Environmental Impact Assessment

Project Number: 50165-002
May 2017

Bhutan: Amochhu Land Development and Township Project

Draft Report (Appendixes 33-39)

Prepared by Construction Development Corporation Limited, Royal Government of Bhutan for the Asian Development Bank.

Environmental Impact Assessment (EIA) Report

For

Amochhu Land Development and Township Project (ALDTP), Phuentsholing, Bhutan

MAY 2017

CONSTRUCTION DEVELOPMENT CORPORATION LIMITED, BHUTAN

Appendix 33:
About EIA Consultant- Kadam Environmental Consultants

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Brief Resume and Nature of Consultancy rendered by Kadam Environmental Consultants

Kadam Environmental Consultants (KEC) was established in 1981 and has more than three decades of varied experience in the field of environment. The mission of company is providing sustainable solutions on "Environment for Development".

The company has a dedicated and experienced team of more than 200 technical staff. The team comprises of environmental planners and engineers, chemical and civil engineers, geologists, socio-economic experts, microbiologists, zoologists, botanists and industrial/analytical chemists. The Company's strength lies in project management, performing risk assessment, formulating environmental disaster plans, use of satellite Imagery in impact assessment, use of mathematical models for air, water and soil assessment and expertise in public consultation.

The company has two sister concerns namely: Kadam Pollution Control Pvt. Ltd dealing in operation and maintenance contracts of sewage, effluent and water treatment plants, Kadam Projects dealing in supply of Effluent and Sewage treatment plants on turnkey basis.

Customer services are mainly categorized into:

1. **Consultancy Services:** in the field of Environmental Impact Assessment , Environmental Site Assessment and Due Diligence, Enviro Legal Services, Statutory Environmental Audits/Statements, Risk Assessments and HAZOP, Energy Audit, Environmental , Health and Safety Management Systems and Waste Management Systems.

2. **Engineering Services:** for collection and conveyance of liquid and solid wastes, designing and executing effluent and sewage treatment plants, municipal solid waste studies and solid waste management systems, bio gas plants , rain water harvesting systems and deep sea marine disposal systems.

3. **Laboratory services:** in chemical and waste testing, microbiology, soil testing and Field sampling (we have amongst the highest number of environmental field sampling equipment amongst environmental companies in the country. The company has a well-equipped laboratory with modern instruments and experienced staff catering to the need of statutory and advisory environmental testing for air, water and wastewater and hazardous solid waste. Laboratory has also received NABL accreditation, OSHAS 18001 certification. It is also a MoEF recognized laboratory.

The group has a varied industrial clientele encompassing Indian and Multinational Companies covering the industrial and services spectrum viz. Bulk Drugs and Pharmaceuticals, Paints, Chemicals, Oil & Gas, Real Estate, Hospitality and Infrastructure sectors. Whilst the heart of our clientele encompasses the top 50/Blue Chip Indian companies (GNFC, Zuari, RCF, Reliance Industries, ONGC, Infosys, ITC, ICICI, Indian Oil, GAIL, ONGC/GSPL, Sun Pharma, NTPC, Reliance Energy/Reliance Power, Welspun, RC Fertilizers and many others) who have placed implicit trust in us over the decades. We are increasingly working with several multinationals (such as : ABB, Alstom, Areva, GM, Hindustan Lever, Honeywell, Kohler, Sabic and Tyco amongst others) who value our deep rooted general domain and India centric functional knowledge, reasonable costs and comparable services as those offered by our multinational competitors. Their continued patronage is our biggest testimonial.

The Group has branch offices at Delhi.

KEC has received ISO 9001:2008 certification for its Quality management System from BSI-MS.

The company is accredited for 24 sectors by NABET, Quality Council of India under EIA accreditation scheme as per mandatory requirement of the MOEF, Govt. of India for carrying out Environmental Clearance studies. It has approved EIA coordinators and Functional Area Experts.

Table 9-47: EIA Consultant Team

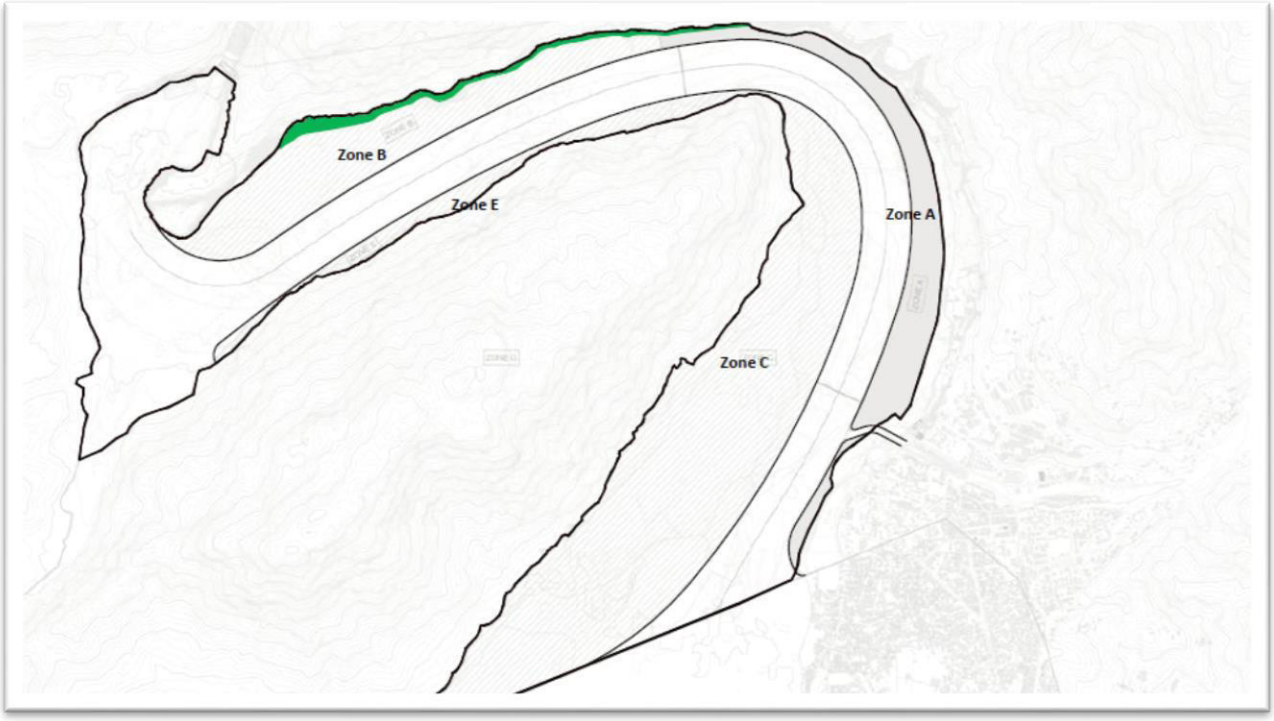
SN.	EIA Consultant Team	Qualification	Experience (No. of years)
01	Dr. Dibyendu Banerjee	Ph.D. in Environmental Science	16 years
02	Mr. Sangram Kadam	M. Tech. Environmental Planning	19 years
03	Ms. Sheetal Kadam	Bachelor of Architecture	12 years
04	Mr. Satish Joshi	M. Tech. Chemical Engineering	37 years
05	Mr. K. K. Antani	B. E. Civil	21 years
06	Ms. Shruti Shah	B.E. Civil , MBA marketing	7 years
07	Dr. Sourav Kundu	Ph. D. Marine Biology & Oceanography	10 Years
08	Dr. Kamal Gangwar	Ph.D. in Environmental Science	10 Years
09	Mr. Neelkanth Kavalanekar	M. Tech. Hydrology	40 Years
10	Dr. B K Patel	Ph. D. Soil Science	45 Years
11	Mr. Mahendra Jadhav	M. Sc. Environmental Science	20 Years
12	Mr. Anup Ojha	B.Sc. Chemistry	5 Years
13	Mr. Neeraj Sharma	M. Sc. Geology	5 Years
14	Mr. Virsingh Anand	Bachelor of Science	20 Years
15	Ms. Parul Patel	M.Sc. (Organic Chemistry)	10 years
16	Ms. Kundan Ajudiya	B. E. Chemical Engineering	8 Years
17	Ms. Aarti Sharma	Master of Commerce with Business Economics	9 years
18	Mr. Viraj Vyas	I.T.I.	9 years

Appendix 34:
Landscape strategy for slope stabilization

Eroding slopes on the western boundary

The site condition is especially evident along the eastern boundary below the new Phuentsholing-Samtse highway. Such continuous and large-scale erosion needs to be checked if a large project such as ALDTP needs to be undertaken.

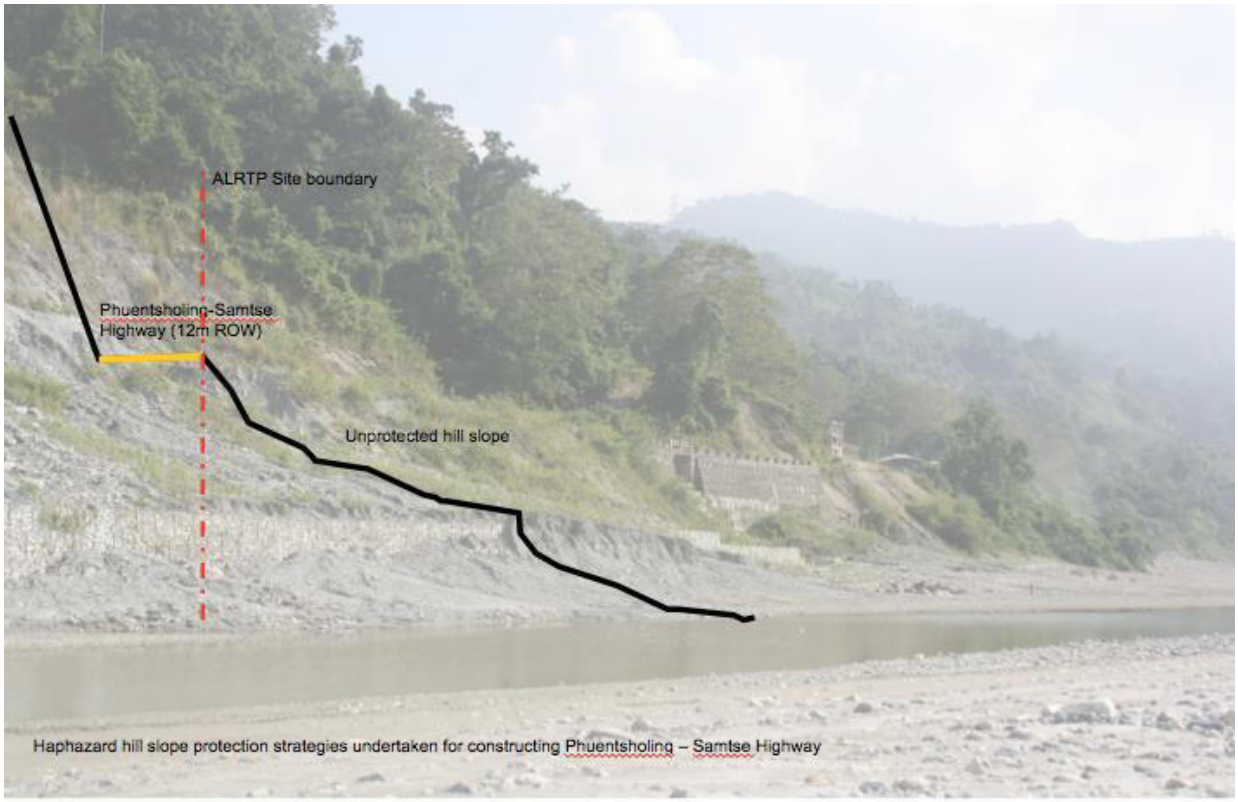
Figure 9-26: Portion of ALDTP requiring slope stabilization



It is proposed that these slopes be stabilized using Vetiver grass planting. The Vetiver System (VS), which is based on the application of vetiver grass (Vetiveria zizanioides L Nash, now reclassified as Chrysopogon zizanioides L Roberty), was first introduced by the World Bank for soil and water conservation in India in the mid-1980s. While this application still plays a vital role in agricultural land management, research and development conducted in the last 20 years has clearly demonstrated that, due to vetiver grass' extraordinary characteristics, vetiver also has important application as a bio-engineering technique for steep slope stabilization, wastewater disposal, phyto-remediation of contaminated land and water, and other environmental protection purposes.

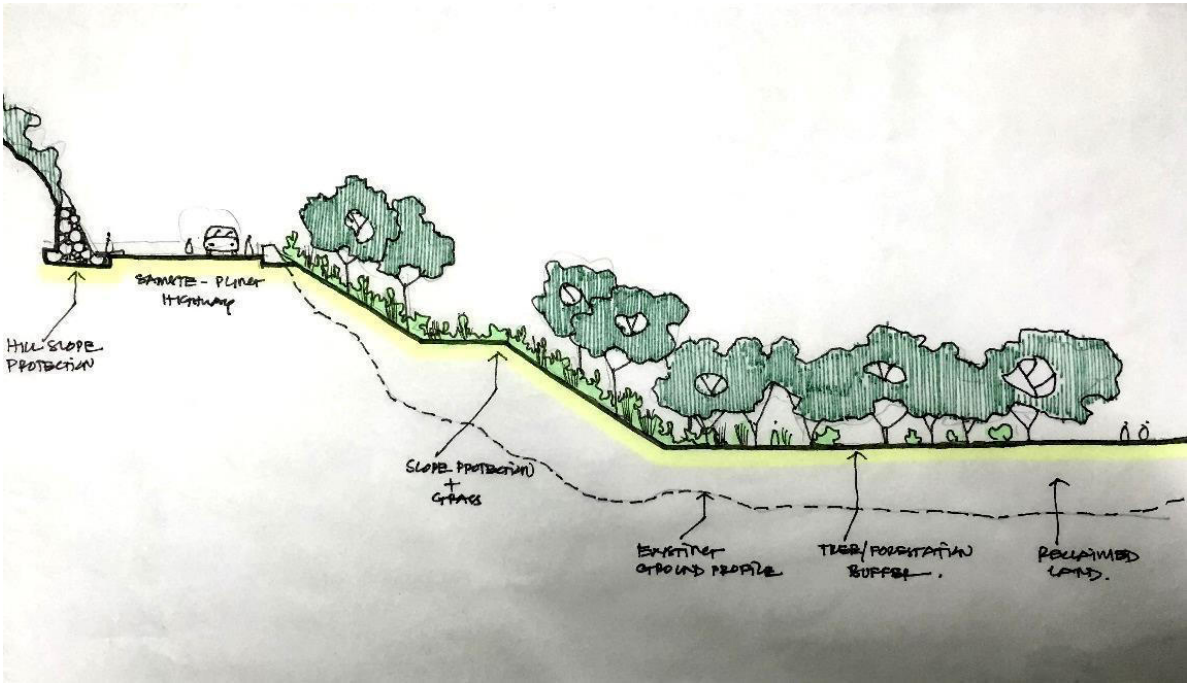
When vetiver roots interact with the soil in which it is grown, a new composite material comprising roots with high tensile strength and adhesion embedded in a matrix of lower tensile strength is formed. Vetiver roots reinforce the soil by transfer of shear stress in the soil matrix to tensile inclusions. In other words, the shear strength of the soil is enhanced by the root matrix (Styczen and Morgan, 1995). Vetiver roots are very strong with high mean tensile strength of 75 MPa or approximately 1/6th of strength of mild steel. When the dense and massive root networks act in unison, they resemble the behavior of soil nails normally used in civil engineering works. With its innate power to penetrate through hardpans or rocky layers, the action of vetiver roots is analogically likened to 'living soil nails' by the author (Hengchaovanich, 1998).

Figure 9-27: Existing site condition requiring protection



Proposed treatment for hill slope stabilization:

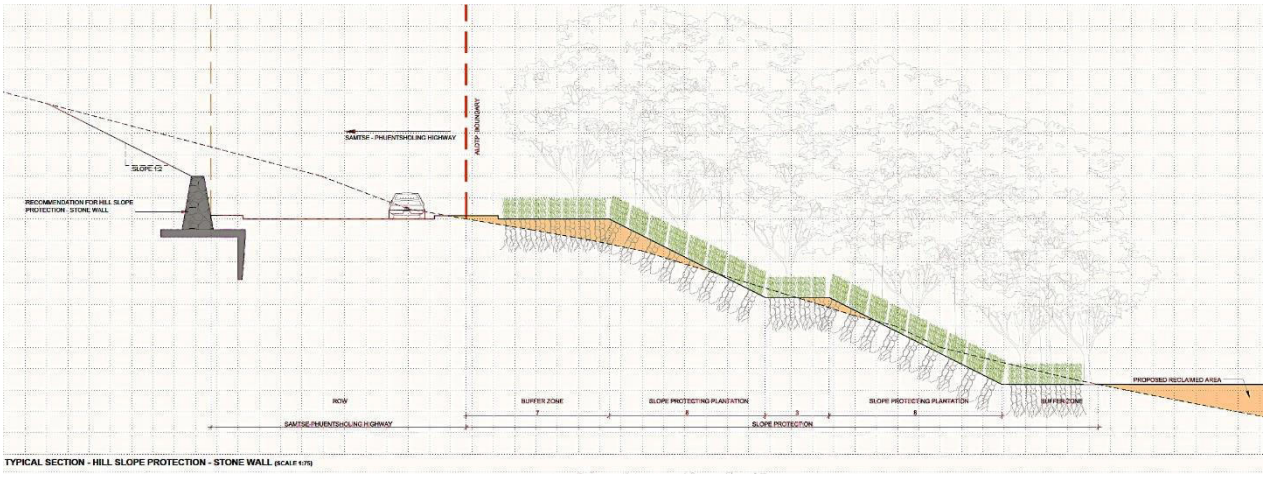
Figure 9-28: Section through western boundary of Zone A.



Evolution of the Landscape Design Strategy

The landscape design strategy involves creating terraced slopes over the existing random slopes at site. The slopes are then planted with vetiver grass which provides a very high degree of stability to the soil against erosion. Additionally, trees will be planted on the slope as well as in the terraces, creating dense bio-diversity habitats.

Figure 9-29: Slope stabilization using vetiver grass plantation



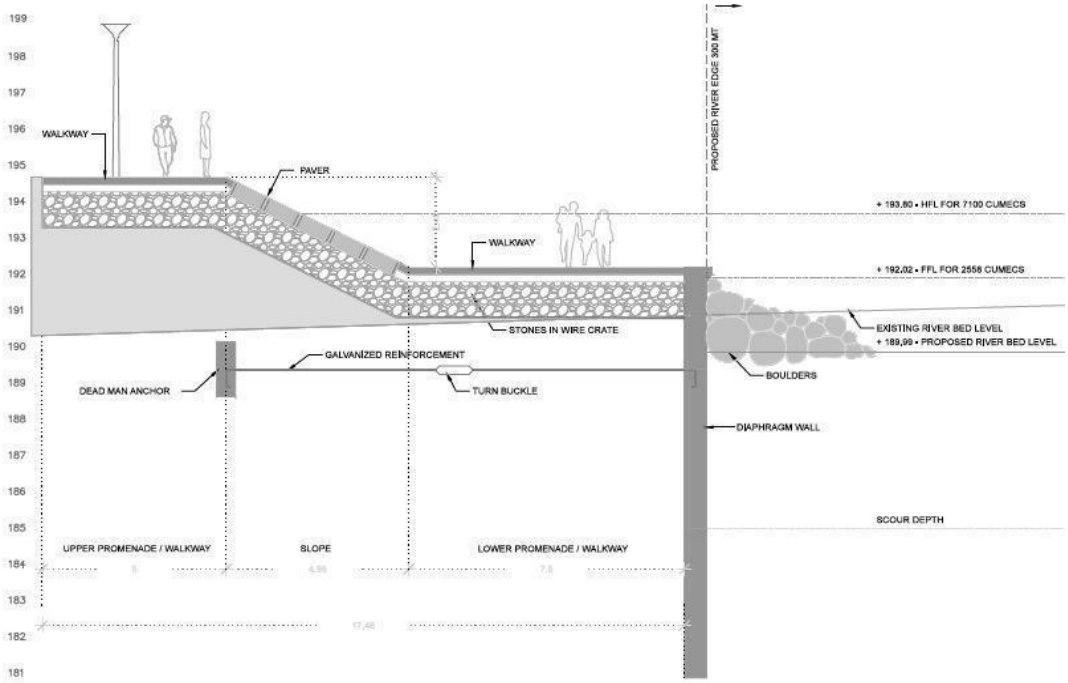
Landscape Strategy for the higher level sloped embankments of river training.

Although this aspect does not figure in the initial site conditions for Landscape Analysis, this input arises as a part of the ecological requirement for the stabilization of the sloped embankment of river training. The sloped embankment needs sustainable protection that is effective as well as aesthetically pleasing.

Evolution of Landscape Strategy for the embankment slope stabilization:

The initial structural design for river embankment is shown below:

Figure 9-30: Initial structural design for river embankment



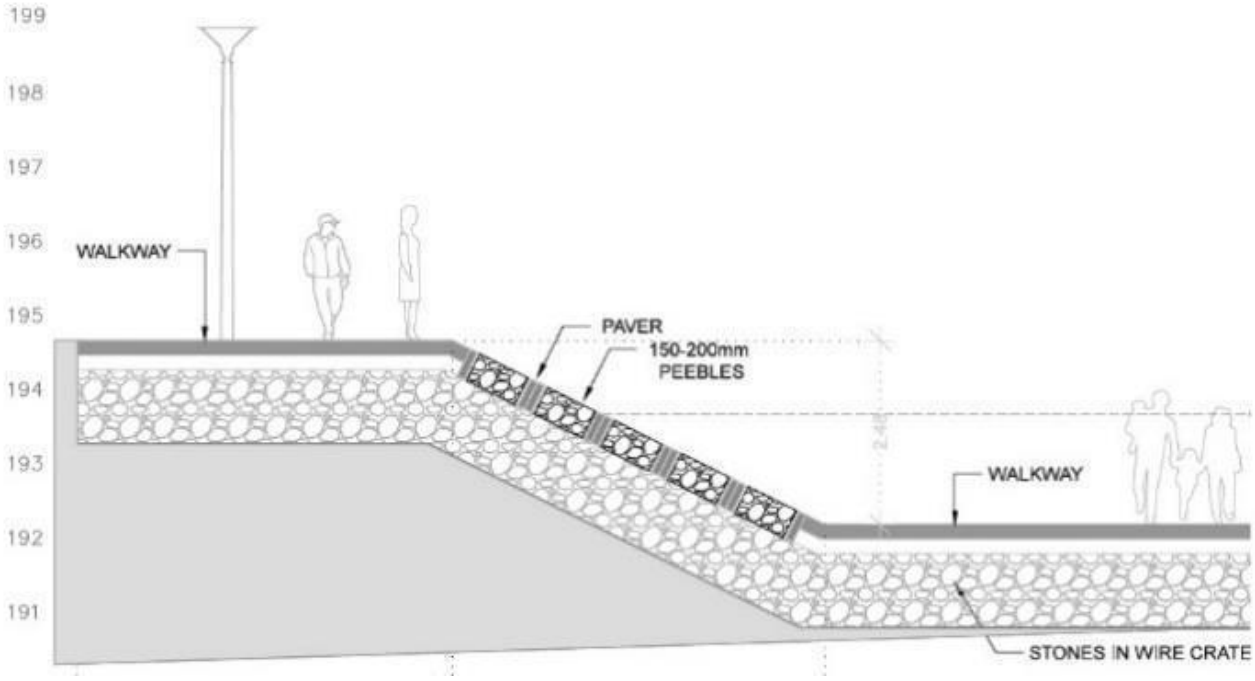
As evident, the embankment above the FFL for 2558 cumecs has a sloped profile. It has the dual reinforcement of the gabion wire crates below and the precast concrete blocks above. However, such a large expanse of hardscape stretching on either side of the river will have limited aesthetic appeal. It will also create pocket heat islands along the river that will diminish the experience of walking along the upper

and lower promenades in the summer season. Also, the logistics of handling and installing such heavy precast concrete blocks of 1000 X 1000 X 250 mm and aligning them perfectly over the gabion crates can prove particularly challenging.

In order to break the monotony of the hardscape consisting of precast concrete blocks, a second option is considered where the blocks have 800mm dia. holes in them. This will help create blocks which are lightweight, and the logistics of handling and installation will become very manageable.

These holes can be filled with large decorative pebbles ranging from 150-250 mm dia., after the precast concrete pavers have been placed over the gabion wire crates. This is indicated in the Figure 9-31.

Figure 9-31: Second stage structural design for river embankment.



This design will provide a break in the monotony of the texture, but will not take care of the local heat island effect. The water velocity could dislodge these decorative pebbles during such high flood conditions. This may result in periodic maintenance of replacing these dislodged decorative pebbles after high flood conditions, which is not an option.

Further enhancements, in the treatment of the sloped embankment that can take care of these shortcomings, will be required. This design, while being an improvement over the use of precast pavers with pebble infill, does not in itself, have the potential of being sustainable in the long run.

Bio-stabilization of sloped embankment:

The following special conditions will exist in the sloped embankment:

- The precast concrete pavers sit on the gabion wire crates filled with boulders.
- The boulders will have interstices, which will be filled with garden soil.
- The thickness of the precast concrete pavers is only 250mm. The depth of planting in the 800mm dia. pocket in the block will be limited to 250mm.
- Natural ground is situated only below the gabion layer, which is 1000mm below the planting layer. Planting species should have roots that penetrate to such depths.
- After exploring several options for plants that can fulfill these special conditions, the Vetiver System is recommended as the ideal solution.

The Vetiver System (VS), which is based on the application of vetiver grass (Vetiveria zizanioides L Nash, now reclassified as Chrysopogon zizanioides L Roberty), is the only planting system that fulfills all the above design recommendations. The Vetiver System (VS), which is based on the application of vetiver grass (Vetiveria zizanioides L Nash, now reclassified as Chrysopogon zizanioides L Roberty), was first introduced by the World Bank for soil and water conservation in India in the mid-1980s. While this application still plays a vital role in agricultural land management, R&D conducted in the last 20 years has

clearly demonstrated that, due to vetiver grass' extraordinary characteristics, VS also has important application as a bio-engineering technique for steep slope stabilization, wastewater disposal, phyto-remediation of contaminated land and water, and other environmental protection purposes.

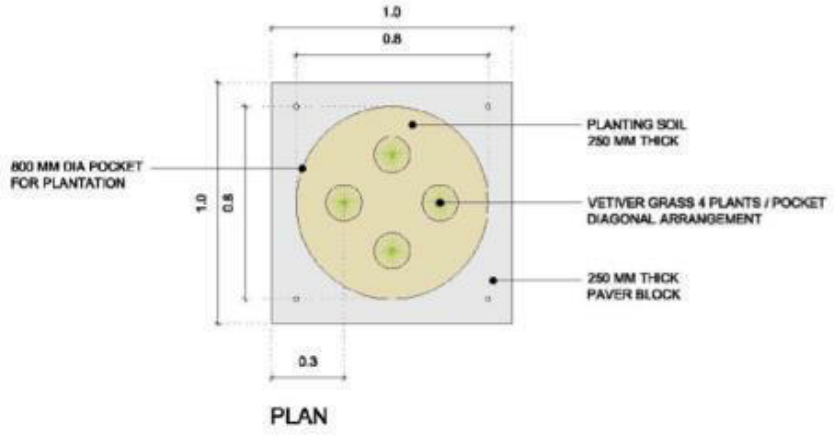
It is proposed the Vetiver grass be used to stabilize the sloped embankment between the upper and lower walkways of the river training. Vetiver will be planted in the 800mm dia. Pockets in the 250mm thick paver blocks.

Advantages:

- Vetiver grass does not have stolon or rhizomes. Its massive finely structured root system that can grow very fast, in some applications rooting depth can reach 3-4m in the first year. This deep root system makes Vetiver plant extremely drought tolerant and difficult to dislodge by strong current.
- Stiff and erect stems, which can stand up to relatively deep water flow. Highly resistant to pests, diseases and fire.
- A dense hedge is formed when planted close together acting as a very effective sediment filter and water spreader.
- New shoots develop from the underground crown making Vetiver resistant to fire, frosts, traffic and heavy grazing pressure.
- New roots grow from nodes when buried by trapped sediment. Vetiver will continue to grow up with the deposited silt eventually forming terraces, if trapped sediment is not removed.

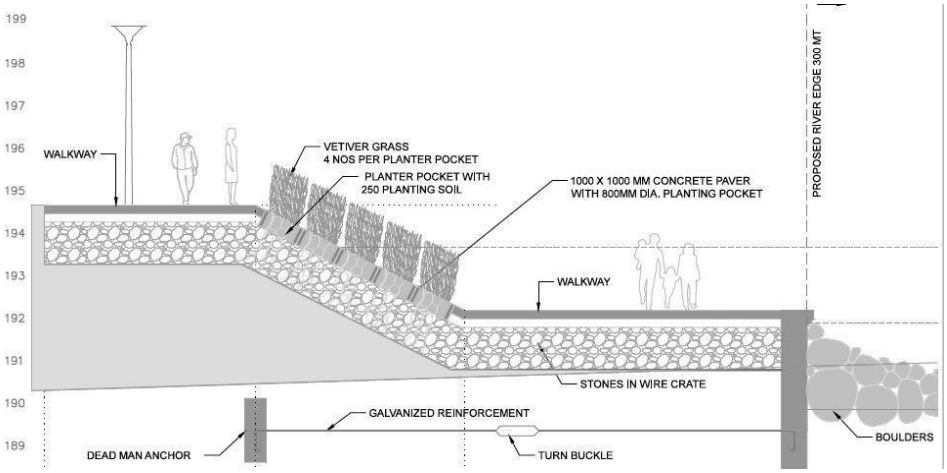
The planting of the Vetiver shoots will be done at the density of 4 per pocket of 800 mm dia. planted in the shape of a diamond as shown in the plan and section below.

Figure 9-32: Planting layout for vetiver in the precast concrete blocks



Final design incorporating Vetiver plantation

Figure 9-33: Design incorporating vetiver plantation



Examples of Vetiver use in soil stabilization

Picture 1: Vetiver grass root system

Picture 2: Vetiver grass root 6 months grow[8]

Picture 3: Vetiver grass planting on riverbank

Picture 4: Vetiver grass one month growth

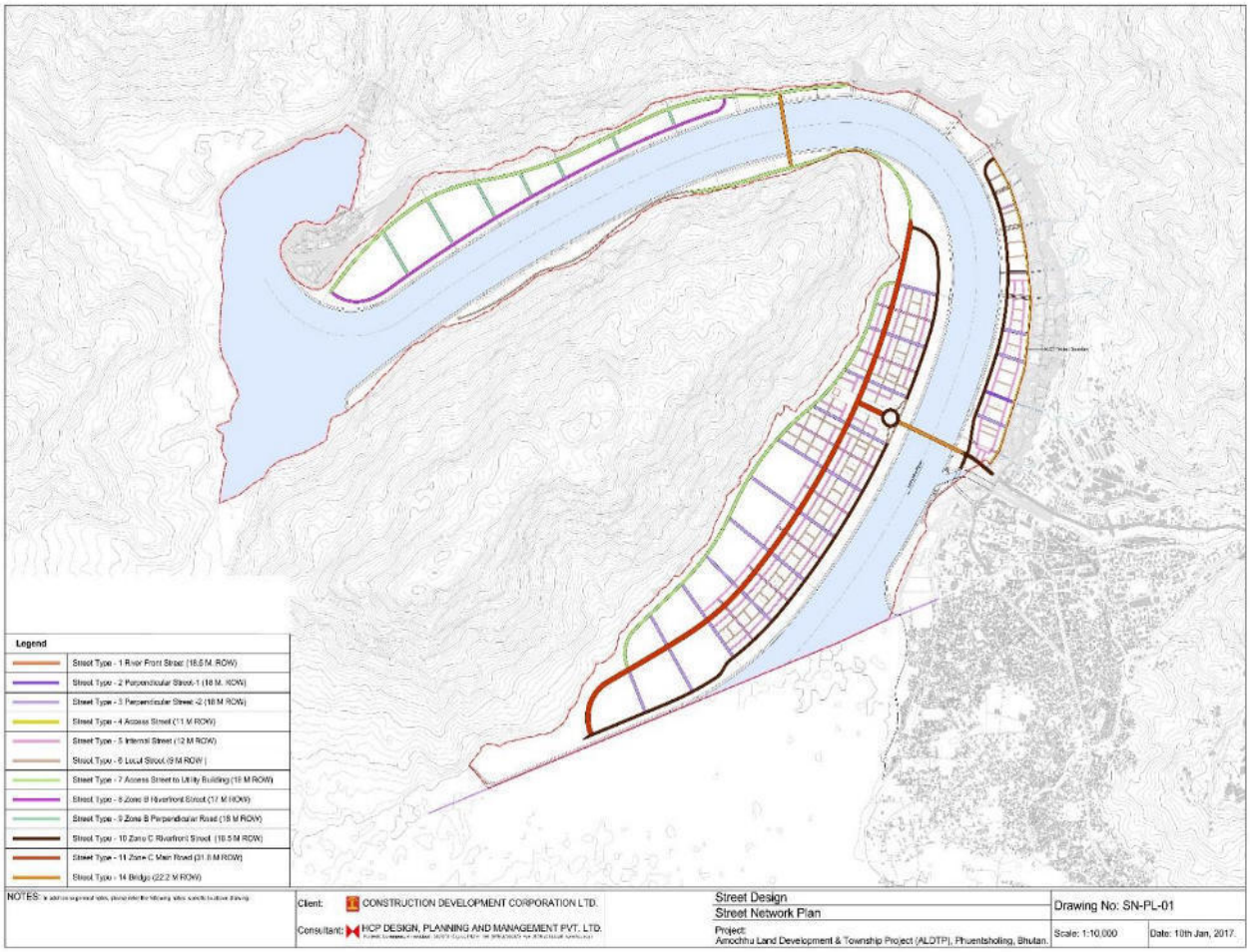
8 Vetiver Grass: A Thin Green Line against Erosion. National Academy Press, Washington DC, USA

Appendix 35:
Road Network

Appendix 35: Road network

As the urban areas redevelop and expand to accommodate future growth, the transportation network will need to be improved or expanded to serve these areas. The road network map can be shown as below in Figure 9-34

Figure 9-34: Road Network Map



40M Right of Way Street Section

Purpose

Designed to be a Major Arterial Street it is defined as Riverfront Street. It is intended to carry major traffic connecting Zone A and Zone C. It shall have retail shopping experience along with few important office buildings and will form an important part of ALDTP project skyline.

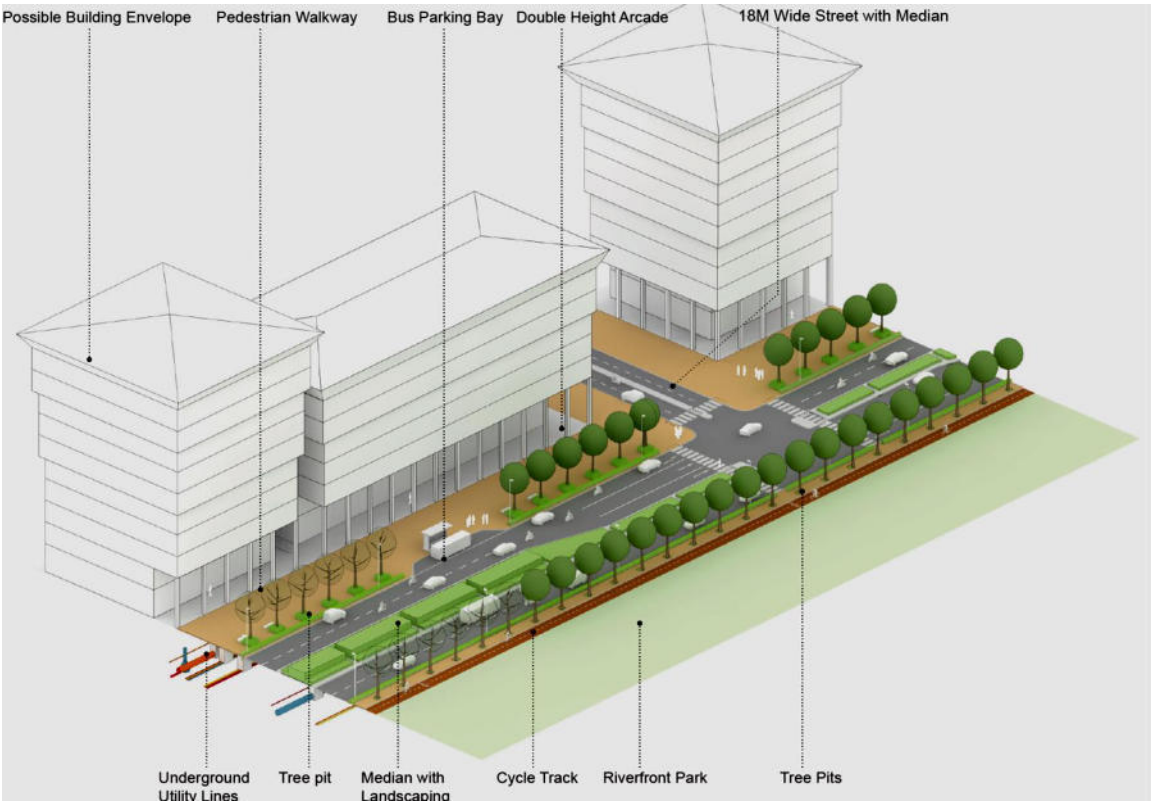
Location - Parallel to Riverfront Park in Zone C

Typical Design Parameters - Bus parking bays, Projection zone from building to accommodate building projections as well as utility chambers, Underground utilities, Landscape Design criteria, 2 Way Cycling lane, Wide median to accommodate Public Transport in future need.

Detail Design and Considerations -

- 40m street section is detailed with 2 way carriage way, 7m each.
- Pedestrian walkways will be detailed to integrate manhole opening with surface paving.
- Tree pits and other landscape element shall be detailed based upon landscape guidelines
- Projection zone of 3m is considered which shall have accommodated building projecting outward as per traditional architectural guidelines and also integrate the manhole chamber of underground utility lines.
- Street will be typically made from M-30 Grade Cement Concrete.
- Tree pits and Street lights are aligned following a specific grid of 6m and 30m c/c.
- A dedicated 2 way cycling lane shall run along the edge of Riverfront Park and Riverfront Street.

Figure 9-35: Isometric Street view illustrating the visual character of 40M Street Section



30M Right of Way Street Section

Purpose - Designed to be a Minor Arterial Street it is defined as Main Street. It shall be a street with regular commute between neighborhoods connected with a continuous retail arcade experience with uses as permissible in DCR. It shall be mixed use and comprise residential as well small commercial frontages which can support residential neighborhood. It connects 2 important nodes, Cultural Center and Health care, providing a unique experience

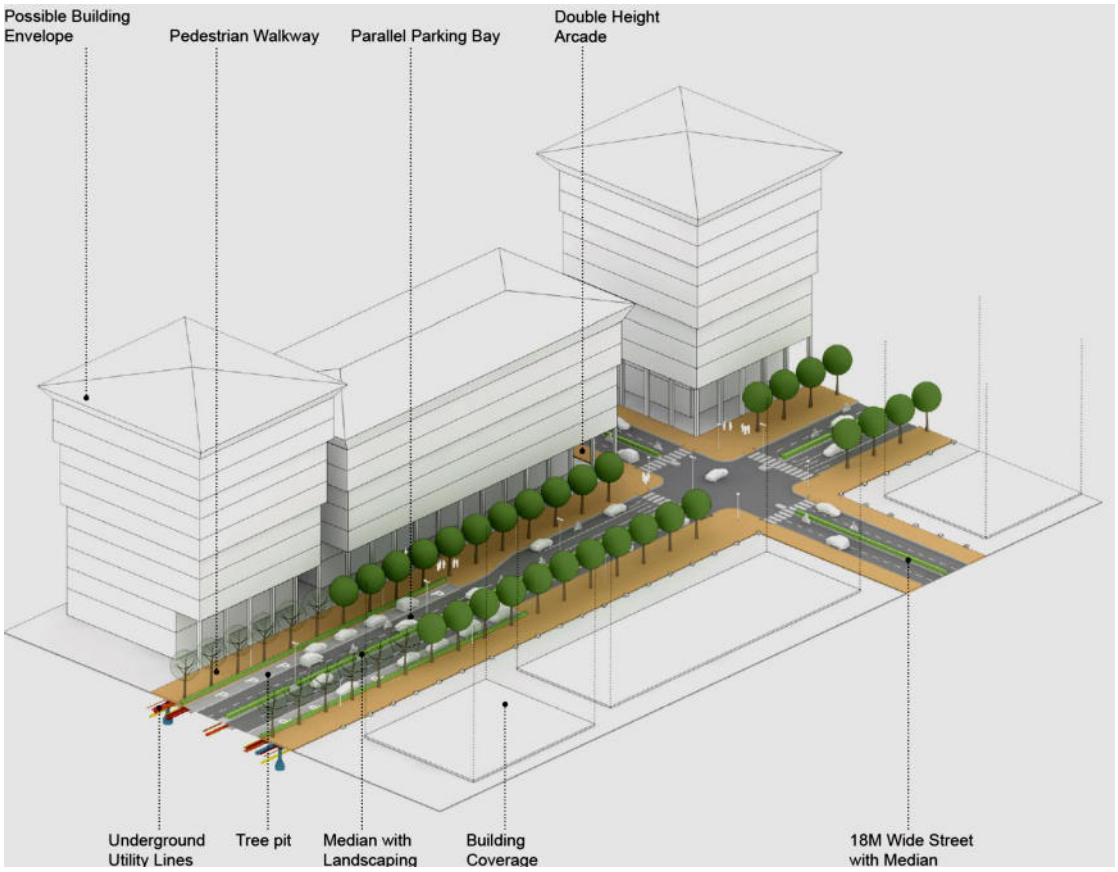
Location - Parallel to Riverfront Street.

Typical Design Parameters - Parallel Parking Bays, Projection zone from building to accommodate building projections as well as utility chambers, Underground utilities, Landscape Design criteria.

Detail Design and Considerations -

- 30M street section is detailed with 2 way carriage way, 4.5M each with additional 2.5M for parallel Parking bays.
- Pedestrian walkways will be detailed to integrate manhole opening with surface paving.
- Tree pits and other landscape element shall be detailed based upon landscape guidelines
- Projection zone of 3M shall accommodate building projecting outward as per traditional architectural guidelines and also integrate the manhole chamber of underground utility lines.
- Street will be typically made from M-30 Grade Cement Concrete.
- Tree pits and Street lights are aligned following a specific grid of 6m and 30m c/c.

Figure 9-36: Isometric Street view illustrating the visual character of 30M Street Section



24M Right of Way Street Section

Purpose - Designed to be a Major Arterial Street it is defined as riverfront Street similar to 40M Riverfront Street. It shall be a street with regular commute between neighborhoods and more connected with current city and Amochhu LAP. It shall comprise mixed use with residential as well small commercial frontages which can support residential neighborhoods. It connects 2 Commercial Centers making one of them as a town center.

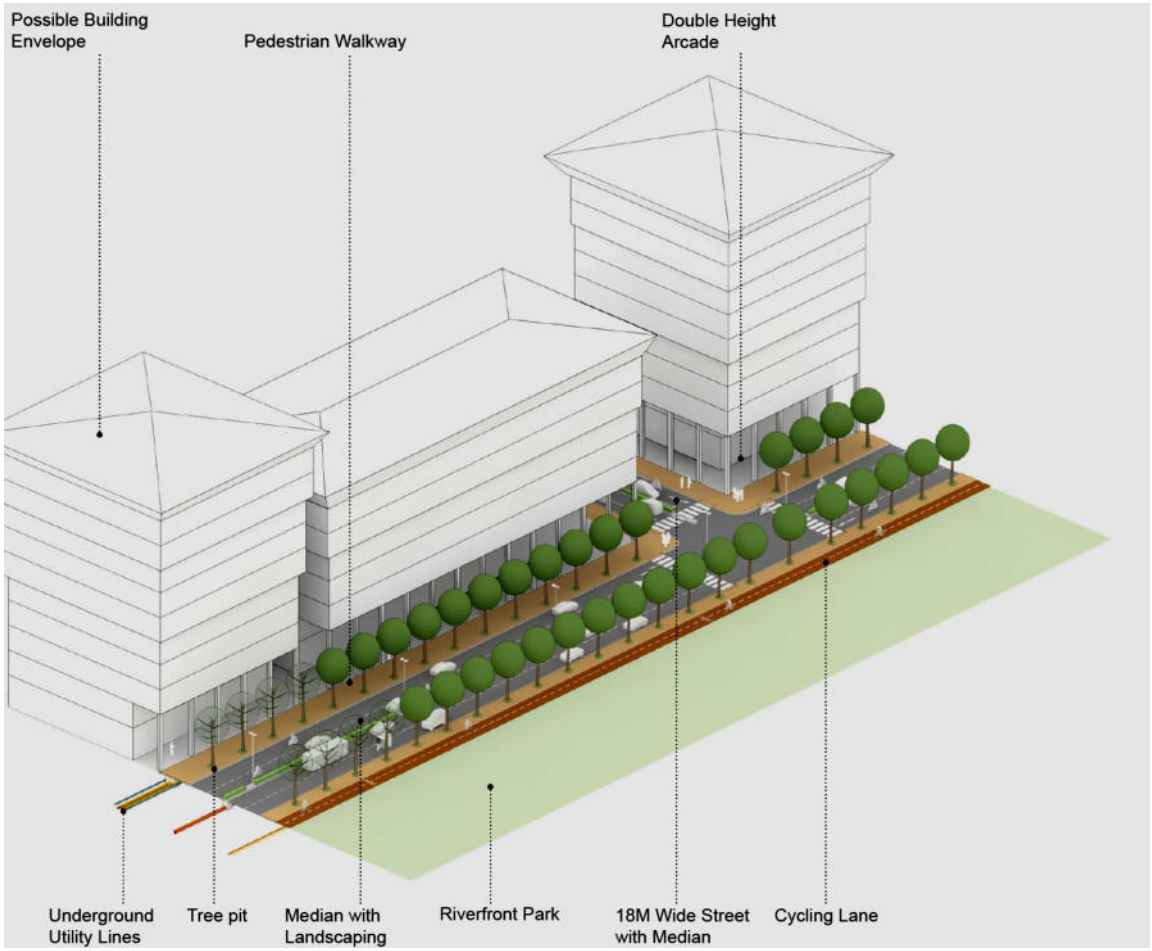
Location - Parallel to Riverfront Park in Zone A.

Typical Design Parameters - Bus Parking Bays, Projection zone from building to accommodate building projections as well as utility chambers, Underground utilities, Landscape Design criteria, 2 Way Cycling lane.

Detail Design and Considerations –

- 24M street section is detailed with 2 way carriage way, 6.0M each.
- Pedestrian walkways will be detailed to integrate manhole opening with surface paving.
- Tree pits and other landscape element shall be detailed based upon landscape guidelines
- Projection zone of 3M shall accommodate building projecting outward as per traditional architectural guidelines and also integrate the manhole chamber of underground utility lines.
- Street will be typically made from M-30 Grade Cement Concrete.
- Tree pits and Street lights are aligned following a specific grid of 6m and 30m c/c.

Figure 9-37: Isometric Street view illustrating the visual character of 24M Street Section



18M Right of Way Street Section

Type - 1: 18M ROW Street Section with Median

Type - 2: 18M ROW Street Section without Median

Purpose - Designed to be a Major Street, it is defined in the Master Plan as Neighborhood Street. It shall be a street with regular commute between neighborhoods, with uses as permissible in DCR. It shall be a residential street to support all the residential neighborhoods within the Master Plan. 18M Street have been conceptualized. One with median which will be more urban in nature whereas other one without median, with more landscaped and natural features supporting it.

Location - Perpendicular to Riverfront Street and Main Street

Typical Design Parameters - Parallel Parking Bays, Projection zone from building to accommodate building projections as well as utility chambers, Underground utilities, Landscape Design criteria.

Detail Design and Considerations -

- 18M street section is detailed with 2 way carriage way, 4.5M each with additional 2.5M for Parallel Parking bays in the road with median.
- Pedestrian walkways will be detailed to integrate manhole opening with surface paving.
- Tree pits and other landscape element shall be detailed based upon landscape guidelines.
- Projection zone of 3M shall accommodate building projecting outward as per traditional architectural guidelines and also integrate the manhole chamber of underground utility lines.
- Street will be typically made from M-30 Grade Cement Concrete.
- Tree pits and Street lights are aligned following a specific grid of 6m and 30m c/c.

Figure 9-38: Isometric Street view illustrating the visual character of 20 M Street Section

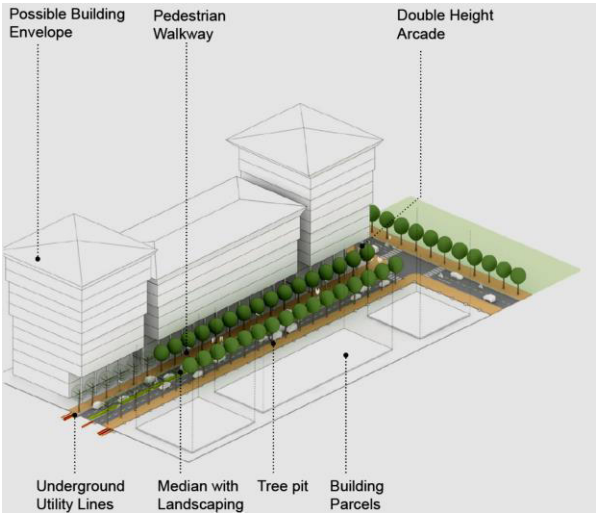
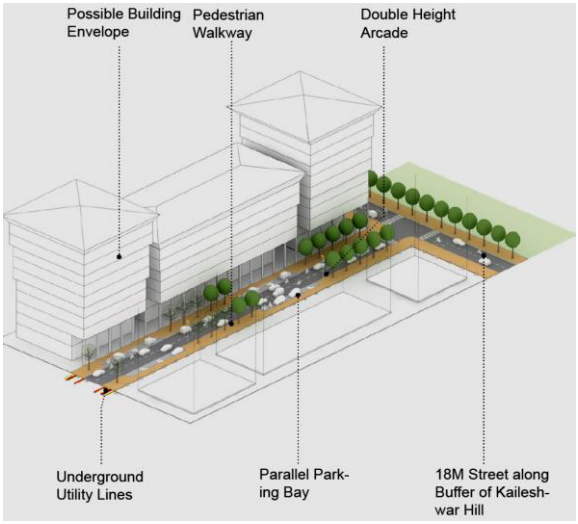


Figure 9-39: 18M Street Section without median showing typical elements considered while designing



18M Right of Way Street Section

Type - 3: 18M ROW Street Section without Median along buffer of Kaileshwar Hill

Purpose - Designed to be a Street carrying more of a highway traffic, it is defined in the Master Plan as Buffer Street. It shall be a street which will allow for service entry to major functions spread across Zone C and Zone E in the Master Plan. It shall be used to support all logistical needs to different functions in the Master Plan. It also connects the Phuentsholing Samtse highway after the crossing the second proposed bridge which will enable moment of heavy vehicle on this road.

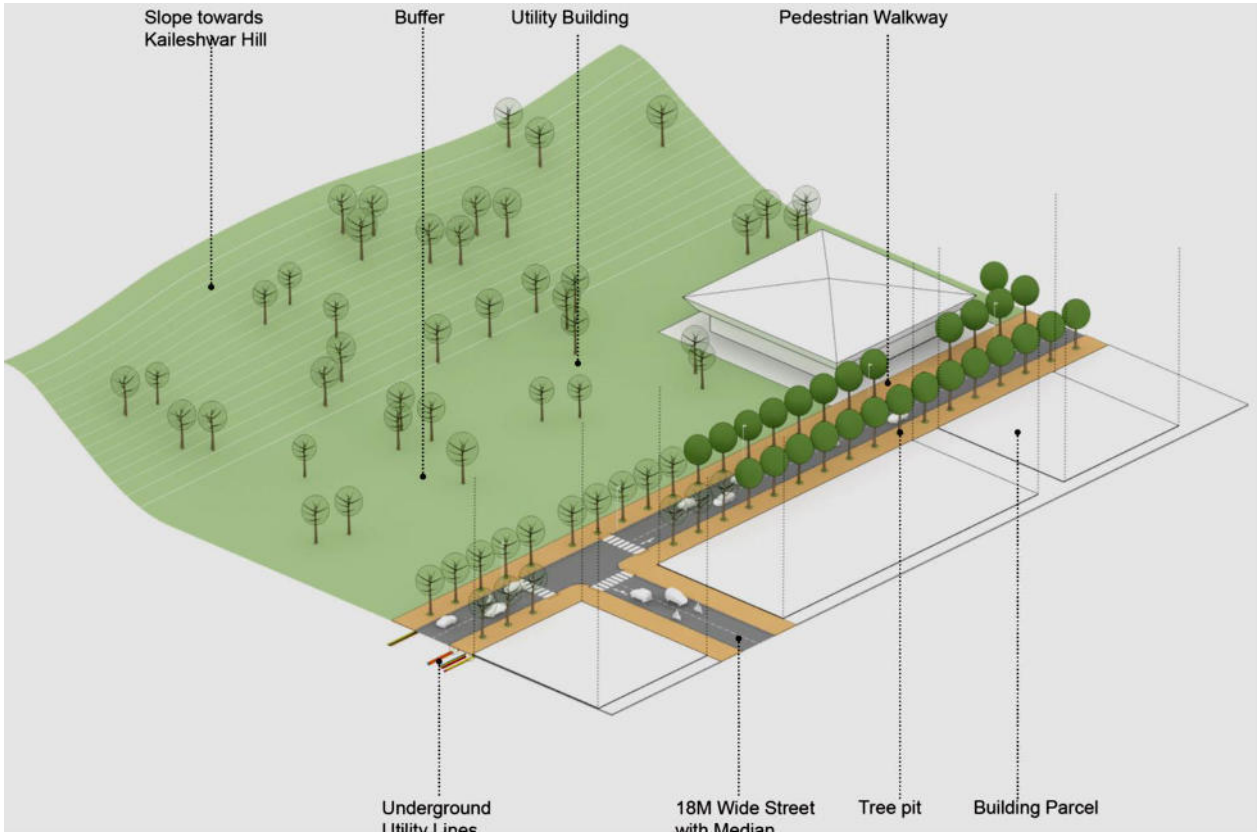
L**ocation -** Perpendicular to Riverfront Street and Main Street.

Typical Design Parameters - Parallel Parking Bays, Projection zone from building to accommodate building projections as well as utility chambers, Underground utilities, Landscape Design criteria

Detail Design and Considerations -

- 18 M Street along the buffer is detailed with 2-way carriage way, undivided of total 7.5M width.
- Pedestrian walkways will be detailed to integrate manhole opening with surface paving.
- Tree pits and other landscape element shall be detailed based upon landscape guidelines. Tree pits will be important as they will support the buffer along Kaileshwar next to the street.
- Street will be typically made from M-30 Grade Cement Concrete.
- Tree pits and Street lights are aligned following a specific grid of 6m and 30m c/c.

Figure 9-40: 18M Street Section along the buffer of Kaileshwar Hill showing typical elements considered while designing



12 M Right of Way Street Section

Purpose - Designed to be a Neighborhood Street, it is defined in the Master Plan as Local Street. It shall be a street which will cater to access to individual plots in the Master Plan.

Location - Within Neighborhood Zone

Typical Design Parameters - Parallel Parking Bays, Projection zone from building to accommodate building projections as well as utility chambers, Underground utilities.

Detail Design and Considerations -

- 12M Street along the buffer is detailed with 2-way carriage way, undivided of total 6.6M width with additional 2.5M of parking bay on either of the side of road or alternate.
- Maximum of 1.5M wide Pedestrian walkway can be provided and they will be detailed to integrate manhole opening with surface paving.
- Tree pits and other landscape element shall be provided at key locations like parking bays.
- Street will be typically made from M-30 Grade Cement Concrete.
- Tree pits and Street lights are aligned following a specific grid of 6m and 30m c/c.

09 M Right of Way Street Section

Purpose - Designed to be a Neighborhood Street, it is defined in the Master Plan as Local Street. It shall be a street which will act as a service street for Riverfront Street and Main Street.

Location - Within Neighborhood Zone

Typical Design Parameters - Parallel Parking Bays, Projection zone from building to accommodate building projections as well as utility chambers, Underground utilities.

Detail Design and Considerations -

- 09M Street along the buffer is detailed with 2-way carriageway, undivided of total 6.6M width.
- Maximum of 1.2M Pedestrian walkways will be provided with integrated surface paving and manhole chambers
- Street will be typically made from M-30 Grade Cement Concrete.
- Tree pits and Street lights are aligned following a specific grid of 6m and 30m c/c.

Appendix 36:
Bridge

Bridges form an integral and essential element of the proposed township. They will not only connect Phuentsholing with the proposed township, but also provide access to open public spaces.

Location

Bridge at upstream connecting Zone B, Zone E and Phuentsholing Samtse Highway

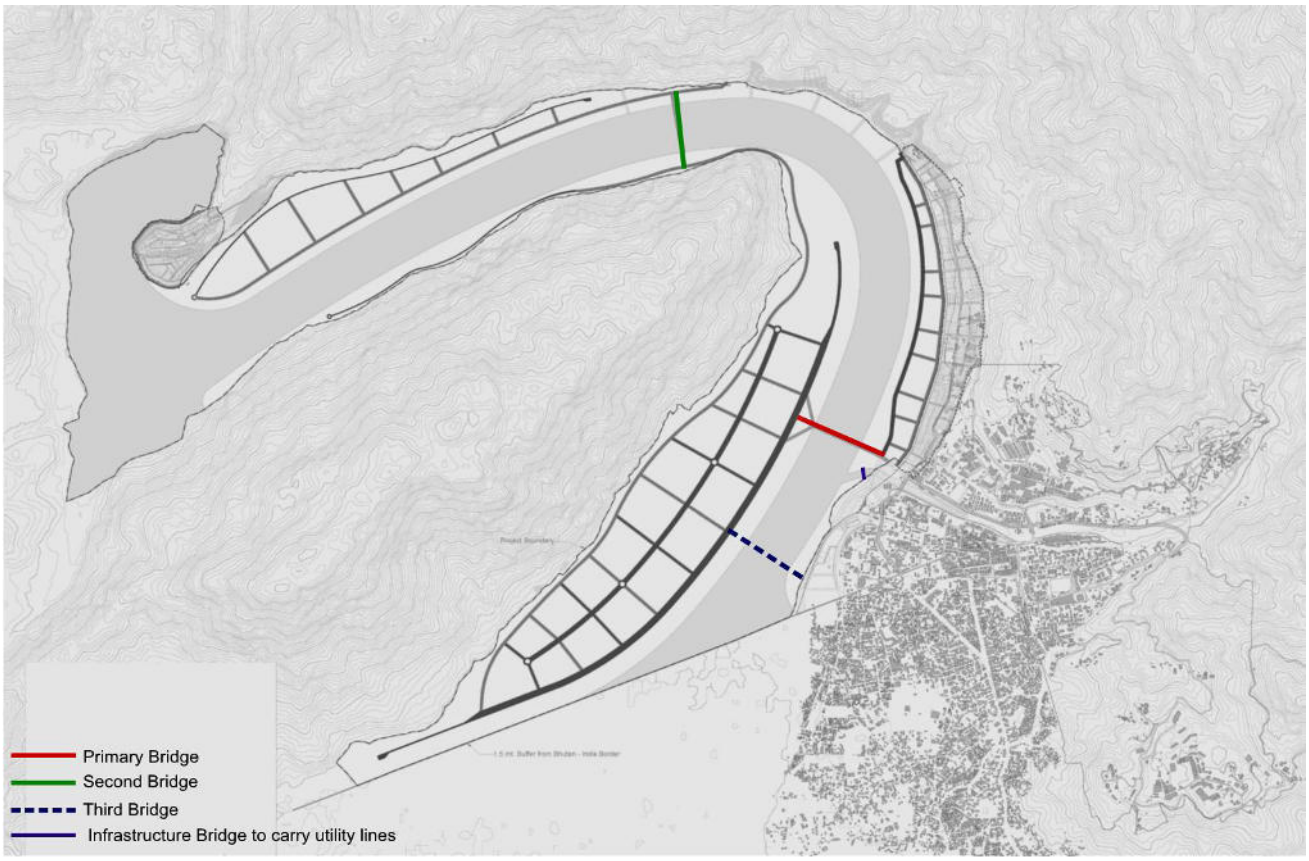
Bridge at downstream connecting Zone C, Zone A, Existing city and Amochhu LAP (figure 1)

Typical Design Parameters - Maintaining 1:25 slope for bridge approach and termination, Continuous Riverfront Park through under space of bridge, approx. 22M ROW for detail design, Provision for Service/Utility lines, Minimum 1.5M Free board above HFL as per IRC 005-1998, Section 106.2.1

Detail Design and Considerations -

- Bridge is designed with approx. 22M ROW 2 lane both side of 6.6m each divided by 1.2M median. Bridge shall have a dedicated cycle track of 0.9M for one way movement on both side.
- Bridge shall have provision for carrying service/utility lines which are required to cross between, Zone A, Zone C and existing city.
- Landing of bridge shall maintain minimum slope of 1:25 to arrive at a gradual gradient as required for vehicular traffic movement.
- Under space of bridge shall be designed to make it usable, it will also facilitate a continuous Riverfront Park.
- Approx. 50M free space will be provided between every span of 2 columns

Figure 9-41: Bridge Location in ALDTP



Span of the bridge:

The proposed bridge is required to span across 300m of the Trained River width. This 300m could be a free span, or divided up into multiple parts. The extent to which the bridge can span depends on the type of bridge proposed. Few examples are illustrated below.

RCC Deck Bridge with pylons would break the 300m span into multiple smaller spans. However, this would result in high afflux at the upstream side of the bridge. Too much afflux during floods could cause water to flood the embankments.

Suspension bridge would require far fewer pylons. However, to make this work, the pylons will have to be very high.

Cable Stayed Bridge, similar to suspension bridge, could be built with far fewer pylons. However, they would also require being very high. Variation of this bridge exists in form of eccentric cable stayed and cantilever spar cable stayed bridge. Since these have fewer elements, are require taller pylons, they appear aesthetically iconic.

Extra dosed bridge can span large distances without requiring high pylons. The suspension, cable stayed and extra dosed bridge types are capable of free spanning long distances thereby reducing the dependence on numerous pylons, thus, the afflux created on the upstream side is far smaller, making the embankments safer.

Bridge deck termination level: Once the bridge type is chosen, the locations where it terminates needs to be closely detailed. Sufficient height for pedestrians and vehicles to cross underneath must be provided. This can be done in two ways:

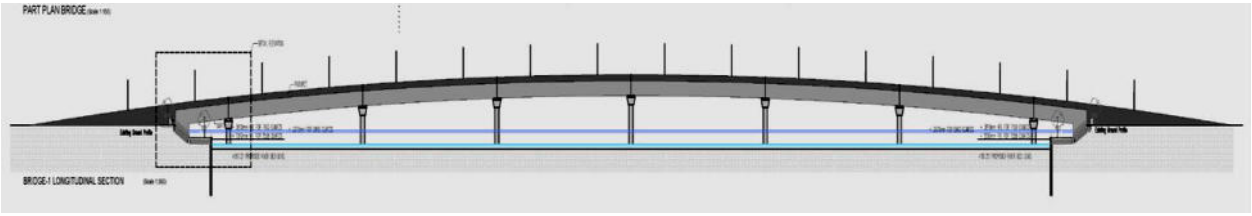
The bridge on/ off ramp can terminate the top of embankment level. In this case an underpass will be constructed to allow free flow of pedestrians and vehicles.

The soffit of bridge deck is a few meters above top of embankment level allowing free flow of pedestrians and vehicles at grade. However, in this case, the on/off ramp will extend for a certain distance based on the relevant slope as per adopted road design standards.

Recommended bridge type best suited for ALDTP

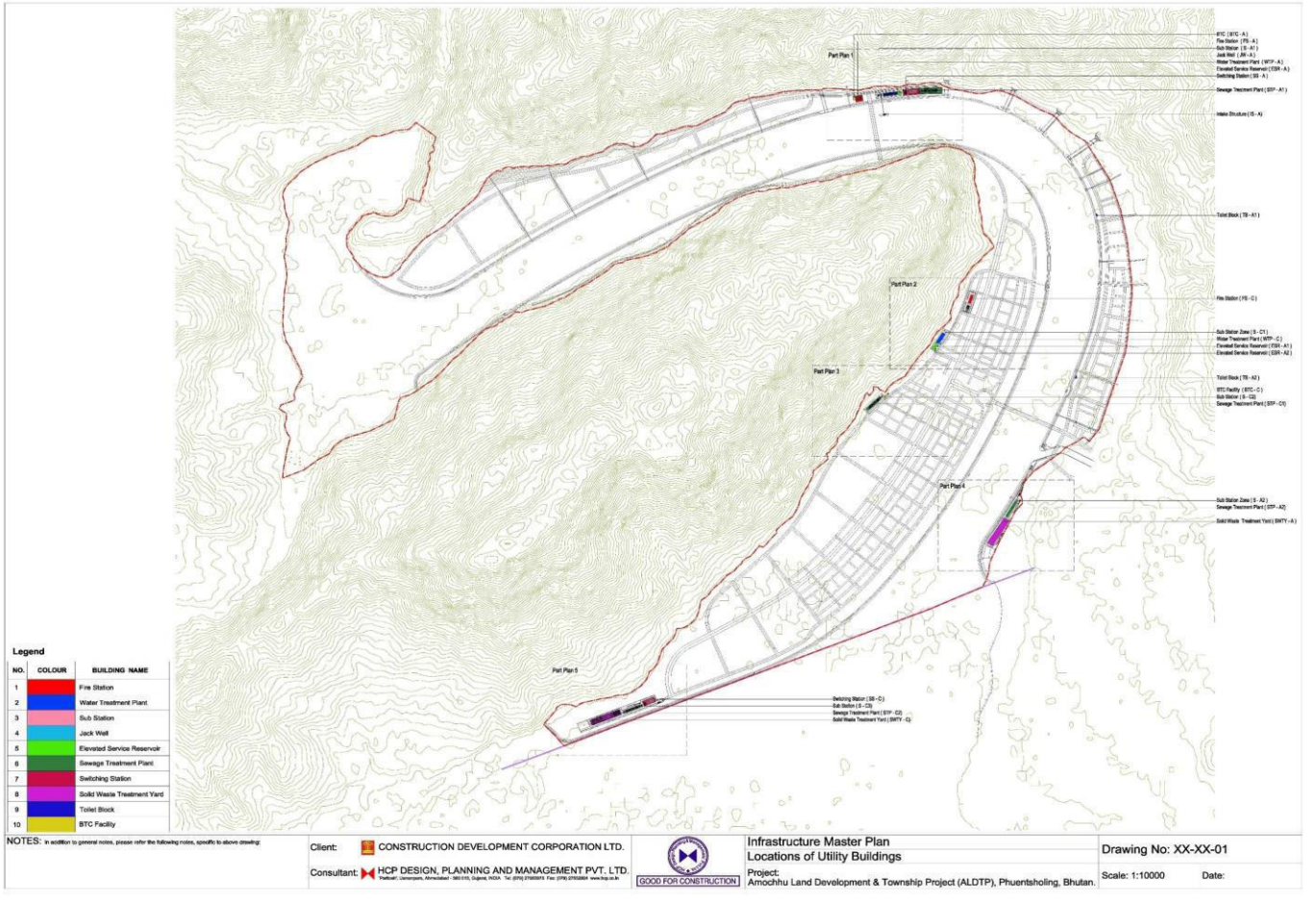
Based on the above listed bridge designs and financial implications to the overall project the below mentioned bridge has been considered as best suited for ALDTP after detailed discussions with environmental, financial experts and inputs from client.

Figure 9-42: Proposed R.C.C. Bridge Deck Structure connection Zone A and Zone C



Appendix 37:
Infrastructure Master Plan showing location of utilities

Appendix 37: Infrastructure Master Plan showing location of utilities



The forecasting and early-warning system is proposed to anticipate the occurrence of flooding, warning the population and taking the measures necessary to reduce losses due to flooding. Flood warning system is a way of detecting threatening events in advance. This enables the public to be warned so that actions can be taken to reduce the adverse effects of flood. As such, the primary objective of a flood warning system is to reduce adverse effects of flood & damages to the property & life. The purpose of a flood warning service is to detect and forecast threatening flood events so that the public can be alerted in advance and can undertake appropriate responses to minimize the impact of the event and reduce the massive loss to the property & life.

A real-time forecasting and warning system involves the following:

- System for collecting and transmitting weather and hydrological information; monitoring system over computerized network, satellite or radar and transmission of that information to the forecasting center.
- Forecasting center: reception and processing of information; model for forecasting, evaluation and warning.
- Civil defense: prevention programs: education, warning map, critical places, etc.; warning to public systems: schools, hospitals, infrastructure, etc.; warning of population at risk, removal and protection of population affected during the emergency or by flooding.

Forecasting Centre	⇒	Data reception and processing system
	⇒	Real time level forecasting model
	⇒	Forecasting assessment & early warning
Civil Defense	⇒	Preventive programs
	⇒	Warning of public systems
	⇒	Warning to population

This system operates in three distinct phases, namely: prevention, warning and mitigation. Prevention consists of activities to minimize flooding when it occurs. This involves training the Civil Defense team, educating the public through information campaigns, the warning map identifying areas flooded during the occurrence, planning of the areas to receive the affected population, etc.

Warning is the phase of handing the actual occurrence of the rainfall events as follows:

Monitoring levels: level from which technical staff monitor the development of the flood water. At this point, a warning is issued to Civil Defense of the possibility of a flood event. Real-time level forecasting is just beginning;

Warning levels: these are the levels from which the relevant agencies forecast that a potentially damaging water level will be attained within the time horizon of the forecast. Next, Civil Defense and the municipal authorities regularly receive the forecasts for the city;

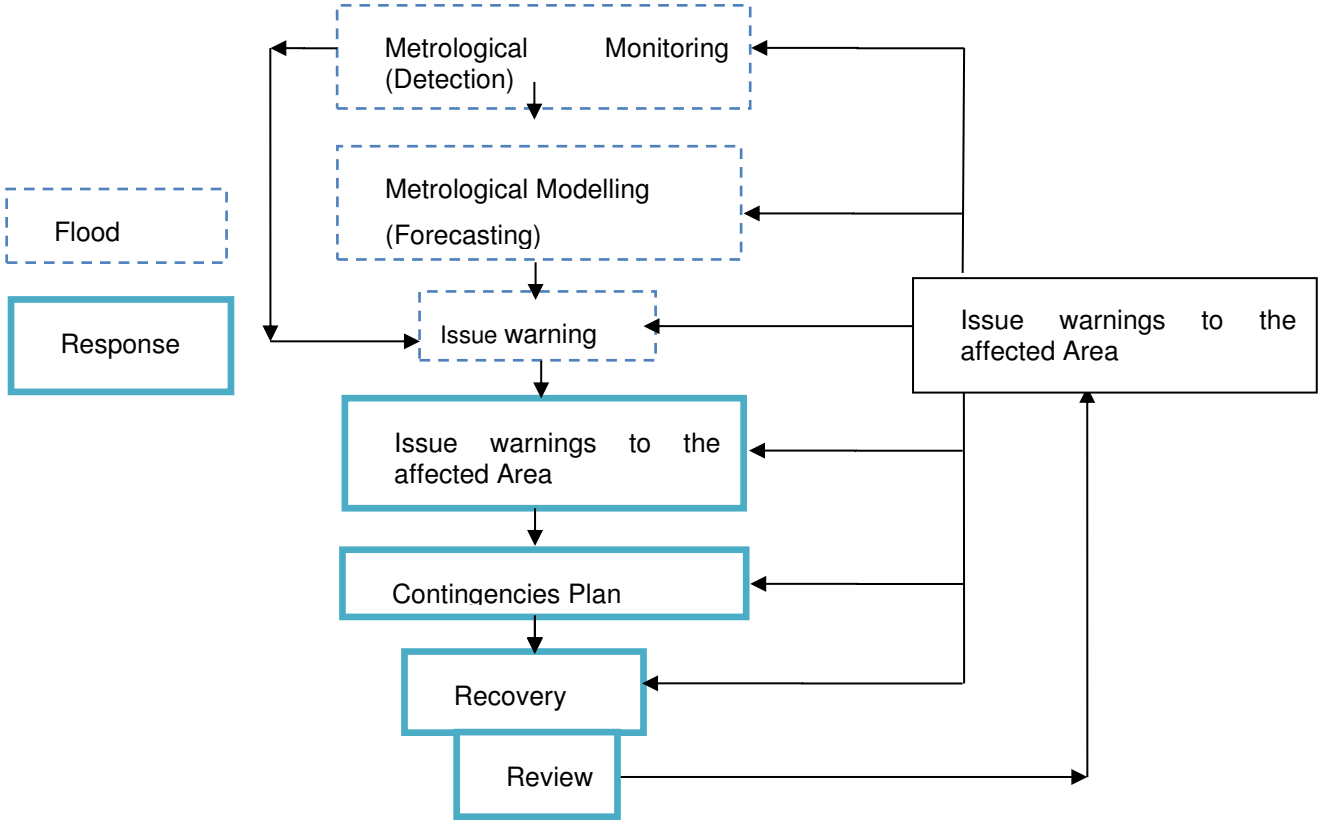
Emergency levels: It is the level at which material damage and human losses occur. The information is passed on to the population. This information that the population receives are the current and forecasted levels and the probable error range produced by the models;

The mitigation phase concerns the measures to be taken to reduce the population's losses when flooding occurs. Includes action such as sealing off streets and areas at risk, evacuating the population and animals, and protecting places of public interest.

The warning map needs to be prepared with water level values for each zone of the risk area. On the basis of the absolute water level of the zones, this value has to be converted into the water level referred to the staff gauge. This means that, when a gauge is indicating a given water level value, the population will know how much higher it has to go to flood each zone. This helps to deal with flooding as it occurs.

Flood protection and Alarm System

Figure 9-43: Flood Control System

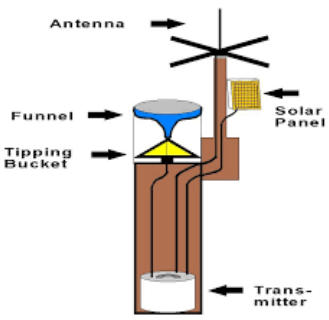


Flood Warning System Components

The flood warning system components are Rain gages, Radio frequency transmission, and ALERT Decoder with digital processing equipment.

Rain Gages: The gages have two basic factions, Sensing and communicating. Sensing involves detection of an event to the extent smallest unit. Communicating involves reporting the event to the user location. The gage assigns a unique identifier to each individual sensor type such as precipitations, temperature, wind speed, relative humidity etc. Radio reporting gages are the widely used. The only disadvantage of this gage is availability of power, for this solar power operated rain gages are also available.

Figure 9-44: Rain gauge stations



Radio reporting Gage

Manual Rain Gage

Rain gages should be placed on the ground, in locations that are uniformly exposed in all directions. The gage has to be positioned away from trees, buildings and other obstructions. The gages shall be installed away from object; this distance shall be double the height of the object. Automated Local Evaluation in Real Time (ALERT) is widely used for Flood protection. ALERT systems are fast, good resolution and very low

operating cost. Most of the communication based platforms are Very High Frequency (VHF) / Ultra High Frequency (UHF). These platforms use the ALERT radio transmission protocol of the events of each sensor in real time.

The available option is manually operated rain gages. These gages are installed in remote areas where the frequency and power is not available. The rain gage is mounted over a steel cylinder open from the top to collect the rain. The rain falls on to the funnel through a screen and from the funnel rain will get collected in to a plastic measuring jar. If the flow meter is connected to the plastic jar, flow will get measured and recorded. If digital flow meters are installed, the data can be transferred to the ALERT.

Proposed system for ALDTP- It is recommended to install rain gages & flow measuring devices on the upstream side of the ALDTP.

Flood Warning System for ALDTP-

The flooding is the frequently observed situation in the vicinity. In order to protect the development and losses due to flooding, it is recommended to provide a minimum Flood control system for the premises as well as giving information to the development on the downstream side of the project area. The flood warning system for the proposed development is comprises of the following main components.

Rain Gauge Station: The hourly rainfall in the catchment area will be recorded at centralized station. The hourly rainfall data will be stored at monitored in order to estimate the flow from the premises. There are 5 rain gauge stations proposed, out of which 2 rain gauges will be installed on the upstream side of the project area and 3 rain gauges within the premises.

Weather Station: A weather station is a facility, either on land or sea, with instruments and equipment for measuring atmospheric conditions to provide information for weather forecasts and to study the weather and climate. Normally temperature, barometric pressure, humidity, wind speed, wind direction. Wind measurements are taken with as few other obstructions as possible, while temperature and humidity measurements are kept free from direct solar radiation, or insolation. There are 5 weather stations proposed (3 within the premises& 2 outside the premises)

River Flow Measurements: Float devices are proposed for indicating the water level in the River basin. These water levels will be monitored.

The layout showing the Flood control system proposed for ALDTP is attached separately. Please refer CUI-FS-03 for details.

Recommended System Components

It is recommended to adopt the following Fire system components for the proposed ALDTP.

- The fire system for the Building shall be developed in line with the guidelines of the City Planning authority. The fire system requirement (like wet riser/ down comer) and the storages (at underground & overhead) shall be designed and provided based on the type of building.
- Fire station shall be proposed in the premises shall comprises of the Main fire station in Zone C & secondary fire station in Zone B.
- Zone C fire station shall be proposed considering the high-rise buildings and high fire rescue staff. The Zone B Fire station shall comprise of the 3 nos. small fire tenders, maintenance bay & staff Quarters along with the Fire storage tank and small administrative office.
- Zone C fire station will be with all the advanced facility. This shall be spaces for Heavy Fire tenders, Fire storage, Maintenance Bay, Administrative Office with spaces for Chief Fire officer, Training, Library, Conference and space for 3 Main Fire Tenders and 1 small fire tender.
- The separate fire department will be formed at city level and the exclusive experts in the field shall be appointed for taking care of the fire system at City level.
- The Flood control system is proposed for ALDTP. The existing Dorokha rain gauge station will be upgraded with the advancement. The flow measuring devices will be installed and river gauging will be carried out frequently. The river discharge and the submergence level will be given to the CMS frequently and the Flood situation will be controlled within ALDTP.
- It is also recommended to install rain gauge station and flood control system in between Dorokha and ALDTP in order to have the better results.

Appendix 39: Anticipated Environmental Impact and Mitigation Matrix

Appendix 40: Landscape Assessment and Strategy

Appendix 41: Social Impact Assessment

Appendix 42: Running and Maintenance Guideline for ALDTP

Appendix 39:
Impact Identification, prediction, amassment
&
Mitigation matrix

Appendix 39: Impact Identification, prediction, amassment and mitigation matrix

EVALUATION OF ENVIRONMENTAL IMPACTS

We have used a method of scale, severity and duration for assessment of environmental impacts as generally described in the international environmental management system (EMS) standard ISO 14001:2015. The system has been calibrated for the proposed ALDTP project. On running the activities through the impact screening tool described in this Section, we arrive at:

- Minor impacting activities: which may (or may not) require suitable mitigation. In case mitigation is required, it is specified after the letters 'MM'. Mitigation measures shall be agreed upon between the contractors / sub-contractors and the project authorities; and the actions specified in the Mitigation Measures, shall be part of the specific Standard Operating Procedures (SOPs) for the activity under discussion.
- Medium impacting activities: These shall require formulation of formal environmental management plans (discussed in Chapter 7) which after implementation, shall be specified in the activity specific SOPs; and
- High impacting activities: **It is required that high impacting activities be mitigated so that their level comes down to the level of medium impacting activities at the minimum**. Once this is done, these too will require formal management plans (also discussed in Chapter 7) after implementation of which, resultant actions shall be demarcated in the SOPs.

The evaluation of impacts on the baseline environment is described below for each developmental activity using a matrix approach. The impact evaluation criteria are given in Table 1. The criteria have been tailored to the project and intentionally kept simple for periodic review reassessments by the project authorities prior to commencement of the activity and as required, periodically. The rationale for the evaluation is provided at the end of each aspect-impact string explaining why a given score is what it is.

The evaluation system that follows is a living document. It is strongly recommended that the scoring criteria be reviewed by the project implementing authorities prior to and during the relevant project stages. Changes if any, must be recorded and subsequent actions (including revisions in management plans and SOPs) be carried out, as appropriate. Basis for Descriptor Values in the Environment Impact Matrix is given in **Table 1:**

Table 1: Basis for Descriptor Values in the Environment Impact Matrix – ALDTP Project, Bhutan

S. No.	Descriptor	Values (Score)	Explanation
1	Type	• Positive • Negative	• Positive: Positive to the Environment • Negative: Negative to the Environment
2	Nature	• Direct • Indirect	• Direct: Directly impacts the environment • Indirect: Indirectly impacts the environment (typically through other media such as air, surface or ground water, soil or terrain)
3	Area of Impact (i.e. scale). Local and regional impacts go into India, downstream.	Within Site (1)	Within Site Boundary
		Study Area (2)	Within Study Area: Study Area (Score: 2)
		Local (3)	Outside the Study Area but within Phuentsholing-Jaigaon area.
		Regional (4)	Beyond Phuentsholing / Jaigaon Area but within 50.0 km of Site Boundary
		National (5)	Impacts felt across the Country
		Global (6)	Can have impacts felt around the World: Global
4	Intensity	Low (1) Medium (2) High (3)	Assessment of intensity (i.e. severity) for low, medium or high degrees of impacts needs competence, which scorers should possess. Relevant opinion of the scorer should therefore be recorded in the remarks column as

S. No.	Descriptor	Values (Score)	Explanation
			justification for the score.
5	Duration	Very Short Term (1)	Up to one month
		Short Term (2)	One month - one season or three months
		Medium Term (3)	One season - one year
		Long Term (4)	Longer than one year
6	Reversibility	Reversible (1)	If, on cessation of environmental impact creating activity, the baseline environmental component being impacted returns to its original state
		Irreversible (3)	If, on cessation of environmental impact creating activity, the baseline environmental component being impacted does not returns to its original state. Irreversible impacts are scaled higher since they indicate a new normal.
7	Significance	• Minor (<20) • Medium (>20<40) (considered as Significant) • High (>40) (considered Highly Significant)	The significance is depending on product (multiplication) of area, intensity, duration and reversibility scores. Following actions are required based on the scoring results: • < 20: **Minor** (Adverse / Beneficial). Does not require EMP but needs to be addressed in Contractor's Standard Operating Procedures (SOPs). • Between >20 to 40: **Medium** (Adverse / Beneficial). Considered 'Significant' and will require formal EMPs without modifying the activity. • >40: **High** (Adverse / Beneficial). High Adverse impacts require the activity to be modified so as to result in lower impact or risk.

It is important to note that each activity need not impact each environmental component. Also, the link between some activities and their impact on environmental components may be absent, tenuous (far-fetched) or de-minimis (so insignificant they would normally not be a source of regulatory interest if brought to regulatory notice). Such cells are left blank with a dash (-).

The environment impact matrix tables for each phase of the project (pre-construction, construction and operations) follow. The color coding used for distinguishing various types of impacts due to the corresponding activities and aspects are shown in **Table 2**

Table 2: Different color coding used for distinguishing various types of impacts due to the corresponding activities and aspects

Color used	Impact Type indicated
	Medium Adverse impact
	High Adverse Impact
	High Beneficial Impact

1.1.1 PRE-CONSTRUCTION PHASE

Pre-construction phase includes the following activities:

- Site access and traffic management (includes security)
- Equipment delivery and assembly (mainly concrete batch mix plants and crusher plants)
- Material storage, work areas and housing for workers
- Providing infrastructure (water, power and similar) for the above

What follows is a list of impacting activities with scoring, mitigation and residual impact estimation based on the discussion provided earlier in this Section.

1.1.1.1 SITE ACCESS AND TRAFFIC MANAGEMENT

Site Access and traffic management related impacts are as mentioned in **Table -3**

Table -3: Site access and traffic management related impacts

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environment Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score/ Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score/ Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
1.1	Preparing roads for access to site and management of traffic	Air	Movement of heavy vehicles for preparing site access roads for further work: dust / gas generation	Negative	Direct	Regional (4)	High (2)	Very Short Term (1)	Reversible (1)	-8: Minor Adverse	Dust from vehicles preparing access roads (less than a month). **MM:** Ensure that road construction up to the construction site are paved (they are not currently). Vehicles to be well maintained so as to not release objectionable fumes; Preparation and implementation of a Traffic management plan so as to ensure smooth traffic flow of project related vehicles as well as other vehicles.	Local (3)	Medium (2)	Very Short Term (1)	Reversible (1)	-6: Minor Adverse	Reduced air pollution due to implementation of mitigation measure
1.2		Water Quality	Water runoff to the river during road construction activities	Negative	Direct	Local (3)	Low (1)	Very Short Term (1)	Reversible (1)	-3: Minor Adverse	Muddy water generated due to road construction activities like compaction, equipment cleaning etc. may runoff and pollute the river. **MM:** Provision of barriers, drains to arrest such water runoff; adoption of water conservation measures right at the start of the project	Study Area (2)	Low (1)	Very Short Term (1)	Reversible (1)	-2: Minor Adverse	Reduced water pollution due to implementation of mitigation measure
1.3		Noise	Equipment operation: noise	Negative	Direct	Local (3)	Low (1)	Very Short Term (1)	Reversible (1)	-3: Minor Adverse	Noise during construction. **MM:** to maintain vehicles as per their maintenance schedule; To limit access road construction working hours to daytime only	Local (1)	Low (1)	Very Short Term (1)	Reversible (1)	-2: Minor Adverse	Reduced noise pollution due to implementation of mitigation measure
1.5		Ecology	Water runoff to river: aquatic ecology / soil	Negative	Indirect	Study Area (2)	Low (1)	Very Short Term (1)	Reversible (1)	-2: Minor Adverse	Discussion and **MM** as in S. No. 1.2 C3-C12 (Water Quality)	Study Area (2)	Low (1)	Very Short Term (1)	Reversible (1)	-2: Minor Adverse	No Change
1.6		Socio-Economics	Equipment set-up: short term employment	Positive	Direct	Regional (4)	Low (1)	Very Short Term (1)	Reversible (1)	+4: Minor Beneficial	Short term employment during set-up	-	-	-	-	-	-
1.7		Risk Hazards	Construction hazards: Injuries of a temporary nature	Negative	Direct	Site (1)	Medium (2)	Very Short term (1)	Reversible (1)	-2: Minor Adverse	Construction hazards leading to injuries. **MM:** pre-project job safety analysis to be done; worker safety training prior to commencement of	Site (1)	Medium (2)	Very Short term (1)	Reversible (1)	-2: Minor Adverse	No Change

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environment Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score/ Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score/ Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
											work; use of personal protective equipment (PPE) as required.						
1.8		Risk Hazards	Construction hazards: Injuries of a permanent nature or fatalities	Negative	Direct	Site (1)	High (3)	Long term (4)	Irreversible (3)	-36: Significant Adverse	Construction hazards leading to permanent injury or fatality. **MM:** Occupational Safety and Health Management Plan (OHSMP): Traffic Sub-Management Plan	Within Site (1)	Medium (2)	Long term (4)	Irreversible (3)	-24: Minor Adverse	Reduction due to implementation of mitigation measure. EMP required.
1.9		Land use / cover	Change in land cover – open area to built-up	Negative	Direct	Local (1)		Very Short Term (1)	Irreversible (3)	-3: Minor Adverse	Change in Land cover (natural to build form) is considered as a minor negative impact	Local (1)		Very Short Term (1)	Irreversible (3)	-3: Minor Adverse	No Change

1.1.1.2 EQUIPMENT DELIVERY AND ASSEMBLY

Equipment delivery and assembly related impacts are as mentioned in Table -4

Table -4: Equipment delivery and assembly related impacts

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environment Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score/ Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score/ Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
1.1	Establishment of equipment and machinery including concrete batch mix plant and crushers (getting heavy machinery to site and setting it up – the activity is likely to take up to two months by a specialised crew of ~40 persons distinct from the crew mentioned earlier)	Air	Movement of heavy vehicles for getting equipment to site: dust / gas generation	Negative	Direct	Regional (4)	Medium (2)	Very Short Term (1)	Reversible (1)	-8: Minor Adverse	Dust from vehicles carrying disassembled portions of the crushers and concrete batch-mix plants (less than a month). **MM:** Ensure that roads up to the construction site are paved (they are not currently). Vehicles to be well maintained so as to not release objectionable fumes.	Local (3)	Medium (2)	Very Short Term (1)	Reversible (1)	-6: Minor Adverse	Reduction due to implementation of mitigation measure
1.2		Air	Equipment assembly: dust generation	Negative	Direct	Regional (4)	Medium (2)	Very Short Term (1)	Reversible (1)	-8: Minor Adverse	Crusher / cement batch mix plant assembly should less than a month. **MM:** Ensure that the equipment is erected on a concrete paved apron so that impact dust is not generated.	Local (3)	Medium (2)	Very Short Term (1)	Reversible (1)	-6: Minor Adverse	Reduction due to implementation of mitigation measure
1.3		Water Quality	Use of toilets:	Negative	Direct	Study	Low (1)	Very	Reversible	-2: Minor	Discussion as in	Study	Low (1)	Very	Reversible	-2:	No Change

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environment Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score/ Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score/ Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
			sewage discharge to river			Area (2)		Short Term (1)	(1)	Adverse	S. No. 1.2 C3-C12 (Water Quality)	Area (2)		Short Term (1)	(1)	Minor Adverse	
4.4		Noise	Equipment set-up: noise	Negative	Direct	Local (1)	Low (1)	Very Short Term (1)	Reversible (1)	-1: Minor Adverse	Noise during set up.	Local (1)	Low (1)	Very Short Term (1)	Reversible (1)	-1: Minor Adverse	No Change
1.6		Soil	Construction activities: and Construction & Demolition (C&D) Waste Generation	Negative	Direct	Study Area (2)	Low (1)	Very Short Term (1)	Reversible (1)	-2: Minor Adverse	Limited construction activities for a short duration. **MM:** Follow C&D Waste Management Rules	Within Site (1)	Low (1)	Very Short Term (1)	Reversible (1)	-1: Minor Adverse	Reduction due to implementation of mitigation measure
1.7		Soil	Construction activities / worker housing and offices: Municipal Solid Waste (MSW) generation	Negative	Direct	Study Area (2)	Low (1)	Very Short Term (1)	Reversible (1)	-2: Minor Adverse	Limited construction activities for a short duration. **MM:** Follow Waste Prevention Management Regulation (2012) as amended in 2016	Within Site (1)	Low (1)	Very Short Term (1)	Reversible (1)	-1: Minor Adverse	Reduction due to implementation of mitigation measure
1.8		Ecology	Sewage release to river: aquatic ecology / soil	Negative	Indirect	Study Area (2)	Low (1)	Very Short Term (1)	Reversible (1)	-2: Minor Adverse	Discussion and **MM** as in S. No. 1.2 C3-C12 (Water Quality)	Study Area (2)	Low (1)	Very Short Term (1)	Reversible (1)	-2: Minor Adverse	No Change
1.9		Socio-Economics	Equipment set-up: short term employment	Positive	Direct	Regional (4)	Low (1)	Very Short Term (1)	Reversible (1)	+4: Minor Beneficial	Short term employment during set-up	-	-	-	-	-	-
1.10		Water Regime	Water consumption: ground water	Negative	Direct	Study Area (2)	Low (1)	Very Short Term	Reversible (1)	-2: Minor Adverse	Discussion and **MM** as in S. No. 1.12 C3-C12	Study Area (2)	Low (1)	Very Short Term	Reversible (1)	-2: Minor Adverse	No Change

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environment Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score/ Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score/ Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
			drawl					(1)			(Water Regime)			(1)			
1.11		Risk Hazards	Construction hazards: Injuries of a temporary nature	Negative	Direct	Site (1)	Medium (2)	Very Short term (1)	Reversible (1)	-2: Minor Adverse	Construction hazards leading to injuries. **MM:** pre-project job safety analysis to be done; worker safety training prior to commencement of work; use of personal protective equipment (PPE) as required.	Site (1)	Medium (2)	Very Short term (1)	Reversible (1)	-2: Minor Adverse	No Change
1.12		Risk Hazards	Construction hazards: Injuries of a permanent nature or fatalities	Negative	Direct	Site (1)	High (3)	Long term (4)	Irreversible (3)	-36: Significant Adverse	Construction hazards leading to permanent injury or fatality. **MM:** Occupational Safety and Health Management Plan (OHSMP). Location of the equipment should be at an elevation higher than the High Flood Level (HFL).	Within Site (1)	Medium (2)	Long term (4)	Irreversible (3)	-24: Minor Adverse	Reduction due to implementation of mitigation measure
1.13		Land use / cover	Change in land cover – open area to built-up	Negative	Direct	Local (1)	Low (1)	Very Short Term (1)	Irreversible (3)	-3: Minor Adverse	Change in Land cover (natural to build form) is considered as a minor negative impact	Local (1)	Low (1)	Very Short Term (1)	Irreversible (3)	-3: Minor Adverse	No Change

1.1.1.3 MATERIAL STORAGE, WORK AREAS AND HOUSING FOR WORKERS

Material storage, work areas and housing for workers related impacts are as mentioned in Table -5

Table -5: Material storage, work areas and housing for workers related impacts

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environment Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score/ Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score/ Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
1.1	Establishment of workers camp for housing construction workers (duration ~2 months). Same crew will be used as in S. No. 1.	Air	Construction equipment use: dust / gas generation	Negative	Direct	Local (3)	Low (1)	Short term (2)	Reversible (1)	-6: Minor Adverse	Nominal dust / noise generation for short duration with on-site impacts. **MM:** site barricading prior to commencement of construction work.	Within Site (1)	Low (1)	Short term (2)	Reversible (1)	-2: Minor Adverse	Reduced air pollution due to implementation of mitigation measure
1.2		Air	Construction vehicles: dust / gas generation	Negative	Direct	Local (3)	Medium (2)	Short term (2)	Reversible (1)	-12: Minor Adverse	Few vehicles required for this activity. **MM:** vehicles to be covered in case they are carrying construction materials or the like; vehicles to be well maintained so as to not release objectionable fumes	Within Site (1)	Low (1)	Short term (2)	Reversible (1)	-2: Minor Adverse	Reduced air pollution due to implementation of mitigation measure
1.3		Air	Cooking by workers or in canteen: gas generation	Negative	Direct	Study Area (2)	Medium (2)	Short term (2)	Reversible (1)	-8: Minor Adverse	Effects are for the duration of the camp. **MM:** Liquid fuels to be provided to workers by contractor. No fuelwood burning.	Within Site (1)	Low (1)	Short term (2)	Reversible (1)	-2: Minor Adverse	Reduced air pollution due to implementation of mitigation measure
1.4		Water Quality	Use of toilets: sewage discharge to river	Negative	Direct	Study Area (2)	Medium (2)	Short term (2)	Reversible (1)	-6: Minor Adverse	Sewage will be in small quantities for ~40 workers. **MM:** Construct toilets for workers @ one toilet / 20 workers. Establish soak pit prior to commencement of construction and connect each toilet to the soak pit.	Within Site (1)	Low (1)	Short term (2)	Reversible (1)	-2: Minor Adverse	Reduced in water pollution due to implementation of mitigation measure
1.5		Noise	Construction work: noise	Negative	Direct	Site (1)	Low (1)	Short term (2)	Reversible (1)	-2: Minor Adverse	Nominal noise generation for short duration with largely on-site impacts. **MM:** site barricading prior to commencement of construction work.	Within Site (1)	Low (1)	Short term (2)	Reversible (1)	-2: Minor Adverse	No Change

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environment Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score/ Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score/ Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
1.6		Noise	Vehicles: noise	Negative	Direct	Local (3)	Low (1)	Short term (2)	Reversible (1)	-6: Minor Adverse	Noise from construction related vehicles moving in the area. **MM:** Implementation of no-honking rules (except abnormal conditions), vehicles with warning lights, roads on the construction site to have a median / partition for segregation of incoming and outgoing vehicles.	Within Site (1)	Low (1)	Short term (2)	Reversible (1)	-2: Minor Adverse	Reduction due to implementation of mitigation measure
1.8		Soil	Construction activities: and Construction & Demolition (C&D) Waste Generation	Negative	Direct	Study Occupational Safety and Health Management Plan (OHSMP)Area (2)	Low (1)	Short term (2)	Reversible (1)	-4: Minor Adverse	Limited construction activities. **MM:** Follow C&D Waste Management Plan	Study Area (2)	Low (1)	Short term (2)	Reversible (1)	-4: Minor Adverse	No Change
1.9		Soil	Construction activities / worker housing and offices: Municipal Solid Waste (MSW) generation	Negative	Direct	Study Area (2)	Low (1)	Short term (2)	Reversible (1)	-4: Minor Adverse	Limited construction activities. **MM:** Follow Waste Prevention Management Regulation (2012) as amended in 2016	Study Area (2)	Low (1)	Short term (2)	Reversible (1)	-4: Minor Adverse	No Change
1.10		Ecology	Sewage release to river: aquatic ecology / soil	Negative	Indirect	Study Area (2)	Low (1)	Short term (2)	Reversible (1)	-4: Minor Adverse	Release of small amounts of untreated sewage to the River. **MM:** Same as in S. No. 1.4, C3 (water quality)	Study Area (2)	Low (1)	Short term (2)	Reversible (1)	-4: Minor Adverse	No Change
		Risk / Hazard	Construction hazards: Injuries of a permanent nature or fatalities	Negative	Direct	Site (1)	High (3)	Long term (4)	Irreversible (3)	-36: Significant Adverse	Construction hazards leading to permanent injury or fatality. **MM:** Occupational Safety and Health Management Plan (OHSMP). Location of the camps should be at an elevation higher than the High Flood Level (HFL) of the	Site (1)	Medium (2)	Long term (4)	Irreversible (3)	-24: Significant Adverse	Reduction due to implementation of mitigation measure

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environment Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score/ Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score/ Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
											River.						
1.11		Socio-Economics	Employment generation	Positive	Direct	National (3)	Low (1)	Short term (2)	Reversible (1)	+6: Minor Beneficial	Employment of workers from within the country for two months.	-	-	-	-	-	-
2.1	Establishment of stores, warehouse and parking areas (duration ~2 months) by the same crew mentioned in S. No. 1 above.	Water Regime	Water consumption: ground water drawl (tube well)	Negative	Direct	Study Area (2)	Low (1)	Short term (2)	Reversible (1)	-4: Minor Adverse	Water drawn is an insignificant fraction of the water available. **MM:** take relevant regulatory permissions before water drawl.	Study Area (2)	Low (1)	Short term (2)	Reversible (1)	-4: Minor Adverse	No Change
2.2		Risk Hazard	Construction hazards: Injuries of a temporary nature	Negative	Direct	Site (1)	Medium (2)	Very Short term (1)	Reversible (1)	-2: Minor Adverse	Construction hazards leading to injuries. **MM:** pre-project job safety analysis to be done; worker safety training prior to commencement of work; use of personal protective equipment (PPE) as required.	Site (1)	Medium (2)	Very Short term (1)	Reversible (1)	-2: Minor Adverse	No Change
2.3		Risk/Hazard	Construction hazards: Injuries of a permanent nature or fatalities	Negative	Direct	Site (1)	High (3)	Long term (4)	Irreversible (3)	-36: Significant Adverse	Construction hazards leading to permanent injury or fatality. **MM:** Occupational Safety and Health Management Plan (OHSMP). Location of the equipment should be at an elevation higher than the High Flood Level (HFL).	Site (1)	Medium (2)	Long term (4)	Irreversible (3)	-24: Significant Adverse	Reduction due to implementation of mitigation measure
2.4		Land use / cover	Change in land cover – open area to built-up	Negative	Direct	Site (1)	Low (1)	Long term (2)	Reversible (3)	-6: Minor Adverse	Change in Land cover (natural to build form) for the site office area only.	Site (1)	Low (1)	Long term (2)	Reversible (3)	-6: Minor Adverse	No Change

CONSTRUCTION PHASE

1.1.1.4 RIVERBED TRAINING

RIVERBED LEVELLING

The riverbed is proposed to be levelled to ensure a smooth flow of water. The entire riverbed would NOT be levelled. Only the Humps / Crests present at the bottom would be levelled so as to make a smooth bottom profile. The impacts associated with various activities involved in riverbed levelling are mentioned in Table -6**.**

Table -6: impacts associated with various activities involved in riverbed levelling

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environmental Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
1.1	Operation of crushers to produce gravel and coarse materials for channelization and for subsequent phases of construction (24 months) including embankment works and establishment of urban infrastructure.	Air	Release of dust from operations: particulate emissions	Negative	Direct	Regional (3)	Medium (2)	Long Term (4)	Reversible (1)	-24: Significant Adverse	Particulate emissions from the crushers. MM: Ensure that air pollution control equipment (such as venturi cyclones / bag filters) are available in all equipment to reduce particulate air emissions to <100 mg/nm3.	Study Area (2)	Medium (2)	Long Term (4)	Reversible (1)	-16: Minor Adverse	Reduction due to implementation of mitigation measure
1.2		Water Quality	Plant run-off: off-plant wastewater	Negative	Direct / Indirect	Regional (3)	Low (1)	Long Term (4)	Reversible (1)	-12: Minor Adverse	Run-off water from crushers bears risks of entering the River. Release of dust particulates can settle on River water. MM: Ensure garland drains around the crusher apron with collection sump sending the water (after screening in settling tank) for dust suppression through sprinkling.	Study Area (2)	Low (1)	Long Term (4)	Reversible (1)	-8: Minor Adverse	Reduction due to implementation of mitigation measure
1.3		Noise	Crusher plant operations: noise	Negative	Direct	Regional (4)	Medium (2)	Long Term (4)	Reversible (1)	-32: Significant Adverse	Noise from crushing operations. MM: Ensure the crusher has acoustic wall enclosures to reduce in / out noise insertion loss by >10 dB(A), bring the crusher to the floor levels, preventive maintenance programme on all vehicles, a sound traffic management plan to ensure that back-up beepers on trucks are required less frequently,	Study Area (2)	Medium (2)	Long Term (4)	Reversible (1)	-16: Minor Adverse	Reduction due to implementation of mitigation measure

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environmental Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
1.5		Ecology	Release of dust from operations: dry deposition on River or vegetation nearby	Negative	Indirect	Regional (4)	Medium (2)	Long Term (4)	Reversible (1)	-32: Significant Adverse	Release of dust particulates can impact flora and fauna. MM: as mentioned in in air pollution (S. No. 1.1)	Study Area (2)	Medium (2)	Long Term (4)	Reversible (1)	-16: Minor Adverse	Reduction due to implementation of mitigation measure
1.6		Socio-Economics	Employment	Positive	Direct	Regional (2)	Low (1)	Long Term (4)	Reversible (1)	+8: Minor Beneficial	Employment leading to improved local economy.	-		-	-	-	-
1.8		Risk Hazard	Construction hazards: Injuries of a temporary nature	Negative	Direct	Site (1)	Medium (2)	Very Short term (1)	Reversible (1)	-2: Minor Adverse	Construction hazards leading to injuries. MM: pre-project job safety analysis to be done; worker safety training prior to commencement of work; use of personal protective equipment (PPE) as required.	Site (1)	Medium (2)	Very Short term (1)	Reversible (1)	-2: Minor Adverse	No Change
1.9			Construction hazards: Injuries of a permanent nature or fatalities	Negative	Direct	Site (1)	High (3)	Long term (4)	Irreversible (3)	-36: Significant Adverse	Construction hazards leading to permanent injury or fatality. MM: Occupational Safety and Health Management Plan (OHSMP)	Site (1)	High (3)	Long term (4)	Reversible (1)	-12: Minor Adverse	Reduction due to implementation of mitigation measure
		Land use / Land cover	Change in land cover – open area to built-up	Negative	Direct	Site (1)	Low (1)	Short term (2)	Irreversible (5)	-10: Minor Adverse	Change in Land cover (natural to build form) is considered as a minor negative impact	Site (1)	Low (1)	Short term (2)	Irreversible (5)	-10: Minor Adverse	No Change
2.1	Operation of Concrete Batch Mix Plant (a concrete plant is needed to supply the concrete of different specifications for the duration of the project: ~24 months). It will consume water for the mix preparation along with cement, fine and coarse gravel. It will need fuel to operate.	Air	Operation: particulate emissions	Negative	Direct	Regional (4)	Medium (2)	Long Term (4)	Reversible (1)	-32: Significant Adverse	Particulate emissions from the cement concrete plant. MM: Construct paved apron for the entire batch mix plants. Ensure that sand and aggregates are wet during transfer and storage. These should be stored in hoppers, or bunkers with water sprays that shield them from wind. Ensure air pollution control equipment are attached to the cement-concrete batch mix plants. Use of closed conveyer belts with double rubber curtain seals at transfer point outlets and belt cleaners at return side transferring	Study Area (2)	Medium (2)	Long Term (4)	Reversible (1)	-16: Significant Adverse	Reduction due to implementation of mitigation measure

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environmental Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
											materials in a closed bin. Cement to be stored in storage silos and delivered in sealed vehicles with pneumatic transfer facility. Use of fabric filter dust collectors (FFDC) at all particulate exhaust points is mandatory. FFDCs must be maintained as per manufacturer's instructions. Particulate Matter exhaust from FFDC to be <100 mg/nm3.						
2.2		Water Quality	Plant run-off: off-plant wastewater	Negative	Direct	Local (3)	Low (1)	Long Term (4)	Reversible (1)	-12: Minor Adverse	Run-off water from plant operations risks entering the River. MM: Ensure garland drains around the crusher apron with collection sump sending the water (after screening in settling tank) to the construction phase WWTP / STP.	Study Area (2)	Low (1)	Long Term (4)	Reversible (1)	-8: Minor Adverse	Reduction due to implementation of mitigation measure
2.3		Noise	Plant operations: noise	Negative	Direct	Regional (4)	Medium (2)	Long Term (4)	Reversible (1)	-32: Significant Adverse	Noise from charging, conveyance, mixing and evacuation by trucks. MM: Enclose noisy equipment behind acoustic enclosures, use self-cleaning weigh hoppers, enclose compressors and pumps, fit silencing devices on all pressure operated equipment, line hoppers with rubber, all access roads and internal roads of concrete or bitumen, visual alarms preferred over hooters, muffling devices on engines, personal paging devices preferred to public address systems, weigh fine aggregates	Study Area (2)	Low (1)	Long Term (4)	Reversible (1)	-8: Minor Adverse	Reduction due to implementation of mitigation measure

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environmental Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
											before coarse aggregates, barricading all around the site.						
2.4		Soil	Plant operations: particulate dry deposition	Negative	Direct / Indirect	Regional (4)	Medium (2)	Long Term (4)	Reversible (1)	-32: Significant Adverse	Dry deposition from (dry) mixing plants over time in case of absence of filters. **MM**: as per S. No. 2.1 above.	Study Area (2)	Low (1)	Long Term (4)	Reversible (1)	-8: Minor Adverse	Reduction due to implementation of mitigation measure
2.5		Ecology	Plant operations: dry deposition on aquatic and terrestrial flora / fauna	Negative	Indirect	Study Area (2)	Low (1)	Long Term (4)	Reversible (1)	-8: Minor Adverse	The possibility of combined impacts from different sources impacting riverine and terrestrial ecology. MM: as per S. No. 2.1 and 2.3 above.	Study Area (2)	Low (1)	Long Term (4)	Reversible (1)	-8: Minor Adverse	No Change
2.6		Socio-Economics	Employment	Positive	Direct	Study Area (2)	Low (1)	Long Term (4)	Reversible (1)	+8: Minor Beneficial	Employment leading to improved local economy	-	-		-	-	-
2.7		Water Resources	-	-	-	-		-	-	-	Read S. No. 2.2 (Water) for impacts on local hydrology	-	-	-	-		-
2.8		Risk Hazard	Construction hazards: Injuries of a temporary nature	Negative	Direct	Site (1)	Medium (2)	Very Short term (1)	Reversible (1)	-2: Minor Adverse	Construction hazards leading to injuries. MM: pre-project job safety analysis to be done; worker safety training prior to commencement of work; use of personal protective equipment (PPE) as required.	Site (1)	Medium (2)	Very Short term (1)	Reversible (1)	-2: Minor Adverse	No Change
2.9			Construction hazards: Injuries of a permanent nature or fatalities	Negative	Direct	Site (1)	High (3)	Long term (4)	Irreversible (3)	-36: Significant Adverse	Construction hazards leading to permanent injury or fatality. MM: Occupational Safety and Health Management Plan (OHSMP)	Site (1)	High (3)	Long term (4)	Reversible (1)	-12: Minor Adverse	Reduction due to implementation of mitigation measure
2.10		Land use / Land cover	Change in land cover – open area to built-up	Negative	Direct	Site (1)	Low (1)	Short term (2)	Irreversible (5)	-10: Minor Adverse	Change in Land cover (natural to build form) for the concrete batch plant site is considered as a minor negative impact						
3.1	Riverbed levelling (Riverbed levelling is required for making the river gradient uniform for hydraulic reasons. This will be done through	Air	Equipment operation: generation of dust and gaseous air emissions (from vehicles)	Negative	Direct	Study Area (2)	Medium (2)	Medium Term (3)	Irreversible (3)	-36: Significant Adverse	Dust generation will persist during the duration of the Riverbed levelling. **MM:** Ensure that the earth is being levelled in moist conditions so	Study Area (2)	Medium (2)	Medium Term (3)	Reversible (1)	-12: Minor Adverse	Reduction due to implementation of mitigation measure

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environmental Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
	earth moving equipment in dry riverbed)										that the dust is not generated or immediately settled.						
3.2		Water Quality	Excavated material mixing with water: turbidity increase	Negative	Direct	Local (3)	High (3)	Long Term (4)	Reversible (1)	-36: Highly Adverse	The activity of Riverbed levelling can increase turbidity and suspended particles in the water for the duration of the Riverbed levelling. **MM:** • Partial diversion of the river portion being levelled to ensure that levelling is only done in dry areas • Levelling in those areas where there are 'humps' on the riverbed only, and no other places • Disposal of excess excavated materials to fill locations	Study Area (2)	Medium (2)	Long Term (4)	Reversible (1)	-16: Minor Adverse	Reduction due to implementation of mitigation measure
3.3		Noise	Riverbed levelling equipment operations	Negative	Direct	Study Area (2)	Medium (2)	Long Term (4)	Reversible (1)	-16: Minor Adverse	Noise from Riverbed levelling operations will increase ambient noise levels marginally. MM: as per S. No. 2.3 above.	Study Area (2)	Medium (2)	Medium Term (3)	Reversible (1)	-12: Minor Adverse	Reduction due to implementation of mitigation measure
3.4		Soil	Riverbed levelling operations: muck generation and dry deposition of dust on soil	Negative	Direct	Study Area (2)	Low (1)	Long Term (4)	Irreversible (2)	-16: Minor Adverse	Quantities of muck will be generated and will be disposed in the low-lying areas within the ALDTP. Care required to ensure muck doesn't enter river. MM: as mentioned in in air pollution (S. No. 1.1)	Study Area (2)	Low (1)	Long Term (4)	Irreversible (2)	-16: Minor Adverse	Reduction due to implementation of mitigation measure
3.5		Ecology	Riverbed levelling operations: changes in river bottom profile leading to disturbances to benthic organisms and fishes. The levelling activities are limited and will be done only in those locations	Negative	Indirect	Study area (2)	Low (1)	Long Term (4)	Reversible / Irreversible (3)	-24: Significant Adverse	Riverbed levelling and related increase in turbidity can lead to reduced fish availability in turbid waters. Consequently fishes may shift to other areas for the duration of the Riverbed levelling. **MM:** Ensure that the riverbed levelling programme doesn't	Study area (2)	Low (1)	Medium Term (3)	Reversible (1)	-6: Minor Adverse	Reduction in impact to Ecology due to implementation of mitigation measure

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environmental Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
			where there are "Humps" or Crests on the riverbed. This will lead to a smooth surface profile and better design performance during floods								increase turbidity in the River. This could be done through suitable Engineering techniques including those described in S. No. 3.2.						
3.6		Socio-Economics	Employment generation	Positive	Direct	Regional (4)	Medium (2)	Long Term (4)	Reversible (1)	+64:: Major Beneficial	This is a significant activity that will lead to substantial employment leading to improved local economy.	-	-	-	-	-	-
3.7		Water Regime	Works: Changes in river flow pattern from the current turbulent, braided river system to a smooth river system post Riverbed levelling (and embankment construction)	Negative	Direct	Study Area (2)	Medium (2)	Long Term (4)	Irreversible (3)	-32: Significant Adverse	Riverbed levelling will lead to less turbulent river flow and change the flow pattern of the current river. Post development it is anticipated that a braided river will re-form within the 300m river width during each dry season and be changed during each wet season. Inevitably there will be some very small changes in water depth and velocity distribution within each braid during the dry season, but the changes are not significant in such a dynamic alluvial environment.	Study Area (2)	Medium (2)	Long Term (4)	Irreversible (3)	-32: Significant Adverse	No Change
3.8		Risk Hazards	-	-	-	-	-	-	-	-	Please read S. No. 1.8 and 1.9 above (Risk and Hazards)	-	-	-	-	-	-
4.0	Channelization (2 months duration) consisting of: Grading, i.e. removal of vegetation above and below the water for clearing the bank Dispatch of stones from river bank to site of work Earthwork including: excavation of pit for apron, construction of	Air	Equipment / vehicle operation: generation of dust and gaseous air emissions (from vehicles)	Negative	Direct	Local (3)	Medium (2)	Long Term (4)	Reversible (1)	-24: Significant Adverse	Dust generation will persist during the duration of the channelization. MM: Ensure trucks used for transportation of materials are covered with HDPE sheets; trucks should be well maintained (as per manufacturer's instructions) with	Study Area (2)	Medium (2)	Long Term (4)	Reversible (1)	-16: Minor Adverse	Reduction due to implementation of mitigation measure

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environmental Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
	approach banks, laying of stones in apron and slopes, construction of guide bunds at termination ends.										emissions complying with National Environmental Standards 2010; tyres should be cleaned before entering public roads through suitable washing / scraping equipment.						
4.1		Water Quality	Works: mixing of construction debris or muck in water	Negative	Direct	Study Area (2)	Medium (2)	Long Term (4)	Reversible (1)	-16: Minor Adverse	Construction material or muck generated can enter River. **MM:** Ensure adequate bunding around the muck storage area, preferably with garland drains and gabion structures to prevent muck from entering the River.	Study Area (2)	Medium (2)	Medium Term (3)	Reversible (1)	-12: Minor Adverse	Reduction due to implementation of mitigation measure
4.2		Noise	Construction equipment and vehicles: noise	Negative	Direct	Study Area (2)	Medium (2)	Long Term (4)	Reversible (1)	-16: Minor Adverse	Noise generation from works. **MM:** Barricading portions of the construction site using materials which help muffle the noise, where ever river training works are underway. all access roads and internal roads of concrete or bitumen, visual alarms preferred over hooters, muffling devices on engines, personal paging devices preferred to public address systems	Study Area (2)	Medium (2)	Medium Term (3)	Reversible (1)	-12: Minor Adverse	Reduction due to implementation of mitigation measure
4.3		Soil	Works: muck generation and dry deposition of dust on soil	Negative	Direct / Indirect	Study Area (2)	Medium (2)	Long Term (4)	Reversible (1)	-16: Minor Adverse	Muck will be generated and will be disposed in the low-lying areas within the ALDTP. Care required to ensure muck doesn't enter river.	Study Area (2)	Medium (2)	Long Term (4)	Reversible (1)	-16: Minor Adverse	No Change
4.4		Ecology	Plant operations: dry deposition on aquatic and terrestrial flora / fauna	Negative	Indirect	Local (3)	High (2)	Long Term (4)	Reversible (1)	-24: Significant Adverse	The possibility of combined impacts from different sources impacting riverine and terrestrial ecology. In particular Riverbed levelling and channelization can lead to perturbation of	Local Area (3)	High (2)	Long Term (4)	Reversible (1)	-24: Significant Adverse	Impacts could reduce after fish conservation plan is prepared and implemented

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environmental Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
											the aquatic ecology, including potential change in turbidity. There are some known vulnerable and near threatened species of fish found in the River. **MM:** Preparation of important fish species conservation plan in consultation with the Department of Livestock after bio-diversity survey over three years.						
4.5		Socio-Economics	Works: Employment generation	Positive	Direct	Local Area (3)	Medium (2)	Long Term (4)	Reversible (1)	+24: Significant Beneficial	Employment leading to improved local economy.	-	-	-	-	-	-
4.6			Works: Generation of excess land for township after training	Positive	Direct / Indirect	National (5)	High (3)	Long Term (4)	Irreversible (3)	+180: High Beneficial	This is the single most important benefit of the proposed project in addition to the flood risk reduction. Availability of additional land will give Phuentsholing space to expand and provide Bhutan with land to showcase several of its strengths, well into the 21st Century.	-	-	-	-	-	-
4.7		Water Regime	Works: permanent change in the River Morphology due to training works	Negative	Direct	Site Area (1)	High (3)	Long Term (4)	Irreversible (3)	-36: Significant Adverse	The river alignment will be permanently changed in the project area. This is the project premise with a trade off in terms of flood risk reduction and township availability for expansion of Phuentsholing.	Site Area (1)	High (3)	Long Term (4)	Irreversible (3)	-36: Significant Adverse	No Change
4.8		Risk / Hazards	Works: Reduction of flood risk for Phuentsholing	Positive	Direct	Local (3)	High (3)	Long Term (4)	Irreversible (3)	+108: Highly Beneficial	The flood risk protection component is one of the two main benefits of the project.	-	-	-	-	-	-
4.9		Risk / Hazards	-	-	-	-		-	-	-	Please read S. No. 1.8 and 1.9 above (Risk and Hazards)						
4.10		Land use / Land cover	-	-	-	-		-	-	-	Please read S. No. 2.10 (Land use / Land cover) in this Table.						

EMBANKMENT WORKS

Impacts related to Embankment works are as mentioned in Table -7

Table -7: Impacts related to Embankment works

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environmental Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
1.1	Construction of Diaphragm Wall (Excavation, insertion of reinforcements, pouring of concrete, covering with finished material / walkway: duration of activity: 8 months)	Air	Vehicular movement, excavation, earth works, concrete pouring: dust emissions	Negative	Direct	Study Area (2)	Medium (2)	Medium Term (3)	Reversible (1)	-12: Minor Adverse	Dust from works. MM: Provide Dust barriers to minimise dust travel	Within Site (1)	Medium (2)	Medium Term (3)	Reversible (1)	-6: Minor Adverse	Reduction due to implementation of mitigation measure
1.2		Water Quality	Works: mixing of construction debris or muck in water	Negative	Direct	Study Area (2)	Medium (2)	Medium Term (3)	Reversible (1)	-12: Minor Adverse	Construction material or muck generated can enter River. MM: Provide Barriers to prevent entry of muck into the river; Deposit muck by backfilling in low lying areas	Within Site (1)	Medium (2)	Medium Term (3)	Reversible (1)	-6: Minor Adverse	Reduction due to implementation of mitigation measure
1.3		Noise	Construction works: noise	Negative	Direct	Study Area (2)	Medium (2)	Medium Term (3)	Reversible (1)	-12: Minor Adverse	Noise generation from works MM: Enclose noisy equipment behind acoustic enclosures, fit silencing devices on all operated equipment, visual alarms preferred over hooters, muffling devices on engines, personal paging devices preferred to public address systems, barricading all around the site	Within Site (1)	Medium (2)	Medium Term (3)	Reversible (1)	-6: Minor Adverse	Reduction due to implementation of mitigation measure

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environmental Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
1.4		Soil	Works: muck generation and dry deposition of dust on soil; loss of topsoil	Negative	Direct	Study Area (2)	Medium (2)	Long Term (4)	Reversible (1)	-16: Minor Adverse	Muck will be generated and will be disposed in the low-lying areas within the ALDTP, may enter river. MM: Provide Barriers to prevent entry of muck into the river; Deposit muck by backfilling in low lying areas	Within Site (1)	Medium (2)	Medium Term (3)	Reversible (1)	-6: Minor Adverse	Reduction due to implementation of mitigation measure
1.5		Ecology	Plant operations: dry deposition on aquatic and terrestrial flora / fauna	Negative	Indirect	Study Area (2)	Medium (2)	Long Term (4)	Reversible (1)	-16: Minor Adverse	The possibility of combined impacts from different sources impacting riverine and terrestrial ecology.	Study Area (2)	Medium (2)	Long Term (4)	Reversible (1)	-16: Minor Adverse	No Change
1.6		Socio-Economics	Employment generation	Positive	Direct	Regional (3)	Low (1)	Medium Term (3)	Reversible (1)	+9: Minor Beneficial	Employment leading to improved local economy.	-	-	-	-	-	-
1.8		Risk Hazard	Construction hazards: Injuries of a temporary nature	Negative	Direct	Site (1)	Medium (2)	Very Short term (1)	Reversible (1)	-2: Minor Adverse	Construction hazards leading to injuries. MM: pre-project job safety analysis to be done; worker safety training prior to commencement of work; use of personal protective equipment (PPE) as required.	Site (1)	Medium (2)	Very Short term (1)	Reversible (1)	-2: Minor Adverse	No Change
1.9		Risk Hazard	Construction hazards: Injuries of a permanent nature or	Negative	Direct	Site (1)	High (3)	Long term (4)	Irreversible (3)	-36: Significant Adverse	Construction hazards leading to permanent injury or fatality. MM: Construction	Site (1)	High (3)	Long term (4)	Reversible (1)	-12: Minor Adverse	Reduction due to implementation of mitigation measure

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environmental Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
			fatalities								hazards leading to permanent injury or fatality. **MM:** Occupational Health and Safety Management Sub-Plan (OHSMP)						
1.10		Land use / Land cover	Works: Change in land cover – open area to built-up	Negative	Direct	Site (1)	Low (1)	Short term (2)	Irreversible (3)	-6: Minor Adverse	Change in Land cover (natural to build form) is considered as a minor negative impact	Site (1)	Low (1)	Short term (2)	Irreversible (3)	-6: Minor Adverse	No Change
2.1	Construction of Dead Man Anchor / Anchor Slab (Excavation, pouring of concrete, connection with diaphragm wall with buckle and backfilling; duration of activity: 2 months)	Air	Vehicular movement, excavation, earth works, concrete pouring: dust emissions	Negative	Direct	Study Area (2)	Medium (2)	Short Term (2)	Reversible (1)	-8: Minor Adverse	Dust from works. MM: Please read Sr. No. 1.1 above	Within Site (1)	Medium (2)	Medium Term (3)	Reversible (1)	-6: Minor Adverse	Reduction due to implementation of mitigation measure
2.2		Water Quality	Works: mixing of construction debris or muck in water	Negative	Direct	Study Area (2)	Medium (2)	Short Term (2)	Reversible (1)	-8: Minor Adverse	Construction material or muck generated can enter River. MM: Please read Sr. No. 1.2 Above.	Within Site (1)	Medium (2)	Medium Term (3)	Reversible (1)	-6: Minor Adverse	Reduction due to implementation of mitigation measure
2.3		Noise	Construction works: noise	Negative	Direct	Study Area (2)	Medium (2)	Short Term (2)	Reversible (1)	-8: Minor Adverse	Noise from activities MM: Please read Sr. No. 1.3 Above.	Within Site (1)	Medium (2)	Medium Term (3)	Reversible (1)	-6: Minor Adverse	Reduction due to implementation of mitigation measure
2.4		Soil	Works: muck generation and dry deposition of dust on soil;	Negative	Direct	Study Area (2)	Medium (2)	Long Term (4)	Reversible (1)	-16: Minor Adverse	Topsoil loss potential and muck management. MM: Please read Sr. No. 1.4 Above.	Within Site (1)	Medium (2)	Medium Term (3)	Reversible (1)	-6: Minor Adverse	Reduction due to implementation of mitigation measure
2.4		Ecology	Plant operations: dry deposition on	Negative	Indirect	Study Area (2)	Medium (2)	Long Term (4)	Reversible (1)	-16: Minor Adverse	The possibility of combined impacts from different	Study Area (2)	Medium (2)	Long Term (4)	Reversible (1)	-16: Minor Adverse	No Change

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environmental Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
			aquatic and terrestrial flora / fauna								sources impacting riverine and terrestrial ecology						
2.6		Socio-Economics	Works: Employment generation	Positive	Direct	Regional (3)	Low (1)	Short Term (2)	Reversible (1)	+6: Minor Beneficial	Employment leading to improved local economy.	-	-	-	-	-	-
2.8		Risk Hazard	-	-	-	-	-	-	-	-	Please read S. No. 1.8 and 1.9 above (Risk and Hazards)	-	-	-	-	-	-
2.9		Land use / Land cover	-	-	-	-	-	-	-	-	Please read S. No. 1.10 (Land use / Land cover) in this Table	-	-	-	-	-	-
3.1	Embankment construction including stone in wire crates for a duration of ~6 months (will include landfilling, stone pitching, pouring of concrete and finishing in different combinations). Embankments will be: Stone in wire crates, paver block and vetiver grass (10.5 km) over dead man anchor Stone retaining wall over anchor slab (at the turn of the river around the Hill	Air	Vehicular movement, excavation, earth works, concrete pouring: dust emissions	Negative	Direct	Study Area (2)	Medium (2)	Medium Term (3)	Reversible (1)	-12: Minor Adverse	Dust from works. MM: Please read Sr. No. 1.1 Above.	Within Site (1)	Medium (2)	Medium Term (3)	Reversible (1)	-6: Minor Adverse	Reduction due to implementation of mitigation measure
3.2		Water Quality	-	-	-	-	-	-	-	-	-						
3.3		Noise	Construction works: noise	Negative	Direct	Study Area (2)	Medium (2)	Short Term (2)	Reversible (1)	-8: Minor Adverse	Noise from activities Please read Sr. No. 1.3 Above.	Within Site (1)	Medium (2)	Medium Term (3)	Reversible (1)	-6: Minor Adverse	Reduction due to implementation of mitigation measure
3.4		Soil	Soil removal and reinstatement: loss of topsoil	Negative	Direct	Site (1)	Medium (2)	Long Term (4)	Reversible (1)	-8: Minor Adverse	Topsoil loss needs to be made up with soil import.	Site (1)	Medium (2)	Long Term (4)	Reversible (1)	-8: Minor Adverse	No Change
3.5		Ecology	Works: Creation of embankments with landscaping	Positive	Direct / Indirect	Regional (4)	Medium (2)	Long Term (4)	Irreversible (3)	+96: Significant Beneficial	Aesthetically pleasing embankments with landscaping will improve the ecological function of the site and generally improve the ecological	-	-	-	-	-	-

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environmental Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
	on the west bank) RCC retaining wall over anchor slab (at the turn of the river on the Hill on the east bank) Stone pitching at termination points										value of the built environment of Phuentsholing.						
3.6		Socio-Economics	Works: Employment generation	Positive	Direct	Regional (4)	Low (1)	Short Term (2)	Reversible (1)	+8: Minor Beneficial	Employment leading to improved local economy.						
3.7		Water Resources	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3.8		Risk Hazard	Works: Accidents and Hazards	-	-	-	-	-	-	-	Please read S. No. 1.8 and 1.9 (Risk and Hazards)						
3.9		Land use / Land cover	Works: change in land cover from riverbed to embankment with landscaping	Positive	Direct / Indirect	Site (1)	Low (1)	Long Term (4)	Irreversible (3)	+12: Minor Beneficial	We believe the change in Land cover from existing conditions is positive and welcome.	-	-	-	-	-	-

1.1.1.5 LAND RECLAMATION WORK

Impacts related to reclamation works are as mentioned in Table -8

Table -8: Impacts related to reclamation works

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environmental Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
1.1	Reclamation Work – Cut, Fill and Compaction: this will entail the movement of few hundred trucks a day from the Riverbed levelling and cut areas to the fill areas to raise the level of the ground. ~2.64 million m3 of soil will be locally shifted to raise levels and 10.93 million tons of earth will be filled from surrounding borrow areas. Duration of work will be: 88 months.	Air Quality	Works: Dust suspension from site clearance, machinery	Negative	Direct	Local (3)	High (3)	Long Term (4)	Reversible (1)	-36: Significant Adverse	Substantial cut and fill work for two years. **MM**: Trucks transporting the materials should be covered with HDPE sheets; trucks should be having emission norms (valid emission test certificate) or equivalent; trucks should be following preventive maintenance requirements of manufacturers	Local (3)	Medium (2)	Long Term (4)	Reversible (1)	-24: Significant Adverse	Reduction due to implementation of mitigation measure
1.2		Water Quality	Works: Dry deposition into the River. Runoff from stores, parking.	Negative	Direct	Local (3)	Medium (2)	Long Term (4)	Reversible (1)	-24: Significant Adverse	Substantial cut and fill work for two years. **MM:** Provision of runoff capture drains and conveying runoff downstream of the portion where the work is being carried out	Study area (2)	Medium (2)	Long Term (4)	Reversible (1)	-16: Minor Adverse	Reduction due to implementation of mitigation measure
1.3		Noise	Works: Site clearing, compaction, filling, cutting	Negative	Direct	Local (3)	Medium (2)	Long Term (4)	Reversible (1)	-24: Significant Adverse	Substantial cut and fill work for two years. MM: Installation of Noise level barriers, Use of low noise	Study area (2)	Medium (2)	Long Term (4)	Reversible (1)	-16: Minor Adverse	Reduction due to implementation of mitigation measure

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environmental Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
											generating equipment, provision of Ear plugs to workers						
1.4		Soil	Works: top soil across 30% of the site	Positive	Direct	Site (1)	Medium (2)	Long Term (4)	Irreversible (3)	24: Significant Beneficial	Better soil quality in landscaped areas	-	-	-	-	-	-
1.5		Ecology	Removal of grassland and vegetation	Negative	Direct	Site (1)	High (3)	Long Term (4)	Irreversible (3)	-36: High Adverse	Cutting of existing grasslands (Zone C) and vegetation. **MM:** The greenbelt plan implementation ensures compensation for loss of vegetation. A detailed landscape plan has been prepared and will be implemented.	Regional (3)	Medium (2)	Long Term (4)	Reversible (1)	-24: Minor Adverse	Reduction due to implementation of mitigation measure
1.6		Ecology	Development of Zone C – POSSIBLE impact on Aquatic and Terrestrial Bio-Diversity in Zone C (for e.g. large terrestrial fauna such as elephants and threatened / vulnerable species in the River)	Negative	Indirect	Global (6)	High (3)	Long Term (4)	Irreversible (3)	-216 High Adverse	Development of Zone C COULD lead to a potential impact on movement of large terrestrial fauna (for e.g. elephants). MM: A THOROUGH Bio-diversity assessment spread over 3 years to determine the actual status of	Global (6)	High (3)	Long Term (4)	Irreversible (3)	-216 High Adverse	Needs evaluation after bio-diversity assessment and implementation of the recommendations therein

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environmental Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
											protected, large terrestrial fauna and potential impacts of other faunal / aquatic bio-diversity due to development of Zone C. This study will be done prior to development of Zone C and will be shared with relevant stakeholders and regulators for their comments and approval.						
1.7		Socio-Economics	Works: Reduction of flood risk for Phuentsholing	Positive	Direct	Local (3)	High (3)	Long Term (4)	Irreversible (3)	+108: Highly Beneficial	The flood risk protection component is one of the two main benefits of the project.	-	-	-	-	-	-
1.8		Socio-Economics	Employment generation for duration of reclamation work	Positive	Direct	Local (3)	Medium (2)	Long Term (4)	Long Term (4)	+24: Significant Beneficial	Generating employment for 400+ workers and their families for two years or more	-	-	-	-	-	-
1.9		Water Flow / Resources	Change in River Morphology due to training	-	-	-	-	-	-	-	Discussed in Table 8.5, S. No. 4.7						
1.10		Risk Hazard	Accidents and Hazards due to works	-	-	-	-	-	-	-	Please read Table 1.8 and 1.9 in previous tables						
1.11		Land use /	Grassland to	Negative	Direct	Regional	Medium	Long	Irreversible	-96: High	Loss of	Local (3)	Medium	Long	Reversible	-24:	Reduction due to

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environmental Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
		Land cover	Landscaped Urban area			(4)	(2)	Term (4)	(3)	Adverse	grasslands. MM: Available soil from the grasslands will be reused to the extent possible. A detailed landscape plan has been prepared and will be implemented.		(2)	Term (4)	(1)	Medium Adverse	implementation of mitigation measure
2.1	Transport of borrow materials from local quarries (three quarries identified: 10.93 million m3 of materials will be brought from quarries within the region (<30.0 kms) from the site to the site for filling. Likely that several hundred trucks trips per day will be required for conveying the materials	Air	Transport: Dust and emission during transport, loading, unloading	Negative	Direct	Regional (4)	High (3)	Long Term (4)	Reversible (1)	-48 High Adverse	Transmission of dust to atmosphere en-route to site at the time of transport of materials en-route and at / near site. MM: Transport will be done with permission of local authorities. Trucks transporting the materials should be covered with HDPE sheets; trucks should be having emission norms complying with National Environmental Standards; trucks should be following	Local (3)	Medium (2)	Long Term (4)	Reversible (1)	-24 High Adverse	Reduction due to implementation of mitigation measure

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environmental Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
	to the site for the duration of the project construction.										preventive maintenance requirements of manufacturers						
2.2		Water Quality / Resources	Loading / Unloading: Contamination and runoff from material stock pile into River	Negative	Direct	Site (1)	Medium (2)	Long Term (4)	Reversible (1)	-8: Minor Adverse	Possibility of materials entering the River during landfilling MM: Provision of runoff capture drains	Site (1)	Medium (2)	Medium Term (3)	Reversible (1)	-6: Minor Adverse	Reduction due to implementation of mitigation measure
2.3		Noise	Vehicle noise, loading, unloading: Noise	Negative	Direct	Regional (4)	Medium (2)	Long Term (4)	Reversible (1)	-32: Significant Adverse	Several hundred truck trips daily along one or more sources for two years. MM: Enclose noisy equipment behind acoustic enclosures, fit silencing devices on all operated equipment, visual alarms preferred over hooters, muffling devices on engines, personal paging devices preferred to public address systems, barricading all around the site	Local (3)	Medium (2)	Long Term (4)	Reversible (1)	-24 Medium Adverse	Reduction due to implementation of mitigation measures
2.4		Soil	Unloading: Contamination to soil from borrow material	Negative	Direct	Site (1)	Low (1)	Long Term (4)	Reversible (1)	-4: Minor Adverse	The possibility of borrow materials reducing the	Site (1)	Low (1)	Long Term (4)	Reversible (1)	-4: Minor Adverse	No Change

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environmental Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
			from quarries								productivity of the in-situ / imported top soil if not stacked separately						
2.5		Ecology	Impact on riverine ecology due to the material transport programme (in terms of increase in turbidity due to dry deposition of light materials being transported)	Negative	Indirect	Regional (4)	Low (1)	Long Term (4)	Reversible (1)	-16: Minor Adverse	The possibility that some quantities of borrowed material / dust from the same will be dry deposited on the river. MM: continuous spraying of water at the cut and fill area to prevent large increases in baseline PM10 and PM2.5 levels. All dispatch of aggregate / fill materials should be watered at the time of commencement of the trip to reduce emissions.	Local (3)	Low (1)	Long Term (4)	Reversible (1)	-12: Minor Adverse	Reduction due to implementation of mitigation measure
2.6		Socio-Economics	Traffic Management in transportation	Negative	Direct	Regional (4)	Medium (2)	Long Term (4)	Reversible (1)	-32: Significant Adverse	Traffic issues in transport of reclamation materials vis-à-vis road carriage capacity. MM: a thorough traffic	Local (3)	Medium (2)	Long Term (4)	Reversible (1)	-24: Significant Adverse	Reduction due to implementation of mitigation measure

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environmental Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
											management plan needs to be put in place to ensure that trucks conveying material to the site do not choke up traffic within Phuentsholing and surrounding areas. If required, transportation of materials may have to be only done during the night time. Special roads will have to be made near the site to ensure that the traffic from the Samtse-Phuentsholing area is not held up due to the transport of borrow materials.						
2.8		Risk Hazard	Transport: accidents leading to injuries / fatalities	Negative	Direct	Regional (4)	Medium (2)	Long Term (4)	Irreversible (3)	-96: High Adverse	The possibility that transport of materials will pose a risk to safety of surrounding communities. **MM:** A very strict transport	Local (3)	Low (1)	Long Term (4)	Irreversible (3)	-36: High Adverse	Reduction due to implementation of mitigation measure

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environmental Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
											safety management plan to be put in place and approved by the project authorities prior to commencement of borrow material transport, covering driver training, transport timings, transport routes, traffic segregation (separation of construction and non-construction traffic) near the construction site and liaison with local community.						

1.1.1.6 HILL SLOPE STABILITY

Impacts associated with construction activities of ensuring stability of Hill slopes are as mentioned in Table-9

Table-9: Impacts associated with construction activities of ensuring stability of Hill slopes

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environmental Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
1.1	Hill slope stability entails development of RCC / stone retaining walls with suitable landscape strategy along the hill slopes on portions of the Site.	Air	Dust from slope preparation, levelling	Negative	Direct	Local (3)	Medium (2)	Short Term (2)	Reversible (1)	-12: Minor Adverse	The nominal air pollution due to dust generation will reduce once the activity is ceased. MM: Water sprinkling during slope stabilization	Study area (2)	Medium (2)	Short Term (2)	Reversible (1)	-8: Minor Adverse	Reduction due to implementation of mitigation measure
1.2		Water	Runoff from slope preparation	Negative	Direct	Local (3)	Medium (2)	Short Term (2)	Reversible (1)	-12: Minor Adverse	The runoff results only when the activity is performed. MM: Runoff interception drains to be provided	Study area (2)	Medium (2)	Short Term (2)	Reversible (1)	-8: Minor Adverse	Reduction due to implementation of mitigation measure
1.3		Noise	Site preparation	Negative	Direct	Local (3)	Medium (2)	Short Term (2)	Reversible (1)	-12: Minor Adverse	Nominal Noise will be generated during the activity and will cease once the activity is stopped. MM: Provision of Noise Barriers / enclosures, Ear Plugs for workers engaged in the tasks.	Study area (2)	Medium (2)	Short Term (2)	Reversible (1)	-8: Minor Adverse	Reduction due to implementation of mitigation measure
1.4		Soil	Top soil removal, levelling	Negative	Direct	Local (3)	Medium (2)	Short Term (2)	Reversible (1)	-12: Minor Adverse	The top soil will be removed during the activity. MM: The removed soil will be used in landscaping elsewhere in the project.	Study area (2)	Medium (2)	Short Term (2)	Reversible (1)	-8: Minor Adverse	Reduction due to implementation of mitigation measure
1.5		Ecology	Improved due to landscaping and slope plantation	Positive	Direct	Local (3)	Medium (2)	Long Term (4)	Reversible (1)	+24 Significant Beneficial	Landscaping will add to the aesthetics of the project thereby	-	-	-	-	-	-

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environmental Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
											improving the local ecology						
1.6		Socio-Economics	Improved road communication, control of landslide	Positive	Direct	Regional (4)	Medium (2)	Long Term (4)	Irreversible (3)	+96: High Beneficial	Enhances quality of life for local populace, Provides employment to local people	-	-	-	-	-	-
1.7		Hydrology/ geology	Control of landslide	Positive	Direct	Regional (4)	Medium (2)	Long term (4)	-	+32: Minor Beneficial	Improves safety and liveability of local people	-	-	-	-	-	-
1.8		Risk/hazard	Control of landslide	Positive	Direct	Regional (4)	Medium (2)	Long term (4)	-	+32: Minor Beneficial	Improves safety and liveability of local people	-	-	-	-	-	-

1.1.2 COMMON URBAN INFRASTRUCTURE

The common urban infrastructure for the proposed ALDTP project comprises of components like Roads, Bridges, water drawl and supply, Sewerage system, Storm water management, Hill slope stability, Solid Waste Management, Power supply and distribution system, telecommunication system and landscaping

ROADS

Impacts related to road construction works are as mentioned in Table -10

Table -10: Impacts related to road construction works

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environmental Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
1.1	Roads: ALDTP Master Plan comprises of Approx. 45 Kms of road network comprising of roughly 186 Acres of land. Streets include the following configurations: 40.0 m, 30.0 m, 24.0 m, 18.0 m, 12.0 m and 9.0 m. All roads are of concrete, will be pre-designed to convey drainage, water supply and underground utilities. Major streets will have cycle paths and pedestrian walkways. Streets will be built to design, in-situ. Duration: 22 months.	Air	Land clearing, laying of network, concrete pouring and finishing: dust suspension, and gaseous emissions	Negative	Direct	Study Area (2)	Medium (2)	Long Term (4)	Reversible (1)	-16: Minor adverse	The air impact is not likely to exceed the study area at the max. Impacts will stop once the activity ceases. Air emissions during foundation work. MM: Provision of Dust barriers, water spraying during such operations; Vehicles used in this activity to be well maintained and to have exhaust norms of Bharat Stage IV or equivalent.	Study Area (2)	Medium (2)	Long Term (4)	Reversible (1)	-16: Minor adverse	No Change
1.2		Water Quality / Resources	Runoff into river	Negative	Direct	Study Area (2)	Low (1)	Long Term (4)	Reversible (1)	-8: Minor adverse	Impacts into the River from this activity are likely to be limited. MM: Construction of interceptor drains / scientifically designed storm water drains	Study Area (2)	Low (1)	Medium Term (3)	Reversible (1)	-6: Minor adverse	Reduced water pollution due to implementation of mitigation measure
1.3		Noise	Road works and machinery	Negative	Direct	Study Area (2)	Medium (2)	Long Term (4)	Reversible (1)	-16: Minor adverse	Noise perception may exceed the site area but unlikely to go beyond the study area. MM: Provision of Noise barriers &	Study Area (2)	Medium (2)	Medium Term (3)	Reversible (1)	-12: Minor adverse	Reduction due to implementation of mitigation measure

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environmental Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
											enclosures						
1.4		Soil	Soil contamination due to waste	Negative	Direct	Site (1)	Low (1)	Long Term (4)	Reversible (1)	-4: Minor adverse	Wastes will include construction debris, mainly. MM: Construction debris management plan including construction of facilities thereof	Site (1)	Low (1)	Short Term (2)	Reversible (1)	-2: Minor adverse	Reduction due to implementation of mitigation measure
1.6		Socio-Economics	Better Communication, Employment generation	Positive	Direct and Indirect	Regional (4)	-	Long Term (4)	Irreversible (5)	+80: Major Beneficial	The street network will greatly enhance the connectivity of the Region and de-congest Phuentsholing.	-	-	-	-	-	-
1.8		Risk Hazard	Workplace accidents: heavy machinery, hits, fall, drowning	Negative	Indirect	Site (1)		Long Term (4)	Irreversible (3)	-12: Minor Significant	Possibility of injuries is ever-present. MM: Sinages, imparting training to workers who may be exposed to such risks.	Site (1)		Medium Term (3)	Irreversible (3)	-9: Minor Significant	Reduction due to implementation of mitigation measure

BRIDGES

Impacts related to bridge construction works are as mentioned in Table -11

Table -11: Impacts related to bridge construction works

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environmental Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
1.1	Foundations (civil works, 6 months duration)	Air	Machinery, piling and earth work: dust and gases	Negative	Direct	Site (1)	Low (1)	Medium Term (3)	Reversible (1)	-3: Minor adverse	Air emissions during foundation work. MM: Provision of Dust barriers, water spraying during such operations; Vehicles used in this activity to be well maintained and to have exhaust norms of Bharat Stage IV or equivalent.	Site (1)	Low (1)	Medium Term (3)	Reversible (1)	-3: Minor adverse	No Change
1.2		Water Quality / Resources	Muck and dust from works: increased turbidity in river	Negative	Direct	Site (1)	Low (1)	Medium Term (3)	Reversible (1)	-3: Minor adverse	Risk of water pollution due to works MM: Provision of muck arresting barriers.	Site (1)	Low (1)	Short Term (2)	Reversible (1)	-2: Minor adverse	Reduction due to implementation of mitigation measure
1.3		Noise	Machinery, piling, civil works: noise	Negative	Direct	Site (1)	Medium (2)	Medium Term (3)	Reversible (1)	-3: Minor adverse	Noise from piling and other works MM: Enclose noisy equipment behind acoustic enclosures, fit silencing devices on all operated equipment, visual alarms preferred over hooters, muffling devices on engines, personal paging devices preferred to public address systems, barricading all around the site, Providing PPEs for workers	Site (1)	Low (1)	Short Term (2)	Reversible (1)	-2: Minor adverse	Reduction due to implementation of mitigation measure
1.4		Soil	Works: muck deposition on top soil	Negative	Direct	Site (1)	Low (1)	Medium Term (3)	Reversible (1)	-3: Minor adverse	Possibility of soil contamination due to muck deposition. MM: Same as Sr. no. 1.2 above	Site (1)	Low (1)	Short Term (2)	Reversible (1)	-2: Minor adverse	Reduction due to implementation of mitigation measure
1.5		Ecology	Works: impacts to aquatic macro and	Negative	Direct	Local (3)	Low (1)	Medium Term (3)	Reversible (1)	-9: Minor adverse	Possibility of river pollution due to works. MM:	Local (3)	Low (1)	Short Term (2)	Reversible (1)	-6 Minor adverse	Reduced impacts to Ecology due to

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environmental Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
			micro flora / fauna								Construction of suitable barriers like Coffer dams & / or similar infrastructure so as to limit the impacts						implementation of mitigation measure
1.6		Socio-Economics	Bridge: Improved access linkage to west bank of river	Positive	Indirect / Direct	Local (3)	Medium (2)	Long Term (4)	Irreversible (5)	+60: Highly beneficial	The likelihood that the bridge will be an important link for local persons and will provide a boost to the local economy over the long term	-	-	-	-	-	-
1.7		Hydrology	Flow changes during construction	Negative	Direct	Site (1)	Low (1)	Long Term (4)	Reversible (1)	-4: Minor Adverse	The slight change in water flow around the piers. MM: Pier design to consider aspects of eddy currents and vortices.	Site (1)	Low (1)	Medium Term (3)	Reversible (1)	-3: Minor Adverse	Reduction due to implementation of mitigation measure
1.8		Risk Hazard	Construction hazards: Injuries of a temporary nature	Negative	Direct	Site (1)	Medium (2)	Very Short term (1)	Reversible (1)	-2: Minor Adverse	Construction hazards leading to injuries. MM: pre-project job safety analysis to be done; worker safety training prior to commencement of work; use of personal protective equipment (PPE) as required.	Site (1)	Medium (2)	Very Short term (1)	Reversible (1)	-2: Minor Adverse	No Change
1.9		Risk Hazard	Construction hazards: Injuries of a permanent nature or fatalities	Negative	Direct	Site (1)	High (3)	Long term (4)	Irreversible (3)	-36: Significant Adverse	Construction hazards leading to permanent injury or fatality. MM: Occupational Health and Safety Management Plan (OHSMP) Sub-Plan	Site (1)	Medium (2)	Long term (4)	Irreversible (3)	-12: Significant Adverse	Reduction due to implementation of mitigation measure
2.1	Super and sub-structures (pier, deck, abutment civil works, 16 months duration)	Air	Superstructure related work: dust and gases	Negative	Direct	Site (1)	Low (1)	Long Term (4)	Reversible (1)	-4: Minor Adverse	Air emissions during foundation work. MM: Please refer Sr. No. 1.1 above	Site (1)	Low (1)	Medium Term (3)	Reversible (1)	-3: Minor Adverse	Reduction due to implementation of mitigation measure
2.2		Water Quality / Resources	Civil works: contamination from material,	Negative	Direct	Study Area (2)	Low (1)	Long Term (4)	Reversible (1)	-8: Minor Adverse	Risk of water pollution due to works. MM: Please	Site (1)	Low (1)	Short Term (2)	Reversible (1)	-2: Minor adverse	Reduction due to implementation

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environmental Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
			boulders, cement, aggregate, solid wastes								refer Sr. No. 1.2 above						of mitigation measure
2.3		Noise	Machinery, civil works: noise	Negative	Direct	Site (1)	Low (1)	Long Term (4)	Reversible (1)	-4: Minor Adverse	Noise from superstructure and other works MM: Enclose noise generating equipment behind acoustic enclosures, fit silencing devices on all operated equipment, visual alarms preferred over hooters, muffling devices on engines, personal paging devices preferred to public address systems, barricading all around the site; Providing PPEs for workers	Site (1)	Low (1)	Medium Term (3)	Reversible (1)	-3: Minor adverse	Reduction due to implementation of mitigation measure
2.6		Socio-Economics	Works: employment	Positive	Direct	Local (3)	Low (1)	Long Term (4)	Reversible (1)	+12: Minor beneficial	Employment opportunities to local persons for almost two years	-	-	-	-	-	-
2.7			Bridge: Improved access to west bank of river	-	-	-	-	-	-	-	Please read S. No. 1.6 of this table	-	-	-	-	-	-
2.8		Hydrology	Flow augmented during construction	Negative	Direct	Site (1)	Medium (2)	Medium Term (3)	Reversible (1)	-6: Minor Adverse	The slight change in water flow around the piers. MM: Piers and their spacing designed in such a way as to reduce vortices, eddy currents etc.	Site (1)	Low (1)	Medium Term (3)	Reversible (1)	-2: Minor Adverse	Reduction due to implementation of mitigation measure
2.9		Risk Hazard	Accidents, Structure Collapse, land slide	-	-	-	-	-	-	-	See S. No. 1.8 and 1.9.	-	-	-	-	-	-

WATER DRAWL AND SUPPLY

Impacts associated with Water drawl and supply infrastructure facilities for CONSTRUCTION activities are as mentioned in Table -12

Table -12: Water Drawl for Construction Activities

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environment Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score/ Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score/ Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
1.1	Abstraction of surface water / groundwater from the River (7200 KLD) for construction activities and (100 KL/D) from a tube well for domestic use. It is expected that water drawl for construction purposes will be done using a mud pump at appropriate locations depending on construction needs.	Hydrogeology	Water Drawl: Potential impact on ground water level reduction in the future.	Direct	Adverse	Local (3)	Low(1)	Long Term (4)	Reversible (1)	-12: Minor Adverse	Withdrawal of water for domestic use only will not lead to significant depletion of water table.	Local (3)	Low (1)	Long Term (4)	Reversible (1)	-12: Minor Adverse	No Change
1.2		Hydrogeology	Water Drawl: Potential impact on surface water flows due to drawl of water from the River.	Direct	Adverse	Regional (4)	Low (1)	Long Term (4)	Reversible (1)	-16: Minor Adverse	The water drawl for construction purposes amounts to less than 1% of the lean season flow of the River.	Regional (4)	Low (1)	Long Term (4)	Reversible (1)	-16: Minor Adverse	No change
1.3		Socio-Economics	Water Drawl: Sharing of water with local communities	Direct	Beneficial	Local (3)	Medium (2)	Long Term (4)	Reversible (1)	+24: Significant Beneficial	Availability of additional usable water for these communities	-	-	-	-	-	-
1.4		Socio-Economics	Water Drawl: Consumption of water by up to 1300 workers	Direct	Adverse	Site (1)	Medium (2)	Long Term (4)	Reversible (1)	-8: Minor Adverse	Existing water quality is Class A, but needs disinfection before consumption. Consumption of untreated water may lead to gastro-intestinal diseases. **MM:** Water will be disinfected before consumption.	Site (1)	Low (1)	Long Term (4)	Reversible (1)	-4: Minor Adverse	Reduction due to implementation of mitigation measure.
1.5		Noise	Construction work: noise	Negative	Direct	Site (1)	Low (1)	Short term (2)	Reversible (1)	-2: Minor Adverse	Nominal noise generation for short duration with largely on-site impacts. **MM:** Site barricading prior to commencement of construction work.	Within Site (1)	Low (1)	Short term (2)	Reversible (1)	-2: Minor Adverse	No Change.

Impacts associated with Water drawl and supply infrastructure facilities for OPERATION phase activities are as mentioned in Table -13

Table -13: Impacts related to establishment of facilities for Water Drawl and Supply for Project Operation Stage

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environmental Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
2.1	Water drawl and supply network. This will consist of a water intake system from the River (initially ground water from 4 tube wells for Zone A, treatment plant, ground and elevated storage reservoirs, distribution system up to the neighbourhood level). Activity duration: 20 months.	Air	Reservoirs, and piping: vehicles, concrete pouring, use of light equipment for piping: limited air emissions	Negative	Direct	Site (1)	Medium (2)	Long Term (4)	Reversible (1)	-8 Minor adverse	Laying of pipelines along linear and cross-drainage facilities fabricated with road network: limited emissions associated with vehicles only. **MM:** Proper vehicle maintenance, emissions from vehicles used should be Bharat Stage IV or equivalent	Site (1)	Low (1)	Medium Term (3)	Reversible (1)	-3: Minor adverse	Reduction due to implementation of mitigation measure
2.2		Water Quality / Resources	Contamination during intake point setup	Negative	Direct	Site (1)	Low (1)	Long Term (4)	Irreversible (3)	-12: Minor adverse	Although water is plentiful in the River, impact score indicates the permanent nature of the drawl (from ground or surface) and reduced balance available. **MM:** Provision of Water recharging methods like infiltration wells etc.	Site (1)	Low (1)	Medium Term (3)	Reversible (1)	-3: Minor adverse	Reduction due to implementation of mitigation measure
2.3		Noise	Works: Noise	Negative	Direct	Site (1)	Medium (2)	Long Term (4)	Reversible (1)	-8: Minor adverse	Noise from works. **MM:** Provision of Noise barriers & enclosures, low noise generating equipment	Site (1)	Low (1)	Medium Term (3)	Reversible (1)	-3: Minor adverse	Reduction due to implementation of mitigation measure
2.4		Soil	Works: Soil contamination	Negative	Direct	Site (1)	Medium (2)	Long Term (4)	Reversible (1)	-8: Minor adverse	Minor wastes entering the soil. **MM:** Waste segregation and safe disposal thereof.	Site (1)	Low (1)	Medium Term (3)	Reversible (1)	-3: Minor adverse	Reduction due to implementation of mitigation measure

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environmental Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
2.5		Socio-Economics	Employment for workers	Positive	Direct	Local (3)	Medium (2)	Long Term (4)	Reversible (1)	+24: Significant beneficial	Substantial employment in water networking possible. Availability of clean water for domestic use to the population of Phuentsholing / ALDTP	-		-	-	-	-
2.6		Risk Hazard	Accidents during laying of pipes / working in closed spaces with low oxygen	Negative	Direct	Site (1)	Medium (2)	Long Term (4)	Irreversible (3)	-24: Significant adverse	Substantial risks to workers especially working in enclosed spaces below road levels. MM: Sinages, imparting training to workers who may be exposed to such risks.	Site (1)	Low (1)	Long Term (4)	Reversible (1)	-4: Minor adverse	Reduction due to implementation of mitigation measure

SEWERAGE SYSTEM

Impacts associated with construction and operation of the sewerage system for the CONSTRUCTION stage (for labour camps and site offices) are as mentioned in Table 14

Table 14 - Impacts associated with construction and operation of the sewerage system

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environment Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score/ Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score/ Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
1.1	Construction and operation of selection drains and soak pits. Three septic tanks of	Air	Odour emission	Negative	Direct	Study Area (2)	Medium (2)	Short term (2)	Reversible (1)	-8: Minor Adverse	There would be odours if improperly designed and constructed sewers are provided **MM**: Ensure that	Within Site (1)	Medium (2)	Short term (2)	Reversible (1)	-4: Minor Adverse	Reduced air pollution due to implementation of mitigation

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environment Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score/ Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score/ Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
	25 KLD with soak pits and up flow filters are proposed and sludge will be disposed to the existing sanitary landfill at Phuentsholing.										closed sewers and soak pits are properly constructed and cleaned frequently by requisite equipment (No manual cleaning would be allowed);						measure
1.2		Soil/land	Sludge handling during cleaning and maintenance of drains – sludge disposal	Negative	Direct	Within Site (1)	Low (1)	Short term (2)	Reversible (1)	-2: Minor Adverse	Sludge will be produced as a result of drain and soak pit cleaning activities. **MM:** Sludge generated from sewer and soak pit cleaning to be disposed to the sanitary landfill facility of Phuentsholing. No manual cleaning.	Within Site (1)	Low (1)	Very Short term (1)	Reversible (1)	-1: Minor Adverse	Reduction due to implementation of mitigation measure
1.3		Hydrology/geology	Spillages / leakages from treatment units	Negative	Direct	Within Site (1)	High (3)	Short term (2)	Reversible (1)	-6: Minor Adverse	There may be accidental overflows, leakages, spillages of sewage from sewers and soak pits.**MM**: Ensuring quality during construction phase, Periodic maintenance of sewer and soak pit and relevant appurtenances,	Within Site (1)	Low (1)	Short term (2)	Reversible (1)	-2: Minor Adverse	Reduction due to implementation of mitigation measure
1.4		Socio-Economics	Odour	Negative	Direct	Study area (2)	Medium (2)	Short term (2)	Reversible (1)	-8: Minor Adverse	Odours resulting from sewer drains & soak pits may affect the persons living in the site. **MM**: Provision of covered drains and soak pits	Within Site (1)	Medium (2)	Very Short term (1)	Reversible (1)	-2: Minor Adverse	Reduction due to implementation of mitigation measure
1.5		Risk/Hazard	Accidents	Negative	Direct	Within Site (1)	Medium (2)	Short term (2)	Reversible (1)	-4: Minor Adverse	There are chances of accidents to workers occurring during Sewer cleaning and soak pit cleaning operations. **MM**: Avoid manual cleaning of Sewers; Impart training to cleaning staff on accident handling, First Aid treatment; follow on site emergency procedures; Ensure and access to and availability of healthcare facilities, ambulances / Medevac systems; Preparing and implementing Procedures for such incidents.	Within Site (1)	Low (1)	Short term (2)	Reversible (1)	-2: Minor Adverse	Reduction due to implementation of mitigation measure

Impacts associated with construction of the sewerage system for the project operations are shown in Table -15**.**

Table -15: Impacts associated with construction activities of sewage collection and sewage treatment plant facilities

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environmental Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
2.1	Construction of Sewage collection network and Sewage treatment plant. This will consist of construction of sewer pipes / channels with zonal sewage pumping stations up to the Sewage treatment plant.	Air	Piping: vehicles, excavations, use of light equipment for piping: limited air emissions	Negative	Direct	Site (1)	Medium (2)	Long Term (4)	Reversible (1)	-8: Minor adverse	Laying of sewer pipelines along linear and cross-drainage facilities fabricated with road network: limited emissions associated with vehicles only. MM: Proper vehicle maintenance, emissions from vehicles used should be Bharat Stage IV or equivalent. Sprinkling of water.	Site (1)	Low (1)	Long Term (4)	Reversible (1)	-4: Minor adverse	Reduction due to implementation of mitigation measure
2.2		Noise	Works: Noise	Negative	Direct	Site (1)	Medium (2)	Long Term (4)	Reversible (1)	-8: Minor adverse	Noise from works. MM: Provision of Noise barriers & enclosures, low noise generating equipment	Site (1)	Low (1)	Long Term (4)	Reversible (1)	-4: Minor adverse	Reduction due to implementation of mitigation measure
2.3		Soil	Works: Soil contamination	Negative	Direct	Site (1)	Medium (2)	Long Term (4)	Reversible (1)	-8: Minor adverse	Minor wastes entering the soil from pipe laying. MM: Waste segregation and safe disposal thereof.	Site (1)	Low (1)	Long Term (4)	Reversible (1)	-4: Minor adverse	Reduction due to implementation of mitigation measure
2.4		Socio-Economics	Employment for workers	Positive	Direct	Local (3)	Medium (2)	Long Term (4)	Reversible (1)	+24: Minor beneficial	Substantial employment in sewage networking possible. Clean living environment for the populace of Phuentsholing / ALDTP due to removal of sewage, it's treatment and subsequent	-		-	-	-	-

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environmental Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
											disposal						
2.5		Risk Hazard	Accidents during laying of pipes / working in closed spaces with low oxygen	Negative	Direct	Site (1)	Medium (2)	Long Term (4)	Irreversible (3)	-24: Medium Adverse	Substantial risks to workers especially working in enclosed spaces below road levels. MM: Sinages, imparting training to workers who may be exposed to such risks. Compliance with OHSMP.	Site (1)	Low (1)	Long Term (4)	Irreversible (3)	-12: Minor adverse	Reduction due to implementation of mitigation measure

STORM WATER MANAGEMENT

Impacts associated with construction and operation of Storm water facilities during the construction phase are given in **Table -16.**

Table -16: Storm water Management related impacts

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environment Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score/ Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score/ Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
1.1	Construction phase storm water management (This will entail construction and operation of a runoff system directing runoff from the hard paved areas into tube well for	Water	Discharge of potentially contaminated runoff into the Amochhu River	Negative	Direct	Local (3)	High (3)	Short Term (2)	Reversible (1)	-18: Minor Adverse	Storm water runoff has potential to cause floods within the labour camp areas and carry construction and other debris from the construction site into the river. **MM**: Provision and Laying storm water drainage network for safe conveyance of storm water and its	Local (3)	Low (1)	Short term (2)	Reversible (1)	-6: Minor Adverse	Reduction due to implementation of mitigation measure

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environment Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score/ Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score/ Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
	recharge.										discharge at selected points into the tube well. Prior to recharge the water must be cleaned through a filtration and oil and grease separation process.						
1.2		Soil/land	For laying storm water drains	Negative	Direct	Local (3)	Medium (2)	Short term (2)	Reversible (1)	-12: Minor Adverse	Soil would be displaced for construction of storm water drainage networks. **MM**: Filling up displaced soil in low lying areas / reuse displaced soil in landscaping activities	Within site (1)	Medium (2)	Short term (2)	Reversible (1)	-4: Minor Adverse	Reduction due to implementation of mitigation measure
1.3		Hydrology/geology	Groundwater recharge (after filtration / separation)	Positive	Direct	Regional (4)	Low (1)	Long Term (4)	Reversible (1)	+16: Significant Beneficial	Improves the groundwater quality and quantity	-	-	-	-	-	-
1.6		Risk/Hazard	Clogging and pipe / drain leakage	Negative	Direct	Local (3)	Medium (2)	Short term (2)	Reversible (1)	-12: Minor Adverse	Presence of obstructions in the form of debris (vegetation, wastes etc.) will create obstructions in the drains. **MM**: Construction Contractors / local facility management company to ensure that timely pre-monsoon and post monsoon drain / pipeline cleaning activities are carried out.	Local (3)	Low (1)	Short term (2)	Reversible (1)	-6: Minor Adverse	Reduction due to implementation of mitigation measure
1.7		Risk/Hazard	Flood waters from outfalls and in the Amochhu river owing to excessive run-off, damaging the construction site and potentially causing injury	Negative	Direct	Regional (4)	High (3)	Medium Term (3)	Reversible (1)	-36: Significant Adverse	Flood waters have a potential to cause large scale damage to property and loss of life. **MM:** Establishment and implementation of On-site / Off Site emergency plan and site evacuation plans in conjunction with upstream flood warning stations	Local (3)	Medium (2)	Short Term (2)	Reversible (1)	-12: Minor Adverse	Reduction due to implementation of mitigation measure

Impacts associated with construction activities of storm water evacuation network for the operation stage of the project are as mentioned in Table -17

Table -17: Impacts associated with construction activities of storm water evacuation network

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environmental Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
2.1	Storm water network. This will consist of a network of dedicated underground channels / pipelines within the proposed ALDTP to evacuate storm water during rains / similar storms. Activity duration: 20 months.	Air	Reservoirs, and piping: vehicles, concrete pouring, use of light equipment for piping: limited air emissions	Negative	Direct	Site (1)	Medium (2)	Long Term (4)	Reversible (1)	-8 Minor adverse	Laying of pipelines along linear and cross-drainage facilities fabricated with road network: limited emissions associated with vehicles only. MM: Proper vehicle maintenance, emissions from vehicles used should be Bharat Stage IV or equivalent	Site (1)	Low (1)	Medium Term (3)	Reversible (1)	-3: Minor adverse	Reduction due to implementation of mitigation measure
2.2		Noise	Works: Noise	Negative	Direct	Site (1)	Medium (2)	Long Term (4)	Reversible (1)	-8: Minor adverse	Noise from works. MM: Provision of Noise barriers & enclosures, low noise generating equipment	Site (1)	Low (1)	Medium Term (3)	Reversible (1)	-3: Minor adverse	Reduction due to implementation of mitigation measure
2.3		Soil	Works: Soil contamination	Negative	Direct	Site (1)	Medium (2)	Long Term (4)	Reversible (1)	-8: Minor adverse	Minor wastes entering the soil. MM: Waste segregation and safe disposal thereof.	Site (1)	Low (1)	Medium Term (3)	Reversible (1)	-3: Minor adverse	Reduction due to implementation of mitigation measure
2.4		Socio-Economics	Employment for workers	Positive	Direct	Local (3)	Medium (2)	Long Term (4)	Reversible (1)	+24: Significant beneficial	Substantial employment in storm water networking possible. Construction of infrastructure to evacuate rainwater from the ALDTP thereby reducing flood risks.	-		-	-	-	-
2.5		Risk Hazard	Accidents during laying of pipes / working in closed spaces with low oxygen or due to flooding during construction stage.	Negative	Direct	Site (1)	Medium (2)	Long Term (4)	Irreversible (3)	-24: Medium adverse	Substantial risks to workers especially working in enclosed spaces below road levels. **MM:** Checking the ambient oxygen levels before entering such areas.	Site (1)	Low (1)	Long Term (4)	Reversible (1)	-4: Minor adverse	Reduction due to implementation of mitigation measure

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environmental Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
											Sinages, imparting training to workers who may be exposed to such risks and flood warning system during construction stage. This issues should be addressed in the OHSMP Sub-Plan.						
2.6		Risk Hazard	Flooding risk and damage to property / people due to runoff from hillslopes entering / flooding the surrounding area during the monsoons	Negative	Direct	Study Area (2)	High (3)	Short Term (2)	Irreversible (3)	-36: Medium adverse	There is a risk of runoff water during the monsoons entering the project site and study area and flooding it. **MM**: installation of ducts / channels to ensure the water is discharged into the river without overflowing the channels.	Site (1)	Low (1)	Short Term (2)	Irreversible (3)	-6: Minor adverse	Reduction due to implementation of mitigation measure

SOLID WASTE MANAGEMENT

Impacts associated with construction and operation of solid waste facilities during the construction phase are given in Table -18**.**

Table -18: Solid Waste Management related impacts

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environment Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score/ Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score/ Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
1.1	Solid Waste Management – Generation of Municipal Solid Wastes (construction	Air	Odour	Negative	Direct	Study Area (2)	Medium (2)	Long Term (4)	Reversible (1)	-16: Minor Adverse	There would be odours by waste kept haphazardly in the open. **MM**: Ensure closed dust bins / waste containers. Implement	Within site (1)	Low (1)	Long Term (4)	Reversible (1)	-4: Minor Adverse	Reduction due to implementation of mitigation measure

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environment Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score/ Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score/ Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
	waste, bio-degradable and non-biodegradable)										provisions of Bhutan's Waste Prevention and Management Regulation 2012, as amended in 2016,						
1.2		Water	Generation of leachate (as a result of water mixed with stored wastes)	Negative	Direct	Study Area (2)	Medium (2)	Short term (2)	Reversible (1)	-8: Minor Adverse	Spillages may occur when waste comes in contact with water. **MM**: Provision of drains with traps; Provision of storm water drains in the facility; Clean-up of spillages	Within site (1)	Low (1)	Long Term (4)	Reversible (1)	-4: Minor Adverse	Reduction due to implementation of mitigation measure
1.3		Soil/land	Contamination	Negative	Direct	Study Area (2)	Medium (2)	Short term (2)	Reversible (1)	-8: Minor Adverse	Soil / Land may get contaminated if MSW comes in contact with it. **MM**: Provision of paved floors in the facility	Within site (1)	Low (1)	Long Term (4)	Reversible (1)	-4: Minor Adverse	Reduction due to implementation of mitigation measure
1.4		Risk/Hazard	Disease vectors accessing the wastes; Exposure to diseases and creation of un-hygienic living conditions within labour camps	Negative	Direct	Study Area (2)	Medium (2)	Short term (2)	Reversible (1)	-8: Minor Adverse	There are chances of accidents occurring during waste handling operations. **MM**: Ensure closed dust bins / waste containers. Implement provisions of Bhutan's Waste Prevention and Management Regulation 2012, as amended in 2016,	Within site (1)	Low (1)	Long Term (4)	Reversible (1)	-4: Minor Adverse	Reduction due to implementation of mitigation measure
2.1	Solid Waste Management – Generation of Construction wastes and scrap	Air	Dust generation	Negative	Direct	Study Area (2)	Medium (2)	Long Term (4)	Reversible (1)	-16: Minor Adverse	There would be dust generated by scrap / waste kept haphazardly in the open. **MM**: Ensure closed dust bins / waste containers / tarpaulins to cover the wastes. Implement provisions of Bhutan's Waste Prevention and Management Regulation 2012, as amended in 2016,	Within site (1)	Low (1)	Long Term (4)	Reversible (1)	-4: Minor Adverse	Reduction due to implementation of mitigation measure
2.2		Water	Generation of leachate (as a result of water mixed with stored wastes)	Negative	Direct	Study Area (2)	Medium (2)	Short term (2)	Reversible (1)	-8: Minor Adverse	Spillages may occur when waste comes in contact with water. **MM**: Provision of drains with traps; Provision of storm water drains in the facility; Clean-up of spillages	Within site (1)	Low (1)	Long Term (4)	Reversible (1)	-4: Minor Adverse	Reduction due to implementation of mitigation measure
2.3		Soil/land	Contamination	Negative	Direct	Study Area (2)	Medium (2)	Short term (2)	Reversible (1)	-8: Minor Adverse	Soil / Land may get contaminated if some wastes (though in small quantities) comes in contact with it. **MM**: Provision of paved floors in the facility	Within site (1)	Low (1)	Long Term (4)	Reversible (1)	-4: Minor Adverse	Reduction due to implementation of mitigation measure
2.4		Risk/Hazard	Exposure to sharp wastes having injury	Negative	Direct	Study Area	Medium (2)	Short term	Reversible (1)	-8: Minor	There are chances of accidents occurring during	Within site	Low (1)	Long Term	Reversible (1)	-4: Minor	Reduction due to implementation

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environment Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score/ Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score/ Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
			risks			(2)		(2)		Adverse	waste handling operations. **MM**: Ensure waste handlers wear requisite and adequate PPEs; closed dust bins / waste containers. Implement provisions of Bhutan's Waste Prevention and Management Regulation 2012, as amended in 2016,	(1)		(4)		Adverse	of mitigation measure

Impacts associated with construction activities of solid waste management facilities for the operation phase are as mentioned in Table -19

Table -19: Impacts associated with construction activities of solid waste management facilities

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environmental Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
3.1	Solid waste management system: Construction of municipal solid waste (MSW) treatment yards (buildings) where vehicles will deposit the waste after door to door collection. Construction Period 12 months.	Air	Landfill construction emissions	Negative	Direct	Site (1)	Low (1)	Long Term (4)	Reversible (1)	-4: Minor adverse	Air emissions during construction activities MM: Proper vehicle maintenance, emissions from vehicles used should be Bharat Stage IV or equivalent	Site (1)	Low (1)	Medium Term (3)	Reversible (1)	-3: Minor adverse	Reduction due to implementation of mitigation measure
3.2		Water Quality / Resources	Runoff from construction site	Negative	Direct	Site (1)	Low (1)	Long Term (4)	Reversible (1)	-4: Minor adverse	Occasional, marginal, run-off from construction site that may enter River. MM: Provision of Barriers to prevent entry of such water	Site (1)	Low (1)	Medium Term (3)	Reversible (1)	-3: Minor adverse	Reduction due to implementation of mitigation measure

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environmental Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
											into the river						
3.3		Noise	Construction noise	Negative	Direct	Site (1)	Low (1)	Long Term (4)	Reversible (1)	-4: Minor adverse	Generation of noise from construction activities. MM: Provision of Noise barriers & enclosures, low noise generating equipment	Site (1)	Low (1)	Medium Term (3)	Reversible (1)	-3: Minor adverse	Reduction due to implementation of mitigation measure
3.4		Soil	Site preparation for landfill, top soil removal	Negative	Direct	Site (1)	Low (1)	Long Term (4)	Reversible (1)	-4: Minor adverse	Minor soil loss. (To reconfirm whether the landfill is being constructed at ALDTP or the Phuentsholing landfill is being used).	Site (1)	Low (1)	Long Term (4)	Reversible (1)	-4: Minor adverse	No Change
3.6		Socio-Economics	Employment generation	Positive	Direct	Site (1)	Low (1)	Long Term (4)	Reversible (1)	+4: Minor beneficial	Some employment for the duration of construction	-	-	-	-	-	-
3.8		Risk Hazard	Accidents during construction	Negative	Direct	Site (1)	Low (1)	Long Term (4)	Irreversible (3)	-12: Minor adverse	Construction risks. MM: Sinages, imparting training to workers who may be exposed to such risks.	Site (1)	Low (1)	Medium Term (3)	Irreversible (3)	-9: Minor adverse	Reduction due to implementation of mitigation measure
3.9		Land use / Land cover	Open land to disposal site	-	-	-	-	-	-	-	-	-		-	-	-	-

POWER SUPPLY AND DISTRIBUTION SYSTEM

Impacts associated with construction and operation of the temporary power supply for the construction stage are given in **Table -20.**

Table -20: Impacts associated with construction and operation of the temporary power supply during the construction stage

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environment Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score/ Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score/ Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
1.1	Provision of Pre-Construction Power (including operation of backup power in the form of Diesel Generator sets)	Air	Digging, laying are erection of poles, transformers, Air emissions during Diesel Generator set operations	Negative	Direct	Site (1)	Low (1)	Long Term (4)	Reversible (1)	-4: Minor adverse	Air emissions during construction activities. MM: Site barricading, water sprinkling.	Site (1)	Low (1)	Medium Term (3)	Reversible (1)	-3: Minor adverse	Reduction due to implementation of mitigation measure
1.2		Water Quality / Resources	Occasional, marginal, run-off from construction site that may enter River.	Negative	Direct	Site (1)	Low (1)	Long Term (4)	Reversible (1)	-4: Minor adverse	Occasional, marginal, run-off from construction site that may enter River. MM: Provision of Barriers to prevent entry of such water into the river	Site (1)	Low (1)	Medium Term (3)	Reversible (1)	-3: Minor adverse	Reduction due to implementation of mitigation measure
1.3		Noise	Laying, digging noise, Noise during Diesel Generator set operations	Negative	Direct	Site (1)	Medium (2)	Long Term (4)	Reversible (1)	-8: Minor adverse	Generation of noise from pre-construction activities, Diesel Generator set commissioning MM: Provision of Noise barriers & enclosures, low noise generating equipment, Provision of ear plugs; Use of Diesel Generator set with Acoustic Enclosure.	Site (1)	Low (1)	Medium Term (3)	Reversible (1)	-3: Minor adverse	Reduction due to implementation of mitigation measure
1.4		Soil	Top soil removal and mixing	Negative	Direct	Site (1)	Low (1)	Long Term (4)	Reversible (1)	-4: Minor adverse	Minor loss of topsoil. MM: Preparing and implementing a soil reclamation plan	Site (1)	Low (1)	Medium Term (3)	Reversible (1)	-3: Minor adverse	Reduction due to implementation of mitigation measure
1.5		Socio-Economics	Employment generation	Positive	Direct	Site (1)	Medium (2)	Long Term (4)	Reversible (1)	+8: Minor beneficial	Some employment for the duration of construction	-		-	-	-	-
1.6		Risk Hazard	Injuries due to electric cable and other equipment unloading	Negative	Direct	Site (1)	High (3)	Long Term (4)	Irreversible (3)	-36: Significant adverse	Substantial risks to workers especially working in enclosed spaces below road levels. MM: Strict implementation of OHSMP Sub-Plan. Placing signage, Ensuring adequate initial and follow up training is imparted to relevant personnel, Provision and use of PPEs	Site (1)	Medium (2)	Medium Term (3)	Irreversible (3)	-18: Minor adverse	Reduction due to implementation of mitigation measure

Impacts associated with construction of permanent power supply and distribution system for the operation stage are as mentioned in **Table -21.**

Table -21: Impacts associated with construction of power supply and distribution system

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environmental Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
4.1	Power supply and distribution system: Construction of 2 switching stations in Zone A and one in Zone C, to step down high voltage to usable high voltage. Further 8 sub-stations are proposed in the ALDTP to step down high voltage to one or three-phase supply. Duration of construction: 18 months.	Air	Digging, laying are erection of poles, transformers	Negative	Direct	Site (1)	Low (1)	Long Term (4)	Reversible (1)	-4: Minor adverse	Air emissions during construction activities. MM: Proper vehicle maintenance, emissions from vehicles used should be National Environmental Standards, or equivalent	Site (1)	Low (1)	Medium Term (3)	Reversible (1)	-3: Minor adverse	Reduction due to implementation of mitigation measure
4.2		Water Quality / Resources	Occasional, marginal, run-off from construction site that may enter River.	Negative	Direct	Site (1)	Low (1)	Long Term (4)	Reversible (1)	-4: Minor adverse	Occasional, marginal, run-off from construction site that may enter River. MM: Provision of Barriers to prevent entry of such water into the river	Site (1)	Low (1)	Medium Term (3)	Reversible (1)	-3: Minor adverse	Reduction due to implementation of mitigation measure
4.3		Noise	Laying, digging noise	Negative	Direct	Site (1)	Low (1)	Long Term (4)	Reversible (1)	-4: Minor adverse	Generation of noise from construction activities MM: Provision of Noise barriers & enclosures, low noise generating equipment, Provision of ear plugs	Site (1)	Low (1)	Medium Term (3)	Reversible (1)	-3: Minor adverse	Reduction due to implementation of mitigation measure
4.4		Soil	Top soil removal and mixing	Negative	Direct	Site (1)	Low (1)	Long Term (4)	Reversible (1)	-4: Minor adverse	Minor loss of topsoil. MM: Preparing and implementing a soil reclamation plan	Site (1)	Low (1)	Medium Term (3)	Reversible (1)	-3: Minor adverse	Reduction due to implementation of mitigation measure
4.6		Socio-Economics	Employment generation	Positive	Direct	Site (1)	Low (1)	Long Term (4)	Reversible (1)	+4: Minor beneficial	Some employment for the duration of construction	-		-	-	-	-
4.8		Risk Hazard	From electric cable shocks during setup / working in confined spaces in case of underground	Negative	Direct	Site (1)	High (3)	Long Term (4)	Irreversible (3)	-36: Significant adverse	Substantial risks to workers especially working in enclosed spaces below road levels from electric shocks and due to nature of confined spaces. **MM:**	Site (1)	Medium (2)	Medium Term (3)	Irreversible (3)	-18: Minor adverse	Reduction due to implementation of mitigation measure

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environmental Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
			telecom cables								Implementation of OHSMP. Placing signage, Ensuring adequate initial and follow up training is imparted to relevant personnel, Provision and use of PPEs						

TELECOMMUNICATION SYSTEM

For the construction stage, the existing telecommunication facilities (Tashi Cell / B Mobile) will be used. Hence no impact due to operation of the construction phase telecommunication system is anticipated.

For the operation stage, impacts associated with construction of the telecommunication system are provided in **Table-22.**

Table-22: Impacts associated with construction of telecommunication system

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environmental Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
4.1	Construction of telecom network will include laying of fibre optic cables till the houses and installation of telecom transmission towers for cellular phones. Duration of construction: 18 months.	Air	Digging, laying are erection of towers, transformers	Negative	Direct	Site (1)	Low (1)	Long Term (4)	Reversible (1)	-4: Minor adverse	Air emissions during construction activities. MM: Please refer Table 8.9 Sr., No. 3.1	Site (1)	Low (1)	Medium Term (3)	Reversible (1)	-3: Minor adverse	Reduction due to implementation of mitigation measure
4.2		Water Quality / Resources	Occasional, marginal, run-off from construction site that may enter River.	Negative	Direct	Site (1)	Low (1)	Long Term (4)	Reversible (1)	-4: Minor adverse	Occasional, marginal, run-off from construction site that may enter River. MM: Provision of Barriers to prevent entry of such water	Site (1)	Low (1)	Medium Term (3)	Reversible (1)	-3: Minor adverse	Reduction due to implementation of mitigation measure

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environmental Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
											into the river						
4.3		Noise	Laying, digging noise	Negative	Direct	Site (1)	Low (1)	Long Term (4)	Reversible (1)	-4: Minor adverse	Generation of noise from construction activities MM: Provision of Noise barriers & enclosures, low noise generating equipment, Provision of ear plugs	Site (1)	Low (1)	Medium Term (3)	Reversible (1)	-3: Minor adverse	Reduction due to implementation of mitigation measure
4.4		Soil	Top soil removal and mixing	Negative	Direct	Site (1)	Low (1)	Long Term (4)	Reversible (1)	-4: Minor adverse	Minor loss of topsoil. MM: Preparing and implementing a soil reclamation plan	Site (1)	Low (1)	Medium Term (3)	Reversible (1)	-3: Minor adverse	Reduction due to implementation of mitigation measure
4.6		Socio-Economics	Employment generation	Positive	Direct	Site (1)	Low (1)	Medium Term (3)	Reversible (1)	+3: Minor beneficial	Some employment for the duration of construction	-		-	-	-	-
4.8		Risk Hazard	From electric cable shocks during setup / working in confined spaces in case of underground telecom cables	Negative	Direct	Site (1)	Low (1)	Long Term (4)	Irreversible (3)	-12: Minor adverse	Substantial risks to workers especially working in enclosed spaces below road levels. MM: Placing signage, Ensuring adequate initial and follow up training is imparted to relevant personnel, Provision and use of PPEs	Site (1)	Low (1)	Medium Term (3)	Irreversible (3)	-9: Minor adverse	Reduction due to implementation of mitigation measure

FIRE FIGHTING SYSTEM

Construction and Operation of Fire-fighting system related impacts for the construction stage are mentioned in Table -23.

Table -23: Construction and Operation of Fire-fighting system related impacts

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environmental Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
4.1	The primary firefighting system in the form of dry chemical extinguishers will be installed at probable fire locations such as labour housing, site offices and project offices, and near relevant electrical installations.	Soil	Wastes from a fire.	Negative	Direct	Site (1)	Low (1)	Short Term (2)	Reversible (1)	-2: Minor adverse	Waste from both the firefighting material and materials burnt due to the fire will be generated. **MM:** Wastes from the fire should not be allowed to enter the River and stored for later disposal in the landfill at Phuentsholing.	Site (1)	Low (1)	Very Short Term (1)	Reversible (1)	-1: Minor adverse	Reduction due to implementation of mitigation measure
4.2		Water Quality / Resources	Occasional, marginal, run-off from construction site that may enter River.	Negative	Direct	Local (3)	Low (1)	Short Term (2)	Reversible (1)	-6: Minor adverse	Occasional, marginal, run-off from construction site that may enter River. MM: Provision of Barriers to prevent entry of such water into the river. For e.g.: a closed garland drain with substantial capacity to store used firewater, to be built around the work area.	Site (1)	Low (1)	Very Short Term (1)	Reversible (1)	-1: Minor adverse	Reduction due to implementation of mitigation measure

FLOOD WARNING SYSTEM

This will entail establishment of rainfall and water level sensors, at select locations and therefore does not entail any environmental impact of note.

LANDSCAPING

No landscaping activities are being proposed for the construction stage.

Impacts associated with construction of landscaping spaces for the operation stage are as mentioned in **Table -24.**

Table -24: Impacts associated with construction of landscaping spaces

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environmental Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
1.1	Includes spaces kept available for parks and gardens, riverside promenades, green buffers and corridors. Duration: 24 months.	Air	Suspended dust from site preparation, digging	Negative	Direct	Site (1)	Low (1)	Long Term (4)	Reversible (1)	-4: Minor adverse	Nominal air pollution in shifting of soil and other materials	Site (1)	Low (1)	Medium Term (3)	Reversible (1)	-3: Minor adverse	Reduction due to implementation of mitigation measure
1.2		Water Quality / Resources	Fresh water requirement	Negative	Direct	Site (1)	Low (1)	Long Term (4)	Irreversible (3)	-12: Minor adverse	Consumption of water for landscaping.	Site (1)	Low (1)	Long Term (4)	Irreversible (3)	-12: Minor adverse	No change.
1.3		Noise	Site preparation and planting	Negative	Direct	Site (1)	Low (1)	Long Term (4)	Reversible (1)	-4: Minor adverse	Nominal construction noise MM: Provision of Noise barriers & enclosures, low noise generating equipment, Provision of ear plugs	Site (1)	Low (1)	Medium Term (3)	Reversible (1)	-4: Minor adverse	Reduction due to implementation of mitigation measure
1.4		Soil	Improvement in condition and fertility	Positive	Direct	Site (1)	Low (1)	Long Term (4)	Reversible (1)	+4: Minor beneficial	Improved soil quality over time with additional inputs	-	-	-	-	-	-
1.5		Ecology	Improvement in local ecology and environment	Positive	Direct	Regional (4)	Low (1)	Long term (4)	Irreversible (3)	+48: Highly beneficial	Enhanced ecological condition of site	-	-	-	-	-	-
1.6		Socio-Economics	Employment for preparing greens	Positive	Direct	Local (3)		Long Term (4)	Reversible (1)	+12: Minor beneficial	Employment for locals	-	-	-	-	-	-
1.7		Hydrology	Better soil holding and binding. Control erosion	Positive	Direct	Site (1)		Long Term (4)	Irreversible (3)	+12: Minor beneficial	Improved water holding	-	-	-	-	-	-
1.9		Land use / Land cover	Open soil to landscaped greenery	Positive	Direct	Local (3)	Low (1)	Long Term (4)	Irreversible (3)	+36: Significant beneficial	Change in ecological and aesthetic value of the open areas.	-		-	-	-	-

1.1.3 CONSTRUCTION PHASE DE-COMMISSIONING PLAN

Once the construction activities of various components listed above is completed, de-commissioning activities are required to be undertaken. These would typically include Waste and scrap disposal, removal of construction equipment, formwork removal (for RCC structures), hydraulic testing of all water retaining structures (as part of construction completion).

Table -25: Impacts associated with decommissioning of the project site

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environmental Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
1.1	Includes removal of staff housing, equipment, labour camps and all temporary structures safely from the project site (1-2 months)	Air	Suspended dust demolishing of temporary structures	Negative	Direct	Site (1)	Low (1)	Short Term (2)	Reversible (1)	-2: Minor adverse	Nominal air pollution.	-	-	-	-	-	No change.
1.2		Water Quality / Resources	Disposal of debris or wastes into river	Negative	Direct	Local (3)	Medium (2)	Short Term (2)	Reversible (1)	-12: Minor adverse	Debris from decommissioning activities can be dumped into the river if not properly supervised. **MM:** Ensure that the decommission procedure clean-up of spillage, securing of wastes and their sale / disposal to authorised dealers / landfill or suitable disposal site.	Site (1)	Low (1)	Short Term (2)	Reversible (1)	-2: Minor adverse	Reduction due to implementation of mitigation measure
1.3		Noise	Noise during site decommissioning	Negative	Direct	Study Area (2)	Medium (2)	Short Term (2)	Reversible (1)	-8: Minor adverse	Nominal construction noise **MM:** Provision of Noise barriers & enclosures, Provision of ear plugs	Site (1)	Low (1)	Short Term (2)	Reversible (1)	-2: Minor adverse	Reduction due to implementation of mitigation measure
1.4		Soil	Spillage of waste	Positive	Direct	Site (1)	Medium (2)	Long Term (4)	Reversible (1)	-8: Minor adverse	The materials likely to be spilt will not be toxic or harmful but can cause deterioration of soil fertility. MM: Establish and supervise a waste collection and removal plan	Site (1)	Low (1)	Short Term (2)	Reversible (1)	-2: Minor adverse	Reduction due to implementation of mitigation measure

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environmental Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
											complying with National Environmental Standards and International Good Practices.						
1.5		Socio-Economics	Employment for preparing greens	Positive	Direct	Local (3)		Short Term (2)	Reversible (1)	+6: Minor beneficial	Employment for locals	-	-	-	-	-	-
1.6		Risk / Hazards	Construction hazards: Injuries of a permanent nature or fatalities	Negative	Direct	Site (1)	High (3)	Long term (4)	Irreversible (3)	-36: Significant Adverse	Construction hazards leading to permanent injury or fatality. MM: Occupational Safety and Health Management Plan (OHSMP) Sub-Plan	Site (1)	Medium (2)	Long term (4)	Irreversible (3)	-12: Significant Adverse	Reduction due to implementation of mitigation measure
1.7		Land use / Land cover	Temporary Construction Site to Township	Positive	Direct	Study Area (2)	Low (1)	Long Term (4)	Irreversible (3)	+24: Medium beneficial	Change in ecological and aesthetic value of the open areas.	-		-	-	-	-

OPERATION STAGE

1.1.3.1 RIVER EMBANKMENT STRUCTURES

Impacts associated with operation and maintenance of river embankment structures are as mentioned in **Table -26**

Table -26: Impacts associated with operation and maintenance of river embankment structures

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environmental Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
1.1	Maintenance of Diaphragm Wall	Water Quality	Works: Cleaning activities resulting in generation of dirt, slime etc.	Negative	Direct	Study area (2)	Low (1)	Short Term (2)	Reversible (1)	-4: Minor Adverse	Muck and slime generated can enter River. **MM**: Provide Barriers to prevent entry of muck into the river; Deposit muck / slime by backfilling in low lying areas	Within Site (1)	Low (1)	Short Term (2)	Reversible (1)	-2: Minor Adverse	Reduction due to implementation of mitigation measure
1.2		Noise	Noise due to cleaning activities	Negative	Direct	Study area (2)	Low (1)	Short Term (2)	Reversible (1)	-4: Minor Adverse	Noise generation from works **MM**: Enclose noisy equipment behind acoustic enclosures, fit silencing devices on all operated equipment, visual alarms preferred over hooters, muffling devices on engines, personal paging devices preferred to public address systems, barricading all around the site	Within Site (1)	Low (1)	Short Term (2)	Reversible (1)	-2: Minor Adverse	Reduction due to implementation of mitigation measure
1.3		Soil	Cleaning work: muck generation and slime deposition of slime, muck on soil	Negative	Direct	Study area (2)	Low (1)	Short Term (2)	Reversible (1)	-4: Minor Adverse	Muck will be generated and will be disposed in the low-lying areas within the ALDTP, may enter river. **MM**: Provide Barriers to prevent entry of muck into the river; Deposit	Within Site (1)	Low (1)	Short Term (2)	Reversible (1)	-2: Minor Adverse	Reduction due to implementation of mitigation measure

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environmental Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
											muck by backfilling in low lying areas						
1.4		Ecology	Potential effect on aquatic flora / fauna due to increased turbidity due to entry of muck, slime into the river	Negative	Indirect	Study Area (2)	Medium (2)	Short Term (2)	Reversible (1)	-8: Minor Adverse	Muck and slime could enter the river during cleaning work MM: Provide barriers to prevent entry of muck, slime into the river	Within Site (1)	Low (1)	Short Term (2)	Reversible (1)	-2: Minor Adverse	Reduction due to implementation of mitigation measure
1.5		Socio-Economics	Employment generation	Positive	Direct	Regional (3)	Low (1)	Medium Term (3)	Reversible (1)	+9: Minor Beneficial	Employment leading to improved local economy.	-	-	-	-	-	-
1.6		Risk Hazard	Risks of temporary injury to persons engaged in cleaning activity.	Negative	Direct	Site (1)	Medium (2)	Very Short term (1)	Reversible (1)	-2: Minor Adverse	Construction hazards leading to injuries. **MM:** pre-project job safety analysis to be done; worker safety training prior to commencement of work; use of personal protective equipment (PPE) as required.	Site (1)	Medium (2)	Very Short term (1)	Reversible (1)	-2: Minor Adverse	No Change
1.7		Risk Hazard	Risks of Injuries of a permanent nature or fatalities and drowning in the river (during floods) to persons engaged in cleaning activity.	Negative	Direct	Site (1)	High (3)	Long term (4)	Irreversible (3)	-36: Significant Adverse	Injuries due to fall on hard ground AND / OR falling into the river resulting in drowning leading to permanent injury or fatality. **MM:** Employ trained staff who can swim; performing cleaning activities during non-flood seasons only; Keep life saver floats readily deployed during such activities; perform these	Site (1)	High (3)	Long term (4)	Reversible (1)	-12: Minor Adverse	Reduction due to implementation of mitigation measure

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environmental Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
											activities under supervision of skilled swimmer, Provide PPEs. This should be a part of the OHSMP Sub-Plan.						
2.1	Maintenance of Embankment including stone in wire crates, paver block and vetiver grass (10.5 km) over dead man anchor Stone retaining wall over anchor slab (at the turn of the river around the Hill on the west bank) RCC retaining wall over anchor slab (at the turn of the river on the Hill on the east bank). Stone pitching at termination points	Water Quality	Works: Cleaning activities resulting in generation of dirt, slime etc.	Negative	Direct	Study area (2)	Low (1)	Short Term (2)	Reversible (1)	-4: Minor Adverse	Muck and slime generated can enter River. **MM**: Provide Barriers to prevent entry of muck into the river; Deposit muck / slime by backfilling in low lying areas	Within Site (1)	Low (1)	Short Term (2)	Reversible (1)	-2: Minor Adverse	Reduction due to implementation of mitigation measure
2.2		Noise	Noise due to cleaning activities	Negative	Direct	Study area (2)	Low (1)	Short Term (2)	Reversible (1)	-4: Minor Adverse	Noise generation from works **MM**: Enclose noisy equipment behind acoustic enclosures, fit silencing devices on all operated equipment, visual alarms preferred over hooters, muffling devices on engines, personal paging devices preferred to public address systems, barricading all around the site	Within Site (1)	Low (1)	Short Term (2)	Reversible (1)	-2: Minor Adverse	Reduction due to implementation of mitigation measure
2.3		Soil	Cleaning work: muck generation and slime deposition of slime, muck on soil	Negative	Direct	Study area (2)	Low (1)	Short Term (2)	Reversible (1)	-4: Minor Adverse	Muck will be generated and will be disposed in the low-lying areas within the ALDTP, may enter river. **MM**: Provide Barriers to prevent entry of muck into the river; Deposit	Within Site (1)	Low (1)	Short Term (2)	Reversible (1)	-2: Minor Adverse	Reduction due to implementation of mitigation measure

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environmental Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
											muck by backfilling in low lying areas						
2.4		Ecology	Potential effect on aquatic flora / fauna due to increased turbidity due to entry of muck, slime into the river	Negative	Indirect	Study Area (2)	Medium (2)	Short Term (2)	Reversible (1)	-8: Minor Adverse	Muck and slime could enter the river during cleaning work MM: Provide barriers to prevent entry of muck, slime into the river	Within Site (1)	Low (1)	Short Term (2)	Reversible (1)	-2: Minor Adverse	Reduction due to implementation of mitigation measure
2.5		Socio-Economics	Employment generation	Positive	Direct	Regional (3)	Low (1)	Medium Term (3)	Reversible (1)	+9: Minor Beneficial	Employment leading to improved local economy.	-	-	-	-	-	-
2.6		Risk Hazard	Risks of temporary injury to persons engaged in cleaning activity.	Negative	Direct	Site (1)	Medium (2)	Very Short term (1)	Reversible (1)	-2: Minor Adverse	Construction hazards leading to injuries. **MM:** pre-project job safety analysis to be done; worker safety training prior to commencement of work; use of personal protective equipment (PPE) as required.	Site (1)	Medium (2)	Very Short term (1)	Reversible (1)	-2: Minor Adverse	No Change
2.7		Risk Hazard	Risks of Injuries of a permanent nature or fatalities and drowning in the river (during floods) to persons engaged in cleaning activity.	Negative	Direct	Site (1)	High (3)	Long term (4)	Irreversible (3)	-36: Medium Adverse	Injuries due to fall on hard ground AND / OR falling into the river resulting in drowning leading to permanent injury or fatality. **MM:** Employ trained staff who can swim; performing cleaning activities during non-flood seasons only; Keep life saver floats readily deployed during such activities; perform these	Site (1)	High (3)	Long term (4)	Reversible (1)	-12: Minor Adverse	Reduction due to implementation of mitigation measure

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environmental Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
											activities under supervision of skilled swimmer. This should be a part of the OHSMP Sub-Plan.						
3.1	Maintenance of Channelized River	Soil	Generation of sediment which will be removed	Positive	Direct	Site (1)	Low (1)	Long Term (3)	Reversible (1)	+3: Minor Beneficial	Maintenance of the channel will be required periodically to ensure that adequate depth of the channel is maintained at all times to protect against flooding. **MM:** Ensure that the spoil material from the levelling is used for landscaping or as fill material (as needed)	-	-	-	-	-	-
		Water Quality	Impact of riverbed maintenance levelling on water quality, especially turbidity	Negative	Direct	Study Area (2)	Medium (2)	Long Term (3)	Reversible (1)	-12: Minor Beneficial	Turbidity can rise in case of maintenance activities occurring in flowing river. **MM**: Ensure that maintenance activities are carried out during the lean season and when the maintenance activities do not require levelling in flowing water.	Site (1)	Low (1)	Long Term (3)	Reversible (1)	-3: Minor Adverse	Reduction due to implementation of mitigation measure
		Ecology	Riverbed maintenance levelling on aquatic eco-system	Negative	Direct	Local (3)	Medium (2)	Long Term (3)	Reversible (1)	-18: Minor Adverse	The riverbed levelling if done in flowing water can disturb the benthic, phytoplankton and zooplankton, thereby affecting	Site (1)	Low (1)	Long Term (3)	Reversible (1)	-3: Minor Adverse	Reduction due to implementation of mitigation measure

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environmental Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
											fish presence and availability. **MM:** Ensure that maintenance activities are carried out during the lean season and when the maintenance activities do not require levelling in flowing water. By doing so, there is no damage to phytoplankton or zooplankton and thus fish availability will be unaffected.						

1.1.3.2 HILL SLOPE STABILITY

Impacts associated with operation and maintenance activity of Hill slope constructed in ALDTP are as mentioned in **Table -27**

Table -27: Impacts associated with operation and maintenance activity of Hill slope constructed in ALDTP

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environmental Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
1.5	Maintenance of RCC / Stone Retaining walls and ensuring landscaping on the hill slope stability structure is maintained.	Risk/hazard	Control of landslide	Positive	Direct	Regional (4)	Medium (2)	Long term (4)	-	+32: Minor Beneficial	Improves safety and liveability of local people	-	-	-	-	-	-

1.1.3.3 COMMON URBAN INFRASTRUCTURE

Impacts associated with operation and maintenance of various common urban infrastructure are as mentioned in the following tables.

ROADS AND TRAFFIC MANAGEMENT

Impacts associated with roads and traffic management of ALDTP are as mentioned in **Table -28.**

Table -28: Impacts associated with roads and traffic management of ALDTP

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environmental Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
1.1	Traffic management and roads	Air	Increased Traffic	Negative	Direct	Local (3)	Medium (2)	Long Term (4)	Reversible (1)	-24: Significant Adverse	Air pollution resulting in vehicular exhaust emissions. **MM**: Ensure that vehicles exhausts of Public transport vehicles are compliant with National Environmental Standards (ES 2010) or equivalent; Implementing a strategic public transportation plan which provides for plying of public transport vehicles as per road type.	Study Area (2)	Medium (2)	Long Term (4)	Reversible (1)	-16: Minor Adverse	Reduction due to implementation of mitigation measure
1.2		Noise	Increased Traffic	Negative	Direct	Local (3)	Medium (2)	Long Term (4)	Reversible (1)	-24: Significant Adverse	Noise due to vehicular movement on roads. **MM**: Provision of Natural or Artificial noise barriers at sensitive receptor locations such as Hospitals and residential areas.	Local (3)	Medium (2)	Medium Term (3)	Reversible (1)	-18: Minor Adverse	Reduction due to implementation of mitigation measure
1.3		Water	Runoff from roads	Negative	Direct	Within Site (1)	Medium (2)	Long Term (4)	Reversible (1)	-8: Minor Adverse	The runoff would occur during the rainy seasons. **MM:** Provision (and Maintenance of) storm water drainage network of adequate capacity	Within site (1)	Medium (2)	Medium Term (3)	Reversible (1)	-6: Minor Adverse	Reduction due to implementation of mitigation measure
1.4		Soil/land	Dust settling on soil from vehicle movement	Negative	Direct	Within Site (1)	Medium (2)	Long Term (4)	Reversible (1)	-8: Minor Adverse	Dust would settle due to winds, deposition from vehicles, spillages	Within site (1)	Medium (2)	Short Term (3)	Reversible (1)	-6: Minor Adverse	Reduction due to implementation of mitigation

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environmental Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
											etc. **MM**: Frequency of Road sweeping should ensure that roads are clean						measure
1.5		Socio-Economics	Improved communication	Positive	Direct	Regional (4)	-	Long Term (4)	-	+16: Minor Beneficial	Enhanced public transport and Increased communication and connectivity will result in smoother and rapid flow of trade commodities, conveyance of people	-	-	-	-	-	-
1.8		Risk/Hazard	Road accidents	Negative	Direct	Local (3)	High (3)	Long term (4)	Reversible (1)	-36: Significant Adverse	The potential for Accidents to occur will depend on road, weather and lighting conditions as well as driving habits of vehicle drivers. **MM**: Provision of signage, Deputing requisite number of Traffic Police personnel, Ensure persons have valid driving license, Adoption of Strict norms by RSTA for issue of Driving licenses, Levying penalties for rash driving; Provision of Street Lights during night time / low light duration as per road width; Local administration to ensure availability of adequate ambulance / Medevac vehicles.	Local (3)	Medium (2)	Long term (4)	Reversible (1)	-24: Significant Adverse	Reduction due to implementation of mitigation measure

BRIDGES

Impacts associated with operation and maintenance of bridges constructed in ALDTP are as mentioned in **Table -29**

Table -29: Impacts associated with operation and maintenance of bridges constructed in ALDTP

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environmental Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
2.1	Maintenance of Super and sub-structures (pier, deck, abutment civil works,	Air	Superstructure related work: dust and gases during repaving work	Negative	Direct	Site (1)	Low (1)	Short Term (2)	Reversible (1)	-2: Minor Adverse	Air emissions during road re-paving work. **MM:** Use of environmentally friendly techniques of road paving; Bitumen hot mix plant to have controlled emissions into air	Site (1)	Low (1)	Very Short Term (1)	Reversible (1)	-1: Minor Adverse	Reduction due to implementation of mitigation measure
2.2		Water Quality / Resources	Spillages of bitumen, paints	Negative	Direct	Study Area (2)	Low (1)	Short Term (2)	Reversible (1)	-4: Minor Adverse	Risk of water pollution due to spillages of bitumen and paints (used for painting the bridge components viz. Railings, signage, Arches / Girders etc.). **MM**: Spillage clean up and prevention procedures to be kept in place	Site (1)	Low (1)	Very Short Term (1)	Reversible (1)	-1: Minor adverse	Reduction due to implementation of mitigation measure
2.3		Noise	Machinery: noise	Negative	Direct	Site (1)	Low (1)	Short Term (2)	Reversible (1)	-4: Minor Adverse	Noise from paving and other maintenance works **MM**: Enclose noise generating equipment behind acoustic enclosures, fit silencing devices on all operated equipment, visual alarms preferred over hooters, muffling devices on engines, personal paging devices preferred to public address systems, barricading all around the site; Providing PPEs for workers	Site (1)	Low (1)	Very Short Term (1)	Reversible (1)	-1: Minor adverse	Reduction due to implementation of mitigation measure
2.4		Socio-Economics	Works: employment	Positive	Direct	Local (3)	Low (1)	Long Term (4)	Reversible (1)	+12: Minor beneficial	Employment opportunities to local persons for almost two years	-	-	-	-	-	-
2.5		Hydrology	Painting of	Positive	Direct	Local	High (3)	Long	Reversible	+12: Minor	Regular painting of	-	-	-	-	-	-

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environmental Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
			Flood level markers every year including high flood level (HFL) and it's date			(1)		Term (4)	(1)	beneficial	flood level markers and the corresponding year results in better information input to planning flood warning systems upstream as well as downstream of the project site. This also assists in information sharing.						
2.6		Risk and hazards	Accidents	Negative	Direct	Site (1)	High (3)	Long Term (4)	Reversible (1)	-12: Minor Adverse	There is a potential for accidents to occur for bridge users. **MM:** Provide and repaint Sinages, maintain lighting fixtures, follow OHSMP strictly	Site (1)	Short term (2)	Long Term (4)	Reversible (1)	-8: Minor Adverse	Reduction due to implementation of mitigation measure
2.7		Land use	Linking of Zone A with Zone C and consequent disturbance of Zone C	Negative	Direct	Site (1)	High (3)	Long Term (4)	Irreversible (3)	-36: Medium Adverse	Likelihood of building a bridge into Zone C will cause damage to grasslands since people and vehicles will start using the bridge. **MM:** Avoid building the bridge till final decision on development of Zone C is taken.	Site (1)	High (3)	Long Term (4)	Irreversible (3)	-36: Medium Adverse	There will likely be a permanent damage of grasslands once a decision to build the bridge is taken. Hence it should be taken only once the decision to build the bridge is finalised.

WATER DRAWL AND SUPPLY

Impacts associated with operation and maintenance of Water drawl and supply facilities constructed in ALDTP are as mentioned in **Table-30**

Table-30: Impacts associated with operation and maintenance of Water drawl and supply facilities constructed in ALDTP

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environmental Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
1.1	Ongoing abstraction of groundwater from ground water tube wells (drawl of water @ 17000 KL/D. Out of this about 6000 KL/D will be from tube wells for the initial phase only. Once the full project is completed, entire 17000 KL/D will be sourced from the River.	Hydrogeology	Water Drawl: Potential impact on ground water level reduction in the future	Direct	Adverse	Local (3)	Medium (2)	Long Term (4)	Reversible (1)	-24: High Adverse	Withdrawal of water for various purposes may lead to depletion of water table. **MM:** Planning and implementing water harvesting methods, strategies, infrastructure including groundwater re-charge. Also stop using ground water one Zone B and C are commissioned and shift to surface water.	Local (3)	Low (1)	Long Term (4)	Reversible (1)	-12: Minor Adverse	Reduction due to implementation of mitigation measure
11.2		Socio-Economics	Water Drawl: Sharing of water with Amochhu Local Area Plan and Torsa Tar communities	Direct	Beneficial	Local (3)	Medium (2)	Long Term (4)	Reversible (1)	+24: Significant Beneficial	Availability of additional usable water for these communities	-	-	-	-	-	-

SEWERAGE SYSTEM

Impacts associated with operation and maintenance of Sewerage and sewage treatment facilities constructed in ALDTP are as mentioned in Table -31

Table -31: Impacts associated with operation and maintenance of Sewerage and sewage treatment facilities constructed in ALDTP

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environmental Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
1.1	Operation of	Air	Odour emission	Negative	Direct	Study Area	Medium (2)	Short term (2)	Reversible (1)	-8: Minor Adverse	There would be odours associated with gas	Within Site	Medium (2)	Short term	Reversible (1)	-4: Minor	Reduction due to

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environmental Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
	Sewerage System and Sewage Treatment Plant (STP)					(2)					build up in sewers as well as aerobic / anaerobic treatment process adopted in sewage treatment plant **MM**: Ensure that sewers are cleaned frequently by requisite automated sewer cleaning machines (No manual cleaning would be allowed); Erecting adequate barriers in the form of green belt in and around the Sewage Treatment Plant (STP); Providing adequate training to STP workers (as per Operation and Maintenance manual provided by the STP consultant / designer / contractor) in their operations so that treatment processes give off minimal odour; Provision of leak detection systems and alarms in case of anaerobic processes.	(1)		(2)		Adverse	implementation of mitigation measure
1.2		Noise	STP operation	Negative	Direct	Study Area (2)	Low (1)	Short term (2)	Reversible (1)	-4: Minor Adverse	Equipment like Pumps etc. will generate some noise. **MM**: Provision of Noise proof enclosures for workers cabin / operating areas; Provision of Noise barriers around high noise equipment; Provision of adequate PPEs to workers (along with requisite training) who are working in such areas.	Within Site (1)	Low (1)	Short term (2)	Reversible (1)	-2: Minor Adverse	Reduction due to implementation of mitigation measure
1.3		Water	Requirement increase	Negative	Direct	Within Site (1)	Low (1)	Long Term (4)	Reversible (1)	-4: Minor Adverse	Treated sewage has immense potential for reuse. **MM**: Operate all the treatment units of	Within Site (1)	Low (1)	Short Term (2)	Reversible (1)	-2: Minor Adverse	Reduction due to implementation of mitigation

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environmental Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
											STP as per Operation and Maintenance (O&M) Manual and provide adequate training to STP staff; Design STP to include treatment units for treated sewage reuse and recovery for city usage e.g. In Plantations, gardening.						measure
1.4		Soil/land	Sludge handling	Negative	Direct	Within Site (1)	Low (1)	Short term (2)	Reversible (1)	-2: Minor Adverse	Sludge will be produced as a result of sewage treatment process as well as Sewer cleaning activity. **MM:** Sludge generated from Sewer cleaning to be treated in STP appropriately; Dried STP sludge can be used as a soil conditioner for horticultural purposes.	Within Site (1)	Low (1)	Very Short term (1)	Reversible (1)	-1: Minor Adverse	Reduction due to implementation of mitigation measure
1.5		Hydrology/geology	Spillages / leakages from treatment units	Negative	Direct	Within Site (1)	High (3)	Short term (2)	Reversible (1)	-6: Minor Adverse	There may be accidental overflows, leakages, spillages of untreated / partially treated sewage from STP units as well as sewers.**MM**: Ensuring quality during construction phase, Periodic maintenance of sewer and STP units and relevant appurtenances,	Within Site (1)	Low (1)	Short term (2)	Reversible (1)	-2: Minor Adverse	Reduction due to implementation of mitigation measure
1.6		Ecology	Birds/Animals attracted towards STP	Negative	Direct	Within Site (1)	Low (1)	Short term (2)	Reversible (1)	-2: Minor Adverse	Birds will commence their nesting activities and use the STP premises as a habitat. On one side it adds to the local biodiversity but on the other side it adds to nuisance value in terms of bird droppings, dead birds, entry of predators etc. **MM**: Provision of barriers to prevent entry of predators; Provision of enclosures on STP units	Within Site (1)	Low (1)	Very Short term (1)	Reversible (1)	-1: Minor Adverse	Reduction due to implementation of mitigation measure

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environmental Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
											wherever feasible), installation of scarecrows at selected locations.						
1.7		Socio-Economics	Odour	Negative	Direct	Study area (2)	Medium (2)	Short term (2)	Reversible (1)	-8: Minor Adverse	Odours resulting from sewage treatment may affect the nearby populace. **MM**: Provision of barriers around the STP units and STP facility; Proper operation of STP units	Within Site (1)	Medium (2)	Very Short term (1)	Reversible (1)	-2: Minor Adverse	Reduction due to implementation of mitigation measure
1.8		Risk/Hazard	Accidents	Negative	Direct	Within Site (1)	Medium (2)	Short term (2)	Reversible (1)	-4: Minor Adverse	There are chances of accidents to workers occurring during STP and Sewer operations which may adversely affect STP and Sewer Cleaning workers. **MM**: Avoid manual cleaning of Sewers; Impart training to STP staff on accident handling, First Aid treatment; follow on site emergency plan of the STP; Ensure and access to and availability of healthcare facilities, ambulances / Medevac systems; Preparing and implementing Procedures for such incidents.	Within Site (1)	Low (1)	Short term (2)	Reversible (1)	-2: Minor Adverse	Reduction due to implementation of mitigation measure

STORM WATER MANAGEMENT

Impacts associated with operation and maintenance of Storm water management facilities constructed in ALDTP are as mentioned in Table - 32

Table - 32: Impacts associated with operation and maintenance of Storm water management facilities constructed in ALDTP

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environmental Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
1.1	Storm Water management system	Water	Increased quantity	Negative	Direct	Regional (4)	High (3)	Long Term (4)	Reversible (1)	-48: Highly Adverse	Increased storm water runoff has potential to cause floods within the city. **MM**: Provision and Laying storm water drainage network for safe conveyance of storm water and its discharge at selected points in the river.	Local (3)	Medium (2)	Medium Term (3)	Reversible (1)	-18: Minor Adverse	Reduction due to implementation of mitigation measure
1.2		Soil/land	For laying storm water drains	Negative	Direct	Local (3)	Medium (2)	Short term (2)	Reversible (1)	-6: Minor Adverse	Soil would be displaced for construction of storm water drainage networks. **MM**: Filling up displaced soil in low lying areas / reuse displaced soil in landscaping activities	Within site (1)	Medium (2)	Short term (2)	Reversible (1)	-4: Minor Adverse	Reduction due to implementation of mitigation measure
1.5		Hydrology/geology	Groundwater recharge	Positive	Direct	Regional (4)	Medium (2)	Long Term (4)	Reversible (1)	+32: Significant Beneficial	Improves the groundwater quality and quantity	-	-	-	-	-	-
1.6		Ecology	Capture basin	Positive	Direct	Local (3)	Medium (2)	Long Term (4)	Reversible (1)	+24: Significant Beneficial	Improves local ecological aesthetics by providing habitats to local Flora and Fauna	-	-	-	-	-	-
1.7		Socio-Economics	Storm water management	Positive	Direct	Regional (4)	High (3)	Long Term (4)	Reversible (1)	+48: Highly Beneficial	Prevents flooding of the city thereby providing a safe living environment	-	-	-	-	-	-

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environmental Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
											to the inhabitants.						
1.8		Risk/Hazard	Clogging and pipe / drain leakage	Negative	Direct	Local (3)	Medium (2)	Short term (2)	Reversible (1)	-12: Minor Adverse	Presence of obstructions in the form of debris (vegetation, wastes etc.) will create obstructions in the drains. **MM**: Local Civic Authority to ensure that timely pre-monsoon and post monsoon drain / pipeline cleaning activities are carried out.	Local (3)	Low (1)	Short term (2)	Reversible (1)	-6: Minor Adverse	Reduction due to implementation of mitigation measure
2.1	Flood Warning System – Operation and Maintenance (O&M)	Risks & Hazards	Improver and irregular (O&M) of system leading to floods	Negative	Direct	Regional (4)	High (3)	Short Term (2)	Reversible (1)	-24 Significant adverse	Improper O&M practices, delays in maintenance, testing of components and systems involved in this crucial project component can have potential to cause floods in the city which could affect human life, safety and the project as a whole. **MM:** Timely maintenance and testing of all components and systems along with requisite record keeping	Local (3)	Medium (3)	Short Term (2)	Reversible (1)	-18 Minor adverse	Reduction due to implementation of mitigation measure
3.1	Cross-drainage / Outfalls – Zone A and B	Water	Blockages: flash floods and backflow of water	Negative	Direct	Regional (4)	High (3)	Short Term (2)	Reversible (1)	-24 Significant adverse	The blockages due to obstructions like silting, debris etc.	Study Area (2)	Low (1)	Short Term (2)	Reversible (1)	-4 Minor adverse	Reduction due to implementation of mitigation

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environmental Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
	(within Project Area only[1])										in the cross-drainage networks / outfalls will cause blockages resulting in back flow of flood water thereby putting the area under severe flood risk. **MM:** Ensure regular inspection, de-siling, maintenance and repair work of these cross drainages and outfalls.						measure
3.2	Cross-drainage / Outfalls – Zone C	Water	Blockages: flash floods and backflow of water	Negative	Direct	Regional (4)	High (3)	Short Term (2)	Reversible (1)	-24 Significant adverse	The blockages due to obstructions like silting, debris etc. in the cross-drainage networks / outfalls will cause blockages resulting in back flow of flood water thereby putting the area under sever flood risk. **MM**: Detention ponds will be provided and allow the entrapment and removal of debris and allow a steady flow of water into the Amochhu River; Ensure regular inspection,	Regional (4)	Medium (2)	Short Term (2)	Reversible (1)	-16 Minor adverse	Reduction due to implementation of mitigation measure

[1] Outfall construction and maintenance along the Samtse-Phuentsholing Highway will be managed by the Department of Roads, Ministry of Roads and Human Settlements

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environmental Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
											de-siling, maintenance and repair work of these cross drainages and outfalls.						

SOLID WASTE MANAGEMENT

Impacts associated with operation and maintenance of Solid waste management facilities constructed in ALDTP are as mentioned in Table - 33

Table - 33: Impacts associated with operation and maintenance of Solid waste management facilities constructed in ALDTP

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environmental Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
1.1	Solid Waste management – C*ollection and transportation of Municipal Solid Wastes (MSW), Road sweeping for wastes,*	Air	Vehicular Exhaust emissions, Odour from Waste carried in the vehicles, Dust from road sweeping	Negative	Direct	Local (3)	Medium (2)	Very Short Term (1)	Reversible (1)	-6: Minor Adverse	The vehicles engaged in MSW collection and transportation will emit exhaust gases. The waste carried by the vehicles will emit bad odours. Dust will be generated during road sweeping activities. **MM**: Ensure that all vehicles engaged in MSW collection and	Local (3)	Low (1)	Very Short Term (1)	Reversible (1)	-3: Minor Adverse	Reduction due to implementation of mitigation measure

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environmental Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
											transportation are compliant with Bharat Stage IV or equivalent; Regular vehicle exhaust monitoring; Provision of enclosed / covered body of these vehicles for carrying wastes; Provision of PPEs to Sanitation workers engaged in Street sweeping activities.						
1.2		Noise	Generated from vehicles	Negative	Direct	Study area (2)	Medium (2)	Very Short term (1)	Reversible (1)	-4: Minor Adverse	Noise will be generated due to operation of vehicles engaged in MSW collection and transportation, street sweeping work. **MM**: Ensure timely maintenance and vehicle fleet replenishment / replacement.	Within Site (1)	Medium (2)	Very Short term (1)	Reversible (1)	-2: Minor Adverse	Reduction due to implementation of mitigation measure
1.3		Water	Spillage of water mixed with wastes	Negative	Direct	Study area (2)	Medium (2)	Very Short term (1)	Reversible (1)	-4: Minor Adverse	Water from wet waste may spill via leakages in the vehicle body. **MM**: Ensure good quality fabrication of vehicle body	Within Site (1)	Low (1)	Very Short term (1)	Reversible (1)	-1: Minor Adverse	Reduction due to implementation of mitigation measure
1.4		Soil/land	Contamination	Negative	Direct	Study Area (2)	Medium (2)	Short term (2)	Reversible (1)	-8: Minor Adverse	Soil may get contaminated due to spillages **MM**: Ensure that spillages are cleaned up at the earliest by sanitation team	Within Site (1)	Low (1)	Very Short term (1)	Reversible (1)	-1: Minor Adverse	Reduction due to implementation of mitigation measure
1.5		Socio-Economics	Odour	Negative	Direct	Study Area (2)	Low (1)	Short term (2)	Reversible (1)	-4: Minor Adverse	People near these vehicles at traffic junctions may be affected by odour emanating from	Within Site (1)	Low (1)	Short term (2)	Reversible (1)	-2: Minor Adverse	Reduction due to implementation of mitigation measure

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environmental Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
											these vehicles. **MM**: Providing closed, covered body of these vehicles						
1.6		Risk/Hazard	Accidents of these vehicles	Negative	Direct	Study Area (2)	Medium (2)	Short term (2)	Reversible (1)	-8: Minor Adverse	Accidents may occur due to plying of these vehicles on roads. **MM**: Ensure that drivers possess valid driving license to operate the class of vehicle (Light, medium or heavy) being used for the operation; Defence driving training be imparted to drivers	Within Site (1)	Low (1)	Short term (2)	Reversible (1)	-2: Minor Adverse	Reduction due to implementation of mitigation measure
2.1	Solid Waste management – *Operation of Compost Plant / Waste Processing Facilities*	Air	Dust from Plant operations, Odour	Negative	Direct	Study Area (2)	Medium (2)	Long Term (4)	Reversible (1)	-16: Minor Adverse	There would be odours, dust generation from plant operations. **MM**: Ensure enclosed equipment, hoods etc.	Within site (1)	Low (1)	Long Term (4)	Reversible (1)	-4: Minor Adverse	Reduction due to implementation of mitigation measure
2.2		Noise	Generated from operation of plant equipment	Negative	Direct	Study Area (2)	Medium (2)	Short term (2)	Reversible (1)	-8: Minor Adverse	Noise would be generated during plant operations. **MM**: Provision of noise barriers; Provision of ear plugs to workers; Timely maintenance of plant equipment	Within site (1)	Low (1)	Long Term (4)	Reversible (1)	-4: Minor Adverse	Reduction due to implementation of mitigation measure
2.3		Water	Shop floor spillages	Negative	Direct	Study Area (2)	Medium (2)	Short term (2)	Reversible (1)	-8: Minor Adverse	Spillages may occur when waste comes in contact with water. **MM**: Provision of drains with traps; Provision of storm water drains in the facility; Clean-up of spillages	Within site (1)	Low (1)	Long Term (4)	Reversible (1)	-4: Minor Adverse	Reduction due to implementation of mitigation measure
2.4		Soil/land	Contamination	Negative	Direct	Study Area (2)	Medium (2)	Short term (2)	Reversible (1)	-8: Minor Adverse	Soil / Land may get contaminated if MSW comes in	Within site (1)	Low (1)	Long Term (4)	Reversible (1)	-4: Minor Adverse	Reduction due to implementation of mitigation

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environmental Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
											contact with it. **MM**: Provision of paved floors in the facility						measure
2.6		Socio-Economics	Odour	Negative	Direct	Study Area (2)	Medium (2)	Short term (2)	Reversible (1)	-8: Minor Adverse	The surrounding populace may face odour nuisance due to plant operations. **MM**: Please refer Sr. No. 2.1 above	Within site (1)	Low (1)	Long Term (4)	Reversible (1)	-4: Minor Adverse	Reduction due to implementation of mitigation measure
2.7		Risk/Hazard	Accidents	Negative	Direct	Study Area (2)	Medium (2)	Short term (2)	Reversible (1)	-8: Minor Adverse	There are chances of accidents occurring during plant operations. **MM**: Please refer points mentioned in Sr. no. 1.6 above	Within site (1)	Low (1)	Long Term (4)	Reversible (1)	-4: Minor Adverse	Reduction due to implementation of mitigation measure
3.1	Solid Waste management – *Landfill operations in Thromde Area*	Air	Suspended particles and matter from collection, transport, offloading, Odour	Negative	Indirect	Study Area (2)	Medium (2)	Long Term (4)	Reversible (1)	-16: Minor Adverse	There would be odours, dust generation from landfill operations. **MM**: Ensure daily earth cover on the waste body; ensure that landfill is designed as per prevailing wind direction in location; Ensure vehicles used in landfill operations are Bharat Stage IV or equivalent	Within site (1)	Low (1)	Long Term (4)	Reversible (1)	-4: Minor Adverse	Reduction due to implementation of mitigation measure
3.2		Noise	Generated from vehicles	Negative	Indirect	Study Area (2)	Medium (2)	Long term (4)	Reversible (1)	-16: Minor Adverse	Vehicle movement would result in noise Generation. **MM**: Ensure proper vehicle maintenance, fleet replenishment	Study Area (2)	Low (1)	Very Short term (1)	Reversible (1)	-1: Minor Adverse	Reduction due to implementation of mitigation measure
3.3		Water	Landfill leachate mixing with ground water	Negative	Indirect	Study Area (2)	Medium (2)	Short term (2)	Irreversible (3)	-18: Minor Adverse	Leachate would be generated when wet wastes are inadvertently disposed of in the landfill or during rainfall. **MM**: Provision of	Study Area (2)	Low (1)	Short term (2)	Reversible (1)	-4: Minor Adverse	Reduction due to implementation of mitigation measure

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environmental Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
											leachate drainage, collection and treatment measures; Providing storm water drainage along the periphery of the landfill site.						
3.4		Soil/land	Contamination	Negative	Indirect	Study Area (2)	Medium (2)	Short term (2)	Reversible (1)	-8: Minor Adverse	Soil may get contaminated during landfill operations. **MM**: Proper landfill design as per Bhutan's Waste Prevention and Management Regulation 2012, as amended in 2016, as well as equivalent Indian Central Pollution Control Board (CPCB) guidelines	Study Area (2)	Low (1)	Short term (2)	Reversible (1)	-4: Minor Adverse	Reduction due to implementation of mitigation measure
3.5		Ecology	Birds, animals attracted towards landfill	Negative	Indirect	Study Area (2)	Low (1)	Short term (2)	Reversible (1)	-4: Minor Adverse	Birds may be attracted to the waste body lying within the landfill. **MM**: Provision of scarecrows at selected portions of the landfill	Within Site (1)	Low (1)	Short term (2)	Reversible (1)	-2: Minor Adverse	Reduction due to implementation of mitigation measure
3.6		Socio-Economics	Odour	Negative	Indirect	Study Area (2)	Medium (2)	Short term (2)	Reversible (1)	-8: Minor Adverse	Untreated or Raw wastes may be dumped in the landfill. **MM**: Rejects generated from Waste processing are to dumped in the landfill	Within Site (1)	Low (1)	Short term (2)	Reversible (1)	-2: Minor Adverse	Reduction due to implementation of mitigation measure
3.7		Risk/Hazard	Accidents, gas release from landfill	Negative	Indirect	Study Area (2)	Medium (2)	Short term (2)	Reversible (1)	-8: Minor Adverse	Gases may be released during landfill operations including Post closure. **MM**: Provision of gas vents in the landfill	Within Site (1)	Low (1)	Short term (2)	Reversible (1)	-2: Minor Adverse	Reduction due to implementation of mitigation measure

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environmental Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
											especially after landfill closure						
3.8		Land use	Change in land use	Negative	Indirect	Study Area (2)	Medium (2)	Short term (2)	Reversible (1)	-8: Minor Adverse	Depending on the type of land acquired to establish the landfill, there would be change in land use. However, this change is a trade-off for setting up of waste processing and disposal facilities to achieve proper management of Municipal Solid Wastes.	Study Area (2)	Medium (2)	Short term (2)	Reversible (1)	-8: Minor Adverse	No Change
4.1	Operation of Biomedical waste facilities within the ALDTP.	Air	Suspended particles and matter from operation of incineration facilities, Odour	Negative	Direct	Local (3)	Medium (2)	Long Term (4)	Reversible (1)	-24: Significant Adverse	Improper waste storage can lead to bad odours due to decomposition. Improper incineration of wastes can lead to deterioration in local air quality. **MM:** Proper storage of wastes in designated colour coded containers as per Bhutan's Waste Prevention and Management Regulation, 2012 as amended in 2016 as well as Integrated solid Waste Management strategy; Design, installation and operation of a scientific biomedical waste incinerator, the emissions of which conform to the National Air	Within Site (1)	Low (1)	Medium Term (3)	Reversible (1)	-3: Minor Adverse	Reduction due to implementation of mitigation measure

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environmental Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
											emission standards						
4.2		Noise	Generated from operation of incineration plant equipment	Negative	Direct	Within site (1)	High (3)	Long term (3)	Reversible (1)	-9: Minor Adverse	Noise would be generated due to improperly maintained equipment, wrong equipment selection, absence of noise barriers. This would affect the surrounding populate	Within site (1)	Low (1)	Long term (4)	Reversible (1)	-4: Minor Adverse	Reduction due to implementation of mitigation measure
4.3		Water	Leakages from punctured waste bags	Negative	Direct	Within site (1)	High (3)	Short term (2)	Reversible (1)	-6: Minor Adverse	Leakages from punctured waste storage bags could contaminate water. **MM:** Store wastes in bags of adequate thickness in enclosed paved segregated storage areas with access restrictions	Within site (1)	Low (1)	Short term (2)	Reversible (1)	-2: Minor Adverse	Reduction due to implementation of mitigation measure
4.4		Soil/land	Contamination due to spillages	Negative	Direct	Within site (1)	High (3)	Short term (2)	Reversible (1)	-6: Minor Adverse	Waste spills during handling, transportation and storage of wastes could lead to contamination of soil. **MM:** Impart training to personnel handling wastes, spill clean up	Within site (1)	Low (1)	Very Short term (1)	Reversible (1)	-1: Minor Adverse	Reduction due to implementation of mitigation measure
4.5		Ecology	Disease vectors like birds, rodents, flies attracted towards improperly stored waste	Negative	Direct	Study Area (2)	High (3)	Long term (4)	Reversible (1)	-24: Significant Adverse	Birds and disease vectors like rodents etc. can spread infectious diseases to the populace if these come into contact with improperly stored wastes. **MM:** Store wastes in enclosed paved segregated storage areas with access restrictions;	Within Site (1)	Low (1)	Medium term (3)	Reversible (1)	-3: Minor Adverse	Reduction due to implementation of mitigation measure

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environmental Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
											Ensure minimum storage duration and timely waste incineration / disposal						
4.6		Socio-Economics	Odour	Negative	Direct	Within site (1)	High (3)	Long term (4)	Reversible (1)	-12: Minor Adverse	Decomposing waste will emanate unwanted odours at storage location. **MM:** Store wastes in packed bags, in enclosed paved segregated storage areas with access restrictions; Ensure minimum storage duration and timely waste incineration / disposal	Within Site (1)	Low (1)	Medium term (3)	Reversible (1)	-3: Minor Adverse	Reduction due to implementation of mitigation measure
4.7		Risk/Hazard	Exposure to decomposing infected waste; injuries to personnel handling sharp wastes and exposing them to infection risks	Negative	Direct	Local (3)	High (3)	Long term (4)	Reversible (1)	-36: Significant Adverse	Personnel involved in handling of sharp waste may sustain injuries. They would also be exposed to resulting infections. Decomposing waste would also create unhygienic conditions which would result in spread of infectious diseases. **MM:** Training to be imparted to personnel in handling sharp wastes. Disinfect sharp wastes before disposal. Store wastes in packed bags, in enclosed paved segregated storage areas with access restrictions; Ensure minimum storage duration and timely	Within Site (1)	Low (1)	Medium term (3)	Reversible (1)	-3: Minor Adverse	Reduction due to implementation of mitigation measure

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environmental Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
											waste incineration / disposal						
5.1	E-Waste generation after end-of-life use	Air	Gaseous emissions, noxious fumes due to open burning for material recovery	Negative	Direct	Local (3)	High (3)	Long Term (4)	Reversible (1)	-36: Significant Adverse	Some Discarded e-waste would be burnt in the open to recover materials like Gold, Silver, and Aluminium etc. **MM:** Ensure that all e-wastes are handled as per Bhutan's Waste Prevention and Management Regulation, 2012 as amended in 2016 as well as Integrated solid Waste Management strategy	Within site (1)	Medium (2)	Long Term (4)	Reversible (1)	-8: Minor Adverse	Reduction due to implementation of mitigation measure
5.2		Water	Leachate mixing with ground and surface water	Negative	Direct	Study Area (2)	High (3)	Short term (2)	Irreversible (3)	-36: Significant Adverse	E-Waste storage in the open as well as unorganized waste processing operations of any kind would lead to generation of leachates especially during rainy seasons. This has the potential to contaminate water (surface & ground). **MM:** Ensure that all e-wastes are handled as per Bhutan's Waste Prevention and Management Regulation, 2012 as amended in 2016 as well as Integrated solid Waste Management strategy	Within site (1)	Medium (2)	Long Term (4)	Reversible (1)	-8: Minor Adverse	Reduction due to implementation of mitigation measure

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environmental Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
5.2		Soil/land	Contamination	Negative	Direct	Study Area (2)	High (3)	Long term (4)	Reversible (1)	-24: Significant Adverse	E-Wastes lying in the open would contaminate land. **MM:** Same as Sr. No. 5.2 above	Within Site (1)	Low (1)	Long term (4)	Reversible (1)	-4: Minor Adverse	Reduction due to implementation of mitigation measure
5.3		Socio-Economics	Growth of un-organized waste processing sector along with growth of rag pickers	Negative	Direct	Local (3)	High (3)	Short term (2)	Reversible (1)	-4: Minor Adverse	Unorganised e-waste processing could lead to rise in rag pickers and unorganised e-waste processing sector. **MM:** Same as Sr. No. 5.2 above. Additionally, drawing up a Social development plan covering upliftment of rag pickers	Within Site (1)	Low (1)	Long term (4)	Reversible (1)	-4: Minor Adverse	Reduction due to implementation of mitigation measure. Beneficial due to social upliftment of rag pickers enabling them to choose an alternate profession
5.4		Risk/Hazard	Injuries to personnel handling wastes; Fire; Health effects due to inhalation of fumes during open burning for material recovery	Negative	Direct	Study Area (2)	High (3)	Medium term (3)	Reversible (1)	-18: Minor Adverse	Personnel handling e-wastes may be injured by handling sharp wastes and would be exposed to respiratory illnesses due to inhalation of toxic fumes generated during open burning for material recovery. **MM:** Same as Sr. No. 5.2 above.	Within Site (1)	Low (1)	Medium term (3)	Reversible (1)	-3: Minor Adverse	Reduction due to implementation of mitigation measure.

POWER SUPPLY AND DISTRIBUTION SYSTEM

Impacts associated with operation and maintenance of power supply and distribution system constructed in ALDTP are as mentioned in **Table - 34**

Table - 34: Impacts associated with operation and maintenance of power supply and distribution system constructed in ALDTP

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environmental Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
1.1	Power supply and distribution system: Maintenance of 2 switching stations in Zone A and one in Zone C, to step down high voltage to usable high voltage. Further 8 sub-stations are proposed in the ALDTP to step down high voltage to one or three-phase supply.	Soil	Occasional transformer or similar oil spillages	Negative	Direct	Site (1)	Low (1)	Short term (2)	Reversible (1)	-2: Minor adverse	Occasional transformer or similar Oil spillage. **MM**: Spill clean-up and prevention procedures to be in place and implemented. Training to be imparted in the same	Site (1)	Low (1)	Very Short Term (1)	Reversible (1)	-1: Minor adverse	Reduction due to implementation of mitigation measure
1.2			Waste generation – Generation of used electrical items like wires, switches, panel boxes etc.	Negative	Direct	Site (1)	Low (1)	Long term (4)	Reversible (1)	-4: Minor adverse	During maintenance work, waste materials like wires, switches etc. would be generated. **MM:** Manage these wastes and ensure proper disposal as per the Waste Management plan	Site (1)	Low (1)	Very Short Term (1)	Reversible (1)	-1: Minor adverse	Reduction due to implementation of mitigation measure
1.3		Risk Hazard	From electric cable shocks during maintenance / working in confined spaces in case of underground telecom cables	Negative	Direct	Site (1)	High (3)	Long Term (4)	Irreversible (3)	-36: Significant adverse	Substantial risks to workers especially working in enclosed spaces below road levels. **MM:** Placing signage, Ensuring adequate initial and follow up training is imparted to relevant personnel, Provision and use of PPEs	Site (1)	Medium (2)	Medium Term (3)	Irreversible (3)	-18: Minor adverse	Reduction due to implementation of mitigation measure

TELECOMMUNICATION SYSTEM

Impacts associated with operation and maintenance of telecommunication system constructed in ALDTP are as mentioned in Table -35

Table -35: Impacts associated with operation and maintenance of telecommunication system constructed in ALDTP

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environmental Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
4.1	Maintenance of telecom network will include inspection and repairs of fibre optic cable network till the houses, telecom transmission towers for cellular phones	Air	Dust generation during Digging during repairs to underground ducting of fibre optic network	Negative	Direct	Site (1)	Low (1)	Short Term (2)	Reversible (1)	-4: Minor adverse	Air emissions during construction activities. **MM**: Provision of PPEs, barriers	Site (1)	Low (1)	Very Short Term (1)	Reversible (1)	-1: Minor adverse	Reduction due to implementation of mitigation measure
4.2		Noise	Noise generation during Digging during repairs to underground ducting of fibre optic network	Negative	Direct	Site (1)	Low (1)	Short Term (2)	Reversible (1)	-4: Minor adverse	Generation of noise from construction activities **MM:** Provision of Noise barriers & enclosures, low noise generating equipment, Provision of ear plugs	Site (1)	Low (1)	Very Short Term (1)	Reversible (1)	-1: Minor adverse	Reduction due to implementation of mitigation measure
4.3		Risk Hazard	From electric cable shocks during setup / working in confined spaces in case of underground telecom cables	Negative	Direct	Site (1)	High (3)	Long Term (4)	Irreversible (3)	-36: Significant adverse	Substantial risks to workers especially working in enclosed spaces below road levels. **MM:** Placing signage, Ensuring adequate initial and follow up training is imparted to relevant personnel, Provision and use of PPEs	Site (1)	Medium (2)	Medium Term (3)	Irreversible (3)	-18: Minor adverse	Reduction due to implementation of mitigation measure

LANDSCAPING

Impacts associated with ongoing Landscaping operation and maintenance work in ALDTP are as mentioned in **Table -36**

Table -36: Impacts associated with ongoing Landscaping operation and maintenance work in ALDTP

S. No.	Activities	Identification of Impact		Prediction of Impacts assuming Business as Usual Scenario / without Mitigation Measures							Rationale for Intensity and other inputs, along with (as relevant): Mitigation Measures (marked MM) to be added in SOPs or Name and number of Management Plan for Significant Aspects (marked MP)	Likely RESIDUAL Impacts AFTER Implementation of Mitigation Measures					Remarks
		Environmental Component Impacted	Activity and Aspect	Type	Nature	Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance		Impact Area	Impact Intensity	Impact Duration	Impact Reversibility	Impact Score / Significance	
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18
1.1	Maintenance of spaces kept available for parks and gardens, riverside promenades, green buffers and corridors.	Water Quality / Resources	Fresh water requirement	Negative	Direct	Site (1)	Low (1)	Long Term (4)	Irreversible (3)	-12: Minor adverse	Consumption of water for landscaping. **MM**: Adoption of water conservation measures	Site (1)	Low (1)	Long Term (4)	Reversible (1)	-4: Minor adverse	Reduction due to implementation of mitigation measure
1.2		Soil	Improvement in condition and fertility	Positive	Direct	Site (1)	Low (1)	Long Term (4)	Reversible (1)	+4: Minor beneficial	Improved soil quality over time with additional inputs	-	-	-	-	-	-
1.3		Ecology	Improvement in local ecology and environment	Positive	Direct	Regional (4)	Low (1)	Long term (4)	Irreversible (3)	+48: Highly beneficial	Enhanced ecological condition of site	-	-	-	-	-	-
1.4		Socio-Economics	Employment for preparing greens	Positive	Direct	Local (3)		Long Term (4)	Reversible (1)	+12: Minor beneficial	Employment for locals	-	-	-	-	-	-
1.5		Hydrology	Better soil holding and binding. Control erosion	Positive	Direct	Site (1)		Long Term (4)	Irreversible (3)	+12: Minor beneficial	Improved water holding	-	-	-	-	-	-
1.6		Land use / Land cover	Open soil to landscaped greenery	Positive	Direct	Local (3)	Low (1)	Long Term (4)	Irreversible (3)	+36: Significant beneficial	Change in ecological and aesthetic value of the open areas.	-		-	-	-	-