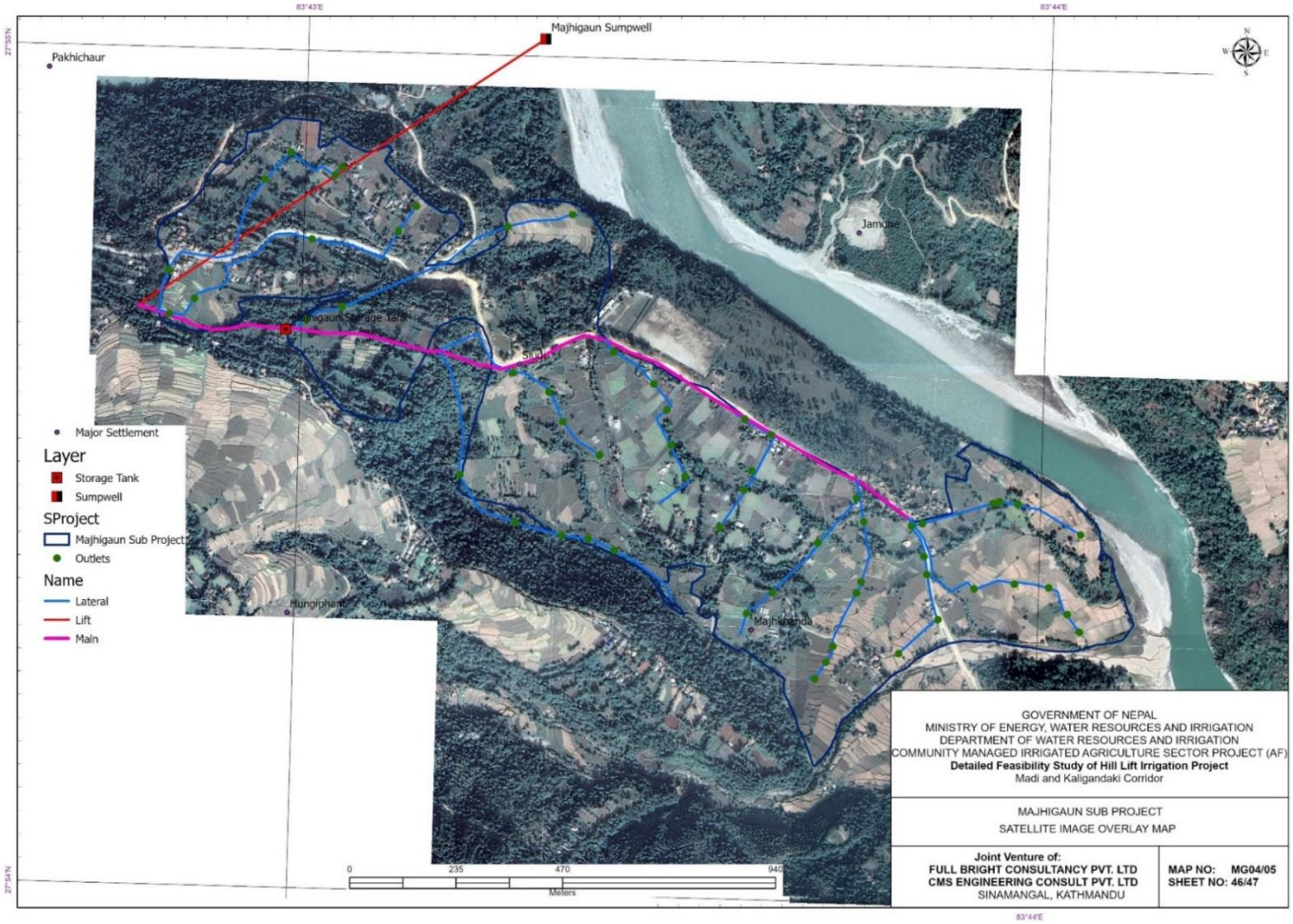
Source: Detail Feasibility Study Report, 2022

Figure 21: Ramtar Kumalgaun Subproject Layou Map



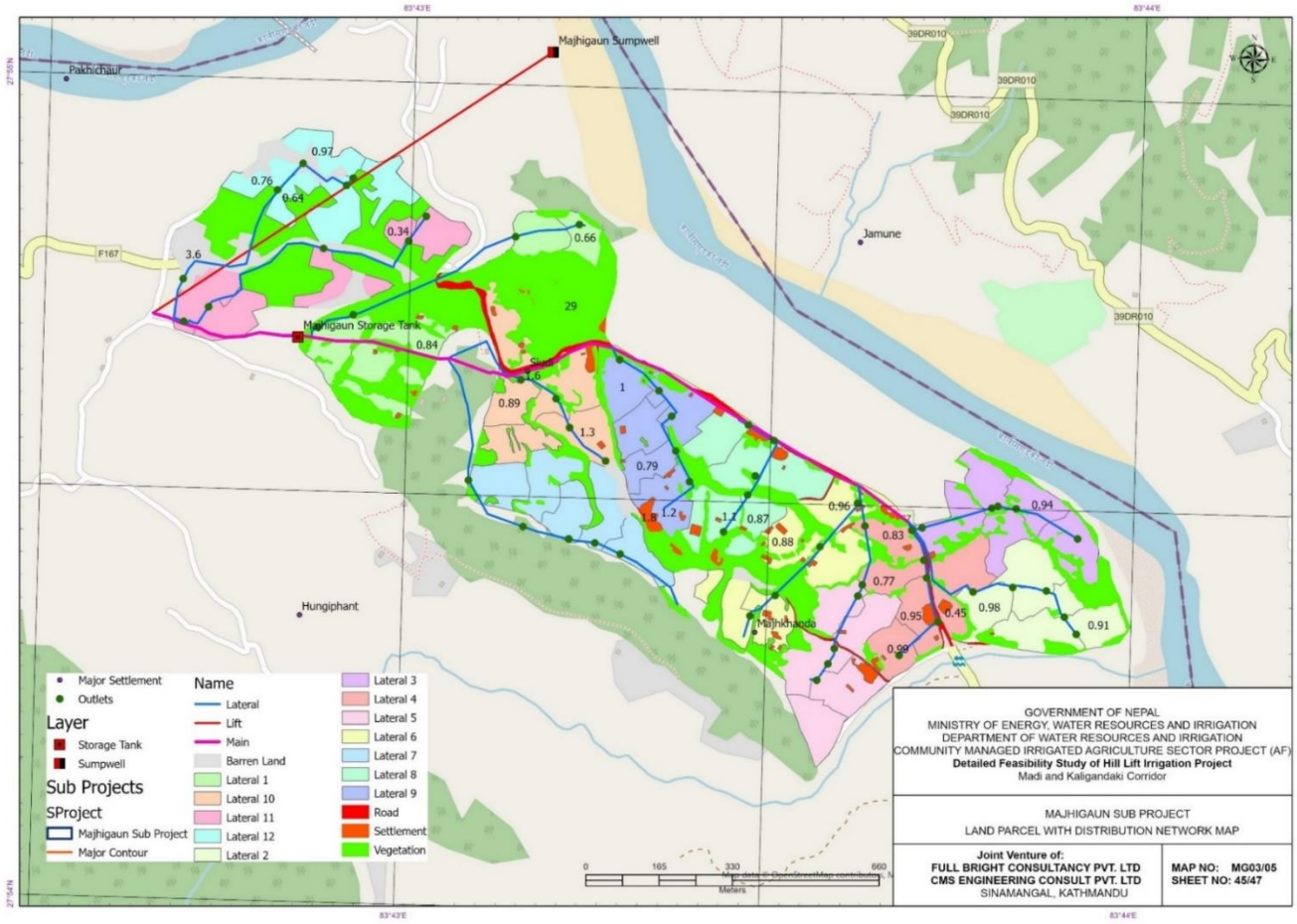
Source: Detail Feasibility Study Report, 2022

Figure 22: Majhigaun Subproject Satellite Image Overlay



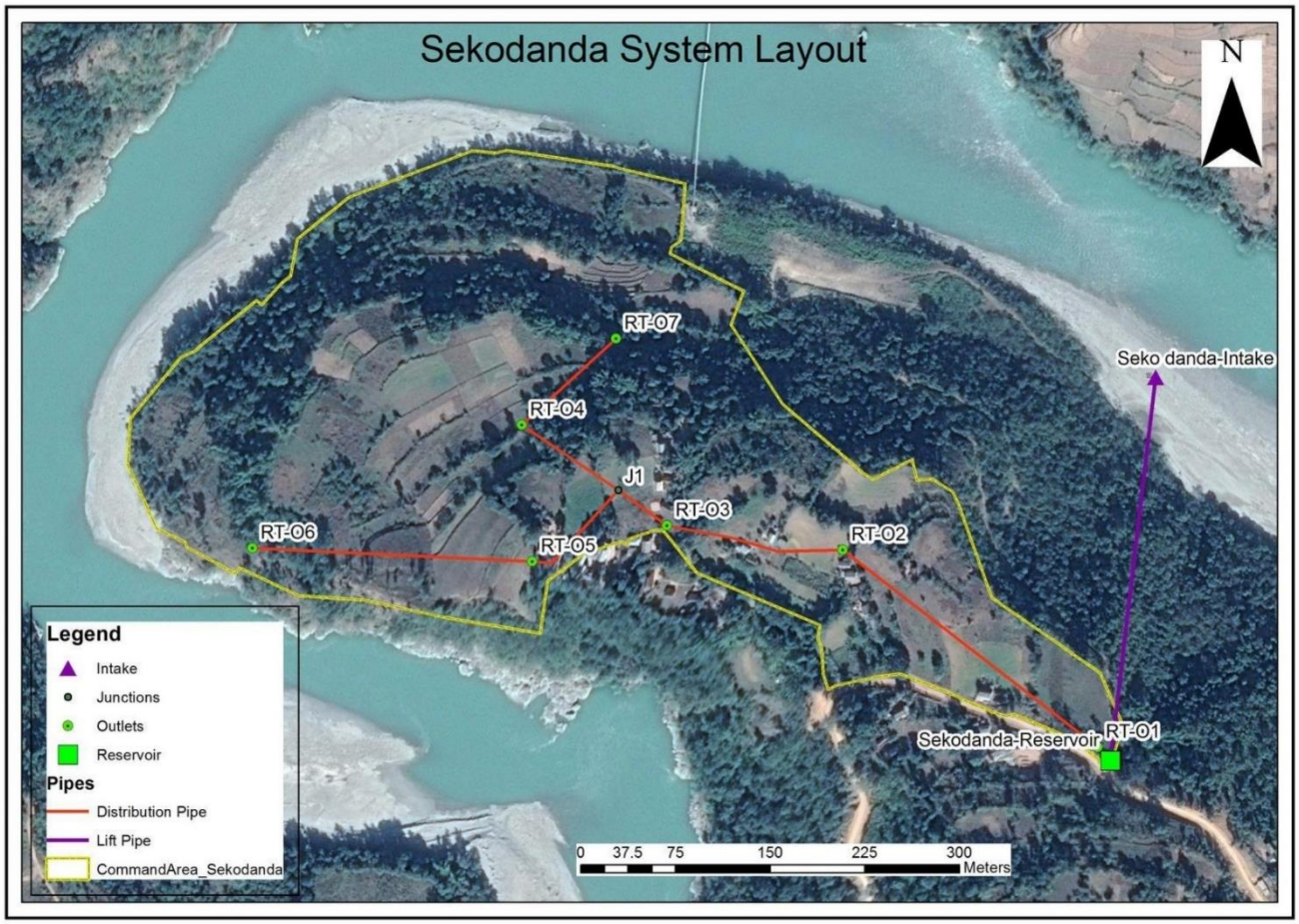
Source: Detail Feasibility Study Report, 2022

Figure 23: Majhigaun Subproject Layout Map



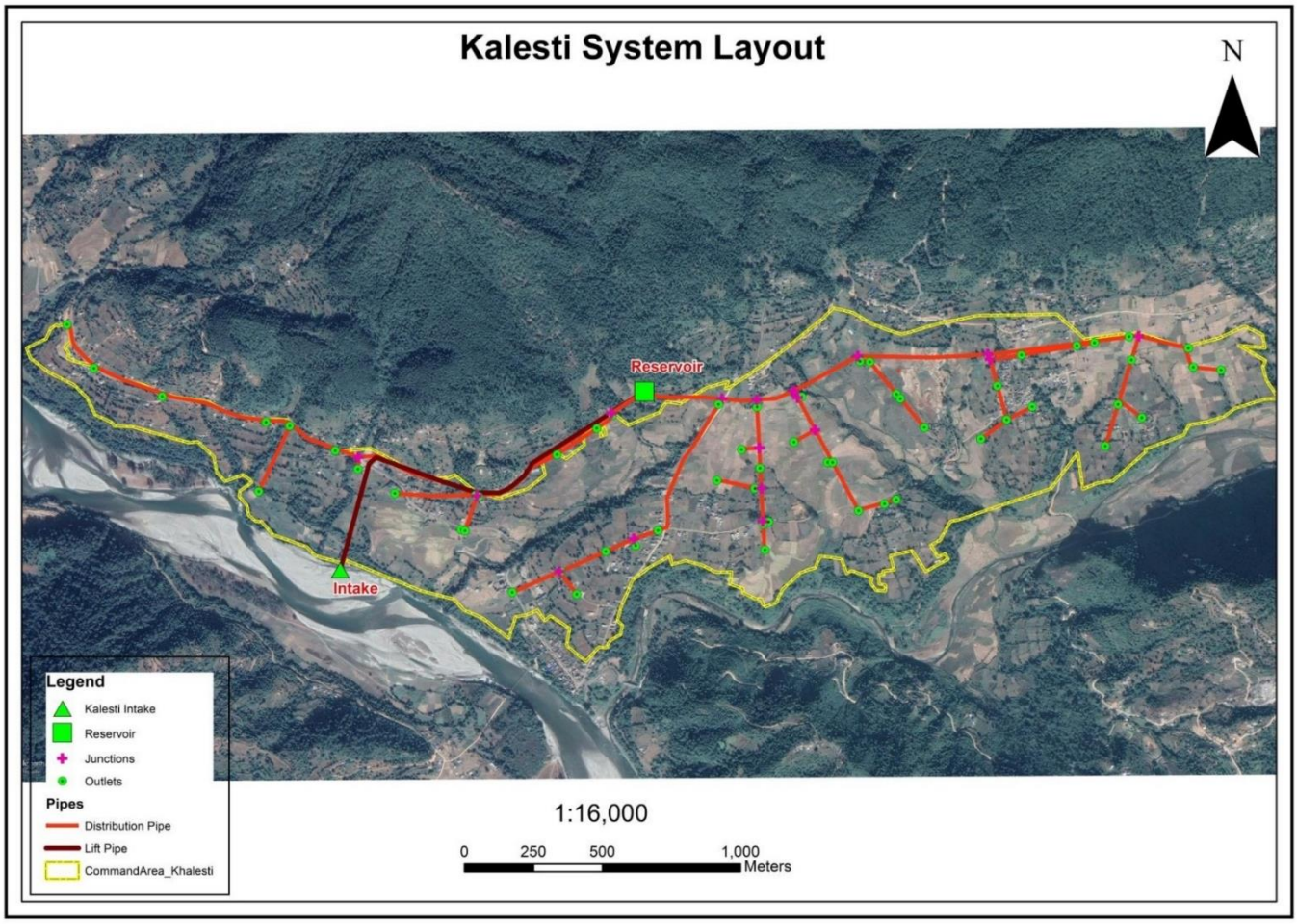
Source: Detail Feasibility Study Report, 2022

Figure 24: Sekodanda Subproject Satellite Image Overlay



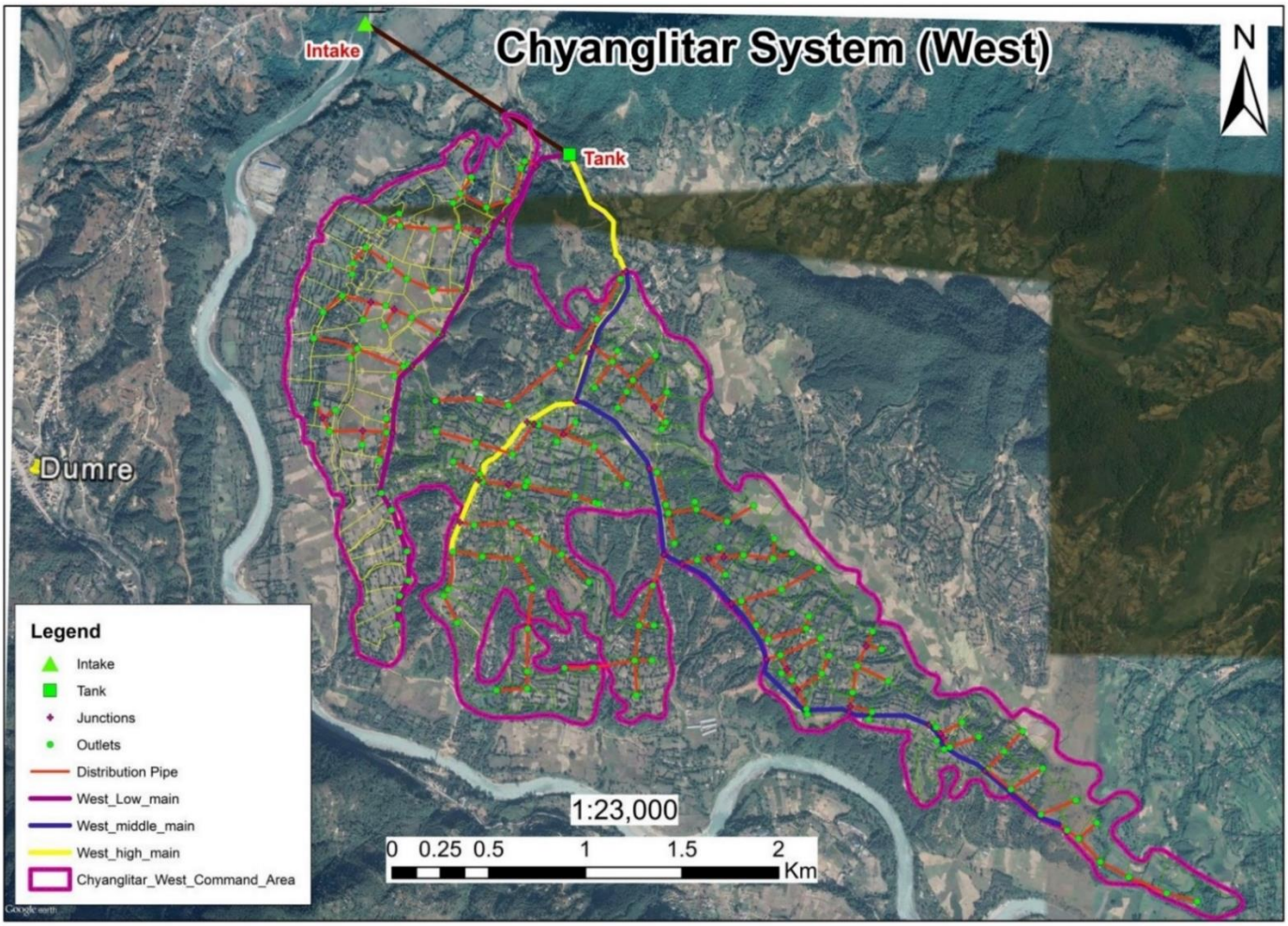
Source: Detail Feasibility Study Report, 2022

Figure 25: Kalesti Subproject Satellite Image Overlay



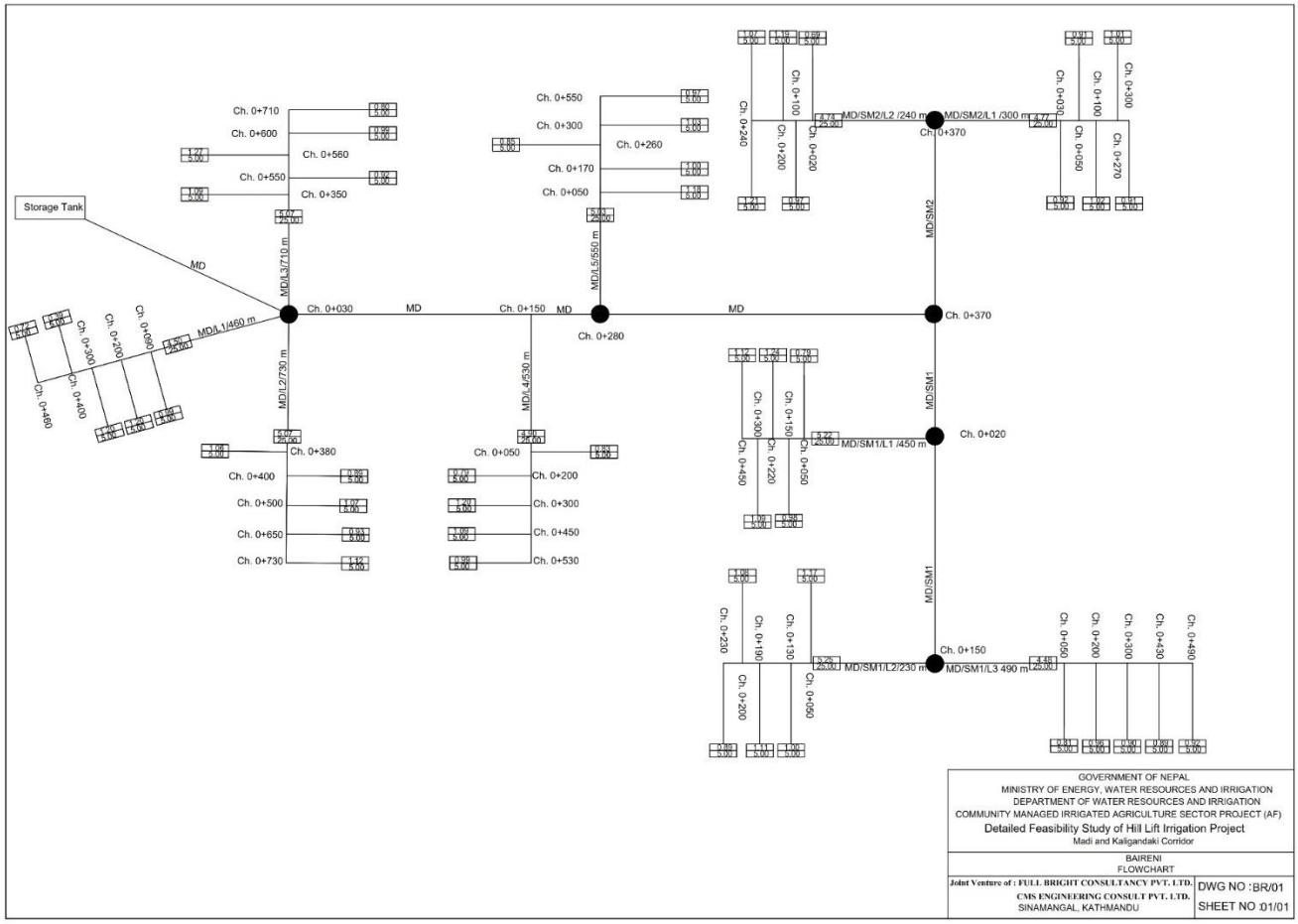
Source: Detail Feasibility Study Report, 2022

Figure 26: Chyanglitar Subproject Satellite Image Overlay



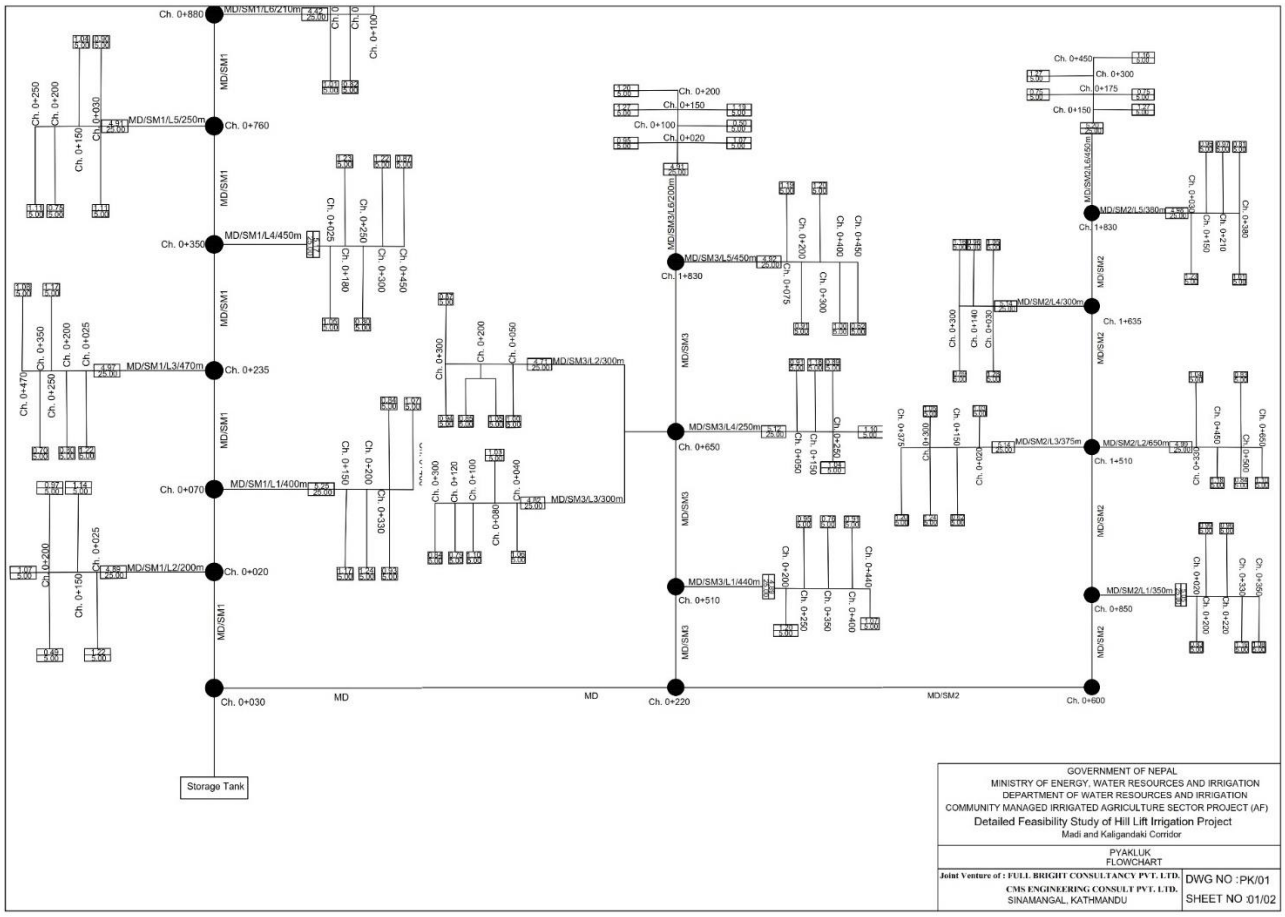
Source: Detail Feasibility Study Report, 2022

Figure 27: Pipe distribution network flow chart of Baireni Subproject in Madi River Corridor



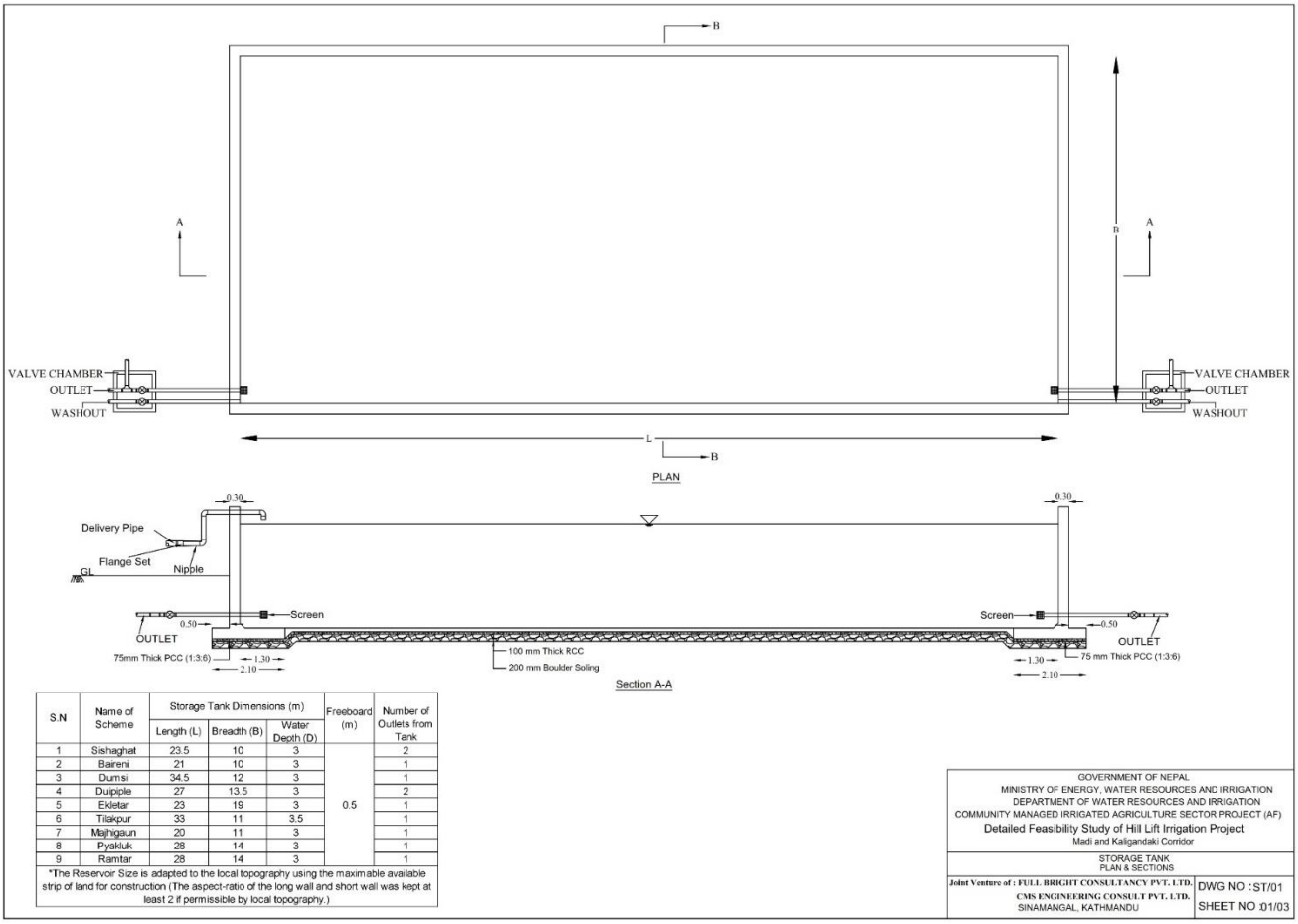
Source: Detail Feasibility Study Report, 2022

Figure 28: Pipe distribution network flow chart of Pyakluk Subproject in Kaligandaki River Corridor



Source: Detail Feasibility Study Report, 2022

Figure 29: Plan and Section view of the Storage tank proposed for the Hill Lift Irrigation Subprojects



S.N	Name of Scheme	Storage Tank Dimensions (m)			Freeboard (m)	Number of Outlets from Tank
		Length (L)	Breadth (B)	Water Depth (D)		
1	Sishaghat	23.5	10	3	0.5	2
2	Bairani	21	10	3		1
3	Dumsi	34.5	12	3		1
4	Duipiple	27	13.5	3		2
5	Ekletar	23	19	3		1
6	Tilakpur	33	11	3.5		1
7	Majhigaun	20	11	3		1
8	Pyakiuk	28	14	3		1
9	Ramtar	28	14	3		1

*The Reservoir Size is adapted to the local topography using the maximable available strip of land for construction (The aspect-ratio of the long wall and short wall was kept at least 2 if permissible by local topography.)

GOVERNMENT OF NEPAL
MINISTRY OF ENERGY, WATER RESOURCES AND IRRIGATION
DEPARTMENT OF WATER RESOURCES AND IRRIGATION
COMMUNITY MANAGED IRRIGATED AGRICULTURE SECTOR PROJECT (AF)
Detailed Feasibility Study of Hill Lift Irrigation Project
Madi and Kaligandaki Corridor

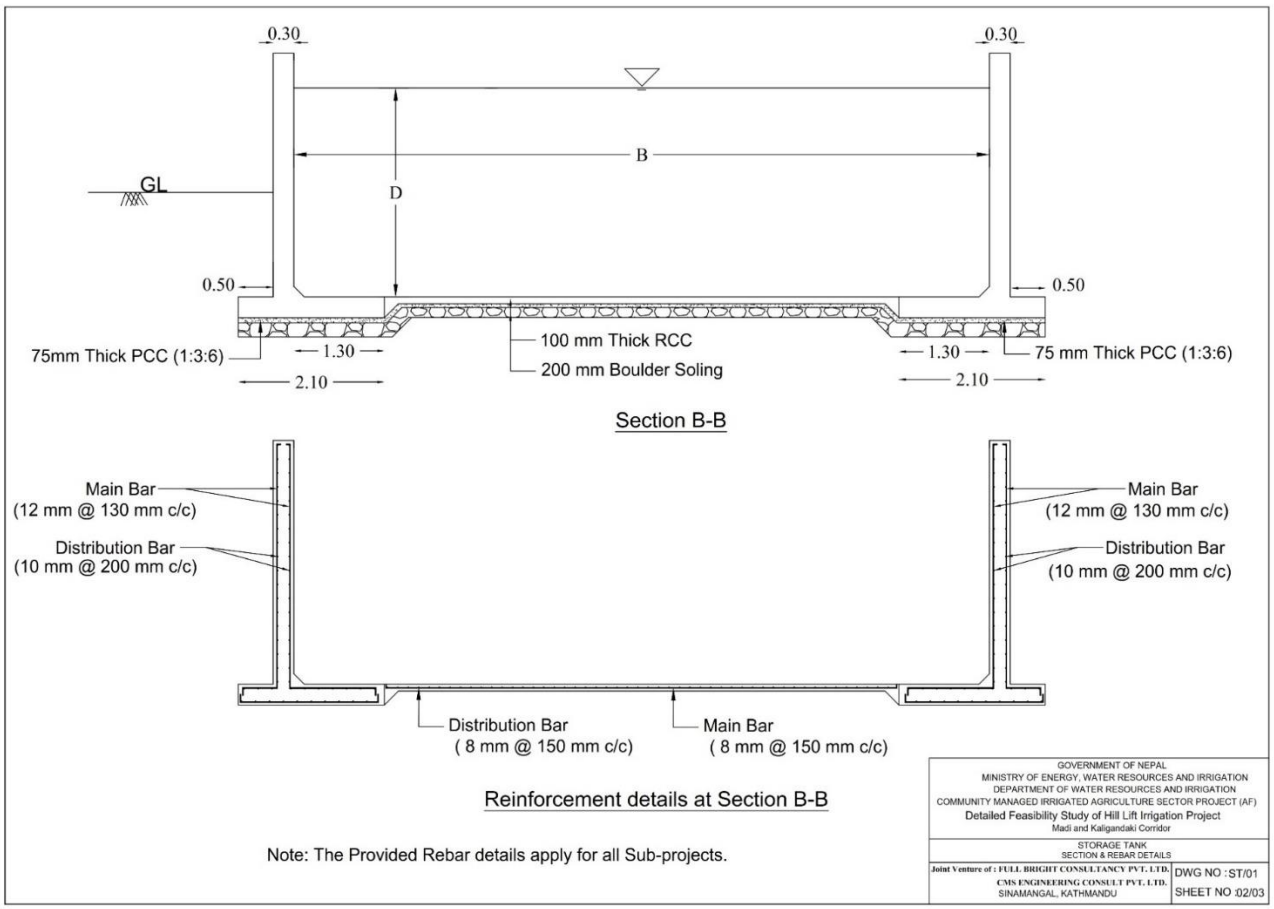
STORAGE TANK
PLAN & SECTIONS

Joint Venture of : FULL BRIGHT CONSULTANCY PVT. LTD.
CMS ENGINEERING CONSULT PVT. LTD.
SINAMANGAL, KATHMANDU

DWG NO : ST/01
SHEET NO :01/03

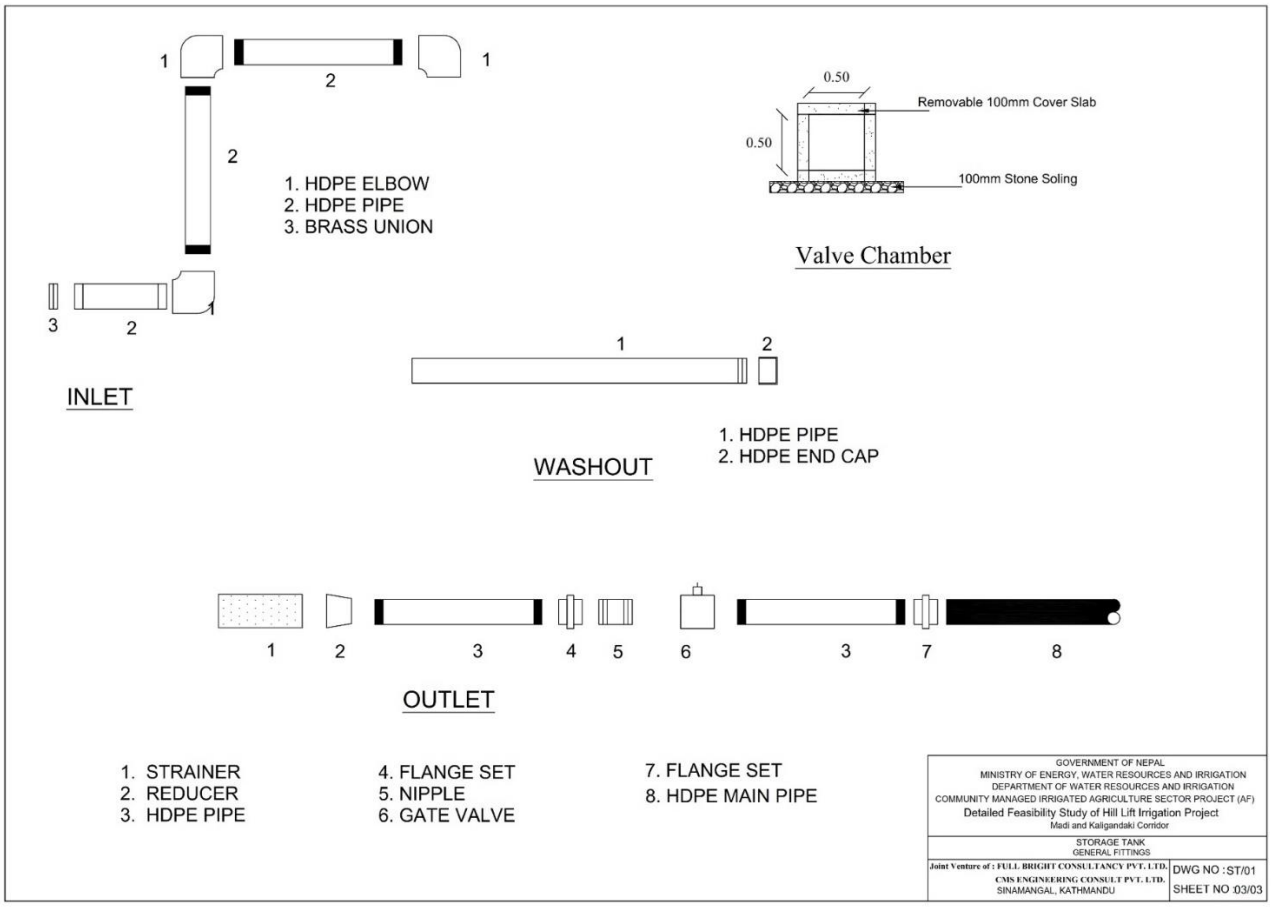
Source: Detail Feasibility Study Report, 2022

Figure 30: Section and Rebar details of the Storage tank proposed for the Hill Lift Irrigation Subprojects



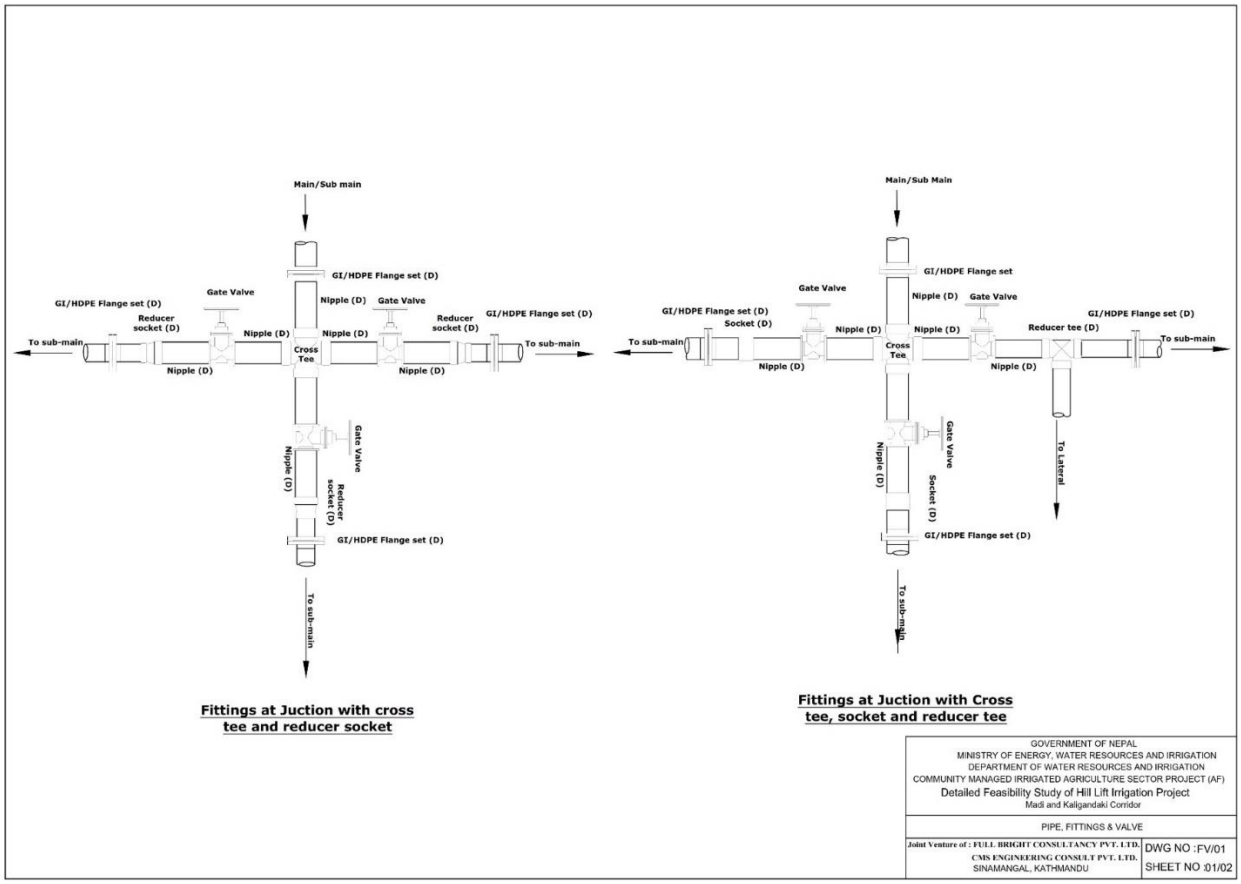
Source: Detail Feasibility Study Report, 2022

Figure 31: Storage Tank General Fittings for the Hill Lift Irrigation Subprojects



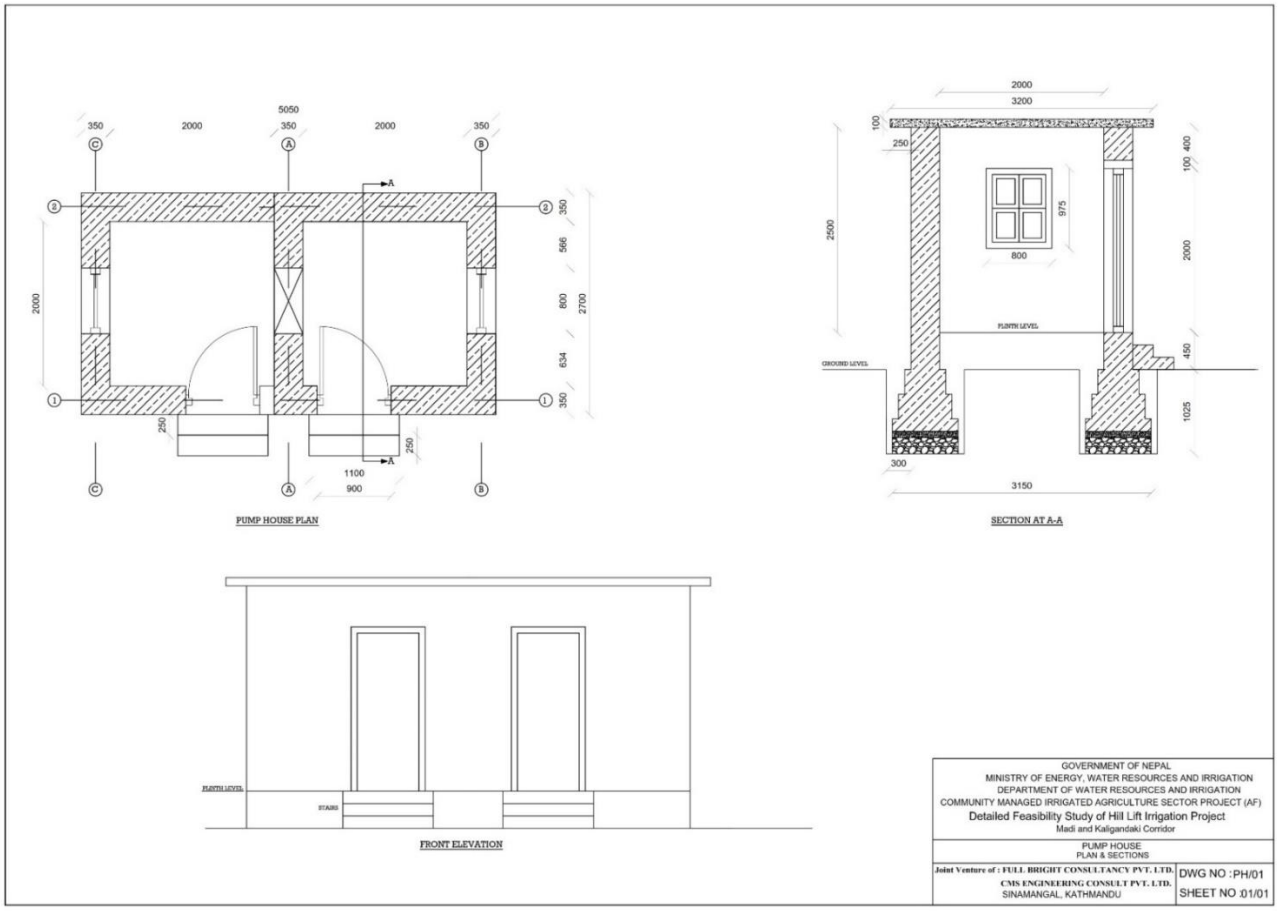
Source: Detail Feasibility Study Report, 2022

Figure 32: Pipe Fittings and Valve for the Hill Lift Irrigation Subprojects



Source: Detail Feasibility Study Report, 2022

Figure 33: Pump House Plan and Sections for the Hill Lift Irrigation Subprojects



Source: Detail Feasibility Study Report, 2022

IV. BASELINE ENVIRONMENT OF THE PROJECT

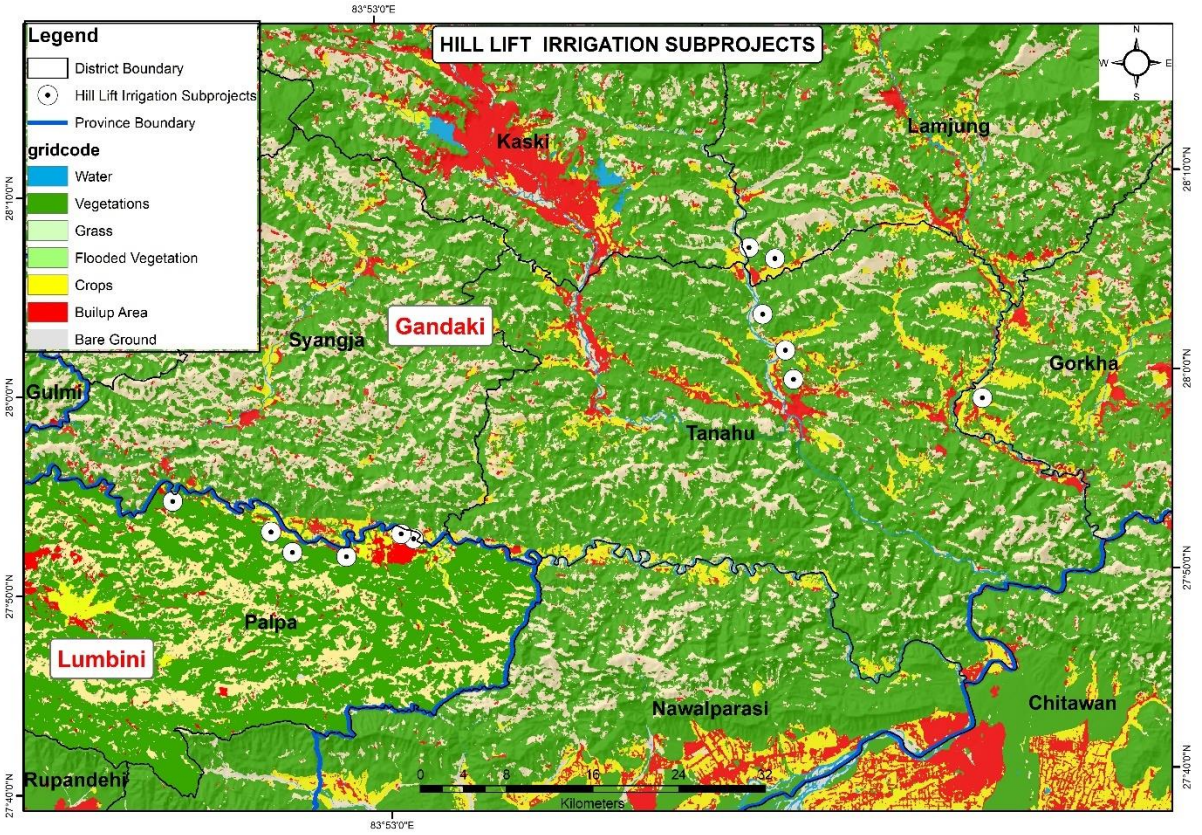
A. Physical Environment

79. **Location and Accessibility.** The location and accessibility of the selected subprojects are provided in Table 3. All subprojects are fairly accessible as they are all located along motorable and with year-round and dependable transportation. Also, all subprojects are located near rapidly growing urban and commercial centres. Dumsi and Baireni subprojects in Ward No. 10 of Vyas Municipality are close to Damauli Bazar (at a distance of ≤ 10 km), a rapidly growing urban area and commercial centre in Tanahun District. Similarly, the Duipiple and Sisaghat subprojects are located near Duipiple Bazar, a rapidly urbanizing area with a swiftly expanding population, as well as trade and commerce. The Chyanglitar subproject is located near the Dumre Bazar.

80. Similarly, of the 5 subprojects in Kaligandaki river corridor, four subprojects (Talakpur, Pyakluk, Ekletar and Ramtar-Kumalgaun) are located in Rampur Municipality and Majhigaun subproject is located in Ramghatar Rural Municipality. Rampur Bazar is a rapidly growing urban area and the second major centre for trade and commerce in the Palpa District after Tansen Bazar. The population in all of the five subprojects in Kaligandaki River Corridor is also undergoing rapid social and economic changes due to improvements in the access to infrastructure and services (road, electricity, transportation and communication, education, health and banking) and income and livelihoods of the people. Kaligandaki road corridor project completed in 2077 B.S. has increased the connectivity of the people to major trade centres in the Terai (e.g. Butwal and Narayanghat) and hills (Tansen, Pokhara and Kathmandu). As many as 7 road connectivity projects are at different stages of construction, all of them expected to be completed within a year's time. Completing these road projects will further enhance Rampur Bazar's connectivity to other towns and trade centres in the vicinity. These include: i) Rampur-Bhimad-Khairenitar road, connecting Rampur to Kharienitar on Pokhara-Kathmandu Highway, ii) Rampur-Aryabhanjyang-Tansen road, connecting Rampur to Tansen Bazar, iii) Kaligandaki corridor road passing through Rampur connecting Gaidakot (Naryanghat) in Terai and Pipaldanda (Ramdi Bazar) on Sunauli-Pokhara Highway, iv) Waling-Rampur road, connecting Rampur to Waling Bazar, v) Galayang-Chapakot-Rampur road, connecting Rampur to Galyang Bazar in Syangja, vi) Rampur-Arunkhola road connecting Rampur to Arunkhola on Narayangarh-Butwal Highway.

81. **Topography and Land Use.** The proposed lift irrigation systems are located in the river valleys of mid hills along the corridors of Marsyangdi, Madi and Kaligandaki Rivers in Gorkha, Tanahu and Palpa Districts of Western Nepal. The topography of these lift irrigation schemes comprises level terraces, sloping terraces, and river valleys intersected by numerous streams and Rivers. These areas are popularly known as tars, and they have scarce water resources for irrigation. The altitude of these areas varies from 300 to 500 m with elevated reliefs of the river valleys. The command areas of these schemes are stretched on the foothills of the Mahabharat Range. Cultivated land followed by forest lands mostly dominate the land use of these areas.

Figure 34: Land use map of the subproject area.



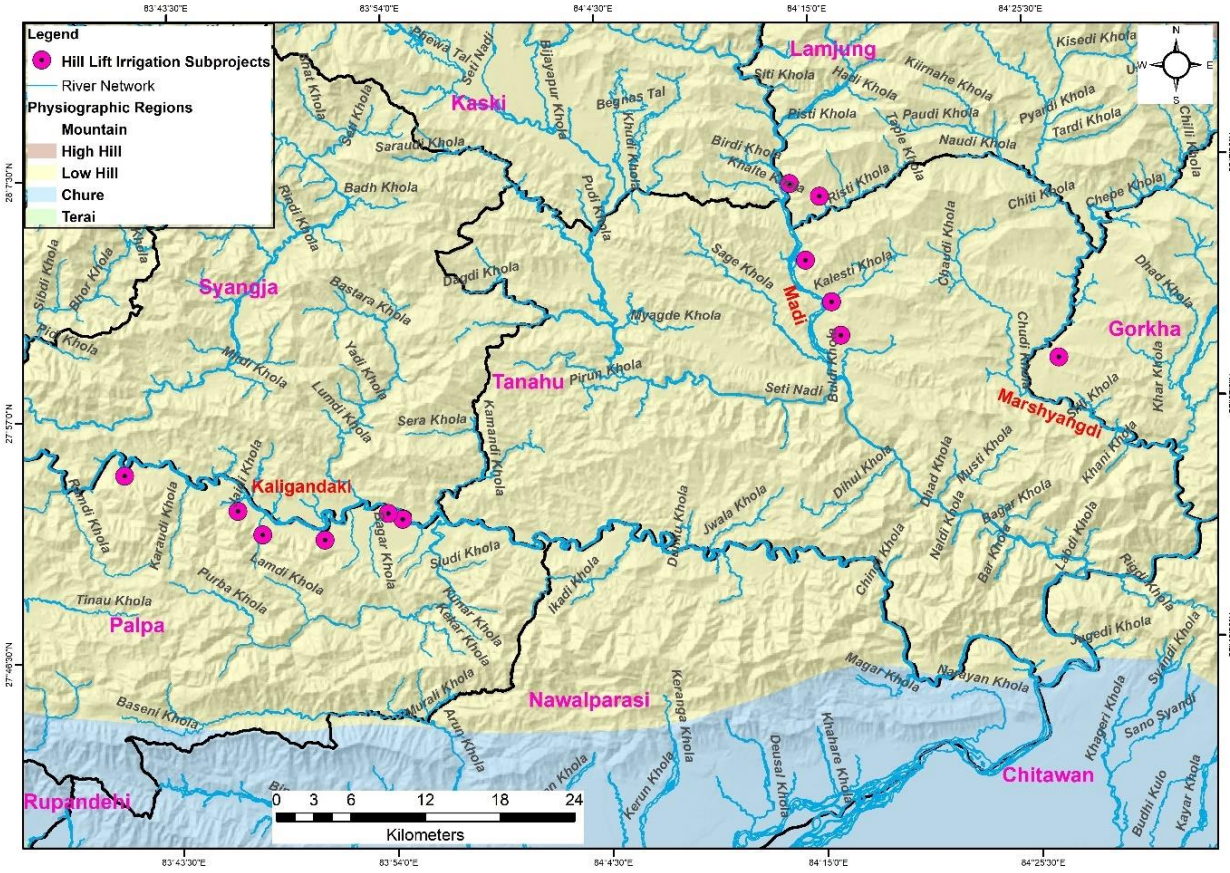
Source: ESRI Land Use 2020 and Department of Survey, GoN

82. **Climate and Water Resources.** The climate of all of the subprojects is tropical to sub-tropical. The valley floors near the rivers are generally hot and humid in summer and monsoon and cold to warm in winter. Ridges and upper terraces are cooler in summer and receive plenty of sunlight in winter. Much rainfall in the river corridors occurs during the summer monsoon season, which lasts from June to September. The average annual rainfall in the subproject areas ranges from 1,600 to 1,900mm. Mean daily maximum temperature ranges from 19°Cto 34°C while minimum temperature ranges from 8°C to 24°C. The hottest are June and July, and the coldest are December and January. The monthly summary of weather (temperature, relative humidity and rainfall) of two reference stations- Damauli (station# 817) and Chapakot (station# 810), which are in proximity of the subprojects in Madi and Kaligandaki river corridors, respectively, is provided in table 2-2. The climate of the project area favours three distinct crop seasons- monsoon cropping (July-October), winter cropping (November-February) and summer/spring cropping (March-June) and the possibility to grow diverse cereals, pulses, oilseeds and vegetables throughout the year.

83. The mid-hill areas of Western Nepal have been gifted with a number of perennial rivers that originate from the Himalayas. Marsyangdi, Madi, and Kaligandaki are the three main rivers used for lift irrigation schemes. All these rivers are the main tributaries of the Gandaki River system, which meet together at Devghat of Tanahu District. The hydrology of these rivers reveals sufficient water even during the low flow periods and high peaks during monsoon. Rishti and Kalesti are left-bank tributaries in the Madi River in the project area. Similarly, Baha Khola and Turundi Khola are the right bank

tributaries in the Kaligandaki River that pass through the subproject areas. Farmers tap these seasonal and perennial streams by developing several Farmers Managed Irrigation Systems (FMIS) to provide irrigation to patches of agricultural lands located close to them. For proposed hill lift irrigation subprojects, water pumped from Madi and Kaligandaki Rivers has been considered the exclusive water source. In the Duipiple subproject, however, water pumped from Rishti Khola upstream of its confluence to Madi River has been considered as the source of supply.

Figure 35: River Networks Nearby the subproject areas.



Source: Department of Survey, GoN

Table 18: Monthly summary of climate at representative weather stations in the two river corridors

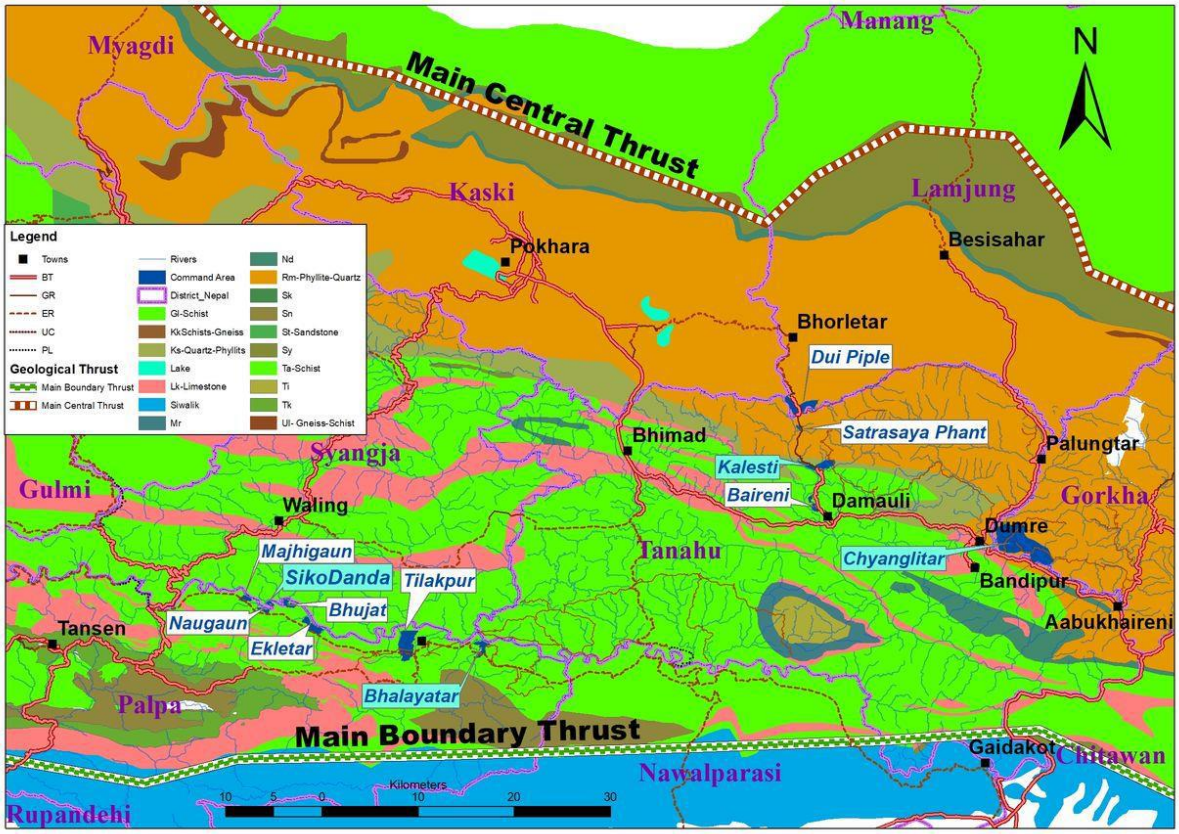
Month	Madi River Corridor Damauli (Station# 817)			Kaligandaki River Corridor Chapakot (Station# 810)		
	Temperature (^{0}C)	Rainfall (mm)	Relative humidity (%)	Temperature (^{0}C)	Rainfall (mm)	Relative humidity (%)
January	15.1	17.7	88.7	13.5	23.0	80.9
February	18.4	31.2	80.1	16.0	21.7	75.5
March	22.0	45.4	69.4	19.6	39.5	69.3
April	25.5	99.5	66.4	23.4	80.4	69.9
May	27.0	233.9	72.4	24.8	172.4	74.7
June	28.4	337.9	76.1	26.0	311.6	81.3
July	29.0	438.4	82.3	25.9	404.6	85.4
August	29.1	350.1	82.2	25.7	354.2	85.0
September	27.9	197.5	82.9	24.7	158.6	84.8
October	25.1	38.6	85.2	22.4	30.9	82.4

Month	Madi River Corridor Damauli (Station# 817)			Kaligandaki River Corridor Chapakot (Station# 810)		
	Temperature (^{0}C)	Rainfall (mm)	Relative humidity (%)	Temperature (^{0}C)	Rainfall (mm)	Relative humidity (%)
November	19.5	6.8	89.7	18.0	5.3	81.2
December	15.4	17.5	91.7	14.7	10.5	80.7

Source: DHM (1987-2020)

84. **Geology** The geology of Nepal is complex, given the country's location in the Himalayan region and the continued geodynamic processes that result in the formation of several thrusts, faults, folds, and metamorphic effects. The Himalayan range can be divided into four distinct morpho-geotectonic zones from south to north- the Terai, Shiwalik hills (Chure range), Lesser Himalayas and Higher Himalayas. The subproject areas in the two river corridors lie in the Lesser Himalaya zone, which is known as the Mahabharata Range. This complex Lesser Himalaya zone has rugged terrain with a highly dissected mountainous area bounded by Main Boundary Thrust (MBT) in the south and Main Central Thrust (MCT) in the North. The Lesser Himalayan belt is formed with a thick succession of largely non-fossiliferous meta-sediments, supporting higher-grade metamorphic rocks and the structural depression. It is mostly made up of sedimentary and meta-sedimentary rocks of the Palaeozoic and Mesozoic eras. The total width of Lesser Himalaya ranges from 60 km to 80 km. The geological map of Nepal showing the subproject locations in the three-river corridor is provided in the figure below.

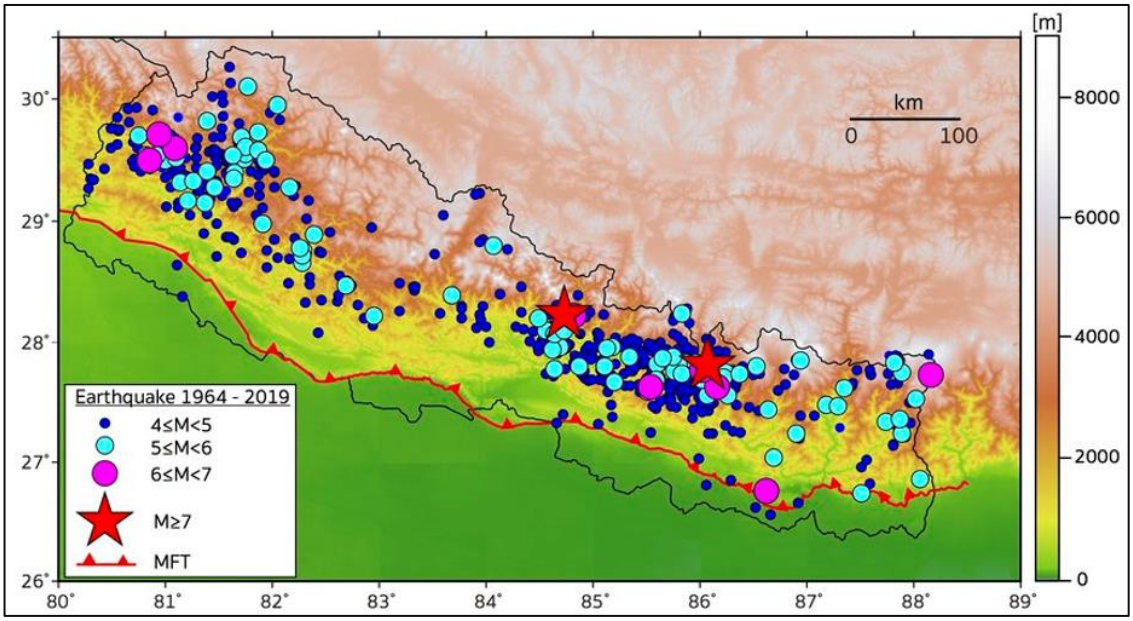
Figure 36: Geological map of the project area



Source: Detailed Feasibility Study Report 2022

85. **Seismology.** The entire country of Nepal is in a seismically active zone caused by the subduction of the Indian tectonic plate. According to the National Seismological Center of Nepal, several big earthquakes have been felt in Nepal; the earthquakes of magnitude 6 to 7 are mostly confined to the Main Himalayan Thrust (MHT) between the foothills and the Higher Himalayas. Moreover, earthquake generation is confined to the crustal depth of 20 km. However, shallow earthquakes at depths down to 6 km are generated due to strike-slip faults. Therefore, the tube well and the reservoir tank will be designed and operated in accordance with seismic design requirements and best engineering practices. The seismic activity in Nepal between 1964 and 2019, as in the IUSGS portal, is shown in Figure 37.

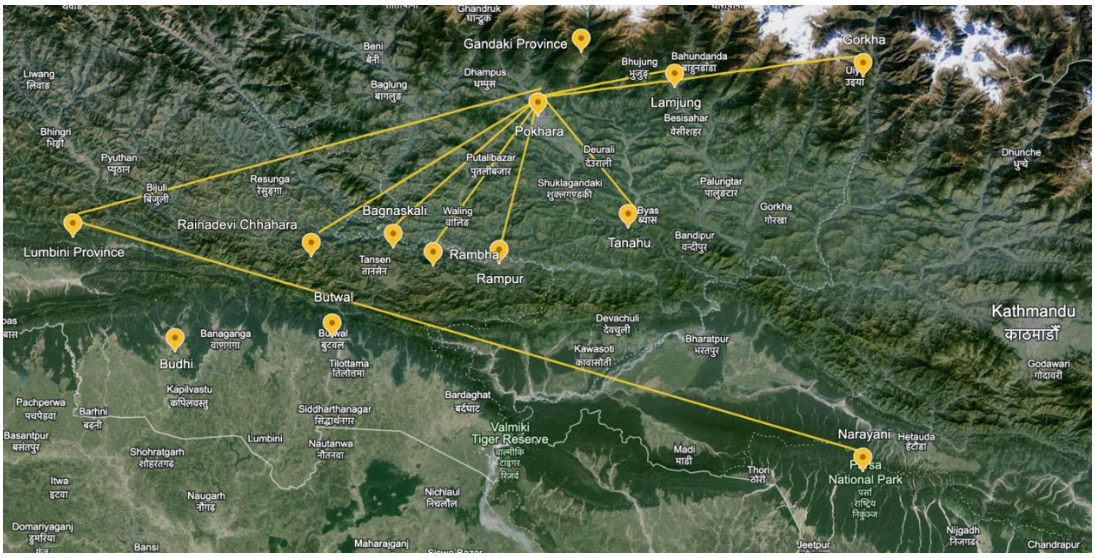
Figure 37. Seismicity map of Nepal from 1964 -2019*[13]*



86. **Air Quality.** Based on online sources[14] there are air quality monitoring stations near the project sites in Lumbini Province and Gandaki Province, Nepal. These are found in Pokhara and Narayani. However, based on Google Earth, Pokhara, the capital city of Gandaki Province, is nearest to the said sites (see Figure 38). The 2023 average PM2.5 concentration in Nepal is 8.5 times the WHO annual air quality guideline value.

[13] *Source: USGS catalogue, 2019*
[14] https://www.iqair.com/nepal and https://aqicn.org/map/nepal/

Figure 38. Location of Air Quality Monitoring sites near Lumbini and Gandaki Provinces, Nepal



Source: Google Earth

87. The data on air quality for different locations within the of Lumbini Province. Areas such as Rambha, Rampur, Bagnaskali, and Rainadevi Chhahara were monitored, with data indicating varying levels of pollutants such as $PM_{2.5}$, PM_{10}, O_3, NO_2, SO_2, and CO. For instance, $PM_{2.5}$ levels ranged from 12 µg/m³ to 61 µg/m³, while PM_{10} levels ranged from 23 µg/m³ to 118 µg/m³.

Table 19. Air Quality (compared with AQI[15]) in Lumbini Province, Nepal

	LOCATION									
Pollutant	**Lumbini Province**		**Rambha[16]**		**Rampur[17]**		**Bagnaskali[18]**		**Rainadevi Chhahara[19]**	
PM 2.5	152 AQI	61 ug/m3	40 AQI	12 ug/m3	78 AQI	24 ug/m3	70 AQI	21 ug/m3	70 AQI	15 ug/m3
PM 10	124 AQI	118 ug/m3	28 AQI	23 ug/m3	58 AQI	50 ug/m3	50 AQI	45 ug/m3	50 AQI	45 ug/m3
O3	37 AQI	83 ug/m3	24 AQI	66 ug/m3	33 AQI	77 ug/m3	25 AQI	66 ug/m3	25 AQI	66 ug/m3
NO2	20 AQI	10 ug/m3	14 AQI	7 ug/m3	6 AQI	3 ug/m3	14 AQI	7 ug/m3	14 AQI	7 ug/m3
SO2	8 AQI	8 ug/m3	5 AQI	5 ug/m3	5 AQI	5 ug/m3	5 AQI	5 ug/m3	5 AQI	5 ug/m3
CO	4 AQI	359 ug/m3	3 AQI	311 ug/m3	3 AQI	300 ug/m3	3 AQI	308 ug/m3	3 AQI	308 ug/m3

Source: https://www.accuweather.com/en/np/lumbini/248971/air-quality-index/248971

[15] The Air Quality Index (AQI) is a standardized indicator used to communicate the quality of air in a specific area. It is a numerical scale that ranges from 0 to 500, where lower values represent good air quality, and higher values indicate poor air quality. The AQI provides a clear and simple way to understand how polluted the air currently is or how polluted it is forecasted to become, along with the potential health effects associated with different levels of pollution.

[16] Results taken from Pipaldanda, Lumbini, Nepal

[17] Results taken from Chapakot, Gandaki, Nepal

[18] Results taken from Tansen, Lumbini, Nepal

[19] Results taken from Khasyauli, Lumbini, Nepal

88. In Gandaki Province, similar monitoring was conducted in locations like Tanahun, Lamjung, and Gorkha. The data shows $PM_{2.5}$ levels ranging from 10 µg/m³ to 24 µg/m³ and PM_{10} levels from 22 µg/m³ to 46 µg/m³. Based on real-time AQI, PM2.5 and PM10 as of May 19, 2024, in Pokhara, Nepal, is 65 AQI (Moderate). The AQI data of the subproject area's nearby locations are provided in the following tables.

Table 20. Air Quality (compared with AQI) in Gandaki Province, Nepal

	LOCATION							
Pollutant	Gandaki Province[20]		Tanahun		Lamjung		Gorkha	
PM 2.5	69 AQI	21 ug/m3	77 AQI	23 ug/m3	36 AQI	10 ug/m3	80 AQI	24 ug/m3
PM 10	51 AQI	46 ug/m3	41 AQI	36 ug/m3	27 AQI	22 ug/m3	42 AQI	37 ug/m3
O3	27 AQI	69 ug/m3	42 AQI	89 ug/m3	31 AQI	75 ug/m3	42 AQI	90 ug/m3
NO2	11 AQI	6 ug/m3	9 AQI	4 ug/m3	14 AQI	7 ug/m3	9 AQI	5 ug/m3
SO2	3 AQI	3 ug/m3	5 AQI	5 ug/m3	3 AQI	3 ug/m3	5 AQI	5 ug/m3
CO	3 AQI	256 ug/m3	3 AQI	283 ug/m3	2 AQI	244 ug/m3	3 AQI	280 ug/m3

Source: https://www.accuweather.com/en/np/pokhara/243170/air-quality-index/243170

89. The levels of particulate matter in Lumbini and Gandaki provinces can be attributed to various sources. Emissions from vehicle exhausts, construction activities, and industrial operations significantly contribute to air pollution. Additionally, poor dust suppression measures and the burning of construction waste further exacerbate the air quality issues.

90. **Water Quality**. The Marshyangdi River is a perennial snow-fed river with a length of approximately 150 km and located within 27°50’42” to 28°54’11” N Latitudes and 83°47’24” to 84°48’04” E Longitudes covering a watershed area of 4,748 sq. km. The Marshyangdi River begins at the confluence of two mountain rivers, the Khangsar and the Jharsang, northwest of the Annapurna massif at an altitude of 3600 above mean sea level (masl). Then it flows eastward through Manang district and southward through the Lamjung district covering other districts, Gorkha and Tanahu, and finally, it joins the Trishuli River at Mugling. The Physicochemical parameters of Marshyangdi River during pre-monsoon are mentioned in Table 2019.

[20] Results taken from Pokhara, capital city of Gandaki Province, Nepal

Table 21. Physicochemical parameters of Marshyangdi River during pre-monsoon 2019 (n=3)

Site Code	pH	DO (mg/L)	TDS (mg/L)	EC µS/cm	Cl^- (mg/L)	NH_3 (mg/L)	NO_3^- (mg/L)	PO_4^{3-} (mg/L)
M01	8.8	6.1	144.0	286.5	32.66	0.04	1.07	0.03
M02	8.7	7.1	121.5	251.5	84.85	0.07	0.74	0.06
M03	8.9	6.4	113.5	226.0	12.07	0.04	0.03	0.02
M04	8.9	6.6	158.5	316.5	19.53	0.10	0.92	0.01
M05	8.8	6.9	152.5	308.0	18.82	0.18	1.00	0.01
M06	9.0	5.2	94.0	186.5	8.52	0.06	0.85	0.01
M07	8.7	7.4	97.0	297.5	15.62	0.05	1.11	0.01
M08	8.5	6.4	51.5	106.0	7.10	0.05	0.59	0.01
M09	9.0	5.7	61.0	123.0	11.72	0.07	0.26	0.02
M10	8.5	7.2	145.0	279.5	19.88	0.03	1.03	0.01
M11	8.3	7.1	39.9	148.0	11.36	0.03	1.11	0.01
M12	8.5	7.3	148.5	295.0	19.17	0.11	0.59	0.01
M13	8.8	6.8	122.5	248.5	35.86	0.03	1.22	0.02
M14	8.5	6.5	49.5	100.0	9.94	0.03	1.40	0.10
M15	8.4	6.7	175.0	351.5	25.21	0.03	1.11	0.05
M16	8.8	5.9	175.5	360.0	22.72	0.03	0.67	0.02
M17	8.9	5.1	165.0	328.5	18.11	0.03	1.25	0.04
M18	8.9	5.6	153.0	312.0	12.03	0.03	1.37	0.04
M19	8.9	6.7	105.0	299.5	11.36	0.03	1.41	0.04
M20	8.9	5.9	127.5	249.0	13.49	0.03	1.15	0.04
M21	8.7	6.5	168.0	357.5	12.78	0.03	0.78	0.04

Source: Singh, Reeta & Pradhanang, Sadhana & Pandey, Vishnu. (2021). Journal of Institute of Science and Technology. 26. 13-21. 10.3126/jist. v26i2.41271.

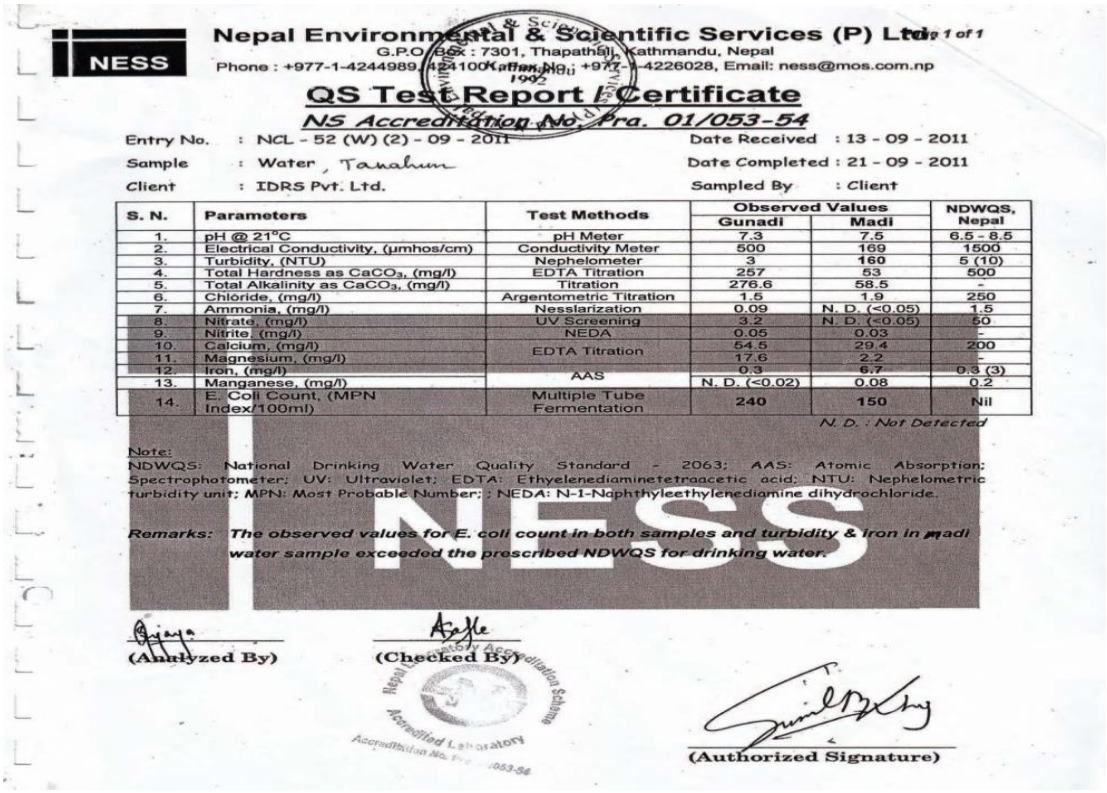
91. The water quality data across various sites show a range of values for key parameters, indicating generally good water quality with some variations. The pH levels, ranging from 8.5 to 9.0, suggest that the water is slightly alkaline, a typical characteristic influenced by the presence of carbonate and bicarbonate ions. Dissolved oxygen (DO) levels, varying from 4.4 mg/L to 7.4 mg/L, are mostly above the 5 mg/L threshold, indicating healthy conditions for aquatic life, although the lowest value of 4.4 mg/L could stress some organisms. Total dissolved solids (TDS) range from 51.0 mg/L to 168.0 mg/L, with all values well below 300 mg/L, suggesting the water is suitable for drinking with minimal dissolved minerals.

92. Electrical conductivity (EC) values, spanning from 100.0 µS/cm to 375.5 µS/cm, reflect the concentration of dissolved salts, with higher values indicating more ions in the water. Chloride (Cl-) concentrations range from 7.10 mg/L to 84.85 mg/L; while generally not harmful, higher levels can affect water taste and corrode infrastructure. Ammonia (NH3) levels are low, between 0.01 mg/L and 0.18 mg/L, posing no significant threat to aquatic life. Nitrate (NO3-) concentrations, from 0.03 mg/L to 1.10 mg/L, are within safe drinking limits, preventing risks of eutrophication. Lastly, phosphate (PO43-) levels, ranging from 0.01 mg/L to 0.07 mg/L, are low enough to avoid contributing to nutrient pollution and algal blooms.

93. Overall, the data indicate that the water is of good quality, with most parameters falling within acceptable ranges for natural waters. The slight alkalinity, adequate dissolved oxygen, and low levels of ammonia, nitrate, and phosphate suggest minimal ecological risk, supporting both human use and aquatic life.

94. Madi River water quality around the project area is observed to be good, and people use springs, pipe/tap water and small streams for drinking purposes (ADB, 2019)[21]. Another ADB-funded project, "Second Small Towns Water Supply and Sanitation Sector Project- Vyas Town Project", provides water quality test results for Madi River.

Figure 39. Water Quality test results in Madi River, Nepal



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Nepal Environmental & Scientific Services (P) Ltd. Page 1 of 1

G.P.O. Box : 7301, Thapathali, Kathmandu, Nepal

Phone : +977-1-4244989, 4241004 Fax No. : +977-1-4226028, Email: ness@mos.com.np

QS Test Report / Certificate

NS Accreditation No. Pra. 01/053-54

Entry No. : NCL - 52 (W) (2) - 09 - 2011 Date Received : 13 - 09 - 2011

Sample : Water, Tanahun Date Completed : 21 - 09 - 2011

Client : IDRS Pvt. Ltd. Sampled By : Client

S. N.	Parameters	Test Methods	Observed Values		NDWQS, Nepal
			Gunadi	Madi	
1.	pH @ 21°C	pH Meter	7.3	7.5	6.5 - 8.5
2.	Electrical Conductivity, (µmhos/cm)	Conductivity Meter	500	169	1500
3.	Turbidity, (NTU)	Nephelometer	3	160	5 (10)
4.	Total Hardness as $CaCO_3$, (mg/l)	EDTA Titration	257	53	500
5.	Total Alkalinity as $CaCO_3$, (mg/l)	Titration	276.6	58.5	-
6.	Chloride, (mg/l)	Argentometric Titration	1.5	1.9	250
7.	Ammonia, (mg/l)	Nesslarization	0.09	N. D. (<0.05)	1.5
8.	Nitrate, (mg/l)	UV Screening	3.2	N. D. (<0.05)	50
9.	Nitrite, (mg/l)	NEDA	0.05	0.03	-
10.	Calcium, (mg/l)	EDTA Titration	54.5	29.4	200
11.	Magnesium, (mg/l)		17.6	2.2	-
12.	Iron, (mg/l)	AAS	0.3	6.7	0.3 (3)
13.	Manganese, (mg/l)		N. D. (<0.02)	0.08	0.2
14.	E. Coli Count, (MPN Index/100ml)	Multiple Tube Fermentation	240	150	Nil

N. D. : Not Detected

Note:
NDWQS: National Drinking Water Quality Standard - 2063; AAS: Atomic Absorption Spectrophotometer; UV: Ultraviolet; EDTA: Ethyelenediaminetetraacetic acid; NTU: Nephelometric turbidity unit; MPN: Most Probable Number; : NEDA: N-1-Naphthyleethylenediamine dihydrochloride.

Remarks: The observed values for E. coli count in both samples and turbidity & iron in madi water sample exceeded the prescribed NDWQS for drinking water.

(Analyzed By) (Checked By) (Authorized Signature)

Source: https://www.adb.org/sites/default/files/project-documents//41022-022-iee-08.pdf

B. Biological Environment

95. There are no protected areas such as national parks, wildlife reserves, hunting reserves, conservation areas, or buffer zones in the project site. The proposed project area will not cover any forest areas. Details on the biological environment compared with CITES Appendixes, IUCN Red-lists, and protected by the Forest Act and National Park and Wildlife Conservation Act of Nepal are presented in the following Tables.

96. Furthermore, trees will not be cut for other purposes, such as reservoir camps and storage. Various measures will be integrated to protect wildlife through strengthening law enforcement, implementing stricter penalties, and raising awareness about the consequences of wildlife trafficking. Additionally, implementing strategies that include fencing, deterrents, and compensation schemes within the project site can help mitigate ecological disturbances for endangered species.

Flora

97. The surrounding subproject area are with the community forests and involves the major tree species like Sisau *(Dalbergia sissoo),* Khote Salla *(Pinus roxburghii),* Chilaune *(Schima wallichii),*

[21] IEE Nepal: SASEC Mugling-Pokhara Highway Improvement Phase 1 Project

Katus *(Castonopsis indica),* Teak *(Tectona grandis)*, Mango *(Mangifera indica),* Peepal *(Ficus religiosa),* Bar *(Ficus bengalensis),* Bel *(Aegle marmelos),* Jamun *(Syzygium cumini),* and Kapur *(Cinamomum camphora).* The main non-timber forest species found in the subproject areas are Amala *(Phyllanthus emblica),* Tejpatta *(Cinnamomum tamala),* Neem *(Azadirchta indica),* Tulsi *(Ocimum scantum),* and Bojho *(Acorus calamus).*

Table 22: Major types of Vegetation in the Subproject Area

Local name	Scientific Name	Family	CITES	IUCN	Forest Act
Sisau	*Dalbergia sissoo*	Fabaceae	-	LC	-
Khote sallo	*Pinus roxburghii*	Pinaceae	-	LC	-
Chilaune	*Schima wallichii*	Theaceae	-	LC	-
Katus	*Castonopsis indica*	Fagaceae	-	-	-
Teak	*Tectona grandis*	Lamiaceae	-	-	
Mango	*Mangifera indica*	Anacardiaceae	-	-	
Peepal	*Ficus religiosa*	Moraceae	-	-	Protected
Bar	*Ficus bengalensis*	Moraceae	-	-	
Bel	*Aegle marmelos*	Rutaceae	-	NT	
Jamun	*Syzygium cumini*	Myrtaceae	-	LC	
Kapur	*Cinamomum camphora*	Lauraceae	-	-	
Amala	*Phyllanthus emblica*	Phyllanthaceae	-	LC	
Tejpatta	*Cinnamomum tamala*	Lauraceae	-	-	
Neem	*Azadirchta indica*	Meliaceae	-	LC	
Tulsi	*Ocimum scantum*	Lamiaceae	-	-	
Bojho	*Acorus calamus*	Acoraceae	-	LC	

Note: LC-Least Concern, NT- Not Threatened

Mammals

98. The surrounding area also has a few common wild animal species- Northern Red Muntjac (*Muntiacus vaginalis*), Common Leopard (*Panthera pardus*), Rhesus Monkey (*Macaca mulatta*), Golden Jackal (*Canis aureus*), House Rat (*Rattus rattus*), Wild Boar (*Sus scrofa*), and Greater Shortnosed Fruit Bat (*Cynopterus sphinx*) are the animal species found in the nearby forest in proposed project area.

99. The mammal species found in Gandaki and Lumbini Provinces occupy diverse habitats that range from dense forests and grasslands to urban areas and agricultural landscapes. Species like the Northern Red Muntjac and Common Leopard prefer forested and hilly regions with ample cover and prey availability, which are crucial for survival. In contrast, the Golden Jackal and Small Indian Mongoose showcase high adaptability, thriving in various habitats, including near human settlements, providing abundant food sources. The House Rat is ubiquitous, commonly found in human dwellings and agricultural fields, highlighting its resilience and close association with human environments.

100. Species such as the Rhesus Monkey and Tree Squirrel inhabit a mix of natural and urban areas, benefiting from their ability to exploit resources in both environments. The Wild Boar is another highly adaptable species that thrives in forests, grasslands, and agricultural areas, utilizing a wide range of food resources. The Greater Short-nosed Fruit Bat, crucial for pollination and seed dispersal, is found in tropical and subtropical regions, roosting in trees, caves, and buildings. Understanding these habitat preferences is essential for effective conservation efforts, ensuring the protection of these species and the biodiversity of Gandaki and Lumbini Provinces. By preserving a variety of habitats, conservation strategies can support the survival and health of these mammal populations.

Table 23: Commonly found Mammal Species in the Area

Name			CITES*	IUCN	NPWC Act
Local	**English**	**Scientific**			
Ratuwa	Northern Red Muntjac	*Muntiacus vaginalis*	II	LC	-
Syal	Golden Jackal	*Canis aureus*	III	LC	-
Chituwa	Common Leopard	*Panthera pardus*	I	VU	-
Musa	House Rat	*Rattus rattus*	-	LC	-
Nyauri Musa	Small Indian Mongoose	*Herpestes auropunctatus*	II	LC	-
Rato Bandar	Rhesus Monkey	*Macacca mulatta*	II	LC	-
Lokharke	Tree Squirrel	*Marmota himalayana*	III	LC	-
Bandel	Wild Boar	*Sus scrofa*	III	LC	-
Chamero	Greater Shortnosed Fruit Bat	*Cynopterus sphinx*	-	LC	-

Note: LC-Least Concern, V- Vulnerable

Birds Species

101. The commonly found birds in the Subproject area are House Sparrow (Passer domesticus), Bengal Florican (*Eupodotis bengalensis*), Rose-ringed Parakeet (*Psittacula krameri*), House Crow (*Corvus splendens*), Red Jungle Fowl (*Gallus gallus*), Common Hill Myna (*Gracula religiosa*), Laughing Dove (*Streptopelia senegalensis*), Cattle Egret (*Bubulcus ibis*) etc.

102. The bird species occupy a diverse range of habitats that highlight their adaptability and ecological significance. Species such as the House Sparrow and House Crow thrive in urban and rural areas, showcasing their ability to coexist closely with human settlements. The Rose-ringed Parakeet and Red Jungle Fowl inhabit forested regions and agricultural lands, indicating their preference for natural and modified environments.

103. Other species, like the Laughing Dove and Cattle Egret, are commonly found in open woodlands, agricultural fields, and wetlands, reflecting their adaptability to various environments. The Common Hill Myna and Common Cuckoo prefer forested areas and hilly regions, while the Red-vented Bulbul thrives in diverse habitats, including urban gardens and parks. These birds play crucial roles in their ecosystems, from seed dispersal to insect control. Understanding their habitat preferences is essential for developing effective conservation strategies to safeguard the avian biodiversity in Gandaki and Lumbini Provinces.

Table 24: Commonly found bird species in the Area

Name			CITES	IUCN	NPWC Act
Local	**English**	**Scientific**			
Ghar Bhangera	House Sparrow	*Passer domesticus*	-	LC	-
Ghar Kaag	House Crow	*Corvus splendens*	-	LC	-
Sugaa	Rose-ringed Parakeet	*Alexandrinus krameri*	-	LC	-
Luiche	Red Jungle Fowl	*Gallus gallus*	-	LC	-
Dhusar Dhukur	Laughing Dove	*Streptopelia senegalensis*	III	LC	-
Bakulla	Cattle Egret	*Bubulcus ibis*	III	LC	-
Maina	Common Hill Myna	*Gracula religiosa*	-	LC	-
Cuckoo Koili	Common Cuckoo	*Cuculus canorus*	-	LC	-
Jureli	Red-vented bulbul	*Pycnonotus cafer*	-	LC	-

Note: LC-Least Concern, EN- Endangered

Reptiles and Amphibians

104. Commonly found Reptiles in the area are Bengal Monitor Lizard (*Varanus Bengalensis*), Changeable Lizard (*Calotes versicular*), Indian Bullfrog (*Hoplobatrachus tigerinus*), Toad (*Bufo melanosticus*), Land tortoise (*Testudinidae* species), Indian Cobra (*Naja naja*), King Cobra (*Ophiophagus hannah*), Chequered Keelback (*Natrix piscator*) and common rat snake (*Ptyas mucosus*). The Bengal Monitor Lizard and Changeable Lizard thrive in various environments, ranging from forests and grasslands to agricultural fields and urban areas. These species benefit from open spaces and ample sunlight for basking, and they are often seen near water bodies where they hunt for prey. Similarly, the Indian Bullfrog and Chequered Keelback are closely associated with aquatic environments such as wetlands, rice paddies, and other freshwater habitats. These species depend on abundant water for breeding and feeding, highlighting the importance of preserving aquatic ecosystems. The Green Pit Viper prefers forested and hilly regions, particularly in moist environments near streams and water sources. This species' presence in dense forests underscores the need to conserve forest habitats in these provinces. The Common Rat Snake, on the other hand, is highly adaptable and found in various habitats, including forests, grasslands, and urban areas. Its ability to thrive near human settlements and agricultural fields reflects its role in controlling rodent populations.

Table 25: Herpetofauna (reptiles and amphibians) in the Surrounding Area

Name			CITES	IUCN	NPWC
Local	**English**	**Scientific**			
Bhainse Gohoro	Bengal Monitor Lizard	*Varanus Bengalensis*	I	-	-
Chheparo	Changeable Lizard	*Calotes versicular*	I	-	-
Bhyaguta	Indian Bullfrog	*Hoplobatrachus tigerinus*	II	-	-
Hariyo Sarpa	Green Pit Viper	*Trimeresurus septentrionalis*	II	LC	-
Paani Sarpa	Chequered Keelback	*Fowlea piscator*	II	LC	-
Dhaman	Common Rat Snake	*Ptyas mucosa*	II	LC	-

Note: LC-Least Concern

Fish Species

105. Kaligandaki, Marshyangdi, and Madi Rivers are the major rivers with fish species like Asla (*Schizothorax richardsonii*), Catfish (*Wallago attu*), Hile *(Channa punchtatus),* Indian Mottled Eel *(Anguilla bengalensis*), Thed (*Labeo angra*), Sidra (*Puntius guganio),* Bam *(Amphipnous cuchia*) and Katley (*Neolisssochilus hexagonolepis*), as people say during discussions in the project area.

106. The Kaligandaki, Marshyangdi, and Madi Rivers in Gandaki Province, Nepal, are home to fish species, each adapted to specific types of aquatic habitats. The Asla (*Schizothorax richardsonii*) and Katley (*Neolissochilus hexagonolepis*) thrive in the cold, clear, and fast-flowing upper reaches of these rivers, where the water is well-oxygenated and rocky substrates provide ideal conditions for feeding and spawning. In contrast, the Catfish (*Wallago attu*) and Bam (Amphipnous cuchia) prefer slow-moving or stagnant waters with soft, muddy bottoms and abundant cover. These species are well-suited to warm water temperatures and can survive in low-oxygen conditions, often found in deeper pools and swamps with dense aquatic vegetation.

107. The Hile (*Channa punctatus*) and Indian Mottled Eel (*Anguilla bengalensis*) are found in various freshwater habitats, including shallow, weedy areas and water bodies with ample hiding places such as rocks and submerged vegetation. The Thed (*Labeo angra*) and Sidra (*Puntius guganio*) are commonly found in slow-moving rivers and floodplains, as well as clear, fast-flowing streams with sandy or gravelly substrates. These habitats provide the conditions for their diet and lifestyle, with varying water quality and temperature adaptations.

Protected Areas in Gandaki and Lumbini

108. The Manaslu Conservation Area is primarily within the Gorkha District of Nepal's Gandaki Province. This district is renowned for encompassing Mount Manaslu, the eighth-highest peak in the world, which is a significant attraction for trekkers and mountaineers. The Manaslu Circuit Trek, a popular trekking route, winds through several villages such as Samagaon, Samdo, and Lho, offering trekkers stunning mountain views and an immersive experience of the local culture. Manaslu Conservation Area protects the region's rich biodiversity, unique wildlife, and cultural heritage. The area is home to various ecosystems ranging from sub-tropical forests to alpine meadows and high-altitude glaciers. Key wildlife species include the endangered snow leopard, red panda, and Himalayan musk deer, which find refuge in this protected habitat.

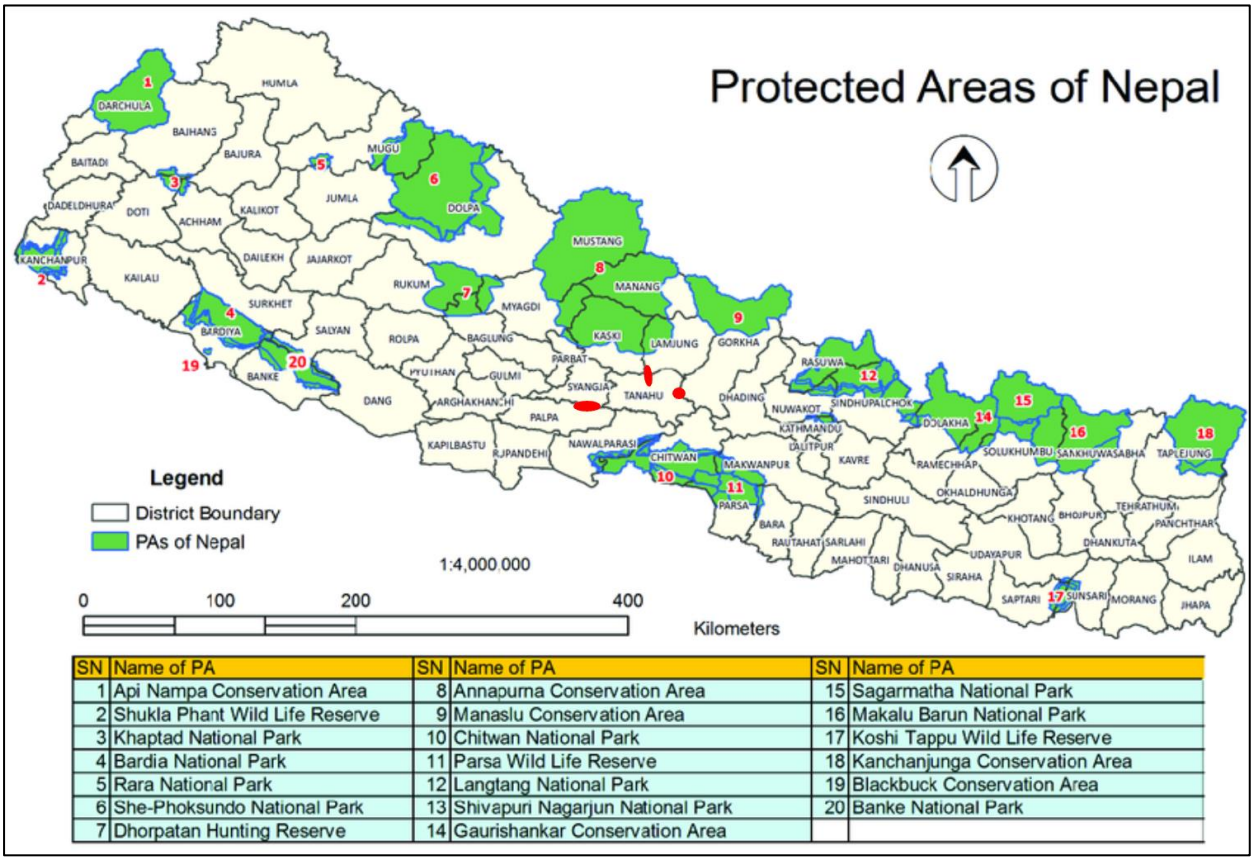
109. The Annapurna Conservation Area is the largest protected area in Nepal, spanning several districts within the Gandaki Province, including Kaski, Lamjung, Manang, Mustang, and Myagdi. The Kaski District serves as the central hub of this conservation area, with the city of Pokhara acting as the main gateway for trekkers heading into the Annapurna region. This district features prominent trekking routes, such as the Annapurna Base Camp trek, which draws thousands of visitors annually.

110. Lamjung District lies to the southeast and is known for its scenic southern slopes of the Annapurna range, often serving as the starting point for the Annapurna Circuit trek. Moving north, the Manang District encompasses high-altitude terrains and includes the challenging Thorong La pass, one of the highest trekking passes globally. This remote district houses villages like Manang and Braga, integral stops on the Annapurna Circuit route. The Mustang District, situated to the northwest, is characterized by its arid landscapes and rich cultural heritage, including the pilgrimage site of Muktinath. Finally, the Myagdi District covers the western part of the conservation area, featuring routes to the Annapurna Base Camp and notable spots like Ghorepani and Poon Hill, which are famous for their panoramic views.

111. The Annapurna Conservation Area aims to protect a diverse range of ecosystems, from subtropical lowlands to alpine meadows and high-altitude deserts. It is a sanctuary for numerous plant and animal species, including endangered species such as the snow leopard and Himalayan tahr. Additionally, the area preserves the cultural heritage of various ethnic groups, including the Gurung, Magar, and Thakali communities. Sustainable tourism practices are promoted to balance conservation efforts with the economic benefits derived from tourism. This includes engaging local communities in conservation initiatives, ensuring that they share in the benefits of tourism and environmental preservation. The involvement of local communities is crucial for the long-term sustainability of the conservation efforts, helping to maintain both the natural environment and cultural heritage.

112. As per the map, none of the HLIP is within the protected areas in Gandaki and Lumbini.

Figure 40. Map showing the protected areas of Nepal and proposed HLIP under IMEP



SN	Name of PA	SN	Name of PA	SN	Name of PA
1	Api Nampa Conservation Area	8	Annapurna Conservation Area	15	Sagarmatha National Park
2	Shukla Phant Wild Life Reserve	9	Manaslu Conservation Area	16	Makalu Barun National Park
3	Khaptad National Park	10	Chitwan National Park	17	Koshi Tappu Wild Life Reserve
4	Bardia National Park	11	Parsa Wild Life Reserve	18	Kanchanjunga Conservation Area
5	Rara National Park	12	Langtang National Park	19	Blackbuck Conservation Area
6	She-Phoksundo National Park	13	Shivapuri Nagarjun National Park	20	Banke National Park
7	Dhorpatan Hunting Reserve	14	Gaurishankar Conservation Area		

Important Bird Area in Rampur Valley

113. Rampur Valley, also known as Rampurphant, is located in the Palpa district of west-central Nepal, bordered to the north by the Kali Gandaki River. Approximately 41.85% of the district is dedicated to agricultural land, while forests cover around 39.6%. The district is sparsely populated, with most residents being farmers who practice terraced agriculture on the lower slopes, while the higher slopes remain forested. The site has been identified as an Important Bird Area (IBA) due to its significant White-rumped Vulture nesting colony. Vulture nests are found along a 15 km stretch of riverine forests along the Kali Gandaki River, with Khaireni forest hosting over 30 nests. The riverine forests are composed of Silk-Cotton Tree (*Bombax ceiba*), *Trewia nudiflora*, *Acacia catechu*, and various other tree species, with the Silk-Cotton Tree being the primary nesting tree.

114. Three irrigation schemes— Pyakluk, Tilakpur, and Alketar —are proposed for financing. The predominant land use in the areas of Pyakluk, Tilakpur, and Alketar is agriculture. The agricultural land is primarily used for cultivating staple crops such as rice, maize, and wheat, which are essential for the local economy and food security. The location also indicates the presence of small settlements interspersed among the fields, highlighting a rural community where agriculture is the mainstay.

115. The location is situated in the mid-hills of Nepal, characterized by a mix of flat valley floors and steep, forested hills. The elevation varies significantly, with the valley areas being relatively low-lying and suitable for extensive farming, while the surrounding hills rise steeply, providing a natural backdrop to the agricultural fields. The region is bordered by the Kali Gandaki River, which meanders through the landscape, creating fertile floodplains that are ideal for agriculture. The river's presence is crucial

for irrigation, supporting the extensive farming activities. The forested hills surrounding the valleys are part of the Siwalik range, known for their rich biodiversity and ecological significance.

Figure 41. Map of the proposed irrigation system in Pyakluk, Tilakpur, and Alketar

Critical Habitat Assessment

116. Critical habitat refers to areas of high biodiversity value in which development would be particularly sensitive and require special attention. The purpose of a critical habitat assessment is to identify the level of high biodiversity value within the subproject areas. Critical habitat is defined in ADB SPS 2009 as areas or sites:

(i) with high biodiversity value, including habitat required for the survival of critically endangered or endangered species;

(ii) having special significance for endemic or restricted-range species;

(iii) that are critical for the survival of migratory species;

(iv) supporting globally significant concentrations or numbers of individuals of congregatory species;

(v) with unique assemblages of species or that are associated with key evolutionary processes or provide key ecosystem services;

(vi) having biodiversity of significant social, economic, or cultural importance to local communities

117. Moreover, based on ADB SPS 2009, critical habitats can be either natural or modified or a combination of both. These include legally protected areas or those officially proposed for protection, such as areas that meet the criteria of the World Conservation Union classification, the Ramsar List of Wetlands of International Importance, and the United Nations Educational, Scientific, and Cultural Organization's world natural heritage sites.

118. The area of analysis (AoA) for assessing critical habitat is assigned for the locations of subproject areas (i.e. HLIP command areas). To assess critical habitats, the boundaries around each subproject location at 500m, such as FMIS structures, are established. Existing ecological data are used to identify critical habitats within the AoA. This step ensures that all significant ecological areas are considered in the assessment.

119. To support the critical habitat assessment in subproject sites, International Finance Corporation's (IFC) Guidance Note 6 on Biodiversity Conservation and Sustainable Management of

Living Natural Resources is used to determine any trigger as per SPS 2009.[22] The guidance note defines critical habitat as areas of high biodiversity value that include or meet at least one of the following:

(i) Criterion 1: Critically Endangered (CR) and/or Endangered (EN) species

(ii) Criterion 2: Endemic or restricted-range species

(iii) Criterion 3: Migratory or congregatory species

(iv) Criterion 4: Key evolutionary processes

(v) Criterion 5: Areas having biodiversity of significant social, economic, or cultural importance to local communities.

(vi) Criterion 6: Protected Areas

120. ***Criterion 1*: *Critically Endangered (CR) and/or Endangered (EN) species***. Species threatened with global extinction and listed as CR and EN on the IUCN Red List of Threatened Species shall be considered as part of Criterion 1. Critically Endangered species face an extremely high risk of extinction in the wild. Endangered species face a very high risk of extinction in the wild. Thresholds and analysis for Criterion 1 are the following:

(i) *Areas that support globally important concentrations of an IUCN Red-listed EN or CR species (≥ 0.5% of the global population AND ≥ 5 reproductive units of a CR or EN species).*

(ii) Areas that support globally important concentrations of an IUCN Red-listed Vulnerable (VU) species, the loss of which would result in the change of the IUCN Red List status to EN or CR and meet the thresholds in (a).

(iii) As appropriate, areas containing important concentrations of a nationally or regionally listed EN or CR species.

121. The following species listed below are categorized as critically endangered (CR), and vulnerable (VU), and there have been no firsthand sightings of these animals in the subproject areas. Nevertheless, these species may be likely present in the HLIP areas according to secondary information.

(i) *Gyps bengalensis*, CR (White-Rumped Vulture): Listed as CR on the IUCN Red List, with a global population estimated to between 4,000 to 6,000 mature individuals. In the provinces of Nepal, the population has shown some stability due to these conservation measures. Monitoring from 2010 to 2021 in the Argha Important Bird and Biodiversity Area indicates that the vulture population remained stable during this period.

(ii) *Panthera pardus*, VU (Leopard): Recent studies and reports indicate that the leopard population in Nepal is relatively stable, though precise numbers are difficult to ascertain due to the elusive nature of these big cats. Estimates suggest that Nepal is home to several hundred leopards, but exact figures can vary based on the region and the methods used for counting.

[22] International Finance Corporation's Guidance Note 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources (ifc.org)

Figure 42. Image of Leopard (*Panthera pardus*) commonly found in different areas in Nepal

Source: A.R. Joshi. Mongabay.

122. The species above are unlikely trigger criterion 1. Moreover, there are three subprojects—Pyakluk, Tilakpur, and Alketar—situated within the Rampur Valley area, which may potentially impact Important Bird Areas (IBA) as specified in item (c) of criterion 1. Nevertheless, the HLIP works will be restricted to the existing command areas and involve minimal disruption to habitats. These regions have long been used for agriculture and irrigation, making them already altered environments with well-established farming practices. By focusing the work solely within these areas, the project avoids encroaching on more environmentally sensitive wildlife habitats, thereby not triggering item (c) of the criterion.

123. ***Criterion 2: Endemic and Restricted-range Species*.** For terrestrial vertebrates and plants, restricted-range species are defined as those species that have an extent of occurrence less than 50,000 square kilometers (km^2). The threshold for Criterion 2 is area holds ≥10% of the global population size and ≥10 reproductive units of a species.

124. The species in the subproject areas can be found across multiple countries in South Asia, and while they may be significant to local ecosystems, these are not considered endemic or restricted range species limited to the specific subproject sites.

125. ***Criterion 3: Migratory and Congregatory Species.*** Migratory species are defined as any species of which a significant proportion of its members cyclically and predictably move from one geographical area to another (including within the same ecosystem). While, congregatory species are defined as species whose individuals gather in large groups on a cyclical or otherwise regular and/or predictable. The thresholds for Criterion 3 are:

(i) Areas known to sustain, on a cyclical or otherwise regular basis, ≥ 1 percent of the global population of a migratory or congregatory species at any point of the species' lifecycle.

(ii) Areas that predictably support ≥10 percent of the global population of a species during periods of environmental stress.

126. The following species migratory in nature, and can be found at the subproject sites of HLIP based on secondary information:

(i) *Anguilla bengalensis* (Indian Mottled Eel) is a migratory species found across South and

Southeast Asia, including the rivers of Gandaki and Lumbini Provinces in Nepal. This eel spends most of its life in freshwater habitats but migrates to the Indian Ocean to breed. Due to its wide distribution, specific population numbers in Gandaki and Lumbini Provinces are not well-documented. However, the species is classified as Near Threatened (NT) by the IUCN.

Figure 43. Sample photograph of Indian Mottled Eel (*Anguilla bengalensis*)

Source: Fishbase.org

(i) *Cuculus canorus* (Common Cuckoo). It is a well-known migratory bird that breeds across Europe and Asia, including the regions of Gandaki and Lumbini Provinces in Nepal, before migrating to Africa for the winter. While exact population numbers in these specific provinces are not readily available, the global population is estimated to be between 25 million and 100 million individuals, with the species classified as Least Concern (LC) by the IUCN.

127. The species above do not trigger the criterion 3.

128. ***Criterion 4: Key evolutionary processes.*** Topography, geology, soil, temperature, vegetation, and their combinations can affect evolutionary processes that create regional species and ecological features. Unique landscape features have been linked to genetically distinct plant and animal populations. Physical or geographical elements are commonly linked to species diversification as surrogates or spatial accelerators for evolutionary and ecological processes. In recent decades, biodiversity conservation has focused on maintaining these crucial evolutionary processes in a landscape and the resulting species (or subpopulations). Genetic diversity conservation is especially important. In a rapidly changing climate, species variety and genetic variation within species enable evolutionary flexibility.

129. There is no such site within the subproject area that is characterized as above. Thus, this criterion is not triggered.

130. ***Criterion 5: Areas having biodiversity of significant social, economic, or cultural importance to local communities.***

131. Areas having biodiversity of significant social, economic, or cultural importance to local communities. This criterion focuses on regions where biodiversity is intrinsically linked to the well-being of local communities through various means such as traditional practices, economic benefits, cultural values, or social significance. Such areas often support livelihoods, maintain cultural heritage, and provide ecosystem services that are crucial for local communities. Identifying and conserving these areas is essential to ensure that biodiversity conservation efforts also support the social and economic fabric of the communities that depend on them.

132. The HLIP subproject locations do not include areas where biodiversity is essential to the local

communities through traditional practices, economic gains, cultural values, or social importance. These subproject sites consist mainly of agricultural lands that have long been utilized for farming and irrigation, aimed at improving agricultural production.

133. ***Criterion 6: Legally protected or officially proposed for protection.*** This critical habitat requirement, as stipulated by the SPS 2009, focuses on areas that are either legally protected or officially proposed for protection.

134. There are no such protected area nor officially proposed protection. Thus, this criteria is not triggered by the subprojects.

135. **Conclusion.** Based on the guidelines provided by IFC GN6 and ADB SPS 2009 for CHA, HLIP sites do not have critical habitat. There may be occurrence of species such as *Gyps bengalensis* (White-Rumped Vulture) in Rampur Valley. The available information is not sufficient to conclude achieving the thresholds. Rampur Valley is an IBA, however, the works will be restricted to the existing command areas and involve minimal disruption to any habitats. These command areas have long been used for agriculture and irrigation, making them already altered environments with well-established farming practices.

136. Although the HLIP sites do not trigger critical habitat thresholds, project design and monitoring should take wildlife protection into account in order to prevent, minimize, mitigate, and even partially offset any possible negative effects to wildlife. The Biodiversity Action Plan (BAP) detailed in Appendix 5 of the IEE provides a strategic framework designed to mitigate any significant adverse impacts on wildlife and biodiversity. This comprehensive plan is developed in alignment with government regulations and the ADB Safeguards Policy Statement of 2009. The primary purpose of the BAP is to ensure that the rehabilitation and construction activities within the FMIS do not result in net biodiversity loss and maintain the ecological integrity of the areas affected.

Table 26. Summary of Critical Habitat Assessment

Critical Habitat defined by ADB (2009)	Quantitative Thresholds of Critical Habitat based in IFC PS-6	Species/sites	Likelihood to trigger criterion	Remark
Criterion 1: The area includes habitat required for the survival of critically endangered (CR) or endangered (EN) species	(a) Areas that support globally important concentrations of an IUCN Red-listed EN or CR species (≥ 0.5% of the global population AND ≥ 5 reproductive units GN16 of a CR or EN species).	*Gyps bengalensis*, CR (White Rumped Vulture)	Unlikely	Based on Vulture Conservation Action Plan for Nepal 2023-2027, there are <2,000 individuals across Nepal. They are concentrated in key conservation areas, including Chitwan National Park, Nawalparasi District, Dang District's Uchanimbu Community Forest, Rupandehi's Bhrikuti Community Forest, and Pithauli in Nawalpur.
	(b) Areas that support globally important concentrations of an IUCN Red-listed Vulnerable (VU) species, the loss of which would result in the change of the IUCN Red List status to EN or CR and meet the thresholds of (a).	*Panthera pardus*, VU (Leopard)	Unlikely	The most recent data on the leopard population in Nepal estimates around 1,000 individuals. The global population is estimated to be between 50,000 and 100,000 individuals as of 2024. This number includes various subspecies spread across different regions.
	(c) As appropriate, areas containing important concentrations of a nationally or regionally listed EN or CR species	Rampur Valley	Unlikely	The rehabilitation activities are confined to existing command areas and involve minimal land disruption.
Criterion 2: The area has special significance for endemic or restricted-range species;	a) Areas that regularly hold ≥10% of the global population size AND ≥10 reproductive units of a species	NA	-	The species in the subproject areas can be found across multiple countries in South Asia
Criterion 3: The area represents a site that is critical for the survival of migratory species; or supports globally significant concentrations or numbers	(a) Areas known to sustain, on a cyclical or otherwise regular basis, ≥ 1 percent of the global population of a migratory or congregatory species at any point of the species' lifecycle.	*Anguilla bengalensis* (Indian Mottled Eel)	Unlikely	Found across South Asia, including India, Nepal (Gandaki, Koshi, Karnali, Mahakali), Bangladesh, Pakistan, and Sri Lanka. It also inhabits parts of Southeast

Critical Habitat defined by ADB (2009)	Quantitative Thresholds of Critical Habitat based in IFC PS-6	Species/sites	Likelihood to trigger criterion	Remark
of individuals of congregatory species;				Asia, including Myanmar and the East Indies, and some regions in Southeast Africa.
		Cuculus canorus (Common Cuckoo)	Unlikely	Exact population numbers in the provinces are not readily available. Global population is estimated to be between 25 million and 100 million individuals.
	(b) Areas that predictably support ≥10 percent of the global population of a species during periods of environmental stress.	NA	Unlikely	There is no such site within the subproject areas.
Criterion 4: The area includes unique assemblages of species that are associated with key evolutionary processes or provide key ecosystem services;		NA	Unlikely	There is no such site within the subproject areas.
Criterion 5: The area holds biodiversity of significant social, economic, or cultural importance to local communities;		NA	Unlikely	The subproject sites of HLIP do not encompass regions where biodiversity is intrinsically linked to the well-being of local communities through traditional practices, economic benefits, cultural values, or social significance.
Criterion 6: The area is either legally protected or officially proposed for protection, such as areas that meet the criteria of the World Conservation Union classification, the Ramsar List of Wetlands of International Importance, and the United Nations		NA	Unlikely	Proposed WHS sites covered in the subproject district are well away from the legally protected area, reserved forest, heritage site, Ramsar site etc. Not triggering Criterion 6.

Critical Habitat defined by ADB (2009)	Quantitative Thresholds of Critical Habitat based in IFC PS-6	Species/sites	Likelihood to trigger criterion	Remark
Educational, Scientific, and Cultural Organization's World natural Heritage sites.				

EN = Endangered, IUCN = International Union for Conservation of Nature, PAI =project area of influence, VU = vulnerable

C. Socio-Economic Environment

137. **Population and Household.** The population of all the twelve subprojects is mixed, in caste and ethnicity, and they are dependent on farming as a primary occupation and source of income. The demography of the subprojects started changing after 1980 with the development of road connectivity, which intensified after 1990 following the priority investment of GoN in road infrastructure development across the country. This promoted rural-urban migration, urbanization, and the growth of trade and commerce in the project area. This subsequently led to an increase in the population and produced changes in the population composition. In all of the twelve subprojects, the female population is larger than the male population, with a sex ratio of 0.81 in Madi and 0.76 in Kaligandaki and Marshyangdi River corridor, while the family size of the household is 4.18, 3.68 and 4.11 persons, respectively.

Table 27: Population and Households of the Project Area

S.N.	Name of the subproject	Number of households	Population			Gender Ratio
			Male	Female	Total	
Subprojects in Madi River Corridor:						
1.	Baireni	374	716	892	1608	0.80
2.	Dumsi	418	800	997	1797	0.80
3.	Duipiple	310	556	675	1231	0.82
4.	Sisaghat	131	235	285	520	0.82
5.	Kalesti Bategaun	810	1333	1799	3132	0.74
Subprojects in Kaligandaki River Corridor:						
6.	Tilakpur	379	709	914	1623	0.78
7.	Pyakluk	411	769	992	1761	0.78
8.	Ekletar	650	650	862	1512	0.75
9.	Ramtar-Kumalgaun	366	714	964	1678	0.74
10.	Majhigaun	121	222	301	523	0.74
11.	Siko Danda	109	212	288	500	0.73
Subprojects in Marshyangdi River Corridor						
12.	Chyanglitar	1,250	2218	2923	5141	0.76

Source: Detail Feasibility Study Report, 2022

138. **Caste and Ethnicity.** Caste is as a multifaceted status hierarchy composed of all members of the society in Nepal, each of the hereditary classes of Hindu society, distinguished by relative degree of rituals, purity or pollution and of the social status. However, the Population Census 2021 of Nepal (CBS) has categorised the population of Nepal into ten major ethnic groups (Brahmin, Chettri, Gharti, Bote, Kumal, Gurung, Magar, Tamang, Newar, and Dalits). Ethnicity is the fact or state of belonging to a social group that has a common national or shared cultural tradition. The Indigenous groups (Adhibasi/ Janajati) include some tribals (Kumal, Gurung, Magar, Tamang etc.), each and every Adhibasi/ Janajati recognizes with their own language, culture and costumes. The project area comprises a heterogeneous mix of caste and ethnic groups.

139. In the Tilakpur subproject, for example, households belonging to Kumal ethnic groups are in the majority, while in the Pyakluk subproject, which is a contiguous area to Tilakpur, Brahmin and Chettri are the majority households. In the Ramtar-Kumlgaun subproject, again, Kumal are the majority of households. In the Majhigaun subproject, Majhi (Bote) are the original inhabitants of the area, but they are no longer the majority of households. In the Kalesti subproject, the Magar and Gurung are the major Janajati residing in the area. In the Chyanglitar subproject, most of the caste and ethnicity people live since the subproject is large with a household of 1250.

Table 28: Distribution of Potential Beneficiaries by Caste/Ethnicity

	No. of households											
Caste and Ethnicity	**Dumsi**	**Baireni**	**Duipiple**	**Sisaghat**	**Tilakpur**	**Pyakuk**	**Ekletar**	**Ramtar-Kumalgaun**	**Majhigaun**	**Kalesti Bategaun**	**Siko Danda**	**Chyanglitar**
Brahmin and Chettri	151	148	50	32	85	287	250	83	79	310	42	479
Thakuri	-	-	4	-	-	-	-	-	-	-	-	-
Gharti	-	-	-	-	45	62	-	-	4	-	-	42
Darai	111	110	-	-	-	-	-	-	-	-	-	28
Bote	28	68	-	-	-	-	-	-	27	-	-	-
Kumal	-	-	177	-	214	-	100	274	-	-	-	60
Gurung	8	12	12	-	5	-	-	-	-	125	20	206
Magar	41	20	8	-	8	21	35	3	9	255	34	310
Tamang	-	-	-	12	-	-	-	6	-	52	4	20
Newar	-	-	4	74	-	-	15	-	-	26	3	40
Dalits	79	16	55	13	22	41	250	-	2	42	6	65
Others	-	-	-	-	-	-	-	-	-	-	-	-
Total	**418**	**374**	**310**	**131**	**379**	**411**	**650**	**366**	**121**	**810**	**109**	**1250**

Source: Detail Feasibility Study Report, 2022

140. **Literacy Rate.** In the project area covering three Districts of Gorkha, Tanahu and Palpa, the literacy rate is satisfactory, while gender differences in terms of educational attainment are more pronounced in older ages than in younger age groups. The high literacy rates in the age groups 11-30 in the area indicate an improvement in access to education and a decrease in gender gaps. The age groups of 2130 are all literate, which indicates very positive achievement. The details of the education situation of the project area is presented in the table below.

Table 29: Education Status in the Project Area Districts.

	Hill Projects													
	Age Group Male (%)							Age Group Female (%)						
Education Level	**5-10**	**11-20**	**21-30**	**31-40**	**41-50**	**51-60**	**61+**	**5-10**	**11-20**	**21-30**	**31-40**	**41-50**	**51-60**	**61+**
Pre-Primary Education	21.3	1.1	0.9	0.0	1.9	3.5	7.1	14.0	0.0	3.0	1.8	7.0	8.7	16.3
Primary	76.6	16.1	5.7	11.6	30.8	35.1	21.4	83.7	9.3	3.0	25.5	24.6	10.9	6.1
Lower Secondary/ Secondary Education	2.1	51.6	30.2	44.9	30.8	21.1	11.9	2.3	48.5	31.0	32.7	14.0	2.2	0.0
SLC and Above	0.0	31.2	57.5	31.9	23.1	15.8	2.4	0.0	38.1	54.0	18.2	5.3	2.2	0.0
Formal Education	0.0	0.0	0.9	0.0	0.0	0.0	0.0	0.0	1.0	1.0	0.0	0.0	0.0	0.0
Literate/Informal Education	0.0	0.0	1.9	4.3	7.7	8.8	40.5	0.0	1.0	4.0	10.9	36.8	47.8	30.6
Illiterate	0.0	0.0	2.8	7.2	5.8	15.8	16.7	0.0	2.1	4.0	10.9	12.3	28.3	46.9
Total (N)	**47**	**93**	**100**	**69**	**52**	**57**	**42**	**43**	**97**	**100**	**55**	**57**	**46**	**49**

Source: HH survey, 2018

Source: Detail Feasibility Study Report, 2022

141. **Infrastructure Development.** The construction of the Prithvi Highway (Pokhara-Naubise road), completed in 1974, has been the founding infrastructure in the subprojects in the Madi river corridor that have had a significant impact on socio-economic transformation and also on

furthering road connectivity to adjoining areas. The completion of this road increased the area's connectivity to Kathmandu and through the Siddhartha Highway (Pokhara-Sunauli road completed in 1971) to the Indian border in the south. This road helped develop a supply chain for food and construction materials that subsequently helped trade and commerce in the area. Construction of the Aabukhareni-Gorkha and Mugling-Narayanhgat roads was completed in 1983, and connectivity developed through these two road corridors to the central and eastern Terai further boosted the trade and commerce in the area. Construction of district and rural roads, extending from major towns and commercial centres on the highways to district headquarters and hinterlands in the subsequent periods, helped intensify the connectivity and increase the trade and commerce and the employment and income opportunities of the people in the area. These include the construction of the Vyas Highway, Dumre-Besisahar Road and Duipiple-Pokhara Road, all of them in the period after 1990. Construction of the lower Marshyngi Hydropower Project completed in 1990 increased the opportunity for electrification and subsequently opened avenues for industrialization in the area.

142. Compared to the subprojects in the Madi corridor, the road connectivity in the Kaligandaki corridor started developing in later periods. The only road connectivity developed prior to 1995 was Rampur-Aryabhanjyang Road, which connected Rampur Bazar to Aryabhanjyng on Siddhartha Highway, on which vehicular traffic was possible only in the dry season. The area's connectivity improved significantly with the construction of the Kaligandaki Corridor road in 2021. Following the construction of this road, Rampur Bazar has grown into a sizable urban area with significant growth in trade and commerce.

143. The growth in road connectivity and the trend of urbanization in the two river corridors have had two simultaneous impacts on the livelihoods of the people in the area. The first impact has been an improvement in people's access to the market and services- education, health, banking, credit and insurance. The second impact has been the diversification of income and income opportunities. The emergence of townships and market centres along the road corridors produced demand for agricultural products and also created employment opportunities at the local level. An increase in the construction of houses, roads, hydropower projects, marketplaces and other infrastructures in the area produced an opportunity for the masons, carpenters, plumbers and non-skilled workers to engage in construction works at the local level. Landless, poor and economically marginalized groups are involved in the construction works in large numbers, which has helped diversify their income opportunity.

144. **Agricultural Landholding.** The majority of the households own some agricultural land, though the size of landholding is small, which has also reduced over time due to the division of ancestral land within the family and also due to the shift in the occupation of the people from farming to off-farm activities. The majority of the households are small landholders with a landholding size of 3-8 ropani (0.15-0.31 ha). The average landholding size is slightly larger in the Kaligandaki Corridor subprojects than those in the Madi River Corridor. Also, the number of landless households in the subprojects is negligibly small. This would mean most households have some crop and livestock farming land. Also, there are only a small number of households with agricultural landholding larger than 1 ha (≥1 ha or 20 ropani). The average landholding size in the subproject is smaller than the national average landholding of 0.7 ha in the rural and 0.5 ha in the urban areas. The size of the households in the subprojects' agricultural holdings is provided in the table.

Table 30: Distribution of households by the size of agricultural holding

	% of households with indicated landholding in possession								
Size of landholding (ropani*)	**Dumsi**	**Baireni**	**Duipiple**	**Sisaghat**	**Tilakpur**	**Pyakluk**	**Ekletar**	**Ramtar-Kumalgaun**	**Majhigaun**
Landless	2	2	2	2	1	2	0.5	0	0
< 1	4	5	3	3	3	5	1.5	3	4
1-5	60	55	45	45	30	30	30	30	40
6-10	20	20	20	20	60	50	50	50	45
11-20	6	8	15	15	5.50	10	13	15	10
>20	8	10	15	15	0.50	3	5	2	1
Mean landholding (ropani)	5.90	6.50	8.25	8.25	6.60	7.00	7.90	7.60	6.50
Mean landholding (ha*)	0.31	0.34	0.43	0.43	0.34	0.36	0.41	0.39	0.34

*1 ha = 19.46 ropani

Source: Detail Feasibility Study Report, 2022

145. The agricultural holding of the households belongs to three categories of land in their possession- i) relatively flat and terraced *khet* land located on the valley floor, along the river, with the possibility of irrigation and/or rainwater accumulation with no limitation of soil moisture, suitable to grow paddy in the monsoon and other crops such as legumes, vegetables and oilseeds in the dry season, ii) unirrigated *pakho (bari)* land where crop cultivation is possible only during monsoon and winter due to limitation of soil moisture, and iii) *kharbari*, which is non-terraced upland in possession of the households to be able to grow fuelwood and fodder trees, forage and thatching materials. Also, the land in the possession of the households is not necessarily titled, locally called *Aailani* land. *Aailani* lands are essentially public land located along the river course and at the fringe of the public forest and shrubland, which people bring to their control and cultivate them. Some of these lands have been in possession of the households for more than two generations. Much of the khet land in the possession of households in the Dumsi subproject is untitled Aailani land, which is in cultivation and under private ownership- people in this subproject revealed that nearly 25% of the agricultural landholding is *Aailani land*. Although *Aailani* land in private possession was found to be smaller in other subprojects, some households do have untitled land in all nine subprojects.

146. When the householders were inquired about the size of agricultural landholding that would be adequate to maintain the sustenance of a 5 to 6-member family, they identified the need for a minimum of 8 ropani (0.41 ha) of land to maintain living with mixed crop and livestock farming and with some supplemental income earning made from off-farm activities. If this threshold landholding size is used as a yardstick of minimum landholding to maintain living, more than half of the households in the subprojects in the two river corridors do not possess the needed landholding to maintain living. These households depend on off-farm employment and income to maintain a living or perform sharecropping and contract farming on the land belonging to large landholders in the area. Sharecropping is widely used practice in some of the subprojects like Dumsi, Duipiple, Sisaghat, Tilakpur, Pyakluk and Ekletar, where the sharecropper (tenant) cultivates the land belonging to large landholders and the cost of inputs (seed and fertilizer, except labour needs) is provided by land owner and crop produce is divided equally between the sharecropper and land owner. The sharecropping obliges the tenant to provide all labour from planting to harvesting of the crop. Contract farming, though not very prevalent in the subprojects,

is an arrangement of leasing out the land by large landholders for a fixed period and for a fixed amount of crop produce or cash to be paid by the tenant. Another practice of land tenure in the area is cultivation on *Bandhaki* land- the land mortgaged by the land owner for a fixed amount of money. The tenant is entitled to cultivate on this land until the time that that amount is paid back without any obligation on the part of the tenant to share the crop produce with the land owner. This practice prevails in those subprojects where many absentee landowners exist. The majority of the sharecroppers or contract farmers in most subprojects are landless peasants and those belonging to Darai, Bote and Kumal ethnic groups who do not own the land to produce rice to meet the food needs of the family. A large proportion of the land located on the valley floor and along the river course in Dumsi, Duipiple, Tiklakpur and Ekletar subprojects belongs to Brahmin and Chettri households that have their dwellings located on the lower and middle terrace. Darai and Bote communities dwell on the middle to upper terrace, and they own much of the unirrigated pakho bari, where cultivation of only maize, black gram and millet is possible during monsoon and spring seasons. They generally depend on sharecropping or contract farming on the land of large landholders, who are generally Brahmin and Chettri households.

147. **Employment, Income and Livelihoods.** Farming, both crop cultivation and livestock rearing on own land and sharecropping, is by far the primary source of employment and sustenance for most households in the nine subprojects. The source of employment and income basket of the households have, however, diversified in recent years with one or more family members engaged in the off-farm employment and income sources. With the increase in educational attainment, people have moved in large numbers for jobs in the government and private sector, or they have started their own businesses at the local level or in other parts of the country. The distribution of households with sources of employment is provided in the table.

Table 31: Distribution of households by sources of employment

	% households by indicated sources of employment and income in the subprojects								
	Subprojects of Madi River corridor				**Subprojects of Kaligandaki corridor**				
` Sources of employment	**Baireni**	**Dumsi**	**Duipiple**	**Sisaghat**	**Tilakpur**	**Pyakluk**	**Ekletar**	**Ramtar-Kumalgaun**	**Majhigaun**
Farming (crop and livestock) only	30	25	30	30	30	30	30	30	35
Farming+ agricultural wage earning at the local level	5	2	5	5	2	3	5	5	5
Farming + jobs in the government and private sector	25	33	25	25	25	25	20	20	20
Farming + foreign employment	25	25	20	20	25	25	20	25	20
Farming + small business at the local level	10	12	18	15	15	15	20	15	15
Others	5	3	2	5	3	2	5	5	5
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Source: Detail Feasibility Study Report, 2022

148. Youths from both the river corridors have moved out for off-farm employment in other parts of the country and in foreign employment. India has been a traditional destination for foreign employment, and people migrated seasonally to earn income, primarily through unskilled employment. This changed after 1990, with many youths migrating for skilled and non-skilled

employment in the Gulf countries and South East and East Asia. Malaysia, Korea and Japan have emerged as important destinations of foreign employment for the people in the two areas. Migration of the youths in large numbers for jobs in foreign countries has produced a shortage of labour and, consequently, feminization of agriculture- women members in the family are responsible for most agricultural decision-making and contributing most labour needs in farming prevails in the subprojects.

149. Increased migration has produced positive and negative consequences on people's relationship with land and land-based resources. The dependence of the people on farming as a primary source of income has reduced over time. This has also produced a tendency to keep a large portion of land fallow or lease out for sharecropping, contract farming, or under *Bandhaki* arrangement. Increased shift of people to off-farm employment and income within the country or seeking foreign employment has increased the remittance flow to the area. The share of foreign employment in the annual family income is significantly large, as much as 40-80 per cent, although this depends on the destination of foreign employment and the educational attainment and skill of the person seeking employment. Although the income made from foreign employment goes primarily to meet the existential challenges- food, clothing, building houses and meeting the expenses of marriages and other family rituals, some returnees from foreign employment, particularly those youths who had to return in the face of COVID-19 Pandemic, have also started income-earning enterprises, such as commercial scale dairy, goat rearing and piggery.

150. **Access to Services.** The growth in the roads and other infrastructures in the area has had some important social and economic impacts on the livelihoods of the people. The first impact has been improving the connectedness of the people with the market and services- education, health, banking, credit and insurance. The second impact area has been the diversification of income and income opportunities. The emergence of townships and market centres along the developed road corridors has increased the demand for food commodities- grain, vegetables, fruits and other consumer goods- and expanded the market for agricultural products. The linked effect has been changing people's income basket and lifestyle.

151. Almost all households have modern brick and concrete houses, access to electricity, a piped drinking water supply, and toilets within the homestead. Most households send their children to school—the number of public and private schools in the area increased after 1990. Most households also send girl children to school, although girls' educational attainment beyond higher secondary school is still low.

152. **Poverty and Food Security.** More than 50% of the households in the subproject areas, as explained in the previous section, are smallholders operating on agricultural landholding of 3-8 ropani (0.15-0.41 ha) and supplement their food production and income through sharecropping and making earnings through wage earning, jobs in private and public entities and from foreign employment. Remittance in-flow from foreign employment has had a significant role over the past decade in helping households make an escape from rampant poverty. In the present context, most households are food-secured. However, security in the food supply to meet the households' needs for food is not necessarily based on their own production. The income from off-farm sources and, consequently, the purchasing capacity of the households have increased. The human development index (HDI) score of the districts where the subprojects are located, which aggregates the indicators on poverty, housing, health, education and food security, are provided in Table 2-9 below. The HDI score reveals that the districts with the subprojects have higher scores than Nepal's national aggregated HDI score (0.458). However, there are persisting gaps in improving living standards and livelihoods. Another important aspect relating to poverty and food security in Nepal's mid-hill living is high exposure to recurrent disasters, such as earthquakes, landslides, soil erosion and mass wasting, and this makes the households face the risk of getting pushed into poverty and food insecurity after the episodic disaster events.

153. **Existing Cropping System and Livestock.** This section provides a synthesis of existing agricultural systems and practices and the productivity of crop and livestock-based enterprises in the project area. The information on the prevailing cropping system was obtained through consultations with different groups of farmers, individually and collectively. A summary of the existing cropping system and practices and area coverage of crops in different crop seasons in the subprojects in the Madi and Kaligandaki river corridors is provided in the table below**.**

Table 32: Existing crop coverage (% of net command area) in the subprojects by crop season

Name of the subproject	Crops and area coverage (ha) by season			
	Monsoon (June-October)	Winter (October-February)	Spring (March-June)	Cropping intensity
Subprojects of Madi River				
Dumsi	Rice- 25% (limited to lower terrace along the river) Black gram- 30% Other legumes- 5% Vegetables- 5% Perennial fodder-5% Fallow- 30%	Wheat- 20% Potato- 5% Rapeseed/Mustard-5% Winter vegetables- 5% Forage (Jai, barseem)- 5% Perennial fodder- 5% Fallow- 55%	Maize- 40% Summer vegetables-5% Perennial fodder- 5% Fallow- 50%	165%
Baireni	Rice-15% Black gram-30% Other legumes- 5% Vegetables-5% Perennial fodder- 5% Fallow-40%	Wheat- 15% Potato-5% Rapeseed/Mustard-5% Winter vegetables- 10% Forage (Jai, barseem)- 5% Perennial fodder-5% Fallow- 55%	Maize- 40% Summer vegetables-5% Perennial fodder-5% Fallow- 50%	155%
Duipiple	Rice- 60% (late planted) Black gram- 10% Other legumes-5% Perennial fodder-5% Fallow-20%	Wheat-20% Rapeseed/Mustard- 25% Potato- 5% Forage (Jai, barseem)- 5% Winter vegetables- 5% Perennial fodder-5% Fallow-35%	Maize-45% Summer vegetables-5% Perennial fodder-5% Fallow- 45%	200%
Sisaghat	Rice- 70% Black gram- 5% Other legumes-2% Perennial fodder-3% Fallow-20%	Wheat-20% Rapeseed/Mustard- 25% Potato-5% Forage (jai, barseem)-2% Winter vegetables-5% Perennial fodder-3% Fallow- 40%	Maize- 45% Summer vegetables-2% Perennial fodder-3% Fallow-50%	190%
Subprojects of Kaligandaki River				
Tilakpur	Rice-60% Black gram-5% Other legumes- 10% Vegetables-5% Perennial fodder-5% Fallow-15%	Wheat-15% Rapeseed/Mustard-10% Potato-5% Peas/Beans-5% Winter vegetables-5% Forage (jai, barseem)-5% Perennial fodder-5% Fallow-50%	Maize-40% Summer vegetables-5% Perennial fodder-5% Fallow- 50%	185%
Pyakluk	Rice-60% Black gram-5% Other legumes (cowpea, soybean-8% Perennial fodder-5% Fruit orchard- 2% Fallow- 20%	Wheat-15% Rapeseed/Mustard-10% Potato-5% Peas/beans-3% Winter vegetables-5% Forage (jai, barseem)- 5% Perennial fodder-5% Fruit orchard-2%	Maize-40% Summer vegetables-5% Perennial fodder-5% Fallow-50%	180%

Name of the subproject	Crops and area coverage (ha) by season			
	Monsoon (June-October)	Winter (October-February)	Spring (March-June)	Cropping intensity
		Fallow-50%		
Ekletar	Rice-60% Black gram- 5% Other legumes- 3% Perennial fodder-5% Fruit orchard-2% Perennial fodder-5% Fallow- 20%	Wheat-20% Rapeseed/Mustard- 10% Potato-5% Winter vegetables-5% Forage (jai, barseem)- 3% Perennial fodder-5% Fruit orchard- 2% Fallow-50%	Maize-40% Summer vegetables-3% Perennial fodder- 5% Fruit orchard- 2% Fallow-50%	180%
Ramtar-Kumalgaun	Rice-60% Black gram-5% Other legumes- 3% Vegetales-2% Fruit orchard-2% Perennial fodder-3% Fallow-25%	Wheat-25% Rapeseed/Mustard-10% Peas/beans-5% Potato-5% Winter vegetables-5% Fruit orchard-2% Perennial fodder-3% Fallow-45%	Maize-40% Summer vegetables-5% Perennial fodder-3% Fruit orchard-2% Fallow-50%	180%
Majhigaun	Rice-50% Finger millet-5% Black gram-5% Other legumes-5% Perennial fodder-5% Fruit orchard- 5% Fallow- 25%	Wheat- 20% Rapeseed/Mustard-5% Potato-5% Winter vegetables-5% Peas/beans-5% Forage (jai, barseem)-5% Perennial fodder-5% Fruit orchard -5% Fallow-45%	Maize-40% Summer vegetables-5% Perennial fodder-5% Fruit orchard- 5% Fallow-45%	185%

Source: Detail Feasibility Study Report, 2022

154. Based on the table above, cropping patterns and area coverage data for the subprojects of the Madi and Kaligandaki Rivers offer an insightful look into the agricultural practices across three key seasons: Monsoon (June-October), Winter (October-February), and Spring (March-June). This information is crucial for understanding how farmers utilize their land throughout the year and the overall cropping intensity, reflecting the total land used for crop production. For the subprojects of the Madi River, Dumsi shows that during the monsoon season, 25% of the land is used for rice cultivation, limited to lower terraces along the river, with black gram covering 30% and other legumes, vegetables, and perennial fodder each contributing smaller percentages. Notably, 30% of the land remains fallow. In winter, most of the land (55%) is left fallow, with wheat occupying 20% and other crops such as potatoes, rapeseed/mustard, and forage covering minor areas. In spring, maize becomes the primary crop (40%), but half of the land is still fallow. This results in a cropping intensity of 165%, indicating moderate land use efficiency.

155. Baireni follows a similar pattern, with rice and black gram being the major monsoon crops and significant fallow periods in both winter (55%) and spring (50%). The cropping intensity here is slightly lower at 155%, suggesting even more unused land during non-monsoon seasons. Duipiple shows a higher intensity (200%), with 60% of the land used for rice during the monsoon and rapeseed/mustard prominent in winter alongside wheat. Maize remains a key crop in spring, yet a substantial portion of land is still fallow. Sisaghat has the highest monsoon rice coverage (70%) among the Madi River subprojects, but similarly high fallow periods in winter and spring lead to a cropping intensity of 190%. This indicates a high but not optimal use of agricultural land throughout the year.

156. For the subprojects of the Kaligandaki River, Tilakpur shows a balanced use of land during

the monsoon, with 60% for rice and smaller percentages for legumes and vegetables. Still, like the Madi River subprojects, a large portion of the land is left fallow during winter and spring, resulting in a cropping intensity of 185%. Pyakluk and Ekletar have similar patterns with cropping intensities of 180%, where rice dominates the monsoon season and significant fallow periods persist in other seasons. Ramtar-Kumalgaun mirrors this pattern, with 60% of land used for rice in the monsoon and a high percentage of fallow land in winter and spring, resulting in a cropping intensity of 180%. Majhigaun, with a slightly different crop mix, including finger millet and fruit orchards, has a cropping intensity of 185%, indicating a similar level of land use efficiency as Tilakpur.

157. In summary, the data reveal a strong reliance on rice during the monsoon season across all subprojects, with less intensive land use during the winter and spring seasons. The significant fallow periods indicate potential for increasing agricultural productivity through improved irrigation and crop diversification. While varied, the cropping intensities suggest considerable room for enhancing land use efficiency across these regions by adopting more intensive cropping patterns and better water management practices.

158. Livestock has traditionally been integral to the farming system in other country's lower and middle hill areas. Most farmers traditionally kept one or two cows and buffalo, goats, and a few poultry birds (chicken and pigeon) to meet the needs of milk, eggs, and meat and also for sale for income. Goat rearing has traditionally been a specific enterprise in the area, as in other parts of the country. The farmers have innovated the traditional practice of livestock production with the increase in the demand for livestock products at the local level and in the adjoining urban areas and commercial centers. Some of the critical innovations in livestock production have been- i) replacing the traditional breeds of cows with cross-bred cows of Jersey and Holstein breeds that have higher milk yield, ii) replacing the traditional Khari breed of goats that the farmers traditionally kept with cross-bred and Boer breeds that have higher growth rate and high feed to meat conversion ratio, iii) some farmers also the investing to start dairy and goat husbandry to commercial scale, and iv) shift from traditional open grazing practice to stall feeding and improved animal husbandry practices in managing feed, fodder, parasite and disease control of the animals. These innovations have led to a significant increase in livestock production and an increase in the share of income from livestock production to the annual income of the farmers. The increase in the revenue from livestock production has also contributed to increasing the income earning and producing financial self-reliance on women, who have traditionally been involved in livestock rearing. These innovations in livestock production systems have been possible by improving livestock services- breeding, feed supply, and nursery for fodder plantation and health care facilities and processing and marketing of livestock products promoted by government agencies, development organizations, and private sector agencies. Dairy cooperatives and access to credit facilities by the banks, as well as micro-financial insurance and livestock insurance subprojects promoted by GoN, have been instrumental in supporting farmers' innovation in livestock production.

Cultural Sites

159. Cultural places in Lumbini and Gandaki provinces are integral to preserving and promoting Nepal's rich cultural traditions. These sites attract pilgrims and tourists and play a crucial role in maintaining the country's cultural and religious heritage. However, none of the HLIP sites are close to these sites. The list of places with high artistic and spiritual significance is described below.

Lumbini Province

160. Lumbini Garden is a site of immense cultural and religious significance. It is the birthplace of Siddhartha Gautama, who later became Buddha. As a UNESCO World Heritage Site, Lumbini

Garden attracts pilgrims and visitors from around the world who come to pay homage to the place where Buddha was born. The garden is home to several important monuments and archaeological remains, including a marker stone that indicates the exact birthplace of Buddha.

161. Within Lumbini Garden lies the Mayadevi Temple, dedicated to Queen Maya Devi, the mother of Buddha. The temple was built at the precise location where Buddha was born, making it a revered site for Buddhists. Visitors can see ancient ruins and marker stones inside the temple that signify this momentous event. The temple's surrounding area is dotted with stupas and monasteries, adding to its spiritual ambiance.

162. The Ashoka Pillar is a testament to Emperor Ashoka's reverence for Lumbini. Erected in 249 BC, it bears inscriptions in Brahmi script commemorating Ashoka's visit to this sacred site. This pillar not only marks the historical significance of Lumbini but also highlights Ashoka's role in spreading Buddhism.

163. Another significant structure in Lumbini is the World Peace Pagoda, built by Japanese Buddhists. This pagoda symbolizes peace and harmony and offers visitors serene views of the surrounding gardens and monasteries. It stands as a beacon of universal peace, reflecting the core teachings of Buddhism.

164. Lumbini is also renowned for its International Monasteries, constructed by various Buddhist countries. These monasteries showcase different architectural styles and cultural traditions of Buddhism, providing a unique opportunity for visitors to experience the global diversity of Buddhist practices. Notable monasteries include those from Myanmar, the People's Republic of China, and Germany, each reflecting their respective countries' unique cultural and religious elements.

Gandaki Province

165. The Gandaki region is home to several culturally significant sites, each with its own unique heritage. Muktinath Temple, located in the Mustang District, is a sacred site for Hindus and Buddhists. Believed to offer salvation (moksha), Muktinath Temple attracts pilgrims seeking spiritual liberation. The temple complex includes a pagoda-style temple, 108 water spouts, and eternal flames fueled by natural gas, symbolizing the elements of fire and water.

166. Barahi Temple, situated on an island in Phewa Lake in Pokhara, is dedicated to the Hindu goddess Varahi, an incarnation of Durga. This two-storied pagoda temple is not only a place of worship but also a popular tourist destination due to its unique location, accessible by boat. The temple's serene setting amidst the lake makes it a picturesque and spiritually enriching site.

167. Tashi Palkhiel Monastery in Hemja, Pokhara, is a significant monastery that serves as a center for religious study and meditation. The monastery complex includes stupas, prayer wheels, and residential quarters for monks, offering visitors a glimpse into the culture and religious practices.

168. Bindhyabasini Temple, one of the oldest temples in Pokhara, is dedicated to the goddess Bhagwati. This temple is a focal point for local festivals and rituals and provides panoramic views of Pokhara city and the Annapurna range. It is an important cultural and religious site for the local Hindu community.

169. Gorkha Durbar in the Gorkha District is the historic palace of King Prithvi Narayan Shah, the founder of modern Nepal. The complex includes the old royal palace, temples, and fortifications, offering insights into the history and culture of the Shah dynasty. Gorkha Durbar is a site of historical significance and a symbol of Nepalese heritage.

170. Tansen, located in the Palpa District, is known for its Newari culture and architecture. This historic hill town features traditional Newari houses and temples, reflecting the region's rich

cultural heritage. Key attractions include the Rani Mahal, a palace on the banks of the Kali Gandaki River, which adds to the town's charm and historical significance.

171. Finally, the Manakamana Temple in the Gorkha District is a major Hindu pilgrimage site. Dedicated to the goddess Manakamana, believed to fulfil the wishes of her devotees, the temple is accessible via a cable car, providing stunning views of the surrounding hills and valleys. Manakamana Temple is an important cultural and spiritual destination that attracts numerous pilgrims seeking blessings and fulfilment of their desires.

V. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

172. A thorough assessment of the environmental impact of the HLIP is conducted throughout various stages, including pre-construction, construction, and operation. At first, the study team visited the proposed project locations and the areas around them. These visits were crucial for directly observing and identifying potential environmental impacts from project activities. During these site visits, the team interacted with local stakeholders through meetings aimed at collecting a wide range of perspectives and insights. This stakeholder engagement was crucial, enabling the team to integrate local knowledge and concerns into the environmental assessment. In addition, thorough field examinations were conducted, along with meticulous data collection, to ensure a comprehensive analysis of the environmental baseline and possible disruptions.

173. Negative effects identified from these activities are crucial, as they will be the basis for developing an environmental management plan (EMP). This plan aims to address and minimize potential environmental impacts throughout the project. The report will contain precise measures to address the distinct challenges and impacts identified in every project stage.

174. To provide a comprehensive analysis of the potential environmental impacts, it is necessary to delve into each project phase.

(i) Pre-construction: Emphasizes the effects associated with site preparation, including temporary land disturbance, potential pollution from construction material staging, and initial disruptions to local people.

(ii) Construction involves various factors that need to be considered, such as the effects of noise pollution, dust generation, increased traffic and its emissions, and the possibility of risks to the local village.

(iii) This operation considers the long-term effects, including potential changes to water flow and quality, the possible introduction of non-native species through new water channels, and the potential impact on local ecosystems.

175. The subsequent sections delve into each phase, offering a comprehensive overview of the expected environmental challenges and the strategic measures devised to tackle them. This comprehensive environmental analysis guarantees that the project complies with sustainable practices and reduces its environmental impact in line with local regulations and global environmental standards.

A. Beneficial Impacts

176. Development efforts, particularly the construction of the HLIP, will have multifold beneficial impacts, i.e., an increase in crop production. Irrigation projects generally aim to improve the economic and social welfare of the people living in the command area.

177. **Boost in cop production.** The HLIP is designed to significantly boost agricultural productivity through the enhancement of irrigation infrastructure, ensuring a more reliable and efficient water supply. This initiative is particularly transformative for the hill lift irrigation systems, which provide irrigation to previously unirrigated or under-irrigated lands located on old river terraces, commonly known as "Tar" lands. By installing tube wells on river floodplains and constructing reservoir tanks, the project enables the lifting of water to higher elevations and its distribution through a network of pipelines to agricultural fields. This approach will convert lands into more productive fields, allowing for multiple cropping cycles within a year and enabling farmers to diversify their crop production.

178. **Skill Enhancement.** Employment in construction work is likely to enhance the skills of the workers, and a large number of local semi-skilled and unskilled workers will get practical hands-on training. This will improve their technical skills in various areas of the construction

industry, which could get them good jobs in the future. They will also be trained for future repair and maintenance of the embankments and shelters. This impact is indirect, of high significance, regional, and long-term.

179. **Women's involvement.** The project proponent will encourage local women's employment opportunities through the contractor. In this context, women will not be discriminated against regarding wages based on equal job-equal wages. Gender violations and deviant behaviour will be strictly prohibited. The impact is indirect, medium-significant local, and long-term in nature.

B. Operational Impacts

180. **Socio-Economic Benefits.** Implementing the subproject will result in a significant increase in agricultural production with a rise in crop yield. The proposed project aims to ensure the irrigation facility raises land areas along the river valley. It will also help convert barren land into arable land and increase agricultural production and productivity through the intensification and diversification of crops. It will help make the area attractive for investments, increase economic activities, create income-generating opportunities, and stabilize livelihoods.

181. **Promotion in Agricultural Production.** The improved irrigation facilities will ensure continuous and smooth production of agricultural crops in the project command area. The proposed project assists in promoting vegetables and crops through the availability of agricultural goods all year round. People will be lured to establish new businesses. Agriculture support services in the command area of the project are moderate. There are agro-vets and private agriculture co-operatives within the command area that supply agricultural input, especially seeds, manure, and plant protection materials.

182. **Promote the Aquaculture.** Besides the increment in agricultural production through irrigation, it will provide opportunities for aquaculture, which could provide to increase food production and economic returns, enhance livelihoods and public health outcomes, and maintain key ecosystem services. The new aquatic habitat created by irrigation may provide opportunities for new fisheries. There is considerable scope to optimize the benefits of irrigation systems by integrating fisheries from the outset of project planning and design through to operation and management.

183. **Quality of Life.** The provision of potable water and proper sanitation will improve personal, household, and community hygiene practices, resulting in better health for the family and community and, ultimately, an overall improvement in the locals' quality of life.

C. Negative Impact and Mitigation Measures

Construction Phase

C.1.1 Physical Environment

184. **Soil Erosion/Siltation.** The influence of soil will mainly be concentrated in the vicinity of the project operations. The excavation procedures necessary for the project's infrastructure, such as excavating trenches, might result in soil erosion and an elevated amount of debris in the runoff. Inadequately handled excavation material has the potential to disturb the surrounding topography. Moreover, some areas may be susceptible to erosion due to changes in land use and drainage patterns. Soil pollution caused by dust and runoff is a significant hazard when building road access. Additionally, the rainy season threatens erosion along the distribution lines due to possible floods. Effective mitigation of these hazards requires meticulous construction planning and diligent site management.

185. **Mitigation Measures**: The following are the mitigation measures for the potential impacts on land use, topography and soil.

(i) All excavations shall be done to the minimum dimension required for safety and working facility.

(ii) Precautionary measures shall be taken, and the proper filling of excavated trenches and the excavated soil with burying of the pipeline will be done properly as per the instructions from the safety superintendents of the contractor and environmental monitor of the PIMS.

(iii) Limit the use of heavy equipment and machinery on agricultural land.

(iv) Manual labor shall be promoted in the trench works, erection of the electrical poles and road works

(v) Cropping calendar shall be considered while road works, and erecting poles and stringing of conductors to avoid loss of standing crops.

(vi) The spoil placed at the side of the trenches shall be backfilled shortly after the pipeline is placed in the trench.

(vii) Adequate drainage shall be provided to channel the rain-storm water during monsoon in the project component areas

(viii) Concrete foundation is recommended for steel tubular pole installation

(ix) Creating diversion ditches or retention basins to manage runoff during the rainy season and reduce the risk of flooding and erosion.

(x) Promptly revegetating any disturbed areas to reduce the risk of soil erosion.

186. **Soil Quality.** Laying the distribution pipeline necessitates soil excavation, which, if not properly handled, may result in runoff and erosion. This, in turn, can lead to the degradation of fertile agriculture, water contamination, and silt accumulation. It is necessary to preserve and replace the topsoil while opening the trench for installing the distribution pipes in all 12 subprojects.

187. The project should avoid any extended storage of materials and should prioritize efficient execution of tasks such as excavation, pipe installation, and backfilling to minimize soil disturbance. For the storage of topsoil, suitable conveyance, proper placement of the storage area, and sufficient drainage are necessary. Once the construction is finished, the dirt dug beforehand will be used to restore the damaged regions and enhance production.

188. **Mitigation measures**. During earthworks will include the implementation of measures to prevent soil damage and erosion, and maintain humus fertility and its quality, namely:

(i) After the completion of the trench construction, the previously removed topsoil should be used to restore the damaged areas and improve fertility.

(ii) The transport and equipment routes must be strictly followed.

(iii) Topsoil removal and storage should be done separately from other materials on a pre-selected site protected from surface runoff and covered until backfilling or disposal.

(iv) Digging and backfilling of trenches should be done as quickly as possible.

(v) Temporary water-diversion channels should be provided along the perimeter of the topsoil piles.

(vi) In the case of long-term storage of topsoil, its care should also be planned to ensure its fertility is protected.

(vii) The use of double-walled tanks or tanks with secondary containment systems is highly

recommended to prevent accidental spills.

(viii) Conduct regular inspections of the tank, berm, and associated infrastructure to identify and address potential issues early.

(ix) The ground/soil contaminated accidentally during the construction should be cut and removed as soon as possible.

189. **Air Environment.** During the building phase of the HLIP, there will be a temporary, although minimal, effect on the air quality in the designated subproject area. The causes of these consequences may be traced back to several factors, including emissions from concrete mixing, excavation activities, site clearance, and inadequate storage of building materials. More precisely, the use of construction equipment, diesel-powered generators, and project-related cars is anticipated to emit exhaust gases that comprise carbon monoxide (CO), sulfur dioxide (SO2), nitrogen oxides (NOx), and particulate matter (PM). While these emissions are temporary, they might cause a temporary decline in the air quality at the project site and along the access roads. Smoke emissions generated from fuel burning during these activities are equally concerning since they add to the overall effect on air quality during the building phase.

190. **Mitigation Measures**: The following are the mitigation measures for the potential impacts on Ambient Air Quality.

(i) Risk exposure can be decreased with careful site planning. This involves ensuring enough ventilation and regulating the placement of large machines as the primary goal to minimize the generation of dust and fumes at the source. On the other hand, to prioritize the safety and health of the workers, it is still highly recommended and necessary to use N95 dust masks as a supplementary measure to minimize inhalation of particulate matter and other pollutants.

(ii) Regular maintenance of construction equipment can minimize the emission of exhaust fumes. Using modern, well-maintained machinery with lower emissions can significantly reduce worker exposure to harmful fumes

(iii) Vehicles delivering loose and fine materials like sand and aggregates shall be covered.

(iv) Dust suppression measures, such as water sprinkling, shall be applied in all dust-prone locations, such as unpaved haulage roads, earthworks, and stockpiles.

(v) Planting grass or other ground cover vegetation in non-active areas can help stabilize the soil and reduce dust.

(vi) Apply gravel or other aggregates to unpaved roads to provide a more stable driving surface and reduce dust generation.

(vii) Utilize existing vegetation or plant new trees and shrubs to act as windbreaks, reducing the movement of dust.

(viii) Designate specific routes for construction vehicles to minimize the area affected by dust. Repeatedly using the same paths can help contain dust in certain areas.

(ix) Position any stationary emission sources as far as practical from sensitive receptors (houses, schools, clinics, temples, etc.).

(x) Regular checks and maintenance of construction equipment and vehicles to keep them in good working order to meet emission standards.

(xi) Enforce strict no-burn policies at temporary campsites and proper disposal protocols for construction waste to avoid open burning.

(xii) Develop a traffic management plan to reduce congestion and optimize routes for project vehicles to minimize idle time and associated emissions.

(xiii) Where possible, use alternative construction materials that produce less dust and opt for electric-powered equipment over diesel-powered to reduce exhaust emissions.

(xiv) Continuous monitoring of air quality at the construction site and surrounding areas to ensure levels of pollutants are within acceptable standards and to make adjustments to mitigation measures as necessary.

(xv) Educate construction workers on best practices for minimizing air pollution, including proper equipment operation and adherence to waste management procedures.

(xvi) Keep the local community informed about the construction schedule, potential impacts, and the measures in place to mitigate air quality issues.

(xvii) Prompt revegetation of cleared areas to stabilize the soil and reduce erosion and dust.

191. **Noise Environment.** Within the scope of the subprojects, various static construction sources, including concrete mixers, diesel generators (DG sets), cranes, and other heavy machinery, are identified as significant contributors to onsite noise pollution. Noise levels near these sources have been recorded, revealing potential spikes in sound intensity exceeding 90 dB(A). This level of noise generation is considerable and, with appropriate control measures, can benefit construction workers and nearby residents. The use of heavy machinery during road construction contributes to noise pollution, affecting the local community.

192. It is important to note that the intensity of noise from these sources diminishes with distance due to the natural spread of sound waves, also known as wave divergence. Despite this, prolonged exposure to high decibels may lead to various adverse health effects. These include temporary to permanent hearing loss, depending on the duration and intensity of exposure, and non-auditory impact, such as increased stress, resulting in conditions like hypertension and high blood pressure. Such health risks underscore the necessity for implementing stringent noise mitigation strategies throughout the construction activities.

193. **Mitigation Measures**: The mitigation measures for the potential increase in the noise and vibration in the Subproject area are:

(i) **Avoidance**: (1) Choose construction sites and access routes that are as far away from residential areas, schools, hospitals, and sensitive agricultural zones as possible to avoid exposing people and livestock to excessive noise; (2) Schedule noisy activities during times of the day when they are least likely to disturb nearby residents or agricultural activities. Avoid early morning, late evening, and night-time operations whenever possible.

(ii) **Minimization**: (1) Select construction equipment and vehicles designed to operate more quietly. Regularly maintain and service machinery to ensure it runs as quietly as possible; (2) Implement operational changes such as reducing the speed of vehicles, limiting the use of horns, and avoiding idling of engines near sensitive areas.

(iii) **Mitigation**: (1) Increase the distance between noisy activities and sensitive receptors (residential areas, schools, farms) by creating buffer zones; (2) Plant trees and shrubs along construction boundaries. Vegetation can help absorb noise and provide a visual barrier.

(iv) Provide workers with hearing protection such as earplugs or earmuffs. Ensure that they are trained on adequately using and maintaining these devices.

(v) Any stationary equipment that produces high noise levels shall be positioned as far as is

practical from sensitive receptors.

(vi) Construction traffic routes will be defined in cooperation with local communities and traffic police to minimize noise and nuisance. The speed of vehicles and mobile equipment on site will be regulated to reduce noise emissions.

(vii) Use modern, quieter machinery and ensure all equipment is well-maintained to reduce noise output. This could include fitting silencers or mufflers on noisy machinery.

(viii) Limit the hours of operation for the noisiest equipment to less frequent periods, avoiding early morning, late evening, and night, when possible, to minimize disturbance.

(ix) Position noisy equipment far away from sensitive receptors, such as residential areas and schools.

(x) Notify local communities before periods of expected high noise levels and establish communication channels for complaints and concerns about noise.

(xi) Continuously monitor noise levels to ensure they stay within acceptable limits and review construction practices regularly to identify opportunities for noise reduction.

(xii) Train all staff and workers in the best practices for noise control and the importance of adhering to noise mitigation measures.

(xiii) Continuously assess the effectiveness of noise mitigation measures and make adjustments as needed. Implement best practices and innovations in noise reduction.

194. **Groundwater Resources (construction and operations).** Establish the tube wells for pumping towards the proposed reservoirs. This may cause a decrease in the groundwater table. Specifically, tube wells draw groundwater from aquifers, which can lower the groundwater locally if extraction rates exceed natural recharge rates. Moreover, overuse of tube wells across regions can lead to a more widespread decline in groundwater levels, affecting water availability in agriculture, communities, and ecosystems.

195. **Mitigation Measures**: The mitigation measures for the potential impact on water resources are:

(i) Protection of nearby water sources to maintain water seeping and recharge the aquifer system from natural and artificial sources.

(ii) Water testing is required to ensure the quality of the pumped water: once during drilling and once a year during the operations phase of the Tube Wells period.

(iii) Integrated water resource management, including monitoring, regulation, and community involvement, is critical to sustainably managing groundwater and surface water resources and mitigating adverse impacts on the groundwater table.

(iv) As far as practical, earthworks will be limited and, in the short-term, done during the dry season to minimize exposed areas subject to erosion by surface water runoff.

(v) Establish dedicated fuel, oil, and chemicals stores on an impermeable bunded area to prevent spills and leaks from contaminating soil and affecting water quality.

(vi) Wastewater release will be managed properly by constructing separate soak pits and septic tanks away from the water body.

(vii) Earthworks will be done during the dry season, as far as practical, to minimize exposed areas subject to erosion by surface water runoff.

(viii) Establish dedicated fuel, oil, and chemicals stores in impermeable bunded areas.

196. **Solid Waste Generation from Construction.** Throughout the development of the HLIP, a variety of structures will need the use of construction materials. These materials will usually come from specific quarries. A substantial amount of earthwork will be carried out as part of the project's operations. The excavated earth will be used entirely within the project's scope, namely for the building and strengthening of the canal system's banks. This method guarantees that no surplus dirt will remain at the location, reducing the need for off-site disposal and the resulting implications on land usage. The area allocated for prospective muck disposal is now categorized as wasteland, which helps to minimize any interference with current land use. Regarding the construction of grid connection distribution lines, the expected excavation operations are forecasted to be limited, therefore decreasing the environmental impact of this part of the project.

197. **Mitigation Measures**: The mitigation measures for the management of solid waste release **during** construction are:

(i) Careful planning, selection of borrow pits, and timing of cut and fill operations.

(ii) Reuse spoil and other materials for construction purposes.

(iii) Stockpiling sites of construction materials will be designated at demarcated places.

(iv) Ensure that the labor camps have proper facilities for waste segregation and even for composting biodegradable waste.

(v) Provide temporary prefabricated mobile toilets in the construction sites.

(vi) Separate provision for collection and disposal of hazardous waste, if any, as prescribed by government rules and regulations

(vii) Ensure that construction materials are sourced responsibly from quarries that follow environmental management practices and government requirements.

(viii) Implement strict inventory management to prevent over-ordering, which can lead to waste, and promote using recycled materials where possible.

(ix) Develop a soil management plan to ensure that all excavated soil is utilized beneficially within the project, such as for bank reinforcement, thus avoiding generating surplus material.

(x) After using the wasteland for muck disposal, engage in land restoration activities to return the land to a usable state, potentially for ecological, agricultural, or community use.

(xi) Implement erosion control measures such as silt fences, sedimentation ponds, and temporary vegetation to prevent soil erosion from disturbed areas.

198. **Solid Waste Generation in Labor Campsite.** The work camps during the building phase of HLIP might have distinct effects on solid waste management. These consequences have several aspects, affecting the local environment and larger social and health implications. Solid waste produced by labor camps consists of household garbage from everyday activities, packaging, and leftover materials from building procedures, and sometimes, it may include dangerous waste from chemicals and construction materials. In the absence of effective administration, this trash has the potential to cause ecological deterioration, contaminating nearby soil and water reserves and generating unhygienic circumstances that might facilitate the spread of diseases among workers and the local populace.

199. **Mitigation Measures**: The measures for the management of solid waste in labor camps are:

(i) Implement on-site waste segregation to enable the reuse, recycling, or appropriate disposal of materials. Separate bins for different types of waste should be provided.

(ii) Encourage recycling of materials such as metal, plastic, and concrete. Reuse materials whenever possible to minimize waste and reduce the demand for new materials.

(iii) Ensure that all non-recyclable waste is disposed of responsibly in accordance with local environmental regulations, using licensed waste management services.

(iv) Develop and implement a waste reduction plan for the project, which includes guidelines for minimizing waste at the source.

(v) Properly handle hazardous wastes[23] By storing them in designated areas and disposing of them according to hazardous waste disposal guidelines.

(vi) Conduct training sessions for workers and subcontractors on waste management practices to ensure compliance with the waste reduction plan.

(vii) Perform regular audits of waste generated to identify opportunities for waste reduction and improve management practices.

(viii) Monitor the amount and type of waste generated and report it to the relevant authorities as required. This can help in tracking the effectiveness of waste management strategies.

C.1.2 Biological Environment

200. **Vegetations.** The project does not encroach upon any protected, conservation, or wildlife reserve areas, minimizing the likelihood of substantial ecological disruption. Within the HLIP's scope, forest and land covers will be preserved mainly due to careful planning. The construction of tube wells and buried pipe distribution networks is strategically designed to avoid forested areas, opting for alternative routes and the storage tank area to prevent the need for vegetation clearance. While there may be peripheral pressure on forest resources, no substantial impact on the area's vegetation and biodiversity is expected.

201. **Terrestrial habitat.** These are expected to remain largely undisturbed by the HLIP. Construction sites and operational areas have been deliberately located outside protected natural zones, ensuring the project's footprint does not affect significant wildlife habitats. This strategic siting reflects a commitment to preserving the existing terrestrial ecosystem throughout the project lifecycle.

202. **Mitigation Measures**: The mitigation measures for the potential impact on biological resources are:

(i) Ensure that trees are not cut during construction. If unavoidable, the project should obtain prior permission from the concerned authority before cutting any tree.

(ii) The excavated topsoil will be placed in its original position after the completion of excavation works to bury distribution pipes.

(iii) Ensure the use of clean sources of energy (e.g., LPG gas for cooking) in the construction labor camp.

[23] Polychlorinated Biphenyls (PCBs) are found in older transformers and capacitors and require careful handling, storage, and disposal. Sulfur Hexafluoride (SF6) is used in high-voltage electrical equipment for insulation and is a potent greenhouse gas with a high global warming potential, necessitating leak detection and management to prevent atmospheric release. Oil and lubricants used in various machinery and electrical equipment can become contaminated with hazardous substances and require proper disposal to prevent soil and water contamination. Lead-acid batteries used in backup power systems contain heavy metals and acid that can be harmful if not disposed of correctly. Chemical solvents used in the cleaning and maintenance of electrical equipment can be toxic and flammable, requiring proper storage and disposal to prevent environmental contamination.

(iv) Labours and staff shall be made aware to avoid illegal activities in adjoining forest

(v) Awareness programs regarding policy related to the conservation of existing flora & fauna, to the workers prior to the construction and the community during various meetings and discussion programs.

(vi) Regularly monitoring construction sites to ensure compliance with environmental guidelines and taking corrective action when necessary.

C.1.3 Socio-Economic Environment

203. **Loss of Land and Crops.** In each subproject, after pumping the water from the tube wells, water is stored in storage tanks with a land area of 20m*10m and with 2.5 to 3m depth for storing the pumped water for irrigation. This land will be placed in the public land area under the local government's jurisdiction. Establishing the storage tank inside the community forest is to be avoided since the land transformations and tree-cutting issues will take a long time, and governmental approval and clearances from the forest are required prior to the construction work. The construction phase, which includes laying out the distribution pipe network and creating temporary access roads to the pump houses, is anticipated to lead to some crop loss. Mitigation measures will be implemented to minimize this impact, such as compensating farmers for the crop loss and restoring the land post-construction. Detailed planning will ensure that disturbances to agricultural activities are kept to the least amount possible, and affected areas will be rehabilitated to maintain the land's long-term productivity.

204. **Mitigation Measures**: The mitigation measures for the potential impact on biological resources are:

(i) Communicate with the local farmers, wards, and municipality personnel to start the work in a timely manner, making less impact on the growing crops in the command area.

(ii) Enough drain outlets need to be prepared and manage the released water during the installation of the Tube Wells.

(iii) Manage stockpile timely during the excavation work of the distribution canals

(iv) Compensation will be provided to the farmers whose crops will be lost due to construction activities.

(v) Once construction is completed, implement land restoration measures to return the farmland to its original or better condition for agricultural use.

(vi) Designing temporary access roads to minimize the amount of farmland affected and using methods that prevent long-term damage to the soil structure.

(vii) Engaging with the farming community to ensure their concerns are addressed and their cooperation is gained.

205. **Power line installation hazards**. The HLIP power lines infrastructure consists of 11 kV power lines and transformer facilities connected to the tube well sites using concrete poles. The physical installation may exacerbate soil erosion, especially in areas where vegetation clearing is required. During the building phase, equipment operation may contribute to noise and air pollution in certain areas. Local disruptions to linear infrastructures, such as roadways, may occur. Implementing mitigation methods will be crucial in order to limit the negative effects resulting from various power supply operations.

(i) **Mitigation Measures**: The measures for the management of these impacts are:

(ii) Transmission lines will be strategically placed to minimize any potential impact on tree stands.

(iii) Electric poles will be strategically located to utilize the natural topography, ensuring ample vertical clearance over the land, thus reducing the necessity of tree removal.

(iv) To safeguard the local wildlife populations, it is imperative for Contractors to diligently enforce a strict "no hunting provision" among their workers.

(v) Maximize the utilization of the excavated earth and rock to strengthen the foundation of electric poles. The spoils from the foundation excavations will be carefully managed by placing them in landform depressions.

(vi) The temporary access roads and paths will be restored by removing the side-casted spoils material and reshaping the cross-slope.

(vii) Local infrastructure departments will be notified of the timing and location of power line construction that may impact their respective infrastructure facilities.

(viii) To enable road margins to be used safely as temporary materials staging areas, pullouts or temporary staging areas will be identified where construction materials can be deposited without spilling out onto the roadway and without disrupting the flow of traffic.

(ix) Electric pole foundations that must be located close to roads will be constructed to ensure foundations do not create hazards to motorists.

206. **Occupational Health and Safety.** Throughout the construction phase, the safety and health of work personnel are of paramount importance. Workers will be at risk of various construction-related health hazards, including injuries from operating heavy machinery without proper safety measures and equipment. It is essential to enforce rigorous safety protocols and provide comprehensive training to mitigate such risks.

207. The health risks extend beyond the construction site to the living conditions in labor camps. Poor camp conditions, including unsafe drinking water and inadequate sanitary facilities (such as a lack of latrines and washing stations), can lead to the spread of waterborne diseases like dysentery, diarrhea, and cholera. Additionally, improperly managed standing water, such as water logging and borrow pits, increases the risk of vector-borne diseases, including malaria.

208. Amid concerns such as COVID-19 and other diseases, strict health and safety guidelines must be in place to protect the workforce. This includes enforcing social distancing where possible, providing personal protective equipment (PPE), ensuring access to clean water and sanitation, and establishing protocols for testing, tracing, and managing infections. Such comprehensive health measures will safeguard against endemic diseases and emerging health threats, maintaining the well-being of the workers involved in the project.

209. **Mitigation Measures**: The following are the recommended mitigation measures for such potential impact.

(i) A first aid facility will be provided at the site.

(ii) Ensure good housekeeping in the premises at all times, including on construction sites, workers camps, storage areas, etc.

(iii) Provision of contingency planning, safe drinking water/sanitation, and a latrine facility will help maintain the health and hygiene of the workers on the site.

(iv) The Contractor will be responsible for the safe removal and/or storage of all waste in order to prevent environmental pollution of any type that may be harmful to people or animals.

(v) A site and safety plan will be prepared, encouraging the use of safety measures and

PPE. Dustbins will be provided on the work site to collect waste. The camp will be well managed, with adequate space, light, ventilation, drinking water, and toilet facilities.

(vi) Follow established occupational health and safety protocols regarding emerging infectious diseases, such as coronavirus disease (COVID-19).

(vii) The prevention measures for COVID-19 include the worker having the appropriate test (PCR) before involvement is done.

(viii) Provide on-site medical facilities and trained healthcare providers to manage health issues promptly.

(ix) Enforce strict health and safety regulations on-site, including properly using machinery and tools.

(x) Develop and implement an emergency response plan for handling accidents and outbreaks of diseases.

(xi) Implement vector control measures such as proper drainage to prevent waterlogging and use mosquito nets and repellents to reduce the risk of vector-borne diseases.

(xii) Appropriate PPE (OSHA-recommended PPE), including masks, gloves, and the use of sanitizer with proper hygiene measures, will be compelled within the work and camp area.

(xiii) Record of incidents /accidents / near-miss/ fatalities associated with the project will be maintained

(xiv) Records of issues raised will be maintained in accordance with the project GRM

(xv) Implement SEMP (e.g. Site-Specific Environmental Management Plan, Health and Safety Plan, Camp Management Plan)

(xvi) Conduct regular safety training sessions for workers on how to handle machinery and use safety equipment properly.

(xvii) Provide barricade fencing to mitigate trespassing

(xviii) Provide a barricade to temporarily enclose open excavated trenches/slopes.

210. **Community health and safety risks**. The presence of construction vehicles and machines, as well as changes in traffic patterns, can present safety concerns for residents in the area. The rise in the number of vehicles on the road frequently results in traffic congestion, increasing the likelihood of accidents. These accidents can have a significant impact on vulnerable populations, including schoolchildren and the elderly. These individuals often face higher risks as they move through areas that become more complicated and dangerous due to construction activities.

211. **Mitigation Measures**: The following are the measures for this potential impact.

(i) Implement a comprehensive traffic management plan that coordinates construction schedules with peak traffic hours to minimize congestion. This should include the designation of alternative routes for construction traffic and clear signage to direct vehicles efficiently.

(ii) Install appropriate signage in areas affected by construction activities. These signs should warn of upcoming construction, altered traffic patterns, and the presence of heavy vehicles. They can also direct pedestrians to safe crossing points.

(iii) Enforce strict speed limits in construction zones, using speed bumps or digital speed

display signs to ensure drivers adhere to the limits. Flagged persons can also be beneficial for managing traffic flow, particularly during peak hours or when children are travelling to and from school.

(iv) Establish and maintain safe pedestrian crossing points equipped with crossing guards during busy times to assist schoolchildren and the elderly. Where possible, temporary pedestrian bridges or tunnels may be beneficial.

(v) Launch awareness campaigns to inform residents about the construction schedule, potential hazards, and safety measures in place. Providing this information helps the community adjust their routines and travel paths to avoid construction areas.

(vi) Regularly monitor traffic conditions and enforce safety measures through patrols or surveillance cameras to ensure compliance with traffic rules and construction safety protocols.

(vii) Develop a clear emergency response plan for traffic-related incidents, ensuring that all construction personnel are trained in first aid and that procedures are in place for rapid emergency services access to the construction site.

188. **Risks associated with Agricultural Activities.** When construction activities, particularly those involving the movement of vehicles along unpaved roads connecting fields, intersect with agricultural operations, they can significantly impact farming activities, especially during critical times like planting or harvesting seasons. Dust generated by construction vehicles can settle on crops, potentially harming plant health and reducing the quality of produce.

189. **Mitigation measures:** To mitigate these impacts, the following considerations and activities shall be integrated:

(i) Schedule construction activities during periods of low agricultural activity to minimize interference. For instance, avoid construction during peak planting and harvesting seasons.

(ii) Communicate with local farmers to understand their schedules and needs. Develop a construction timetable that considers critical agricultural periods.

(iii) Implement traffic control measures such as signage, speed limits, and designated crossing points to ensure the safe and efficient movement of both construction vehicles and agricultural equipment.

(iv) Regularly spray water on unpaved roads to suppress dust, and consider using dust suppression chemicals where appropriate.

(v) Establish channels for farmers to provide feedback and report issues related to construction activities. This can help in promptly addressing any concerns.

(vi) Conduct thorough environmental impact assessments to identify potential impacts on agriculture and develop strategies to mitigate them.

(vii) Ensure construction activities comply with local agricultural and environmental regulations to protect farmland and farming operations.

(viii) Develop a compensation plan for farmers who experience losses or damages due to construction activities. This can help mitigate the financial impact on their livelihoods.

(ix) Provide support services such as temporary access solutions, soil restoration, and dust mitigation to assist farmers during the construction period.

190. **Cultural and religious risks**: Construction activities can potentially impact areas that may

hold spiritual or cultural importance to local communities. For example, inadvertent disruptions to sites of worship can result in community distress. Such impacts can lead to delays if local opposition grows strong, and they may undermine the social license to operate. Moreover, altering traditional land use can affect community rituals and festivities tied to agricultural cycles, potentially eroding the intangible heritage that sustains these practices. It is crucial, therefore, for the HLIP to engage in thorough cultural safeguards and foster open dialogue with community leaders to mitigate any adverse impacts on the religious and cultural spheres of the project area.

212. **Cultural and religious risks**: Construction activities can potentially impact areas that may hold spiritual or cultural importance to local communities. For example, inadvertent disruptions to worship sites can result in community distress. Such impacts can lead to delays if local opposition grows strong, and they may undermine the social license to operate. Moreover, altering traditional land use can affect community rituals and festivities tied to agricultural cycles, potentially eroding the intangible heritage that sustains these practices. It is crucial, therefore, for the HLIP to engage in thorough cultural safeguards and foster open dialogue with community leaders to mitigate any adverse impacts on the religious and cultural spheres of the project area.

213. **Mitigation measures:** To mitigate the impacts of the HLIP on religious and cultural aspects in the project areas, several measures can be implemented:

- Identify cultural and religious sites within the project area. This should involve consulting with local community leaders to understand their significance.
- Engage with local communities, particularly religious and cultural leaders, to understand their values and concerns. These consultations should be ongoing throughout the project to ensure community feedback is continuously incorporated.
- Provide cultural sensitivity training for project staff and workers to foster respect for local traditions and practices. Understanding the cultural context can minimize inadvertent disrespect or harm to cultural practices.
- Rerouting of construction vehicles, creating access paths during construction or even adjusting project timelines to accommodate important cultural events.
- Document cultural sites and practices with the community's help to create records that can serve educational purposes and promote cultural understanding. Sharing this documentation can help foster pride in the local heritage and facilitate its preservation.

C.2. OPERATIONAL PHASE

192. **Routine Operations.** The facilities will require regular maintenance and may have several potential environmental impacts. These can include contamination from lubricants or fuels used in maintenance and disturbance to local areas. There are also health and safety considerations for workers, such as risks associated with machinery operation, and for the local community, which may face increased exposure to noise and potential water quality issues. It's crucial that these operations incorporate strict environmental and safety protocols to minimize and manage these impacts effectively.

193. **Mitigation Measures**: The following are the recommended mitigation measures for such potential impact.

(i) Train workers and staff in safe and efficient operation and SOPs

(ii) Ensure that all safety equipment, and personnel protection equipment are provided and are used properly, and are in working conditions

(iii) Provide training on safe machinery operation and emergency response.

(iv) Ensure proper maintenance of facilities and amenities like drinking water and sanitation

(v) Ensure that qualified/trained supervision is available at all times in the Tube well pump locations

(vi) Provide necessary first aid and ensure on-call service with local hospitals

(vii) Implement water-saving techniques and monitor groundwater levels to prevent over-extraction

(viii) Use containment procedures and proper storage of lubricants and fuels to prevent contamination

(ix) Install noise dampeners and schedule maintenance during less sensitive times

(x) Regularly test local water sources for contaminants to ensure community health

194. **Public Hazard**. Power lines present a hazard for accidental electrocution if a tree, wire, line, or other object comes into contact with a live conductor and creates a ground.

195. **Mitigation measures** are:

(i) Regularly trimming trees and removing debris around power lines to prevent contact.

(ii) Installing insulated sleeves on wires to prevent conductive contact.

(iii) Conducting awareness campaigns on the dangers of power lines and the importance of maintaining a safe distance.

(iv) Installing clear warning signs near power lines to alert the public to the potential hazards.

(v) Properly grounding all electrical systems to safely dissipate electricity in the event of a fault.

(vi) Ensuring all power lines and associated infrastructure comply with national and international safety standards.

(vii) Developing and disseminating clear protocols for responding to electrical accidents to minimize harm when incidents occur.

196. **Increase of water-borne disease**. The creation of stagnant water bodies through inefficient irrigation practices can facilitate the spread of water-borne diseases. Inefficient irrigation practices, such as over-irrigation or poor water management, can lead to the accumulation of stagnant water in the subproject command area. Stagnant water bodies are optimal breeding grounds for mosquitoes, which are vectors for water-borne diseases. The increased incidences of water-borne diseases could affect the health and productivity of the local population.

197. **Mitigation measures** are:

(i) Careful management of water storage and distribution to prevent stagnation, which is conducive to disease vectors.

(ii) Design and construction of drainage canals can include features that deter the accumulation of stagnant water. For instance, ensuring proper slope and flow can prevent the creation of stagnant pools.

(iii) Informing and working with local communities can lead to better maintenance of the irrigation infrastructure and reduce the incidence of water-borne diseases. Communities can be educated on the risks and prevention methods for water-borne diseases.

(iv) Employing integrated pest management or IPM can reduce the reliance on chemical

pesticides, which can contaminate water sources, opting instead for more sustainable pest control methods.

VI. ENVIRONMENTAL MANAGEMENT PLAN

A. Environmental Management Plan Overview

214. As per ADB SPS, 2009, this HLIP is classified as environmental category B and does not require further environmental impact assessment. This IEE has been prepared based on the design report of the HLIP prepared by the DWRI and ADB. The CPMO, with support from PIMS, shall update this draft IEE based on the final detailed design and submit it to ADB for review, clearance, and disclosure. The proposed HLIP, with all Subprojects, i.e., 12 systems, are the new irrigation systems. Since the proposed irrigation systems are new, with a command area of more than 100 ha. in all three river basins, and an IEE needs to be prepared as per EPR, 2020. Thus, as per EPR 2020, the project component scope triggers IEE for the Hill Lift Irrigation Subprojects. The CPMO shall prepare the IEE report and be approved by the Ministry of Energy, Water Resources and Irrigation (MEWRI). The DWRI will take the IEE clearances prior to the construction work starting in the project area districts. The CPMO shall obtain all the necessary consents and permits from the concerned Ministries and the stakeholders in the project area, mainly the Rural Municipalities/ Municipalities (local governments) where the Tube wells and storage tanks will be established.

215. Following the requirements of the SPS 2009, an essential component of an IEE report is the environmental management plan (EMP). The goal of the EMP is to develop the mitigation and monitoring measures for the impacts identified within the scope of the IEE procedures to be used in practice by the project implementing agency - the DWRI, and thus, bring its activities into compliance with the environmental and social requirements envisaged by the national legislation as well as with the environmental and social policies of the international finance organizations.

216. The given EMP is based on the information given in the previous chapters, in particular, activity specifics, background properties of the natural and social environment of the working area and expected negative impacts during the activity and their propagation area. The EMP is drafted for different stages of activity, including preparatory works planning phases. The EMP is a live document, and it can be detailed immediately during the accomplishment of the activities following the monitoring outcomes or other practical terms. Any changes or corrections to this EMP will be done based on the formal agreement between DWRI and the ADB.

217. The EMP document will be incorporated into the work tender documents, and the tender participants will be able to specify their environmental protection duties in their proposals. After the onset of the construction works, the EMP will be part of the agreement between the client and the construction contractor, and it will be necessary to accomplish during the construction works.

B. Institutional Arrangement

218. The Ministry of Energy, Water Resources and Irrigation (MEWRI) will be the Executing Agency (EA), and the Department of Water Resources and Irrigation (DWRI) will be the implementing agency of the project. The Central Project Management Office (CPMO) will be responsible for the overall implementation of the project and ensuring compliance with ADB's environmental safeguards requirements. The two PIUs in Gorkha district will be responsible for field supervision and monitoring for the Madi and Marshyangdi subprojects, whereas the subprojects of Kaligandaki corridors will be looked at by the PIU office at Butwal, which are under the management DWRI of the federal government.

The CPMO will establish a "Central Safeguard Desk" (CSD) and comprise a Safeguard Liaison Officer (SLO) supported by an Environmental Safeguard Specialist (ESS) of PIMS. The SLO will fully comply with the project's environmental and social safeguards requirements. The SLO will work closely with the PIU's environmental and social development focal points. The provincial office shall work under the guidance of CSD and report to their safeguard and safety details. The PIU

Office Chief will be supported by one safeguard field monitor, association organizer, and community mobilizers for safeguard implementation in FMIS.

219. The Chief of the PIU or Engineer designated as site in-charge will act as safeguard focal person (SFP) at PIUs. The SFP will be supported by the Senior/Association Organizers of PIU and social mobilizers deployed at the subproject level. The contractor will appoint a safeguard and safety assurance officer in each contract package, as provisioned in the contract. PIMS provincial social development specialists and environment monitors will provide technical assistance while implementing safeguard-related activities. The safeguard desk at PIU will be responsible for:

(i) Lead the implementation of IPP/RIP/EMP and monitor compliance with project safeguard requirements on a day-to-day basis. Provide timely corrective measures to address any issues.
(ii) Support PIMS social development consultant by providing field-level information to consolidate safeguard monitoring reports.
(iii) Organize or support organizing periodic consultations with beneficiaries/affected persons.
(iv) Form GRM at PIU, support/facilitate beneficiary farmer in registration grievance, if any.
(v) Collect/ maintain project-induced beneficial impacts

220. **Project Implementation and Management Support Consultants (PIMS).** The PIMS-ESS will support SLO in CPMO and DWRI. The ESS will have intermittent inputs of 15 months. The specialist will support the CPMO and field offices in maintaining overall environmental safeguards and OHS requirements in the project. The ESS will prepare an e-MIS and support safeguarding field monitors at field offices in monitoring environmental and OHS activities. The CPMO will mobilize a full-time Environmental Safeguard Monitor (ESM) at the project site. ESM will work under the guidance of ESS of PIMS. The monitor will coordinate with the PIU field team and monitor the safeguard compliance of the contractors in project implantation activities. They will support field offices and the PIU field team in overall safeguards assurance monitoring, undertake corrective actions, and report to the senior environment specialist at CPMO.

221. **Civil Works Contract and Contractor**. The IEE with EMP will form part of the bidding and contract documents and be verified by CPMO. The contractor supporting civil works under DWRI shall include the cost of preparing and implementing site-specific environmental management and the OHS plan (SEMP). The integrated SEMP will be approved by the employer prior to their field mobilization. The contractor will submit the resumes of the proposed senior safeguard officer and senior safety officer at least 15 days before their mobilization at the site. The SEMP shall include (i) the proposed locations and specification of the workers camp and associated facilities; (ii) the operation of the quarry; (iii) transport and storage of construction materials (aggregates, fabricated structural components, fuel, lubricants, paints etc.); (iv) spoil management and waste disposal site; (v) OHS and emergency plan; (vii) budget for SEMP/OHS implementation; and (vi) template of daily safeguards reporting checklist. No work shall commence prior to the approval of the integrated SEMP and resume of the senior safeguard officer and a senior safety officer by the Employer. The contractor will fill daily safeguard assurance checklist and report to the safeguard monitors in the respective field offices.

222. A copy of the approved SEMP will be kept at the site at all times during construction. Non-compliance with, or any deviation from, the conditions set out in the SEMP shall constitute a failure in compliance and will require corrective actions. Prolonged non-compliance upon repeated notices to correct may lead to financial punishment through deducting an agreed percentage of the claim in the interim bills up to termination of the contract if required. Such provision shall be clearly stated in the contract agreement. Any non-compliance with the EMP would be a breach of the contract and trigger penalties associated with the breach in accordance with the terms and conditions of the contract.

C. Environmental Management Plan (EMP)

223. The EMP is necessary on the grounds that it will manage the environment by offsetting the negative impacts with possible mitigation measures and enhancing the positive impacts within the allocated funds from the project. Thus, the main objectives of the EMP are to:

(i) Display a range of measures to mitigate potential impacts to minimal or insignificant levels;
(ii) Identify measures that could optimize beneficial impacts;
(iii) Establish a method of monitoring environmental management practices during all phases of development;
(iv) Ensure project implementation and operational phases are within the principles of ADB SPS 2009 and national environmental policies;
(v) Ensure that the health and safety recommendations are complied with;
(vi) Propose mechanisms for monitoring compliance with the EMP and reporting thereon; and
(vii) Specify time periods within which the measures contemplated in the final environmental management plan must be implemented, where appropriate.

224. The EMP Matrix for the Pre-Construction Phase, Construction Phase and Operation Phase of the FMIS subprojects is presented in Table 28.

Table 32. Environmental Management Plan Matrix Applicable to Hill Lift Irrigation Project

Environmental Components and/or Activities	Environmental Impacts	Mitigation Measures	Institutional Responsibility	
			Implementation	Monitoring/ Supervision
Design Phase				
Consents and Permits Requirements	Failure to obtain necessary consents, permits, and clearances can result in design revisions and/or stoppage of the Works.	• Obtain all the necessary consents and permits from MEWRI and the local government stakeholders before the start of civil works.	Contractor	CPMO, DWRI PIMS
Community awareness of project activities	Lack of community awareness of project activities may result in potential community health and safety concerns and complaints.	• Before the start of project construction, a meaningful consultation with the affected communities will be conducted. • Meaningful consultation will aim to engage community stakeholders, listen to their views, and arrive at a common understanding of how to implement the project.	CPMO PIMS Municipalities Wards Contractor	DWRI
Preparation of construction environmental, site-specific environmental management and OHS plan (SEMP) and environmental monitoring plan (EMoP)	Without SEMP and EMoP would result in unmanaged environmental impacts of construction and operations.	• Conduct a site reconnaissance survey to verify the data provided in the bid document and collect information from community and field conditions. • Preparation of construction SEMP and EMoP based on the bid document, environmental management plan, survey results, and community consultation. • Submit construction SEMP, EMoP, and forms to PIMS and CPMO for approval.	Contractor	CPMO, DWRI PIMS
Groundwater testing	No appropriate information on the groundwater quality of schemes may result in tube well failure	• Perform groundwater quality tests at target areas. • Select sites with acceptable groundwater quality as per the bidding document. • Do not select sites that do not pass groundwater quality standards.	Contractor	CPMO, DWRI PIMS PIU
Construction planning	Inadequate planning could result in the non-implementation of SEMP during the construction phase, which would lead to significant environmental impacts and non-compliance with ADB's environmental safeguard requirements.	• Recruit environment, health and safety officers as per the requirement of the bidding document. • Conduct training on the implementation of the SEMP to enhance general understanding and clarify responsibilities regarding implementation, including monitoring and reporting, must also be provided to all relevant staff of contractors; • No works can commence prior to approval of SEMP.	Contractor	CPMO PIMS PIU
Camp establishment and construction mobilization	Clearing land for camps and construction can lead to soil erosion and landscape alteration.	• Clear land selectively and retain as much native vegetation as possible to maintain habitat and reduce erosion. • Establish proper sanitation facilities and wastewater treatment processes to prevent contamination of local water sources.	Contractor	CPMO PIMS PIU

Environmental Components and/or Activities	Environmental Impacts	Mitigation Measures	Institutional Responsibility	
			Implementation	Monitoring/ Supervision
	The presence of heavy machinery and equipment can increase air and noise pollution.	• Use water sprays to reduce dust emissions. • Implement noise control measures such as sound barriers and restrict noisy activities to certain times of the day. • Provide workers with adequate living conditions, including safe housing, clean water, and sanitary facilities. • Implement the labor camp plan approved by CPMO and/or PIMS		
Construction Phase				
Soil environment	Trench construction and excavation works may lead to erosion and silt runoff. Impact on top fertile soil	• All excavations shall be done to the minimum dimension required for safety and working facility. • Precautionary measures shall be taken, and the proper filling of excavated trenches and the excavated soil with burying of the pipeline will be done properly as per the instructions from the safety superintendents of the contractor and environmental monitor of the PIMS. • Limit the use of heavy equipment and machinery on agricultural land. • Manual labours shall be promoted in the trench works, erection of the electrical poles and road works • Cropping calendar shall be considered while road works, and poles and stringing of conductors shall be erect to avoid loss of standing crops. • The spoil placed at the side of the trenches shall be backfilled shortly after the pipeline is placed in the trench. • Adequate drainage shall be provided to channel the rain-storm water during monsoon in the project component areas • Concrete foundation is recommended for steel tubular pole installation • Creating diversion ditches or retention basins to manage runoff during the rainy season and reduce the risk of flooding and erosion. • Promptly revegetating any disturbed areas to reduce the risk of soil erosion.	Contractor	CPMO PIMS PIU
Soil Quality	The distribution pipeline will be laid by removing soil, which, if poorly managed, can lead to runoff and erosion, causing a loss of productive farmland, water pollution, and sedimentation.	• After the completion of the trench construction, the previously removed topsoil should be used to restore the damaged areas and improve fertility. • The transport and equipment routes must be strictly followed. • Topsoil removal and storage should be done separately from other materials on a pre-selected site protected from surface runoff and covered until backfilling or disposal.	Contractor	CPMO PIMS PIU

Environmental Components and/or Activities	Environmental Impacts	Mitigation Measures	Institutional Responsibility	
			Implementation	Monitoring/ Supervision
		• Digging and backfilling of trenches should be done as quickly as possible. • Temporary water-diversion channels should be provided along the perimeter of the topsoil piles. • In the long-term storage of topsoil, its care should also be planned to protect its fertility. • The fuel tank should be placed in an area protected by berms or earthfills to stop accidental spills as necessary. • Accidental spills should be contained and cleaned up immediately using absorbent materials. • The ground/soil contaminated accidentally during the construction should be cut and removed as soon as possible.		
Air Environment	Use of concrete mixers, earth excavation, site clearance, haphazard stockpiling of construction materials, and waste burning at campsites. Impacts on air quality include a temporary increase in PM levels in the ambient. Exhaust emissions containing carbon monoxide (CO), sulphur dioxide (SO2), oxides of nitrogen (NOx), and particulate matter (PM) are released due to DTW, power supply, and road works.	• Ensure workers working in close proximity to or having long exposure to vehicle exhausts and earthworks are provided with clean N95 dust masks to minimize inhalation of particulate matter and other pollutants. • Vehicles delivering loose and fine materials like sand and aggregates shall be covered. • Dust suppression measures, such as water sprinkling, shall be applied in all dust-prone locations, such as unpaved haulage roads, earthworks, and stockpiles. • Position any stationary emission sources as far as practical from sensitive receptors (houses, schools, clinics, temples, etc.). • Regular checks and maintenance of construction equipment and vehicles to keep them in good working order to meet emission standards. • Enforce strict no-burn policies at temporary campsites and proper disposal protocols for construction waste to avoid open burning. • Develop a traffic management plan to reduce congestion and optimize routes for project vehicles to minimize idle time and associated emissions. • Where possible, use alternative construction materials that produce less dust and opt for electric-powered equipment over diesel-powered to reduce exhaust emissions. • Continuous monitoring of air quality at the construction site and surrounding areas to ensure levels of pollutants are within acceptable standards and to make adjustments to mitigation measures as necessary.	Contractor	CPMO PIMS PIU

Environmental Components and/or Activities	Environmental Impacts	Mitigation Measures	Institutional Responsibility	
			Implementation	Monitoring/ Supervision
		• Educate construction workers on best practices for minimizing air pollution, including proper equipment operation and adherence to waste management procedures. • Keep the local community informed about the construction schedule, potential impacts, and the measures in place to mitigate air quality issues. • Prompt revegetation of cleared areas to stabilize the soil and reduce erosion and dust.		
Noise Environment	Exposure to high noise levels may result in annoyance, fatigue, a temporary shift of the threshold limit of hearing, permanent loss of hearing, and hypertension and high blood pressure from DTW, power supply, and road works.	• Construction workers should be provided with Personal Protective Equipment (PPE), such as earplugs, ear muffs, etc. • Any stationary equipment that produces high noise levels shall be positioned as far as is practical from sensitive receptors. • Construction traffic routes will be defined in cooperation with local communities and traffic police to minimize noise and nuisance. The speed of vehicles and mobile equipment on site will be regulated to reduce noise emissions. • Use modern, quieter machinery and ensure all equipment is well-maintained to reduce noise output. This could include fitting silencers or mufflers on noisy machinery. • Limit the hours of operation for the noisiest equipment to less frequent periods, avoiding early morning, late evening, and night when possible to minimize disturbance. • Position noisy equipment as far away from sensitive receptors as possible, such as residential areas and schools. • Notify local communities before periods of expected high noise levels and establish communication channels for complaints and concerns about noise. • Continuously monitor noise levels to ensure they stay within acceptable limits and review construction practices regularly to identify opportunities for noise reduction. • Train all staff and workers in the best practices for noise control and the importance of adhering to noise mitigation measures.	Contractor	CPMO PIMS PIU
Groundwater Resources	Operations of irrigation facilities may slightly decrease groundwater levels.	• Protection of nearby water sources to maintain water seeping and recharge the aquifer system from both natural and man-made sources. • To ensure that the pumped water is of good quality, water testing is required: one time during drilling time and one time a	Contractor	CPMO PIMS PIU

Environmental Components and/or Activities	Environmental Impacts	Mitigation Measures	Institutional Responsibility	
			Implementation	Monitoring/ Supervision
		year during the operations phase of the period of the Tube wells. • Wastewater release will be managed properly through the construction of separate soak pits and septic tanks in the camp locations, preventing direct discharge to the water body. • As far as practical, earthworks will be limited and short-term, done during the dry season to minimize exposed areas subject to erosion by surface water runoff.		
Water Resources	Wastewater during the construction (release during the construction phase from the labour camp) discharges can pose a significant impact, if discharged directly.	• Establish dedicated fuel, oil, and chemicals stores on an impermeable bunded area to prevent spills and leaks from contaminating soil and affecting water quality. • Strict prohibition on open defecation and urination by construction workers and use of pit latrines or toilets for worker camps. • Wastewater release will be managed properly by constructing a separate soak pit away from the water body. • Earthworks will be done during the dry season, as far as practical, to minimize exposed areas subject to erosion by surface water runoff. • Establish dedicated fuel, oil, and chemicals stores in impermeable bunded area • Implementation of hazardous waste management plan) as approved by CPMO and/or PIMS.	Contractor	CPMO PIMS PIU
Solid Waste Generation in Construction Areas	The remain of construction materials may accumulate on land, and through time may impact local people	• Careful planning, selection of borrow pits, and timing of cut and fill operations. • Reuse spoil and other materials for construction purposes. • Stockpiling sites of construction materials will be designated at demarcated places. • Ensure that the labour camps have proper facilities for waste segregation and even for composting biodegradable waste. • Provide temporary prefabricated mobile toilets in the construction sites. • Separate provision for collection and disposal of hazardous waste, if any, as prescribed by government rules and regulations • Ensure that construction materials are sourced responsibly from quarries that follow environmental management practices and government requirements. • Implement strict inventory management to prevent over-ordering, which can lead to waste, and promote using recycled materials where possible. • Develop a soil management plan to ensure that all excavated soil is utilized	Contractor	CPMO PIMS PIU

Environmental Components and/or Activities	Environmental Impacts	Mitigation Measures	Institutional Responsibility	
			Implementation	Monitoring/ Supervision
		beneficially within the project, such as for bank reinforcement, thus avoiding generating surplus material. • After using the wasteland for muck disposal, engage in land restoration activities to return the land to a usable state, potentially for ecological, agricultural, or community use. • Implement erosion control measures such as silt fences, sedimentation ponds, and temporary vegetation to prevent soil erosion from disturbed areas. • Implement spoil/muck management plan (construction areas) as approved by CPMO and/or PIMS.		
Solid Waste Generation in Labor Campsites	Environmental degradation, polluting local soil and water resources, and creating unsanitary conditions	• Implement on-site waste segregation to enable the reuse, recycling, or appropriate disposal of materials. Separate bins for different types of waste should be provided. • Encourage recycling of materials such as metal, plastic, and concrete. Reuse materials whenever possible to minimize waste and reduce the demand for new materials. • Ensure that all non-recyclable waste is disposed of responsibly, in accordance with local environmental regulations, using licensed waste management services. • Develop and implement a waste reduction plan for the project, which includes guidelines for minimizing waste at the source. • Properly handle hazardous waste such as PCBs and SF6 (if any), oils, lubricants, and paints by storing them in designated areas and disposing them according to hazardous waste disposal guidelines. • Conduct training sessions for workers and subcontractors on waste management practices to ensure compliance with the waste reduction plan. • Perform regular audits of waste generated to identify opportunities for waste reduction and improve management practices. • Monitor the amount and type of waste generated and report it to the relevant authorities as required. This can help in tracking the effectiveness of waste management strategies. • Implement a solid waste management plan (labor camp) as approved by CPMO and/or PIMS.	Contractor	CPMO PIMS PIU
Flora and Fauna	Pressure on forest resources	• Ensure that trees are not cut during construction. If unavoidable, the project should obtain prior permission from the concerned authority before cutting any	Contractor	CPMO PIMS PIU

Environmental Components and/or Activities	Environmental Impacts	Mitigation Measures	Institutional Responsibility	
			Implementation	Monitoring/ Supervision
	Disturbance on wild animals in the agricultural land	tree. • The excavated topsoil will be placed in its original position after the completion of excavation works to bury distribution pipes. • Ensure the construction labour camp uses clean energy sources (e.g., LPG gas for cooking). • Labourers and staff shall be made aware of the need to avoid illegal activities in any adjoining forest. • Conduct thorough surveys to identify wildlife species that may be affected by project activities. This should include assessing nesting sites, breeding grounds, and migratory paths. • Where possible, modify the design scheme to avoid habitats, such as breeding and nesting areas. Implement buffer zones around these sensitive areas to minimize disturbance. • Enforce speed limits and post signage in areas where construction traffic intersects with animal movement patterns to reduce the risk of vehicle-wildlife collisions. • Properly manage and dispose of construction waste to prevent pollution and deter wildlife from entering the site. Secure waste containers and chemical storage to prevent accidental ingestion or contamination. • Awareness programs regarding policy related to the conservation of existing flora & fauna to the workers prior to the construction and the community during various meetings and discussion programs. • Regularly monitor construction sites to ensure compliance with environmental guidelines and take corrective action when necessary. • Implement biodiversity action plan in Pyakluk, Tilakpur, and Alketar due to being within an IBA. Additional measures are indicated in Appendix 5.		
Socio-Economic Environment	Loss of crops during excavation and laying of distribution pipelines	• Communicate with the local farmers, wards, and municipal personnel to start the work promptly, less impacting the growing crops in the command area. • Enough drain outlets must be prepared, and the released water must be managed while installing the tube wells. • Manage stockpile timely during the excavation work of the distribution canals • Compensation will be provided to the farmers whose crops will be lost due to construction activities.	Contractor, Municipalities and Ward Members, Farmers	CPMO PIMS PIU

Environmental Components and/or Activities	Environmental Impacts	Mitigation Measures	Institutional Responsibility	
			Implementation	Monitoring/ Supervision
		• Once construction is completed, implement land restoration measures to return the farmland to its original or better condition for agricultural use. • Designing temporary access roads to minimize the amount of farmland affected and using methods that prevent long-term damage to the soil structure. • Engaging with the farming community to ensure their concerns are addressed and their cooperation is gained.		
Power line installations	Disrupt local ecosystems, affecting wildlife habitats and land cover due to electrification works.	• Transmission lines will be strategically placed to minimize any potential impact on tree stands. • Electric poles will be strategically located to utilize the natural topography, ensuring ample vertical clearance over the land, thus reducing the necessity of tree removal. • To safeguard the local wildlife populations, it is imperative for Contractors to diligently enforce a strict "no hunting provision" among their workers. • Maximize the utilization of the excavated earth and rock to strengthen the foundation of electric poles. The spoils from the foundation excavations will be carefully managed by placing them in landform depressions. • The temporary access roads and paths will be restored by removing the side-casted spoils material and reshaping the cross-slope. • Local infrastructure departments will be notified of the timing and location of power line construction that may impact their respective infrastructure facilities. • To enable road margins to be used safely as temporary materials staging areas, pullouts or temporary staging areas will be identified where construction materials can be deposited without spilling out onto the roadway and without disrupting the traffic flow. • Electric pole foundations that must be located close to roads will be constructed to ensure foundations do not create hazards to motorists.	Contractor	CPMO PIMS PIU
Occupational Health and Safety	Construction activities could create health and safety risks to construction workers.	• Provision of a first aid facility at the site. • Always ensure good housekeeping on the premises, including on construction sites, workers' camps, storage areas, etc. • Provision of contingency planning, safe drinking water/sanitation, and a latrine facility will help maintain the health and hygiene of the workers on the site.	Contractor	CPMO PIMS PIU

Environmental Components and/or Activities	Environmental Impacts	Mitigation Measures	Institutional Responsibility	
			Implementation	Monitoring/ Supervision
		• The Contractor will be responsible for the safe removal and/or storage of all waste to prevent environmental pollution of any type that may be harmful to people or animals. • A site and safety plan will be prepared, encouraging the use of safety measures and PPE. Dustbins will be provided on the work site to collect waste. The camp will be well managed, with adequate space, light, ventilation, drinking water, and toilet facilities. • Implement COVID-19 and other disease management plans as approved by CPMO and /or PIMS. • The prevention measures for COVID-19 include having the worker take the appropriate test (PCR) before involvement is done. • Provide on-site medical facilities and trained healthcare providers to manage health issues promptly. • Enforce strict health and safety regulations on-site, including properly using machinery and tools. • Develop and implement an emergency response plan for handling accidents and outbreaks of diseases. • Implement vector control measures such as proper drainage to prevent waterlogging and use mosquito nets and repellents to reduce the risk of vector-borne diseases. • Appropriate PPE (OSHA-recommended PPE), including masks, gloves, and the use of sanitizer with proper hygiene measures, will be compelled within the work and camp area. • Record of incidents /accidents / near-miss/ fatalities associated with the project will be maintained • Records of issues raised will be maintained in accordance with the project GRM • Conduct regular safety training sessions for workers on handling machinery and properly using safety equipment. • Provide barricade fencing to mitigate trespassing • Provide a barricade to temporarily enclose open excavated trenches/slopes. • Implementation of (i) health and safety management plan and (ii) community health and safety plan as approved by CPMO and/or PIMS.		
Community health and safety	Accidents due to vehicle and machine operations	• Implement a comprehensive traffic management plan that coordinates construction schedules with peak traffic hours to minimize congestion. This should include the designation of alternative	Contractor	CPMO PIMS PIU

Environmental Components and/or Activities	Environmental Impacts	Mitigation Measures	Institutional Responsibility	
			Implementation	Monitoring/ Supervision
		routes for construction traffic and clear signage to direct vehicles efficiently. • Install appropriate signage in areas affected by construction activities. These signs should warn of upcoming construction, altered traffic patterns, and the presence of heavy vehicles. They can also direct pedestrians to safe crossing points. • Enforce strict speed limits in construction zones, using speed bumps or digital speed display signs to ensure drivers adhere to the limits. Flagged persons can also be beneficial for managing traffic flow, particularly during peak hours or when children are traveling to and from school. • Establish and maintain safe pedestrian crossing points equipped with crossing guards during busy times to assist school children and the elderly. Where possible, constructing temporary pedestrian bridges or tunnels may be beneficial. • Launch awareness campaigns to inform residents about the construction schedule, potential hazards, and safety measures in place. Providing this information helps the community adjust their routines and travel paths to avoid construction areas. • Regularly monitor traffic conditions and enforce safety measures through patrols or surveillance cameras to ensure compliance with traffic rules and construction safety protocols. • Develop a clear emergency response plan for traffic-related incidents, ensuring that all construction personnel are trained in first aid and that procedures are in place for rapid emergency services access to the construction site.		
Cultural and religious aspects	inadvertent disruptions to sites of worship or culturally significant landscapes	• Identify cultural and religious sites within the project area. This should involve consulting with local community leaders to understand their significance. • Engage with local communities, particularly religious and cultural leaders, to understand their values and concerns. These consultations should be ongoing throughout the project to ensure continuous incorporation of community feedback. • Provide cultural sensitivity training for project staff and workers to foster respect for local traditions and practices. Understanding the cultural context can minimize inadvertent disrespect or harm to cultural practices.	Contractor	CPMO PIMS PIU

Environmental Components and/or Activities	Environmental Impacts	Mitigation Measures	Institutional Responsibility	
			Implementation	Monitoring/ Supervision
		• Rerouting of construction vehicles, creating access paths during construction or even adjusting project timelines to accommodate important cultural events. • Document cultural sites and practices with the community's help to create records that can serve educational purposes and promote cultural understanding. Sharing this documentation can help foster pride in the local heritage and facilitate its preservation.		
Operational Phase				
Routine Operations	Operations of the facility will impact the environment and the health and safety of workers and the local community.	• Train workers and staff in safe and efficient operation and SOPs • Ensure that all safety equipment and personnel protection equipment are provided and are used properly and are in working conditions • Provide training on safe machinery operation and emergency response. • Ensure proper maintenance of facilities and amenities like drinking water and sanitation • Ensure that qualified/trained supervision is available at all times in the Tube wells pump locations and • Provide necessary first aid, and ensure on-call service with local hospitals • Implement a water-saving management plan, and monitor groundwater levels to prevent over-extraction • Use containment procedures and proper storage of lubricants and fuels to prevent contamination • Install noise dampeners and schedule maintenance during less sensitive times • Regularly test local water sources for contaminants to ensure community health • Keep the community informed and involved in environmental monitoring efforts.	PIU	CPM PIU
Public hazard	Accidental electrocution and harm due to power supply	• Regularly trimming trees and removing debris around power lines to prevent contact. • Installing insulated sleeves on wires to prevent conductive contact. • Conducting awareness campaigns on the dangers of power lines and the importance of maintaining a safe distance. • Clear warning signs should be installed near power lines to alert the public to potential hazards. • Properly ground all electrical systems to dissipate electricity safely in the event of a fault. • Ensuring all power lines and associated infrastructure comply with national and international safety standards.	PIU	CPMO PIMS

Environmental Components and/or Activities	Environmental Impacts	Mitigation Measures	Institutional Responsibility	
			Implementation	Monitoring/ Supervision
		• Developing and disseminating clear protocols for responding to electrical accidents to minimize harm when incidents occur.		
Irrigation operations	Increase of water-borne disease due to stagnant water	• Careful water storage and distribution management to prevent stagnation, which is conducive to disease vectors. • Design and construction of drainage canals can include features that deter the accumulation of stagnant water. For instance, ensuring proper slope and flow can prevent the creation of stagnant pools. • Informing and working with local communities can lead to better maintenance of the irrigation infrastructure and reduce the incidence of water-borne diseases. Communities can be educated on the risks and prevention methods for water-borne diseases. • Employing integrated pest management or IPM can reduce the reliance on chemical pesticides, which can contaminate water sources, opting instead for more sustainable pest control methods.	PIU	CPMO PI

D. Environmental Monitoring Program

225. Monitoring of mitigation measures during construction is the responsibility of the CPMO, which the PIMS Environmental Safeguard Specialist and the Environmental monitor support. The Contractor will be responsible for monitoring the activities, i.e., monitoring the environmental parameters. The Contractor shall submit monthly reports to the Employer's Representative on the carrying out of SEMP and compliance with government rules. The contractor will prepare and accomplish the environmental monitoring reports and submit them to the Employer's Representative. Such reports shall be monitored by the Environment Officer of the Employer's Representative. The table below shows the proposed Environmental Monitoring Program for the HLIP, which specifies the various monitoring activities, indicating location, frequency of monitoring and responsibility.

Table 33. Environmental Monitoring Program

Activities or Items to Monitor	Location	Responsible for Activities	Monitoring Method	Monitoring Frequency	Monitoring Responsibility
PRE-CONSTRUCTION					
IEEs and EMPs are included in bid and contract documents	CPMO office	CPMO, PIMS	Copies of bid and contract documents	Before approval tender document	CPMO, PIMS
Construction SEMP and other relevant sub plans submitted by the Contractor for approval by CPMO	CPMO office	Contractor	Copy of approved SEMP	Before construction activities commence	CPMO, PIMS
Secure all other necessary permits and licenses from relevant government agencies.		CPMO, Contractor	Copies of permits and licenses	Before construction activities commence	CPMO, PIMS
Conduct baseline ambient air quality and noise level monitoring	Project site	Contractor	Site visits and observations, Contractor records, Results of Air Quality Sampling and Noise Level measurements.	Before construction activities commence	CPMO, PIMS
Conduct baseline groundwater quality monitoring	Project site	Contractor	Site visits and observations, Contractor records, Results of laboratory analyses	Before construction activities commence	CPMO, PIMS
CONSTRUCTION					
Implementation of SEMP, including implementation of community and occupational health and safety measures.	Project site	Contractor	Site visits, Contractor records,	Weekly or as needed	CPMO, PIMS, PIU
Implementation of SMP	Project site	Contractor	Site visits, Contractor records,	Weekly or as needed	CPMO, PIMS, PIU
Ambient air quality monitoring	Project site	Contractor	Site visits and observations, Contractor records, Results of laboratory	Once before start of construction and biannual (yearly 2-times) during	CPMO, PIMS, PIU

Activities or Items to Monitor	Location	Responsible for Activities	Monitoring Method	Monitoring Frequency	Monitoring Responsibility
			analyses,	construction for 18 months period	
Ambient noise level monitoring	Project site	Contractor	Results of noise level measurements- Daytime and nighttime noise levels	Once before start of construction and biannual (yearly 2-times) during construction for 18 months period Total 3 times in all 12 subprojects	CPMO, PIMS, PIU
Conduct of Tube wells water quality monitoring	Project site	Contractor	Site visits and observations, Contractor records, Results of laboratory analyses	Once during the Installation time of all Tube wells Once a year during the operation phase in all subprojects 2 times Total 3 times in all 12 subprojects	CPMO, PIMS, PIU
Soil Quality	HLIP irrigated farmland	Contractor	Site visits and observations, Contractor records, Results of laboratory analyses	1 Samples Prior Operation of Tube wells in each subproject 2 Samples once a year during the Operation period Total 3 times in all 12 subprojects	CPMO, PIMS, PIU
Provide EHS training for all personnel.	Project site	Contractor	Contractor records; Interviews with workers	Monthly	CPMO, PIMS, PIU
Keep accident reports and records.	Project site	Contractor	Contractor records; Interviews with workers and community people	Monthly	CPMO, PIMS, PIU
Employ workforce from communities near sites.	Project site	Contractor	Contractor records	Monthly	CPMO, PIMS, PIU
Implementation of EHS measures at construction camps	Construction campsite	Contractor	Site visits; Interviews with workers at camp	Monthly	CPMO, PIMS, PIU

226. The Contractor needs to perform the Environmental Monitoring plan, i.e. sampling and analysis of the parameters as shown in **Table 13**. During the construction and operation period, environmental standards need to be followed: National Ambient Air Quality Standards, 2003; National Water Quality Guidelines for Irrigation Water, 2008; and WHO standards.

E. Capacity Development Training

227. The PIMS Consultant Environmental Safeguard Specialist will train the CPMO and contractor. Training modules will need to cover safeguards awareness and management in accordance with both ADB and government requirements as specified below.

(i) sensitization on ADB's safeguard policy on the environment;

(ii) introduction to environment and environmental considerations in urban infrastructures;

(iii) review of IEEs and integration into the project's detailed design;

(iv) improved coordination within nodal departments; and

(v) monitoring and reporting system. The contractors will be required to conduct environmental awareness and orientation of workers prior to deployment to work sites.

228. **Methodology.** Capacity-building activities will be achieved through the available practical methodologies, such as expert lecture and workshop training, on-the-job training and mentoring, and continuing team meetings and exercises. The PIMS Consultant Environmental Safeguard Specialist will spearhead the designing of specific programs appropriate for the target participants or stakeholders, including executing these programs during the different implementation phases of the HLIP. Pre-training and post-training assessment will be an integral part of the overall program to measure its effectiveness and identify any other interventions needed to improve effectiveness, if necessary.

229. As a fundamental component of the capacity building program, basic lectures and seminar training sessions will be provided by the PIMS Environmental Safeguard Specialist to strengthen the awareness of project stakeholders on the requirements of ADB SPS and government environmental laws, rules and regulations. Modules will be prepared and customized based on the skill set and needs of the different stakeholders. The entire training will cover basic principles of environmental assessment and management mitigation plans and programs, implementation techniques, monitoring methods and tools. A proposed lecture and seminar training program, along with the frequency of sessions, is presented in the following table.

Table 34. Sample Lecture and Seminar Training Program for Environmental Management

Items	Pre-construction	Construction	
Training Title	Orientation workshop	Orientation program/ workshop for contractors and supervisory staff	Experiences and best practices sharing
Purpose	To make the participants aware of the environmental safeguard requirements of ADB and the Government of Nepal and how the project will meet these requirements	To build the capacity of the staff for effective implementation of the designed EMPs aimed at meeting the environmental safeguard compliance of ADB and the Government of Nepal	Improving the implementation of EMP
Contents	Module 1: Orientation ADB Safeguards Policy Statement Government of Nepal Environmental Laws and Regulations Module 2: Environmental Assessment Process ADB environmental process, identification of impacts and mitigation measures, formulation of an environmental management plan (EMP), implementation, and monitoring requirements Review of environmental assessment report to comply with ADB requirements Incorporation of EMP into the	Roles and responsibilities of officials/contractors/consultants towards the protection of the environment Environmental issues during construction Implementation of EMP Monitoring of EMP implementation Reporting requirements	Experiences on EMP implementation - issues and challenges

Items	Pre-construction	Construction	
	project design and contracts		
Duration	1day	1day	Best practices followed
Participants	CPMO and Municipalities staff (technical and environmental) involved in the project implementation	CPMO, Contractors	Experiences and best practices sharing

F. Environmental Management and Monitoring Plan Implementation Cost (Indicative)

230. Most environmental mitigation and enhancement measures are integrated into the design, and costs are included as part of the civil works contract. Some items need to be incorporated in the Bill of Quantities (BOQ) of this project component, including the environmental monitoring costs. The environmental costs presented in the table below are tentative provisions based on experience of undertaking similar works under different DWRI projects. Individual contract package bid documents may be consulted for the details of environmental costs under civil works contracts. The contractor will bear the direct costs of all mitigation measures during construction, which will be included in the tender and contract documents; this includes features built into facility designs to prevent environmental impacts from arising.

Environmental Monitoring and Reporting

231. CPMO will monitor the overall progress of EMP implementation of the HLIP. The CPMO, PIMS and Contractor safeguard team will undertake their respective roles in site inspections and document review to verify compliance with the EMP and SEMP and progress toward the final outcome. The Contractor will conduct day-to-day implementation of the SEMP and/or its updated version due to revalidation of data based on the site visit and discussions with the Community prior to work, and SEMP may be updated by the Contractor with guidance from the Employer's Representative and PIMS Environmental Safeguard Specialist.

232. The Contractor will submit monthly reports to the PIMS. The monthly reports will include a compilation of copies of monitoring sheets accomplished and duly signed by the contractor's Environmental Safeguard /Occupational Health and Safety Officers daily and weekly. This monitoring sheet is indicative and can be further enhanced depending on the actual situation at project construction sites.

233. The PIMS will submit quarterly environmental monitoring reports to CPMO, including a summary of the contractor's monthly monitoring activities and results of any independent monitoring or inspection activities of the project. In conducting these independent inspection activities, CPMO will be supported by a PIMS consultant. This checklist is indicative and can be further enhanced depending on the actual situation at the project component construction site.

234. CPMO, with support from the PIMS, shall accomplish semi-annual environmental monitoring reports (EMRs) starting from the effectivity date up to the end of the construction phase, which shall be submitted to ADB for review and disclosure on the ADB website. The PIMS shall prepare and submit an annual environmental monitoring report during the operation phase until ADB issues a project completion report. Submission of these reports to ADB will be within thirty (30) days from the end date of the reporting period.

Table 35. Indicative Environmental Management Plan Budget for Bill of Quantities (BOQ)

S. N.	Particulars	Stages	Unit	Total Number	Rate (NPR)	Cost (NPR)	Costs Covered By
A.	**Mitigation Measures**						
1	Obtaining and submitting copies (to PMU) of all consents, permits, clearances, no objection clearances or NOCs, and other relevant permits from various authorities/stakeholders before the start of construction	Pre-Construction & Construction	Lump sum	12 subprojects	100,000	1,200,000	Civil works contract
2	Insurance Cover for the following: (a) Workmen's Compensation and (b) Damages to Third Party	Pre-Construction & Construction	Lump sum	12 subprojects			Part of works contract
3	Provision of all requisite facilities (i.e., accommodation, drinking water supply, sanitation facilities, soak pits, domestic solid waste collection & disposal, fuel supply etc.) at construction camps.	Construction & Operation	Lump sum	12 subprojects	500,000	6,000,000	Civil works contract
4	Personal Protective Equipment (PPE) is to the complete satisfaction of the engineer-in-charge (at HLIP construction sites) and barricade with green nets at construction sites.	Construction & Operation	Lump sum	12 subprojects	300,000	3,600,000	Civil works contract
5	Water sprinkling for dust suppression in the access road to the construction sites and truck covers for transporting construction materials	Construction	Lump sum	12 subprojects	500,000	6,000,000	Civil works contract
6	Establish and maintain a first aid box and fire extinguisher at the campsite to the entire satisfaction of the engineer-in-charge.	Construction	Lump sum	12 subprojects	300,000	3,600,000	Civil works contract
7	Separate male-female toilet facilities for camp and worksite to the entire satisfaction of the engineer-in-charge	Construction	Lump sum	12 subprojects	300,000	3,600,000	Civil works contract
8	Implementation of additional occupational health and safety measures related to the prevention of COVID-19/other pandemic preparation	Construction	Lump sum	12 subprojects	300,000	3,600,000	Civil works contract
9	Establish a temporary shelter for the workers to rest and eat their lunch. Keep drinking water, first aid and safety gear at the resting place (local shade).	Construction	Lump sum	12 subprojects	200,000	2,400,000	Civil works contract
10	Installing clear warning signs at the construction sites to alert the public to the potential risks	Construction & Operation	Lump Sum	12 subprojects	100,000	1,200,000	Civil works contract
11	Conduct consultations with affected people and communities	Construction & Operation	Lump Sum	12 subprojects	100,000	1,200,000	Civil works contract
12	Implementation of grievance redress mechanism	Construction & Operation	Lump Sum	12 subprojects	100,000	1,200,000	Civil works contract
13	Implementation of sub plans - Traffic management plan	Construction & Operation	Lump Sum		500,000	6,000,000	Civil works contract

S. N.	Particulars	Stages	Unit	Total Number	Rate (NPR)	Cost (NPR)	Costs Covered By
	- Community Health and Safety plan (e.g. IFC Health and Safety Guidelines) - Emergency response plan - Water-saving management plan - Spoil management plan (construction areas) - Hazardous waste management plan - Biodiversity Action Plan			12 subprojects			
Subtotal (A)						**39,600,000**	
B.	**Monitoring Activities (with Monitoring Parameters) during pre-construction and construction in 12 Subprojects**						
1	Air quality monitoring (PM_{10}, $PM_{2.5}$, NO_2, SO_2, CO)	Pre-Construction & Construction	Per sample	36	15,000	540,000	Civil works contract
2	Ambient Noise monitoring (Day time and nighttime noise levels)	Pre-Construction & Construction	Per sample	36	5,000	180,000	Civil works contract
3	Groundwater quality monitoring (Tube well) Water constituents test - pH, Suspended Solids, Electrical conductivity, Total Alkalinity (mg/l), Arsenic (As), Sodium (meqL-1), Chloride (meqL-1), Boron (meqL-1)	Pre-Construction & Construction	Per sample	36	15,000	540,000	Civil works contract
4	Soil quality monitoring (Soil constituents test- pH, Salinity, Electrical conductivity, Organic Carbon (%), Nitrogen (kg/ha), Phosphorus (kg/ha), Potassium (kg/ha)	Pre-Construction & Construction	Per sample	36	15,000	540,000	Civil works contract
5	Environment Health and Safety Officer	Construction	Per Month (10PM)	12	65,000	7, 800,000	Civil works contract
Subtotal (B)						**1,800,000**	
C.	**Capacity Building for Workers and Community Level**						
1	Training on EMP implementation, health & safety inductions to workers, and awareness & empowerment programs to the community in the project area Municipality and Rural Municipality	Pre-construction & Construction	Lump sum	12	200,000	2,400,000	Civil works contract
Subtotal (C)						**2,400,000**	
Total (A+B+C)						**43,800,000**	
Miscellaneous, provisional sum and contingency @ 5% of the subtotal						**2,190,000**	
					Grand Total	**45,990,000**	**USD 344,546**

Remarks - 12 HLIP subproject have been considered-addition/ reduction of the subprojects will vary the total EMP cost

VII. INFORMATION DISCLOSURE, CONSULTATION AND PARTICIPATION

A. Consultation and Participation

235. Meaningful consultation is an essential part of the environmental assessment process, which enables the incorporation of all relevant views of affected people and other stakeholders into decision-making, such as project design, mitigation measures, the sharing of development benefits and opportunities, and implementation issues. The process also helps avoid potential conflicts with stakeholders for smooth project implementation. The findings from the public consultations are documented and considered in the development of the EMP, especially in identifying the significant impacts of the proposed project components and developing the corresponding mitigation measures. The key stakeholders consulted were:

(i) Project beneficiaries' farmers and Water Users Association members;
(ii) Elected representatives, community leaders and representatives of community-based organizations;
(iii) Local government and relevant government agency representatives and other relevant government departments;

B. Public Consultation Conducted

236. Consultations were undertaken in the proposed HLIP project area districts, Municipalities/Rural Municipalities, beneficiaries' farmers and the stakeholders in line with the social and environmental considerations requirements. Prior to consultation meetings with local stakeholders, advance notification was circulated, and coordination was established with stakeholders through the project office. Additionally, the consultations were focused on seeking stakeholders' opinions, especially the local government's views on potential environmental and socio-economic impacts and key risks, including mitigation measures and many more.

Table 36. Hill Lift Irrigation Project - Summary of Public Consultations

S. N	Date and Place	Persons Consulted	Number of Participants			
			Male	Female	Total	Janjati (IP)
1	15 February 2024 Rampur Municipality	Mayor /deputy mayor and other elected representatives	11	3	14	3
2	15 February 2024 Tilakpur & Pyakluk hill lift scheme Ward -6, Pyakluk	Ward members and beneficiaries of the proposed system	5	2	7	2
3	15 February 2024 Akletar Irrigation system Ward -8 Ramtar	Ward members and beneficiaries of the proposed system	22	7	29	6
4	16 February 2024 Majhigaun Lift system Ward -1 Rambha RM, Hungi	Ward members and beneficiaries of the proposed system	8	3	11	0
5	16 February 2024 Ramtar-Kumal Gaun 2and Siko Danda schemes Ward -8 Rampur	Ward members and beneficiaries of the proposed system	29	2	31	9
6	17 February 2024 Sirsaghat scheme Ward -4 Madhya Nepal Municipality	WUA representatives, beneficiaries of the proposed system	26	18	54	24

S. N	Date and Place	Persons Consulted	Number of Participants			
			Male	Female	Total	Janjati (IP)
7	17 February 2024 Baireni & Dumsi scheme Byas Municipality - 10	WUA representatives, beneficiaries of the proposed system	7	0	7	0
Total			**108**	**35**	**153**	**44**

Source: Focus group discussion, February 2024

C. Key Point Discussed in Consultation and Public Hearing

237. The key discussions and the assessment information shared with the different stakeholders during the consultations are as follows:

(i) Rampur Municipality, Tilakpur and Pyakluk schemes: Rampur Municipality Ward no-6

- ADB safeguard requirements on land acquisition, involuntary resettlement, GRM procedures, etc., were shared with Municipal authorities and beneficiaries of proposed hill lift systems.
- The mayor of Rampur municipality suggested organizing a series of discussions/consultations to assess the system's acceptability. The municipal authority advises confirming whether the farmers will be ready to accept the system's higher O&M cost when they have access to surface irrigation.
- Two proposed hill lift schemes lie in the existing command area of the Rampurphant irrigation system. In addition to this, four small FMIS are also operational in the same area. The project needs to revisit the scope of both Hill lift schemes.
- A small portion of the proposed area (Kumal gain of Tilakpur system) seems not to have access to water from the Rampur plant. Hence, a small system designed for about 5 ha could be enough instead of the entire system.
- The land proposed for the reservoir of Tilakpur is public land, managed by the Talpokhara Conservation Committee (a committee formed to manage the natural pond redeveloped for recreational purposes). To use the land for the reservoir, consent or agreement with the conservation committee and Rampur Municipality is required.
- Similarly, the proposed location of the reservoir of Pyakluk schemes lies on public land. During the field visit, the land was barren and unusable. The project has to initiate the process to obtain the right to use public land.
- The local people also requested a connection to recharge the Talpokhara pond. This may require to be negotiated with the committee as they will have to provide the land. The water requirement may need to be recalculated in this context to address the community demand.
- In the proposed area of both systems, more than 75% of the land was covered by winter crops. Hence, distribution pipeline laying work may be required to compensate for the standing crops.
- Obtained environmental information in relation to the project footprint area and highlighted the possible impacts, such as dust and noise during the construction period, and measures to be taken by the contractor.

(ii) Akletar hill lift system, Rampur Municipality - 8

- The construction of a reservoir is proposed on Public Land. The land is not being used for any purpose; hence, no IR and IP issues were envisioned. However, the project must initiate the process to obtain the right to use the public land.
- In the proposed area of the Ekletar hill scheme, there is a defunct hill lift scheme developed by the provincial government. Pipelines for lifting water to the reservoir and distribution

network were already installed; however, due to technical issues in the tubewell, the system is nonfunctional.

- As informed during the consultation, the government has allocated some resources to repair and maintain the defunct system. The operation of the system after repair and maintenance will reduce the proposed command area, which will require revising the entire scope of the scheme.
- Around 30 percent of the proposed area was found to have winter crops. This may require assessing the real-time data of standing crops before initiating the pipeline laying work.
- Obtained environmental information in relation to the project footprint area and highlighted the possible impacts, such as dust and noise during the construction period, and measures to be taken by the contractor.

(iii) Ramtar-Kumalgaun & Siko Danda

- The command area proposed under Ramtar-Kumalgaun is being served by an old Farmer-Managed Irrigation System, “Helkung Fanth Sinchai Aayojana.” The farmers were reluctant to accept the proposed hill lift irrigation.
- A lift scheme, “Chahare Lift Irrigation Project,” was developed but was not functional due to a water pumping issue. The farmer did not follow up with the concerned agency to repair and fix the pumping issues mainly because the O&M cost of the lift irrigation was considered too high. This indicates the need for an in-depth assessment of the farmer’s willingness to pay for O&M costs.
- During the consultation, the farmer and ward representatives enquired about their share of the contribution to system development and the likely O&M cost. The project needs to analyze the cost (beneficiary’s contribution to system development and O&M cost) and the mode of system development and inform during the immediate next consultation.
- The proposed Siko Danda Hill lift Irrigation system is well accepted by the farmer as there is no other source of irrigation.
- For the Siko Danda scheme, the proposed reservoir location lies on Mr. Ramchandra Chapagain's private land. It was reported that the owner of the proposed land was ready for a voluntary donation, although the team could not meet him during the field visit. A consent letter may need to be obtained from the owner with third-party certification.
- The consultant’s team observed that around 10 percent of the command area was covered with winter crops using the water from small streams available near the field. Hence, an assessment of the real-time data of standing crops will be required before initiating the pipeline laying work.
- Obtained environmental information in relation to the project footprint area and highlighted the possible impacts, such as dust and noise during the construction period, and measures to be taken by the contractor.

(iv) Ramgha-1, Kumalgaun Hill lift, Rambha Rural Municipality - 1

- The proposed location for reservoir construction is on public land. Hence, the project needs to initiate the process to obtain the right to use public land. The proposed land is free of encumbrances, having no formal or informal use or occupation. The local government was found supportive of providing the land essential for reservoir construction.
- The municipal team showed one defunct lift irrigation system designed and constructed for 35 ha. (same area proposed under IMEP). The local people were requested to explore the possibilities of utilizing the distribution network, overhead tank, and all structures that have developed and are existing.
- If the local request discussed above is accepted, the scope of the project will be limited to constructing the tubewell in the river and expansion of pipelines.

- Obtained environmental information in relation to the project footprint area and highlighted the possible impacts, such as dust and noise during the construction period, and measures to be taken by the contractor.

(v) Sishaghat and Duipiple Scheme: Madhya Nepal Municipality - 4

- The proposed location of reservoirs in both systems is in national forests managed by communities. The proposed locations are free of encumbrances and have no formal or informal use or occupation; hence, no IR and IP impacts are envisioned. However, the project needs to be initiated to obtain the right to use the forest land following the process detailed in Forest Regulation 2022.
- The major portion of the command area (above 60%) of multiple schemes lies in the command area of the "Ramghatar Irrigation project." Hence, the design of the system may need to be revised to limit its use within the area with no current irrigation facilities.
- Obtained environmental information in relation to the project footprint area and highlighted the possible impacts, such as dust and noise during the construction period, and measures to be taken by the contractor.

(vi) Bays Kalesti, Dumsi and Bairaini schemes: Byas

- The proposed reservoir in Kalesti is located in forest land. Similarly, out of the two reservoirs proposed in Baireni, one lies in a national forest managed by communities and one on public land. The proposed locations are free of any kind of use; however, in both cases, the right to use the land has to be obtained from the concerned government authorities.
- The reservoir in Dumse is proposed on public land, not being utilized for any purposes. The proposed land is free of encumbrances and has no formal or informal use or occupation. Hence, no IR or IP issues are assessed.
- In Dumse, the "Parewa Raha Dumsi Darai Gaun Lift Irrigation system" for 25 ha has already been developed. However, a review of the command area to identify the remaining irrigation requirements needs to be assessed, which will change the size of the reservoir and other components.
- A farmer's share of contribution with likely O&M cost has to be analyzed and discussed with the farmer prior to detailed design. This will be the key factor in whether the farmer will accept the system or not.
- Obtained environmental information in relation to the project footprint area and highlighted the possible impacts, such as dust and noise during the construction period, and measures to be taken by the contractor.

B. Future Consultations during Detailed Design Stage

238. Stakeholder consultations will continue during the project implementation. DWRI, CPMO, and PIUs will ensure that consultations are conducted in a meaningful manner per the definition of ADB SPS 2009. The summary of IEE will be locally disclosed in an accessible place and in a form and language(s) that are understandable to affected people and other stakeholders before consultations to allow stakeholders to read it and consult experts.

C. Information Disclosure

239.

240. Information shall be disclosed through public consultation, and relevant documents shall be made available in public locations. The CPMO will submit the following documents to ADB for review and disclosure on its website. ADB will disclose upon receipt of acceptable reports and endorsement from the CPMO:

(i) IEE report (including subproject EMP);
(ii) Updated IEE (including EMP); and
(iii) Semi-annual environmental monitoring reports and corrective action plans prepared during project implementation, if any.

241. The EA/IA will send a written endorsement to ADB for disclosing these documents on the ADB website. The PIUs will provide relevant safeguard information in a timely manner, in an accessible place and in a form and language understandable to affected people and other stakeholders. For illiterate people, other suitable communication methods will be used. For the benefit of the community, the summary of the IEE will be translated into Nepali and made available at (i) the office of CPMO and (ii) the offices of the contractors. Hard copies of the IEE report will also be available at the CPMO and accessible to citizens as a means of disclosing the document and, at the same time, creating wider public awareness. On-demand, the person seeking information can obtain a hard copy of the complete IEE document at the cost of a photocopy from the Project Office on a written request and payment for the same. The electronic version of the IEE will be placed on the official website of DWRI after the government approves the documents and clearance from ADB. Disclosure will follow ADB's Access to Information Policy, 2018.

Figure 44. Public Consultation in the Proposed HLIP Area

Meeting with Mayor and Municipal Team- Rampur Municipality

Consultation in Ward -6 Rampur Municipality – Palpa

Consultation with Beneficiaries of Akletar system- Rampur -8 Palpa

Observation of poposed reservoir location Rambha Rural Municipality – 8 Palpa

Discussion with Ward Chairperson about Changlitar hill lift subproject, Palungtar-7, Gorkha

	
Consultation with the benefacaries of Ramtar and Siko danda schemes – Rampur-8 Palpa	Consultation with the benefacaries of Sirshaghat schemes – Madhyanepal- Lamjung
	
Discussion with the benefacaries of Kalesthi scheme Byas – 7 Tanahun	Discussion with WUA member of Bairaini scheme, Byas 10 Tanahun

VII. GRIEVANCE REDRESS MECHANISM (GRM)

A. Common Grievance Redress Mechanism

242. A common GRM will be in place to redress environmental and social safeguard concerns about the project. Grievance is defined as any issues/concerns resulting in the non-performance of obligations of any parties involved in project processes, particularly in safeguards implementation. The GRM described below has been developed in consultation with the stakeholders and will apply to all subprojects implemented by DWRI and CAMO under the IMEP. The GRM is anchored on the five principles, underpinning the grievance redress processes and the arrangements envisaged to implement these:

(i) **Transparency.** The GRM encourages comments and feedback (negative and positive) to improve the Project. The community must be aware of all complaints, grievances, and problems reported, involved in their redress, and kept informed on progress made in resolving grievances. A public awareness campaign will ensure awareness of the project and its grievance redress procedures is generated. The campaign will ensure that the poor, women, IPs, the vulnerable, and the disadvantaged groups are made aware of grievance redress procedures, and CPMO (the central office of the DWRI) and the CAMO (the central agriculture management office of DOA) will ensure that their grievances are addressed according to the time schedule. Feedback will be provided to the affected person or the complainant.

(ii) **Socially Inclusive**. The whole community, and even those outside, can raise concerns and have the right to receive a response. The GRM provides an accessible, inclusive, gender-sensitive, and culturally appropriate platform for receiving and facilitating the resolution of affected persons' grievances related to the project.

(iii) **Simple and Accessible.** Procedures to file complaints and seek redress are kept simple and easy to understand by the affected people, most especially the non-literate and their communities. Affected persons will have the flexibility of conveying grievances/suggestions through verbal narration from walk-in affected person, by dropping grievance redress/suggestion forms in complaints/suggestion boxes put up at accessible locations, through telephone hotlines, by e-mail, by post, or by writing in a complaint register at project site, SMC (Subproject Management Committee), and CPMO offices.

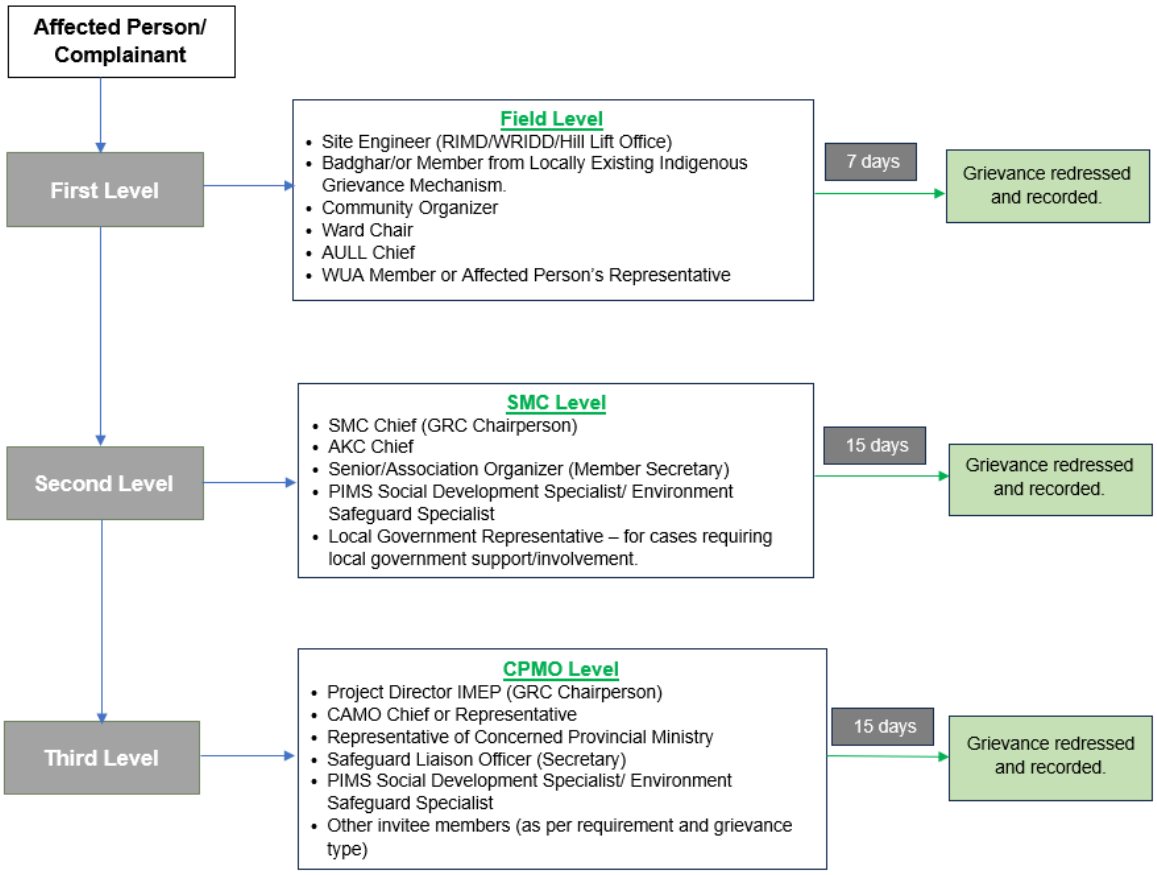
(iv) **Anonymity and Security**. To remain accessible, open, and trusted, the GRM ensures that the identities of those complaining are kept confidential. This encourages people to participate and file grievances openly. The project will maintain careful documentation of the name of the complainant, date of receipt of the complaint, address/contact details of the person, location of the problem area and the grievance detail. The project will ensure a grievance tracking and monitoring system, response accorded, resolution status and closure. SMC and CPMO’s Social Development Specialists will be responsible for timely grievance redressal on safeguards and gender issues and registration of grievances, related disclosure, and communication with the aggrieved party.

(v) **Institutional Capacity Building.** Through the GRM, the SMC and CPMO will strengthen communication channels and mechanisms for grievance redress at the community/project area level.

B. Grievance Redress Arrangements and Role Functions

243. The GRM is a three-tier arrangement that facilitates time-bound grievance resolution at each level. Responsible persons and agencies/offices are identified to address grievances and seek appropriate advice at each stage, as required. Institutional arrangements, including the constitution of grievance redress committees (GRC) at various levels, will be ensured to function throughout the project duration. The CPMO shall ensure the constitution of these committees and oversee the implementation of grievance redress processes, including adherence to time limits, record keeping, and documentation at each level.

Figure 45. Grievance Redress Mechanism



244. **Field Level:** The first level of the GRM will function at the project location/site. The field-level arrangement will consist of ground implementation staff led by the project's Site Engineer, a Community Organizer, a Badghar or a member from a locally existing Indigenous grievance settlement mechanism, and a representative of the affected persons. All minor issues and those perceived as immediate and urgent by the complainant will be resolved at the field level itself (within 7 days). For cases requiring input and involvement of local bodies, the field-level grievance cell will be strengthened by including a Ward Chair (at least one female member and one representative from the local Indigenous community. In cases of larger issues that cannot be resolved at the field level, the matter will be escalated to the district/subproject level GRC, the second level arrangement. The Community Organizer will be responsible for documentation and record-keeping. A summary of grievance records will be submitted to the CPMO monthly. The province-based PIMS Social Development Specialist will both monitor and provide guidance and support to the field staff in grievance redress and record-keeping.

245. **SMC Level:** A GRC will be established at the SMC level and headed by the SMC chief**. The** Senior/Association Organizer of the Institutional Development section of WRIDD/SD/RIMD will function as the member secretary of the GRC, supported by the PIMS Social Development Specialist/Environmental Safeguard Specialist. The committee will include a representative from the local body, the AKC Chief, as per the nature of the grievance. All grievances that cannot be resolved at the field level and those directly registered at this level will be addressed by this body within 15 days of complaint receipt. Proper documentation of grievances (including records of grievances redressed at the field level) will be maintained by the Institutional Development unit of WRIDD/RIMO and offices responsible for hill lift schemes. In cases where the GRC at this level cannot resolve a grievance within the stipulated period, the case will be escalated to a higher level for resolution. The SMC level will also maintain follow-up for each grievance, periodically disseminate information to complainants on the status of their grievance, and record their feedback (satisfaction/dissatisfaction and suggestions).

246. **CPMO Level**: The arrangement at the highest level will involve the constitution of a project-level committee headed by the CPMO PD as the chairperson. The committee will receive support from the Social Development Specialist/Environmental Safeguard Specialist or technical experts relevant to grievances, the CAMO Chief or representative, the representative or senior officer from the concerned provincial ministry, and other members as required based on the type of grievance. All grievances that cannot be resolved by the SMC level GRC will be brought to the attention of this body, seeking its advice or referral for resolution at this level. Grievances received or referred to this committee will be resolved within 15 days. Periodic information will be provided to complainants on the status of their grievance resolution. The Safeguard Liaison Officer will act as the secretary for the CPMO-level committee and will also be responsible for compiling grievance redress records, including project-level documentation and reporting.

247. The affected person/complainant shall have access to the country's legal system at any stage. Further, accessing the country's legal system can run parallel to accessing the GRM and is not dependent on the negative outcome of the GRM.

248. **ADB Accountability Mechanism.** If the established GRM cannot resolve a grievance, the affected person can also use the ADB Accountability Mechanism by directly contacting (in writing) the Complaint Receiving Officer at ADB headquarters or the ADB Nepal Resident Mission

(NRM). Before submitting a complaint to the Accountability Mechanism, the affected/aggrieved person/s should make a good-faith effort to solve the problem by working with the concerned ADB operations department and/or NRM. Only after doing so, and if they are still dissatisfied, will the Accountability Mechanism consider the complaint eligible for review.[24] The complaint can be submitted in any of the official languages of ADB's developing member countries. The ADB Accountability Mechanism information will be included in the project-relevant information to be distributed to the affected communities, as part of the project GRM.

249. **Consultation arrangements and information dissemination**. The GRM will adopt a consultative and participatory approach to grievance resolution, which may sometimes require one-to-one consultation with individual complainants or the aggrieved community. Furthermore, the CPMO and the PIMS Social Development Specialist/Environmental Safeguard Specialist will be responsible for disseminating information to affected persons on the grievance redressal procedure, ensuring that the host community understands the grievance redress process, and encouraging them to register complaints. Adequate consultations, meetings, and public awareness campaigns will be conducted to achieve this objective. Information on grievances received and responses provided will be documented and reported back to the affected persons. All grievances will be treated with utmost confidentiality, and the complainant's identity will not be disclosed. A sample grievance registration form is provided in **Appendix 3.**

250. **Record Keeping.** Records of all grievances received, including contact details of the complainant, date the complaint was received, nature of the grievance, agreed corrective actions and the date these were taken, and the outcome would be maintained by the CPMO (with the support of PIMS Social Development Specialist/Environmental Safeguard Specialist). As part of record-keeping and reporting practices, information on grievance tracking will also be maintained. Grievance reporting by SMC and CPMO at their respective levels will include information for the reporting period and the cumulative data on select parameters such as total grievances received, redressed, pending, etc., since the project's inception. Summarized information will be included in the CPMO's periodic reporting, with support from PIMS and ADB.

251. **Periodic review and documentation of lessons learned**. The CPMO will periodically review the functioning of the GRM and record information on the mechanism's effectiveness, particularly in preventing and addressing grievances within the project.

252. **Costs**. The project will bear all costs involved in resolving the complaints (meetings, consultations, communication, and reporting/information dissemination).

[24] Accountability Mechanism. http://www.adb.org/Accountability-Mechanism/default.asp.

X. CONCLUSIONS AND RECOMMENDATIONS

198. The preparation of the Hill Lift Irrigation Project, funded by the Asian Development Bank (ADB) and implemented by the Ministry of Energy, Water Resources, and Irrigation, aims to increase agricultural production and productivity in the land areas of the river valleys called Tar areas of Madi River of Tanahun and Lamjung district, Marshandi River of Gorkha and Kaligandaki River of Palpa. Department of Water Resources and Irrigation is promoting lift irrigation in the tar areas, considering the demand of medium to marginal farmers in the project area.

199. The IMEP aims to construct the 12 hill lift irrigation systems in the raised agricultural land areas of Madi, Kaligandaki, and Marshyangdi River Corridor. Implementing the 12-hill lift irrigation aims to increase agricultural production and productivity through the intensification and diversification of crops by introducing an assured irrigation facility to 14,00 ha of land. In most of the subprojects, the farmers have made efforts to create their own private or collective facility to irrigate patches of agricultural land. Still, none of them provide dependable year-round irrigation to the extent of the need to support diversified agricultural production. The proposed Tilakpur and Pyakluk subprojects in Kaligandaki River of Palpa district are located in the tail reach of Branch Canals No. 4 and 5 of Rampur Tar Irrigation System, and access to irrigation is deficient even for monsoon due to deficiency of water at the source and also due to frequent incidences of landslide in the head reaches of the main canal. This IEE further provides the following conclusions:

(i) The HLIP is not within an environmentally sensitive area, so it is unlikely to significantly adversely impact the area's flora and fauna.
(ii) Since it is a physical development intervention, it will have some impacts on the local environment. However, the extent of impacts is expected to be local, confined within the Tube wells schemes' main areas of influence, reversible for a short period of time, and can be mitigated through appropriate measures.
(iii) Meticulous activities during the construction of Tube wells the underground distribution pipe networks, and other facilities, and proper management of construction campsites and stockpile areas with spoil management are seen as major areas to focus on with respect to environmental safeguards.

200. Considering the above statement, the following are being recommended:
(i) Mitigation measures integral to socially and environmentally responsible construction practices shall be applied across all Tube well construction sites. Mitigation measures will not be difficult to implement but should be done in a timely manner and closely monitored.
(ii) Effective coordination with and dissemination of information to the local communities of respective Tube wells and the local government stakeholders should be done to minimize disturbances to local activities and damage to public or private properties during the construction works.
(iii) During operation, potential project risks can be mitigated with regular awareness-raising efforts among the users of the centers and the local communities.

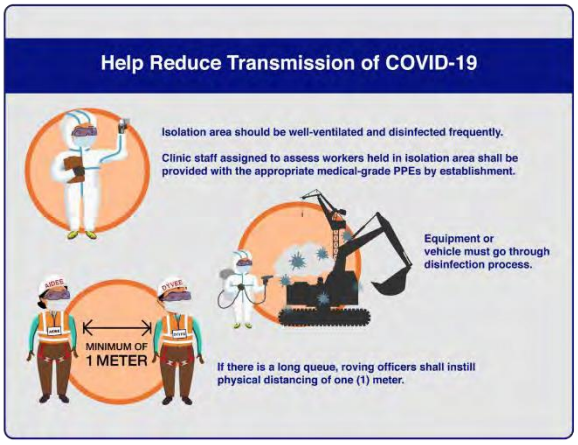
201. The proposed HLIP irrigation project negatively impacts the physical and socio-economic environment during the construction and operation phases. However, the project's positive impacts are more significant in uplifting the people's livelihood and national economic growth than the negative ones. Also, the construction of irrigation facilities will enhance the economic development in the area.

202. According to the ADB Safeguard Policy Statement (SPS-2009), Hill Lift Irrigation is categorized as B, and this IEE report is prepared to comply with ADB's requirements. As per the Environmental Protection Regulation, 2020 (with amendments) of the Government of Nepal, for the implementation of the Hill Lift Irrigation Subprojects, the borrower shall conduct the IEE studies for the subprojects and shall take Environmental clearance from the MoEWRI. The EMPs mentioned in the report are considered sufficient to meet the project's environmental assessment requirements of ADB. However, it will be reviewed and updated as necessary prior to and following the detailed design. In case of any unanticipated impact (including a scope or design change) occurring during project implementation, this IEE and EMP must be further updated by DWRI and cleared by ADB before any related works commence or are cleared to continue.

239. To ensure responsible and sustainable implementation, comprehensive Environmental Management Plans (EMPs) will be developed and implemented. These EMPs will focus on mitigating or minimizing the negative impacts associated with high-lift irrigation to acceptable levels. In summary, while acknowledging the potential negative impacts, it is important to consider implementing effective EMPs that underscore responsible and sustainable development practices.

Appendix 1: COVID-19 Guideline

A. PREPARATION BEFORE WORK



- The worksite and camp will be secured with a gated fence
- A Photo Identity Card will be issued to all workers with a unique identification number
- Preparation will be made for daily medical screening (thermal check and symptoms assessment) of all workers and report to H&SO
- COVID Marshal will measure temperature by wearing a facemask and gloves for their gang of workers before leaving the camp
- Workers with high fever and frequent cough will not be allowed to work. The worker will be asked to stay in quarantine (for residential workers) or sent back home (for non-residential workers).

COVID-19 लक्षणहरू		
सबैभन्दासामान्यलक्षणहरू: – ज्वरोआउने – सुक्खाखोकीलाग्ने – थकाइलाग्ने	सामान्यतयाकमैदेखिनेलक्षणहरू: – पीडाहुनेवादुख्ने – घाँटीदुख्ने – पखालालाग्ने – आँखापोल्ने – टाउकोदुख्ने – स्वादवागन्धथाहानहुने – छालामादागहुनेवाहातवाखुट्टाकाऔंलाकोरङउड्ने	गम्भीरलक्षणहरू: – सासफेर्नगाह्रोहुनेवापटकपटकसासफेर्नुपर्ने – छातीदुख्नेवाछातीमादबाबपर्ने – बोल्नवाहिँडडुलगर्ननसक्ने –
तपाईंमागम्भीरलक्षणहरूदेखिएमातुरुन्तैचिकित्साजाँचगराउनुहोस्। जहिलेपनिआफ्नोडाक्टरवास्वास्थ्यसुविधाप्रदायककहाँजानुअघिकलगर्नुहोस्		

- COVID Test (PCR Test) will be conducted for the staff and workers who have symptoms related to COVID-19 (if required)
- Register records will be maintained
- Quarantine and isolation tents will be established at sufficient distance in the camp from regular shelters
- Specific and separate worksites will be assigned to the new group of workers away from regular workers for a minimum of 14 days to minimize risk

- Work will be arranged in shifts to avoid crowding of workers. Teams will be divided based on (i) workers residing in the same camp, (ii) workers residing outside the camp, (iii) a new group of workers etc.
- Contubetion of liquor and chewable like Khaini, Surti, Paan etc. (those generating the urge for frequent spitting) will be strictly restricted inside the office and work areas

B. PROCEDURE AT ENTRY

- Guards will be oriented by the H&SO on (i) checking temperature, (ii) observing health symptoms, (iii) recording personal details and travel history, and (iv) taking emergency procedures, if required
- Unauthorized persons and visitors will not be allowed to enter
- All new groups of workers will be allowed to enter the site only after showing a COVID Test certificate from an authorized government hospital issued within the last 7 days, which the Assistant Health Worker will check at the Medical Center
- Guards will wear prescribed PPEs at all times and regularly disinfect their hand
- Visitors having COVID symptoms will be sent back, and immediately call HW from the Medical Center for staff and workers showing symptoms

- Personnel should maintain a distance of 1 meter at all times following the floor-marking wherever queue is required
- Guard will direct vehicles supplying materials to the delivery zone

• The guard will inform the visitors about the full-time use of masks and hand washing/sanitizing

C. MINIMIZEWORKER AND COMMUNITY CONTACT

The Contractor will be fully responsible for ensuring taking all preventive measures and safety precautions for COVID-19 risks such as the following:

- The Project Manager will work closely with the Site Charge and Resident Engineer to plan special measures and expedite work implementation at high-risk areas and areas requiring work in close proximity to the communities
- Physical barricades will be made mandatory to separate and minimize contact between workers and local people

- Arrangements will be made to minimize movement of workers from barricaded work areas and camps and visiting settlement areas

- Work sites will be separated into working zones to keep the groups of workers physically separated. Not more than 20 workers will be allowed to work in one group. A group leader will be identified as a COVID Marshal and given orientation to keep close watch on workers and trigger emergency protocol in emergency case

- Emphasis will be given to establishing a sufficient size of the labour camp to keep all workers inside the camp to minimize contact with the community.

D. TRAVEL TO WORK SITE

The workers will observe precautions and the contractor will arrange the following measures for arranging transport for workers to the worksite:

- Travel between sites and labour camps will be arranged through the official vehicle

- All workers will wear facemasks when travelling in a shared vehicle, including the driver, who will wear a mask and glove

- Driver will sanitize had regularly and before & after every trip

- Only 40% of the capacity of the vehicle will be used, and a seat will be kept empty between passengers

- Windows will be opened for natural ventilation

- Workers will stay facing away from each other while in the vehicle

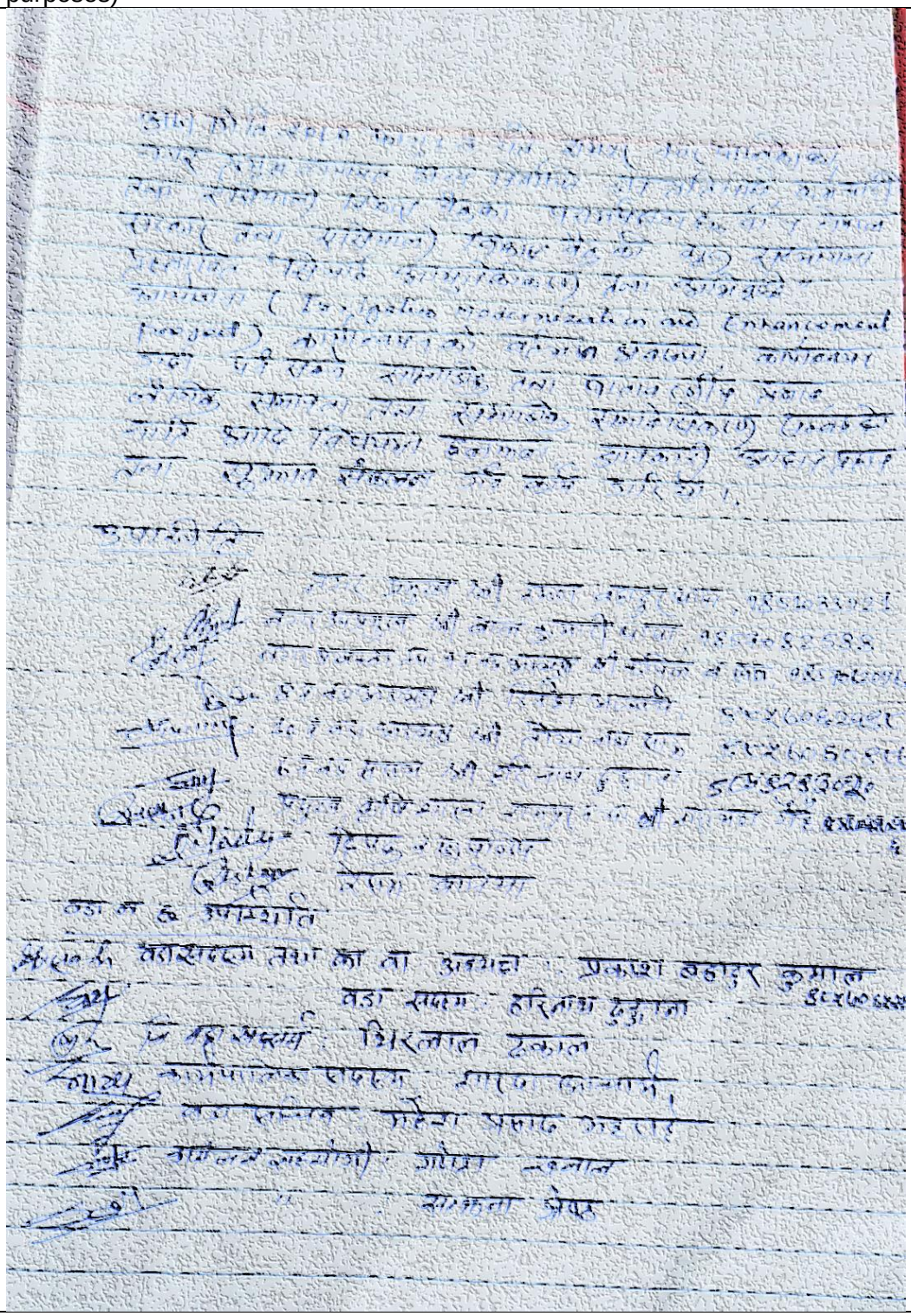
- The vehicle will be cleaned and disinfected thoroughly after every shift, with emphasis on the handles, steering wheel, gear, etc.

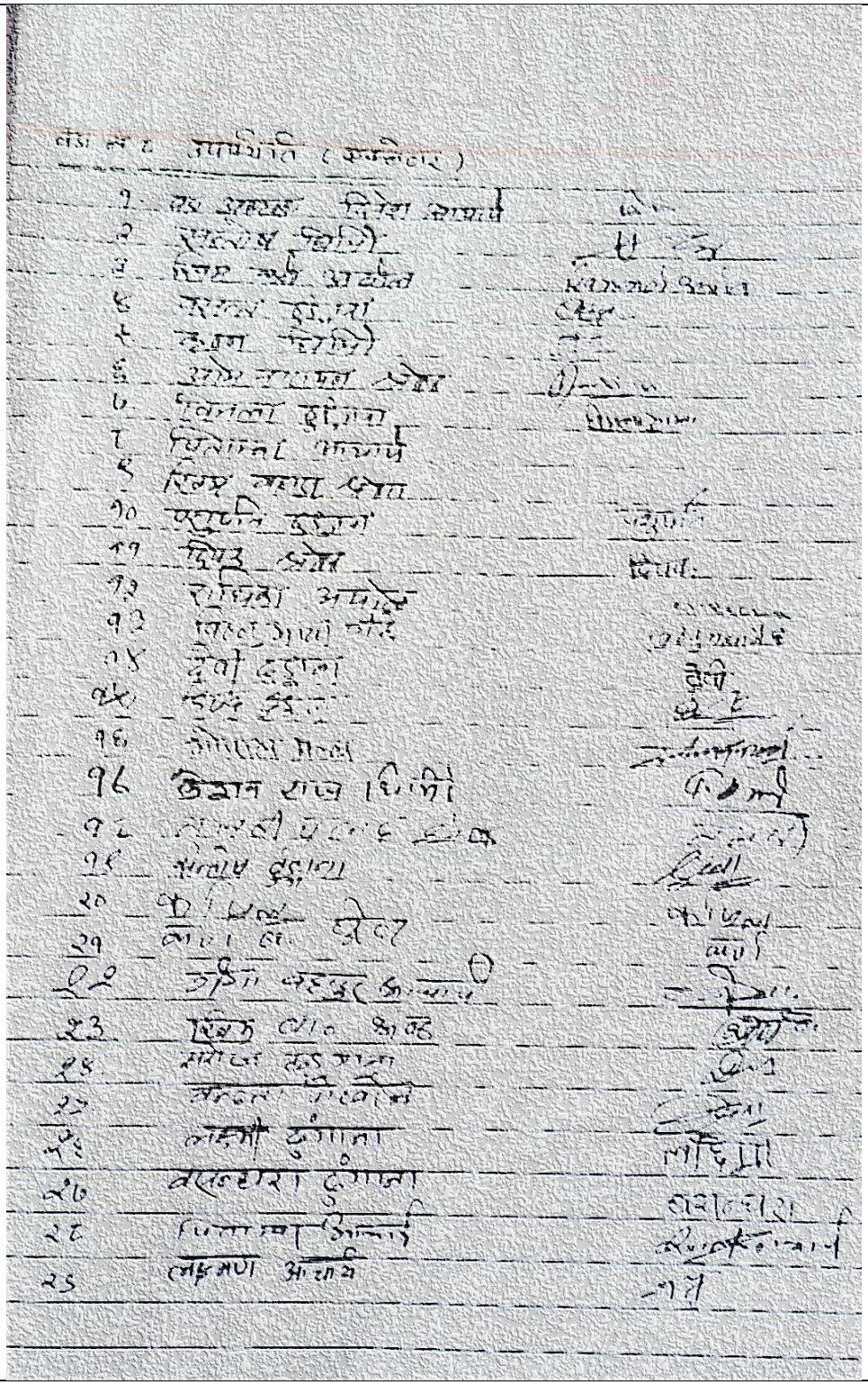
- All workers, prior to entering the vehicle and exiting, will sanitize their hands

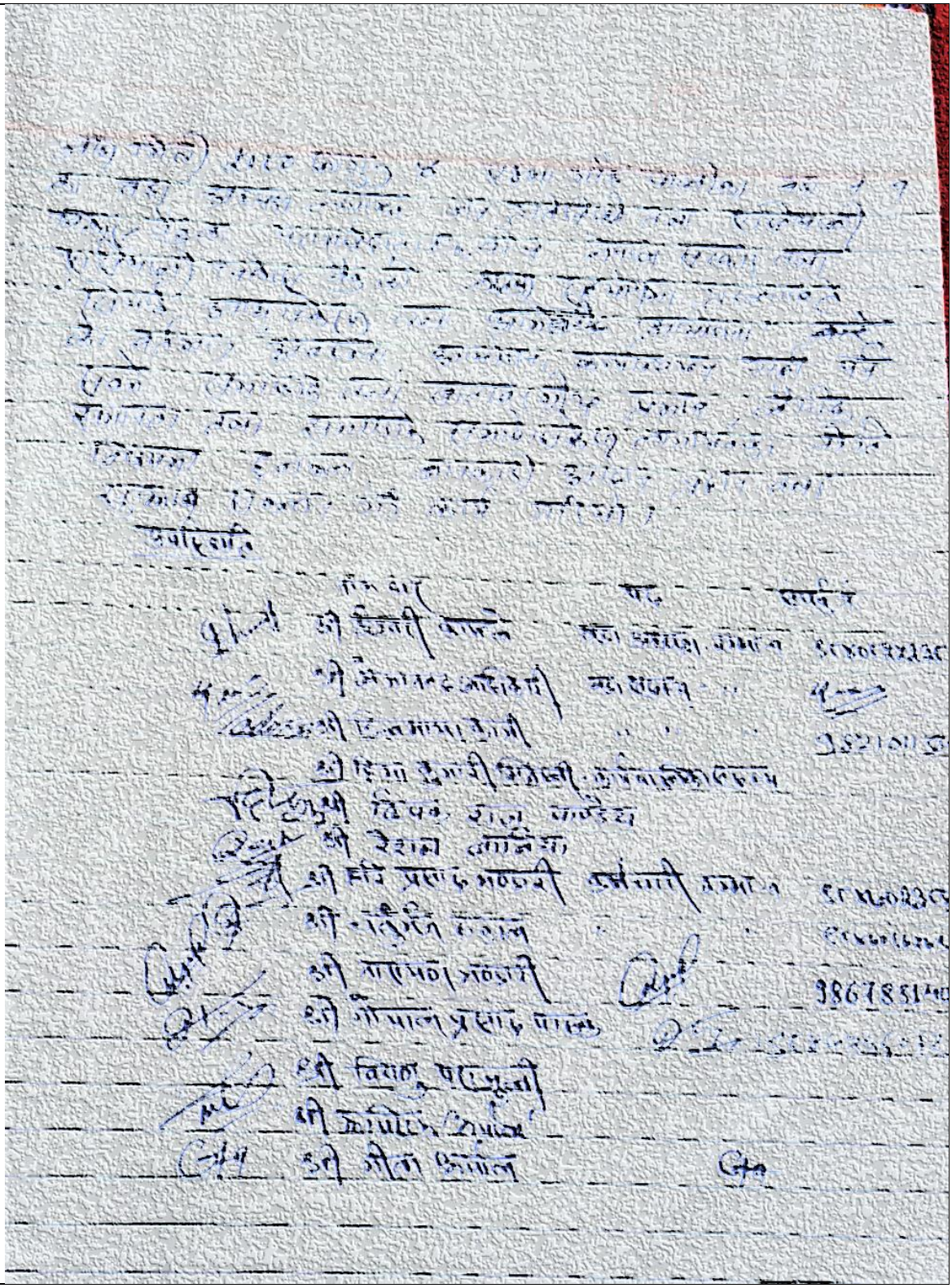
- Prior to entering the vehicles, all nonresidential staff and workers must self-certify that they do not have any COVID-19 symptoms.

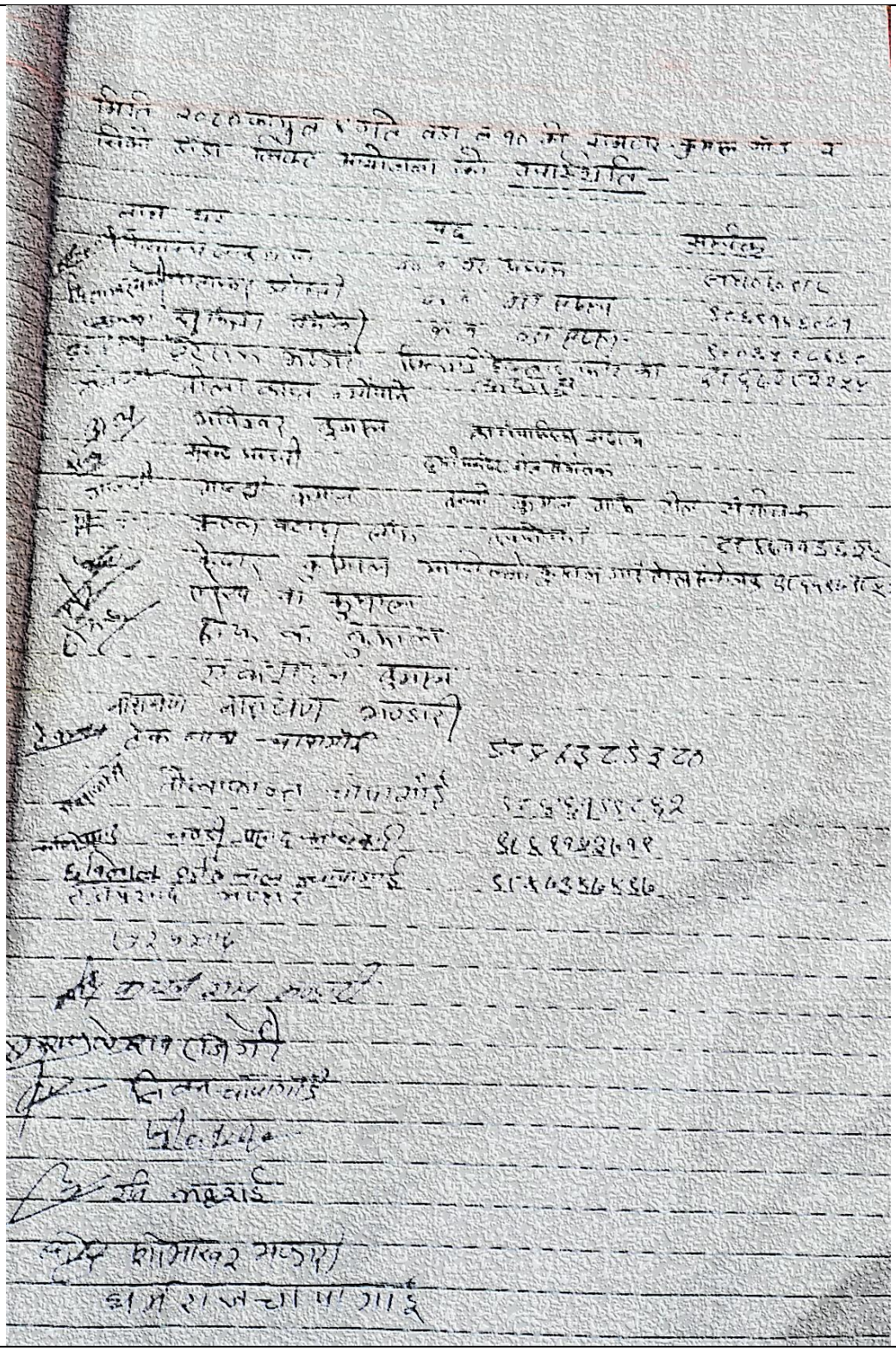
Appendix 2 : Hill Lift Irrigation Project - Attendance sheet with signature

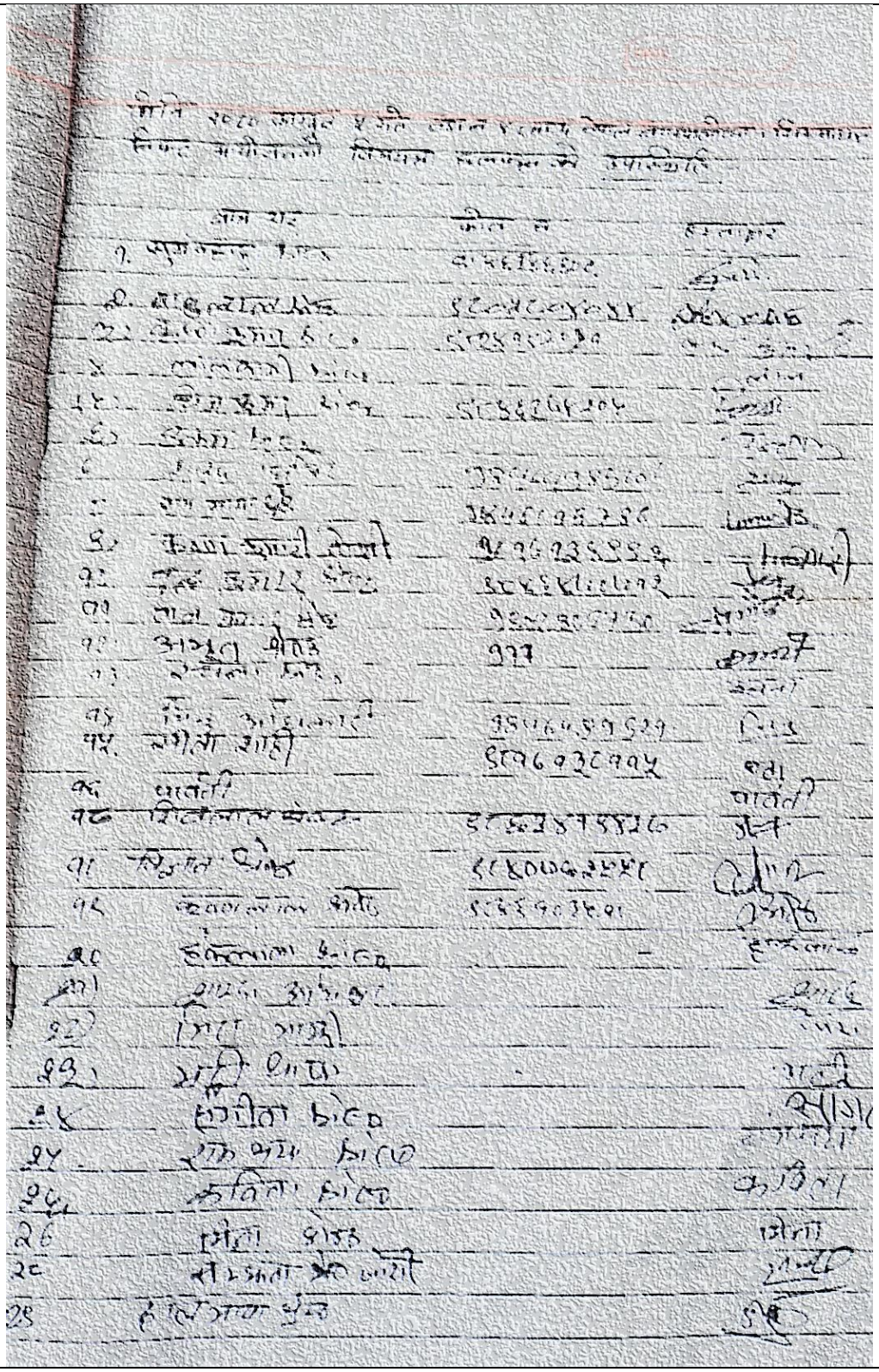
(note: photographs are intentionally blurred to hide personal details that may be used for unintended purposes)

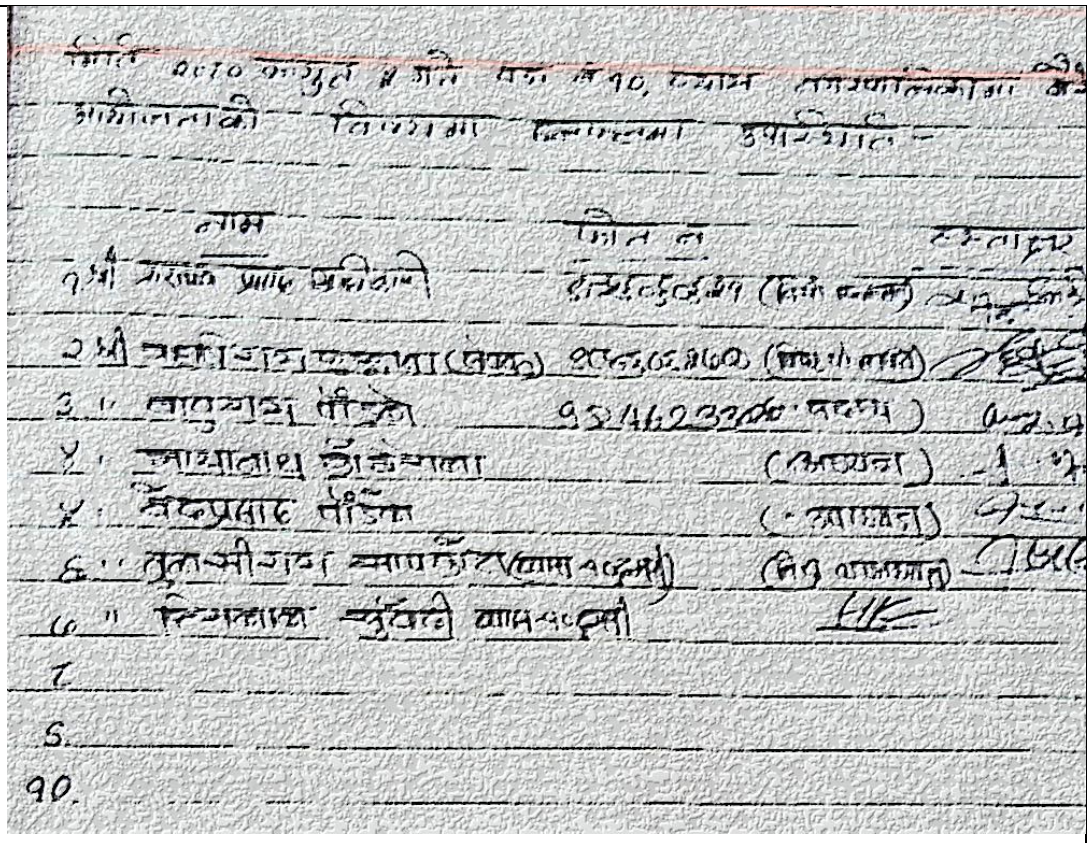












Appendix 3 : Sample Grievance Registration Form

(To be available in Nepali and English)
The_____Project welcomes complaints, suggestions, queries, and comments regarding project implementation. We encourage persons with grievance to provide their name and contact information to enable us to get in touch with you for clarification and feedback.

Should you choose to include your personal details but want that information to remain confidential, please inform us by writing/typing *(CONFIDENTIAL)* above your name. Thank you.

Date	**Place of registration**	**Project Town** **Project:**			
Contact information/personal details					
Name		**Gender**	* Male * Female	**Age**	
Home address					
Place					
Phone no.					
E-mail					
Complaint/suggestion/comment/question Please provide the details (who, what, where, and how) of your grievance below: If included as attachment/note/letter, please tick here:					
How do you want us to reach you for feedback or update on your comment/grievance?					

FOR OFFICIAL USE ONLY

Registered by: (Name of official registering grievance)	
Mode of communication: Note/letter E-mail Verbal/telephonic	
Reviewed by: (Names/positions of officials reviewing grievance)	
Action taken:	
Whether action taken disclosed:	Yes No
Means of disclosure:	

गुनासो दर्ता फारम

सिँचाई आधुनिकरण अभिवृद्धि आयोजना सम्पूर्ण सरोकारवाला ब्यक्ति/संस्थाहरुलाई आयोजना कार्यान्वयन सम्बन्धमा कुनै गुनासा/जिज्ञासा/सल्लाह/सुझाव भए सो बारे जानकारी गराउन अनुरोध गर्दछ । तपाईले दर्ता गर्नु भएका गुनासा, जिज्ञासा, सल्लाह, सुझाव उपर गरिएका निर्णय बारे जानकारी गराउन सहज होस् भन्नका लागि आफ्नो नाम तथा ठेगाना प्रदान गर्न अनुरोध गर्दछौ । यदि तपाई आफ्नो व्यक्तिगत विवरण गोप्य राख्न चाहनुहुन्छ भने आफ्नो नाम को माथि "गोप्य" अंकित गर्नु होला ।

मिति:	दर्ता गरिएको स्थान:	आयोजनाको नाम:
सम्पर्क विवरण		
नाम:		
ठेगाना	गा.पा/न.पा: वार्ड: गाउ /टोल:	फोन: इमेल:
गुनासा, जिज्ञासा, सल्लाह, सुझाव: गुनासो सम्बन्धित बिषय, स्थान, कारण तथा सो मा संलग्न व्यक्ति आदि बारे बिस्तृत विवरण उल्लेख गर्नुहोला ।		
दर्ता भएका गुनासा/जिज्ञासा/सल्लाह/सुझाव उपर गरिएको छानविन / निर्णय बारे तपाईलाई जानकारी गराउने उपयुक्त माध्यम		
कार्यालय प्रयोजनका लागि		
दर्ता गर्ने व्यक्तिको नाम: पद:		
संचार को माध्यम: (क) चिट्ठी (ख) इमेल (ग) मौखिक (घ) अन्य		
प्राप्त गुनासो सम्बोधनमा संलाग्न पदाधिकारी: नाम: पद:		
प्राप्त गुनासो सम्बोधन गर्न लिईएका निर्णय कार्यान्वायनको अवस्था:		
प्राप्त गुनासो सम्बोधन गर्न लिएका/कार्यान्वयन गरिएका निर्णय सार्वजनिकीकरण : (क) भएको (ख) भएको छैन		
सार्वजनिकीकरण गर्न उपयोग गरिएको माध्यम:		

Appendix 4 : Sample Environmental Site Inspection Report

Project Name
Contract Number

NAME: _____ DATE: _____

TITLE: _____ DMA: _____
LOCATION: _____ GROUP: _____

WEATHER:

Project Activity Stage	Survey	
	Design	
	Implementation	
	Pre-Commissioning	
	Guarantee Period	

MONITORING	COMPLIANCE
Compliance marked as Yes / No / Not applicable (NA) / Partially Implemented (PI)	
EHS officers/supervisor appointed by contractor and available on site	
Construction site management plan (spoils, safety, schedule, equipment etc.,) prepared	
Traffic management plan prepared	
Dust is under control	
Excavated soil properly placed within minimum space	
Construction area is confined; no traffic/pedestrian entry observed	
Surplus soil/debris/waste is disposed without delay	
Construction material (sand/gravel/aggregate) brought to site as & when required only	
Tarpaulins used to cover sand & other loose material when transported by vehicles	
After unloading, wheels & undercarriage of vehicles cleaned prior to leaving the site	
No chance finds encountered during excavation	
Work is planned in consultation with traffic police	
Work is not being conducted during heavy traffic	
Work at a stretch is completed within a day (excavation, pipe laying &	
Pipe trenches are not kept open unduly	
Road is not completely closed; work is conducted on edge; at least one line is kept open	
Road is closed; alternative route provided & public informed, information board provided	
Pedestrian access to houses is not blocked due to pipe laying	
Spaces left in between trenches for access	
Wooden planks/metal sheets provided across trench for pedestrian	
No public/unauthorized entry observed in work site	

MONITORING ITEMS	COMPLIANCE
Children safety measures (barricades, security) in place at works in residential areas	
Prior public information provided about the work, schedule and disturbances	
Caution/warning board provided on site	
Guards with red flag provided during work at busy roads	
Workers using appropriate PPE (boots, gloves, helmets, ear muffs etc.)	
Workers conducting or near heavy noise work is provided with ear muffs	
Contractor is following standard & safe construction practices	
Deep excavation is conducted with land slip/protection measures	
First aid facilities are available on site and workers informed	
Drinking water provided at the site	
Toilet facility provided at the site	
Separate toilet facility is provided for women workers	
Workers camps are maintained cleanly	
Adequate toilet & bath facilities provided	
Contractor employed local workers as far as possible	
Worker's camp set up with the permission of PMU	
Adequate housing provided	
Sufficient water provided for drinking/washing/bath	
No noisy work is conducted in the nights	
Local people informed of noisy work	
No blasting activity conducted	
Pneumatic drills or other equipment creating vibration is not used near old/risky buildings	

Signature

_____

Sign off

_____ _____

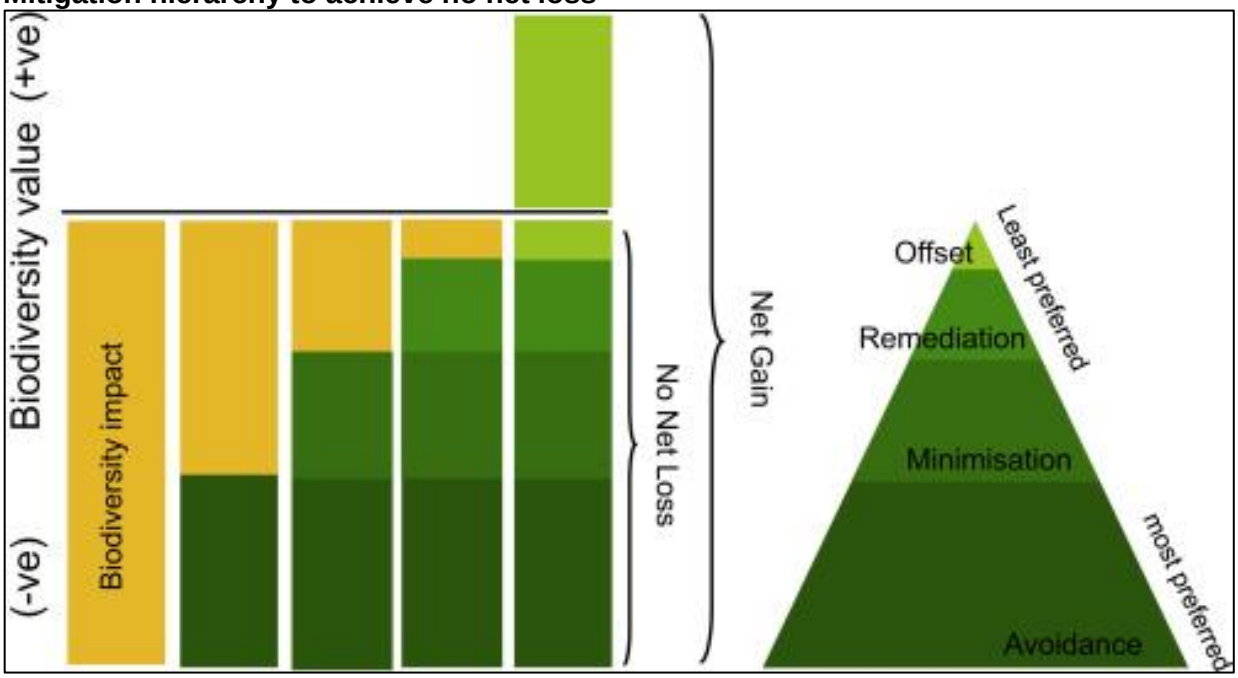
Name **Name**
Position **Position**

Appendix 5: Biodiversity Action Plan (BAP)

This section presents the BAP, which outlines the mitigation measures/actions to ensure that the HLIP (in Pyakluk, Tilakpur, and Alketar) components have no significant adverse impact on wildlife and no net loss in biodiversity, and comply with requirements in accordance with government rules and ADB's Safeguards Policy Statement 2009.

Conservation measures (i.e., prevent, minimize, mitigate/remediate, and compensate/offset) are created to guarantee the application of the mitigation hierarchy and address concerns about biodiversity characteristics as a consequence of the proposed works and operations. Below is an outline of the mitigation hierarchy concept. This will protect the integrity, health, and function of the ecological system and biodiversity characteristics while enabling rigorous risk management and the best potential results for the subproject.

Mitigation hierarchy to achieve no net loss[25]



Following are the action plans proposed for HLIP inside IBA:

1. **Actions to avoid, minimize and/or remediate loss/degradation of habitats during construction**
    - DWRI-Butwal and community organizers, with guidance from PIMs, will gather data on wildlife populations, habitat conditions, and biodiversity in the construction sites prior to works. (minimization)
    - Contractor will reach out to local communities and stakeholders, and incorporate feedback in preparing the CEMP. (minimization)
    - Contractor will employ local wildlife spotters to monitor and guide construction activities to protect animals in the IBA. (minimization)

[25] Figure is sourced from "Net Gain: Seeking Better Outcomes for Local People when Mitigating Biodiversity Loss from Development. One Earth,Volume 1, Issue 2. 195-20" by Jones, J. P. G. and et. al. (2019).

- Contractor will mark the construction site's boundaries and disseminating information about civil work areas to construction staff and laborers. (avoidance)
- DWRI-Butwal will instruct contractor that they are only authorized to cut or clear any vegetation within the designated clearing limits with permission from government authority. (minimization)
- Tree cutting shall be avoided for the establishment of a labor camp, material storage site, and transferring of any machinery, equipment, and vehicles at the subproject site. (avoidance)
- No objection clearance (NOC) for tree cutting to be obtained by the DWRI-Butwal before construction. (minimization)
- Contractor will prohibit collection of firewood, plants, etc., to minimize the impact on natural habitats. (minimization)
- Contractor will select suitable areas for material storage, quarries, borrow areas, spoil/muck disposal areas, construction laydown areas, access roads, and other facilities to minimize forest clearing and environmental impacts. The locations for material storage, quarrying areas, spoil deposits, muck disposal, construction laydown areas, roads, and others have all been selected based on the minimum likely ecological and environmental impacts. (minimization)
- The movement of contractor vehicles across the subproject areas will be strictly monitored, and drivers will be required to use designated roads only. (avoidance)
- All construction staff should be informed about the importance of stream/river habitat and the importance of wildlife. DWRI-Butwal and community organizers will prepare and give information as part of the staff inductions. (minimization)
- Contractor will ensure complete prohibition of fishing and hunting activities. (avoidance)
- Speed limits will be imposed, which should also minimize the dust levels. Off-road vehicle movements can cause habitat degradation and loss. Limit speeds for construction vehicles to 30 km/hr to minimize the generation of fugitive dust and to minimize the risk of wildlife strikes. All construction vehicles will be limited to designated access roads, and construction sites with no off-road vehicle use will be permitted. (minimization)
- When there are trees removed, contractor will replace enough trees and species as per the rule of Nepal. (remediation)

2. Additional mitigation measures for the protection of species

- This will involve an awareness program for Contractors from DWRI-Butwal and community organizers on the conservation importance of protected animals and the national legislation protecting them, including the fines and imprisonment that are imposed on those who violate the law. Appropriate information will be given to all staff as part of their site induction, and leaflets will be displayed in site offices.
- Avoid tree clearance in the breeding season for priority species (if any) reported and undertake mitigation
- Night work shall be prohibited.
- All the equipment likely to generate high noise shall be appropriately enclosed or inbuilt noise enclosures be provided so as to meet the ambient noise standards
- Maintain the equipment, as simple maintenance can reduce noise levels.
- Movement of vehicles should be restricted to working hours only.
- Use sediment barriers and silt screens to prevent construction runoff from increasing sedimentation in rivers, which can affect dolphin habitats.
- DWRI-Butwal, with support from wildlife agencies, will monitor nesting sites at the

proposed locations of HLIP.

3. Reporting and Communication

- DWRI-Butwal will document all activities, observations, and mitigation measures in detail.
- Submit regular reports to wildlife authorities and other stakeholders, including ADB.
- Secure necessary permits and approvals (if any) from relevant authorities before implementing any actions.

4. Institutional Implementation of BAP

Contractor: The Contractor will be responsible for the ground-level implementation of BAP measures. This includes executing specific actions to protect and restore habitats, ensuring that construction activities align with the conservation goals outlined in the BAP, and managing on-site activities to minimize environmental impact.

DWRI: The assigned department will monitor the contractor's compliance with the BAP. DWRI-Butwal will conduct regular inspections and audits to ensure that all BAP measures are correctly implemented and adhered to, providing guidance and corrective actions when necessary.

Community Organizers: They will assist DWRI-Butwal by supporting monitoring efforts, disseminating information to local communities, and conducting capacity-building activities (with support from PIMS). They will help raise awareness about the importance of habitat conservation and ensure that local knowledge and feedback are incorporated into the implementation process.

CPMO: The CPMO and its consultants will offer additional support to DWRI-Butwal by providing technical expertise to characterize the IBA. This includes conducting ecological assessments, mapping sensitive areas, and identifying key species and habitats requiring protection. They will facilitate connections with appropriate government authorities to ensure compliance with environmental regulations and may allocate budgetary resources to ensure the effective implementation of BAP actions.

5. Offsetting strategy

Tree planting in the IBA is a critical conservation activity that involves several important steps. The first step is conducting a thorough site assessment to understand soil conditions, existing vegetation, and local climate, facilitated by DWRI-Butwal and government authorities. This assessment helps in selecting the right tree species, which is crucial for the success of tree planting. Native species are preferred because they are well-adapted to the local environment and support local wildlife, thereby maintaining ecological balance.

Engaging local communities or beneficiaries of HLIP in the tree planting process is also crucial. Local communities are invaluable in identifying areas that need land cover improvements. Their involvement ensures that reforestation efforts are tailored to local needs and conditions. Additionally, these communities can carry out regular maintenance activities such as watering, weeding, and replacing dead seedlings. These activities are essential for the long-term success of reforestation efforts.

The DWRI plays a pivotal role in tree planting efforts. DWRI-Butwal is responsible for coordinating these activities, ensuring that all steps are meticulously followed. They provide the technical expertise and resources needed for successful tree planting. DWRI-Butwal's oversight ensures compliance with environmental regulations and promotes long-term environmental health and biodiversity conservation. By working closely with local communities and government authorities, DWRI-Butwal helps create sustainable reforestation projects that enhance biodiversity and ecological resilience.