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(CDCL)



Kingdom of Bhutan

Phuentsholing Township Development Project

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Semi-Annual Report n°1

Period from 1 January to 30 June 2019

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Phuentsholing Township Development Project

Project Implementation Consultant

PIC Site Office, Near NHDCL Housing Colony

Amochu, Phuentsholing, Chukha

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PHUENTSHOLING TOWNSHIP DEVELOPMENT PROJECT



SEMI ANNUAL ENVIRONMENTAL MONITORING REPORT (JAN-JUNE 2019)



2019



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Abbreviations

ADB	:	Asian Development Bank
AIDS	:	Acquired Immuno Deficiency Syndrome
ALDTP	:	Amochhu Land Development and Township Project
CDCL	:	Construction Development Corporation Limited
DGPS	:	Differential Global Positioning System
DHI	:	Druk Holdings and Investment Ltd.
GRM	:	Grievance Redress Mechanism
EA	:	Executing Agency
EIA	:	Environmental Impact Assessment
CEMP	:	Contractors Environmental Management Plan
FNCR	:	Forest and Nature Conservation Rules
HIV	:	Human Immunodeficiency Virus
IA	:	Implementing Agency
IEE	:	Initial Environmental Examination
IPP	:	Indigenous Peoples Plan
IUCN	:	International Union for Conservation of Nature
NEC	:	National Environment Commission
NLCS	:	National land Commission Secretariat
PIC	:	Project Implementation Consultant
PIU	:	Project Implementation Agency
PMU	:	Project Management Unit
PPE	:	Personal Protective Equipment
PTDP	:	Phuentsholing Township Development Project
RGoB	:	Royal Government of Bhutan
SEMR	:	Semi-Annual Environmental Monitoring Report
SPS	:	Safeguard Policy Statement
STD	:	Sexually Transmitted Diseases

Semi-Annual Environmental Monitoring Report

This report presents the status of social and environmental safeguards compliance, for the period from January to June 2019. The report reviews the compliance of social and environmental activities set in CEMP during the period and proposes practices/innovations leading to an improved and sustainable environment in the future.

1. Project Background

1. The Construction Development Corporation Limited (CDCL) has taken up Phuentsholing Township Development Project (PTDP) with financial assistance from Asian Development Bank (ADB) under Loan Agreement No. 3668-BHU.
2. The Government of Bhutan has proposed for Phuentsholing Township Development Project (PTDP) near Phuentsholing City which will include develop 460 hectares of riparian land near Phuentsholing City, provide protection from floods and erosion, and construct smart urban infrastructure to allow phased urban expansion. The City of Phuentsholing is located adjacent to the Amochhu River on Bhutan's southwestern border with India (Jaigoan, Alipurduar district, West Bengal). Phuentsholing is the country's economic capital and main trading gateway with India. The Royal Government of Bhutan's vision is for Phuentsholing to grow into an economically vibrant, ecologically sustainable, and energy-efficient center that will support economic diversification, employment creation, and income generation.
3. The project aims to protect the existing and new towns from floods and riverbank erosion which currently threatens lives and livelihoods and disrupts connectivity with nearby communities. The project will train the river along both banks of Amochhu and the area reclaimed after river training will be used for the development of the township. The project will be undertaken in phases which are anticipated to be completed within 15 years in accordance with the PTDP Master Plan.
4. The PTDP is divided into five zones: Zone A, Zone B, Zone C, Zone D and Zone E. Zone D represents Kaileshwar Hill which is currently not included in the project development. The remaining four Zones will require about 15 kilometers of riverbank protection works with subsequent development of about 464 hectares of Amochhu riparian land. The development comprises of new common urban infrastructure such as roads, bridges, water supply and wastewater system, municipal solid waste system, power and telecommunications to support the habitation of 50,000 people. The implementation of the project is phased in relation to the scale and demand for development. The allocation of land and riverbank protection for the project's development is shown in Table 1 below:

Table 1: Zone-wise Allocation of Land under PTDP

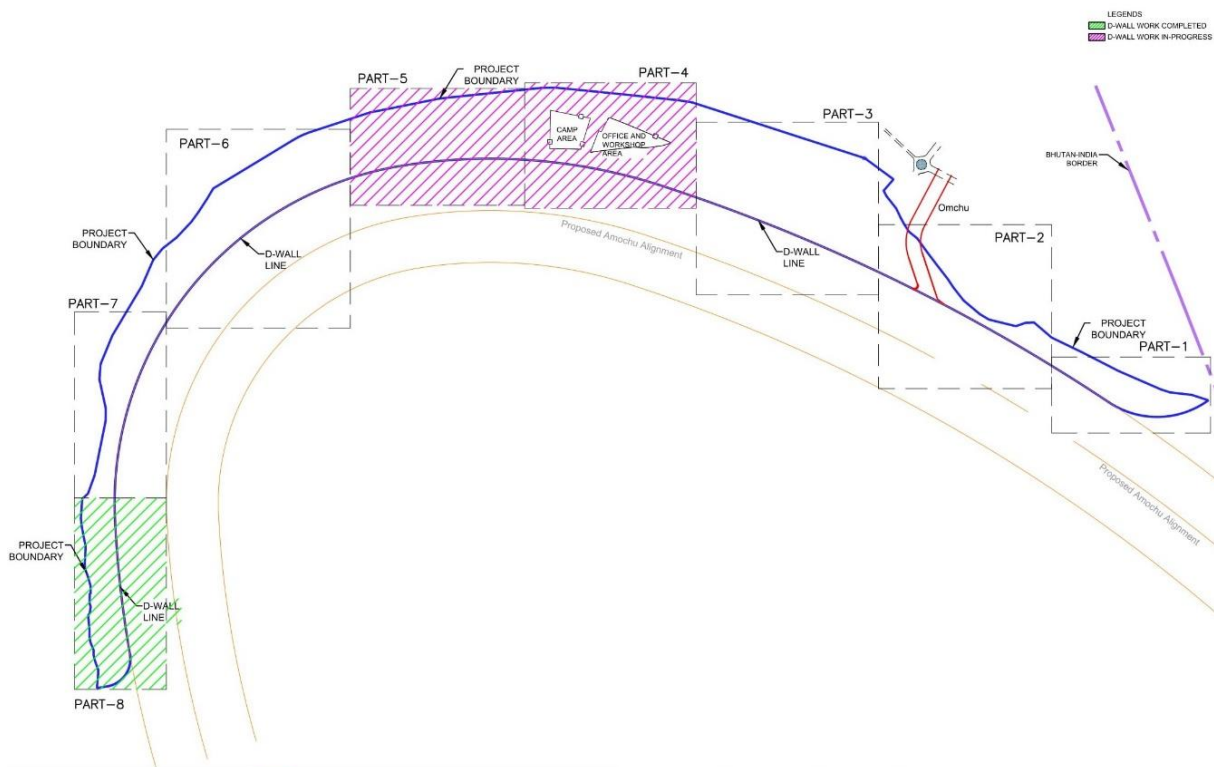
Zone	Area (ha)	Length of Riverbank (m)
A	66	3,974
B	94	3,046
C	277	4,872
E	27	3,083
Total	464	14,975

5. PTDP is being implemented in a phased manner in relation to the scale and demand for development. In the first phase, PTDP has been taken up which include the development of Zone A. In subsequent

phases, the remaining zones will be taken up. Figure 1 and 2 below shows the current project area and progress along Zone A.



Figure 1: Zone A Project Area



PROJECT IMPLEMENTATION CONSULTANT EGIS INTERNATIONAL-GYALTSHEN CONSULTANCY	CLIENT: PROJECT IMPLEMENTATION UNIT CONSTRUCTION DEVELOPMENT CORPORATION LIMITED CONTRACTOR: AFCONS INFRASTRUCTURE LIMITED	PROJECT: PHUENTSHOLING TOWNSHIP DEVELOPMENT PROJECT	PREPARED BY: PHUNTSHO N.	CHECKED BY: RE	SHEET NO.:	DWG No.: PIC/PTDP/IPB/001
			SCALE:	DATE: 18/07/2019	DRAWING TITLE: ZONE A PROJECT BOUNDARY LAYOUT	

Figure 2: Progress along Zone A

6. Phase 1 is financed with support from the Asian Development Bank (ADB) and Druk Holding and Investments (DHI). DHI is the Project Owner and the Executing Agency (EA) and Construction Development Corporation Limited (CDCL), is the Implementing Agency (IA).
7. For the convenience of construction, the development works of Zone-A has been divided into different construction packages. The Package CW-01 includes the construction of approximately 4.5 km of River Training and Embankment works along the Amochhu River in Phuentsholing. The scope of works includes river training (diaphragm wall, Anchor slab), Embankment (retaining walls, outfalls and slope stability), General Earth Filling, Irrigation and Landscape work.
8. The Civil work contract of Package-CW-01 has been awarded to M/s AFCONS Infrastructural Limited, India in the month of September 2018 for a period of 30 months. The CDCL has appointed M/s EGIS International as Project Implementation Consultant (PIC) who will act as Engineer for the project. The Contract of PIC was signed in the month of October 2018.

2. Status of Construction Works:

9. The construction activities at the site are in a preliminary stage. Pre-construction stage is completed and construction activities have commenced. During the reporting period, the following activities were in progress:
 - Finalization of the site for the establishment of their camp office, staff quarters, labour camp, batching plant, stockyards, etc. All these facilities are located in the same place.
 - The construction works for different amenities at the campsite.
 - Re-survey of Differential Global positioning system (DGPS) control points on NLCS points to establish control points for the Project.
 - Commencement of excavation for guide wall works in Part-8, chainage 734 R
 - Commencement of excavation works at Open Outfalls No. 8 and 2 in Part No.8 and Part No. 5 respectively.

3. The Safeguard category of the projects

10. The PTDP falls under category "A" for environmental safeguards as per ADB categorization criteria based on ADB's Environmental Assessment Guidelines 2003, and Safeguard Policy Statement (SPS) 2009. The EIA report was prepared for all the Four Zones (A, B, C & E) based on which the anticipated environmental impacts; Environmental Management Plan (EMP) was formulated for mitigating, managing and enhancing the efficiency of environmental components wherever it is possible. The recommended EMP was included in the domain of detailed design and bid documents for all the sub-projects. There is a separate budgetary allocation for implementation of EMP and have been included in the contracts.
11. In addition, no involuntary resettlement was required and no indigenous peoples were affected and hence the project has been classified as category "C".

4. Scope of the Present Report

12. The scope of this report is mainly to assess the compliance status on social and environmental safeguards during construction in the construction package CW-01 where works are in progress. In particular, the report concentrates on the CW-01 awarded to and being carried out by M/s AFCONS

Infrastructural Limited, India. The assessment of safeguards compliance cover the status of compliance with:

- statutory requirements in each construction packages,
- conditions of EMP stipulated in contract conditions and
- monitoring of environmental attributes at different representative sites

13. The report also contains information on environmental conditions in areas adjacent to the project area gathered through periodical monitoring. The report also assesses the performance and effectiveness of the implementation of environmental safeguards as per the contract specification. Information presented in this report is mainly based on a review of the safeguards documents, contract agreement of Contractor and PIC and observations made during field inspections carried out by the PIU, the engineer's representative and the contractor.

14. The report also assesses the compliance status on health and safety during construction in all the construction packages, where works are in progress, the performance and effectiveness of implementation of Emergency Response Plan, Traffic Management Plan, Occupational Safety and Health Management Plan as per the contract specification. Information presented in this report is mainly based on review of the safeguards documents, contractor's monthly reports and observations made during field inspection.

15. This report is basically documentation of the health and safety procedures followed by the contractor 'Ms. Afcons' during the construction of the Phuentsholing Township Development Project. The reporting period is from January 2019 till June 2019.

5. Approach and methodology adopted for Safeguard monitoring of the projects

16. The monitoring of compliance of EMP and its performance is carried out through the following tasks:

- Site inspections by PIC Environmental Specialist, Social and communication Specialist, local environmental specialist and Environmental Manager of PIU
- Review of Contractor's documents related to the implementation of Environmental safeguards
- Monitoring of selected environmental attributes identified under the Environmental Monitoring Plan

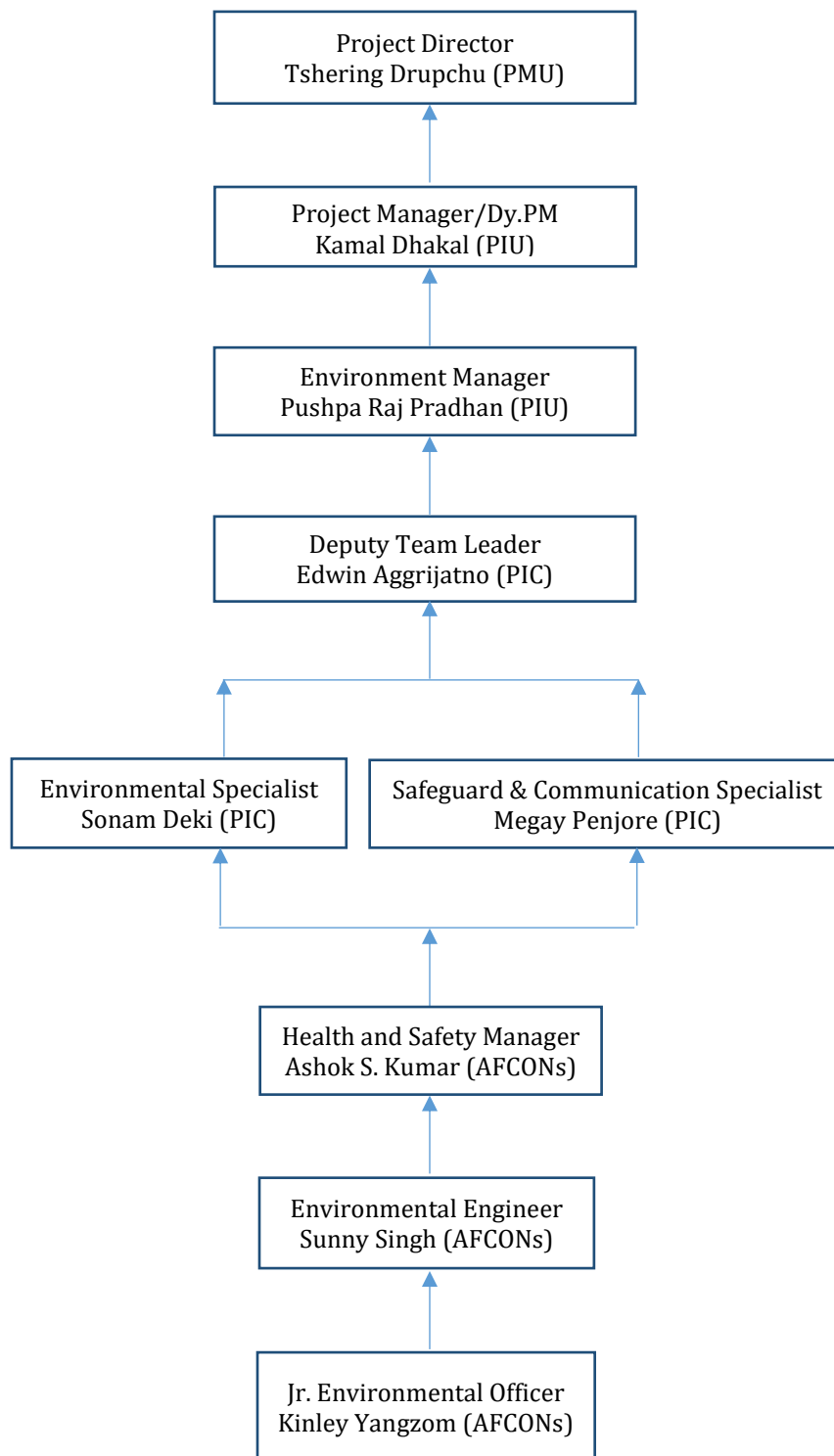
17. Checklist method has been adopted by the PIC for monitoring the safeguards compliance at site. The checklist has been developed by the PIC, which shall be used for compliance monitoring at the site by PIU and PIC environmental staff.

6. Institutional Arrangement for EMP Implementation

18. For the overall implementation and monitoring of environmental safeguards the entities below are responsible:

- Project Management Unit, CDCL (PMU)
- Project Implementation Unit (PIU)
- Project Implementation Consultant (Engineer and his representatives) (PIC)
- Contractors

19. Organizational Chart of Safeguards Supervision Team



20. The contractor is the agency responsible for the direct implementation of environmental mitigation measures at different locations whereas the others are having supervisory/monitoring roles.

21. At each level, there is a provision of environmental personnel for ensuring the effectiveness of implementation and monitoring of environmental mitigation measures. The status of appointment/nomination of environmental personnel at different levels as on date are as follows:

6.1 CDCL Safeguard Team:

22. There is a provision of an Environmental Manager at PMU who will support the Project Director (PMU) and PIU environmental staff. The role of the Environmental Manager (PMU) will to oversee the implementation of environmental safeguards work under the project. He will also be responsible for updating of EMP if necessary throughout project implementation in accordance with ADB's Safeguards Policy Statement (SPS, 2009) and the Environmental Assessment Act (2000), and submit to ADB for review, final approval, and disclosure prior to commencement of works; (ii) before expiry of the initial EIA after five years, review and revise (if necessary) the EIA and undertake necessary actions as required, to obtain NEC and ADB continued approval; and (iii) liaise with the relevant authorities to obtain all required clearances and environmental permits in a timely manner prior to construction;

23. There is also a provision of Environmental Manager at PIU level. The Environment Officer in the PIU, assisted by the environmental specialist on the PIC team, will oversee implementation of environmental safeguards work under the project, including the following activities: (i) facilitate and confirm overall compliance with Government of Bhutan rules, oversee timely preparation and finalization of CEMP by contractors, and assist in obtaining all required clearances and environmental permits in a timely manner prior to construction; (ii) monitor CEMP implementation by the contractors during construction including all mitigation measures and environmental parameters (air and water quality, noise, etc.) and taking corrective actions where necessary; (iii) address and record grievances through the Grievance Redress Mechanism in a timely manner, and taking quick corrective actions where necessary; (iv) ensure that all required environmental study (e.g. biodiversity studies on aquatic ecosystem and elephant social behavior) are professionally and comprehensively carried out; (v) ensure that all environmental quality monitoring required for the project is comprehensively done; and (vi) review monthly environmental monitoring reports submitted to PIU by contractors and consultants, and preparing and submitting semi-annual environmental monitoring reports to ADB on behalf of the PMU.

24. CDCL has appointed Mr. Pushpa Raj Pradhan as Environmental Manager who is presently in-charge of both PMU and PIU Offices. He is responsible for overseeing his implementation of environmental safeguards, coordination with stakeholders, government officials and regulatory authorities on environmental issues, addressing the public grievances on environmental issues.

6.2 PIC Environmental Specialist:

25. There is the provision of an International; Environmental Specialist in the PIC team, which is responsible for:

- Review of the EIA, SIA and EMP and the conditions of Approval of NEC;
- Liaisoning and coordination with PIU's environmental manager and NEC personnel to ensure that roles and responsibilities are clear and documented;
- Review of bidding documents prepared for each contractor in Zone A and ensure that all safeguards requirements from the EIA and NEC approval are included;
- Ensuring the appointment of suitably experienced persons of the contractor at key environmental safeguards positions;

- Ensuring that the personnel are mobilized within one month of Contract Award;
- Supervision and approval of Contractor's EMP (CEMP) in Zone A and in close coordination with the National Safeguards specialist supervise and approve SSHP of each contractor before any construction work commences;
- Supervision of the implementation of each CEMP and SSHP to ensure that contractors submit a monthly report on the implementation of CEMP and SSHP to the PIU;
- Check and clear contractor's claims for all costs to address environmental Prepare semi-annual reports on the overall implementation of EMP to be submitted to ADB by the EA;
- Prepare a detailed TOR for the proposed baseline study and monitoring BMBMS of flora and fauna ecosystems in Zone C;
- Supervise the implementation of the baseline study in Zone C;
- Ensure that all "critical" and/or "natural habitat" (defined in ADB Safeguards Policy Statement, 2009) are identified and using the results of the study prepare a Zone C Environmental Management Plan and any necessary review of the EIA for further approval by NEC;
- In case unexpected impacts occur during construction time, work closely with other PIU team and contractors to prepare remedial measures to manage those impacts;
- Make recommendations to improve or correct environmental management and monitoring for all other zones and other project components such as management of solid waste;
- Work closely with other PIU team members to ensure that all outputs under point 3 above are delivered.

26. The PIC has appointed Dr. Surjit Singh Deepak as Environmental Specialist-International, who will be mobilized at the site from 3rd January 2019. He is working as Environmental Expert of GC team and conducts a periodical site inspection and reviews environmental progress based on actual site visit and information supplied by the PMC. Time to time training workshops on Environmental implementation will be conducted for PIU/PMU and the contractors as capacity building measures on effective implementation and monitoring of EMP in the project during construction.

27. PIC has appointed Ms. Sonam Deki as Local Environmental Specialist, who has been mobilized at the site from 22nd March 2019. She will be conducting a monthly site inspection, and compile the monthly, semi and quarterly report based on the progress.

6.3 PIC Social and Communication Specialist:

28. There is a provision for a national, Safeguard and Communication specialist in the PIC team, which is responsible for:
- Review bidding documents prepared for each contractor and ensure that all safeguards requirements, if any, from SIA are included;
 - Ensure that each contractor has suitably experienced personnel in the key social and gender position;
 - Prepare and implement an overall Communications & Consultation Plan (CCP) for Zone A which includes sub plans on community relations, labour and employment and project induced in-migration (PIIM) also referred to as Influx;
 - In close consultation with each contractor in Zone A prepare an agreement on social monitoring locations and responsibility for collection and input to the Project GIS;
 - Prepare and implement a Social Monitoring Plan for Zone A in close consultation with the contractors and their sub-contractors and ensure all on-going results are documented in the Project GIS;

- Ensure roles and responsibilities for collection of social monitoring data is agreed between PIU and each contractor and their sub-contractors;
- Assist supervise the preparation and implementation of a Security Safety and Health Plan (SSHP) which includes a sub plan on Construction Camp Management by the main Contractors;
- Monitor, report and advice on social issues, including relevant gender components, HIV/AIDS, human trafficking and core labour standards and equal payment for equal work provisions in the civil works contracts;
- Work closely with international specialist to assist him/her in undertaking field monitoring on implementation of CEMP and SSHP and provide inputs on the preparation of semi-annual report for implementing EMP;
- Prepare semi-annual social and monitoring reports for review and approval by PIU for submission to ADB for disclosure;
- Ensure compliance with social impact mitigation requirements of civil works contracts, and providing information to PIU on those processes in the monthly progress reports;
- Lead the implementation of Grievance Redress Mechanism for the project by developing systematic recording claim, organizing meeting to resolve grievances
- Organize and coordinate gender awareness training for the PIU;
- Coordinate with PIU to conduct awareness programs amongst key stakeholders.

29. The PIC has appointed Mr. Megay Penjore as the Safeguard and communication specialist, who has already been mobilized at site.

6.4 Contractor's Environmental Officers:

30. The Contractor has mobilized its Environmental and Safety Personnel. He will be responsible for the following activities on safeguards:

- Implementation of all environmental, health and safety measures as per approved CEMP and contract specification during construction including regular testing and monitoring of environmental parameters outlined
- Coordinating with the PIC during preparation and obtaining approval of the CEMP.
- Ensuring that the contractor engages a suitable expert as a resource person or organization to undertake STIs/ HIV/ AIDS briefings and awareness-raising among the contractor's employees and neighboring communities with follow-up upon request.
- Coordinating with PIU and PIC in respect of community consultation.
- Participating in monitoring and coordinating with PIC to ensure that environmental management activities are reported as required.
- Coordinate and communicate with the PIC as required, to facilitate consultation with the affected villages, various stakeholders, and ensuring smooth implementation of the subproject.
- address public grievances by taking quick corrective actions and reporting status of grievances and redress to PIU/PMU; (iv) undertake its own monitoring of project-related impacts and prepare an environmental section of the monthly report to CDCL environment team and PIC;
- The Contractor has appointed OHSE Manager supported by one Environmental Engineer and one Safety Manager for effective implementation of environmental and safety measures at the site.

31. The environmental and staff have been mobilized by the Contractor at the site as shown in Table 2

Table 2: Environmental and Safety staff mobilized by contractor

S. No.	Name	Designation	Job Responsibility
1.	Mr. S. Ashok Kumar	OHSE Manager	Responsible for the overall occupational health safety and environmental performance of CEMP. He will be directly reporting to the Project Manager. For any issues arising related to the implementation of CEMP provisions, the EHS Manager shall appraise the issue to the Project Manager and the Project Manager will resolve the issue by assigning the task to the person(s) of his choice.
2.	Mr. Sunny	Environment In-charge	To assist OHSE Manager in day to day implementation of Environmental aspect of the CEMP. The Environment Engineer shall be responsible for the induction of all employees to create awareness on the CEMP.
3	Ms. Kinley Yangzom	Junior Environment Officer	To assist OHSE Manager in day to day implementation of Environmental aspect of the CEMP. The Environment officer shall be responsible for the preparing Environmental Monthly Report for the project
3.	Mr. Bijender Kumar Singh	Safety Manager	To assist OHSE Manager in day to day implementation of Safety and social aspect of the CEMP. The manager shall be responsible for the induction of all employees to create awareness on the CEMP

32. In addition to the above positions, the contractor has appointed 4 safety stewards, to oversee the safety at different sites of work.

7. Contractor Environmental Management Plan (CEMP)

33. Only a draft CEMP was submitted as part of the 1st SEMR July-Dec 2019 and clarifications were sought by ADB on the CEMP. After the visit of PIC environmental specialist, the CEMP was re-visited and was jointly approved on Feb 2019. A matrix was prepared as part of the new submission to ADB in the draft CEMP which was submitted as part of the quarterly progress report (Jan-March 2019). The approved matrix table showing the changes and the approved CEMP is attached as Appendix I.

8. Environmental Compliance Monitoring

34. For effective monitoring of Environmental Compliance, environmental parameters have been identified as indicators which may be qualitatively and quantitatively measured periodically and compared over a period of time to ensure the effectiveness of the safeguard measures during project execution. The parameters selected as performance indicators are as follows:

8.1 Compliance to 1st SEMR (July- Dec 2018)

35. The 1st Semi Annual Compliance Report (July- Dec 2018) was submitted on 31st December and was subsequently disclosed at ADB's website for information dissemination. The report was reviewed by ADB and the comments were discussed as shown in Table 3 below:

Table 3: Comments and compliance to SEMR (July-Dec 2018)

S.No	ADB's comment (July -December 2018)	Remarks
1	In paragraph 33, emission certificates are regularly checked in project site. But the document for approved emissions tests are not included in the current EMR. Please include all the certificates of the contractor's vehicle emissions as attachment.	Comments noted and complied. The valid emission tests were attached for the 2 hired vehicles during July-Dec 2018.
2	The license from the government to operate quarry by either AFCON or the commissioned private operator should be included in the attachment. If the permit is not yet available, provide the document as soon as possible and attach in the next SEMR.	Comments noted and complied
3	Include the actual document of worker's permit and labor insurance in the EMR.	Comments noted and complied. All workers permit are acquired from Ministry of Labour and Human resource, which is attached for reference. With regard to the Labor insurance, a contractor All Risk (CAR) policy insurance was attached for reference
4	Provide a map of the water quality sampling stations. This will give understanding where are the locations of the sampling points and in reference to the project area.	Comments noted and complied.

8.1 Compliance with state and national statutes & regulations

36. CDCL obtained the Environmental Clearance in accordance with the Environmental Assessment Act 2000, Regulation 2002 from National Environmental Commission (NEC), RGoB on 1st September 2017 which includes clearance the entire Zones (including Zone A) and is valid up to August 30, 2022 (5 years). Table 4 contains the compliance requirements and the status compliance of PTDP.

Table 4: Compliance with the Terms and Conditions of the Environmental Clearance

No.	Compliance Requirement	Status
I. GENERAL		
1	The holder shall comply with provisions of the National Environmental Protection Act 2007, Environmental Assessment Act 2000 and its Regulation 2016, Waste Preservation and Management Act of Bhutan 2009 and its Regulation 2016, and the Water Act of Bhutan 2011 and its Regulation 2014 and Revised Regulation on the Control of Ozone Depleting Substances (ODS) 2008	Construction is going on as per the mentioned laws. The site is monitored by the PIU Environmental Officer, PIC site supervisors and Environmentalist.
2	The holder shall ensure that construction activities are in line with the Initial Environmental Examination report submitted for EC	Construction is as per the IEE submitted and as per the Environmental Clearance issued
3	The holder shall ensure that local communities, properties, and any religious, cultural, historic and ecologically important sites are not adversely affected by the activities	The construction does not affect any sites of this nature.
4	The holder shall restore the damage of any public or private properties caused by the activities	No damage caused to public or private properties so far.

		Any damages caused to private properties will be discussed and the damages will be restored. Any damages caused to public properties will be reported to relevant authorities and damages will be restored.
5	The holder shall inform NECS and any other relevant authorities of any unanticipated or unforeseen chance-find of any precious metals or minerals or articles, that have economic, cultural, religious, archaeological, and/or ecological importance	Such an incident has not yet occurred. If such an incident occurs, NECS and relevant authorities will be informed.
6	The holder shall erect a signboard at the take-off point of the main entrance of the activities stating the name of the activities and contact address	Safety signboards are at strategic locations which necessitate specific warning signs.
II. ENVIRONMENTAL STANDARDS		
7	The holder shall comply with the existing Environmental Standards	Yes
III. IMPORT AND USE OF SECONDHAND EQUIPMENT		
8	The holder shall ensure that import and use of second-hand equipment and machinery are strictly prohibited.	No second-hand equipment was used at the site. All required equipment were purchased and were all found to be in good condition.
9	The holder shall ensure that import and use ODS are in line with the Revised Regulation on the Control of ODS 2008	As of now, all machinery is new. In the event the Contractor decides to purchase any second-hand equipment, it will be ensured that it is in line with the Revised Regulation on the control on ODS 2008.
IV. PROTECTION AND MANAGEMENT OF WATER RESOURCES		
10	The holder shall ensure that activities do not disrupt the water flow and pollute the water bodies	The PTDP project area is along the Amochhu river, but mitigation measures are strictly implemented to ensure the water body is not impacted or polluted.
V. WASTE PREVENTION AND MANAGEMENT		
11	The holder shall manage wastes generated from the activities (activity site, labour camps, offices, etc.) with the application of 4R (Reduce, reuse, recycle, responsibility) principle and other environmentally friendly methods of waste management	Two pits were made for organic & nonorganic waste, with sufficient, refuse bins within site camps and offices. Tarpaulin is used to cover lightweight materials at the site.
12	The holder shall ensure that import and use of hazardous wastes are strictly prohibited	The project does not require any use or import of hazardous materials. Thus such waste will not be generated.
VI. MANAGEMENT OF EXCAVATED MATERIALS AND RUN-OFF		
13	The holder shall dispose of excess excavated materials at the pre-identified approved dumpsite only	Excavated materials are being reused, thus not requiring a dumpsite.
14	The holder shall put appropriate measures to avoid erosion and landslides	No erosion/landslide issues occurred at the site. Mock drills for flooding is in the planning for all workers.
VII. IMPLEMENTATION PLAN		
15	The holder shall prepare a Detailed Implementation Plan (DIP) focusing on the implementation of terms and conditions of this EC and submit to NECS within three (3) months from the date of issue of this EC	The final CEMP was submitted to NEC incorporate terms and conditions. Refer the letter submitted to NEC on Appendix II

VIII. MONITORING AND REPORTING		
16	The holder shall ensure that the effective day-to-day monitoring of the EC terms and conditions are carried out by the environmental unit or designated environmental focal person	H& S officer from AFCONS, Environmental manager from PIU, and HSE officer from PIC conduct daily monitoring in rotation
17	The holder shall maintain proper records on wastes generated and its management, stating types of wastes, quantities and characteristic and submit to NECS annually	The contractor has submitted records of waste generated for the month of April, May, and June and will continue to for following months.
IX. RENEWAL AND MODIFICATION		
18	The holder shall ensure that renewal of this EC is processed at least three (3) months prior to its expiry along with a copy EC and a report on the implementation of its terms and conditions	Yes
19	The holder shall obtain prior approval from NECS for any modification to the existing proposal/application	There has been no modification in the proposal so far
X. RESERVATION		
20	The NECS may stop the activity or impose additional terms and conditions, as maybe deemed necessary	N/A
21	The EC shall be subject to periodic review and modifications as per Article 25 of the EA Act 2000, without any liability on the part of the Royal Government	Yes
22	The holder may adopt best practices in executing these terms and conditions to avoid adverse environmental impacts.	Yes

8.2 Compliance with the Environmental Management Plan

37. It is the responsibility of the contractor to implement the stipulated environmental safeguard measures set forth in EMP during construction. The compliances with the safeguards requirements by the contractor during construction are being monitored by PIC and PIU at the site. Table 5 reflects the Contractor's compliance with the EMP.

Table 5: Status of Compliance to the activities proposed in CEMP

Sl. no.	Activity	Mitigation Measures	Compliance attained (Yes, No, Partial)	Location	Remarks
1	Establishment of workers camp, material storage, work areas, and parking areas	<p>AIR</p> <ul style="list-style-type: none"> ➤ Site barricading prior to commencement of construction work. ➤ Proper maintenance of equipment, including DGS set/s. ➤ 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 ➤ Liquid fuels or electricity to be provided to workers by the contractor ➤ No fuel wood burning <p>WATER</p> <ul style="list-style-type: none"> ➤ Construct toilets for workers @ one toilet / 20 workers. ➤ Establish a septic tank with soak pit prior to commencement of construction and connect each toilet to the septic system. ➤ Proper pest control, use of nets and regular monitoring <p>NOISE</p> <ul style="list-style-type: none"> ➤ Site barricading prior to commencement of construction work ➤ 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. ➤ Ensure proper maintenance and operation of DG set/s <p>SOIL</p> <ul style="list-style-type: none"> ➤ Follow C&D Waste Management Plan 	<p>AIR</p> <p>All the mentioned points are maintained. Elaborative :</p> <ul style="list-style-type: none"> ➤ Site barricading is done and maintained at all worksites, at all times. ➤ All DGs are new and the Vehicle emission test certificate was sent to both PIC and PIU on the 23rd of March, 2019 (letter no. 196) ➤ There is no wood-burning at the site <p>WATER</p> <ul style="list-style-type: none"> ➤ In the Supervisors Block, the ratio of the toilet to worker and bathroom to workers is 1:5 (approx.) ➤ In the PRW block, the ratio of the toilet to worker and bathroom to workers is 1:2 (approx.) till date ➤ Pest control measures have been taken and in coordination with Phuentsholing general Hospital on the month of April <p>NOISE</p> <ul style="list-style-type: none"> ➤ Barricading is always done prior to any construction work ➤ All AFCONs drivers are aware of the no honking policies unless needed. ➤ Warning lights are intact with the machinery. ➤ Road width is too narrow for definite participation <p>SOIL</p> <ul style="list-style-type: none"> ➤ All the mentioned points are maintained <p>RISK/HAZARD</p> <ul style="list-style-type: none"> ➤ All the mentioned points are maintained 	Zone A	Work which generates loud noise is prohibited at night

		RISK/HAZARD <ul style="list-style-type: none"> ➤ Follow 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 River. 	<ul style="list-style-type: none"> ➤ The camp area is located at an elevation higher than that of the highest flood recorded date 		
2	Establishment of stores, warehouse, and parking areas	WATER REGIME <ul style="list-style-type: none"> ➤ Extract as per the EC issued on the EIA report. RISK HAZARD <ul style="list-style-type: none"> ➤ Pre-project job safety analysis to be done ➤ Worker safety training prior to commencement of work; use of personal protective equipment (PPE) as required. ➤ Preparation and implementation of OHSMP. ➤ Location of the equipment should be at an elevation higher than the HFL. 	WATER REGIME <p>All the mentioned points are maintained</p> RISK HAZARD <ul style="list-style-type: none"> ➤ All the mentioned points are maintained. ➤ Workers are giving designation respective induction during the first day of work. 	Zone A	
3	Installation/establishment of Flood warning system	FLOOD RISK HAZARD <ul style="list-style-type: none"> ➤ Construction of temporary gabion wall near the camp area and project start point. ➤ Designation of assembly points. ➤ Formulation of evacuation plan and Emergency response team. ➤ Identification of Flood monitoring stations at two locations extending beyond the project area 	FLOOD RISK HAZARD <ul style="list-style-type: none"> ➤ All the mentioned points are maintained. 	Zone A	Report on the mock drill conducted for flood
	Preparing roads for access to site and management of traffic	AIR <ul style="list-style-type: none"> ➤ Ensure that road construction up to the construction site are sprinkled. ➤ Vehicles to be well maintained so as to not release objectionable fumes; ➤ Preparation and implementation of a Traffic and Safety Management Plan so as to ensure smooth traffic flow of project-related vehicles as well as other vehicles. WATER	AIR <ul style="list-style-type: none"> ➤ Sprinkling work is done regularly (approx. Once in two hours) ➤ Traffic Survey is carried out once a month ➤ Refer to Appendix III for all vehicle clearance. WATER <ul style="list-style-type: none"> ➤ The mentioned point is maintained NOISE	Zone A	

4		<ul style="list-style-type: none"> ➤ Provision of barriers drains to arrest such water runoff <p>NOISE</p> <ul style="list-style-type: none"> ➤ to maintain vehicles as per their maintenance schedule; ➤ limit access road construction working hours to daytime only <p>ECOLOGY</p> <ul style="list-style-type: none"> ➤ Provision of catch Pits/sedimentation tanks ➤ Provision of barriers drains to arrest such water runoff; <p>RISK/HAZARD</p> <ul style="list-style-type: none"> ➤ pre-project job safety analysis to be done ➤ worker safety training prior to commencement of work ➤ Use of Personal Protective Equipment (PPE) as required. ➤ Preparation and implementation of Occupational Safety and Health Management Plan (OHSMP) ➤ Preparation and implementation of a Traffic and Safety Management Plan so as to ensure smooth traffic flow of project-related vehicles as well as other vehicles. <p>FLOOD/BACKWATERS</p> <p>Proper planning and development of the outfalls and their connection to the Amochhu or as side-channel</p>	<ul style="list-style-type: none"> ➤ All mentioned points are maintained and vehicles used are done as per the site requirements <p>ECOLOGY</p> <ul style="list-style-type: none"> ➤ All the mentioned points are maintained ➤ All wastewater has been channeled <p>RISK/HAZARD</p> <ul style="list-style-type: none"> ➤ All the mentioned points are maintained ➤ Pre-project safety analysis is noted in the CEMP and Safety training are being conducted on a weekly basis. <p>FLOOD/BACKWATERS</p> <ul style="list-style-type: none"> ➤ All the mentioned points are maintained 		
	<p>Solid Waste Management - Generation of Solid Wastes, Construction wastes, and scrap</p>	<p>AIR</p> <ul style="list-style-type: none"> ➤ Ensure closed dust bins/waste containers ➤ Implement provisions of Bhutan's Waste Prevention and Management Regulation 2012, as amended in 2016 <p>WATER</p>	<p>AIR</p> <ul style="list-style-type: none"> ➤ All mentioned points are maintained <p>WATER</p> <ul style="list-style-type: none"> ➤ All the mentioned points are maintained 	Zone A	

5		<ul style="list-style-type: none"> ➤ Provision of drains with traps ➤ Provision of storm water drains in the facility ➤ Clean-up of spillages <p>SOIL/LAND</p> <ul style="list-style-type: none"> ➤ Provision of impervious floors in the facility <p>RISK/HAZARD</p> <ul style="list-style-type: none"> ➤ Ensure closed dust bins/waste containers ➤ Implement provisions of Bhutan’s Waste Prevention and Management Regulation 2012, as amended in 2016 ➤ Preparation and implementation of OHSMP ➤ Work with the Thromde to ensure proper collection and disposal of Municipal Solid Waste. 	<p>SOIL/LAND</p> <ul style="list-style-type: none"> ➤ All the mentioned points are maintained <p>RISK/HAZARD</p> <ul style="list-style-type: none"> ➤ All mentioned points are maintained as per the CEMP which is in accordance with the Waste Prevention and Management Regulation 2012, as amended in 2016 ➤ Waste collection is done by the Thromde accordingly. 		
6	<p>Removal of staff housing, equipment, labour camps and all temporary structures safely from the project site</p>	<p>WATER</p> <ul style="list-style-type: none"> ➤ Ensure that the decommission procedure clean-up of spillage ➤ Securing of wastes and their sale/disposal to authorized dealers/landfill or suitable disposal site. <p>NOISE</p> <ul style="list-style-type: none"> ➤ Provision of Noise barriers & enclosures ➤ Provision of earplugs ➤ Establish and supervise a waste collection and removal plan ➤ Comply with National Environmental Standards and International Good Practices. <p>RISK/HAZARDS</p> <p>Follow the Occupational Safety and Health Management Plan (OHSMP) Plan</p>	<p>WATER</p> <ul style="list-style-type: none"> ➤ All the mentioned points are maintained <p>NOISE</p> <ul style="list-style-type: none"> ➤ Waste collection is done by the Thromde and all Necessary PPEs are provided to the workers and officials. <p>RISK/HAZARDS</p> <ul style="list-style-type: none"> ➤ All mentioned points are maintained in accordance with the CEMP OHSMP. 	Zone A	

8.3 Monitoring of environmental quality

38. The purpose of the environment quality monitoring is to collect data on air, water and noise quality for the project area during the construction phase, so that future variation could be assessed during or after the project implementation (operation phase). AFCONS have engaged Bhutan Ecolab Services, Phuentsholing for carrying out sampling and testing of these attributes.

8.3.1 Air Quality Monitoring

39. Air quality is monitored every day by Ms. Bhutan Ecolab Services, over a period of 24hrs in six locations namely: AA01 (Near B-Mobile Tower), AA02 (Near the STP plant), AA03 (NHDCL Colony), AA04 (Chamkuna Village), AA05 (Toorsa Tar Village) and AA06 (Near Rigzar's Batching Plant).

40. To ensure that the project is not causing or contributing towards the rising pollution in Phuentsholing town, parameters like TSPM, PM 10, PM 2.5, NO_x, SO₂, and CO are being monitored regularly. Depending on the results of the monthly tests, mitigation measures are being strictly implemented. Refer to **Appendix IV** for the Air and Noise equipment Calibration certificate.

An average of the data for air pollution for the past six months January – June are reflected in Table 6.

Table 6: Ambient Air Monitoring data from Jan-June 2019

Station Code		TSPM (µg/m ³)	PM10 (µg/m ³)	PM2.5 (µg/m ³)	NO _x (µg/m ³)	SO ₂ (µg/m ³)	CO (ppm)
	NEC Standard	200	100	-	80	80	2000
	IFC Standards	-	150	75	125	200	160
AA01 (Near Mobile Tower)	Maximum	147.0383	60.20467	42.72667	2.721667	0.479	9.09
	Minimum	25.645	12.767	2.373333	3.78074	0.866	17
	Average	69.52054	31.56833	16.12538	4.370208	0.568333	12.57167
AA02 (Near STP)	Maximum	116.7383	65.09333	22.75667	5.316	2.2255	10.02683
	Minimum	27.01833	11.88667	1.765	0.195067	0.685667	0.174
	Average	68.86667	31.47121	11.73371	2.078902	1.297008	2.473667
AA03 (NHDCL Colony)	Maximum	282.0018	105.7902	63.10833	7.085667	2.634833	17.07517
	Minimum	79.2115	20.4815	7.174667	0.036367	0.396167	18.282
	Average	131.5311	61.67992	39.47183	3.495938	1.092604	12.94667
AA04 (Near White Building)	Maximum	209.1533	95.61667	59.76	6.950167	6.180167	16.1635
	Minimum	45.17133	20.03933	7.295	1.466667	0.166667	17.19333
	Average	106.8086	57.32679	18.41746	4.498083	1.396208	8.490667
AA05 (Near the Shop)	Maximum	189.2017	89.505	47.91333	6.969167	1.155167	1.213333
	Minimum	44.147	18.31667	3.613333	0.391167	0.367833	9.779
	Average	98.36833	40.46188	15.09175	2.403738	0.653604	1.395

AA06 (Near Rigsar's Bathing Plant)	Maximum	110.105	52.81633	21.7	6.484167	0.8425	3.833333
	Minimum	35.00333	15.28667	5.656667	0.397667	0.474333	0.027333
	Average	63.8315	27.83592	12.21092	2.473317	0.656313	1.393167

41. Result and Interpretation of Air Quality Monitoring: The PTDP project is not the only ongoing development, but instead, Phuentsholing town is undergoing a major facelift and has multiple constructions going on simultaneously. Due to which roads in Phuentsholing town are covered in layers of dust, and it is not possible to subside the suspension of settled dust into the air with just sprinkler trucks, especially during the dry winter season which is from January – March. Especially during the months of January – March the project finds an increase in the pollution, because Phuentsholing already has a problem of vehicle congestion, but during the winters the congestion gets worse, as schools are on holiday, and most people from around Bhutan, come to Phuentsholing for their holiday due to perks such as warmer weather, for business and for school shopping. Due to the increase of vehicular movements, and emission from vehicles increasing Nitrogen Oxide are some of the primary reasons for high pollution during those months. The dust levels from the movement of vehicles are occasionally high enough to obscure vision temporarily.
42. The PTDP project is located along the main Phuentsholing – Samtse highway and is not the only activity going on in the area and the town. A combination of natural factors such as high temperature, little rainfall and external factors such as unpaved roads, high vehicular movement and the emission from the movement of vehicles cause settled dust to suspend into the air contributing towards the pollution in the area. In the last three months from April – June, the project has seen an increasing number of trucks parked along the highway carrying construction materials, aggregates, and release of excess emission from the parked trucks and vehicles moving along the highway contributing towards a high level of pollution in the project area. In addition, there are many workshops located along the highway and emissions from vehicles and equipment used from the workshops are another contributor to the high level of pollutants in the vicinity.
43. PTDP is not the only ongoing activity in the area, private firms like Rigsar and Yangkhil have resumed their work, which is located behind the PTDP project site, due to which the project has seen a sudden increase in heavy vehicles moving along the project route transporting constructions materials to and from the Rigsar & Yangkhil site. On most days due to the roads being unpaved and movement of heavy vehicles to and from the Rigsar and Yangkhil site, settled dust soar into the air and are occasionally high enough to obscure vision temporarily.
44. The average pollution level was observed to be high in locations AA03 & AA04, due to following reasons:
- i. AA03 is air monitoring station is located right near the workshops and the NHDCL colony. Factors such as the high movement of vehicles are the primary cause the high TSPM and PM10. The workshops situated along with the AA03 stations also conduct activities such as burning of tires most evening which is another contributor to the pollution.

- ii. AA04 is away from the project and is being monitored to see how the pollution is in areas away from the project vicinity. This location indicated high TSPM because the stations are located near the highway which is unpaved and due to high vehicular movement, settled dust is being suspended into the air, and the emission from the movement of vehicles are all factors contributing towards the sudden rise in pollutants in the locations. Especially during the winter months of January – March, when there is no rain, and heavy wind, the settled dust are all suspended in the air.

45. A graphical representation of TSPM, PM10 & PM2.5 is shown in Figure 3. Only three of the parameters were represented in the form of a graph, as they are the most common pollutants detected while conducting the test.

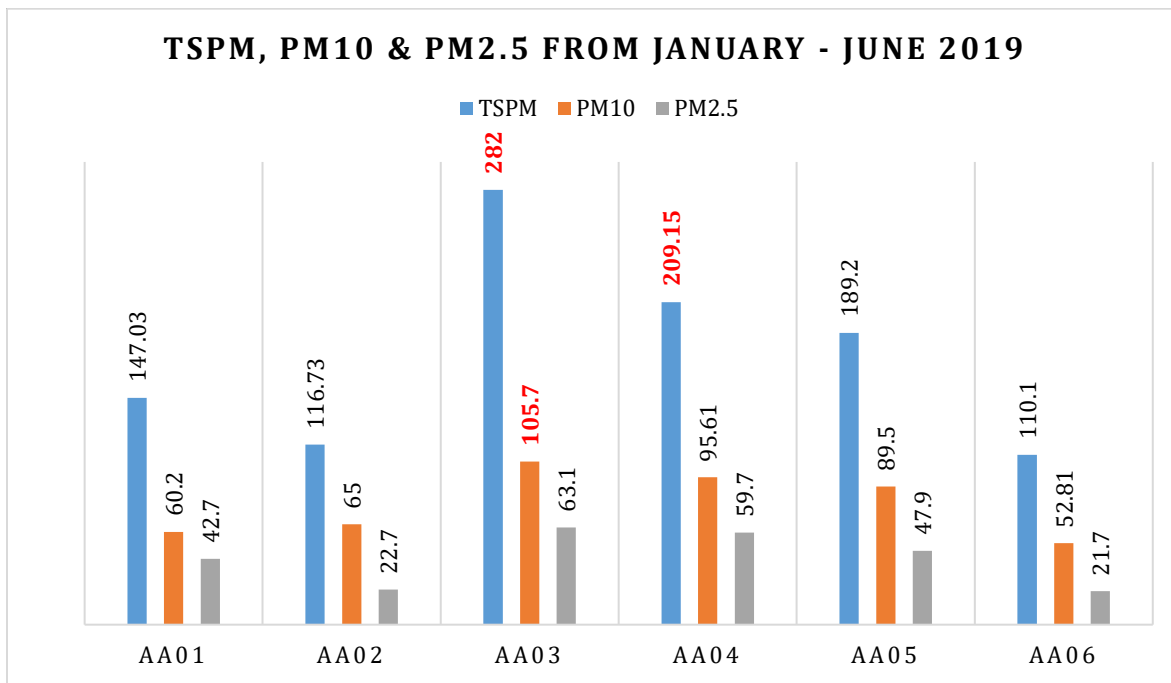


Figure 3: Graphical Representation of the Air quality for TSPM, PM 10 and PM 2.5 (Jan-June 2019)

- 46. Mitigation Measures: To ensure that the project is not contributing towards the rising pollution in Phuentsholing town, and impacting the communities living along the township development, the project ensures that sprinkler trucks are being deployed regularly, speed limit signs have been raised in required locations, speed bumps have been formed along the Phuentsholing-Samtse Highway to ensure that vehicles do not speed, and all project vehicles carrying construction materials are covered in tarpaulin.
- 47. A traffic survey is also conducted every month by the contractors to study the number of times the project vehicles are using the highway in comparison to third-party vehicles. This study is conducted to ensure that project vehicles are not a major contributor to pollution. The detail of the traffic study is discussed in the subsequent **Section 9** of the report.

48. A sprinkler log sheet is also maintained by the contractors to keep track of the number of times the sprinkler trucks are being deployed, to settle the dust. Contracts are also ensuring that all construction materials at the site are covered in tarpaulin.

49. All workers at the site have been informed and encouraged to wear suitable gears and wear their N95 or equivalent mask at all times.

8.3.2 Noise Quality Monitoring

50. Noise quality monitoring is conducted every day over a period of 24 hours by Bhutan Ecolab Services in six locations. The test is conducted once during the day and the other at night time. Noise test is conducted to ensure that the sound generated is not only produced from project activities but from natural factors as well as other undertakings occurring in the vicinity. The test is also to ensure that the noise generated from the project area is temporary and will not have any lasting impact after its completion. Once the noise data has been gathered any mitigation measures which need to be taken care are immediately and strictly implemented.

51. An average of the data for noise pollution for the past six months January – June are reflected in Table 7 and Table 8 respectively.

Table 7: Day- Ambient Noise Monitoring (Jan- June 2019)

Sampling Code/Month	NL01	NL02	NL03	NL04	NL05	NL06	NEC	IFC
January	65.6	62.8	66.8	52.7	55.5	56.8	65	55
February	62.4	65.8	63.7	59.8	58.4	57.8	65	55
March	60.8	63.9	65.9	35.5	49.2	52.7	65	55
April	66.5	69.5	62.8	29.7	46.1	48.7	65	55
May	61.1	51.4	28.9	25.6	43.3	26.7	65	55
June	62.9	59.8	24.8	27.7	41.7	67.7	65	55
Average	63.21667	62.2	52.15	38.5	49.03333	51.73333		

Table 8: Night – Ambient Noise Monitoring from January – June

Sampling Code/Month	NL01	NL02	NL03	NL04	NL05	NL06	NEC	IFC
January	45.5	42.4	54.9	40.8	41.9	51.5	55	45
February	51.5	48.9	42.1	41.7	47.6	43.9	55	45
March	45.6	47	42.7	39.6	48.4	41.9	55	45
April	57.8	55.8	51.9	26.8	39.6	37.6	55	45
May	54.3	38.6	29.1	25.7	27.4	25.5	55	45
June	51.7	53.4	20.5	21.9	25.8	45.2	55	45

Average	51.06667	47.68333	40.2	32.75	38.45	40.93333		
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52. Result and Interpretation of Air Quality Monitoring: As reflected on the table above two out of the six were within the permissible limits, and four out of six locations were exceeding the NEC standard for the day noise monitoring. Whereas for the night noise monitoring, four locations were within the permissible limits and two were exceeding the standards.

53. There are multiple external factors that are contributing towards the high level of noise pollution at the locations along with the PTDP project site:

- i. In the last three month, the project has seen a growing number of trucks parked along the Phuentsholing-Samtse highway. This is not only causing air pollution due to emission from vehicles, but congestion for daily commuters leading to constant honking, and running engines all contributing towards the rise in noise level in the vicinity. This could be one of the major factors for high noise from the months of April – June. The months of April – June are also monsoon season, and Phuentsholing has received heavy rainfall and thunderstorm which are all-natural factors contributing towards noise pollution.
- ii. There are also many workshops located along the highway and noise from the use of equipment are another contributor to the high level of noise in the vicinity.
- iii. Also dredging work by Rigzar and Yangkhil has resumed, which is located behind the project site, use of heavy machinery and constant movement of heavy vehicles with construction materials are all contributors towards the rise in noise especially in location NL06.
- iv. Also, work at part five of the PTDP project started, and location NL06 is not far from the activities. Noise is mostly being generated from the use of heavy machinery for the construction of D-wall and movement of project vehicles. Work which requires the use of heavy and loud machines are only allowed to function until regular working hours.
- v. Locations NL01, NL02 and NL03 are situated away from the main PTDP project site, and this is done to compare and understand how much of the noise is contributed by the project. So a high level of noise indicated are not due to the PTDP project but rather caused by other external factors and activities ongoing along with the two locations. One of the major factors is the problem of vehicle congestion which has exacerbated over the past few months due to developments happening around Phuentsholing town. Other factors include the multiple ongoing activities happening along with the two locations, such as construction activities like drilling, and movement of heavy vehicles carrying construction materials, are all contributors towards the high level of noise pollution in the two locations.

54. The noise generated during the testing are not permanent, and will not have any future impact. A graphical representation of the day and night noise monitoring for the last six months is shown in Figure 4 and Figure 5.

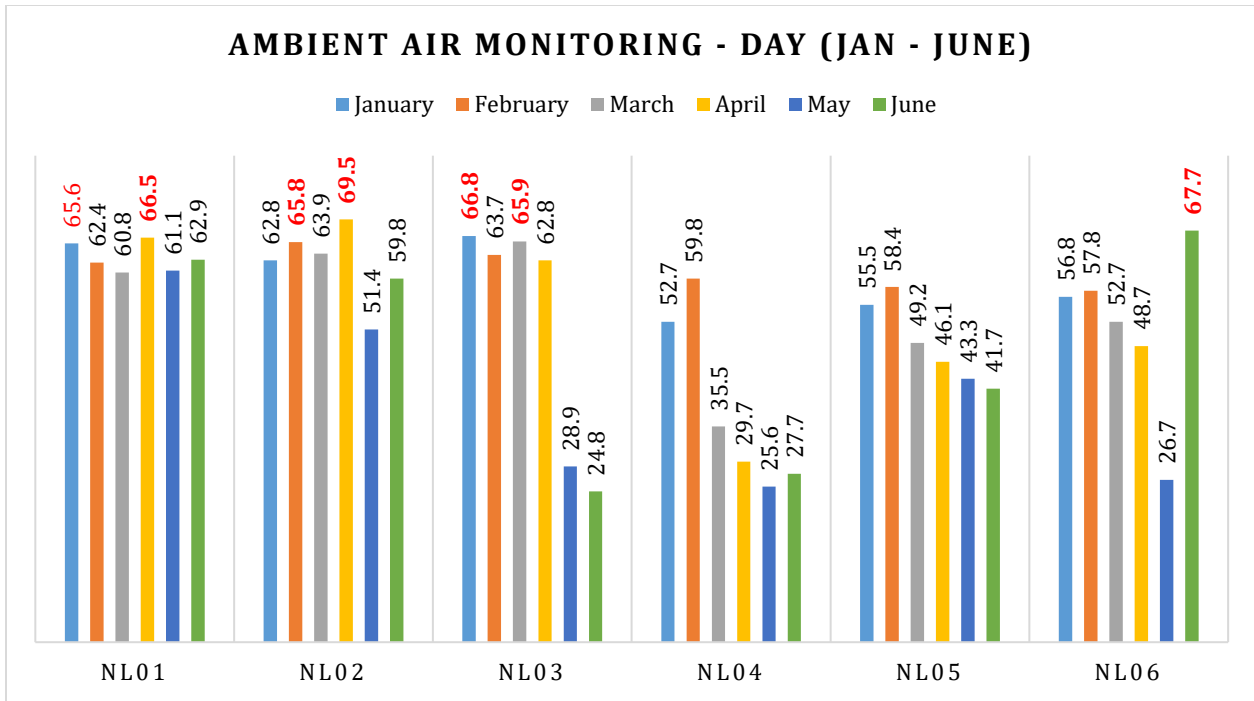


Figure 4: Graphical representation of Ambient Air Quality during day time (Jan-June 2019)

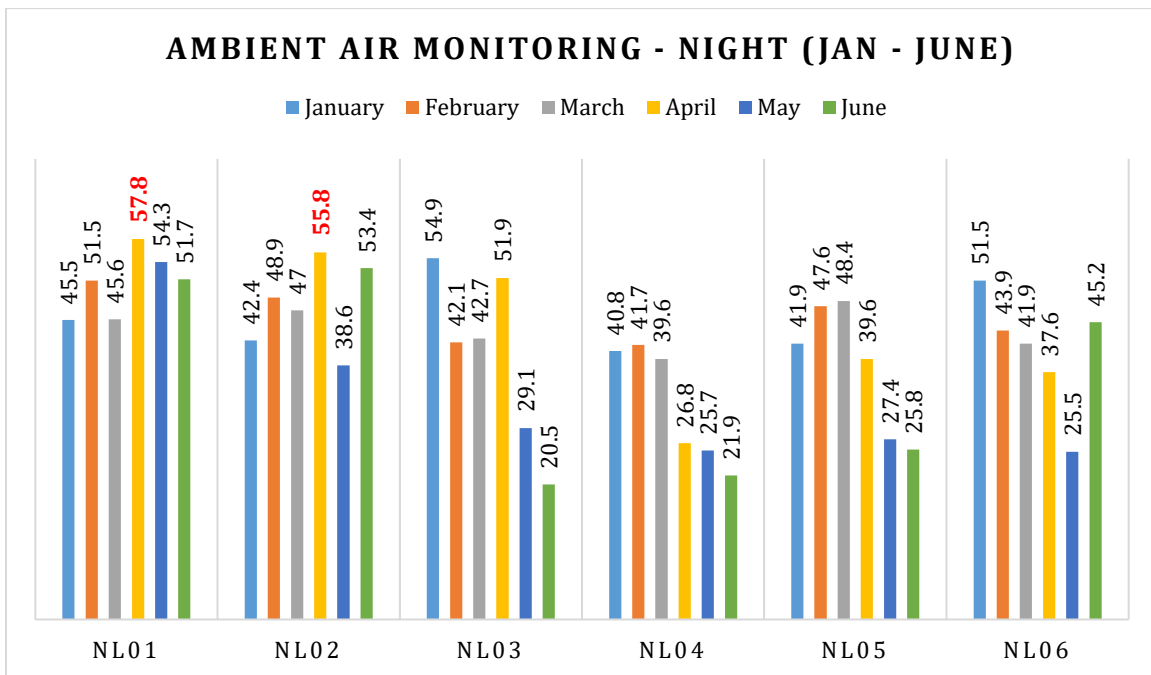


Figure 5: Graphical Representation of Ambient Air quality at night (Jan-June 2019)

55. Mitigation Measures: There are many external factors contributing to the rise in noise pollution which cannot be controlled, but sounds generated from the PTDP project activities are monitored and controlled. Contractors are advised to complete all work which requires the use of heavy machinery,

which could generate loud noise during normal working hours. Contractors are also informed to ensure that all workers living in the camps do not create too much noise which could disturb the neighboring households. All project drivers are also prohibited from unnecessarily honking in the vicinity.

56. All workers at the site have been informed and encouraged to wear suitable gears and wear their earplugs at all times or while functioning machines which generate loud noise.

8.3.3 Surface Water Quality

57. The surface water test is conducted to ensure that the project does not pollute and impact the Amochhu River. Ten locations (SW01-SW10) have been identified to conduct the water quality test. Out of the ten locations, a monthly test is conducted for SW04 & SW05 which are points right above and below the project camp area. This is to monitor and ensure that any camp or project activities are not contributing towards any form of pollution along that stretch of the river. Whereas a pre and post-monsoon water quality test encompassing SW01-SW10 are conducted every six months. In the month of March, surface water test was conducted for SW01-SW10.

58. The data for surface water quality monitoring for the past four months March, April, May and June are reflected in Table 9 and Table 10. Test for all ten locations is reflected in Table 11.

Table 9: Surface Water monitoring (Jan-June 2019) for SW04

Parameter	Unit	Ambient Water Quality Standards as per NEC			IFC Standard	Months						Average
		A Very Good	B Good	C Moderate		Jan	Feb	March	April	May	June	
pH		6.5-8.5	6-9	6-9	6-9	N/A	7.75	8.45	7.68	7.98	7.75	7.922
Conductivity	µs/cm	800	1000	2000	-	N/A	192	90	-42.8	85	87.3	82.3
Total Dissolved Solid	mg/L	-	-	-	-	N/A	45	56	88.3	48	89	65.26
Temperature		-	-	-	-	N/A	17.4	18.27	19.54	19.5	19.7	18.882
Biochemical Oxygen Demand (BOD) at 27° C	mg/L	2	5	50	30	N/A	2.007	1.54	3.05	1.209	2.38	2.0372
Chemical Oxygen Demand (COD)	mg/L	-	-	-	125	N/A	3.488	2.901	4.871	3.83	4.061	3.8302
TSS	mg/L	25	100	-	50	N/A	38.97	206.5	123.8	892	387	701.35
Color	HZ	5	50	-	-	N/A	0.04	1/08	N/A	3	N/A	0.824
Dissolved oxygen	mg/L	6	4	-	-	N/A	14.46	23.88	14.46	18.9	18.61	18.062

Parameter	Unit	Ambient Water Quality Standards as per NEC			IFC Standard	Months						Average
		A Very Good	B Good	C Moderate		Jan	Feb	March	April	May	June	
Salinity	Mg/L	-	-	-	-	N/A	181.4	0.04	0.023	0.88	0.38	36.5446
Phenol	mg/L	0.001	0.002	-	-	N/A	BDL	BDL	BDL	BDL	BDL	0
Sulphates	mg/L	25	100	-	-	N/A	7.082	0.75	5.302	0.097	2.471	3.1404
Nitrate	mg/L	10	50	-	-	N/A	12.41	3.089	6.83	8.09	4.21	6.9258
Fluoride	mg/L	1.0	2.0	-	-	N/A	BDL	BDL	BDL	BDL	BDL	0
SAR	mg/L	-	-	26	-	N/A	2.396	0.982	3.17	0.71	0.391	1.52998
Ammonical Nitrogen	mg/L	-	-	-	-	N/A	BDL	BDL	BDL	BDL	BDL	0
Magnesium	mg/L	-	-	-	-	N/A	7.211	0.079	8.055	1.582	1.925	3.7704
Sodium	mg/L	-	-	-	-	N/A	13.89	7.42	21.46	6.01	24.07	14.57
Potassium	mg/L	-	-	-	-	N/A	4.074	1.563	2.901	0.401	2.813	2.3504
Chloride	mg/L	-	-	-	-	N/A	12.18	2.071	17.56	3.81	9.52	9.0298
Cyanide	mg/L	0.05	0.05	-	-	N/A	BDL	BDL	BDL	BDL	BDL	0
Lead	mg/L	0.002	0.02	-	-	N/A	BDL	BDL	BDL	BDL	BDL	0
Total Coliform	MPN/100 ml	50	5000	10000	400	N/A	11	8	14	12	37	16.4
Fecal coliform	MPN/100 ml	20	2000	5000	-	N/A	13	5	7	9	37	14.2
Odour		unobjectionable	unobjectionable	-	-	N/A	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
Mineral Oil		No Film	No Film	-	-	N/A	No Film	No Film	No Film	No Film	No Film	No Film

Table 10: Surface Water Monitoring from January – June for SW05

Parameter	Unit	Ambient Water Quality Standards as per NEC			IFC Standard	Months						Average
		A Very Good	B Good	C Moderate		Jan	Feb	March	April	May	June	
pH		6.5-8.5	6-9	6-9	6-9	N/A	7.99	7.87	7.85	7.74	7.97	7.884
Conductivity	µs/cm	800	1000	2000	-	N/A	91	N/A	-45.1	89	48.3	36.64

Parameter	Unit	Ambient Water Quality Standards as per NEC			IFC Standard	Months						Average
		A Very Good	B Good	C Moderate		Jan	Feb	March	April	May	June	
Total Dissolved Solid	mg/L	-	-	-	-	N/A	48.2	N/A	48.2	67	98.7	52.42
Temperature		-	-	-	-	N/A	17.68	17.68	18.84	19.6	19	18.56
Biochemical Oxygen Demand (BOD) at 27° C	mg/L	2	5	50	30	N/A	2.663	2.663	4.82	2/08	3.89	3.2232
Chemical Oxygen Demand (COD)	mg/L	-	-	-	125	N/A	4.054	4.054	5.039	3.89	5.704	4.5482
TSS	mg/L	25	100	-	50	N/A	46.31	46.31	128	654	432	261.32
Color	Hz	5	50	-	-	N/A	0.04	0.04	N/A	0.02	N/A	0.02
Dissolved oxygen	mg/L	6	4	-	-	N/A	14.46	14.46	12.08	18.9	18.7	15.72
Salinity	Mg/L	-	-	-	-	N/A	180.8	180.8	0.06	87	0.052	89.7424
Phenol	mg/L	0.001	0.002	-	-	N/A	BDL	BDL	BDL	BDL	BDL	0
Sulphate	mg/L	25	100	-	-	N/A	5.441	5.441	2.376	0.89	0.963	3.0222
Nitrate	mg/L	10	50	-	-	N/A	9.022	9.022	11.07	12.7	8.531	10.069
Fluoride	mg/L	1.0	2.0	-	-	N/A	BDL	BDL	BDL	BDL	BDL	0
SAR	mg/L	-	-	26	-	N/A	3.015	3.015	2.89	3.2	2.48	2.92
Ammonical Nitrogen	mg/L	-	-	-	-	N/A	BDL	1.108	0.761	0.86	BDL	0.5458
Magnesium	mg/L	-	-	-	-	N/A	9.671	7.211	3.65	0.972	0.87	4.4748
Sodium	mg/L	-	-	-	-	N/A	18.83	13.89	4.081	6.08	3.85	9.3462
Potassium	mg/L	-	-	-	-	N/A	4.099	4.074	2.015	4.033	2.09	3.2622
Chloride	mg/L	-	-	-	-	N/A	21.42	12.188	10.4	9.602	8.075	12.3374
Cyanide	mg/L	0.05	0.05	-	-	N/A	BDL	BDL	BDL	BDL	BDL	0
Lead	mg/L	0.002	0.02	-	-	N/A	BDL	BDL	BDL	BDL	BDL	0
Total Coliform	MPN /100 ml	50	5000	10000	400	N/A	8	11	12	12	23	13.2
Fecal coliform	MPN /100 ml	20	2000	5000	-	N/A	12	13	9	16	32	16.4

Parameter	Unit	Ambient Water Quality Standards as per NEC			IFC Standard	Months						Average	
		A Very Good	B Good	C Moderate		Jan	Feb	March	April	May	June		
Odour		unobjectionable	unobjectionable	-	-	N/A	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
Mineral Oil		No Film	No Film	-	-	N/A	No Film	No Film	No Film	No Film	No Film	No Film	No Film

Table 11: Surface Water Monitoring for March (SW01-SW10)

Parameter	Unit	Ambient Water Quality Standards as per NEC			IFC Standard	Months									
		A	B	C		SW 01	SW 02	SW 03	SW 04	SW 05	SW 06	SW 07	SW 08	SW 09	SW 10
pH		6.5-8.5	6-9	6-9	6-9	7.5	8.21	8.65	8.45	7.87	8.78	8.24	8.75	8.29	8.21
Conductivity	µs/cm	800	1000	2000	-	83	87	88	90		91	269	447	92	88
Total Dissolved Solid	mg/L	-	-	-	-	42	43	72	56		46	135	26	46	46
Temperature		-	-	-	-	16.9	16.7	17.7	18.27	17.68	19.1	20.4	16.98	19	19
Biochemical Oxygen Demand (BOD) at 27°C	mg/L	2	5	50	30	2.908	3.097	2.01	1.54	2.663	2.98	2.98	1.09	2.4301	3.988
Chemical Oxygen Demand (COD)	mg/L	-	-	-	125	3.058	4.251	3.856	2.901	4.054	4.109	3.64	2.27	3.962	5.589
TSS	mg/L	25	100	-	50	58.5	75	107	2065	46.31	550	255.5	32.8	46	9055
Color	H _z	5	50	-	-	2.5	1.9	1.5	1.08	0.04	1.8	0.31	0.0027	2.6	2.5
Dissolved oxygen	mg/L	6	4	-	-	20.8	24.82	24.55	23.88	14.46	17.78	20.7	23.5	17.77	22.8
Salinity	Mg/L	-	-	-	-	0.4	0.4	0.4	0.4	180.8	0.4	0.13	0.021	0.4	0.4
Phenol	mg/L	0.001	0.002	-	-	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.081
Sulphate	mg/L	25	100	-	-	0.48	0.067	0.963	0.75	5.441	1.508	3.088	BDL	0.894	1.062
Nitrate	mg/L	10	50	-	-	3.098	2.561	4.46	3.089	9.022	3.207	5.81	0.387	3.086	0.481
Fluoride	mg/L	1.0	2.0	-	-	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
SAR	mg/L	-	-	26	-	1.092	0.783	1.380	0.982	3.015	1.562	2.45	0.076	0.891	0.289

Parameter	Unit	Ambient Water Quality Standards as per NEC			IFC Standard	Months										
		A	B	C		SW 01	SW 02	SW 03	SW 04	SW 05	SW 06	SW 07	SW 08	SW 09	SW 10	
Ammonical Nitrogen	mg/L	-	-	-	-	0.086	BDL	BDL	BDL	BDL	1.108	BDL	BDL	0.00	BDL	BDL
Magnesium	mg/L	-	-	-	-	4.088	3.092	0.067	0.079	7.211	1.082	0.089	0.097	0.648	0.076	0.0
Sodium	mg/L	-	-	-	-	12.081	7.881	5.871	7.42	13.890	7.06	4.886	8.021	5.086	6.402	0.0
Potassium	mg/L	-	-	-	-	0.094	0.075	0.081	1.563	4.074	0.084	3.71	0.065	1.005	0.085	0.0
Chloride	mg/L	-	-	-	-	8.547	5.206	3.091	2.071	12.188	4.021	6.08	2.107	3.851	12.391	0.0
Cyanide	mg/L	0.05	0.05	-	-	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Lead	mg/L	0.002	0.02	-	-	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Total Coliform	MPN/100 ml	50	500	10000	400	16	13	28	8	11	19	6	17	8	19	0.0
Fecal coliform	MPN/100 ml	20	200	5000	-	9	9	6	5	13	12	8	BDL	15	21	0.0
Odour		unobjectionable	unobjectionable	-	-	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
Mineral Oil		No Film	No Film	-	-	No Film	No Film	No Film	No Film	No Film	No Film	No Film	No Film	No Film	No Film	No Film

59. Result and Interpretation of Water Quality Monitoring: The surface water test was conducted for SW04 & SW05 for the months of March, April, May and June. The data for the months of February, March, April, May and June reflects that all parameters are within the permissible limits except the TSS and dissolved Oxygen which is slightly above the permissible limits. In the month of March, a pre-monsoon test for ten locations from SW01-SW10 was conducted.

60. The surface water test for the five months was conducted during the start and peak of monsoon season, where Phuentsholing received heavy rainfall. For the months of February & March Phuentsholing did not receive much rainfall, but in the last three months, an average of 8 mm was recorded for April, an average of 29.71 mm and highest of 170 mm for May and an average of 41.27 mm and highest of 421 mm of rainfall was recorded for June. Due to the heavy rainfall, there was an increase in the river turbidity, which increased siltation and sedimentation in the river. Other factors such as disposal of materials from construction sites along the Omchhu, and industrial waste (from Karma steel) and settlements along the Omchhu are all factors contributing towards high TSS.

61. The data for surface water for all five months also indicated high dissolved oxygen. Dissolved Oxygen concentration in a freshwater system like the Omchhu and Amochhu River will vary depending on the

season, location and water depth. Due to Phuentsholing town’s geographical location at a lower altitude, the rivers are able to hold more dissolved oxygen in comparison to a higher altitude. In addition to the change in climate, heavy rainfall causing an influx of storm water, which leads to an increase in the water level and decrease in the water temperature are all contributors towards a higher DO.

62. **Mitigation Measures:** Since the cause of high TSS and DO in locations SW04, SW05 & SW10 are due to external and natural factors, the PTDP can only ensure that our project and camp activities are not contributing towards the pollution. This can be achieved by ensuring that camp or project sites are:

- Properly collecting and disposing of all waste
- No dumping of construction materials along the riverbed or in the river
- Ensure that all construction materials are well covered
- Ensure that all restrooms in the project and campsites are well maintained so that workers are discouraged from defecating around the project vicinity or near the river
- Making sure to service the septic system at the project site and camps
- Landscaping the project office and camps with native plants

8.3.4 Water Regime Monitoring

63. The first Water Regime monitoring was conducted on 7th March 2019. Pictures of the river will be taken by the contractors twice every week. This monitoring is being conducted, so that the project can record the change in waterways and water level, and examine and analyses the information to ensure that the project will not be impacted.

64. Figure 6 shows that most drastic changes in waterways for the month of March, April, May and June. Due to the heavy rainfall experienced in the past few weeks, the waterways have definitely changed but not drastically. The river has diverted its course and is closer to the river banks.





Figure 6: Pictorial Changes in the water regime

8.3.5 Water Level Monitoring

65. The first water level monitoring was conducted on 4th May 2019. This monitoring will be conducted twice every week (Mondays and Saturdays) between part 5 & 6, where construction activities are currently ongoing. This monitoring is conducted to monitor the increase and decrease in the Amochhu water level. This monitoring is also another way to foresee any warning signs of flooding in the project area.

66. For the month of May, there was a rise of 0.09 m in the water level since the initial measurement which was taken on May 4th.
67. For the month of June, there was a rise of 0.458 m in the river level since the initial measurement which was taken on 1st June. On the 25 & 26th of June Phuentsholing received a cumulative rainfall of 542 mm but before the rainfall water level was monitored on the 24th and the reading was recorded 200.85 m. Another monitoring was conducted on the 27th of June after the rainfall and the reading recorded was 202.18 m. Due to the continuous rainfall, there was a rise of 1.33 m of water level.
68. Due to the heavy rainfall, the river is also changing its course and instead of the water level increasing drastically, the river is becoming wider. Tables Table 12 and Table 13 reflect the change in water level for the month of May and June.

Table 12: Water Level Monitoring for May

Date	River Water Level (m)	Change in river water level (m)
04/05/2019	3.94	+ 0.02
06/05/2019	3.96	
11/05/2019	3.76	+ 0.01
13/05/2019	3.77	
18/05/2019	3.57	+ 0.1
20/05/2019	3.67	
25/05/2019	4.23	- 0.04
27/05/2019	4.04	

Table 13: Water Level Monitoring for June

Date	Time (am)	River Water Level (m)	Change in river water level (m)	Remarks
01/06/2019	8:39	200.3	- 0.1	Fall
03/06/2019	8:47	200.2		
08/06/2019	8:45	200.4	0.14	Rise
10/06/2019	8:39	200.54		
15/06/2019	8:53	201	0.55	Rise
18/06/2019	8:30	200.45		
22/06/2019	8:35	200.45	1.35	Rise
29/06/2019	8:40	201.8		

8.3.6 Ground Contamination

69. To prevent ground contamination while using oil and grease, a tray container is used to prevent ground contamination in addition to the already cemented floor in the workshop. Although the contractors are taking measures to ensure no ground contamination occurs by using tray containers to store unsealed barrels of oil and grease, there were several spots around the project sites where there was leakage of oil and grease in the ground. This could be from vehicles, spillage during movement of barrels or from overflowing of the tray containers.
70. Several strategies for remediation are:
- The encapsulation process to ensure that contaminants do not spread any further.

- Thermal soil process is by baking the contaminated soil so contaminants evaporate and then disposing of the soil.
- Excavate soil and take it to a disposal site away from ready pathways for human or sensitive ecosystem contact.
- Containment of the soil contaminants such as capping or paving over in place.

8.3.7 Ground Water Contamination

71. Groundwater testing is done every six months at two tube wells which are used for drinking and domestic use in the stockyard and the campsite to prevent any form of contamination due to oil and grease spillage.

72. For the month of May, groundwater contamination was conducted at two points GW01 (Camp area) and GW02 (Office area). As shown in Table 13 Table 14, all groundwater parameters are within the permissible limits of the NEC.

Table 14: Ground Water Quality Results

SL. No.	Parameter	Unit	Ambient Water Quality Standards as per NEC			IFC standards	Surface Water Quality	
			A Very Good	B Good	C Moderate		GW01	GW02
1	pH		6.5-8.5	6-9	6-9	6-9	7.5	7.8
2	Conductivity	µs/cm	800	1000	2000	-	159	167
3	Total Dissolved Solid	mg/L	-	-	-	-	116	105
4	Temperature		-	-	-	-	19.21	19.9
5	Biochemical Oxygen Demand (BOD) at 27° C	mg/L	2	5	50	30	0.0052	0.0087
6	Chemical Oxygen Demand (COD)	mg/L	-	-	-	125	0.067	0.087
7	TSS	mg/L	25	100	-	50	1.83	2.013
8	Color	Hz	5	50	-	-	0.13	0.16
9	Dissolved oxygen	mg/L	6	4	-	-	89.6	16.89
10	Salinity	mg/L	-	-	-	-	0.021	0.048
11	Phenol	mg/L	0.001	0.002	-	-	BDL	BDL
12	Sulphate	mg/L	25	100	-	-	BDL	BDL

SL. No.	Parameter	Unit	Ambient Water Quality Standards as per NEC			IFC standards	Surface Water Quality	
			A Very Good	B Good	C Moderate		GW01	GW02
13	Nitrate	mg/L	10	50	-	-	BDL	BDL
14	Fluoride	mg/L	1.0	2.0	-	-	BDL	BDL
15	SAR	Miliequa./L	-	-	26	-	0.046	0.03
16	Ammonical Nitrogen	mg/L	-	-	-	-	BDL	BDL
17	Magnesium	mg/L	-	-	-	-	BDL	BDL
18	Sodium	mg/L	-	-	-	-	1.570	2.87
19	Potassium	mg/L	-	-	-	-	0.07	0.67
20	Chloride	mg/L	-	-	-	-	0.039	0.018
21	Cyanide	mg/L	0.05	0.05	-	-	BDL	BDL
22	Lead	mg/L	0.002	0.02	-	-	BDL	BDL
23	Total Coliform	MPN/100 mL	50	5000	10000	400	BDL	BDL
24	Fecal coliform	MPN/100 mL	20	2000	5000	-	BDL	BDL

8.3.8 Solid Waste Management

73. Although waste was being segregated and collected by the Contractors, details of how much waste was produced each month were only generated from the month of March, after PIU and PIC recommended to incorporate the details. This is to monitor that there is not the excess generation of waste, and if there is an alarming increase during the duration of the project, mitigation measure will immediately be implemented. Color-coded bins have been installed in the project and campsites. Blue for degradable and Green for biodegradable waste. The Phuentsholing Thromde Municipality makes a bi-weekly trip to collect waste from the project site for which a nominal fee is levied. A monthly record is maintained by the contractors to understand the amount of waste generated. Table 15 reflects the waste generated for the months of March, April, May and June.

Table 15: Waste Generated for the months of April, May and June 2019

Month	Degradable	Bio-Degradable
March	2 metric ton	1.5 metric ton
April	1.83 metric ton	1.79 metric ton
May	1.9 metric ton	1.8 metric ton
June	1.8 metric ton	1.6 metric ton

8.3.9 Ecological Study

74. The PTDP will also constantly monitor the aquatic and terrestrial ecology of the areas in and around the project site. An ecological study was carried out by Bhutan Ecolab consultants during the period 27 April to 1 May 2019. The detail assessment and findings from Aquatic and Terrestrial surveys are attached as **Appendix V** and are summarized below:
75. **Aquatic Survey:** The objective of the survey is to assess and determine the diversity of fish species in the Amochhu basin. The first Aquatic survey was conducted on 27th April – 1st May 2019, which details the following:
- Electrofishing method was used to conduct this survey
 - Six sites were located to conduct the fish sampling
 - During the study, 27 species of fishes were found
76. The list of 27 species was then compared to the list of scheduled species under FNCR and International Union for Conservation of Nature (IUCN) Out of the 27 species:
- 16 species were of Least Concern: Badis, Barilus Barna, Garra Gotyla, Garra Annandalei, Schistura Beavani, Crossocheilus Latus, Chagunius Chagunio, Barilus Bendelisis, Mastacembelus Armatus, Petha Ticto, Barilus Vagra, Lepidocephalichthys Guntea, Schizothorax Progastus, Davarioaequipinnatus, Psilorhynchus Balitora, Danio Rerio.
 - Two species were on the Endangered list: Tor Putitora and Amblyceps arunchalensis.
 - Two species were on the Data deficit list: Glyptothrox Panda and Oreichthys sp.
 - Two species were not evaluated by IUCN: Channa Melanostigma and Aborichthys sp.
 - Two species have not been determined by IUCN: Pethia sp and Glyptothorax sp.
 - Three species were not found on the IUCN red list: Neolissochilus hexagonolepis, Semiplotus semiplotus and Channagachu.
 - Zooplankton such as dragonfly larvae, prawns and shrimps were also found.
 - Phytoplankton such as algae was found while testing.
77. **Terrestrial Study:** The objective of this study is to evaluate the diversity of terrestrial ecological components in the project area and the impacts. The Terrestrial Survey was conducted on 22nd June 2019 by Ecolab accompanied by a forester from the Ministry of Agriculture and Forestry Department.
78. All plant species found in the study area are not endangered and are not listed under the IUCN red list. A total of 3 plant species were found in Zone A, B and C namely:
- Kari Pata (Latana Camera)
 - Khari (Acacia Catechu)
 - Bass (Bambusa balcooa)
79. During the survey, no wild animals were sighted. This study is being conducted by Ecolab for all four seasons. This study is being conducted to understand the diversity of species and plants in the PTDP project area.
80. A Biodiversity and Benchmarking Study has been included as part of the PIC contract under Provision Sum. The study will be carried out by a local consultancy for a contract duration of 9 months

spread over 36 months of project duration. The detail ToR has been approved by ADB and the study is expected to commence by August 2019.

9. Social Health and Safeguard Compliance

81. As mentioned earlier, the report also presents the status of health and safeguards compliance, for the period from January to June, 2019. The report reviews the compliance of health and safety activities during the period.
82. The pre-requisite for reporting on health and safety issues in some cases are on a daily basis, some on monthly basis and some on occasional basis. The content of this report is the abstract of the reports submitted by the contractor on the above mentioned periods. The assessment of safeguards compliance covers the status of compliance mainly with the following parameters.

9.1 General Parameters for compliance

- A. General health and safety:
- Workers equipped with PPE
 - Worker trained on safety and hygiene at work
 - First aid boxes available at work site
 - Maintenance of first aid register
 - Availability of radio communication during time of emergencies
 - Visible and legible Safety signage
 - Working condition equipment with proper registration documents such as emission and fitness certificates from the concerned authorities
 - Proper markings and fencings at critical areas such as deep excavations, concreting etc.
 - Vehicle operation safety such as reversing siren, air-horn whistle, etc.
 - Flag men for passing vehicles from and through the project area
 - Proper traffic management plan
 - HIV/AIDS awareness training
 - Proper employee register segregated by gender, nationality and skill
- B. Work environment
- Stockpiles & materials stocked & maintained in safe place and condition
 - Traffic management at site and adequate parking provision
 - Adequate lighting at work site
 - Work areas segregated and adequate signage such as direction, warnings, etc.
- C. Hazardous and dangerous goods and substances
- Fuel storage tanks within sealed area and bunded
 - Hazardous substances sealed and properly labeled
 - Safe disposal of containers of hazardous materials
- D. Dust and smoke
- No burning of wastes of any nature
 - No visible dust clouds from excavation
- E. Toilets and kitchen
- Maintenance of office toilets and washrooms
 - Use of proper septic tanks and its cleaning regularly
 - Placement of garbage bins and proper places including kitchen and emptying them regularly
 - Garbage disposal through the Thromde garbage disposal system
 - Maintenance of kitchen hygiene

- Adequate water supply to the toilets, washrooms and kitchen
- F. Employees accommodation
 - Proper rooms with no seepages
 - Information board for employees
 - Provisions of toilets and washrooms their maintenance for cleanliness
 - Safe power supply
 - Adequate lighting
- G. Mess facility
 - Provision of hygienic food to workers
- H. Fire prevention facility
 - Provision of sufficient number of fire points with suitable equipment available
- I. Transport, security and housekeeping facilities
 - Company transport facility and vehicle condition
 - Appropriate functional security system
 - Cleanliness of the camp area
- J. Fire briefing
 - How to approach fire (for extinguishing)
 - How to use the fire extinguisher
 - Things to keep in mind during fire hazards
- K. Safe Driving
 - Dos and don'ts while driving
 - Use of phone while driving
 - Checking side ways
 - Use of signals
 - Maintenance of vehicles
 - Videos of people driving recklessly were also shown and mistakes were pointed out
- L. PPE awareness
 - What are PPEs
 - Why is it important
 - Experiences sharing regarding use of PPE
- M. Lifting and rigging safety workshop
 - Proper understanding and awareness of one's surrounding
 - Having to put on one's respective PPEs at all times
 - Personal experiences
- N. Lock Out Tag Out Safety (LOTO)
 - Proper understanding and awareness of the work status before logging in or logging out of work
 - Having to put one's respective PPEs at all times
 - Personal experiences
- O. Working at Heights
 - Importance of maintaining PPEs while working
 - Importance of checking the assurance of all PPEs
 - Proper managing and buckling of safety hooks
 - Personal experience
- P. Hot work permit
 - Importance of maintaining PPEs while working

- Personal experiences
- Q. Mock drill
- Emergency alert route
 - Gathering at the assembly point
 - Briefing
 - Safe evacuation from the site

9.2 Sub-contractors compliance with HSE work safety protocols

83. AFCONS also monitors all works that is being carried out by the sub-contractor viz. Rigsar, with regard to HSE. It is made mandatory for the sub-contractor to follow the same HSE protocols at all times when workers are engaged in the sub-contract works.

9.3 General compliance by the contractor

Table 16: General Compliance

Sl. No.	Activity	Detail task	Status & Action taken as per monthly report
1	General health and safety	- Workers equipped with PPE	Report as 'yes' and complied for all the 6 months
		- Worker trained on safety and hygiene at work	Reported 'Yes'
		- First aid boxes available at work site	Present at site
		- Maintenance of first aid register	Followed and maintained
		- Availability of radio communication during times of emergencies	Use of mobile phones as reported
		- Visible and legible Safety signage	Visible at site
		- Working condition equipment with proper registration documents such as emission and fitness certificates from the concerned authorities	Maintained by the contractor and same should be followed by the sub-contractors as well
		- Proper markings and fencings at critical areas such as deep excavations, concreting etc.	Markings are present but fencing get damaged from time to time and are being replaced
		- Vehicle operation safety such as reversing siren, air-horn whistle, etc.	Followed by contractor and same should be followed by the sub-contractors as well
		- Flag men for passing vehicles from & through the project area	Security personals follow it
		- Proper traffic management plan	Traffic management plan in place and followed
- HIV/AIDS awareness training	Conducted for 3 days (21 st – 23 rd March) by Health personnel- 8 female attendance		
- Proper employee register segregated by gender, nationality and skill	Properly maintained for all the six months		
2	Work environment	- Stockpiles & materials stocked & maintained in safe place and condition	Maintained safety
		- Traffic management at site and adequate parking provision	Traffic management (including placement of convex mirrors) adequately managed and traffic counting carried out monthly
		- Adequate lighting at work site	Lighting provision adequately and DGs are kept on standby
		- Work areas segregated and adequate signage such as direction, warnings, etc.	Proper signage put up at proper and strategic locations
3	Hazardous & dangerous goods & substances	- Fuel storage tanks within sealed area & banded	Fuel storage place secure and separate
		- Hazardous substances sealed & properly labeled	Reported as carried out & complied and also physically verified
		- Hazardous materials safe disposal of containers	Reported as done and complied with
4	Dust & smoke	- No burning of wastes of any nature	Not in the project area but outside project area by third party
		- No visible dust clouds from excavation	Water sprinkling carried out on a daily basis during dry months
5	Toilets & kitchen	- Maintenance of office toilets and washrooms	Proper and periodic cleaning of office toilets and washrooms

Sl. No.	Activity	Detail task	Status & Action taken as per monthly report
		<ul style="list-style-type: none"> - Use of proper septic tanks & its cleaning regularly - Placement of garbage bins and proper places including kitchen and emptying them regularly - Garbage disposal through the Thromde garbage disposal system - Maintenance of kitchen hygiene - Adequate water-supply to toilets, washrooms & kitchen 	<ul style="list-style-type: none"> Provision of septic tanks for all toilets Garbage from kitchen, toilet and office space disposed off to the main larger disposal bins regularly Garbage disposed off periodically through the Phuentsholing Thromde garbage collection trucks Kitchens are kept clean as reported Underground water is pumped to supply water for all needs
6	Employees accommodation	<ul style="list-style-type: none"> - Proper rooms with no seepages - Information board for employees - Provisions of toilets and washrooms & their maintenance for cleanliness - Safe power supply - Adequate lighting 	<ul style="list-style-type: none"> Accommodation rooms are of good standard & maintained well Present and on display Provided and maintained well Regular power supply provided Provision for adequate lighting provided
7	Mess facility	<ul style="list-style-type: none"> - Provision of hygienic food to workers 	Food prepared maintaining good hygiene
8	Fire prevention facility	<ul style="list-style-type: none"> - Provision of sufficient number of fire points with suitable equipment available 	Fire extinguishers placed at proper locations
9	Transport, security & house-keeping facilities	<ul style="list-style-type: none"> - Company transport facility and vehicle condition - Appropriate functional security system - Cleanliness of the camp area 	<ul style="list-style-type: none"> Bus service for workers provided Security personals deployed at different locations Camp area kept clean and maintained well
10	Fire briefing	<ul style="list-style-type: none"> - How to approach fire (for extinguishing) - How to use the fire extinguisher - Things to keep in mind during fire hazards - How to approach fire (for extinguishing) 	The briefing was given on 13 th May.2019 to all AFCONS workers, CDCL staff Egis staff
11	Safe Driving	<ul style="list-style-type: none"> - Dos and don'ts while driving - Use of phone while driving - Checking side ways - Use of signals - Maintenance of vehicles - Videos of people driving recklessly were also shown and mistakes were pointed out - Dos and don'ts while driving 	Workshop was conducted on 11 May, 2019 with 24 participants
12	PPE awareness	<ul style="list-style-type: none"> - What are PPEs - Why is it important - Experiences sharing regarding use of PPE - What are PPEs 	Briefing on PPE was given on 18 th May, 2019 to all AFCONS workers
13	Lifting and rigging safety workshop	<ul style="list-style-type: none"> - Proper understanding & awareness of one's surrounding - Need to put on one's respective PPEs at all times - Personal experiences 	Briefing was given on 25 th May, 2019 to lifters and riggers with 11 participants

Sl. No.	Activity	Detail task	Status & Action taken as per monthly report
14	Lock Out Tag Out Safety (LOTO)	<ul style="list-style-type: none"> - Proper understanding and awareness of the work status before logging in or logging out of work - Having to put one's respective PPEs at all times - Personal experiences 	The workshop was conducted on the 8 th of June, 2019 with 9 participants
15	Working at Heights	<ul style="list-style-type: none"> - Importance of maintaining PPEs while working - Importance of checking the assurance of all PPEs - Proper managing and buckling of safety hooks - Personal experience 	The workshop was conducted on the 22 nd June, 2019 with 8 participants who were workers and helpers working at the outfalls
16	Hot work permit	<ul style="list-style-type: none"> - Importance of maintaining PPEs while working - Personal experiences 	The workshop was conducted on the 15 nd June, 2019 with four participants who were welders
17	Mock drill	<ul style="list-style-type: none"> - Emergency alert route - Gathering at the assembly point - Briefing - Safe evacuation from the site 	Conducted on the 27 th June, 2019 and attended by AFCONS workers

Note: Reported for January to June 2019

9.4 Health, Hygiene and Induction program

84. Health awareness campaign was conducted for a period of three days (21st– 23rd of March, 2019, by medical personnel from the Phuentsholing General Hospital. On the first day officials from the PIU/PIC were briefed on HIV/AIDS, Communicable and Non-communicable diseases. And on the second day the same briefing was given to two groups of workers. A total of 64 people from AFCONS attended out of which 13 were female participants. On the third day Health awareness campaign was on Menstrual Hygiene which was attended by all the female employees of AFCONS and two from the PIC. A total of 115 participants attended the Health awareness campaign. Not all the workers could attend the Health awareness campaign programme due to their respective shifts on duty and the urgency of the worker that they were engaged at.
85. Blood donation volunteers have also come forward and have been registered with the Phuentsholing General Hospital for any blood donation emergency and 12 persons from project have registered for it.
- 85 Workshop on food handlers was conducted on the 16th of April 2019 for cooks, kitchen helpers and administrative officer. Topics covered were a) fire causing factors b) fire prevention measures c) fire control protocols d) Dress code (cooking wears) e) Dumping of food waste f) Maintenance of a clean and sanitary working environment and g) personal hygiene.
- 86 For the months of January and February, abstracts on occupational health and safety monitoring reports were submitted where it was reported that toolbox talks were given by the supervisors on various construction related topics such as a) road safety b) health awareness c) electrical safety d) hot work e) Excavation f) lifting and rigging g) health and hygiene and h) housekeeping. All workers were provided with PPE and were made to make use of them for safety on a daily basis.
- 87 All new employees are given the induction program on a) project details b) Details of client and consultant c) Company’s regulations against on site tobacco and sexual harassment and their consequences d) site traffic rules e) Safety briefing including safety wears (PPE) work method and f) familiarizing of the assembly point and the medical unit in case of hazards or injury.
- 88 On the 18th June, 2019 the mini gym was installed at the workers camp in order to encourage the workers to adopt a healthy life style and on 21st June, 2019, the International Day of Yoga was observed at the project premises.
- 89 An induction protocol is followed by AFCONS which is listed in the Table 17 below:

Table 17: Induction Protocol

Activity	Responsible	Purpose	Participants	Interval
Monthly Safety Committee Meeting	Safety Dept.	Review of monthly safety issues, discussions on Accidents/incidents, corrective and preventive actions	Management team, section managers, Safety department and contractor and Employee representative	Every month on last Friday
Tool Box Talk	Site Engineer	Highlighting safe work practice	Construction staff, workers, sub-contractors	Every day Before start of work

Management Review	Chief HSE Manager	Functioning of HSE Plan in the Project	Top Management	Semi-annually
Induction Training	Safety Dept.	To highlight Site safety rules and instructions of work area	Newly recruited workers	At the time of joining

9.5 Signages/labels/tags on site for public awareness

90 A whole lot of posters, signage and awareness materials are displayed at the project site. Some of these materials are for public awareness, some are for direction and some are cautionary materials. These materials are put up at appropriate locations so that workers, public and all concerned are aware of what one should do while entering the work place or the office premises.

Table 18: List of Signage/posters on display

SN	Posters/Signs/labels on display	SN	Posters/Signs/labels on display
1	PPE awareness	23	Speed limit
2	Electrical safety	24	Speed bumps
3	Environment Safety Posters	25	Waste management
4	Lifting and rigging	26	Crane and rigging safety
5	DG Safety Poster	27	Barricade Zone
6	Fire extinguishers (PASS)	28	Harness Safety
7	Reverse handling/driving	29	Helmet Safety
8	Cement bund/aggregate bund	30	Safety Signs and their meanings
9	"Family waiting for you" sign	31	Human machine interface
10	Hand Safety	32	Safety shoes
11	Material handling	33	Assembly Points
12	Equipment handling	34	Fire exits
13	Road based Signs (i.e. Diversion, road conditions etc.)	35	No car washing
14	Cylinder storage and safety	36	No honking
15	No smoking	37	Cautionary signs
16	Fire bucket	38	Workshop based signs
17	Office, Mess, Washroom, Kitchen, toilets etc. (labels)	39	Office vehicle stickers
18	Deep excavation	40	Barricades
19	Men and women at work	41	Contacts points
20	Mandatory PPE	42	HSE contact personals
21	Monthly HSE Summary	43	Body De-hydration signs
22	Place tag	44	Location signs

9.6 Labour employment

91 As per the labor deployment record, the average number of labours hired by the contractors is as per Table 19 presented below. It is evident that the Bhutanese labourers constitute over 30% of the overall labour force engaged in the project and females constitute about 7% of the total.

Table 19: Labour Employment

Category of labourers	Gender of labourers	Average no. of labourers Per month	% of total labourers deployed
Bhutanese Day labourers	Female	19	6.14
Non-Bhutanese Day labourers	Female	2	0.54
Bhutanese Day labourers	Male	73	23.91
Non-Bhutanese Day labourers	Male	67	21.74
Non Bhutanese Resident labourers	Male	146	47.67

9.7 Incidents of health and safety issues

92 The contractor has also been mandated to maintain records of the incidents of health and safety issues. Table 20 below depicts the frequency of the medical cases occurred during the project construction activities. On an average there are about 6.70 first aid cases meaning worker seeking first aid help and less than one case of near miss and accidents. One 'near miss case occurred in the month of June and 2 cases of accidents occurred in the month of March.

Table 20: Cases of accidents and incidents at work sites

Incidents of health and issues	Number of cases	Average of cases
Near miss	1	0.17
Accidents/incident	2	0.33
First aid cases	40	6.67
Safe Man Hours	731,890	121,982
Cumulative Safe man hours	1,569,050	261,508

9.8 Traffic survey

93 Three traffic counts were carried out so as to assess the number of vehicles plying in and around the project area. Only around 24%, 7% and 6% of the total vehicles plying during the day in March, May and June respectively were the project vehicles. The rest i.e. around 76%, 93% and 94% of vehicles plying during day time in March, May and June respectively were all non-project related vehicles. Similarly, around 14%, 9% and 4% of the vehicle plying during the night in March, May and June respectively were

the project vehicles, and around 86%, 91% and 96% of the vehicles plying during the night in March, May and June respectively were all non-project related vehicles.

94 Table 21 below depicts the data of the traffic survey on the three occasions. Therefore, the pollution and traffic congestion in the project area is mostly attributed by non-project related vehicles which calls for a proper traffic management plan that has been put in place in collaboration with the Phuentsholing Thromde and the Royal Bhutan Police.

Table 21: Traffic Survey

Survey date	Traffic Survey count				AFCONS % of vehicles vs. total vehicle movement		Others % of vehicles vs. total vehicle movement		Traffic Survey time
	AFCONS (Project related)		Others (Non-project related)		Day	Night	Day	Night	
	Day	Night	Day	Night					
28 th and 30 th of March, 2019	196	60	626	376	23.84	13.76	76.16	86.24	9 am to 1 pm/2 pm to 5 pm and 8 pm to 8 am
14th May, 2019	181	62	2276	594	7.37	9.45	92.63	90.55	9 am to 5 pm and 8 pm to 8 am
9th, 10th June, 2019	186	37	3136	834	5.60	4.25	94.40	95.75	8 am to 5 pm and 8 pm to 8 am

95 Of these, around 33%, 61% and 41% of vehicles plying in March, May and June 2019 respectively during the day were project related heavy vehicles. Around 53%, 52% and 32% of the vehicles plying during the night in months of March, May and June respectively were project related heavy vehicles. Similarly, around 50%, 42% and 33% of the vehicles plying during the day in March, May and June respectively were non-project related heavy vehicles and around 35%, 41% and 30% of the vehicles plying in March, May and June respectively during the night were non-project related heavy vehicles.

9.9 PTDP site and road sprinkling activity

96 Water sprinkling activity was done during the dry months. Starting at 8 am in the morning, water sprinkling was carried out till 4 am in the morning with a gap of two hours by two vehicle sprinklers. The sprinkling areas not only covered the project areas but also the adjacent area from where a lot of dust is being generated.

9.10 Pest control (Malaria control activities)

97 FICAM D which is a ready for use insecticide dust that gives effective control of pest such as spiders, ants, carpenter ants, cockroaches, carpenter bees, scorpions, large roaches, centipedes and millipedes, termites crickets, silver-fish, wasps, sow bugs, pill bugs, ground beetles, earwigs, pantry pests, etc.

98 On the 27th April, 2019 the Phuentsholing hospital personals visited the project premises and a thorough pest control spraying was carried out in the office premises and workers'/supervisors' and engineers camp and washrooms. Contractor had approached the concerned authorities for use of smokers (fogging machine) in order to control mosquitoes but was told that smokers are not allowed in Bhutan. The authorities however insisted that if there was a problem with regard to pest's infestation then the Phuentsholing hospital authorities would engage in chemical spraying.

99 Besides this the contractor also is in the process of providing mosquito nets to the resident workers and they are in the process of placing appropriate mosquito resistant net at the residents of the workers. Pest control devises are also planned to be provided to the resident workers for use at their camps.

9.11 Safety from Monsoon Hazards

100 The project location and the project amenities are currently based on the banks of the Toorsa River and the river is currently flowing at a distance about 400 meters from the project site protected by the temporary embankment erected by one of the local contractors. With the onset of monsoon, the Toorsa River poses the danger of flooding the whole of the campsite and the office premises where all the machineries and the workers are based. The 2019 monsoon has intensified since mid-July and the river level has risen dangerously high posing threat of flooding. As part of this, a mock drill was conducted on 27th June 2019 which involved all the project officials and the resident workers. The details of the Flood evacuation plan is attached as **Appendix VI**.

101 However, now the contractor has constructed reinforced concreted embankments at the upstream of the river pushing the river further to the right bank. Also improvements of the existing embankments are being carried out currently to prevent the river from breaking the existing temporary embankment. Apart from this the emergency response plan has been strengthened and put on high alert in order to prevent from any disaster. Persons in charge of the safety aspects are now extra vigilant for any such dangers. Forty numbers of life jackets and forty numbers of life buoys along with a boat have are in place in case of any flooding emergencies.

10. Social, Gender and Grievance Redress Mechanism

102 The Grievance redress Mechanism is in place but as of now there have been no cases registered. Two tier mechanism is adopted by the project. The first tier is in the field at the PIU level led by PIU head and the second level/tier GRM is led by the PMU head. There is a grievance box located outside the PIC office. The grievance box is checked at the beginning of every week.

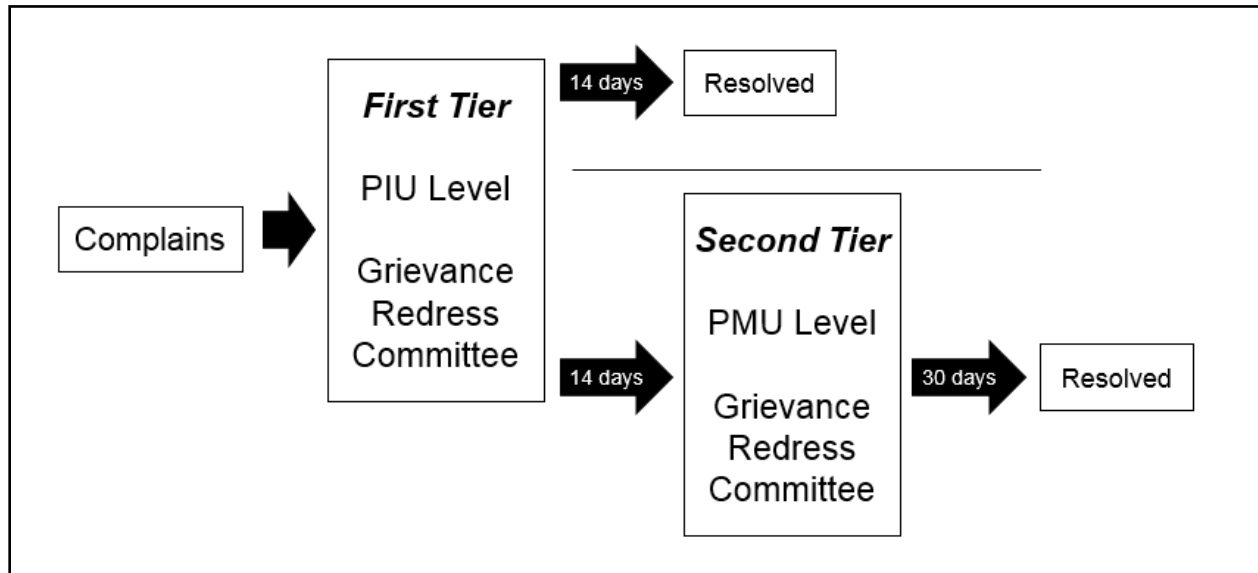


Figure 7: GRM structure

Table 22: First Tier GRC Members

Positions	Names	Remark
PIU Project Manager	Mr. Kamal Dhakal	Chairman
PIU Deputy Project Manager	Mr. Dawa Tshering	Member
PIU Environment Manager	Mr. Pushpa Raj Pradhan	Member
PIC Team Leader/Dy. Team leader	Mr. Robert / Mr. Edwin	Member
PIC Safeguard and communications specialist	Mr. Megay Penjore	Secretary
Representative of local leader		Thromde Constituency Representative (Member)
Representative from District office		Phuentsholing Thromde (Member)
Representative from reputable community-based organization		RENEW (Member)
Contractor	Mr. Ravi, Project Manager	AFCONS (Member)
Members on call basis based on the nature of grievance representing relevant section of district office	-	

Table 23: Second Tier GRC Members

Positions	Names	Remark
PMU Head	Mr. Tshering Dupchu	Chairman
PMU Urban Planner	Ms. Kamala Thapa	Member
PIU Head	Mr. Kamal Dhakal	Member
Environment Officer of PIU	Mr. Pushpa Raj Pradhan	GRC Secretary
Central Government Department		DoFPS (Member)
Reputable community-based organization		RENEW (Member)

11. Conclusions and Recommendation

- 103 The PIU office started to function at Phuentsholing. The Environmental Manager has been appointed under the Project Manager-PIU to oversee the environmental issues of the project. The PIC team has also been mobilized at Phuentsholing since October 2018. The Contract for construction Package CW-01 has been awarded to M/s AFCON Limited, India and the Contractor's team initiated mobilization in the month of September 2018.
- 104 The institutional setup and mechanisms for constant environmental monitoring are in place. The PIU, PIC and the Contractor are carrying out their respective responsibilities in environmental monitoring, oversight and reporting in a coordinated manner. Every once a month PIU, PIC and the HSE team from AFCONs go around the site for HSE monitoring. Any issues witnessed are immediately relayed to the contractor to resolve.
- 105 Monitoring of air and water quality, noise levels, surface & groundwater, water regime & level, ground contamination and ecology study are being carried out by the contractor on a regular basis as per CEMP.
- 106 The contract generates and submits their monthly EMR the 5th of every month to PIC. The report will give an overall update on environmental monitoring and improvements, and Health & Social Safeguards. The report is reviewed by the PIC HSE specialist, the information is also used to generate the monthly report from PIC, which is then submitted to PIU second week of every month.
- 107 Except for a few instances, the environmental conditions in the project site are within the permissible limits. Strict monitoring is conducted every day by PIU, PIC and AFCONs HSE team, and all efforts are implemented to ensure that the project does not contribute towards any form of pollution.
- 108 PIU, PIC and the contractor has mobilized their Environmental and Safety staff at the site. The CEMP has been modified and is reflected on Appendix 1.
- 109 The construction activities are currently ongoing on part 5. The Contractor engineers and workers have all moved into their respective camps.
- 110 World Environment Day was celebrated on 5th June 2019 by planting trees at the campsite and potting 100 plants in and around the office area.
- 111 The contractor has adequately taken care of worker's safety. Appropriate PPEs have been supplied to all the workers at the site and their use has been ensured. Induction training and regular toolbox training of various safety aspects are done by the Contractor for their workers. For the smooth and safe flow of traffic, the contractor has provided diversions and guided signboard has been installed at all the diversion.
- 112 The Health Safety aspects of the PTDP project is seen to be satisfactory as all worker follow mandatory PPE norms, safe workmanship; regular induction programs are delivered to the workers, health and safety officers are fully being engaged and other mandatory norms are being followed on a daily basis. Workshops on safety norms have been reported to be conducted periodically.

- 113 The Phuentsholing General Hospital is also brought on board to address any health emergencies and also delivering talks on HIV/AIDS, Menstrual Health and other health safety measures. Traffic management

has been put in place at the project area with project internal roads exclusively used by the project related vehicles. However, these health and safety measures are being strictly followed by the Contractor, "AFCONS" and the other sub-contractors are seen to be not fully complying with it.

- 114 The Health and Safety measures need to be enforced on the sub-contractors as well and make them comply fully with all the norms. As the sub-contractors are also part of the PTDP, it is mandatory for them to comply with the Health and Safety measures as well as other environmental norms. The main contractor i.e. AFCONS needs to enforce this onto the sub-contractors and periodic monitoring carried out.
- 115 The PIU with assistance from the PIC has developed the Standard Operating Procedure for GRM for dealing with the public complaints with respect to environmental and social issue due to the project.
- 116 Also with the onset of summer and the rains, a lot of river water pooling has emerged in and around the project areas. This attracts the non-project related vehicle drivers either to wash their vehicles in these ponds and many a times the drivers themselves taking bath in these ponds. Apart from this, children from the adjoining establishments such as the workshops, wares houses, housing complex and canteens are seen to be engaged in swimming or taking baths in these ponds. This could lead to fatal accidents which could lead to unpleasant incidences. In order to avoid this from happening, proper signs and barricading of critical areas needs to be done immediately.

ENVIRONMENT PHOTO LOG

January 2019



Noise monitoring equipment



Air monitoring equipment

February 2019



Water Course - 1



Water Course - 2



Speed Breaker between Camp and Lay down Area



Fire Extinguisher at the workshop



Fire Extinguishers at the DG and Switch yard Area



Dustbins for degradable and bio-degradable waste

March 2019



Bentonite sack around site



Bentonite sacks covered in Tarpaulin sheet and barricaded



Dust Pollution along the project corridor



Tier burning across from the Project camp site



SW04 Water testing



SW05 Water testing

April 2019



Pest Control at Camp



Pest Control at PIU office



Sewage Tank opening



Sealed sewage tank opening to avoid odor and soil contamination



Before: Bentonite sack around site covered and well barricaded



Now: Bentonite sacks removed from the well barricaded pile.

May 2019



ADB Missions visit to PTDP. Mr. Brando at part 8 with PIU, PIC and AFCONs HSE team



Preventative measures taken in earthwork area



Preventive measures at workshops to avoid ground contamination



Use of N95 mask while working in such activity



Worker in proper PPE gear



Fire Hazard briefing



Demonstration on how to use a fire extinguisher

June 2019

Celebration of World Environment Day PIU, PIC and AFCONs





Potting of Palm trees Mr. Ravichandran (AFCON)



Potting of Palm trees Mr. Edwin (EGIS)



Potting of Palm trees Mr. Kamal (CDCL)



Potting of Palm trees by Mr. Dawa (CDCL)



Trucks lined up outside the project site



Trucks lined up on the way to the PTDP site



Pollution on the way to PTDP project



Traffic Jam along the PTDP area due to heavy movement of vehicles and trucks parked along the highway

Environmental Monitoring: Surface Water Quality Testing



Surface Water testing at SW04



Surface water testing at SW05

Environmental Monitoring: Ground Contamination Control



Trays used to segregate sand and aggregates



Steel trays used to store open oil barrels

Environmental Monitoring: River Water Level Monitoring



Staff installed at two locations along the Ammochhu to measure change in water level



Staff installed at two locations along the Ammochhu to measure change in water level

Workers Camp



Grass planted at the workers camps



Workout equipments installed at workers camps

SOCIAL, HEALTH AND SAFEGUARDS PHOTO LOG



Monthly safety awards



Tool box talk at outfall No.3



Monthly Safety Award



Work safety sign board



Drop gate to restrict unauthorized vehicle entry



Pest Control in the workers Camp



Briefing Session after gather at the Main Assembly Point-Part of Flood evacuation drill



Talk on fire safety



Safety Harness Demonstration



Briefing Session after gather by the Safety official-Night Mock drill



Road Safety talk to drivers



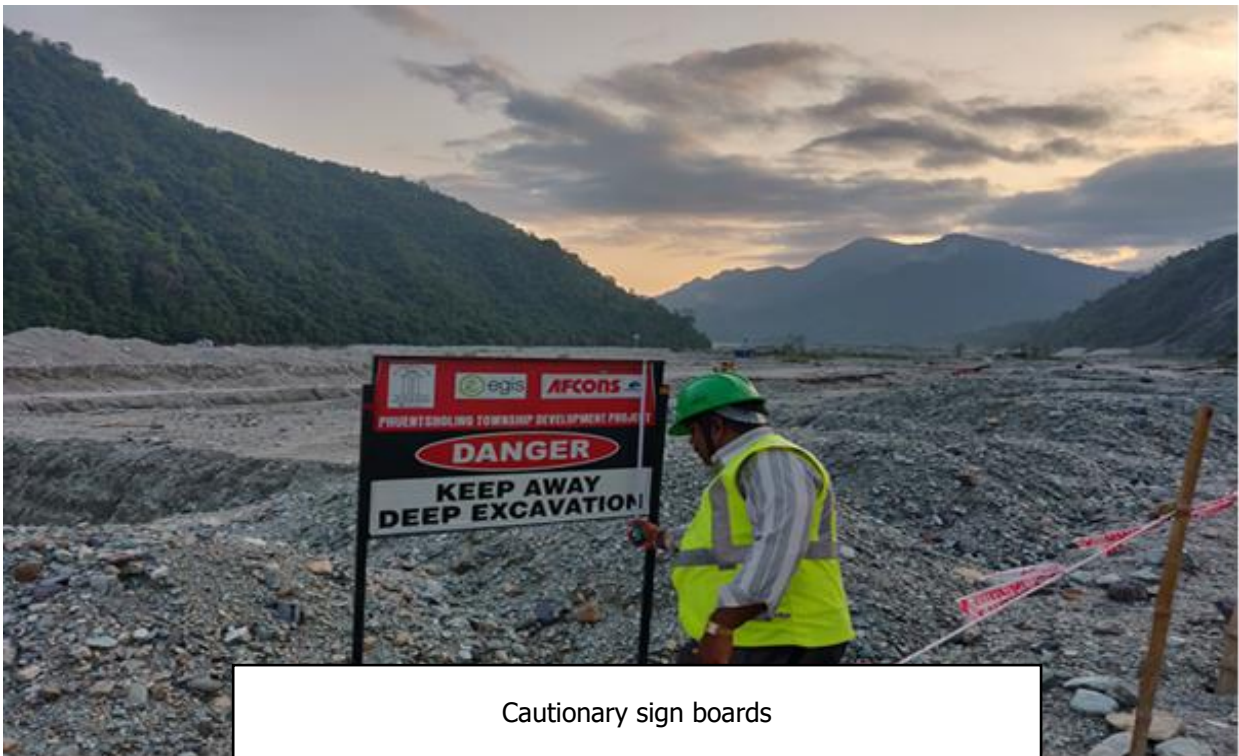
Talk on Use of PPEs



First Health and Safety Campaign



Menstruation Hygiene session by Phuentsholing General Hospital



Cautionary sign boards

Comments/ Observations on CEMP and annexures by ADB

Table 1: ADB's comment on CEMP

Items	Suggestions/reminders from ADB	Response – changes made by PIC/ PIU
Figure 2: Map Showing Sampling Locations of Surface Water (SW01-SW10) and Ground Water (GW01 & GW02)	Why GW1 and GW2 are adjacent to each other? It is likely they will have the same results. If possible, it is better to place at downstream near the Bhutan-India boundary.	GW1 and GW2 are the two tube wells that are dug at the site – one in yard area and another one in camp area. We thought its best to review water quality of both of these locations even if they are nearby. Digging a well in the downstream side will be too expensive without actual need.
Table 5: Project Impact Monitoring Plan S. No. 3. Water Regime	I suggest taking photographs twice a week. It is not complicated to take photographs in two locations. Moreover, frequent photo documentation will provide good information of the change in river water course and water level during project implementation.	Agreed. Incorporated. There will be daily pictures of the site as per the contract. Photo album and video files shall be submitted by contractor to PIC/PIU. Changed in table 5.
Annexure 6: Construction and Demolition Waste Management Plan	I was informed that there is already a landfill that will serve as final disposal area. If this is true, I think there is also an agreement between PMU/PIU on the use of landfill. If there is no landfill yet, please identify the final waste disposal area as soon as possible to avoid waste related problems.	Yes, local landfill will be used. Changes made in the C&D rule.
Annexure 7: Weekly Environment Inspection Checklist	There could be a possibility that some items may be added during the course of the construction. If there are new items found during construction and not in the list, please revise the checklist by and inform ADB the revision through the Environmental Monitoring Report (EMR).	Ok.
Others	I suggest the conduct of trainings or orientations for all workers on the different plans (e.g. CEMP, camp management plan, OHS, emergency plan) at the early stage of construction and repeated semi-annually. In this manner, all workers will be aware of their tasks and how to participate in the CEMP implementation.	Training on OHS and environment provided on Jan 16, 2019. Attended by 15 participants from PIU and contractor.
	In locations where people can see, the contractor will place large outdoor board for displaying (i) project information and (ii) contacts details for any grievances.	Agreed, incorporated in GRM plan

Comments / Observation on CEMP and other annexures by PIC

Table 2: Comments and observation on CEMP and annexures by PIC

Clause/ Section	Comment	Section/Clauses incorporate with by AFCONS
Overall	<p>Many grammatical and incomplete sentences-please double check</p> <p>Page numbering is required</p>	Noted and incorporated accordingly.
3.3 OHSE Organization of Afcons	<p>The responsibility of OHSE and Environment Manager are given in the description. However, in the list of officials, the names of officials for these positions are missing. It is required to match the position of the staff which is proposed in the organizational structure</p>	<p>The position and name of the officials as per given description is made in Section 3.3 OHSE Organization of AFCONS of CEMP and the table 4 is also updated with names of officials (Page No. 15-16)</p>
4.2 Environmental Project Impact Monitoring Plan	<p>Rename as "Environmental Monitoring Plan"</p> <p>Table 5, sl 2: Soil Testing should be replaced by Ground Contamination.</p> <p>Every month; visual observation for contamination by oil, grease and other foreign substances, across the whole project site.</p> <p>Table 5, sl 3: photograph record should be twice a week and not once a week.</p>	<p>Changes are incorporated in section 4.2 Project Impact Monitoring Plan of CEMP in Table 5 at Page No.</p> <p>20Changes are in Section 4.3 Environmental Monitoring Plan in Table 6 at page no. 21</p>
4.3 Environmental Quality Monitoring Plan	<p>Table 6 Sl. 2; Meteorology; month of measurement should be – every month. Compilation of daily data to be reported in monthly mean.</p> <p>Sl. 3; Air Quality; month of measurement should be – every month. Only compilation should be monthly.</p> <p>(Max, Min, Average)</p> <p>Sl. 4; SW Quality;</p> <p>Month of measurement should be SW 04 &05– monthly.</p> <p>Rest of the locations; April and October to capture Pre and Post Monsoon.</p> <p>Sl,5: GW quality; change months to April and October to capture Pre and Post Monsoon data on Water Quality</p>	Defined in section 4.3 of CEMP below Table 8 at page no. 26
Table 8	Define significance of Category A, B and C for water quality as per NEC water Quality Standards	Mentioned in section 4.3 of CEMP below the Table 9 at Page no. 27
Table 9	<p>Day and Night –duration and actual times?</p> <p>Mention the duration for nighttime data and day time data of ambient noise level (dB(A))</p>	ok

Traffic Safety and Management Plan	Valid emission test certificate required for all sections where vehicles and equipment are engaged. Please incorporate the checking and recording of valid Emission Certificate for all construction vehicles and equipment, periodical checking of reverse Horn, lighting, breaks and other safety measures.	Solid waste management plan is mentioned in Annexure 4 Camp Management Plan
Waste Management Plan	Method statement of Waste management plan- collection and disposal is required. This should apply for both general waste and construction waste/ debris/ muck.	
HIV/STD Trainings	HIV/STD Trainings should be provided for all workers at the site + the local community through appropriate mechanisms. Once every two months as per the contract agreement. Include the protocol for carrying out HIV/AIDS awareness programme alongwith proposed schedule	For Construction waste disposal and management Annexure 9 C&D waste management is attached.
Bentonite disposal	Bentonite shall be disposed of to the local landfill after drying and mixing in the form of cakes. Necessary permit shall be sought by the client. Proper storage at site and drying/ mixing shall be done by the contractor.	HIV/STD Training Programme is mentioned in Annexure 7
Drinking Water	Depending on the quality of water, appropriate filtering system should be installed. It has been mentioned about only RO system. If the TDS level is below 400, then it is not advisable to install RO system. So some alternatinve system may be mentiones such as UV filtration.	Protocols of controlling pollution are defined in Annexure 2 Standard Measures for Controlling Pollution and same is referred in Impact matrix table in Chapter 5 of CEMP at
Measures for Management of Air Pollution, Water Pollution and Noise Pollution	The protocol for application for measures for controlling different pollution is not given. Separate protocol for Air Pollution, Water Pollution and Noise Pollution control measures is required to be incorporated and the same should be referred in the Impact table.	
Debris Management	A protocol is required to be developed for managing the Debris/ solid waste. The mitigation measure has been mentioned in the Impact Table but the detailed protocol is not given. The same is required to be added in the CEMP at appropriate location.	Defined in Annexure-9 (C&D waste management)

General Comments and Revision proposed by PIC

Table 3: General Comments and Revision proposed by PIC

S. No.	Comments	Revision/ changes made by PIC/Contractor
1.	The responsibility of OHSE and Environment Manager are given in the description. However, in the list of officials, the names of officials for these are missing.	The position and name of the officials as per given description is made in Section 3.3 OHSE Organization of AFCONS of CEMP and the table 4 is also updated with names of officials (Page No. 15-16)
2.	Soil testing to be replaced with Ground Contamination. Photographs should be recorded twice a week instead of once a week	Changes are incorporated in section 4.2 Project Impact Monitoring Plan of CEMP in Table 5 at Page No. 20
3.	In Meteorology month of measurement should be every month. Change month of monitoring to April and October to capture Pre-Monsoon and Post-Monsoon data of both Surface and Ground Water Quality	Changes are in Section 4.3 Environmental Monitoring Plan in Table 6 at page no. 21
4.	Define Significance of Category A, B and C for Water Quality as per NEC water quality Standards.	Defined in section 4.3 of CEMP below Table 8 at page no. 26
5.	Mention the duration of Daytime and Night time in Ambient Noise level Standards.	Mentioned in section 4.3 of CEMP below the Table 9 at Page no. 27
6.	Method Statement of Waste Management plan- collection and disposal is required for both general and construction-waste	Solid waste management plan is mentioned in Annexure 4 Camp Management Plan For Construction waste disposal and management Annexure 6 C&D waste management is attached.
7.	HIV/STD Trainings as per contract agreement	HIV/STD Training Programme is mentioned in Annexure 7
8.	Define Protocols for Air, Water and Noise Pollution control and same will be referred in the impact matrix table.	Protocols of controlling pollution are defined in Annexure 2 Standard Measures for Controlling Pollution and same is referred in Impact matrix table in Section 5 of CEMP at
9.	Debris Management	Defined in Annexure 6 C&D waste management
10.	Quarry Management plan for getting filling material if not adequate from the project area	Annexure 2 Quarry Management Plan
11.	Mention page number and caption/description for every table or image attached.	Page numbers are mentioned in all the documents and the description related to each tables and images are mentioned in CEMP

CONTRACTORS ENVIRONMENTAL MANAGEMENT PLAN (CEMP)

PHUENTSHOLING TOWNSHIP DEVELOPMENT PROJECT (PTDP)

Client: **Construction Development Corporation Ltd.**
(CDCL)



Consultant: **EGIS International**



Contractor: **AFCONS Infrastructure Ltd.**



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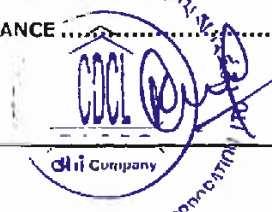
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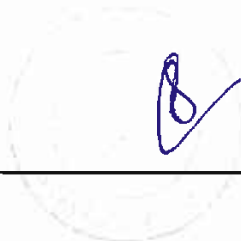
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CHAPTER-1: INTRODUCTION

The present document is the Contractor's Environmental Management Plan (CEMP) which provides the mechanism for implementation of different environmental safeguards measures at different sites during construction of Phase-1 as stipulated in the Contract specification and those of stipulated under EMP. This document has been prepared in compliance with the Contract specification clause No. 1.4.9 of the technical specification of civil contract (PTDP CW-01). This document has been divided into six chapters as follows:

1. **Chapter 1: Introduction:** Contains introduction and description of the project and information of the general contract specification that should be followed to prepare CEMP
2. **Chapter 2: Legal and Administrative Framework on Environmental Safeguards:** This Chapter is all about legal and administration framework that will be followed during implantation of CEMP.
3. **Chapter 3: Institutional Arrangements and Responsibilities for CEMP Implementation:** This Chapter three describes the Institutions involved and their respective responsibilities in implementation of CEMP.
4. **Chapter 4: Environmental Baseline and Monitoring Plan:** Chapter four provides the environmental baseline data that were collected during conducting EIA of the project and also shows the environmental monitoring plan to be implemented during pre-construction and construction phase to mitigate the environmental impact.
5. **Chapter 5: Environmental Impact and Mitigation Measures for Zone A:** This Chapter briefly discusses the impacts and their mitigation measures during various activities of construction work and also shows which document to be referred for the different component.
6. **Chapter 6: Grievance Redress Mechanism:** This describes the mechanism to resolve the grievances raised by public during implementation of the project.
7. **Chapter 7: Zone A Landscape Development Activities:** This Chapter describes how the plantation or landscaping activities will be carried out in project.



1.1 Project Description

8. The Phuentsholing Township Development Project (PTDP) will develop 464 hectares of riparian land near Phuentsholing City, provide protection from floods and erosion, and construct smart urban infrastructure to allow phased urban expansion. The City of Phuentsholing is located adjacent to the Amochhu River on Bhutan's southwestern border with India (Jaigoan, Alipurduar district, West Bengal). It is the country's economic capital and main trading gateway with India. The Royal Government of Bhutan's vision is for Phuentsholing to grow into an economically vibrant, ecologically sustainable, and energy efficient center that will support economic diversification, employment creation, and income generation.

9. The project aims to protect the existing and new towns from floods and riverbank erosion which currently threatens lives and livelihoods and disrupts connectivity with nearby communities. The project will train the river along both banks of Amochhu and the area reclaimed after river training will be used for the development of township. The project will be undertaken in phases which is anticipated to be completed within 15 years in accordance with the PTDP Master Plan.

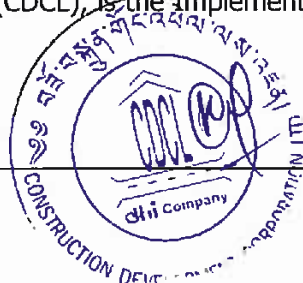
10. The project is divided into five zones: A to E. Zone D represents Kaileshwar Hill which is currently not included in the project development. The remaining four Zones will require about 15 kilometers of riverbank protection works with subsequent development of about 464 hectares of Amochhu riparian land. The development comprises of new common urban infrastructure such as roads, bridges, water supply and waste water system, municipal solid waste system, power and telecommunications to support the habitation of 50,000 people. The implementation of the project is phased in relation to the scale and demand for the development. The allocation of land and riverbank protection for the project's development is shown in Table 1 below:

Table 1: Land Allocation for PTDP

Zone A	Area (ha)	Riverbank Protection Length (m)
A	66	3,974
B	94	3,046
C	277	4,872
E	27	3,083
Total	464	14,975

11. Phase 1 will develop Zone A while subsequent phases will develop the remaining zones. The current scope of work (CW-01) includes construction of approximately 4.5 km of River Training and Embankment works along the Amochhu River in Phuentsholing. Activities include river training (diaphragm wall, Anchor slab), Embankment (retaining walls, outfalls and slope stability), General Earth Filling, Irrigation and Landscape works.

12. Phase 1 is financed with support from Asian Development Bank (ADB) & Druk Holding and Investments (DHI). DHI is the Project Owner and the Executing Agency (EA) and Construction Development Corporation Limited (CDCL) is the Implementing Agency (IA). The Civil work contract



CW-01 has been awarded to M/s AFCONS Infrastructural Limited, India for a period of 30 months and the consultancy service to M/s EGIS International for 60 months.

13. As required by the Environmental Assessment Act 2000, Regulation 2002 and the endorsed Terms of Reference (ToR), an EIA report was prepared for the entire project and subsequently submitted to National Environment Commission (NEC) via. Phuentsholing Thromde (PT). The Environmental Clearance (EC) was obtained on 1st September 2017, a scanned copy of which is attached as Annexure 1.

14. To comply with the ADB requirement, the project was screened by using ADB Safeguard Policy Statement (SPS) 2009 and was categorized as "A" project that needed an EIA study. Hence, the EIA report was prepared as per the RGoB requirement that also complies with ADB's SPS 2009. Hence, the EIA report serves as a guidance for managing the project's social and environmental concerns where the Environmental Management Plan (EMP) provides direction to the implementation of the environmental Safeguards component of the project.

15. In accordance with sub-clause 4.18 of part B specific provision of particular conditions of the contract and clause 1.4.9 of the technical specification of civil contract (PTDP CW-01) the Contractor is required to prepare and submit CEMP for approval to the Engineer within 60 days of contract signing. Incompliance to the contract requirement the AFCONS Infrastructure Ltd. has prepared this CEMP.

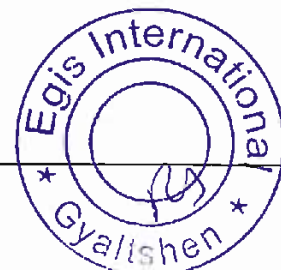
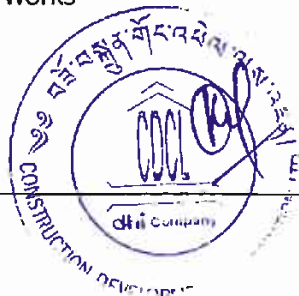
16. The Contractors Environmental Management Plan (CEMP) has been prepared which provides a procedures for implementing environmental mitigation measures as stipulated in EMP and Contract specifications, budget allocation for ensuring implementation of safeguard measures, organizational setup for implementing the mitigation measures and a Grievance Redress Mechanism (GRM) for use by affected stakeholders that addresses issues arising during the construction phase. The plan also takes into consideration of the need of environmental monitoring of the Zone A for daily construction related activities and the seasonal long term environmental monitoring and assessment of the whole PTDP area for future developments. The CEMP also contains a number of sub-plans that address the issues of concern for each construction package.



1.2 Scope of the civilworks

17. The scope of works are as follows:

- A. River Training Works
 - a. Diaphragm wall
 - b. Cast in situ wall
 - c. Anchor slab
 - d. Dead man anchor
- B. Embankment Works
 - a. Embankment
 - b. Retaining wall
 - c. Special filling behind retaining wall
 - d. Ducted outfalls
 - e. Open outfalls
 - f. Access
 - g. Hill slope stability
- C. General Earth Filling Works
 - a. Earth filling
- D. Promenade Finishing
 - a. Lower Level Walkway
 - b. Upper Level Walkway
- E. Irrigation and Landscape Works
 - a. Irrigation works
 - b. Landscape works
 - i. Vetiver plantations on sloped embankments
 - ii. Tree plantation on lower walkway
 - iii. Tree plantation on upper walkway
- F. Miscellaneous works
 - a. Site Access
 - b. Logistics (Traffic Management)
 - c. Mobilization of equipment (Equipment delivery and assembly)
 - d. Mobilization of construction materials
 - e. Work areas establishment with facilities
 - f. Storage of site materials (Material storage)
 - g. Accommodation including fencing, security and food facilities
 - h. Staff welfare activities
 - i. Documentation, meetings
 - j. Vendor management
 - k. Safety, Health & hygiene provisions
 - l. Future interface works

1.3 Environmental Setting

18. The following are the salient features surrounding the project besides the Amochhu River course and Kaileshwar Hill on the western side of the river:

- A. International boundary with India with an access route near Jaigoan (Alipurduar district, West Bengal, India)
- B. Phuentsholing - Chamkuna highway alongside hills on the western side of the river
- C. Northern by-pass route
- D. Alluvial fans observed at each junction where hill slope is aligning with river channel on the eastern side
- E. Marshy land patches
- F. Workshops to facilitate maintenance of equipment
- G. Large fleet of trucks parked haphazardly and put into use for riverbed material carriage
- H. Accumulated eroded river bed material including stones and boulders
- I. Shrubs
- J. Wastewater channel passing through temporary culverts
- K. Stagnated water in septic state
- L. Scrap yards
- M. Agricultural crops
- N. Jaldapara National Park to the south of the project area
- O. Rocky structure in the middle of the Amochhu river course
- P. Temporary structures such as culverts, bunds, deposits of screened river sand
- Q. Rubble
- R. Trucks carrying river bed material
- S. Villagers travelling by passenger cars towards Samtse along the dry river channel
- T. Crusher and concrete Batching plant alongside the river channel
- U. Electricity Transmission system
- V. Maintenance of trucks and construction equipment
- W. Fugitive Dust generation, a dominant scene throughout the Zone-A and other zones due to movement of Trucks, passenger vehicles & construction equipment
- X. Water sprinkling tankers for dust suppression



1.4 PTDP Overall Site Plan of Zone A

19. The location of the Zone A is from border of existing Phuentsholing town next to Omchhu River up to Chamkuna along the Amochhu River extending a length of 3,974 m. The overall site plan of Zone A is shown in Figure 1.

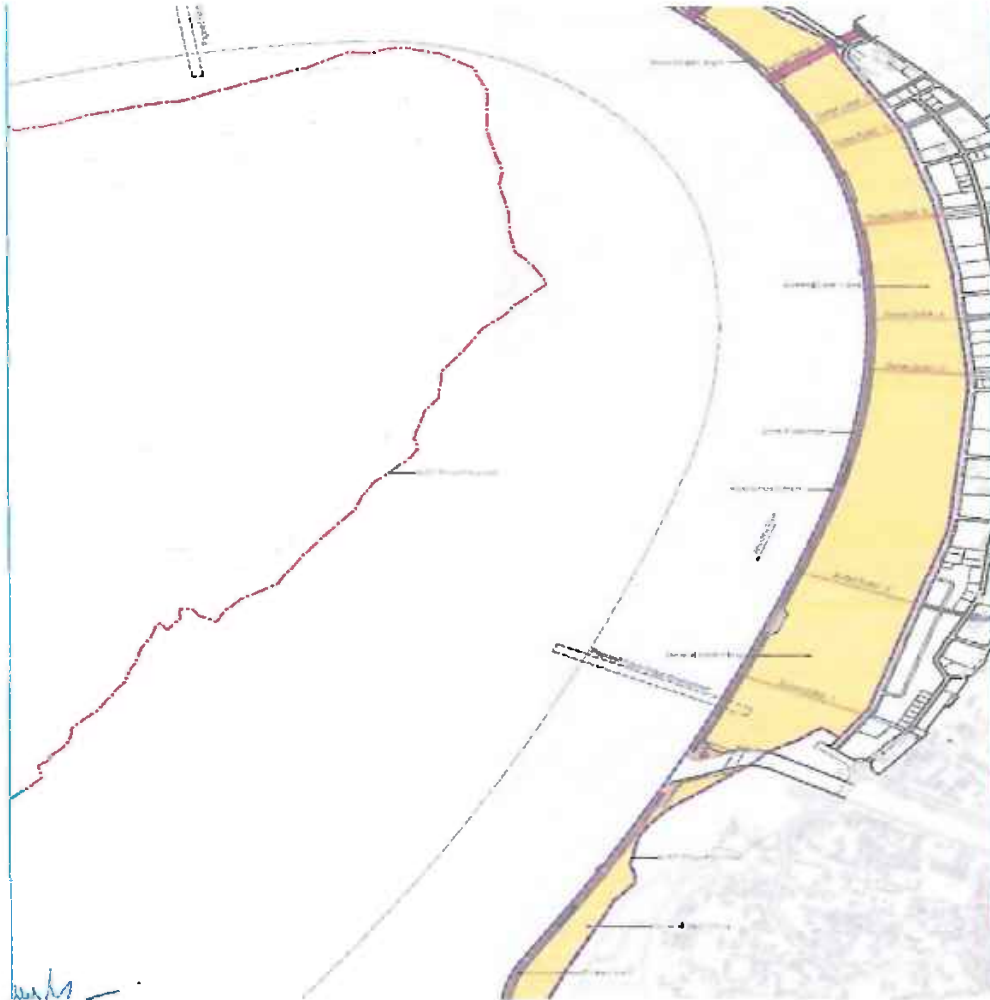
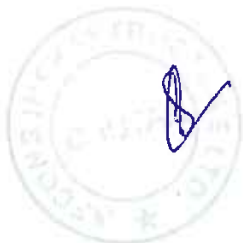


Figure 1 Overall Site Plan of Zone



CHAPTER-2: Legal and Administrative Framework on Environmental Safeguards

20. The CEMP has been prepared in accordance with ADB's SPS 2009 and the overall framework for environmental and related regulations in the form of Policies, Acts, Rules, Notifications and Standards existing within RGoB. The applicability of relevant international statutes and guidelines that regulate the infrastructure sector development project has also been considered. The applicable legislations are summarized in **Table 2** below as follows:

Table 2: Applicable legislation for preparing CEMP

SN	Applicable Legislations	Year
International		
1.	ADB Safeguard Policy Statement (SPS)	2009
2.	World Bank EHS guidelines	
Bhutan		
3.	Forest and Nature Conservation Act	1995
4.	The Environment Assessment Act	2000
5.	The Biodiversity Act	2003
6.	General Rules and Regulations on Occupational Health and Safety (OHS) in Construction, Manufacturing, Mining and Service Industries	2006
7.	National Environment Protection Act	2007
8.	The Labour and Employment Act of Bhutan	2007
9.	Waste Prevention and Management Act	2009
10.	The Local Government Act of Bhutan	2009
11.	Environmental Standards	2010
12.	The Water Act of Bhutan	2011
13.	Waste Prevention and Management Rules	2012
14.	Regulation on Occupational Health and Safety for Construction Industry	2012
15.	Water Regulation of Bhutan	2014
16.	Integrated Solid Waste Management Strategy	2014
17.	Regulation for Environmental Clearance of Projects	2016
18.	The Forest and Nature Conservation Rules and Regulations of Bhutan	2017
19.	Environmental Impact Assessment Report of PTDP	2017
20.	Terms and Conditions of Environmental Clearance from NEC	2017




2.1 ADB's Environmental Safeguard Policy and Requirement

21. The ADB Safeguard Policy Statement (SPS) 2009 covers three important risks to be taken into consideration for ADB's funded projects. These three risks are risks associated with environment impact, involuntary resettlement impacts, and indigenous people impacts. The SPS 2009 describes the objective of adopting these environmental requirements to ensure the environmental soundness and sustainability of ADB's funded projects, and to support the integration of environmental considerations into project decision making process. The environmental safeguard requirements are triggered by screening of the likely environmental impacts and environmental risks. Therefore, all ADB activities has to be screened as early as possible to determine the appropriate extent and type of environmental assessment, and appropriate study to be undertaken to enable identifying potential impacts and potential mitigation measures. Under the ADB SPS 2009, aside from category "A" project, ADB also categorizes a project with no significant environmental impacts as category "B" project, which require the preparation of Initial Environmental Examination (IEE). While a project with no potential environmental impacts will require only the inclusion of environmental requirements in the project design and no environmental impact study will be required

22. With regard to the critical habitat, ADB prohibited any activities in the critical habitat, unless (i) there are no measurable adverse impacts on the critical habitat that could impair its ability to function, (ii) there is no reduction in the population of any recognized endangered or critical endangered species, and (iii) any lesser impact are mitigated. If a project is located within or nearby legally protected area, there must be no significant conversion or degradation unless (i) alternatives are not available, (ii) the overall benefit from the project substantially outweigh the environmental cost and any conversion or degradation is appropriately mitigated. In an area of natural habitats, there must be no significant conversion or degradation, unless (i) alternatives are not available, (ii) the overall benefits from the project substantially outweigh the environmental costs, and (iii) any conversion or degradation is appropriately mitigated.

23. On the basis of ADB's safeguard policy objective and considering ADB's principle of using a precautionary approach in dealing with a project located nearby a legally protected area (i.e. Jaldapara National Park, India), the PTDP has been categorized as a category "A" project. The environmental impact assessment is required to be prepared in order to identify potential impacts on the protected areas and prepare mitigation measures if required.

24. Category "A", projects will require careful monitoring and management of environmental and social implications to ensure that impacts are manageable, and will not become a trigger to generate cumulative and irreversible impacts. On this basis, the PTDP project will also become the subject of strict environmental monitoring, in which, a semi-annual report has to be submitted to be used as a tool to monitor the effectiveness of implementation of environmental management and monitoring plan.



CHAPTER-3: Institutional Arrangements and Responsibilities for CEMP Implementation

3.1 Institutional Arrangement of CEMP

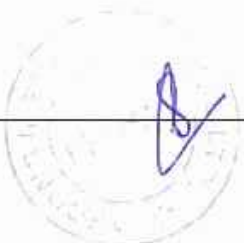
27. The pre-construction and particularly the construction stages of the project will present a variety of significant direct negative impacts with high risks unless these can be adequately mitigated. A clear set of implementation arrangements amongst the various stakeholders is an essential first step in reducing risks.

28. The key stakeholders in the implementation of environmental safeguards during the construction stage are as follows:

- a) Druk Holding and Investments (DHI)
- b) Construction Development Corporation Limited (CDCL)
- c) PTDP Project Management Unit (PMU)
- d) PTDP Project Implementation Unit (PIU)
- e) EGIS International (PIC)
- f) AFCON Infrastructure Ltd (Contractor)
- g) Phuentsholing Thromde, and the affected village communities in the PTDPvicinity
- h) Ministry of Labour and Human Resource (MoLHR)
- i) National Environment Commission (NEC)
- j) Asian Development Bank (ADB)

29. **Druk Holding and Investment (DHI)** is the EA and **Construction Development Corporation Limited (CDCL)** is the IA who is responsible for delivering the entire project including environmental management. It has Project Management Unit (PMU) located in Thimphu to coordinate activities within the National Government and a Project Implementation Unit (PIU) responsible for overall supervision and management with PIC support for the project implementation. The PIU and PIC offices are located in Phuentsholing.

30. **Project Management Unit (PMU)** oversees the implementation of environmental safeguards work under the project. They will also: (i) continue updating the EMP if necessary throughout project implementation in accordance with ADB's Safeguards Policy Statement (SPS, 2009) and the Environmental Assessment Act (2000), and submit to ADB for review, final approval, and disclosure prior to commencement of works; and (ii) before expiry of the initial EC after five years, review and revise (if necessary) the EIA and undertake necessary actions as required, to obtain NEC and ADB's continued approval.

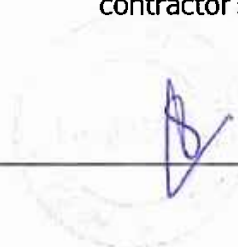


31. **Project Implementation Unit (PIU)** will oversee implementation of environmental safeguards work under the project, including the following activities: (i) facilitate and confirm overall compliance with Government of Bhutan rules, oversee timely preparation and finalization of CEMP by contractors, and obtaining all required clearances and environmental permits in a timely manner prior to construction; (ii) monitor CEMP implementation by the contractors during construction including all mitigation measures and environmental parameters (air and water quality, noise, etc.) and taking corrective actions where necessary; (iii) address and record grievances through the Grievance Redress Mechanism in a timely manner, and taking quick corrective actions where necessary; (iv) ensure that all required environmental study (e.g. biodiversity studies on aquatic ecosystem and elephant social behavior) are professionally and comprehensively carried out; (v) ensure that all environmental quality monitoring required for the project are comprehensively done; and (vi) review monthly environmental monitoring reports submitted to PIU by contractors and consultants, and preparing and submitting semi-annual environmental monitoring reports to ADB on behalf of the PMU. All semi-annual monitoring reports submitted to ADB will be disclosed on ADB's website, as per ADB safeguards and communication policies.

32. **EGIS International (PIC)** will support PIU in design review, construction supervision and monitoring and evaluation. The role of the PIC safeguards team is to oversee overall implementation of the EMP and CEMP, and prepare and implement ongoing ambient monitoring at the monitoring sites used for the completion of the EIA and prepare Environmental Monitoring Report (EMR) for submission to PIU/PMU. It will also advise the overall project engineer on addressing environmental and social management issues.

33. **AFCONS Infrastructure (Contractor)** play a critical role in implementing environmental safeguards including the following activities: (i) prepare and obtain approval of the CEMP, based on the EIA/EMP and outline CEMP prepared during detailed designs and comply with ADB's SPS 2009 and the EMP; (ii) carry out all environmental mitigation measures in the approved CEMPs during construction including regular testing and monitoring of environmental parameters outlined; (iii) address public grievances by taking quick corrective actions and reporting status of grievances and redress to PIU/PMU; (iv) undertake its own monitoring of project related impacts and prepare an environmental section of the monthly report to CDCL environment team and PIC; (v) the contractor is responsible for implementing all environmental, health and safety actions included in the CEMP and relevant clauses in the bidding documents; and (vi) the contractor is required to assign Occupational Health, Safety and Environment Officers whose responsibilities will include:

- a) Coordinating with the PIC during preparation and approval of the CEMP.
- b) Ensuring that the contractor engages a suitable expert as a resource person or organization to undertake STIs/ HIV/ AIDS briefings and awareness raising amongst the contractor's employees and neighboring communities with follow-up upon request.



- c) Coordinating with PIU and PIC in respect of community consultation.
- d) Participating in monitoring and coordinating with PIC to ensure that environmental management activities are reported as required.
- e) Coordinate and communicate with the PIC as required, to facilitate consultation with the affected villages, various stakeholders, and ensuring smooth implementation of the subproject.
- f) Provision will be made in the bidding documents of each package for the costs of environmental management and monitoring including preparation of the CEMP and Environment daily, weekly and monthly progress report and submit to PIC for approval.

34. **National Environment Commission (NEC):** The NEC is the national body primarily responsible for environmental management of proposed and ongoing development. The NEC is responsible for administering the Act and to review the EIA and decide whether an Environmental Clearance can be issued or renewed. The NEC is also legally responsible for monitoring the implementation of the EIA and EMP of the ongoing project.

35. **Ministry of Labour and Human Resource (MoLHR)** is the apex body responsible for administering the Act and ensure an overall safety and health of the workers, taking into account inherent risks, any hazards in the work areas, including physical, chemical, biological, and radiological hazards. The ADB SPS also requires that MoLHR, through the CDCL, take steps to prevent accidents, injury, and disease arising from, associated with, or occurring during the course of work.

36. **Asian Development Bank (ADB)** plays a due diligence role and emphasizes planning, environmental and social impact assessments and safeguard documentation. Through such due diligence and review, ADB will confirm (i) that all key potential social and environmental impacts and risks of a project are identified; (ii) that effective measures to avoid, minimize, mitigate, or compensate for the adverse impacts are incorporated into the safeguard plans and project design; (iii) that the borrower/client understands ADB's safeguard policy principles and requirements and has the necessary commitment and capacity to manage the risks adequately; (iv) that, as required, the role of third parties is appropriately defined in the safeguard plans; and (v) that consultations with affected people are conducted in accordance with ADB's requirements. The ADB ensures that the project adheres to international good practice, as reflected in internationally recognized standards such as the **World Bank Group's Environmental Health and Safety Guidelines**.



3.2 Institutional Responsibility of CEMP

37. The Table 3 below sets out the Institutional responsibilities for the implementation of CEMP:

Table 3: Institutional Responsibility

Stakeholder	Main Role in Implementation of the EMP & OHSMP	Responsibilities						
		Decision maker, Policy Advice and Intergovernmental and Inter-Ministerial Coordination on Safeguards	Prep. of CEMP/Monthly report /EMR	Implementation of Mitigations and/or Management Programs in CEMP	Daily/Weekly Checklists and Monthly Reporting	Env. Quality Control/ Enforcement	Consultation, Advice, Complaint, Feedback	Audit Quality Assurance
CDCL	Implementing Agency	Responsible for overall project supervision & implementation	Decision making based on PIC reccs.	Decision making based on PIC reccs	Decision making based on PIC reccs	Decision making based on PIC reccs	Responsible for resolution of comments and grievances	Decision making based on PIC reccs
CDCL (PMU & PIU)	Project Management, Supervision, Contract Management	Support CDCL at meetings on Policy related to GOB Legislation and Contractual Requirements	Supervision and coordination of Environmental & OHSMP Implementation	Supervision and coordination of Quality control by engineering supervising engineers	Supervision and coordination of Quality control by engineering supervising engineers on contractual requirements	Supervision and coordination of Quality control by engineering supervising engineers on contractual requirements	Coordination	Support Implementation of QA Audit by NEC or Delegated authority to enforce if DEPC constrained by budget or personnel
EGIS International (PIC)	Support to PIU Project Manager & team	Support Project Manager at meetings	Coordination preparation and approval of CEMP documents	Responsible for Supervision	Responsible for Supervision	Input and Support	Preparation of feedback on comments and GRM	Implementation of QA Audit Delegated authority to enforce iDEPC constrained by budget or personnel
AFCONS	Construction	Provides technical	Responsible for	Responsible for	Responsible	Implementation	Provides	Provides

Stakeholder	Main Role in Implementation of the EMP & OHSMP	Responsibilities						
		Decision maker, Policy Advice and Intergovernmental and Inter-Ministerial Coordination on Safeguards	Prep. of CEMP/Monthly report /EMR	Implementation of Mitigations and/or Management Programs in CEMP	Daily/Weekly Checklists and Monthly Reporting	Env. Quality Control/ Enforcement	Consultation, Advice, Complaint, Feedback	Audit Quality Assurance
Contractor		support at meetings on request	Preparation	Implementation	for preparation	n in accordance with legislative and contractual requirements	requested information from site visits	requested information from site visits
Pling Thromde	Consultation and advice	Input to Technical meetings	Inputs to regular consultation	Inputs to regular consultation	Inputs to regular consultation	Monitors contractor performance	Facilitation of feedback to communities	Input
Village Community	Consultation and advice	Provide Advice through CCP process	Inputs to regular consultation	Inputs to regular consultation	Inputs to regular consultation	Monitors contractor performance	Prepares comments and/or grievances	Input
NEC	Monitoring of Compliance of Project Impact Monitoring	Responsible for Safeguards Implementation Approval of EC Provide Advice to CDCL on conditions of approval	Review of CEMP	Monitoring of Implementation	Monitoring of Implementation	Monitoring of Implementation	Monitoring of Implementation	Responsible for review and enforcement of EMP & OHSMP provisions
ADB	Due Diligence and Monitoring of Safeguard Monitoring Reports	Review of EIA, EMR, and CEMP before approval	Review of CEMP	Monitoring of Implementation	Monitoring of Implementation	Monitoring of Implementation	Monitoring of Implementation	Monitoring of Implementation

3.3 OHSE Organization of AFCONS

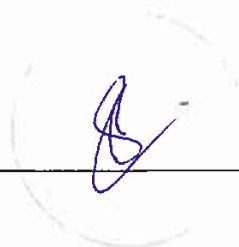
38. **Project Manager** shall be responsible for the overall management of CEMP.
39. **OHSE Manager** shall be responsible for the overall occupational health safety and environmental performance of CEMP. He will be directly reporting to the Project Manager. For any issues arising related to the implementation of CEMP provisions, the EHS Manager shall appraise the issue to the Project Manager and the Project Manager will resolve the issue by assigning the task to the relevant person(s).
40. **Environment Engineer** shall assist OHSE Manager in day to day implementation of Environmental aspect of the CEMP. The Environment Engineer shall be responsible for the induction of all employees to create awareness on the CEMP.
41. **Senior Safety Officer:** shall assist OHSE Manager in day to day implementation of Safety and social aspect of the CEMP. The manager shall be responsible for the induction of all employees to create awareness on the CEMP.
42. **Construction Manager** shall assist the project Manager for ensuring that the site civil works are carried out as per the Contract Agreement. The Construction Manager along with the team will also be responsible to comply with the Environmental terms and conditions as per the CEMP during the execution of the civil works.
43. **Activity In-charges (Admin, CPE, Stores, Batching plant, Logistics)** shall also comply as per the CEMP. They shall perform all their activities only with prior work permit. They shall be aware of the CEMP and the provisions therein. The activity in-charge is responsible for ensuring that all the workers under him are adequately inducted for understanding the CEMP topics and their implementation.
44. **Sub-Contractor personnel** shall also commit and comply the CEMP requirement for protection of environment. The sub-contractor representative shall attend the review meetings to set the course of action for the protection of Environment.
45. **Site Engineers, Supervisors, Operators and Workers** shall follow the instructions of respective Activity in-charge.



46. The List of officials and their position are shown below in **Table 4**

Table 4: List of AFCONS officials

S. No.	Designation	Name	Job Responsibility
1.	Project Manager	Mr. R. Ravichandran	Responsible for overall management of Project including implementation of EMP
2.	Construction Manager	Mr. Dilip Kumar Suryavanshi	Assist Project Manager in day to day implementation of civil works and EMP
3.	OHSE Manager	Mr. S. Ashok Kumar	Responsible for overall OHSE performance in the project
4.	Environment Engineer	Mr. Sunny	Implantation of Environmental measures and training
5.	Sr. Safety Officer	Mr. Bijender Kumar Singh	Assist OHSE Manager for enforcement of safety measures and safety training
6.	Admin In-charge	Mr. Sanjiv Kumar Singh	Responsible for Staff Induction including labours and their welfare
7.	Manager CPE	Mr. Muthukumaran	Responsible for operations and maintenance of plants and logistics

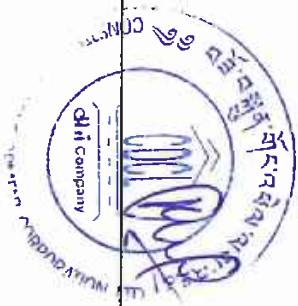



CHAPTER-4: Environmental Baseline and Monitoring plan

4.1 Environmental Baseline Map

47. There will be 10 sites for surface water quality sampling and 2 sites for ground monitoring as shown in figure 2. The surface water quality monitoring is to check the water quality baseline and pollution at different locations while the ground water monitoring is done on the two tube wells that are used for drinking and domestic use at the stock yard and camp site.

Figure 2: Map Showing Sampling Locations of Surface Water (SW01-SW10) and Ground Water (GW01 & GW02)



48. There will be 6 sampling locations for accessing the ambient air and noise quality within the project area. The location map of ambient air and noise quality is shown in **Figure 3**.

49. An automatic meteorological station will also be installed within the office area at a height of about 6 meter above the ground for continuous monitoring. The location of the meteorological station is shown in **figure 3**

Figure 3: Map Showing Sampling Locations of Meteorology, Ambient Air (AA01-AA06) and Noise Quality (NL01-NL06)



50. Ecology survey will also be conducted for determining the effect of construction on aquatic life. The following [figure 4](#) shows the sampling location of aquatic study

Figure 4: Map Showing Sampling Location of Aquatic Study (AQ01-AQ05) and Soil



4.2 Project Impact Monitoring plan

51. To control the impact from construction activity during project implementation the following plan will be made and implemented as per table 5.

Table 5: Project Impact Monitoring Plan

S. No.	Environment Component	Location	Frequency	Parameter	Remark
1.	Noise	1. Batch Mix Plant 2. DG Shed	Every Month	Decibel-(A)	Weekly checklist for noise level monitoring will be prepared by taking instant sampling from sound level meter
2.	Ground Contamination	Zone A	Twice every week	Visual Observation for contamination by oil, grease and other foreign substances, across the whole project site.	To access the quality of soil, photographs will be taken at the entire project area to examine the ground water contamination
3.	Water Regime	1. River Bed levelling Area 2. River Embankment Area	Twice every week	River Bed Level Change, Water Course Change	Photographs will be taken to measure the change in river water course and water level
4.	Land use / Land cover	Project Area (Zone A)	Twice every week at important project area	Land pattern	Photographs will be taken to examine the change in land cover during the project.

4.3 Environmental Quality Monitoring Plan

An environment monitoring plan is made to ensure that ambient environment remains will remain within the acceptable range based on baseline level conducted during EIA. The environmental monitoring plan details are shown in **table 6**.

Table 6: Environment Monitoring Plan

S. No.	Environmental Component	Frequency	Parameter	Number of Samples (Annual)	Month of Measurement/ Reporting
1.	Land Use	Once a Year	Land Use pattern	One	January
2.	Meteorology	Continuous	Wind speed, Wind Direction, Temperature, Relative Humidity, Rainfall	-	Every Month
3.	Air Ambient Quality	Twice Every Week (24-hour Sampling)	TSPM, PM _{2.5} , PM ₁₀ , SO ₂ , NO _x , CO	6 locations x 2samples x 4week x 12 months= 576	Every Month
4.	Surface Water Quality	8 locations once in every six months and SW04 & SW05 (at Zone A) Every month	pH, Colour (Hz), TSS (mg/l), Conductivity (µS/cm), Odour Mineral Oil, Nitrate (mg/l), Fluoride (mg/l), Sulphates (mg/l), Chloride (mg/l), Surfactants(mg/l), Phosphate (mg/l), DO (mg/l), BOD (mg/l), COD (mg/l), Oil & Grease (mg/l)	8 location x 2 times + 2 location x 12 times= 40	Location SW04 and SW05 will be measured every month and other 8 locations will be measured in month of April and October to capture Pre Monsoon and Post Monsoon data






S. No.	Environmental Component	Frequency	Parameter	Number of Samples (Annual)	Month of Measurement/ Reporting
5.	Ground water Quality	Once in Six Month at Zone A	TKN (mg/l), Ammonia (mg/l) T. Coliform (MPN/100ml), Faecal Coliform (MPN/100ml), Dissolved Iron (mg/l), Copper (mg/l), Zinc (mg/l), Arsenic (mg/l), Cadmium (mg/l), Total Chromium (mg/l) Lead (mg/l), Selenium (mg/l), Mercury (mg/l), Phenols (mg/l), Cyanides (mg/l), PAH (mg/l), Total Pesticides (mg/l), PCB (mg/l), SAR, Boron (mg/l), Floating Material	2 locations x 2 times= 4 samples	April and October
6.	Ambient Noise Level	Once every Month (24-hour Sampling)	Decibels- dB (A)	6 locations x 12 Months = 72 Samples	Every month of the year
7.	Ecology	Once per every Season	Terrestrial flora and fauna, Zooplankton, Phytoplankton, Benthos & fishes	-	February, May, August, November
8.	Socio-economics	Quarterly for GRM and consultation meeting whenever required	GRM and Consultation Meeting	-	-

8



52. The environmental quality monitoring will be done on certain location as per the EIA report. The details of the sampling location and methodology adopted for different environmental components are presented from **Table 7** , **Table 8** , **Table 9** , **Table 10** and **Table 11** below:

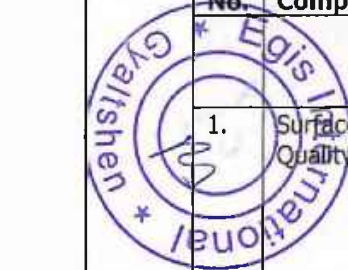
Table 7: Ambient Air Quality, Meteorology & Soil Sampling Location with Environmental Standard

S. No.	Environmental Component	Location			Parameters	Environmental Standard (2010) (Mixed area)		IFC	
		Sampling Code	Location Coordinate (Lat. & Long.)	Description		Maximum (24 Hours)	Yearly Average	Maximum (24 hours)	Minimum (24 Hours)
1.	Meteorology	-	26°52'38.09" N 89°22'33.34" E	Zone Area					
2.	Ground Contamination	-	26°52'38.09" N 89°22'33.34" E	Batching Plant					
3.	Ambient Air Quality	AA01	26°52'01.29" N 89°22'23.7" E	Close to Zone C	TSPM (µg/m ³)	200	140-	-	-
		AA02	26°51'45.3" N 89°22'21.5" E	Nr. Existing STP Area	SPM (µg/m ³)	-	-	-	-
		AA03	26°52'42.68" N 89°22'44.87" E	Near Bangay bazaar	PM10 (µg/m ³)	100	60-	150	50
		AA04	26°53'20.1" N 89°21'52.1" E	Chamkuna Village	PM2.5 (µg/m ³)	-	-	75	25
		AA05	26°52'51.6" N 89°20'03.9" E	Toorsa Tar Village	SO ₂ (µg/m ³)	80	60	125	20
		AA06	26°53'09.5" N 89°19'48.4" E	Nr. PCR Bridge	NO _x (µg/m ³)	80	60	200 (1 Hour) 40 (1 Year)	
						CO (µg/m ³) 8 Hour	2000	4000	160

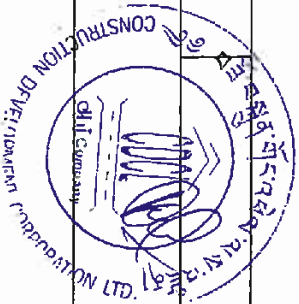
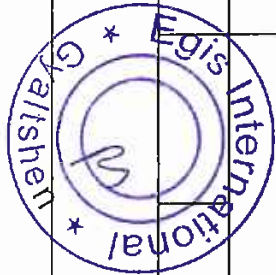



Table 8: Surface and Ground Water Quality Sampling Location with Environmental Standard

S. No.	Environmental Component	Location			Parameter	Environmental Standard (2010)			IFC Guidelines
		Sampling Code	Location Coordinate (Lat. & Long.)	Description		A (Very Good)*	B (Good)*	C (Moderate)*	
1.	Surface Water Quality	SW01	26°53'5.49" N 89°20'1.84" E	Nr. Doyagang (Nr. Bridge)	pH	6.5-8.5	6-9	6-9	6-9
					Colour (Hz)	5	50	-	-
					TSS (mg/l)	25	100	-	50
					Conductivity (µS/cm)	800	1000	2000	-
		SW02	26°52'31.89" N 89°20'25.57" E	Nr. Toorsatar (Nr. Kailashgiri West)	Odour	Unobjectionable	Unobjectionable	-	-
					Mineral Oil	No Film	No Film	-	-
					Nitrate (mg/l)	10	50	-	-
					Fluoride (mg/l)	1.0	2.0	-	-
		SW03	26°53'8.52" N 89°22'9.86" E	Nr. Chamkuna Village	Sulphates (mg/l)	25	100	-	-
					Chloride (mg/l)	50	200	-	-
					Surfactants (mg/l)	0.1	0.2	-	-
		SW04	26°52'42" N 89°22'22" E	Nr. Omchhu	Phosphate (mg/l)	0.5	<1.0	-	2.0
					DO (mg/l)	6	4	-	-
					BOD (mg/l)	2	5	50	30
		SW05	26°52'1.16" N 89°22'25.49" E	Nr. Mobile Tower	COD (mg/l)	-	-	-	125
Oil & Grease (mg/l)	-				-	-	10		




S. No.	Environmental Component	Location			Parameter	Environmental Standard (2010)			IFC Guidelines
		Sampling Code	Location Coordinate (Lat. & Long.)	Description		A (Very Good)*	B (Good)*	C (Moderate)*	
					TKN (mg/l)	0.5	2	-	10
					Ammonia (mg/l)	0.05	0.5	-	-
					T. Coliform (MPN/100ml)	50	5000	10000	400
		SW06	26°51'28" N 89°22'03" E	Nr. India Bhutan Border	Faecal Coliform (MPN/100ml)	20	2000	5000	-
					Dissolved Iron (mg/l)	0.2	0.5	-	-
					Copper (mg/l)	0.05	0.1	-	-
		SW07	26°53'0.01" N 89°19'5.99" E	Nr. Purvey Village	Zinc (mg/l)	0.2	0.5	-	-
					Arsenic (mg/l)	0.01	0.05	-	-
		SW08	26°53'16.1" N 89°21'41.2" E	Nr. Chamkuna Village	Cadmium (mg/l)	0.003	0.003	-	-
					Total Chromium (mg/l)	0.05	0.05	-	-
					Lead (mg/l)	0.02	0.02	-	-
					Selenium (mg/l)	0.01	0.01	-	-
		SW09	26°51'37.83" N 89°22'12.73" E	Nr. Existing STP area	Mercury (mg/l)	0.0005	0.0005	-	-
					Phenols (mg/l)	0.001	0.001	-	-
		SW10	26°51'54.96"	Phuentsholing	Cyanides	0.05	0.05	-	-





S. No.	Environmental Component	Location			Parameter	Environmental Standard (2010)			IFC Guidelines
		Sampling Code	Location Coordinate (Lat. & Long.)	Description		A (Very Good)*	B (Good)*	C (Moderate)*	
			89°22'44.06"	Omchhu	(mg/l)				
					PAH (mg/l)	0.0002	0.0002	0.001	-
					Total Pesticides (mg/l)	0.0005	0.0005	0.001	-
2.	Ground Water Quality	GW01	26°52'38.78" 89°22'32.26"	Camp Area	PCB (mg/l)	0.0002	0.0002	-	-
					SAR	-	-	26	-
					Boron (mg/l)	-	-	1	-
		GW02	26°52'38.09" 89°22'33.34"	Office Area	Floating Material	Absent	Absent	-	-

NOTE:

A: (Very Good)

Drinking water source without conventional treatment but after disinfection whenever necessary

B: (Good)

Drinking water source with conventional system

C: (Moderate)

Uses for irrigation, industrial cooling etc.



Table 9: Ambient Noise Quality Sampling Location with Environmental Standard

S. No.	Environmental Component	Location			Environmental Standard (2010)		IFC	
		Sampling Code	Location Coordinate (Lat. & Long.)	Description	Day*	Night*	Day*	Night*
1.	Ambient Noise Level	NL01	26°51'49.34" N 89°22'23.10" E	Nr. STP Area	65 dB(A)	55 dB(A)	55 dB(A)	45 dB(A)
		NL02	26°51'50.83" N 89°22'45.82" E	Nr. Old Truck Parking				
		NL03	26°52'15.72" N 89°22'44.43" E	Nr. Bhutan Concrete Shop				
		NL04	26°52'21.22" N 89°22'23.88" E	Nr. Bangay Bazar				
		NL05	26°53'20.19" N 89°21'51.51" E	Chamkuna Village				
		NL06	26°52'51.31" N 89°20'04.71" E	Toorsatar Village				

***NOTE:**

Day time is from 0600 hours to 2200 hours (Human Activities)

Night time is from 2200 hours to 0600 hours (No Human Activities)




Table 10: Aquatic Sampling Location and Parameters

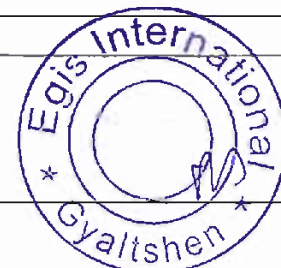
S. No.	Environment Component	Sampling Code	Location Coordinates	Parameters	Methodology
1.	Aquatic Study	AQ 01	26°51'32.70"N 89°22'07.48"E	<ul style="list-style-type: none"> Fishes and other aquatic species Zooplankton Phytoplankton Benthos 	<ul style="list-style-type: none"> CPUE Method/ other suitable method Water sampling Local Fish Market Survey
		AQ 02	26°52'09.91"N 89°22'32.90"E		
		AQ 03	26°53'06.86"N 89°22'14.16"E		
		AQ 04	26°52'53.47"N 89°21'04.93"E		
		AQ 05	26°52'37.42"N 89°19'46.99"E		
		Reference	26°52'59.15"N 89°19'57.51"E		

Table 11: Methodology for testing different environmental component

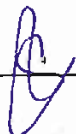
S. No.	Environmental Component	Parameters	Methodology
1.	Meteorology	Wind Speed	IS 8829-1978
		Wind Direction	
		Temperature	
		Relative Humidity	
		Rainfall	
2.	Ambient Water Quality	pH	APHA: 4500 - H+ B(22nd Edition), pH Meter
		Colour	APHA: 2120 B (22nd Edition), Visual Comparison
		Electrical Conductivity	APHA: 2510 B (22nd Edition), Conductivity meter
		TDS	APHA: 2540 C (22nd Edition), Gravimetric
		Turbidity	APHA: 2130 B (22nd Edition), Nephelometric
		Ammoniacal Nitrogen	IS:3025(part-34), 1988, Distillation & colorimetric
		Ca Hardness	APHA: 3500 - Ca B (22nd Edition) Titrimetric, (EDTA method)
		Mg Hardness	APHA: 3500 - Mg B (22nd Edition), By difference
		Calcium	APHA: 3500 - Ca B (22nd Edition) Titrimetric, (EDTA method)
		Magnesium	APHA: 3500 - Mg B (22nd Edition), By difference
		Sodium	APHA:3500 - Na B (22nd Edition), Flame emission Photometric
		Potassium	APHA: 3500- K B (22nd Edition) Flame emission Photometric
		Salinity	APHA: 2520 B (22nd Edition), Electrical Conductivity method




S. No.	Environmental Component	Parameters	Methodology
		COD	APHA: 5220 B(22nd Edition), Titrimetric Open reflux method
		BOD	IS: 3025(part-44), Iodometric
		Chlorides	APHA:4500 – Cl- B (22nd Edition), Titrimetric
		Phenol	APHA: 5530- D(22nd Edition), colorimetric
		Sulphate	APHA:4500- SO4 E (22nd Edition), Turbid metric
		Nitrate	IS:3025 (part-34), 1988 (RA 2003) (ii), Colorimetric
		Fluoride	APHA:4500 F- D(22nd Edition),Colorimetric
		Total Nitrogen	APHA: 4500 N Org, Micro Kjeldahl Distillation (22 nd Edition), Titrimetric
		Total Phosphorous	APHA: 4500 P-C (22nd Edition), colorimetric
		DO	APHA: 4500 O-C (22nd Edition), Iodometric
		SAR	Flamephotometric& EDTA method
		TSS	APHA: 2540 - D (22nd Edition), gravimetric
		Surfactants	APHA: 5540 - C (22nd Edition) titration
		Cyanide	APHA: 4500 CN- D &E(22nd Edition), colorimetric
		Heavy Metals	
		Arsenic (As)	APHA: 3500-As-B (22nd Edition)
		Cadmium (Cd)	APHA: 3111-B (22nd Edition)
		Chromium (Cr)	APHA: 3500-Cr-B (22nd Edition), colorimetric
		Copper (Cu)	APHA: 3111-B & 3500-Cu-B (22nd Edition)
		Iron (Fe)	APHA: 3111-B & 3500-Fe-B (22nd Edition)
		Lead (Pb)	APHA: 3111-B (22nd Edition)
		Mercury (Hg)	APHA: 3111-B (22nd Edition)
		Zinc (Zn)	APHA: 3111-B (22nd Edition)
		Boron (B)	APHA: 4500 B-C (22nd Edition), colorimetric
		Total Coliform	APHA: 9221-B (22nd Edition), Multiple Tube Fermentation
		Fecal Coliform	APHA: 9221-E (22nd Edition), Multiple Tube Fermentation
3.	Ambient Air Quality	PM 10	Gravimetric (HVS) – IS: 5182: Part 4, with cyclone
		PM 2.5	Gravimetric (HVS) – IS: 5182: Part 4,
		SO ₂	IS: 5182(part-2): 2001, Colorimetric
		NO _x	IS: 5182(part-6): 2006, Colorimetric
		CO	PID Sensor
4.	Ambient Noise Quality	Decibels- dB(A)	IS: 9989



S. No.	Environmental Component	Parameters	Methodology
5.	Soil Analysis	Porosity	IS: 2720 Part 7
		Water holding capacity	HMSO, UK
		Permeability	IS: 2720 Part 17
		Moisture content	IS: 2720 Part 2
		Texture	IS: 2720 Part 4
		Particle size distribution	IS: 2720 Part 4
		Cation Exchange Capacity	IS: 2720 Part 24 (1976)
		SAR	Calculation
		pH	APHA: 4500 - H+ B(22nd Edition)
		Electrical conductivity	IS 14767-2000
		Calcium (Ca)	APHA: 3500 Ca B
		Magnesium (Mg)	APHA: 3500 Mg B
		Sodium (Na)	APHA: 3500 Na B
		Potassium (K)	APHA: 3500 K B
		Dry bulk density	IS: 2720-29 (1975)
		Organic Carbon (OC)	IS: 2720-22 (1972)
		Total nitrogen	IS: 2720-22 (1972)
Available Phosphorus	Olsen et. Al. (1954)		
Available Potassium	Jackson (1973)		




CHAPTER-5: Environmental Impact and Mitigation Measures for Zone A

50. This chapter will discuss the details of impacts associated with the different activities during pre-construction and construction phase and gives guidance on mitigation measures or standard operating procedure to be required.

5.1 Site access and traffic management related impacts

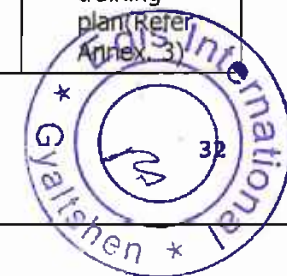
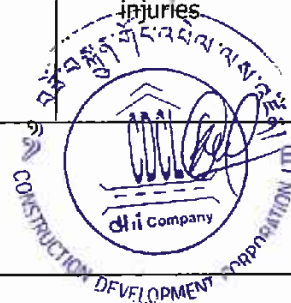
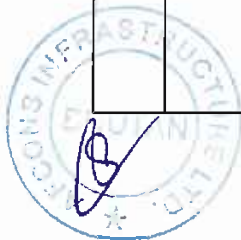
51. The impact and mitigation measures to be taken during Site access and traffic management as shown in table 12

Table 12: Impact Identification Matrix during Site access and traffic management

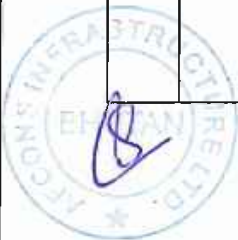
S. No.	Activities	Identification of Impact			Mitigation Measures	Related Documents
		Environment Component Impacted	Activity and Aspect	Impacts		
1.1	Preparing roads for access to site and management of traffic	Air	Movement of heavy vehicles for preparing site access roads for further work	<ul style="list-style-type: none"> ➤ Dust from vehicles preparing access roads 	<ul style="list-style-type: none"> ➤ Ensure that road construction up to the construction site are sprinkled. ➤ Vehicles to be well maintained so as to not release objectionable fumes; ➤ Preparation and implementation of a Traffic and Safety Management Plan so as to ensure smooth traffic flow of project related vehicles as well as other vehicles. 	<ul style="list-style-type: none"> ➤ Traffic and Safety Management Plan(Refer Annex. 8) ➤ The procedure for Controlling Air pollution (Refer Annex 2)
1.2		Water Quality	Water runoff to the river during road preparation activities	<ul style="list-style-type: none"> ➤ Muddy water generated due to road preparation activities 	<ul style="list-style-type: none"> ➤ Provision of barriers drains to arrest such water runoff 	<ul style="list-style-type: none"> ➤ The procedure for




S. No.	Activities	Identification of Impact			Mitigation Measures	Related Documents
		Environment Component Impacted	Activity and Aspect	Impacts		
				<ul style="list-style-type: none"> ➤ equipment cleaning etc. may runoff and pollute the river 		Controlling Water pollution (Refer Annex 3)
1.3		Noise	Equipment operation	<ul style="list-style-type: none"> ➤ Noise during construction. 	<ul style="list-style-type: none"> ➤ to maintain vehicles as per their maintenance schedule; ➤ limit access road construction working hours to daytime only 	<ul style="list-style-type: none"> ➤ The procedure for Controlling Noise pollution (Refer Annex 3)
1.4		Ecology	Water runoff to river	<ul style="list-style-type: none"> ➤ Muddy water generated due to road preparation activities ➤ equipment cleaning etc. may runoff and pollute the river 	<ul style="list-style-type: none"> ➤ Provision of catch Pits/sedimentation tanks ➤ Provision of barriers drains to arrest such water runoff; 	
1.5		Risk Hazards	Construction hazards	<ul style="list-style-type: none"> ➤ Construction hazards leading to injuries 	<ul style="list-style-type: none"> ➤ pre-project job safety analysis to be done ➤ worker safety training prior to commencement of work ➤ Use of Personal Protective Equipment (PPE) as required. 	<ul style="list-style-type: none"> ➤ Worker safety training plan (Refer Annex 3)



S. No.	Activities	Identification of Impact			Mitigation Measures	Related Documents
		Environment Component Impacted	Activity and Aspect	Impacts		
1.6				<ul style="list-style-type: none"> ➤ Construction hazards leading to permanent injury or fatality. 	<ul style="list-style-type: none"> ➤ Preparation and implementation of Occupational Safety and Health Management Plan (OHSMP) ➤ Preparation and implementation of a Traffic and Safety Management Plan so as to ensure smooth traffic flow of project related vehicles as well as other vehicles. 	<ul style="list-style-type: none"> ➤ Occupational Safety and Health Management Plan(Refer Annex. 6) ➤ Traffic and Safety Management Plan(Refer Annex. 8)
1.7		Floods/ back waters	Flooding from the hillside outfalls during monsoon or backwaters	<ul style="list-style-type: none"> ➤ The foods from the outfalls from the hillsides would damage access roads and other construction activities at the site 	<ul style="list-style-type: none"> ➤ Proper planning and development of the outfalls and their connection to the Amochhu or as side channel 	<ul style="list-style-type: none"> ➤ Traffic and Safety Management Plan(Refer Annex. 8)

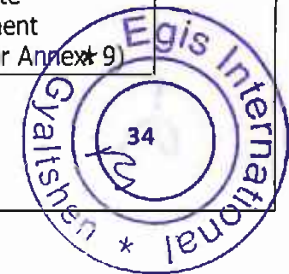
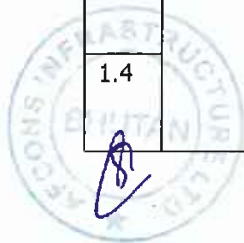


5.2 Batching mix plant assembly, equipment delivery and related impacts

52. The impact and mitigation measures to be taken during Batching mix plant assembly, equipment delivery is shown in **table 13**.

Table 13: Impact Identification Matrix during Batching mix plant assembly, equipment delivery

S. No.	Activities	Identification of Impact			Mitigation Measures	Related Documents
		Environment Component Impacted	Activity and Aspect	Impacts		
1.1	Assembly of batch mix plant, and delivery of machineries, vehicles and other equipment	Air	Movement of heavy vehicles for getting equipment to site	<ul style="list-style-type: none"> ➤ dust / gas generation 	<ul style="list-style-type: none"> ➤ Ensure that roads up to the construction site are sprinkled. ➤ Vehicles to be well maintained so as to not release objectionable fumes. 	<ul style="list-style-type: none"> ➤ Traffic and Safety Management plan(Refer Annex. 8)& Camp Management Plan (Annex.4)
1.2			Batch mix plant assembly (silo, conveyor system, panel room ancillaries)	<ul style="list-style-type: none"> ➤ dust / gas generation 	<ul style="list-style-type: none"> ➤ Ensure that the equipment is erected on a concrete paved apron so that impact dust generation is minimized. 	<ul style="list-style-type: none"> ➤ The procedure for Controlling Air pollution (Refer Annex 3)
1.3		Noise	Movement of heavy vehicles for transporting equipment and establishing batch mix plant in the site	<ul style="list-style-type: none"> ➤ Noise during set up. 	<ul style="list-style-type: none"> ➤ Preparation and implementation of a Traffic management plan so as to lessen noise generation. 	<ul style="list-style-type: none"> ➤ Traffic and Safety Management plan(Refer Annex. 8 and 6) ➤ The procedure for Controlling Noise pollution (Refer Annex 3)
1.4		Soil	Construction activities	<ul style="list-style-type: none"> ➤ Waste generation and accumulation 	<ul style="list-style-type: none"> ➤ Develop and Implement Construction & Demolition (C&D) Waste Management 	<ul style="list-style-type: none"> ➤ C&D Waste Management Plan(Refer Annex 9)



S. No.	Activities	Identification of Impact			Mitigation Measures	Related Documents
		Environment Component Impacted	Activity and Aspect	Impacts		
					Plan	
1.5		Ecology	water release to river and nearby areas	<ul style="list-style-type: none"> ➤ Muddy water generated due to road preparation activities, ➤ equipment cleaning etc. may runoff and pollute the river 	<ul style="list-style-type: none"> ➤ Provision of catch Pits/sedimentation tanks ➤ Provision of barriers drains to arrest such water runoff; 	
1.6		Risk Hazards	Construction hazards	<ul style="list-style-type: none"> ➤ Construction hazards leading to injuries. 	<ul style="list-style-type: none"> ➤ pre-project job safety analysis to be done; ➤ worker safety training prior to commencement of work; ➤ Use of PPE as required. 	<ul style="list-style-type: none"> ➤ Worker safety training plan(Refer Annex. 6)
1.7				<ul style="list-style-type: none"> ➤ Construction hazards leading to permanent injury or fatality. 	<ul style="list-style-type: none"> ➤ Preparation and implementation of OHSMP ➤ Location of the equipment should be at an elevation higher than the High Flood Level (HFL). 	<ul style="list-style-type: none"> ➤ Occupational Safety and Health Management Plan(Refer Annex. 6) ➤ Mark/reference of High Flood Level (HFL)

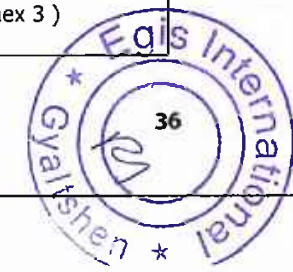
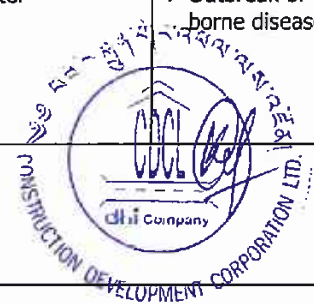


5.3 Material storage, work areas and housing for workers related impacts

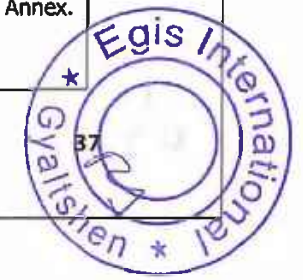
53. The impact and mitigation measures to be taken during Material storage, work areas and housing for workers as shown in **table 14.**

Table 14: Impact Identification Matrix during Material storage, work areas and housing for workers

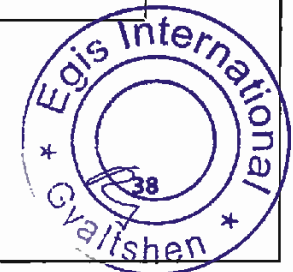
S. No.	Activities	Identification of Impact			Mitigation Measures	Related Documents
		Environment Component Impacted	Activity and Aspect	Impact		
1.1	Establishment of workers camp, material storage, work areas and parking areas	Air	Construction equipment use, including DG sets	➤ Nominal dust / noise generation for short duration with on-site impacts.	➤ Site barricading prior to commencement of construction work. ➤ Proper maintenance of equipment, including DGS set/s.	➤ The procedure for Controlling Air pollution (Refer Annex 3)
1.2			Construction vehicles use	➤ dust / gas generation	➤ 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	
1.3			Cooking by workers or in canteen	➤ gas generation	➤ Liquid fuels or electricity to be provided to workers by contractor ➤ No fuel wood burning.	
1.4		Water Quality	Use of toilets Stagnation of water	➤ sewage discharge to river ➤ Outbreak of vector borne diseases	➤ Construct toilets for workers @ one toilet / 20 workers. ➤ Establish septic tank with soak pit prior to commencement of construction and connect each toilet to the septic	➤ Worker's camp design(Refer Annex. 4) ➤ The procedure for Controlling Water pollution (Refer Annex 3)



					<p>system.</p> <ul style="list-style-type: none"> ➤ Proper pest control, use of nets and regular monitoring 	
1.5		Noise	Construction work	<ul style="list-style-type: none"> ➤ Nominal noise generation for short duration with largely on-site impacts. 	<ul style="list-style-type: none"> ➤ Site barricading prior to commencement of construction work. 	<ul style="list-style-type: none"> ➤ The procedure for Controlling Noise pollution (Refer Annex 3)
1.6			Construction vehicles use	<ul style="list-style-type: none"> ➤ Noise from construction related vehicles moving in the area. 	<ul style="list-style-type: none"> ➤ Implementation of non-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. ➤ Ensure proper maintenance and operation of DG set/s 	<ul style="list-style-type: none"> ➤ Traffic management plan(Refer Annex. 8)
1.8		Soil	Construction activities	<ul style="list-style-type: none"> ➤ Waste generation and accumulation 	<ul style="list-style-type: none"> ➤ Follow C&D Waste Management Plan 	<ul style="list-style-type: none"> ➤ C&D Waste Management Plan(Refer Annex. 9)
		Risk / Hazard	Construction hazards	<ul style="list-style-type: none"> ➤ Construction hazards leading to permanent injury or fatality. 	<ul style="list-style-type: none"> ➤ Follow 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 River. 	<ul style="list-style-type: none"> ➤ Occupational Safety and Health Management Plan ➤ Mark/reference of HFL(Refer Annex. 5) ➤ Emergency Response Plan(Refer Annex. 5)



2.1	Establishment of stores, warehouse and parking areas	Water Regime	Water consumption: ground water drawl (tube well)	<ul style="list-style-type: none"> ➤ Water drawn is an insignificant fraction of the water available. 	<ul style="list-style-type: none"> ➤ Extract as per the EC issued on the EIA report. 	<ul style="list-style-type: none"> ➤ The procedure for Controlling Water pollution (Refer Annex 3)
2.2		Risk Hazard	Construction hazards	<ul style="list-style-type: none"> ➤ Construction hazards leading to injuries. 	<ul style="list-style-type: none"> ➤ Pre-project job safety analysis to be done ➤ Worker safety training prior to commencement of work; use of personal protective equipment (PPE) as required. 	
2.3				<ul style="list-style-type: none"> ➤ Construction hazards leading to permanent injury or fatality. 	<ul style="list-style-type: none"> ➤ Preparation and implementation of OHSMP ➤ Location of the equipment should be at an elevation higher than the HFL 	<ul style="list-style-type: none"> ➤ Occupational Safety and Health Management Plan ➤ Mark/reference of HFL (Refer Annex. 5)
2.4	Installation/establishment of Flood warning system	Flooding risk hazard	Flood risk hazard	<ul style="list-style-type: none"> ➤ Risk to machineries, workers and the project as a whole 	<ul style="list-style-type: none"> ➤ Construction of temporary gabion wall near the camp area and project start point. ➤ Designation of assembly points. ➤ Formulation of evacuation plan and Emergency response team. ➤ Identification of Flood monitoring stations at two locations extending beyond the project area. 	<ul style="list-style-type: none"> ➤ Emergency Response Plan (Refer Annex. 5)



5.4 Impacts from Riverbed levelling activities

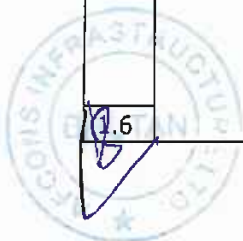
54. The impact and mitigation measures to be taken during River bed leveling is shown in table 15.

Table 15: Impact Identification Matrix during River bed leveling

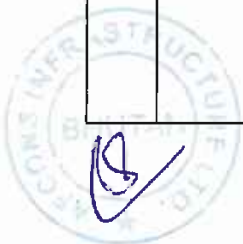
S. No.	Activities	Identification of Impact			Mitigation Measures	Related Documents
		Environmental Component Impacted	Activity and Aspect	Impacts		
1.1	Riverbed levelling (Riverbed levelling is required for making the river gradient uniform for hydraulic reasons. This will be done through earth moving equipment in dry riverbed)	Air	Equipment operation	➤ Dust generation will persist during the duration of the Riverbed levelling.	➤ Ensure that the earth is being levelled in moist conditions so that the dust is minimized or immediately settled.	➤ The procedure for Controlling Air pollution (Refer Annex 3)
1.2		Water Quality	Excavated material mixing with water	➤ The activity of riverbed levelling can increase turbidity and suspended particles in the water	➤ Partial diversion of the river portion being levelled to ensure that levelling is only done in moist areas ➤ Levelling in areas where there are 'humps' on the riverbed only, and no other places ➤ Disposal of excess excavated materials to fill locations	➤ The procedure for Controlling Water pollution (Refer Annex 3)
1.3		Noise	Riverbed levelling equipment operations	➤ Noise from riverbed levelling operations will increase ambient noise levels marginally.	➤ Enclose noisy equipment behind acoustic enclosures ➤ Use self-cleaning weigh hoppers ➤ Enclose compressors and pumps ➤ Fit silencing devices on all pressure operated equipment ➤ Muffling devices on engines ➤ Barricading all around the site.	➤ The procedure for Controlling Noise pollution (Refer Annex 3)



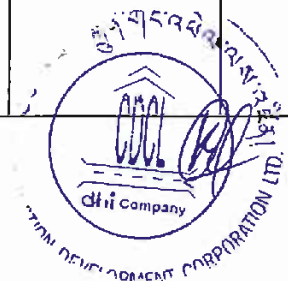
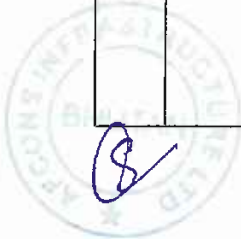

S. No.	Activities	Identification of Impact			Mitigation Measures	Related Documents
		Environmental Component Impacted	Activity and Aspect	Impacts		
1.4		Soil	Riverbed levelling equipment operations	<ul style="list-style-type: none"> ➤ Muck generation and dry deposition of dust on soil 	<ul style="list-style-type: none"> ➤ 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. 	
1.5		Ecology	Changes in river bottom profile leading to disturbances to benthic organisms and fishes.	<ul style="list-style-type: none"> ➤ Riverbed levelling and related increase in turbidity can lead to reduced fish availability in turbid waters such as Chepti (<i>Cyprinion semplotum</i>) VU, Katli (<i>Neolissochilus hexagonolepis</i>) NT and Golden Mahseer (<i>Tor putitora</i>) EN 	<ul style="list-style-type: none"> ➤ Partial diversion of the river portion being levelled to ensure that levelling is only done in moist areas. ➤ Ensure that the river bed is not completely dry at any one particular cross section through proper planning. ➤ Levelling in those areas where there are 'humps' on the riverbed only, and no other places ➤ Disposal of excess excavated materials to fill locations ➤ Prepare and implement a fish conservation monitoring plan for important species. ➤ Supply and installation of geo-textile membranes to prevent debris from falling into the river. 	<ul style="list-style-type: none"> ➤ Baseline information of river species as per the EIA report
1.6		Risk Hazards	Construction	Construction	<ul style="list-style-type: none"> ➤ pre-project job safety analysis 	<ul style="list-style-type: none"> ➤ Occupational



S. No.	Activities	Identification of Impact			Mitigation Measures	Related Documents
		Environmental Component Impacted	Activity and Aspect	Impacts		
			hazards	hazards leading to injuries.	to be done <ul style="list-style-type: none"> ➤ worker safety training prior to commencement of work ➤ Use of personal protective equipment (PPE) as required. 	Safety and Health Management Plan(Refer Annex. 6)
				<ul style="list-style-type: none"> ➤ Construction hazards leading to permanent injury or fatality. 	<ul style="list-style-type: none"> ➤ Preparation and implementation of OHSMP 	<ul style="list-style-type: none"> ➤ Occupational Safety and Health Management Plan(Refer Annex. 6)
2.0	Channelization and Earthworks	Air	Equipment / vehicle operation	<ul style="list-style-type: none"> ➤ Dust generation will persist during the duration of the channelization. 	<ul style="list-style-type: none"> ➤ Ensure trucks used for transportation of materials are covered with HDPE sheets; ➤ trucks should be well maintained (as per manufacturer's instructions) with emissions complying with National Environmental Standards 2010 ➤ Tyres should be cleaned before entering public roads through suitable washing / scraping equipment. 	<ul style="list-style-type: none"> ➤ National Environmental Standards 2010
2.1		Water Quality	Equipment / vehicle operation	<ul style="list-style-type: none"> ➤ Construction material or muck generated can enter River. 	<ul style="list-style-type: none"> ➤ Ensure adequate bunding around the muck storage area, preferably with garland drains and gabion structures to prevent muck from entering 	<ul style="list-style-type: none"> ➤ The procedure for Controlling Water pollution (Refer Annex 3)



S. No.	Activities	Identification of Impact			Mitigation Measures	Related Documents
		Environmental Component Impacted	Activity and Aspect	Impacts		
					the River. ➤ Supply and installation of geotextile membranes to prevent debris from falling into the river.	
2.2		Noise	Construction equipment and vehicles use	➤ Noise generation from works.	➤ Barricading portions of the construction site using materials which help muffle the noise where ever river levelling works are underway. ➤ Muffling devices on engines	➤ The procedure for Controlling Noise pollution (Refer Annex 3)
2.3		Soil	Construction works	➤ Muck will be generated and will be disposed in the low-lying areas	➤ Provisions for silt mesh installation shall be considered as per the site conditions	
2.4		Risk / Hazards	Construction hazards	➤ Construction hazards leading to injuries.	➤ pre-project job safety analysis to be done; ➤ worker safety training prior to commencement of work ➤ Use of personal protective equipment (PPE) as required.	➤ Occupational Safety and Health Management Plan(Refer Annex. 6)
2.5				➤ Construction hazards leading to permanent injury or fatality.	➤ Preparation and implementation of OHSMP	➤ Occupational Safety and Health Management Plan(Refer Annex. 6)

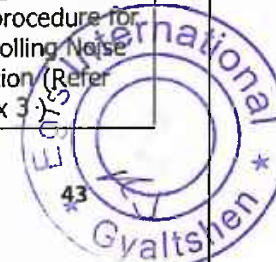
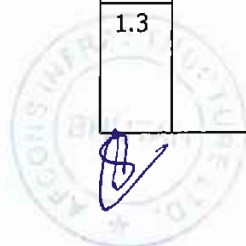


5.5 Embankment works Impacts

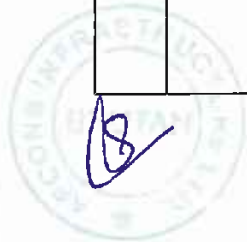
55. The impact and mitigation measures to be taken during Embankment work is shown in **table 16**.

Table 16: Impact Identification Matrix during Embankment work

S. No.	Activities	Identification of Impact			Mitigation Measures	Related Documents
		Environmental Component Impacted	Activity and Aspect	Impacts		
1.1	i. Construction of Diaphragm Wall ii. Construction of Dead Man Anchor and dead man anchor iii. Embankment construction including stone in wire crates	Air	Vehicular movement, excavation, earth works, concrete pouring Crushing and Batching plants with emissions	<ul style="list-style-type: none"> ➤ Dust from works. ➤ Emissions from crushers and batching plants 	<ul style="list-style-type: none"> ➤ Provide Dust barriers to minimise dust travel ➤ Provide air pollution control equipment such as venturi cyclones/ bag filters as required. ➤ Water sprinkling as needed at the sites 	<ul style="list-style-type: none"> ➤ The procedure for Controlling Air pollution(Refer Annex 3)
1.2		Water Quality	Constructions Works: mixing of construction debris or muck in water	<ul style="list-style-type: none"> ➤ Construction material or muck generated can enter river. 	<ul style="list-style-type: none"> ➤ Provide Barriers to prevent entry of muck into the river ➤ Supply and installation of geotextile membranes to prevent debris from falling into the river. ➤ Deposit muck by backfilling in low lying areas 	<ul style="list-style-type: none"> ➤ The procedure for Controlling Water pollution (Refer Annex 3)
1.3		Noise	Noise from construction works	<ul style="list-style-type: none"> ➤ Noise generation from works and machines 	<ul style="list-style-type: none"> ➤ Enclose noisy equipment behind acoustic enclosures ➤ fit silencing devices on all operated equipment 	<ul style="list-style-type: none"> ➤ The procedure for Controlling Noise pollution (Refer Annex 3)



S. No.	Activities	Identification of Impact			Mitigation Measures	Related Documents
		Environmental Component Impacted	Activity and Aspect	Impacts		
					<ul style="list-style-type: none"> ➤ muffling devices on engines ➤ barricading all around the site 	
1.4		Soil	Works: muck generation and dry deposition of dust on soil; loss of topsoil Generation of Bentonite waste and contamination	<ul style="list-style-type: none"> ➤ Muck will be generated and could be disposed in the low-lying areas within the project and may enter river. ➤ Leakage of Bentonite and its ultimate disposal 	<ul style="list-style-type: none"> ➤ Provide Barriers to prevent entry of muck into the river ➤ Deposit muck by backfilling in low lying areas ➤ Proper sealing, and disposal. 	
1.8		Risk Hazard	Construction hazards	<ul style="list-style-type: none"> ➤ Construction hazards leading to injuries. 	<ul style="list-style-type: none"> ➤ pre-project job safety analysis to be done ➤ worker safety training prior to commencement of work ➤ Use of PPE as required. 	<ul style="list-style-type: none"> ➤ Worker safety training
1.9				<ul style="list-style-type: none"> ➤ Construction hazards leading to permanent injury or fatality. 	<ul style="list-style-type: none"> ➤ Preparation and implementation of OHSMP 	<ul style="list-style-type: none"> ➤ Occupational Safety and Health Management Plan (Refer Annex. 6)



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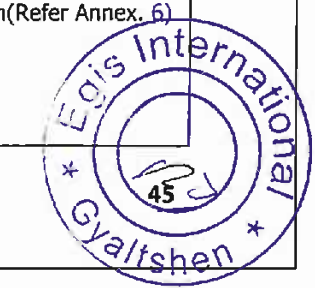


5.6 Identification and addressing reclamation works

56. The impact and mitigation measures to be taken during Reclamation work is shown in **table 17**.

Table 17: Impact Identification Matrix during Reclamation work

S. No.	Activities	Identification of Impact			Mitigation Measures	Related Documents
		Environmental Component Impacted	Activity and Aspect	Impact		
1.1	Reclamation Work – Cut, Fill and Compaction	Air Quality	Substantial cut and fill work for two years	<ul style="list-style-type: none"> ➤ Dust suspension from site clearance and machinery operations 	<ul style="list-style-type: none"> ➤ 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 	<ul style="list-style-type: none"> ➤ Emission test certificate (Refer Annex. 8)
1.2		Water Quality		<ul style="list-style-type: none"> ➤ Dry deposition into the River. Runoff from reclamation areas 	<ul style="list-style-type: none"> ➤ Provision of runoff capture drains and conveying runoff downstream of the portion where the work is being carried out ➤ Supply and installation of geo-textile membranes to prevent debris from falling into the river. 	<ul style="list-style-type: none"> ➤ Environment Monitoring Plan
1.3		Noise		<ul style="list-style-type: none"> ➤ Noise generation from works 	<ul style="list-style-type: none"> ➤ Installation of Noise level barriers ➤ Use of low noise generating equipment ➤ provision of ear plugs to workers 	<ul style="list-style-type: none"> ➤ The procedure for Controlling Noise pollution (Refer Annex 3)
1.4		Risk Hazard		Construction hazards	<ul style="list-style-type: none"> ➤ Accidents and Hazards due to works 	<ul style="list-style-type: none"> ➤ pre-project job safety analysis to be done ➤ worker safety training prior to commencement of work ➤ use of personal protective equipment as required ➤ Follow the Occupational Safety and Health Management Plan



S. No.	Activities	Identification of Impact			Mitigation Measures	Related Documents
		Environmental Component Impacted	Activity and Aspect	Impact		
2.1	Transport of borrow materials from local quarries	Air	Transport of borrow materials Excavation of materials at the local quarries	<ul style="list-style-type: none"> ➤ Transmission of dust to atmosphere en-route to site ➤ Mining of materials at the local quarries 	<ul style="list-style-type: none"> ➤ Transport will be carried out 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 preventive maintenance requirements of manufacturers ➤ Measures should be put in place to conduct the operation of mines as per RGOB regulations and minimum noise, air pollution and soil pollution. 	<ul style="list-style-type: none"> ➤ National Environmental Standards, 2010 ➤ Traffic Management Plan (refer Annex.8)
2.2		Water Quality / Resources	Loading / Unloading of materials	<ul style="list-style-type: none"> ➤ Possibility of materials entering the river during landfilling 	<ul style="list-style-type: none"> ➤ Provision of runoff capture drains 	<ul style="list-style-type: none"> ➤ The procedure for Controlling Water pollution (Refer Annex 3)
2.3		Noise	Daily truck trips from one or more sources	<ul style="list-style-type: none"> ➤ Vehicle and machine operation noise due to loading and unloading of materials 	<ul style="list-style-type: none"> ➤ Enclose noisy equipment behind acoustic enclosures ➤ fit silencing devices on all operated equipment ➤ muffling devices on engines ➤ barricading all around the site 	<ul style="list-style-type: none"> ➤ The procedure for Controlling Noise pollution (Refer Annex 3)
2.5		Ecology	Material transport	<ul style="list-style-type: none"> ➤ increase in turbidity due to dry deposition of light materials being transported 	<ul style="list-style-type: none"> ➤ Continuous spraying of water at the cut and fill area to prevent large increases in baseline PM₁₀ and PM_{2.5} levels ➤ All dispatch of aggregate / fill materials should be watered at the time of commencement of the trip to reduce emissions. 	



S. No.	Activities	Identification of Impact			Mitigation Measures	Related Documents
		Environmental Component Impacted	Activity and Aspect	Impact		
2.6		Socio-Economics	Traffic Management in transportation of materials	<ul style="list-style-type: none"> ➤ Traffic issues 	<ul style="list-style-type: none"> ➤ A thorough Traffic and Safety 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 or early mornings. ➤ 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. 	<ul style="list-style-type: none"> ➤ Traffic and Safety Management Plan(Refer Annex. 8)
2.7		Risk Hazard	Transport: accidents leading to injuries / fatalities	<ul style="list-style-type: none"> ➤ The possibility that transport of materials will pose a risk to safety of surrounding communities. 	<ul style="list-style-type: none"> ➤ A very strict transport 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. 	<ul style="list-style-type: none"> ➤ Traffic and Safety Management Plan(Refer Annex. 8 & 6)

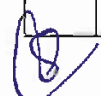



5.7 Solid Waste Management related impacts

The impact and mitigation measures to be taken during Solid Waste Management are shown in **table 18**.

Table 18: Impact Identification Matrix during Solid Waste Management

S. No.	Activities	Identification of Impact			Mitigation Measures	Remarks
		Environment Component Impacted	Activity and Aspect	Impacts		
1.1	Solid Waste Management – Generation of Solid Wastes, Construction wastes and scrap	Air	Odour	<ul style="list-style-type: none"> There would be odours by waste kept haphazardly in the open. 	<ul style="list-style-type: none"> Ensure closed dust bins / waste containers Implement provisions of Bhutan's Waste Prevention and Management Regulation 2012, as amended in 2016, 	<ul style="list-style-type: none"> 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)	<ul style="list-style-type: none"> Spillages may occur when waste comes in contact with water. 	<ul style="list-style-type: none"> Provision of drains with traps Provision of storm water drains in the facility Clean-up of spillages 	
1.3		Soil/Land	Contamination	<ul style="list-style-type: none"> Soil / Land may get contaminated if MSW comes in contact with it. 	<ul style="list-style-type: none"> Provision of impervious floors in the facility 	
1.4		Risk/Hazard	Disease vectors accessing the wastes; Exposure to diseases and creation of un-hygienic living conditions within labour camps, Exposure to sharp wastes having injury risks	<ul style="list-style-type: none"> There are chances of accidents occurring during waste handling operations. 	<ul style="list-style-type: none"> Ensure closed dust bins / waste containers Implement provisions of Bhutan's Waste Prevention and Management Regulation 2012, as amended in 2016 Preparation and implementation of OHSMP Work with the Thromde to ensure proper collection and disposal of Municipal Solid Waste 	<ul style="list-style-type: none"> Waste Prevention and Management Regulation 2012, as amended in 2016 OHSMP



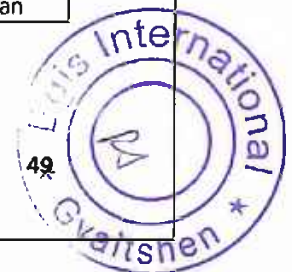

5.8 Decommissioning of the Construction Facilities/ Activities in the Project site

58. The impact and mitigation measures to be taken during Decommissioning are shown in **table 19**.

Table 19: Impact Identification Matrix during Decommissioning

S. No.	Activities	Identification of Impact			Mitigation Measures	Related Documents
		Environmental Component Impacted	Activity and Aspect	Impacts		
1.1	Includes removal of staff housing, equipment, labour camps and all temporary structures safely from the project site	Air	Demolishing or removal of temporary structures	Air pollution.	<ul style="list-style-type: none"> ➤ No change. 	
1.2		Water Quality / Resources	Disposal of debris or wastes	Debris from decommissioning activities can be dumped into the river if not properly supervised.	<ul style="list-style-type: none"> ➤ Ensure that the decommission procedure clean-up of spillage ➤ Securing of wastes and their sale / disposal to authorised dealers / landfill or suitable disposal site. 	<ul style="list-style-type: none"> ➤ C&D Waste Management Plan(Refer Annex. 9)
1.3		Noise	Noise levels	construction noise	<ul style="list-style-type: none"> ➤ Provision of Noise barriers & enclosures ➤ Provision of ear plugs 	
1.4		Soil	Spillage of waste	The materials likely to be spill will not be toxic or harmful but can cause deterioration of soil fertility.	<ul style="list-style-type: none"> ➤ Establish and supervise a waste collection and removal plan ➤ Comply with National Environmental Standards and International Good Practices. 	
1.5		Risk / Hazards	Construction hazards	Construction hazards leading to permanent injury or fatality.	<ul style="list-style-type: none"> ➤ Follow the Occupational Safety and Health Management Plan (OHSMP) Plan 	<ul style="list-style-type: none"> ➤ Occupational Safety and Health Management Plan

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5.9 Zone A Landscape Development Activities

59. The impact and mitigation measures to be taken during Landscape development activity is shown in **table 20**.

Table 20: Impact Identification Matrix during Landscape development

S. No	Activities	Identification of Impact			Mitigation Measures	Related Documents
		Environmental Component Impacted	Activity and Aspect	Impacts		
1.1	Includes collection of top soil and saplings from other places and their plantations in the project area	Soil	Top soil removed from other places	Soil degradation at the source	<ul style="list-style-type: none"> ➤ Establish and supervise a waste collection and removal plan ➤ Comply with National Environmental Standards and International Good Practices. 	➤ Refer Annex. 6
1.2		Ecology	Introduction of alien species and contamination	Introduction of alien species and contamination of the local biodiversity	<ul style="list-style-type: none"> ➤ Follow the Occupational Safety and Health Management Plan (OHSMP) Plan and good environmental practices 	➤ Occupational Health and Safety Management Plan(Refer Annex. 6)



CHAPTER-6: Grievance Redress Mechanism (GRM)

6.1 Objectives of GRM

60 The ADB's SPS states of the following:

"The borrower/client will establish a mechanism to receive and facilitate the resolution of affected persons' concerns and grievances about physical and economic displacement and other project impacts paying particular attention to the impacts on vulnerable groups. The grievance redress mechanism should be scaled to the risks and adverse impacts of the project. It should address affected persons' concerns and complaints promptly, using an understandable and transparent process that is gender responsive, culturally appropriate, and readily accessible to the affected persons at no costs and without retribution. The mechanism should not impede access to the country's judicial or administrative remedies. The borrower/client will inform affected persons about the mechanism."

61 Accordingly, the project is required to have a platform for the affected people to submit their grievances and resolve it, which is focused on Social and Environmental aspects. GRM provides a predictable, transparent and credible process to all parties, resulting in outcomes that is seen as fair, effective and lasting. Accordingly, GRM is appointed to take necessary steps in order to harmonize project activities as well as the wellbeing of the general public.

6.2 Standard Operating Procedure for GRM

62 The project's Grievance Redress Mechanism (GRM) will be institutionalized by the PMU to address grievances which may arise due to project implementation as indicated in Figure 5 below. A two tier mechanisms will be adopted by the project. The first tier will be in the field at the PIU led by PIU head and the second level/tier GRM will be led by the PMU head at a higher level.



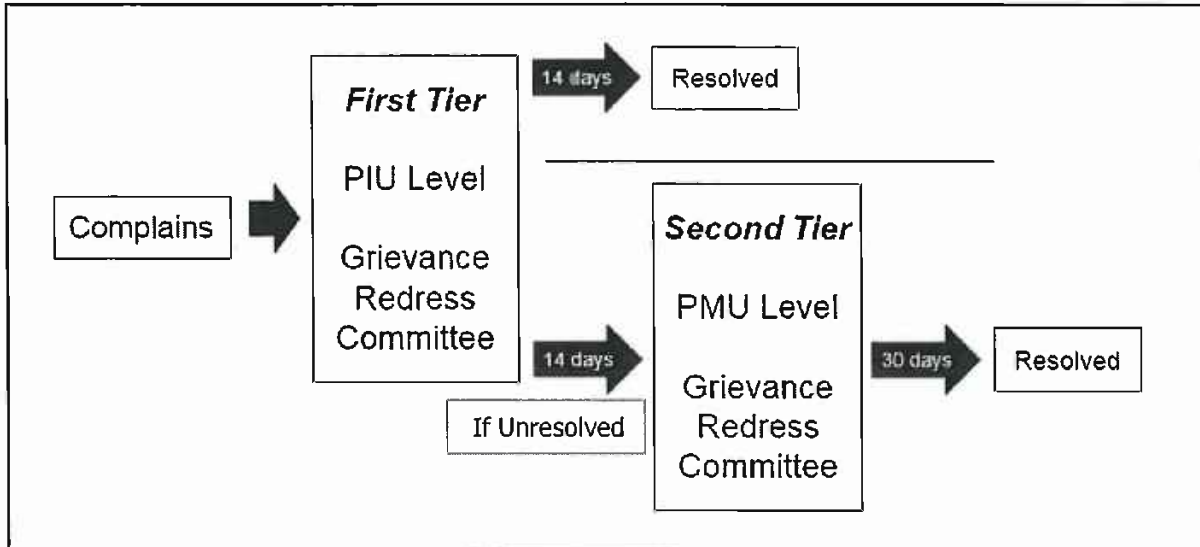


Figure 5: GRM structure for the Phuentsholing Township Development Project.

6.3 First Tier

6.3.1 Secretariat

63 The first level secretariat of GRM will be established in the PIU office, with PIC’s Safeguard and Communication Specialist acting as the secretary. The secretariat (comprising of members as listed in Table 21 below), will actively check with other grievance received and record submitted grievance, complainant’s name, date, concerns/ grievance type.

64 Only complaints related to the project will be accepted and no anonymous complaints will be entertained. The secretariat will call a regular **quarterly** meeting inviting all members, and conduct special meetings as and when the grievances are received. The secretariat will be responsible to review the grievance, identify suitable solutions, and call the meetings with relevant party. Meeting to resolve a grievance should involve the person who submits the grievance. The time to resolve the grievance at the first level will be maximum 14 days. If the first GRM level cannot resolve the grievance, it will go to second tier GRM.

6.3.2 Composition

65 At the first level GRM, the team called as Grievance Redress Committee (GRC) will be established at the PIU level with PIU head as the lead of GRC. The composition of the first tier GRM is shown in Table 21.

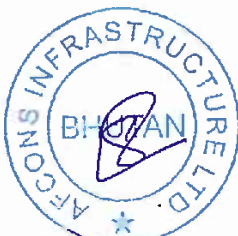


Table 21: Composition of the 1st Tier GRM

Positions	Names	Remark
PIU Project Manager	Mr. Kamal Dhakal	Chairman
PIU Deputy Project Manager	Mr. Dawa Tshering	Member
PIU Environment Manager	Mr. Pushpa Raj Pradhan	Member
PIC Team Leader/Dy. Team leader	Mr. Robert / Mr. Edwin	Member
PIC Safeguard and communications specialist	Mr. Megay Penjore	Secretary
Representative of local leader	Mr. Nar Bahadur Rai	Local Area Representative (Member) (Nyedra Tshogpa)
Representative from District office	Mr. Sonam Tenzin	Phuentsholing Thromde (Member)(Building Inspector)
Representative from reputable community-based organization	Ms. Dechen	RENEW (Member), (CBSS Volunteer)
Contractor	Mr. R. Ravichandran	AFCONS (Member), Project Manager
Members on call basis based on the nature of grievance representing relevant section of Dzongkhag/Dungkhag office		





6.3.3 Information Dissemination Methods

66 GRM process will be widely available to the public. The GRM will be advertised in the local newspaper at the start of the project and signage boards will be placed at prominent locations in the project area. The PIU, assisted by PIC will be responsible for information dissemination to affected persons and general public through the first public consultation meeting and provide details on whom to contact and when, where/ how to register grievance and stages of grievance redress process and procedures. The consultation will ensure that the vulnerable (women) groups and others are made aware of grievance redress procedures.

67 The public will have several mechanisms for lodging a complaint:

- a) GRM dedicated office address and PIU Phone no.
- b) Grievance Register to be kept at PIU office
- c) Grievance Drop Box in:
 - i. PIU office
 - ii. Contractor office
- d) Email address and Phone number of local leader office representative
- e) Phone number of the Thromde office.

68 At any time, an aggrieved person can convey his/her complaint, name and contact details by e-mail, letter or in person to the designated means. All grievances received will be recorded and will be screened for the project relevancy by the committee. Relevant Grievances received and responses provided will also be documented and reported back to the affected persons. The number of grievances recorded and resolved and the outcomes will be displayed/disclosed in the PIU office, as well as reported in the semi-annual safeguard monitoring reports to be submitted to ADB.

69 The grievance Drop Box/ complaint box would have a proper signboard with names and numbers of contact person at all these locations.

70 The broad outline of the first tier level mechanism and flow of information is given below:

- a) The PIC Safeguard and Communication Specialist will communicate any received grievance to the PIU. The GRC will check the grievance readdress boxes regularly.
- b) Each complaint will be issued a reference number. The PIU Environment Manager will issue each aggrieved person acknowledgement that they have received the complaint and details on the process to follow.



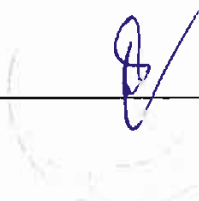
- c) The GRC will work with aggrieved person to resolve the complaint. On settlement of the complaint, the Environment Manager of the PIU will verify that the complaint is addressed (through consultation with the affected parties) and issue a letter to the aggrieved person citing the findings of the GRM investigation and any action taken with regard to the complaint.
- d) The decision on the grievance must be communicated to the aggrieved person by the GRC within a maximum timeframe of 14 days with appropriate action taken for resolution of the issue.
- e) All grievances will be documented and indexed. The meeting proceedings and actions against each of the grievance will be documented by the PIC Safeguard and communications Specialist.
- f) If grievance require a policy decision, the case will be forwarded to PMU Level for further resolution within 14 days.

71 All complaints lodged with the GRM will be recorded in a proper GRM register at the PIU office. All details of the grievance and the compliant should be captured in the register. This shall also be reported to ADB within the bi-annual safeguard report. Details of the aggrieved person's name, nature of complaint, status of complaint, and outcome will be included within the safeguard report. ADB's Independent Environmental Specialist will undertake routine inspections of the GRM to ensure that the GRM is functioning.

6.3.4 Cost

72 All costs involved in resolving the complaints (meetings, consultations, communication and reporting/information dissemination) will be borne by the PIU through provisional sum of the contract document.

73 However, the cost of actual of implementation of the resolutions provided by the GRM shall be borne by the contractor if it's their fault and responsibility. If the issues are beyond the contractor's responsibility, the matter shall be decided by the PIU/PMU.



6.4 Second level

6.4.1 Composition

74 The second level/tier GRM will be led by the PMU head with members from the PIU. (Project Manager/Dy. Project Manager, and Environment Manager), relevant PMU staff and relevant member from the central government level, as well as reputable community-based organization (Table 22). All grievance should be resolved at this level. The total time required will not be more than 30 days after PIU receiving the grievance. Depending on the severity of the case, an additional time may be agreed by the complainant to resolve the grievances. The meeting to resolve a grievance will be held by involving the people who submit the grievance.

Table 22: Composition of the GRM at Second Tier

Positions	Names	Remark
PMU Head	Mr. Tshering Dupchu	Chairman
PMU Urban Planner	Ms. Kamala Thapa	Member
PIU Head	Mr. Kamal Dhakal	Member
Environment Officer of PIU	Mr. Pushpa Raj Pradhan	GRC Secretary
Central Government Department	Mr. Namgay Tshering	DoFPS (Member), Forestry Officer
Reputable community-based organization	Ms. Lhaden	RENEW (Member) Social Welfare officer

75 The broad outline of the second tier level mechanism and flow of information is given as follows:

- The PIC Safeguard and Communication Specialist will communicate to the PMU head on any grievance not resolved in the PIU level within 5 days.
- The assigned PMU head will work with the PIU, contractor and aggrieved person to resolve the complaint. On settlement of the complaint, the Environment Manager of the PIU will verify that the complaint is addressed and issue a letter to the aggrieved person stating the findings of the GRM investigation and action taken.


- c) The decision on the grievance must be communicated to the aggrieved person by the PIU within a maximum timeframe of 30 days from the date of receiving it from the First Tier and with the action taken. Depending on the severity of the case, an additional time mutually agreed between the two parties, may be agreed with the complainant to resolve the grievances.
- d) All grievances must be documented and indexed. The meeting proceedings and actions against each of the grievance will be documented by the PIU Environment Manager

76 All complaints lodged with the GRC will be recorded and reported to ADB within the bi-annual safeguard report. Details of the aggrieved person's name, nature of complaint, status of complaint, and outcome will be included within the safeguard report. ADB staff will undertake routine inspections of the GRM to ensure that the GRM is functioning.

6.4.2 Cost

77 All costs involved in resolving the complaints (meetings, consultations, communication and reporting/information dissemination) will be borne by the PIU through provisional sum.

78 However, the cost of actual of implementation of the resolutions provided by the GRM shall be borne by the contractor if it's their fault and responsibility. If the issues are beyond the contractor's responsibility, the matter shall be decided by the PIU/PMU.





Construction Development Corporation Limited, Bhutan

Phuentsholing Township Development Project,

ENVIRONMENTAL AND SOCIAL GRIEVANCE FORM

Complainant Name	
Contact Details	Address Contact No.:
Location of Complaint	
Details of Complaints	
Directions	
Confidentially Requested	Yes <input type="checkbox"/> <input type="checkbox"/>
Signature of Complainant	Date:
<i>Reference No.:</i>	<i>For official use only</i>
<i>Date Received:</i>	<i>For official use only</i>
<i>Complaint taken by:</i>	<i>For official use only</i>
<i>Complaint assigned</i>	<i>For official use only</i>
<i>Date of complaint Acknowledged:</i>	<i>For official use only</i>
<i>Complaint referred to</i>	<i>For official use only</i>

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Format for Grievance Redress Mechanism Register:-

Sl. No.	Name of the Complainant	Unique complaint number	Address & Contact No.	Gist of the Complaint	Forwarded to whom	Whether grievance redressed or not	If yes, Gist of disposal	If rejected, gist of reasons	If not attended reasons

Monthly status Report on Environmental and Social Grievance Redress-

Sl. No.	Name of the unit	No. of pending complaints at the end of previous month	No. of complaint received during the month	Action initiated during the month	Completed during the month	No. of complaints pending at end of month	No. of grievance redressed	No. of dismissal	Total	Remarks




DHI Company
CONSTRUCTION DEVELOPMENT



Egis International
Gyalshen

CHAPTER-7: Zone A Landscape Development Activities

- 79 The landscape development in proposed ALDTP comprises of a lower walkway, upper walkway and sloping embankment. The tree plantation is proposed at upper & lower walkway and shrub lawns are proposed on the sloping embankment.
- 80 Landscape work tentatively will start from 1st February 2020; it will be carried out phases and part and will continue till 30th January 2021.
- 81 The plantation of trees will be done in pit of size 1m x 1m x 1m on both lower and upper walkway. The tree placement will be at 10m center to center on upper walkway and 5m center to center on lower walkway. Tree guard will be provided around the planted tree and soil for covering the trees will be excavated from the area near Zone C.
- 82 The detail of plants species and their respective locations is shown in Table 23:

Table 23: Tree Plantation location and species

S. No.	Location of Plantation	Species	Quantity
1.	Slopped Embankment	Viteveria zizanoides (Vetiver Grass)	22,480(Approx)
2.	Lower Walkway	Azadiracta Indica	128
		Mesua Ferrea	68
		Pongamia Glabra	142
		Fillicium Decipens	122
		Alsotnia Scholaris	126
3.	Upper Walkway	Classia Javanica	69
		Delonix Regia	36
		Peltophorum Ptericarpum	75
		Tebabuea Roasea	53
		Kigelia Pinnata	26
		Samanea Saman	115



Annexure 1: NEC Environmental Clearance

Annexure 2: Quarry Management Plan

Annexure 3: Standard Measure for Pollution Control

Annexure 4: Camp Management Plan

Annexure 5: Emergency Response Plan

Annexure 6: Occupational Safety and Health Management Plan

Annexure 7: HIV AIDS Awareness Programme

Annexure 8: Traffic Management Plan

Annexure 9: Construction and Demolition Waste Management Plan

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Annexure 5: Emergency Response Plan

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Annexure 5: Emergency Response Plan



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1. Purpose

1. The aim of this emergency preparedness and response plan is to guide personnel in an accident or emergency situation to prevent or minimize injury, damage and material loss and also to prevent or mitigate environmental impact from the accident or emergency. To ensure communication of information related to Occupational Health and Safety to public involved in PTDP construction activities.

2. Definition and Scope

2. The major emergency is defined as one which may affect one or several areas of the site and may cause serious injuries, loss of containment or environmental impacts and may require the help of outside resources in addition to our own to handle it efficiently and effectively.
3. AFCONS's "**EMERGENCY PREPAREDNESS & RESPONSE PLAN**" has been framed in such a manner so as to take immediate action by various groups to meet and control the critical situation within shortest time period with minimum loss of Material, Machine and Property & also to minimize the loss of personnel injuries.
4. It is the responsibility of all the individuals in their respective areas to take the necessary safety measures to eliminate the possibility of the emergency and if at all it occurs limit its impact.

3. Definitions

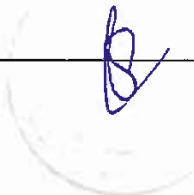
- a) PTDP - Phuentsholing Township Development Project
- b) OHS - Regulations On Occupational Health and Safety (OHS) in Construction, Industry (2012)

4. Legal Requirement.

- a) Regulation on Occupational Health and Safety (OHS) for Construction Industry (2012)
- b) Electricity Act of Bhutan 2001
- c) The Pesticides Act of Bhutan 2000
- d) Labour and employment act 2007

5. Approach

5. The aim of this emergency preparedness and response plan is to guide personnel in an accident or emergency situation to prevent or minimize injury, damage and material loss and also to prevent or mitigate environmental impact from the accident or emergency.
6. **Rationale:** This plan has the two fold purposes. One is to prepare PTDP for the emergency situations by means of Mock Drill Exercises & Other Training programs. The other purpose is to handle emergencies and effective use of all resources in the



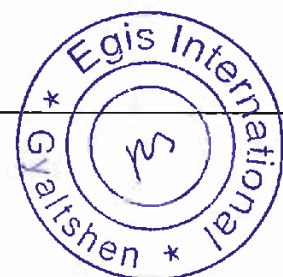
command of AFCONS with complete liaison and coordination with outside agencies to minimize the effect of such a disaster /emergency. The major functions of this plan are to:-

- a) Prepare the associates for the emergency situations described above by MockDrills & Other Safety Trainings.
- b) Rescue the potential victims and treat them suitably.
- c) Safeguard others (evacuating them where necessary).
- d) Contain the incident and control it with minimum damages.
- e) Identify the persons affected.
- f) Inform relatives of the casualties / effected person.
- g) To provide information to all relevant authority.
- h) Preserve relevant records and equipment needed as evidence for any subsequent inquiry.
- i) Rehabilitate the affected areas
- j) All Associates & Visitors registration at gate office for identification.

6. Potential Emergency Situations

7. Following have been identified as potential emergencies:

- a) Incidence of Fire
- b) Spillage/leakage of raw materials;
- c) Leakage/short circuit of any electrical supply;
- d) Major engineering failures such as:
 - i. Collapse of structures/excavation
 - ii. Major utility collapse
- e) Plant/Machinery/Vehicle related accidents;
- f) Unintended explosions;
- g) Flooding at site
- h) Toxic gases.
- i) Evacuation of injured from working area
- j) Food poison
- k) Snake bite
 - i. Stay calm and do not panic
 - ii. Wrap the bitten limb tightly as you would a sprained ankle
 - iii. Attach a splint where possible and immobilize the affected area
 - iv. Keep the victim still and seek immediate medical attention
 - v. If possible try to identify the snake without putting yourself at risk



7. Emergency Response Team

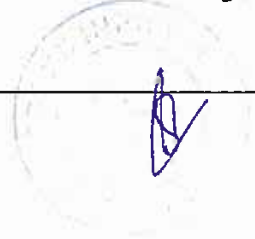
8. Emergency response team comprises:

- a) Main controller
- b) Incident controller
- c) Incident Action Team Members
- d) Site Supervisors

9. The Emergency response team identified at the project site are shown in Table 1 below:

Table 1: PTDP Emergency Response Team

Description	Responsibility	Name	Contact No
Incident Controller	Project Manager	Mr.R.Ravichandran	17309990
	Construction Manager	Mr. DilipkumarSuriyavansi	17284748
	Chief Safety Manager	Mr. S. Ashok Kumar	17325971
Fire Fighting/Rescue Team	Site Supervisor/Worker	Prepared and Displayed Site Wise On Project Notice Board	
Safety Team	Site Safety	Prepared and Displayed Site Wise On Project Notice Board	
First Aid Team	Site First Aider	Mr. Bijendra Kumar Singh	17327152
Administration Team	Admin Head	1.Mr. Sanjeev Kumar Singh	17327427
		2. Mr. Kamlesh Mangain	17327152
Engineering Team	1.Civil	1.Mr. UdayKalore	17326374
	2.Plant	2.Mr.Muthukumar	17326744
	3.Electrical	3.Mr.RatheeshNair	17327010
Ambulance	Health	Ambulance service	112
Police	Police	Traffic	111
		Crime	113
Fire Brigade	Fire Tender/ Extinguisher	Fire	Emergency number 110



Description	Responsibility	Name	Contact No
PIC	Project Manager	Mr. Robert Jeancenelle	17298145
	Environment	Mr. Chhimi Dorji	17556306
	Social Safeguard Specialist	Mr. Megay Penjore	17618624
PIU	Project Manager	Mr. Kamal Dhakal	77341447
	Environment Manager	Mr. Pushpa Raj Pradhan	17951067

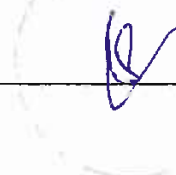
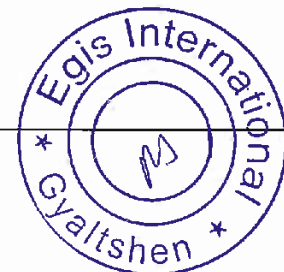
8. Incident Control Center

10. Cabin of Construction Manager(s) has been identified as Incident Control Centre. Following items have been provided in the incident control centre:

- a) Mobile telephone
- b) Site plan with following details:
 - 1) Details of the surrounding community
 - 2) Site entrances, road plan, emergency escape routes and assembly points
 - 3) Vehicle parking areas
 - 4) Location of incident control centre, medical treatment centre (if provided)
 - 5) Storage points of large quantities of hazardous materials including tanks, reactors, drums and compressed gas cylinders
 - 6) Location of water sources including hydrants, fire-fighting and other safety equipment
 - 7) Location of spill control equipment
 - 8) Location of emergency lights, sirens, bells, alarm buttons and other warning devices
 - 9) Location of emergency instruction notice boards

9. Emergency Response kits

- a) Pen, Pencil & Notebook
- b) Clipboard and blank A4 paper.
- c) Camera.
- d) Personal Protective Equipment
- e) First Aid Kit
- f) Torch and Spare Batteries.

- g) Copy of procedure and forms.
- h) Hazard Warning tape.
- i) Traffic batten light
- j) Life jackets

10. Emergency Response Procedures

11. General Guidelines

- a) Do not panic.
- b) Do not approach the incident site as a spectator. Instead, stay at your place unless otherwise instructed.
- c) Do not engage communication channels/Mobile except for handling emergency.
- d) Do not move unnecessarily.
- e) Conduct your guest / visitors away from the site.

10.1 Emergency Procedures of Injury

- a) Individuals who are evident of incident of injury shall report to Site supervisor and Rescue team. All other workmen shall rush to assembly point as per evacuation plan available at site for head counting, and head counting will be done by administrative representative with daily man power report.
- b) Rescue Team shall carry the injured to first Aid centre and then as per requirement can be referred to hospital for further treatment. Rescue Team further act as search team if any workmen has been missed during head counting at assembly point.
- c) Site supervisor shall report about the incident to Site in charge, Safety and Administration for communication to Project Manager, HOD Safety & HOD Administration for necessary arrangement.
- d) HOD Safety will investigate the incident /Accident in order to stop re-occurrence of the same incident/accident and submit the report to Project Manager for necessary action.
- e) HOD Administration will make necessary arrangement for recovery of injured person and to deal with local administration issues.
- f) Site In charge will restore the situation to normal for work.



10.2 Emergency Procedures in case of fire

- a) Individual who is evident of fire should shout 'fire –fire ', call Rescue team and Site Supervisor will rush to fight fire. All other workmen shall rush to assembly point as per evacuation plan available at site for head counting, and head counting will be done by Administration representative with daily man power report.
- b) Rescue team along with fire marshal shall fight fire and if fire is big, site supervisor shall call local fire department. Rescue Team further acts as search team if any workmen are missing during head counting at assembly point. Fire marshal shall be competent to extinguish fire and shall know type of fire and method or which type of fire extinguisher to be used.
- c) Site supervisor shall report about the incident to Site in charge, Safety and Administration for communication to Project Manager, HOD Safety & HOD Administration for necessary arrangement.
- d) HOD Safety will investigate the incident /Accident in order to stop re-occurrence of the same incident/accident and submit the report to Project Manager for necessary action.
- e) HOD Administration will make necessary arrangement for recovery of injured person if any workmen have burnt injury and to deal with local administrative issues.
- f) Site In charge shall restore the situation to normal for work.

10.2.1 General fire protection rules:

- a) Maintain good housekeeping practices.
- b) Ensure that all aisles, entrances and exits, and stairways are always kept free of obstruction.
- c) Check emergency exits to ensure they are not blocked and that the exit signs are clearly visible.

10.2.2 Types of fire extinguishers:

12. Fire extinguishers, of the right kind and in the proper operating condition, are the first line of defence against a fire. Know the location of fire extinguishers and type of fire each is designed to extinguish. These types are:

CLASS "A" – Ordinary combustibles

CLASS "B" – Flammable liquids

CLASS "C" – Gaseous substances

CLASS "D" - Combustible metals



13. The details are explained in Table 2 below:

Table 2: Class of Fire and Suitable type of appliances

TYPE	CLASS OF FIRE	SUITABLE TYPE OF APPLIANCES
A	Fires in ordinary combustibles (wood, vegetable, fibers, rubber, plastics, paper and the like)	Gas expelled water type and anti-freeze type extinguishers and water buckets
B	Fires in flammable liquids, paints, grease solvents and the like.	Chemical extinguishers of carbon dioxide and dry powder types and sand buckets.
C	Fires in gaseous substances under pressure including liquefied gases.	Chemical extinguishers of carbon dioxide and dry powder types.
D	Fires in reactive chemicals, active metals and the like.	Special types of dry powder extinguishers and sand buckets.

10.2.3 Firefighting equipment maintenance

Responsibility

- a) Mechanical In charge will be responsible for the maintenance of all fire extinguishers & equipment's.
- b) Regular checking of fire equipment shall be done by the contracted party & record shall be kept.
- c) All associates are advised to inform any observations on fire safety to his area manager or Manager HSE.

10.3 Action Plan for Construction Material/Chemical Spillage during transport

- a) Drive carefully with bulk road tanker to a pre-identified open space.
- b) Alert the people to be at a safe distance.
- c) If the spillage is of flammable chemical (HSD, LDO) do not allow any spark producing activity in the vicinity of spillage.
- d) Extinguish all naked flames in the vicinity.
- e) If the spilled chemical is of toxic nature do not stand in down wind direction. Evacuate the people in down wind direction to crosswind and upwind direction.
- f) If possible; without endangering life, try to put sand on spillage. This will help to disperse spillage in controlled way.
- g) Stop all traffic on road coming in vulnerable zone of hazard.



- h) If there are any burn/poison affected casualties, move them to the nearby hospital

10.4 Accidental Release Measures; Spills and Leaks

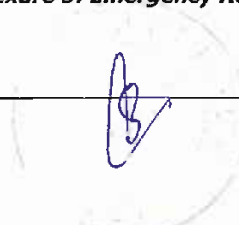
- a) Contain spill, if possible.
- b) Eliminate all possible causes of ignition to avoid fires and explosions – empty containers' residues and should not solder, drill grind or exposed to heat or flame;
- c) Fire extinguishers must be in the vicinity;
- d) Scrub contaminated area with detergent and water;
- e) Prevent entry of spillage into drains and waterways.
- f) Store the recovered product in the sealed air-tight containers/drums;
- g) Supervisors should be informed of spill incidents at site;
- h) Use inert fuel/oil absorbent (such as buckets of sand, sawdust) to cover and remove spilled material or contaminated soil collected for storage in a special drum for later disposal of the waste at dumpsite.

10.5 Action Plan for Engineering Emergencies/natural Calamities

- a) Rush to emergency site on hearing the emergency alarm and/or message.
- b) Set up the task forces with the available persons, consisting of firemen, Security guards. Task force should carry out following jobs:
 - i. Clear the approach road for fire tender and ambulance.
 - ii. Remove the injured person for medical treatment.
 - iii. Control the traffic around the emergency site.
 - iv. Arrange to rescue people, property and materials.
 - v. Ensure the availability of adequate water supply at incident site. Shut off electrical supply to the emergency site, if required in consultation with incident controller as per above emergency procedure.

10.6 Action Plan In Case of fall from Height / Serious Injury

- a) Concerned person shall not be moved in case he has had a fall from height and is suspected to have injured his back.



- b) First aid for any other injury sustained shall be provided at site.
- c) The patient shall be gently lifted and placed on a stretcher so as not to disturb his back.
- d) He shall be made comfortable by removing his shoes, loosening his clothes and given some water to drink.
- e) Immediately a vehicle will be summoned and the stretcher gently lifted and placed inside the vehicle.
- f) Simultaneously the Doctor with whom the site has made standing arrangements shall be contacted on telephone and informed about the condition of the patient and told to be ready to receive the patient.
- g) Some responsible person shall accompany the patient to the Doctor. Remember too many people do not help and are rather a nuisance.
- h) All others concerned shall then be informed by the fastest means.
- i) Work shall be stopped; all personnel shall be collected and delivered a tool box talk highlighting the reasons for the accident, lapses that took place and corrective actions that need be taken. We have to learn from our mistakes and ensure that they are not repeated.

10.7 Action Plan during night and non- working hours

- a) Never work alone in night and non-working hours and if required necessary communication system shall be made available and shall be communicated at regular interval for verification purpose.
- b) Security shall be alert during this hour and if any emergency as noted above shall be communicated as per emergency response team to control the emergency situation and recover to normal situation as soon as possible.

10.8 Action Plan for Abnormal weather such as strong wind and hail stone

- a) All temporary and permanent work shall be designed considering such weather factor.
- b) During such weather it could result to catastrophe, mishap, calamity causing substantial loss of human suffering, or damage to or degradation to environment and is of such a nature or magnitude as to be beyond the coping capacity of the community of the affected area. For such situation we will have disaster management team for implementing measures for evacuation, rescue and relief. Rehabilitation and re-construction and bring the site to normal condition.



10.9 Emergency Procedures for Earth quake

- a) **React instantly:** Stay Calm! Think clearly and use common sense. Duck and cover!
- b) **At Home:** Stay indoors. Crouch under a heavy table or desk and hang onto it. If there is no protective furniture; crouch and brace yourself against an inside doorway, inside corner, or wall.
- c) **Office Building or In a Store:** Don't run for the exit; there may be a stampede. Stay on the same floor. Move away from windows. Crouch under a desk, bench, or table. Do not use the elevator. Expect the fire alarm and sprinkler to activate.
- d) **On Foot:** Stay outside, in the open, away from trees, signs, utility poles and lines, and buildings. If you are near a building, duck into a doorway to avoid falling debris. Do not enter the building.
- e) **In A Vehicle:** Quickly pull to the side of the road. Keep away from buildings, trees, bridges, signs, overpasses, and utility lines and poles. Stay in the vehicle until it stops shaking.
- f) Check for injuries and treat the injured with first aid. Take steps to stop bleeding and call for medical assistance if there is an emergency. Don't attempt to move severely injured persons unless they are in immediate danger of further injury. Cover them with blankets.
- g) Stay calm and use common sense.
- h) Use the telephone only to report severe emergencies.
- i) Put out fires. Don't use matches, lighters, candles, electrical switches or appliances in case there is a gas leak; use flashlights.
- j) Check gas, water and electrical lines and check appliances for damage. If you smell gas or see a broken line, shut off the main valve.
- k) Wear heavy shoes and gloves in areas near fallen debris and broken glass.
- l) Do not touch downed power lines or broken appliances.
- m) Clean up dangerous spills such as glass, bleach or medicines.
- n) Turn on a battery-powered or car radio for instructions and information.
- o) Check to see that sewage lines are intact before using toilet.
- p) Check water and food supplies. If water is cut off, use emergency supplies found in toilet tanks and water heater.
- q) Check the building for damage and cracks. Do not use the fireplace until it is inspected.
- r) Check cabinets and closets. Open carefully and beware of falling objects.
- s) Watch for falling objects when you enter or leave buildings. Do not enter severely damaged structures.
- t) Do not use your vehicle, unless there is an emergency. Do not go sight-seeing to view damage. You may hamper the relief effort. Keep streets clear for passing emergency vehicles.
- u) Render aid and assistance to your community as needed.
- v) Be prepared for aftershocks. They can cause added damage. If near large body of water, evacuate to higher safe ground.



- w) If evacuation is necessary, post a message of where you can be found in clear view. Have designated reunion points. Have a 72-hour survival kit ready to take with you that includes: medicines, first aid kit, flashlight, radio batteries, important papers, cash, food, water, sleeping bags, blankets, and extra clothes.

10.10 Emergency Procedures for Flood

14. Emergency Protection Against Lay Down/Camp from flood includes:

- a) Laydown /Camp Planned at a level which is around 1metre above the highest flood level appeared in a century
- b) Existing temporary bound built by Thromde/Local crushing unit shall be retained till end of august 2019 to act as first line of protection for site installation
- c) Outfalls and Diaphragm wall around site installation area shall be completed before 2019 monsoon to lockup the entire area for second line of defence against flood.
- d) A temporary measurement (gabion wall) will also be constructed along the starting northern point of construction at Outlet No. 8.
- e) Area at higher elevation marked in the site shall be ready for emergency shelter with necessary food stock for 15 days
- f) Two nos. of inflatable boats with engine shall be made available for Emergency evacuation
- g) 50 nos. of life jacket and 10 nos. life buoys shall be made available
- h) Regular communication with upstream flood monitoring team
- i) Before monsoon period we are planning to build a temporary structural stair cases to climb the mountain during Emergency
- j) Before Monsoon Week points along with temporary trench shall be identified and necessary strengthening shall be done
- k) Outfallsrain water around and nearby area to be measured based upon that heightening the camp and lay down area before monsoon. Already identified required level and making the trenches and heightening the area
- l) Required protection of camp and lay down area by diaphragm wall and boulders to be placed by nearby camp area and making trenches to avoid the water pressure to camp area
- m) Flood Monitoring team is available and contact with nearby **DOYAGANG** hydro met station and getting rainfall data from the station and **DOROKHA** it is the place from around 30 kilometres from Phuentsholing so any contact numbers to be identified through client (CDCL/EGIS) and keep on communicating with the person regarding the rainfall from the area and water level in the river.
- n) The site layout for the flood protect is outlines in figure 1

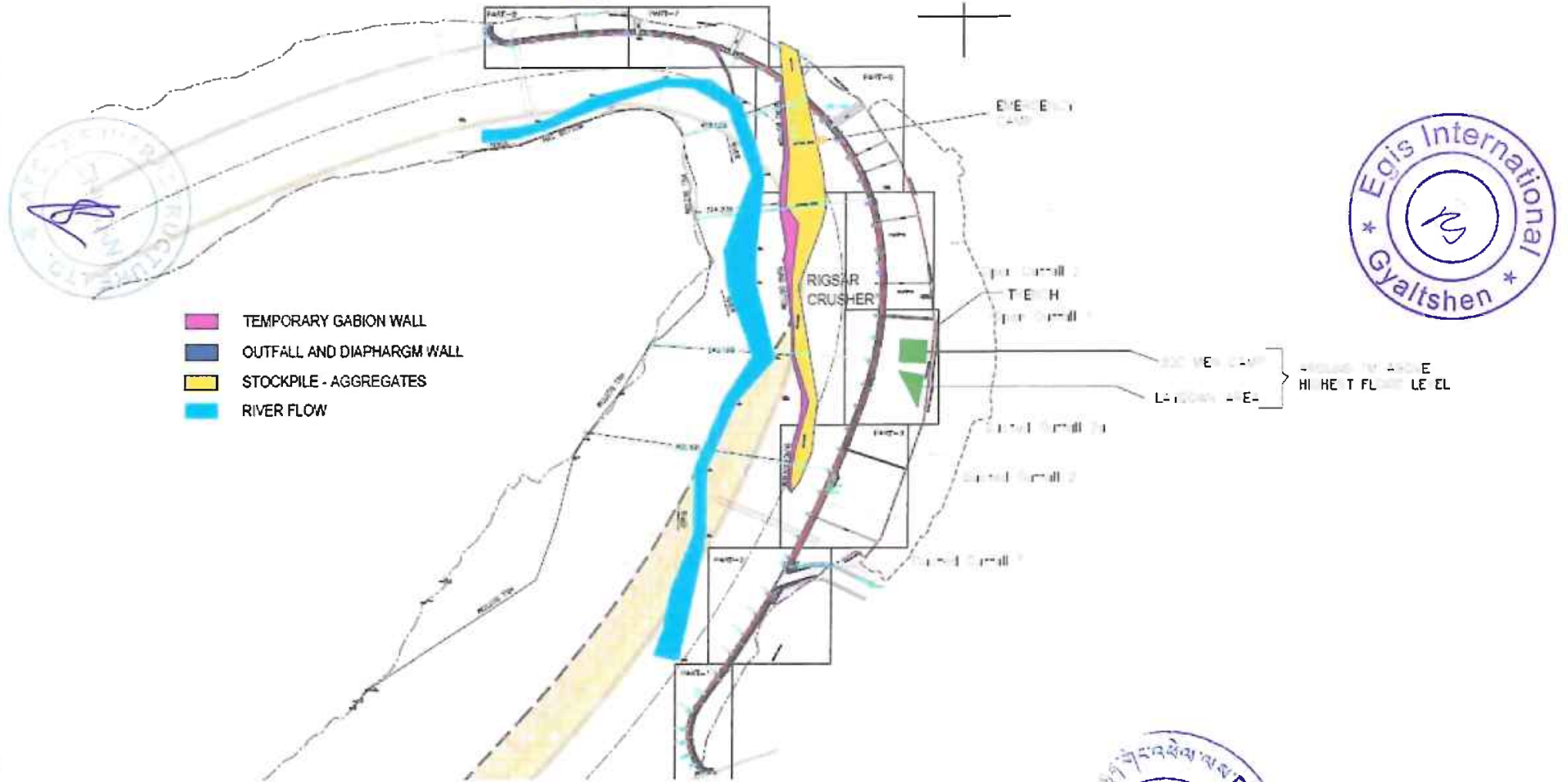


Figure 1: Site Layout Flood protection

Annexure 5: Emergency Response Plan



10.11 Emergency Procedures for Landslide

10.11.1 Before Landslide

15. Evacuation plan: If the site is in danger of being hit by a landslide consider opening of alternative access roads to avoid getting cut off from supplies and access to medical care. Access roads shall be such to allow emergency services to get to our community to provide aid and relief services in the shortest time possible.
16. Preparation of Grab Bag: In an emergency, there will be no time to pack. Escaping and staying out of harm's way is the utmost priority. Prepare in advance a Personal Grab Bag which includes:
 - a) Non-perishable food
 - b) Drinking water
 - c) Identification documents
 - d) Soap and other personal hygiene items
 - e) A change of clothes
 - f) Personal medication
 - g) Cell phone and charger
 - h) Torchlight (with extra batteries)
 - i) Whistles to signal for help
 - j) Wrench or pliers to turn off facilities
17. The landslide may break water pipes and bring down electricity lines in your area, so you may be without basic services for a while. Make sure that you are stocked up with foodstuff in case food relief does not get to you immediately.
18. **Familiarize our self with the land around you:** Watch out for changes in how rainwater flows onto slopes near our site, and especially the places where runoff water meets, increasing flow over soil covered slopes. Watch the all sides around our site for any signs of land movement, such as small landslides or debris flow, or progressively tilting trees. Noticing small changes will alert us to an increased threat of a landslide.

10.11.2 During Landslide

- a. Contact local fire, police, or public works department.
- b. Leave
- c. Getting out of the path of a landslide or debris flow is our best protection. If it is at all possible, run across the path of the landslide, rather than away from it on its path. It is impossible to outrun a landslide.

10.11.3 After Landslide

- a. Stay away from the disaster area. There may be danger of additional slides. Listen carefully for cracking sounds from trees or debris falling down the scar surface of the slope. Stay back from the slide area.

- b. Check for injured and trapped persons and animals near the slide, without entering the slide area. Direct rescuers to their locations – the window of opportunity for survival are generally estimated at two hours.
- c. Help people who require special assistance – elderly people, those without transportation, who may need additional help in an emergency situation, people with disabilities, and the people who care for them. Take them to a relief or operations centre where they can be cared for.
- d. Listen to local stations on a portable, battery-powered radio or television for the latest emergency information.
- e. Watch out for flooding, which may occur after a landslide or debris flow.
- f. Floods sometimes follow landslides and debris flows.
- g. Check our Site's foundation and surrounding land for damage.
- h. Look out for and report broken utility lines to appropriate authorities. Reporting potential hazards will get the utilities turned off as quickly as possible, preventing further hazard and injury. Be especially careful of live electricity cables which may come into contact with water from flooded areas.
- i. Listen for instructions from the emergency personnel or our Relief Centre representative on evacuation, food delivery, road access, and resumption of services.

10.12 Emergency Procedures in case of attacks from miscreants

- a) Report the incidence to the security in-charge immediately
- b) Remain calm and be patient.
- c) Follow the advice of local emergency officials.
- d) If the incidence occurs near you, check for injuries. Give first aid and get help for seriously injured people.
- e) Shut off any other damaged utilities.
- f) Confine or secure your pets.
- g) Call your family contact—do not use the telephone again unless it is a life-threatening emergency.

10.13 Emergency Procedures in case of civil riots

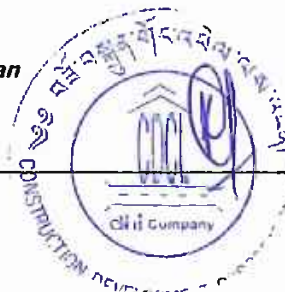
- a) Report to incident controller.
- b) Stay at site office.
- c) Lock the site gate.
- d) Get information from phone or radio or from local authority.
- e) Wait for returning to normal condition.

10.14 Emergency Procedures for Storm

- a) When a thunderstorm or lightning threatens is seen. Stay indoors and don't venture outside unless absolutely necessary.




- b) Stay away from open doors and windows, fireplaces, radiators, stoves, metal pipes, sinks and plug-in appliances.
 - c) Don't use plug-in electrical equipment such as hair dryers, electric blankets or electric razors during the storm.
 - d) Except for emergencies, don't use the telephone during the storm. Lightning may strike telephone lines outside.
 - e) If outside, with no time to reach a safe building or an automobile, follow these rules:
 - i. Do not stand underneath a natural lightning rod such as a tall, isolated tree in an open area.
 - ii. Avoid projecting yourself above the surrounding landscape, as you would do if you were standing on a hilltop, in an open field, on the beach, or fishing from a small boat.
 - iii. Get out of the water and off small boats.
 - iv. Get away from tractors and other metal farm equipment.
 - v. Stay away from wire fences, clotheslines, metal pipes, rails, exposed sheds or anything that is high that would conduct electricity. Some of these could carry electricity to you from some distance away.
 - vi. Don't use metal objects like fishing rods and golf clubs. Golfers' cleated shoes are particularly good lightning rods.
 - vii. Stay in your automobile if you are traveling. Automobiles offer excellent lightning protection.
 - viii. Get off and away from motorcycles, scooters, golf carts and bicycles.
 - ix. If no buildings are available, your best protection is a cave, ditch or canyon, or under head-high clumps of trees or shrubs.
 - x. If only isolated trees are nearby, your best protection is to crouch in the open, keeping twice as far away from isolated trees as the trees are high.
 - xi. When you feel the electrical charge - if your hair stands on end or your skin tingles - lightning may be about to strike. Drop to the ground immediately.
19. **First Aid:** Persons struck by lightning receive a severe electrical shock and may be burned, but they carry no electrical charge and may be handled safely.
20. A person "killed" by lightning can often be revived by prompt mouth-to-mouth resuscitation, cardiac massage, and prolonged artificial respiration.
21. In a group struck by lightning, the apparently dead should be treated first; those who show vital signs will probably recover spontaneously, although burns and other injuries may require treatment.



10.15 Emergency Procedures in case of Gas leakage

- a) Check piping and appliances for damage.
- b) Check for fires or fire hazards.
- c) Do not use matches, lighters or other open flames.
- d) Do not operate electrical switches, appliances or battery operated devices if natural gas leaks are suspected. This could create sparks that could ignite gas from broken lines.
- e) If gas line breakage is suspected, shut off the gas at the meter. This should be done, however, only if there is a strong smell of cooking gas or if you hear gas escaping.
- f) Wear heavy shoes in all areas near broken glass or debris. Keep your head and face protected from falling debris.
- g) Turn on a battery operated radio (if no gas leaks are found) or car radio to receive disaster instructions.
- h) Do not use your telephone except in extreme emergency situations.

10.16 Emergency Procedures in case of collapse of building, Shed or Structure.

- a) This is highly unlikely but still something that could unexpectedly happen without warning.
- b) Leave as quickly as possible.
- c) Stay calm.
- d) Do NOT use the elevators. In the event that the power goes out you may become stuck.
- e) If possible take your emergency kit and cell phone with you.
- f) If you can't get out of the building, then hide under a stable piece of furniture, like a table or a desk.

22. If you get trapped by debris, here are some tips to stay alive:

- a) Try not to move around too much. You might kick up too much dust, making it hard to breathe.
- b) Cover your nose and mouth with a cloth to avoid breathing harmful dust and smoke.
- c) To let rescuers, know where you are, tap on a pipe or wall. Or you can use a whistle. Avoid shouting since this could cause you to breathe in a dangerous amount of dust.
- d) If you have a flashlight, use it to see and to let rescuers know where you are.



11. Hazard Analysis

23. Emergency Risk Assessment

Step -1 Identify potential Hazard in the workplace. Establishments or organization holding more than specified quantities of dangerous substances will have to notify their presence to the enforcing authority and plan emergency procedure for the same;

Step -2 Decide who may be harmed in the dangerous event in the workplace or while trying to escape from it, and note their location. Public, worker, Staff and assets of company?

Step -3 Evaluate the risk from the hazard and decide whether existing emergency evacuation are adequate or not to control the risk. Applying appropriate controls based on an assessment of the hazards, risks and possible consequences, the likelihood of a major accident can be minimized; and Mitigation with even with the best controls, major accidents will never be totally eliminated so the effects of any that do occur should be kept as small as possible. Emergency planning is one of the principal steps to achieve this. Conduct Emergency drill and record the actions.

Step-4 Record finding and communicate it among employees. Mock drill report with deficiencies noted to be circulated for information

Step-5 Keep the assessment under review and revise it when necessary. Review Mock drill report every month.

12. Assembly point

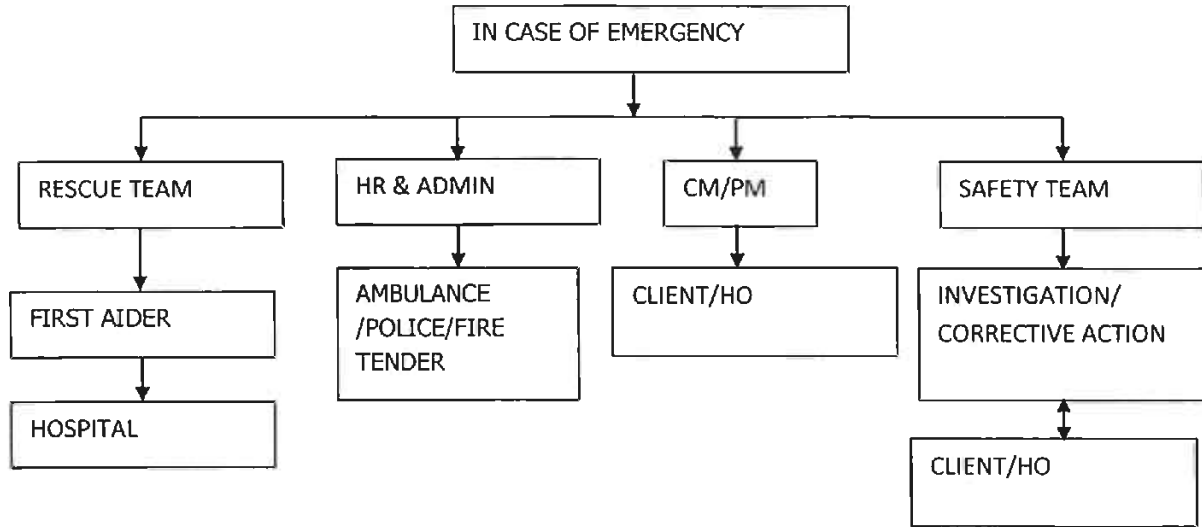
24. Assembly points during emergency have been identified and notified at the site (Figure 2). Safe emergency assembly point board displayed at above 2 meter height at designated safe assembly point and signage's at conspicuous level for directing the workmen and visitors to the safe assembly point easily at the time emergency evacuation made. Access of assembly point must be cleared at all times.

25. Assembly point-Office Area (APA-1 to APA-3) & Assembly point-Camp Area (APA-4 to APA-6) is identified in Figure 2.



13. Reporting System

26. Reporting system for incidences is attached and emergency contact numbers are displayed at the site.






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National Environment Commission
 Royal Government of Bhutan



NECS/ESD/Dzo-Chukha/3496/2017/ 1245

September 1, 2017

Environmental Clearance

In accordance with Section 34.1 of the Environmental Assessment Act 2000 and Section 34 of the Water Act 2011, this Environmental Clearance (EC) is hereby issued to the Chief Executive Officer, Construction Development Corporation Limited, Thimphu for Amochhu Land Development and Township Project proposed at Phuentsholing under Phuentsholing Throm and Samtse Dzongkhag with the following terms and conditions:

I. General

The holder shall:

1. comply with provisions of the National Environment Protection Act 2007, Environmental Assessment Act 2000 and its Regulation 2016, Waste Prevention & Management Act of Bhutan 2009 and its Regulation 2016, The Water Act of Bhutan 2011 and its Regulation 2014 and Revised Regulation on the Control of Ozone Depleting Substances (ODS) 2008;
2. ensure that the activities are in line with Initial Environmental Examination and Environmental Impact Assessment reports submitted for EC;
3. ensure that local communities, properties and any religious, cultural, historic and ecologically important sites are not adversely affected by the activities;
4. restore the damage of any public or private properties caused by the activities;
5. inform NECS and any other relevant authorities of any unanticipated or unforeseen chance-find of any precious metals or minerals or articles, that have economic, cultural, religious, archeological, and/or ecological importance; and
6. erect a signboard at the take-off point of the main entry of the project site stating the name of the project and contact address.

II. Environmental standards

The holder shall comply with the existing Environmental Standards.

III. Import and use of secondhand equipment and ODS

The holder shall:

1. ensure that import and use secondhand equipment and machineries are strictly prohibited; and
2. ensure that import and use ODS are in line with the Revised Regulation on the Control of ODS 2008.

IV. Protection and management of water resources

The holder shall ensure that the activities does not obstruct the water flow and pollute the water bodies.



V. Waste prevention and management

The holder shall:

1. manage wastes generated from the project (Project site, labour camps, offices etc.) with the application of 4R (Reduce, Reuse, Recycle, Responsibility) principle and other environmentally friendly methods of waste management; and
2. ensure that import and use of hazardous wastes are strictly prohibited.

VI. Management of excavated materials and run-off

The holder shall:

1. dispose excess excavated materials generated from the activities at the pre-identified approved dumpsite; and
2. put appropriate measures for management of surface run-off to avoid erosion and landslides.

VII. Implementation plan

The holder shall prepare a detailed implementation plan focusing on the implementation of terms and conditions of this EC and submit to NECS within three (03) months from the date of issue of this EC.

VIII. Monitoring and reporting

The holder shall:

1. ensure that the effective day-to-day monitoring of the EC terms and conditions are carried out by the environmental unit or designated environment focal person; and
2. maintain proper records on wastes generated and its management, stating types of wastes, quantities and characteristic and submit to NECS annually.

IX. Renewal and modification

The holder shall:

1. ensure that renewal of this EC is processed at least three (03) months prior to its expiry along with a copy EC and a report on the implementation of its terms and conditions; and
2. obtain prior approval from NECS for any modification to the existing proposal/application .

Reservation

1. The NECS may stop the activity or impose additional terms and conditions, as may be deemed necessary; and
2. The EC shall be subject to periodic review and modifications as per Article 25 of the EA Act 2000, without any liability on the part of the Royal Government.

The holder may adopt best practices in executing these terms and conditions to avoid adverse environmental impacts.



Failure to comply with any of the above terms and conditions shall constitute an offence and the proponent shall be liable in accordance to the Environmental Assessment Act 2000 and/or existing environmental laws.

Validity:

This EC is issued with valid from **September 1, 2017** until **August 30, 2022** for Amochhu Land Development and Township Project only.

(Sign & seal)
Secretary



To,
Chief Executive Officer
Construction Development Corporation Limited
Thimphu

Copy to:

1. Dasho Dzongdag, Dzongkhag Administration, Samtse for kind information.
2. Dasho Thrompon, Phuentsholing Thromde, Phuentsholing for kind information.
3. Chief Environment Officer, Compliance Monitoring Division, NECS, Thimphu for information.
4. Environment Officer, Dzongkhag Administration, Samtse and Chukha for information.
5. Guard-file (Dzo-Chukha), ESD, NECS for record.



Annexure 2: Quarry/Burrow Management

Source and Impact of Backfilling Materials Quarry

1. It has been estimated that approximately 3.1 million of earth materials will be required for backfilling and reclamation work of the zone A. These materials will be mainly sourced from:
 - a) The Amochu Riverbed along the project site.
 - b) Riverbed near Purbay khola which is a large alluvial fans on the west
 - c) Materials from Tshering Mining, Samtse (Around 15km form Site)
2. All the above quarries are government approved quarry and are in operation stage. These quarries have adequate quantity to meet the required quantity in the project so no opening of additional new quarry is proposed by the contractor.
3. The quarry materials will be collected from Amochhu riverbed and additional material will be procured from licensed vendor already working at quarry.
4. Since quarry site is already in operation so, no drilling and blasting will be carried out only loading and transportation of material from quarry to the project site will be conducted and all the legal requirement will be fulfilled.
5. The anticipated environmental impacts associated with the quarrying activities is as below:
 - (i) Dust generation deterioration of ir quality due to excavation, loading, transportation and unloading activities
 - (ii) Increase in noise pollution due to excavation and transportation
 - (iii) Land degradation/ land slides
 - (iv) Impact on river bed
 - (v) Risk of water contamination due to quarrying activities in the riverbed
 - (vi) Increased accident risks
 - (vii) Traffic jam and road accidents
 - (viii) Occupational health and Safety
 - (ix) Disturbance and loss of aquatic biodiversity

Impact Mitigation Measures

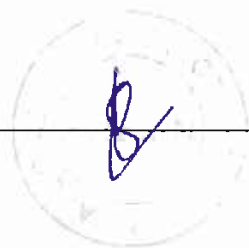
Mitigation measures during transportation:

- Water sprinkle will be carried out on all approach road towards quarry site.



- To avoid spillage of material on roads trucks/dumpers with proper tail board will be engaged and all will be covered with tarpaulin during transportation.
- To avoid noise vibration during transportation vehicle will be properly maintained.
- To avoid congestion on roads or easily movement of vehicle consultation with existing user will be done.

Particulars	Details	Preventive Control Measures
	Loading	Water sprinkling will be done before loading by making it moist.
	Transportation	<ul style="list-style-type: none"> •Water sprinkling during transportation over approach roads will be done for suppression of dust. •Regular maintenance of machinery will be carried out. • Overloading will be prevented. •Trucks/Dumpers will be covered by tarpaulin covers.
	Monitoring	<ul style="list-style-type: none"> •Periodic air quality monitoring will be done and adequate measures will be taken
Noise Management	Transportation	<ul style="list-style-type: none"> • Source of noise will be during operation of transportation vehicles, for this proper maintenance will be done at regular intervals. • Oiling & greasing at regular interval will be done. • Adequate silencers will be provided in all the diesel engines of vehicles. • Minimum use of horns and speed limit of 10 km/hr.in the village area. • It will be ensured that all transportation vehicles carry a valid PUC Certificates.



ANNEXURE 3: STANDARD MEASURES FOR POLLUTION CONTROL

1. Procedures For Air Pollution Control Measures

1. Scope :

This procedure is applicable to the dust and emission generated at the construction site due to different activities such as excavation, movements of vehicles and equipment, transportation of materials, stockyards and operation of different plants and equipment

2. Purpose:

To reduce the impact of dust and gaseous pollutants on the health of personnel and surrounding areas.

3. Description:

Identify the probable Air Emission Equipment, Machines and Operations. The Site should maintain their own list of Equipment and Machines.

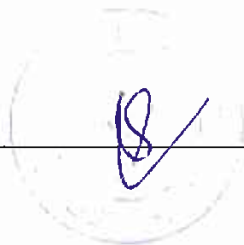
- Carry out the measuring / sampling at the source and at different levels.
- Note the reading in the format.
- If the dust and other pollutant level is observed above the prescribed value by the Legislative requirements or by the Site, initiate the controlling action.

3.1 Control of Dust & Air Emissions

- Air Emissions shall be controlled by using proper Equipment and machines. Equipment maintenance should be carried out at regular intervals.
- Every day morning before the Site operation starts, water spraying / sprinkling should be done to the entire site.
- Proper Spray system should be used so that water can be utilized in effective way without wastage.
- Water sprinkling over the all the exposed surface including the road network within the work area, stock yard, and excavated area will be carried out through tankers fitted with sprinklers. A daily log book will be maintained for indicating the sprinkling duration.
- Every two hours this cycle should be continued so that dust can be under control.



- Sprinkle water on top of the Metal/Coarse aggregate which will also help in settling the dust while transferring metal for concreting / batching plant / crusher.
- The approach road to the site can also be watered using sprinkler system to reduce the dust.
- The top of the Fine aggregate / sand can be sprinkled with water in a mild way to bring down the dust under control.
- While transferring the fine aggregate /sand/metal in dumpers, ensure that it is covered with tarpaulin in order to control the dust
- The point where the cement is transferred to batching plant or mixer shall be covered with Gunny bags or plastic sheet in order to prevent the accumulation of cement dust particles.
- While sprinkling the water the quantity of water used should not exceed that required to control the dust and the concerned person should ensure that water used should not affect the HOUSE KEEPING OF SITE.
- Loose excavated materials to be keep covered.
- The quantity of water to be used will depend on the area of the site.
- The Engineers working at the site and HSE officer should make it sure that the sprinkling is done in a proper way.



2. Procedures For Noise Pollution Control Measures

1. Scope

This procedure is applicable to the noise producing equipment and vehicles operating at the site. The high noise level is anticipated near DG sets, Batching Plant, excavation area in this project

2. Purpose:

To ensure that the noise levels are within the tolerable and acceptable limits. Also the ambient noise level should be within the legal requirements.

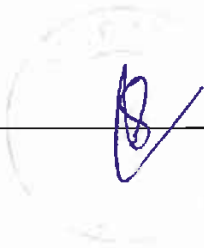
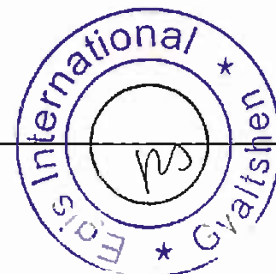
3. Description:

Identify the probable Noise Generating Equipment, Machines and Operations.

- Following are the common Noise Sources:

Sr. No.	Equipment	Noise Level in dB(A)
1.	Dumper	85+
2.	Excavator	85+
3.	Roller	>85
4.	Concrete	98
5.	Shuttering	91
7.	Sand Blasting	85
8.	Concrete Pour	97 (95 to 98)
9.	Carpentry Work	92
10.	Blasting	100
11.	Diesel Generators	95
12.	Air Compressor	95
13.	General Work	94

- Take a Calibrated Noise Level Meter (dB Meter)
- Carry out the measuring / sample at the source and at different levels, during various time of the day once every week. Note the reading in the format.
- If the noise level of the equipment / machines / operations are observed above 85 dB (A), we have to initiate the controlling action.

Control of Noise

- Renew dumper trucks exhaust silencer. Reroute dumper through the quieter site areas.
- Diesel Generator Sets (DG Set):-Normally noiseless generators sets will be installed at site. However the DG set without enclosure at manufacturing level, the noise should be controlled by providing an acoustic enclosure or by treating the room acoustically.
- Maintenance of DG sets and equipment will be carried out at regular interval.
- Ear Protection boundary will be defined at 12-meter distance from the high-level noise Equipment / operation. All person working within this boundary will use ear protection like ear muffs and ear plugs.
- Enough Ear Muffs and Ear Plugs should be easily available for the employees, where high level noise is generated.

Permissible Noise Level Limits (Bhutan Environment Standards 2010):

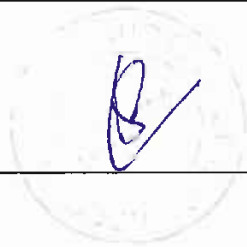
Area	Day Time (0600 hrs-2200 hrs.)	Night Time (2200 hrs. – 0600 hrs.)
Industrial	75	65
Mixed	65	55
Sensitive	55	45

Maximum value allowed in workplace in any point of time is 75 dB (A)

Noise emission limits for construction equipment used during night time hrs.

Measured at 50 ft. from construction equipment:

Equipment Category	L _{MAX} Level dB(A)
Back hoe	80
Bar bender	75
Chain saw	81
Compactor	80
Compressor	80
Concrete Mixer	85



3. Noise Monitoring Format

Noise Monitoring Field Record Sheet		
Monitoring Location		
Description of Location		
Date of Monitoring		
Measurement Start Time (hh:mm)		
Measurement Time Length (min.)		
Noise Meter Model/Identification		
Calibrator Model/Identification		
Measurement Results	L _{day}	
	L _{night}	
	L _{Eq}	
Major Construction Noise Source(s) During Monitoring		
Other Noise Source(s) During Monitoring		
Remarks		
Name	Signature	Date
Recorded By:		
Checked By:		





4. Procedure For Water Pollution Control Measures

1. Procedure:

Water pollution control strategy will comprise:

1. Measures during site planning.
2. Measures for prevention of wastewater generation.
3. Measures for wastewater treatment, and
4. Measures for proper wastewater disposal.

2. Mitigation

Measures for Water Pollution Control in Site Planning

1. A drainage system will be constructed to drain off all surface water from the work site into suitable drain outlet.
2. Temporary drainage works will be maintained, removed and reinstated as necessary, and precautions will be taken for avoidance of damage by flooding and silt.

Measures for Minimization of Generation of Water Pollutants

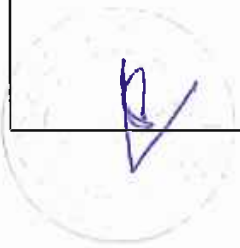
1. Cement Grouts used in diaphragm wall construction will be collected in a separate slurry collection system. It will be reused to the extent possible.
2. When reuse does not remain practicable then it will be disposed off at nearest landfill site after obtaining permission from agency owning the landfill and under the conditions imposed by the agency concerned.

Measures for Wastewater Treatment

1. If waste water discharge is likely to contact surface water body then sedimentation tanks of sufficient capacity to trap silt-laden water before discharge into the outlet drain will be provided.
2. When required, oil separator /interceptors will be provided to prevent the release of oils and grease into the drainage system. These will be cleaned on a regular basis.

Measures for Water Pollution Control with Proper Disposal Arrangement

1. Wastewater arising from site offices, canteens or toilet facilities will be discharge into septic tanks followed by soak pit. No wastewater is let to discharge in river.
2. Washout of construction or excavated materials will be diverted to drainage system through appropriate sediment traps.



Annexure 4: Camp Management Plan

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1. SITE LAYOUT:

1. Temporary campsite will be constructed on the eastern side of Amochhu River. The campsite will have following facilities:

- a) offices for both the employer and contractor,
- b) accommodation for staff, supervisors and labours,
- c) kitchen area for staff, supervisors and labours,
- d) storage area for material and aggregate,
- e) batching plant with silos for storing cement,
- f) DG shed,
- g) weigh bridge,
- h) laboratory containers,
- i) Toilets,
- j) Gym,
- k) parking area,
- l) Guard Cabins

2. The site will be guarded parametrically with galvanised iron sheets to prevent unauthorised entry. Two entry gates will be provided one for the access in office and one for the transport carrying materials and aggregate. Both the gates will have guard post, only authorised persons with valid identity card will be allowed to enter the area. On the other side of the road there will be accommodation area for staffs and labour workers, living area will also have security cabins to prevent unauthorised entry. The site layout that will be constructed shown is below



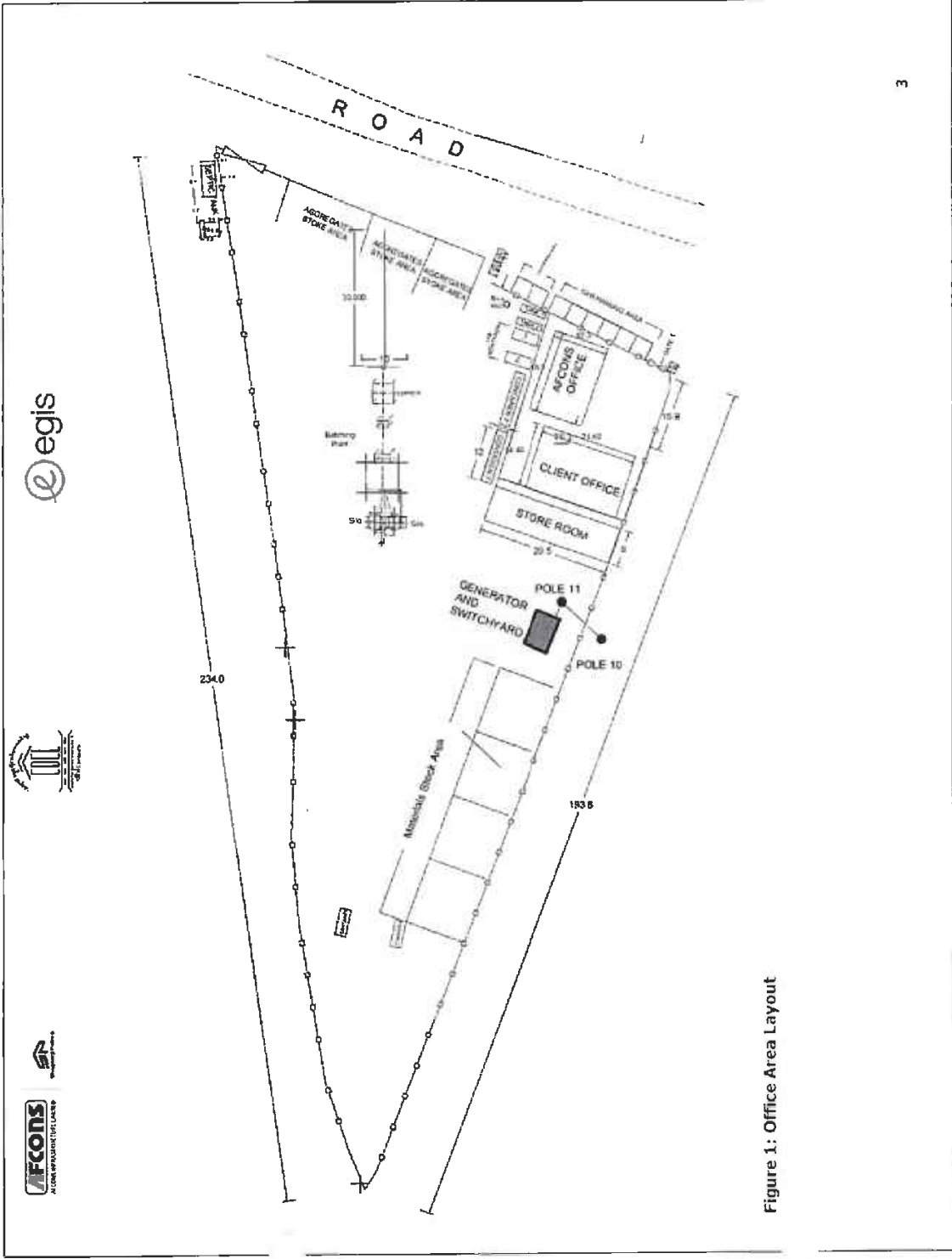


Figure 1: Office Area Layout



CAMP AREA

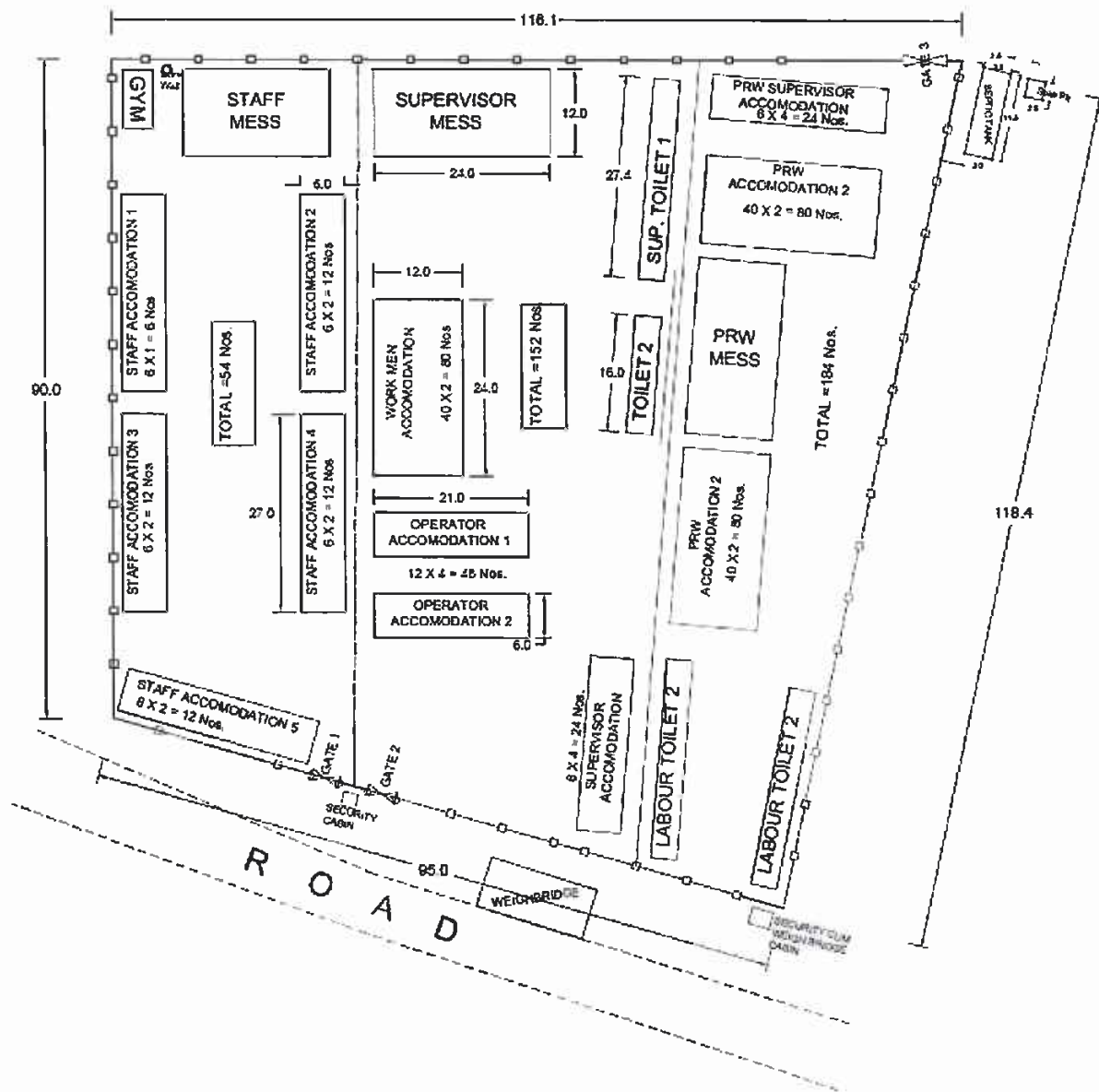


Figure 2: Accommodation Camp Area layout

Handwritten signature or initials.



2. Workforce Requirement

3. The project requires large number of workforces to be employed. Manpower will be recruited from both India and Bhutan. According to the requirement Engineers, Skilled, semi-skilled and unskilled manpower will be deployed at different stages of the project. As per estimation about 700 manpower will be required for different construction activities. Depending upon availability of workers for specific jobs, the recruitment of local workers from Bhutan will be preferred.

Table 1: Category wise workforce requirement

SN.	Type	Number of Manpower
1.	Engineers	50
2.	Highly Skilled	8
3.	Skilled	271
4.	Semi-skilled	28
5.	Unskilled	343
	Total	700

3. Camp Workforce Community & Security Rules

4. All staff/ workmen residing in the project Camp shall abide by the rules of the company and maintain strict discipline and not indulge in activities detrimental to the interest of the Company. Security is utmost important for all of us to follow certain guidelines and protocols to ensure safety of all.

3.1 Security installations:

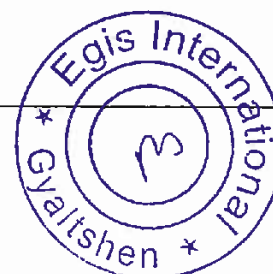
- Heightened boundary wall thought the main Camp.
- Security check posts will be installed for access control on main gate.
- Installation of CCTV cameras at strategic locations.
- Security agency – M/s JSS has been deployed for round the clock security supervision.

3.2 Gate timing:

Main Gate (Residential Camp): Will be locked from 10PM to 5AM;

3.3 Visitors:

- Contractors, labours, drivers, milkman, newspaper vendor, car washing person, cable TV payment collectors, courier personnel i.e. anybody other than Employees & Residents Staffs

needs to enter register during in and out only from front gate and will be frisked. They should display "Visitor" card while staying inside premises. Card to return up on leaving premises.

- b) Visitors arriving at late nights after 10.00 PM and early morning before 6.00AM will be escorts by security guards shall escort.
- c) In case of any doubt by security personnel, respective member may be called to seek permission of the person entry.
- d) No beggars, hawkers, company/person for promotional activity will be allowed inside without permission of Administration.

3.4 Vehicles:

5. Vehicle entry/ exit:

- a) Car entry from main gate only by documenting entry and exit with proper frisking.
- b) Any other vehicle cars, buses, office pick up cars needs to enter and exit from main gate only.
- c) Overnight parking for outside vehicles/ Sub Contractors will not be allowed, unless member provides information to security. These cars may be towed out.

3.5 Alcohol and Drugs Policy:

- a) Any kind of intoxication will strictly be prohibited on the site.
- b) Drinkers will be suspended/terminated from the site without any notice.
- c) Routine alcohol test will be conducted

3.6 Employment Visa Restriction/Work Permit

- 6. The workers engaged locally from Bhutan do not require any employment visa/work permit but there is regulation in Bhutan for engaging foreign workers. In the project AFCONS intends to engage workers from Bhutan and India. For workers from India there is no requirement of working visa however a work permit is required from Department of Immigration for all non-Bhutanese workers including Engineers and labours.
- 7. Before engaging any worker in the project, the valid citizen ID and work permit will be cross checked and recorded.

4. Amenities at Campsite

Following facilities will be at site:



4.1. Dwelling Units

8. At the campsite apart from office complex and plant site, accommodation for staff and labor is proposed. Dwelling unit for 50 staff members and 350 labors will provided in the camp with all basic facilities.
9. Recreational facilities like gym and outdoor game like badminton will be provided and canteen facilities will also be provided within campsite for both residents and day workers.
10. Separate toilet facilities for male and female is provided on the camp site

4.2. Power Supply

11. The power supply will be taken from Bhutan Power Corporation for which permission has already been taken. Apart from that 4 DG sets are also provided for running plants and equipment

4.3. Water Supply and Treatment

12. On an average it is estimated that, about 60 KLD of water will be demanded by 700 workers for domestic purpose, for that it will sourced from the bore well/tube well dig within the camp area. The water will be stored in tanks and supplied for use. The water quality in general is good (Based on EIA Report) and does not requires any elaborate treatment. However, it is proposed to disinfect the water prior to distribution, for that suitable water purifier/filters will be setup.

4.4. Drainage System

13. Waste water generated from the camp will be drained from underlying HDPE drainage pipe line to the septic tank and separate drainage system will be there for the wastewater from Mess. At every 15-meter distance there will be manhole for routine maintenance of drainage system. The drainage line proposed will have adequate slope for the flow of wastewater under gravity. The figure shown below is tentative proposed drainage system.



WATER SUPPLY LINE AND SEWERAGE SYSTEM AT OFFICE AREA

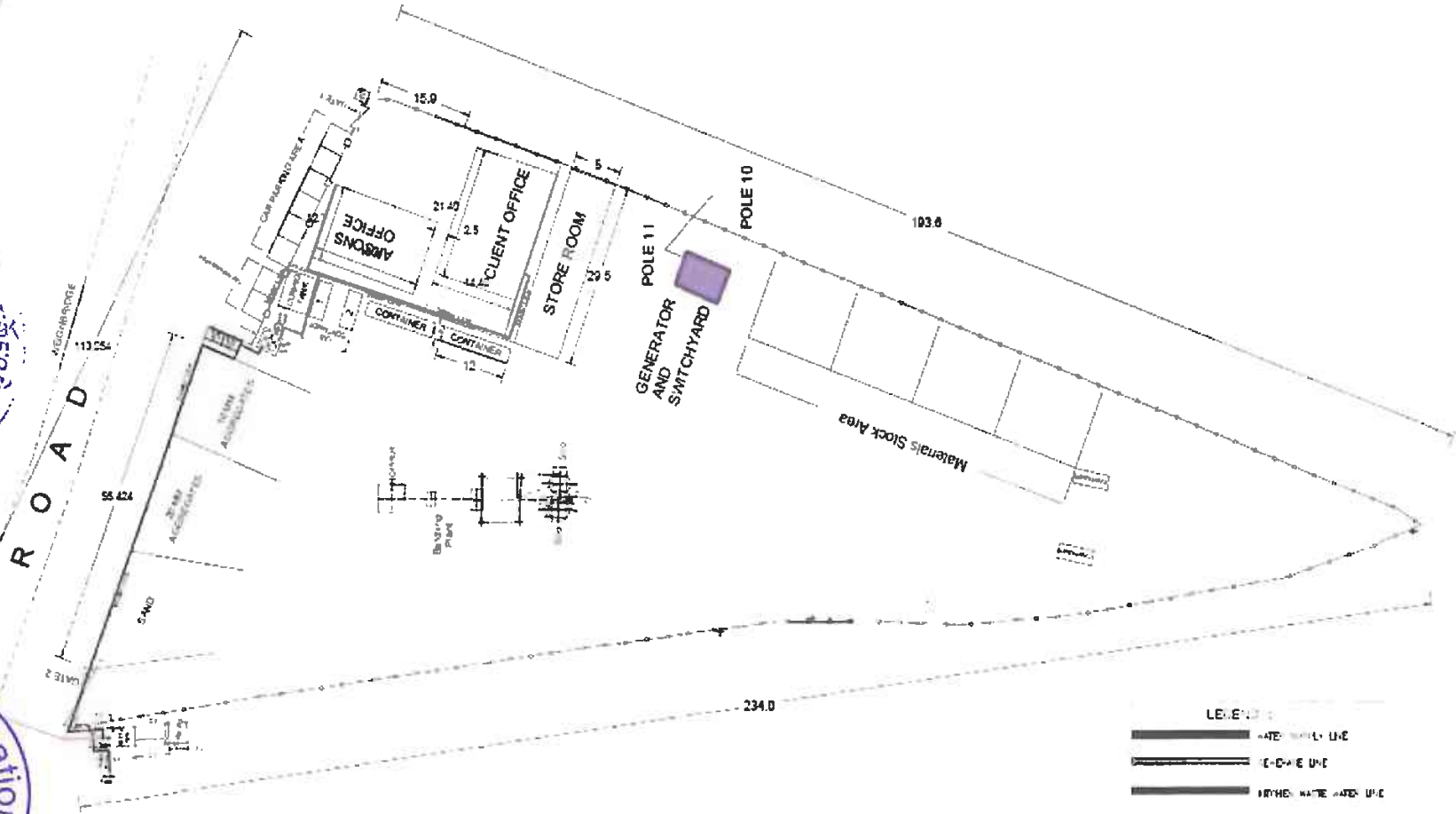


Figure 3. Sewerage Drainage System (Office area)

WATER SUPPLY LINE AND SEWERAGE SYSTEM AT CAMP AREA

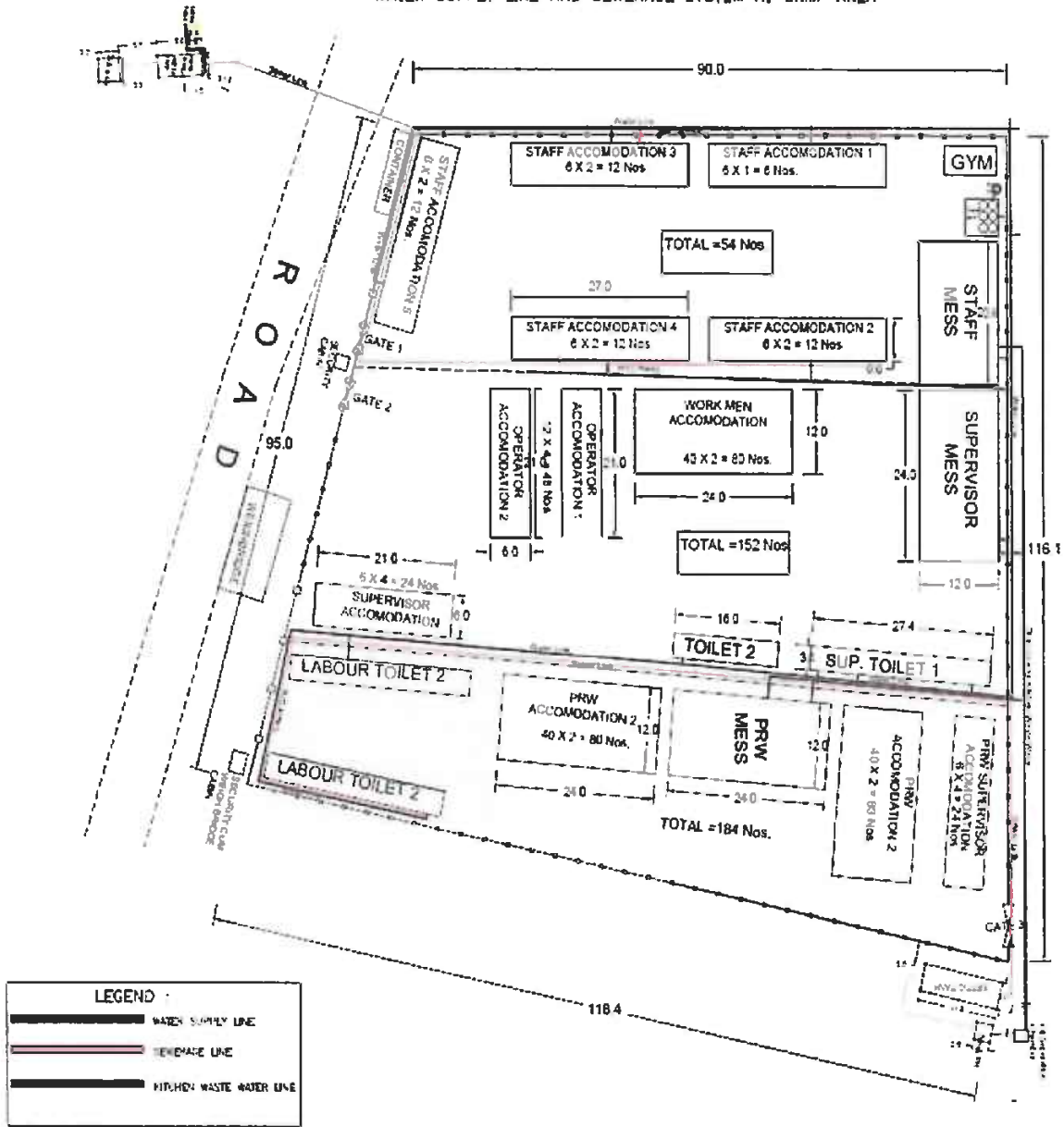
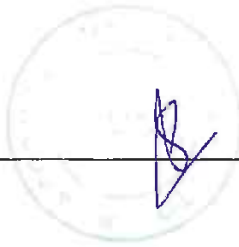


Figure 4: Sewerage drainage system (Accommodation Area)



5. Liquid Waste Management

14. Liquid waste or wastewater will be generated from toilets and kitchen. About 45KLD of wastewater is going to be generated from camp area which is to be treated before final disposal. A separate treatment will be laid for grey water i.e. kitchen area and black water i.e. toilet area.

5.1 Grey Water Treatment

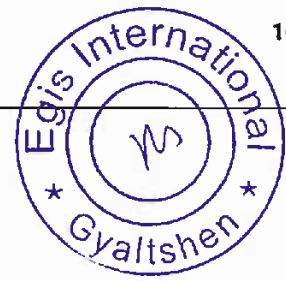
15. Effluent coming from kitchen area contains oil & greasy material which will be removed before treatment for that kitchen area drain line is fitted with grease trap followed by ACF before discharging it into the soak pit. It will be insured that the treated effluent will be under prescribed discharge standard limit before disposal.

5.2 Black water Treatment

16. There are 15 toilets proposed in camp for the staff and other labours, out of which about 45 KLD sewage will be generated, the details of which are shown in Table 2 below. The sewage from toilet will be treated in septic tank followed by soak pit as shown in figure 5 and 6 below. Two septic tanks will be constructed in camp one near office area and one near accommodation area. The sludge from septic tank will be cleaned periodically with local operator at Phuentsholing Thromde.

Table 2: Specification of septic tanks and soak pits

S. No.	Location	Technical Specification
1.	Accommodation Area	
	Septic Tank	
	Population Demand	700 persons
	Quantity/Flow of Sewage	45 KLD(Approx.)
	Quantity of Sludge generation(yearly)	21 KLD(Approx.)
	Detention Period	24 Hours
	Length of the tank	11.5 meters ~ 12 meters
	Breadth of the tank	3.8 meters ~ 4 meters
	Height of the tank	1.5 meters + 0.3-meter free board
	Soak Pit	
	Length of the pit	2.5 meters
	Breadth of the pit	2.5 meters
	Height of the pit	1.8 meter
2.	Office Area	
	Septic Tank	
	Population Demand	300
	Quantity/Flow of Sewage	18 KLD (Approx.)

S. No.	Location	Technical Specification
	Quantity of Sludge generation (Yearly)	9 KLD (Approx.)
	Detention Period	24 Hours
	Length of the tank	7.5 meters
	Breadth of tank	2.5 meter
	Height of the tank	1.5 metes + 0.3 meter free board
	Soak Pit	
	Length of the pit	2.5 meters
	Breadth of the pit	2.5 meters
	Height of the pit	1.8 meter

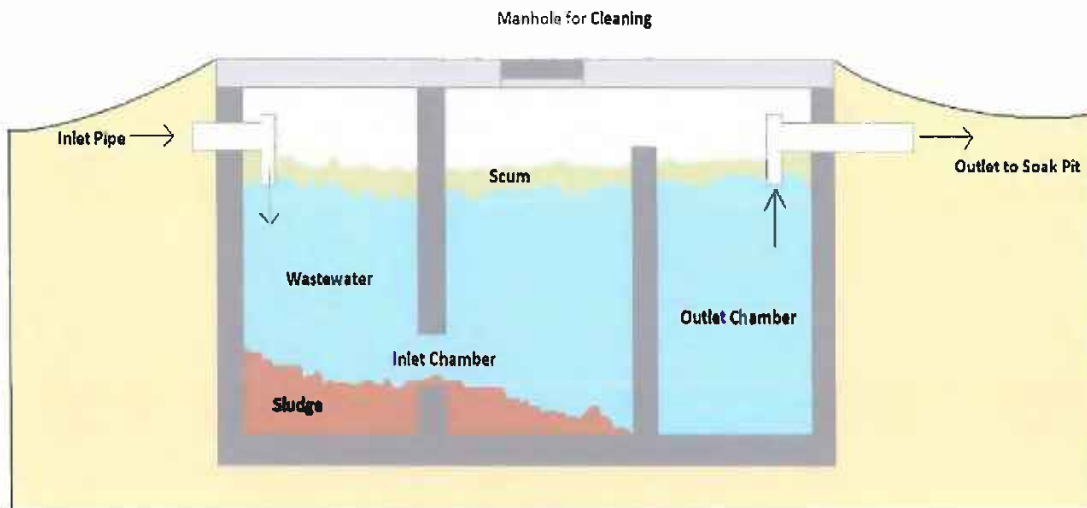


Figure 5: Schematic Diagram showing the layout of septic tank

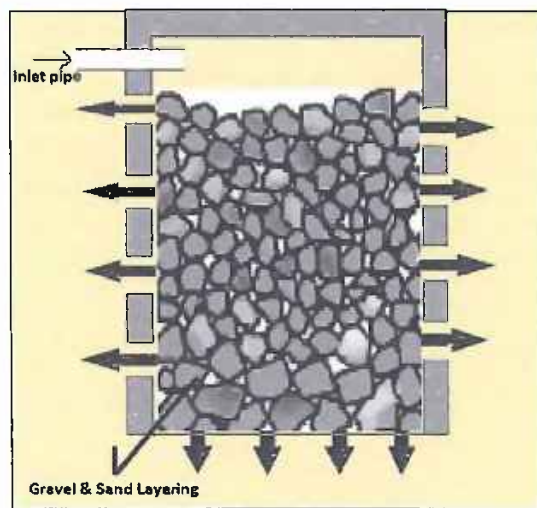
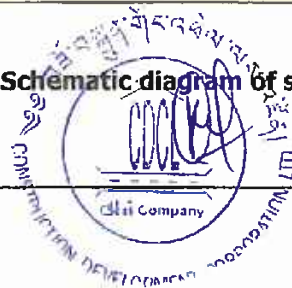
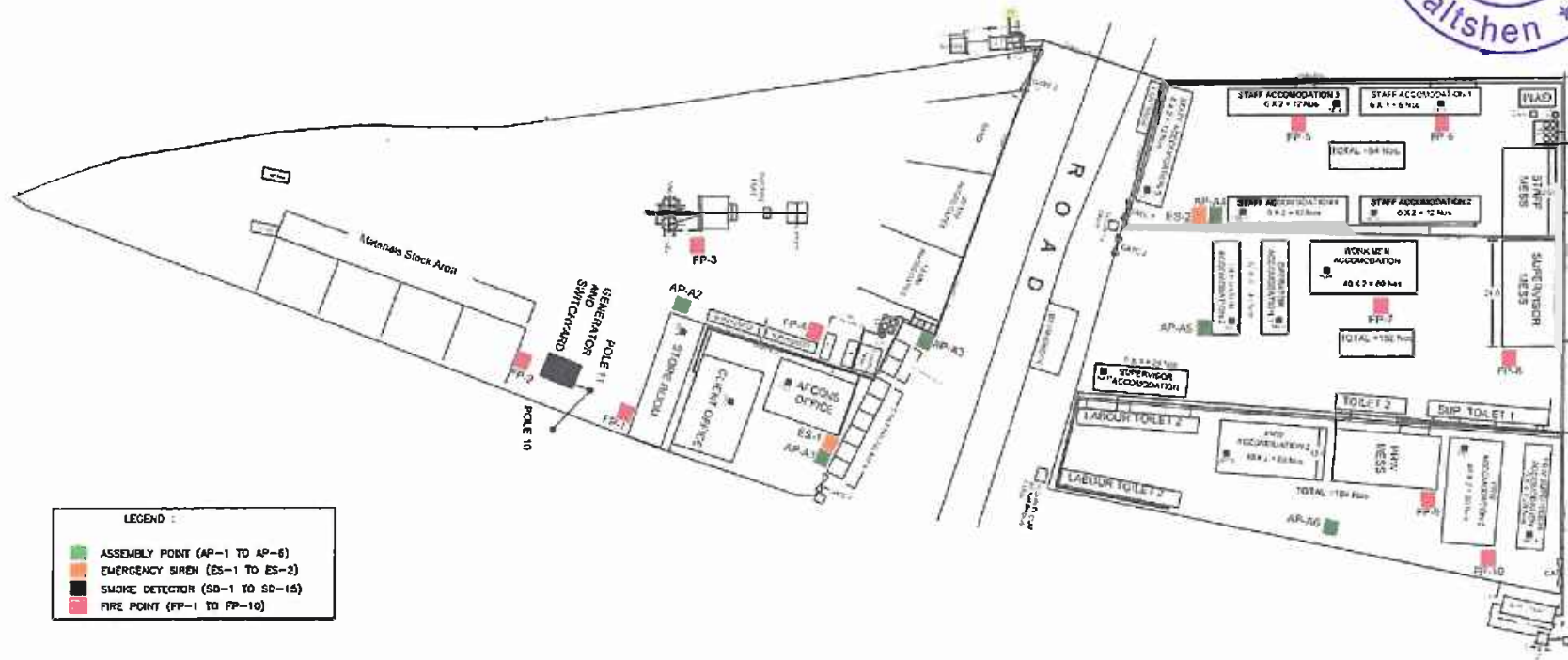


Figure 6: Schematic diagram of soak pit



OVER ALL LAYOT OF OFFICE AND CAMP AREA
WATER SUPPLY AND SEWERAGE SYSYTEM



LEGEND :

■	ASSEMBLY POINT (AP-1 TO AP-6)
■	EMERGENCY SIREN (ES-1 TO ES-2)
■	SMOKE DETECTOR (SD-1 TO SD-15)
■	FIRE POINT (FP-1 TO FP-10)

AFCONS
AFCONS INFRASTRUCTURE LIMITED
AFCONS HOUSE, 16, SHAN INDUSTRIAL ESTATE,
VEERA DESAI ROAD, ANHNER (W), MUMBAI 400023 (INDIA)

CLIENT : M/S CONSTRUCTION DEVELOPMENT CORPORATION LTD.
PROJECT : CONSTRUCTION OF RIVER TRAINING AND EMBANKMENT WORKS FOR PHUENTSHOLING TOWNSHIP DEVELOPMENT PROJECT (PTDP), BHUTAN

DRAWING TITLE : OVER ALL LAYOT OF OFFICE AND CAMP AREA (LOCATION OF FIRE POINT AND ASSEMBLY POINT)

DRG. NO.	AFC/6462/001	DATE	18/12/2018	NO. REV.	
DRAWN BY :		CHECKED BY :		SHEET NO.	01
			SCALE	1 : 1	



Figure 2: Site Layout assembly point, Emergency Sirens, Smoke Detectors and fire points

6. Solid Waste Management

17. During the construction phase of the project, there will be an influx of technical staff, laborers and other service providers into the project area, for that there will be temporary office and employee's accommodation area. About 650 laborers and 50 technical staff will envisage. The solid waste that likely to be generated from camp is about 3.65 MT/Day. The main sources of the waste being generated from camp area are:

- a) Biodegradable and food waste from Kitchen
- b) Soil waste from Septic Tank
- c) Non-Biodegradable waste from both office and accommodation area
- d) E-Waste from Office area
- e) Bio-medical waste from First-aid Area
- f) Hazardous waste from store and mechanical work shop

18. The waste being generated will be segregated and collected in colour coded dustbins. The segregated waste from the site will be collected by Phuentsholing Thromde on regular interval of 3 times a week and that will be disposed at the existing landfill site. Even small amount of medical waste from first-aid activities will also be disposed in existing landfill site.

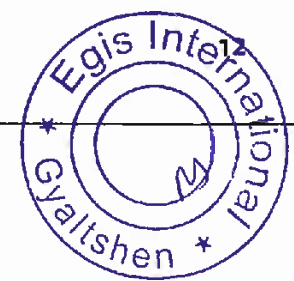
19. The hazardous waste like empty paint, admixtures drums, unused Bentonite and waste fuel and oil will be generated from store and mechanical work shop, these wastes will be recycled to authorised recycler and waste will be store at designated place within the premises.

20. Bentonite used for Diaphragm wall is sodium based on the average 150 metric tonne will be generated as a waste and that will be disposed after proper drying in cakes.

21. Dry cakes of Bentonite will be disposed at the Phuentsholing Landfill

Table 3: Waste characteristics and its storage and disposal methods

S. No.	Types of Waste	Source	Storage/Segregation	Disposal
1.	Biodegradable Waste	1. Kitchen/Mess Area 2. Office Area	Green Bin with Biodegradable Label	Phuentsholing Thromde
2.	Non-Biodegradable Waste	1. Accommodation Area 2. Office Area	Blue Bin with Non-Biodegradable Label	
3.	Soil Waste	1. Septic Tank	-	
4.	Bio-Medical Waste	1. First-Aid Area	Red Bin with Bio-Hazard Label	
5.	E-Waste	1. Office Area	Yellow Bin	

S. No.	Types of Waste	Source	Storage/Segregation	Disposal
6.	Bentonite	1. Diaphragm Wall Construction	Within Waste storage area	Dry cakes and then disposed to decided disposal site at Phuentsholing Landfill

7. Storage Area for fuel, Lubricants & hazardous material

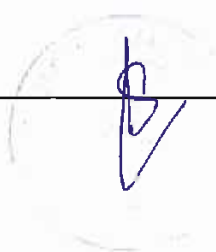
22. During construction diesel, lubricants and hazardous chemical materials like paints, admixtures, solvent etc. will be used for different purposes. All the material will be purchased in bulk or stock will be kept, for this well protected storage area will be constructed within camp area. Storage area will have entry prohibited sign-only authorised personnel is allowed to enter the store area, fire extinguishers and proper label will be displayed for designated storage of material. Storage and handling procedure of such material is discussed below:

7.1 Storage of fuel, oil and lubricants:

- The availability of separate measuring cans (of different capacities – 1 liter, 2-liter, 5-liter) and funnels for the issue of the various grades of oils.
- Proper labelling and handlings instructions will be displayed in containment area.
- Placement of oil drums, cans in drip trays should be ensured for contamination of any spillage.
- Availability & use of appropriate pumps / transfer equipment for the transfer of spilled oil.
- Catch-drain will be provided to arrest any spillage of oil & stored in the designated bin.
- The fresh left-over oil will be kept/poured back into the respective containers kept in the maintenance section / sub store-using funnel to avoid spillage.

7.2 Storage of paint, chemical and hazardous material

- Hazardous material will be stored on raised impervious surface to avoid contamination of land and MSDS will be refer for proper handling of the hazardous material.
- Storage of incompatible, flammable/reactive solvents and chemical will be stored separately.
- Proper labelling and PPE will be used.
- While transferring chemicals and solvents, proper safety will be ensured to prevent any spillage and if spillage occurs, wipe clean with cloth and put in designated bin.
- Chemicals and solvents that are stored for a long period will be check for leakage from time to time.
- Empty containers of chemicals and solvents will be disposed as per Waste Management guidelines.



8. Proposed Operational Compliance Checklist

Table 4: Daily inspection checklist for camp

		PHUENTSHOLING TOWNSHIP DEVELOPMENT PROJECT (6462) Daily Inspection Checklist for Camp	
Doc. No.: CEMP/CMP/6462/01		AFCONS INFRASTRUCTURE LIMITED	Revision No:00
S. No.	Description	Yes/No	Remarks
I	WATER/SANITARY FACILITY		
1.	Adequate drinking water is provided		
2.	Sufficient water facility is provided for cooking, bathing and laundry purpose		
II	TOILET/BATHING & WASHING FACILITY		
3.	Toilet facility is sufficient as per the strength		
4.	Toilet is regularly cleaning		
5.	Floor drain provided in and around the area to remove the waste water and facilitate cleaning		
III	ACCOMMODATION FACILITY		
6.	Sufficient accommodation is provided with proper ventilation		
IV	ELECTRICAL & LIGHTING FACILITY		
7.	Sufficient illumination is available in and around the camp		
V	MESS FACILITY		
8.	Hygienic food is provided to workers		
VI	FIRST AID & FACILITY		
9.	Adequate first aid facilities are available		
10.	First-aid kit contains all necessary items		
11.	Ambulance is available on site		
12.	Ambulance equipment are working properly		
VII	FIRE PREVENTION FACILITY		
13.	Are there sufficient fire points with suitable equipment available		
VIII	HEALTH SURVEILLANCE		
14.	In case of emergency the medical facility is available.		
IX	TRANSPORT FACILITY		
15.	Always the condition of company transport vehicles are fit & maintained.		
X	SECURITY FACILITY		
16.	Appropriate security systems are functioned		
XI	HOUSEKEEPING FACILITY		
17.	Appropriate skips are used in camp premises		
18.	Disposal of waste material, cleaning of camp area and cleaning of drainage block work are carried out on a regular basis		
Date:			
Checked By:	Name and Sign:		
Reviewed By:	Name and Sign:		
Joint Review:	Name and Sign:		Name and Sign:
	HSE In-Charge		Admin In-Charge

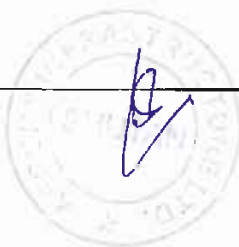


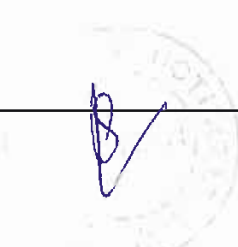


Table 5: Weekly inspection checklist for camp

 		PHUENTSHOLING TOWNSHIP DEVELOPMENT PROJECT (6462) Weekly Inspection Checklist for Camp	
Doc. No.: CEMP/CMP/6462/02		AFCONS INFRASTRUCTURE LIMITED	Revision No:00
S. No.	Description	Yes/No	Remarks
I WATER/SANITARY FACILITY			
1.	Adequate drinking water is provided		
2.	Sufficient water facility is provided for cooking, bathing and laundry purpose		
3.	The distribution lines of water supply is frequent an in good condition.		
4.	Are water tanks cleaned		
5.	R.O. plant filter and membrane quality		
II TOILET/BATHING & WASHING FACILITY			
6.	Toilet facility is sufficient as per the strength		
7.	Toilet is regularly cleaning		
8.	Floor drain provided in and around the area to remove the waste water and facilitate cleaning		
III ACCOMMODATION FACILITY			
9.	Sufficient accommodation is provided with proper ventilation		
10.	Is there notice board with all information		
11.	Proper signage is provided		
IV ELECTRICAL & LIGHTING FACILITY			
12.	Sufficient illumination is available in and around the camp		
13.	DG's & other electrical equipment are properly maintained		
14.	Wires and cables used for connection are of Industrial standard.		
15.	Drip tray provided for DGs		
V MESS FACILITY			
16.	Hygienic food is provided to workers		
17.	Sufficient workers are provided for kitchen work		
18.	Food waste is disposed at proper location		
VI FIRST AID & FACILITY			
19.	Adequate first aid facilities are available		
20.	First aid kit contains all adequate items.		
21.	All time first aider is available		
22.	All time centralized ambulance is available		
23.	Inspection of in ambulance equipment and oxygen cylinder		
24.	Bio-medical waste is disposed as per rules		
VII FIRE PREVENTION FACILITY			
25..	Are there sufficient fire points with suitable equipment available		
26.	Fire equipment inspected daily		
27.	Emergency evacuation plan is displayed		
28.	Proper fire exit signs with arrow marks is provided		
VIII HEALTH SURVEILLANCE			
29.	In case of emergency the medical facility is available.		
30.	Person's employment medical report is available		
31.	Medical examination is done by qualified medical doctor		
IX TRANSPORT FACILITY			
32.	Always the condition of company transport vehicles is fit &		





	maintained.		
33.	Transport service by bus or car available		
X	SECURITY FACILITY		
34.	Appropriate security systems are functioned		
35.	Emergency alarm system is available		
36.	CCTV cameras are working properly		
XI	HOUSEKEEPING FACILITY		
37..	Appropriate skips are used in camp premises		
38..	Disposal of waste material, cleaning of camp area and cleaning of drainage block work are carried out on a regular basis		
XII	STORE AREA		
39.	Fuel, lubricants, paints etc. are stored at designated place with proper handling guidelines.		
40.	Proper warning signs are displayed.		
41.	Fire extinguisher is provided.		

Date: _____

Checked By:	Name and Sign:	
Reviewed By:	Name and Sign:	
Joint Review:	Name and Sign:	Name and Sign:
	HSE In-Charge	Admin In-Charge



Table 6: Health and Hygiene Checklist

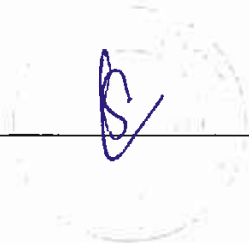
 	PHUENTSHOLING TOWNSHIP DEVELOPMENT PROJECT (6462) Health & Hygiene Checklist
Doc. No.: CEMP/CMP/6462/03	AFCONS INFRASTRUCTURE LIMITED
Revision No:00	

S. No.	Description	Frequency	Yes / No	Remarks
A General				
1	Water accumulation / stagnation are cleared.	Daily		
2	Illumination level is checked and records maintained. (50 - 60 lux at night time)	Weekly		
3	Septic tanks and drains are inspected to prevent overflow or clogging.	Monthly		(Mention last inspection date)
4	Pest control done, mention last pest control date and due date.	Quarterly		
B Living Quarters / Rooms				
1	Floors are cleaned with disinfectant.	Daily		
2	Dust bins with lid are provided in each room and cleaned.	Daily		
3	Windows are fitted with mosquito screens and air tight.	Weekly		
C Bathrooms and Toilets				
1	Bathrooms and toilets clean and cleaned using disinfectant.	Daily		
2	Water supply via tap or bucket is provided in each toilet.	Daily		
3	Liquid soap or similar for hand-washing are available at hand wash unit.	Daily		
4	Leakages to be checked.	Daily		
5	Bathrooms and walkway areas are kept dry and anti-slip.	Daily		
D Drinking Water				
1	Drinking water is provided by dispenser and ensures no leakage.	Daily		
2	RO servicing performed regularly as per manufacturer instructions, if available and records maintained.	Monthly		
3	Drinking water analysis performed and records maintained.	Quarterly		(IS 10500:2012)
E Kitchen, Storage and Dining Area				
1	Food handlers are provided with disposal caps, aprons and plastic hand gloves and are they using while handling food.	Daily		
2	Kitchen is made restricted area and sticker placed.	Daily		
3	Hand-wash soap / liquid are provided in kitchen at sink.	Daily		
4	Exhaust fans are properly working and area well ventilated.	Daily		
5	Waste bins with lid are provided and emptied.	Daily		
6	Kitchen and serving utensils are cleaned with hot water.	Daily		
7	Foods items are properly covered after preparation. Spice /	Daily		



	container lids are closed.			
8	Vegetable stored in shelves at least one foot above the ground.	Daily		
9	Detergent, soap, insect killers and other chemicals are stored in a separate location away from food storage.	Daily		
10	Area illumination level checked (200 lux).	Weekly		
11	Medical examinations (physical and blood investigation) are carried out for all food handlers.	Half-yearly		
F	First Aid Facility			
1	Hand-wash facility is available with liquid soap or similar.	Daily		
2	Bio-medical wastes are disposed in three different color bags (Red, Blue and Yellow) and maintained and disposed regularly with authorized agency.	Daily		
3	First Aider/Doctor visits conducted. Records maintained.	Weekly		(Where first aid room is available)
4	Bed-sheets and pillow cover changed.	Weekly		(or after contamination)
5	First aid box has sufficient items as per list provided in box and inspection checklist is maintained.	Monthly		

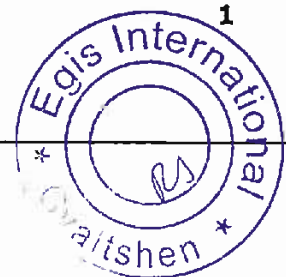
Date:		
Checked By:	Name and Sign:	
Reviewed By:	Name and Sign:	
Joint Review:	Name and Sign:	Name and Sign:
	HSE In-Charge	Admin In-Charge



Annexure 6: Occupational Health And Safety Management Plan

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1. INTRODUCTION

1. The infrastructure development in Bhutan takes place with a balanced and environmentally sustainable development in its projects.
2. As Bhutan is located entirely within the Himalayan mountain range, it is increasingly experiencing water induced disasters such as floods and flash floods. Such disasters occurring from time to time along the Amochhu River have encroached the scarce agricultural land and unsafe terrain including steep hillsides and floodplains of Phuentsholing city.
3. In the process of prioritizing economic and infrastructure development, the Eleventh Five year plan identified Phuentsholing as a Regional growth centre that can be safely expanded through construction of flood protection works and planned Urbanization along the Amochhu river bed.
4. The Asian Development Bank after conducting due diligence on Technical, Financial, Environmental safeguards and other aspects had approved loan and grant for the Phuentsholing Township Development Project (PTDP) (Figure 1) to be implemented by CDCL.
5. Subsequent to the funding of the project, AFCONS has entered into an Agreement with CDCL for the execution of certain Sections of the Works mentioned therein.
6. For performing those works in detail, under the Specific Provisions of the 'Particular Conditions of Contract', a Contractor's Occupational Health and Safety Management Plan shall be prepared and submitted for approval and hence this document is established.

2. SCOPE OF THIS DOCUMENT

7. The scope of this document is defined by the following reference documents:
 - a) Contract Document Sub-clause 4.18 of Contract Conditions
 - b) CLAUSE 6.7: HEALTH AND SAFETY
 - c) Terms and Conditions mentioned in the approvals granted by statutory authorities as applicable for this Project.
 - d) Standing Instructions of the Engineer as per the provisions of the Contract Document, if any during the works
 - e) Standards and Codes of Practices as applicable for certain activities.
 - f) RGoB standards stipulated by Environmental Ministry of Labor and Human Resource



3. BRIEF SCOPE OF WORK

8. The HSE Plan has been prepared for Project: **"PHUENTSHOLING TOWNSHIP DEVELOPMENT PROJECT, BHUTAN."** This HSE Plan is a guideline for all employees of AFCONS INFRASTRUCTURE LTD as well as its subcontractors for ensuring minimum risk to environment, property and human beings working on site or at the interfaces where construction activity is in progress. This HSE Plan will enable the control of Environment, Health & Safety risks and help in the continual improvement of its HSE performance. AFCONS will strive towards achieving a good safety culture throughout the Project to promote Safety as a **"SHARED RESPONSIBILITY"** among all levels in the organization and with sub-contractors. This plan shall be revised as necessary in parallel to the progress and development of the project.

9. In addition to this HSE plan **AFCONS INFRASTRUCTURE LTD**, shall comply with all requirements stated in contract requirements-as well as the bound legal and other requirements.

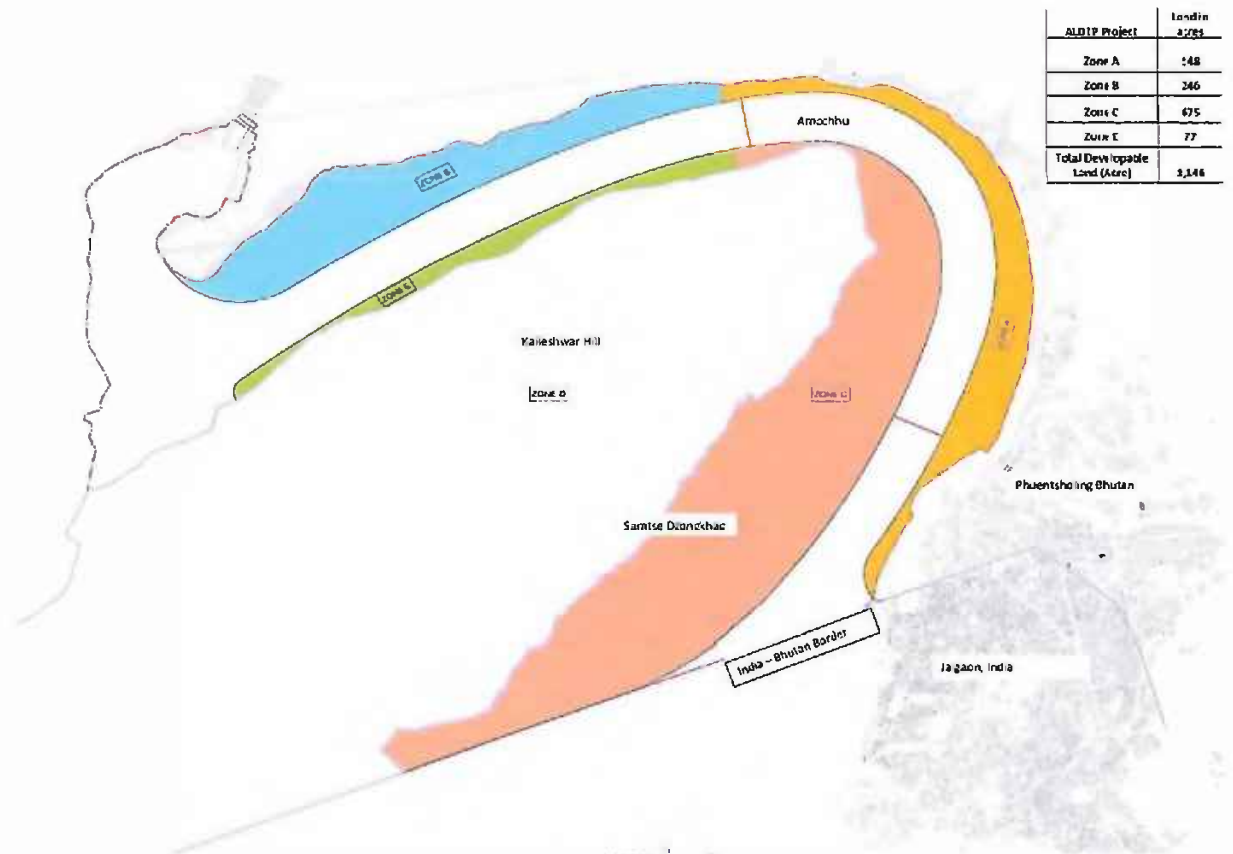


Figure 1: Project Zoning



10. The scope of works are as follows:

1. Riverbank protection length : 3,974m
2. River Training Works
 - a) Diaphragm wall
 - b) Cast in situ wall
 - c) Anchor slab
 - d) Dead man anchor
3. Embankment Works
 - i. Embankment
 - ii. Retaining wall
 - iii. Special filling behind retaining wall
 - iv. Ducted outfalls
 - v. Open outfalls
 - vi. Access
 - vii. Hill slope stability
4. General Earth Filling Works
 - i. Earth filling
5. Promenade Finishing
 - i. Lower Level Walkway
 - ii. Upper Level Walkway
6. Irrigation and Landscape Works
 - i. Irrigation works
 - ii. Landscape works
 - iii. Vetiver works on sloped embankments
 - iv. Tree plantation on lower walkway
 - v. Tree plantation on upper walkway
7. Miscellaneous works
 - i. Site Access
 - ii. Logistics (Traffic Management)
 - iii. Mobilization of equipment (Equipment delivery and assembly)
 - iv. Mobilization of construction materials
 - v. Work areas establishment with facilities
 - vi. Storage of site materials (Material storage)
 - vii. Accommodation including fencing, security and food facilities
 - viii. Staff welfare activities
 - ix. Documentation, meetings
 - x. Vendor management
 - xi. Safety, Health & hygiene provisions
 - xii. Future interface work



4. REFERENCES

11. In making this plan, assistance has been taken from
 - a) ISO 14001:2015 Environmental Management System
 - b) OHSAS 18001:2007 Occupational Health & Safety Management Systems Specification / ISO 45001:2018 OHS Management System
 - c) CLIENT Conditions of Contract Document on Health, Safety & Environment
 - d) Environment Impact Assessment Report, CDCL, Bhutan
 - e) Regulation on Occupational Health and Safety (OHS) for Construction Industry (2012)



5. TERMS AND DEFINITIONS

12. **Project Name: "PHUENTSHOLING TOWNSHIP DEVELOPMENT PROJECT"**
13. **Executing Agency: Asian Development Bank(ADB)& Druk Holding And Investments Ltd.(DHI)**
14. **Implementing Agency (PMU &PIU): Construction Development Corporation Ltd. (CDCL)**
15. **Project Implementing Consultant (PIC): EGIS International**
16. **Contractor Name: AFCONS Infrastructure Ltd**
17. **Subcontractor:** Any individual or company which is engaged by AFCONS Infrastructure Ltd to perform work at the site or to provide labour, equipment, facilities or material, to be used at the site.
18. **Vendors Acts & Regulation:** Any acts and regulation of Bhutan together with the relevant amendments and revision thereof that the AFCONS Infrastructure Ltd and its subcontractors are required to comply with during the contract period.
19. **Environment – Surroundings** in which an organization operates, including air, water, land, natural resources, flora, fauna, humans, and their interaction
20. **Environment aspect – Element** of an organization's activities or products or services that can interact with the environment
21. **Environment Impact – Any change** to the environment, whether adverse or beneficial, wholly or partially resulting from an organization's environmental aspects
22. **Hazard – Source, situation, or act** with a potential for harm in terms of human Injury or ill health, or a combination of these.
23. **Ill Health – Identifiable, adverse physical or mental condition** arising from and/or made worse by a work activity and / or work-related situation
24. **Incident – Work related event (s)** in which an injury or ill health (regardless of severity) or fatality occurred, or could have occurred. An accident is an incident which has given rise to injury, ill health or fatality. An incident where no injury, ill health or fatality occurs may also be referred to as a "near-miss" , "near-hit:", "close call or "dangerous occurrence" An emergency situation is a particular type of incident
25. **Audit – Systematic examination** to determine whether activities and related results conform to planned arrangements are implemented effectively and are suitable for achieving the organization policy and objectives.



26. Interested Parties – Individual or group concerned with or affected by the HSE performance of an organization.
27. Non-Conformity – Any deviation from work standards, practices, procedures, regulations, management system performance, etc. that could either directly or indirectly lead to injury or illness, property damage, damage to workplace environment, or a combination of these.
28. Objectives – Goals in terms of HSE performance that an organization sets itself to Achieve.
29. Occupational Health & Safety – Conditions and factors that affect the well-being of employees, temporary workers, contractor personnel, visitors and any other person in the workplace.
30. HSE Management System – Parts of overall management system that facilitates the management of the HSE risk associated with the business of the organization. This includes the organizational structure, planning activities, responsibilities, practices, procedures, processes and resources for developing, implementing, achieving, reviewing and maintaining the organization’s HSE Policy.
31. Organization – Company, operation, firm enterprise, institution or association, or part thereof, whether incorporated or not, public, that has its own functions and Administration.
32. Performance – Measurable results of the HSE management system, related to the organizations control of environment, health & safety risk, based on its HSE policy and Objectives.
33. Risk – combination of the likelihood and consequences of a specialized hazardous event occurring.
34. Risk assessment – overall process of establishing the magnitude of risk and deciding whether or not the risk is tolerable.
35. Safety – freedom from unacceptable risk of harm.
36. acceptable risk – risk that has been reduced to a level that can be tolerated by the organization having regard to its legal obligations and its own HSE policy
37. Deviation or non-conformity – is defined as something not in compliance with quality standard, specification or measuring requirements, or as deviations from specified procedures or way of working within production, environment, working environment (safety) or security.
38. Corrective action – action taken to eliminate the causes of an existing non-conformity, defect or other undesirable situation.

39. Preventive action – Action taken to eliminate the causes of a potential non-conformity, defect or other undesirable situation in order to prevent occurrence or Recurrence.

6. HSE POLICY

40. **CDCL Occupational Health and Safety Policy Statement declaration**

Annexure 6: Occupational Safety and Health Management Plan





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Construction Development Corporation Limited
Head Office
Thimphu, Bhutan

OCCUPATIONAL HEALTH AND SAFETY POLICY STATEMENT
DECLARATION

The management of Construction Development Corporation Limited (CDCL) is firmly committed to a policy enabling all work activities to be carried out safely and with all possible measures taken to remove or at least reduce risks to the health, safety and welfare of workers, contractors, visitors and anyone who may be affected by our operations.

We are committed to fully comply with the Labour and Employment Act of Bhutan 2007, and relevant occupational Health and Safety Legislations.

The management will:

1. Provide and maintain safe working environment through recognizing, assessing, controlling and evaluating hazards at workplace periodically;
2. Provide and maintain plant at toxic substances in safe condition;
3. Implement emergency management plans/procedures;
4. Provide and maintain facilities for welfare of workers;
5. Provide information, instruction, trainings and supervision that is reasonably necessary to ensure that each worker is safe from injury and risk to health;
6. Assign clear roles and responsibilities at different levels in terms of health and safety at work;
7. Provide adequate budget for occupational safety and health programs including return to work program;
8. Integrate health and safety in all decisions including those dealing with purchase of plants, equipment, machinery, material and selection and placement of personnel;
9. Provide a commitment to continually improve our performance through periodically reviewing policy, regular monitoring and effective management.

We ensure that each worker of the Company shall:

1. Comply with any direction given by management for health and safety;
2. Comply with safe work practices with the intent of avoiding harm/injury to himself or herself and others and damage to plant and equipment;
3. Take reasonable care of the health and safety of himself or herself and others;
4. Wear and maintain personal protective equipment and clothing wherever necessary;
5. Not misuse or unnecessarily interfere with anything provided for health and safety;
6. Report accidents and incidents no matter how minor, occurring on the job immediately;
7. Report all known or observed hazards to their supervisor or manager.

We ensure that all contractors, sub-contractors, transporters other agencies entering the premises of the enterprise and visitors shall adhere to the health and safety rules of the company.

Endorsed on 30th April 2018

(Phuntsho Gyeltshen)
 Chief Executive Officer

Registered Office: Pongyal, Lhasa, China
 Telephone: 86-29-88123456
 Fax: 86-29-88123457
 E-mail: info@cdcl.com

Figure 2: CDCL OHS statement

41. AFCONShas **corporate OHSE policy** which is applicable to all its project sites and offices.

Annexure 6: Occupational Safety and Health Management Plan



AFCONS

OCCUPATIONAL HEALTH, SAFETY & ENVIRONMENTAL POLICY

AFCONS is a largescale Infrastructure business entity engaged in the construction of Jetty works, Bridges, Roads, Heavy Civil Engineering Structures, Viaducts, Underground Metro and Foundation Engineering works in concrete and steel in India & Overseas and Engineering, Procurement, Construction, Installation and Commissioning of Oil & Gas Platforms & Subsea Pipeline works.

At AFCONS, we are devoted to achieve excellence in Infrastructure business complying with Health, Safety and Environmental Standards. Good HSE performance is critical to the success of our business.

We are committed to,

- Identify and comply with Occupational Health, Safety and Environmental related laws, rules and regulations and agreements.
- Clearly define responsibilities for achieving HSE objectives & to ensure adequate resources are provided for imparting training and motivation
- Identify hazards, perform an OH, S & E risk assessment for all site activities to reduce risk to acceptable limits to achieve ZERO accidents.
- Report, Investigate, document & take corrective action to prevent re-occurrence of workplace accidents/incidents.
- Follow a systematic approach in pollution prevention, waste management and conservation of natural resources by their responsible and efficient use in all our operations.
- Have updated Emergency Response Plan to attend to all types of emergencies and disasters offsite & on site.
- Innovate, design and develop inputs using latest national and international best practices to achieve continual improvement in HSE performance & management.
- Review this policy periodically for its continuing suitability and make it available to all the employees and interested parties.

Place: Mumbai

Date: 07/05/2018

S. Paramasivan
Managing Director

Figure 3: AFCONS OHSE Policy

42. A **site HSE Policy** is developed for individual construction sites, focusing mainly on the type of construction activities related to the site.

Annexure 6: Occupational Safety and Health Management Plan



SITE HSE POLICY

We at 6462 Construction of River Training and Embankment Works Project, Bhutan strive to continually improve the effectiveness of the Occupational Health Safety and Environment Management System by:

- 1 Adopting and implementing Environmentally responsible and safe working practices, Methods and Standards
- 2 Providing Policies to ensure a Safe & Healthful workplace, Preventing work related injury and ill health
- 3 Identifying hazards to perform risk assessment for all site activities to reduce risk to acceptable limits to achieve zero incidents
- 4 Ensuring all employees are made aware of the hazards in their work areas and are trained to carry out Their duties in a safe manner by providing adequate resources and motivation
- 5 complying legal and applicable other requirements
- 6 Protecting the Environment, Prevention of Pollution, conserving energy and natural resources and institutionalizing an effective and efficient waste Management System
- 7 Promoting Awareness amongst employees, sub-contractors, customers and any other interested Parties for enhancing the well-being of personnel and the environment
- 8 Involving the workmen and staff to present their ideas for improvement of safety at site
- 9 Ensuring firm Commitment to Consultation and participation of workers or their representatives in occupational health safety and environmental matters
- 10 Reviewing this policy periodically for it's continuing suitability and make it available to all the employees and interested parties
- 11 Prevention of occupational injury ill health and Environment Pollution is our paramount intention

Date: 15-12-2018

Place: Bhutan

Project Manager

Figure 4: Site HSE Policy

7. HSE OBJECTIVES.

43. AFCONS maintains procedures to establish detailed HSE objectives and performance criteria. We have identified five principle objectives. Our long term objectives shall be supported with half yearly, short and medium term objectives set during the HSE Committee meetings, to



enable structured advancement in overall performance. Our Short and medium term objectives aim to facilitate effective monitoring and measurement practices to identify where a directional change may be necessary, Our Long term objectives are:


- a) To eliminate or minimize any unwanted impacts of hazards and risks to the workforce, members of the public, stake holders & the environment, who may be exposed to the undertakings associated with the Phuentsholing Township Development Project.
- b) Establish and maintain an effective, robust HSE Management system.
- c) Actively contribute to our employees and Sub-contractors' development through support, encouragement and transfer of knowledge and skills.
- d) To simplify the risk, to ensure a sensible approach to risk management and provide hazard awareness training during the entire stages of the project
- e) Conduct Mock drill periodically for awareness during emergency situation.

44. To achieve the objectives a program(s) shall be established. The program shall consider the resources required (financial, human, infrastructure) and the tasks to be performed. Depending on the complexity of a particular objective, AFCONS shall assign responsibility, authority, and completion dates for individual tasks to ensure that the HSE objective can be monitored and measured through its accomplishment. The Objectives shall be in consistent with the site HSE Policy and applicable requirements. The results of assessment of risks and opportunities and the results of consultation with workers shall be taken into account while establishing the objectives. The HSE objectives and program(s) shall be communicated via training and/or group briefing sessions to relevant personnel.

45. **Target: ZERO**

- a) Complete the project with "ZERO" Lost Time Accident.
- b) Provide safe working practices for carrying out normal operation of the work site.
- c) Provide for the identification of aspects & hazards and establish safeguards against Significant aspects and hazards
- d) Provide for response to Emergency situations.
- e) Strive to continuously improve HSE management skills.
- f) Create awareness that environment, health and safety is an integral part of work and that production and safety are inseparable.
- g) Provide thorough investigation into incidents or near miss incidents and establish safeguards to prevent recurrence.
- h) Provide a safe place of work
- i) Identify lines of responsibilities for health, safety & environment
- j) The objectives shall be communicated to all levels of employees with the intent that employees are made aware of their individual HSE obligations.

46. Improvement Program: To meet the HSE policy and objectives, the organization shall establish and maintain improvement program that include the documentation of designated responsibilities for achieving the objectives at relevant functions and levels within the organization and the means and time scale by which the objectives are to be achieved.



8. HSE PLANNING

8.1 Hazard Identification, Assessment & Determining control.

47. The establishment of procedures for hazard identification, risk assessment and the implementation of necessary control measures and the maintenance of these procedures are vital for the project organization. The results from these assessments and the effects of these controls are considered when setting the HSE Objectives & Targets

48. Aspect analysis and risk assessment will be carried out and attached to the Method statement at the work planning stage. After receiving approval from all relevant sections including Health & Safety, the work shall be executed.

49. For any planned, new or modified activity the aspect analysis and risk assessment will be carried out and the HSE management system will be based on the significant aspect and risks encountered. The following hierarchy of controls shall be considered in making the action plans for improvements:

- a) Elimination
- b) Reduce/Substitution
- c) Controls such as Engineering controls, Administrative controls and procedural controls
- d) Isolation
- e) Personal protective equipment
- f) Disciplinary action

8.2 Management of change

50. All risk aspects and impacts of a proposed change are thoroughly evaluated, shall be used and the identified change management forms completed and filled. All proposed, temporary or permanent changes to organization, personnel, systems, procedures, equipment, products, materials or substances shall be formally evaluated to ensure that the health, safety, environmental and financial risks arising from these changes remain at an acceptable level.

8.3 Procurement

51. The HSE in-charge shall liaise with the procurement team in respect of all plant equipment and PPEs that may be purchased in order to ensure specification where provided is fully honored.

52. In the procurement of PPEs, the standards shown in Table 1 are followed

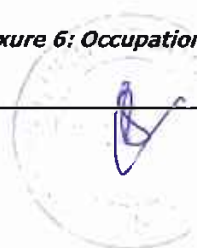
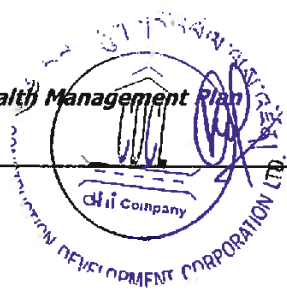
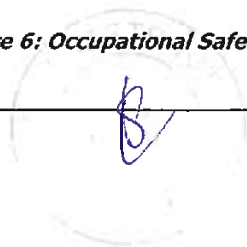


Table 1: PPE Standard range

Description of the PPE	Level of protection offered by PPE
Equipment for eye and ear protection during welding	Goggles, Hand shields and helmets: Direct exposure to moderate and injurious radiation of light, heat, sparks and particles of hot metal.
Rubber Gloves for electrical purpose	Voltage limit: For type 1, 2, 3, & 4; 650, 1100, 7500 and 17000 ac-rms respectively.
Guide for selection of industrial safety equipment for face, ear and eye protection.	<p>Safety spectacles with side shield: Impact against chipping, grinding, stone dressing etc.: Reflected light from sheet metal and lathe work, electrical arc welding etc.</p> <p>Face shield: Impact against chipping, grinding, stone dressing etc.: splashes from molten metals acids, alkali etc., and reflected light and injurious radiant energy.</p> <p>Ear protectors: Noise</p>
Guide for selection of equipment for protection of arms and hands	<p>Leather gloves: Hot work such as welding.</p> <p>Cotton gloves: Light abrasion.</p> <p>Rubber gloves: Light abrasions-Handling cement, concrete, solvents, oil, grease etc.:</p>
Recommendation for selection use and maintenance of respiratory protection equipment	<p>Particle filter: Only particle filtration</p> <p>Gaseous filter: Protection against gases and vapors</p> <p>Self-contained breathing apparatus: Kind of Rescue equipment. Where fresh air is not available or cannot breathe (under water and fume) situations.</p>
Guide for selection of equipment for protection of foot and leg.	<p>Leather safety shoe: Protection from striking against stationary object, Stepping onto hot objects, stepping onto sharp objects, heat radiation and welding sparks and chemicals.</p> <p>Industrial gum-boots: Handling strong acids, chemicals etc.</p>
Guidelines for selection of industrial safety helmet	<p>Chin Strip: Should withstand 10Kgf for 5 minutes</p> <p>Shock absorption: Should withstand 40 KN impact load, independent of the period of application.</p>
Industrial safety belts and harness specifications	Strength: Shall be able to hold a load up to 2000 Kg



Annexure 6: Occupational Safety and Health Management Plan



9. LEGAL AND OTHER REQUIREMENTS

53. The Chief HSE Manager is responsible for reviewing and updating (as and when required) the register of applicable legal and client requirements and for communicating the changes to the relevant personnel, verifying compliance to these requirements. The organization will keep this information up to date.

54. The HSE legal and other requirements applicable to the Project are listed below:

a) The Environment Assessment Act (2000)

As per this Act, whenever CDCL has any Environmental Assessment documents to be submitted to statutory authority, AFCONS shall provide necessary data on written request.

b) Regulation for Environmental Clearance of Projects (2016)

As per this Act, AFCONS shall comply with the Environmental Clearance conditions that are communicated by CDCL / Engineer.

c) The Biodiversity Act (2003)

As per this Act, AFCONS shall strive to conserve and sustainably use the biological resources, if required in the project.

d) Forest and Nature Conservation Act (1995)

As per this Act, AFCONS shall provide protection to the forests, wildlife and use the natural resources optimally during the course of project duration.

e) National Environment Protection Act (2007)

As per this Act, AFCONS shall be participating in replenishing alternative natural resources as part of probable excess resources utilized during the performance of the Contract.

f) Waste Prevention and Management Act (2009) and Waste Prevention and Management Rules (2012)

As per this Act, AFCONS shall be adopting 3R's principle of resource utilization and management. In accordance to this Act and Rules, AFCONS will manage the waste by segregating and disposing to the Authorized recycler.

g) The Water Act of Bhutan (2011) and Water Regulation of Bhutan (2014)

As per this Act, AFCONS shall ensure prevention and control of water pollution.

h) Regulation on Occupational Health and Safety (OHS) in Construction Industry (2012)

As per this Act, AFCONS shall provide facilities to ensure safe and healthful working conditions for the workers and other persons present at workplaces.

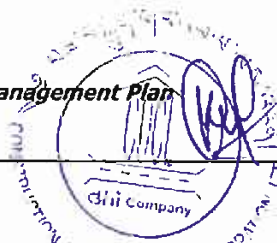
i) Integrated Solid Waste Management Strategy (2014)

As per this Act, AFCONS shall adopt to the objectives of promoting "Zero Waste Bhutan". Our procurement team will be made aware of Extended Producers Responsibility principles to enable them to adopt to the requirements while procuring ancillary materials. AFCONS shall adopt the segregation of waste at the source itself and dispose them in designated color bins as follows:

- j) All organic waste shall be segregated in GREEN bins and non-organic waste in BLUE bins.
- k) All kinds of Healthcare wastes should be kept in RED bags / bins and other domestic hazardous waste and E-waste such as bulbs, CFL, batteries etc. shall be kept in a YELLOW bag / bin and shall not be mixed with any other waste.
- l) All municipalities shall strive for separate collection of inert wastes like road sweep, drain silt, etc.
- m) Construction and demolition wastes shall be stored separately.
- n) Environmental Standards, 2010

As per this standard, AFCONS shall comply with the Ambient Air Quality, Ambient Water Quality, Wastewater Discharge standards, Noise limits and Vehicle Emission Standards and any other standard relevant to the construction activity.

- o) Electricity Act of Bhutan 2001
- p) The Pesticides Act Of Bhutan 2000
- q) Road Safety And Transport Regulations (1999)
- r) Labor and Employment Act 2007



10. IMPLEMENTATION AND OPERATION

10.1 Resources, Roles, Responsibilities, Authority and Accountability

A. Position: Project Manager

Responsibilities and accountability

55. The Project Manager is responsible and accountable for project safety and for working with various departments, employer's representative, and assigned staff to ensure that from project inspection to contract completion adequate resources and top management support are provided to ensure a safe work site in accordance with project safety plan. This includes proper staffing, financial support, safe design and management support for necessary actions taken.

56. The responsibilities and accountabilities shall include the following:

- a) Delegate specific responsibilities and accountabilities to all field management staff and Ensure such functions are carried out.
- b) Establish a realistic Safety Policy for the site.
- c) Make clear and stress at every opportunity that safety and Health are a line responsibility. 'Lead by example'.
- d) Direct field management in carrying out their duties, responsibilities and accountabilities.
- e) He shall be Chairman of Safety Committee Meeting and attend all the internal HSE meetings and delegate this responsibility and accountabilities to Deputy Project Manager or Safety Manager when unable to attend.
- f) Make final decision on matters affecting field construction work, after consultation with various groups within the field organization.
- g) Advise and/or instruct subordinates regarding any actions necessary to correct any hazardous activities or work conditions.
- h) Review and finalize AFCONS INFRASTRUCTURE LTD Safety Management System and Safe Work practices and other Safety Documents.
- i) Authorize Safety Incentive Scheme.
- j) Regular safety walks to the site as frequently as possible to ascertain the work and safety status.
- k) Establish and direct an Accident Investigation Team when an accident occurs.
- l) Suspend work or prohibit the use of facilities, if emergency measures are required, to correct the hazardous activities or work conditions, until their rectification is confirmed.

- m) Remove any person from the site who seriously or repeatedly fails to comply with the safety and security requirements and rules.
- n) Take the lead in promoting housekeeping at the highest standards.
- o) Review safety performance, safety topics, and safety activities, status with the Deputy Project Manager, HSE Manager and the Construction Manager on a regular basis.
- p) Report on safety performance, safety activities, and any accident or near misses, to the employer's representative in a regular and timely manner.
- q) Review and assign the responsibilities and duties of each position.
- r) To monitor and measure, with the field Management Staff and Staff and Safety Department, the safety performance of each employee. Recognition shall be awarded to those who have performed consistently well. Corrective, measure / disciplinary actions
- s) Shall be applied to those who fail to comply with their designated duties, responsibilities and accountabilities.

B. Position: Construction Manager

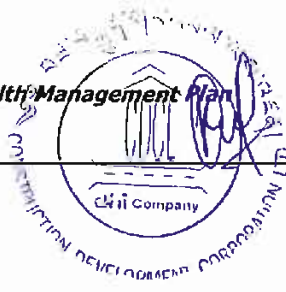
Reports To: Project Manager

Responsibilities and Accountabilities

57. The Construction Manager is to assist the Project Manager to manage, supervise and control construction and safety activities.

58. The responsibilities and accountabilities shall include the following:

- a) Assist Project Manager in construction, co-ordination., schedule / plan, budgeting and technical activities.
- b) Implement Project manager directive as required and acts in his absence or assume fieldwork responsibility when directed.
- c) To Preside over Safety Committee Meeting upon delegation from Project Manager.
- d) Advocate the setting up of the HSE Procedures, Rules and Regulations, HSE Training Plan, etc.
- e) Conduct any other safety meeting and follow up meeting whenever necessary.
- f) Remove any person from the site who seriously or repeatedly fails to comply with the safety and security requirements and rules
- g) Take the lead in promoting housekeeping at the highest standards.



- h) Review HSE performance, HSE topics, and safety activity status with the PM / Chief HSE Manager on a regular basis.

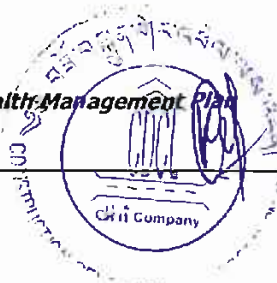
C. Position : HSE Manager

Reports to: Project Manager

Responsibilities and Accountabilities

59. To carry out his duty of ensuring the health, safety & environment of the person employed on site, then he/she shall:

- a) Advise AFCONS INFRASTRUCTURE LTD management on the measures to be taken in the interest of health, safety & environment of persons employed therein.
- b) Develop HSE Management System, HSE Rules and Regulations and Safe Work Practice for the project and monitor its implementation and compliance. Make rules for the disciplinary action in case of any defaults by co-employees or sub contractor's personnel.
- c) Inspect the site personally or direct his/her *safety officer* to Inspect the site on his/her behalf to determine whether there is any Machinery, Plants, Equipment, appliances or any type of manual labor being used in the site which is of such nature that is liable to cause risk or badly injure to any person working or employed in the site.
- d) Investigate any fatal accident and/or dangerous Occurrence, which occurs within the site and any industrial disease contracted in the site.
- e) Compile and maintain HSE statistics and present HSE Performance Report to the AFCONS INFRASTRUCTURE LTD management.
- f) Organize training courses, competitions, contest and other activities, which will develop and maintain the interest of the persons employed on site so as to establish a safe and healthy working condition therein.
- g) Review the Method Statements and Risk Assessment and Suggest improvement or any safety requirement, which needs to be incorporated into the above. Ensure that the respective Engineer applies the approved method statements and safety control stipulated in the Risk Assessments during the execution of the work.
- h) Manage and control situation arising during an emergency. Continuously review the emergency procedure and update accordingly.
- i) Monitor the implementation of the Security Procedure.
- j) Act as Secretary to the Safety Committee established at site and assist the Chairman in directing the functions of the Site Safety Committee.
- k) In the absence of the Chairman, preside at all meeting of the Site Safety Committee.



- l) Monitor the records and compliance of the Maintenance Regime for Construction Equipment and machinery. Shall advise the supervisor on any equipment or machinery, which is due for inspection.
- m) Lease with Statutory Bodies with regards to HSE matters.

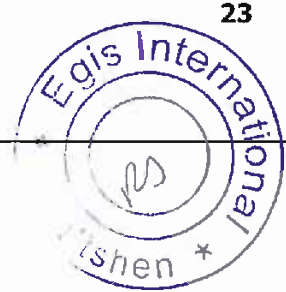
D. Position: Electrical Manager (Electrical Engineer)

Reports To: Project Manager

Responsibilities and Accountabilities

60. The responsibilities and accountabilities shall include the following:

- a) Design of PM / CM Plan of Electrical Equipment as per stipulations in Rules.
- b) Construction, Installation, Protection, Operation and Maintenance of Electrical System, equipment, Instruments and Apparatus at Project sites in line with Rules and conformance of all requisites as per Electrical Rules.
- c) PM and CM of Electrical Equipment as per plan.
- d) Safe Distribution and Utilization of Electrical Power and laying down and compliance of Safety Practices at Batching Plant, Casting Yard and Construction Sites.
- e) Understanding the client's requirements of Electrical safety and communication.
- f) Implementation of best practices at all times.
- g) Maintenance of Bulk Petroleum Storages as per Electrical Norms set forth in Petroleum Act.
- h) Prevention of Electrical Fires- Electrical Energy Management and Control.
- i) Inspection of Own and Contractors Electrical Equipment i.e. ELCB / RCCB Portable Equipment and Tools, Relays, Breakers Welding Sets and Cables etc.
- j) Understanding, Implementation and Training on the following.
 - i. National Electrical Code.
 - ii. Codes of Practice in Electrical Safety set forth by BIS.
 - iii. Codes applicable to Electrical PPE's (And Purchase and Inspection accordingly)
- k) Electrical Energy Conservation Practices and Development of Method Statements.
- l) Energy Budgeting, Monitoring, Control and Optimization.
- m) Analysis of Electrical Breakdowns for CPA and promotion of Safe and Efficient Practices at all levels.
- n) Development of Inspection Protocol in Electrical System in line with Electricity Rules and Check Lists
- o) Calibration of Electrical Equipment / Instruments as per requirement/plan.
- p) Electrical Safety Education, Electrical safety and Energy Audits and Inspection.
- q) Lighting / Illumination and Site Electricity Management.
- r) Operation and Maintenance of DG Sets, Noise Control of DG Sets, Efficient Operation of DG Sets.



- s) Inspection and Audit of Electrical Contractors based on established and controlled Checklists. Licensing of Contractors.
- t) Understanding Aspects/Impacts and Hazards/Risks in Electrical Systems and laying down control practices in line with regulatory provisions and client's requirements to establish, Maintain and Implement HSE System as per ISO 14001: 2015 and OHSAS 18001: 2007/45001:2018 OHS & MS
- u) Electrical Audits by client, Internal Electrical Audits, Inspections and Reporting System adequacy to client's Electrical Engineer.
- v) Training on Bhutan Electrical Rules and Maintenance and Operation of Electrical System and Apparatus.

E. Position: Plant Manager (Mechanical Engineer)

Reports To: Project Manager

61. The responsibilities and accountabilities shall include the following:
- a) Shall report to the Project Manager
 - b) Demonstrate personal commitment to set HSE objectives
 - c) Ensure that all plant sent to site is safe and fully efficient, is guarded and equipped with safety devices and third party tested in accordance with the Construction regulations
 - d) Make certain that all plant operators and banks men are only employed on equipment for which they have been thoroughly trained
 - e) Check that periodic tests, inspections and maintenance are carried out
 - f) Ensure that all repair and maintenance work carried out in site are done in a proper manner by a competent person
 - g) Attend promptly to all plant defects notified or call the attention of site management to the need for dangerous plant to be put out of service until it can be properly repaired
 - h) Check that hired plant is safe and that, where appropriate, copies of current test certificates and relevant documents are available
 - i) Arrange maintenance as per the manufacturer's recommendations

F. Environment Engineer:

Reports To: HSE Manager

62. The responsibilities and accountabilities shall include the following:
- a) The EHS Manager is assisted by the Environment Engineer for the day to day implementation of the approved CEMP.

- b) For any issues arising related to the implementation of CEMP provisions, the EHS Manager appraises the issue to the Project Manager and the Project Manager resolves the issue by assigning the task to competent person(s).
- c) The Environmental Engineer shall be responsible for the induction of all employees to make them aware of the CEMP provisions relevant to them.

G. Position : HSE Engineer
Reports To: HSE Manager

63. The responsibilities and accountabilities shall include the following:

- a) Shall report to HSE Manager
- b) Provide support to the construction department for implementation of project HSE Plan and Set HSE Objectives
- c) Provide leadership, planning and motivation in the implementation of Health, Safety & Environment.
- d) Assist in development and the review of procedures and systems designed to facilitate safe work
- e) Developing, regularly reviewing as appropriate, revising the project HSE plan to ensure that it continues to meet the specific requirements of the project
- f) In consultation with Project Management, regularly review safe work procedures
- g) Establishing a monitoring regime to ensure that unsafe systems, places or practices are identified and remedied at the earliest
- h) Ensure that all reportable accidents and serious incidents are documented and reported to Project Management and the Employer's Representative
- i) Carryout a detailed investigation of major accidents/incidents including near miss on site and convey the findings to all to prevent the recurrence of such type of accidents/incidents in future
- j) Manage and organize the general activities of site safety and give guidance to the Section Managers
- k) Prepare reports at monthly intervals or, as required by Project Management, regarding overall Project HSE Management
- l) Initiate HSE training programmes
- m) Ensuring that the attendance at safety meetings is comprehensive and appropriate. He/she will also ensure that the minutes of such meetings assign actions and timings to named individuals and are promptly distributed to all relevant personnel



- n) Accountable for implementation of HSE plan across the project
- o) Ensuring suitable arrangements are in place to monitor that HSE performance targets are being achieved
- p) Shall ensure that safety committee meeting is conducted on regular basis

H. Position: Safety Supervisors

Reports To: HSE Manager/ Safety Engineer


Responsibilities and Accountabilities

64. The Safety Steward/Supervisor is responsible for the administration of the project HSE plan. Safety steward/Supervisor shall assist the HSE Engineer/ safety officer with HSE matters and ensure liaison and coordination Channels are maintained among the sub-contractor's management on health, safety and environment control.

65. The responsibilities and duties shall include the following:-

- a) Provide HSE information and guidance to supervisors on proper HSE procedures, current and potential hazards and employee training requirements.
- b) Conducts project HSE inspection and reports infractions to the applicable supervisor and the engineer and subsequently inspect to see that infractions are corrected.
- c) Ensure that the respective supervisor applies the approved method statement and HSE control stipulated in the risk assessment during the execution of the work.
- d) Maintain register of any defects or violations observed and of remedial action taken.
- e) Conduct investigation of all fatal, lost time accidents, significant first aid cases, near misses accident and damage to property or equipment. Complete and analyze each accident investigation report.
- f) Conducts the HSE induction programme for new employees and subcontractors.
- g) Assist in HSE training, courses and seminars.
- h) Assist construction supervisors and foremen during the tool box meeting to be held every morning or weekly depending on the working status.
- i) Inspect for fire hazards and check that fire protection equipment is adequate,
- j) Supervise and implement security procedure.
- k) Assist in supervising medical facilities and maintaining medical records.

I. Position : Sr. Engineer / Site Engineer



Reports To: Manager Responsibilities, Accountabilities and Duties

66. The Sr. Engineer shall take the initiative to ensure that the total construction work progress smoothly and safely.
67. The responsibilities and accountabilities shall include the following:
- a) Co-ordinate, plan the work, schedule, and liaise with other necessary department to ensure that conflicts of interest between subcontractors do not occur and are performed in a safe and efficient manner.
 - b) Direct Site Engineers on their safety accountabilities and responsibilities.
 - c) Attend the Construction/Progress Co-ordination Meeting and lead at addressing safety issues in the meetings.
 - d) Analyze all works, identify any serious hazards and be proactive in implementing procedures that encourage safety construction.
 - e) Ensure that the works are carried out as per the approved Method Statement and Risk Assessment.
 - f) Ensure that Method Statements, which incorporate adequate safety provisions for safety, have been provided for all critical work.
 - g) Direct Site. Engineers to check that the work at the site complies fully with the Method Statement and the precautions given.
 - h) Patrol the site daily and ascertain the work and safety Status.
 - i) Advice and/or instruct Site Engineer regarding necessary corrective actions for unsafe activities and hazardous or unhealthy working conditions.
 - j) Review the Tool Box Meeting activities carried out by Subcontractors. Dictate the frequency of Tool Box Meeting of each work group with the advice of the Engineers and Safety Personnel.
 - k) Confirm that Subcontractors are fulfilling their responsibilities with regard to safety requirements.
 - l) When critical measures are required to correct unsafe activities or work conditions, suspend work or prohibit the use of facilities until rectification is confirmed.
 - m) Promote regular housekeeping at the highest standard.
 - n) Ask advice from the Safety Personnel when any doubt exists about Safety Procedure at the site.



- o) Reports to Assistant Manager on any anticipated matters of concern.
- p) Participate in Safety Meetings as required.
- q) Provide assistance and support in any accident investigation.
- r) Identify and instruct/encourage subordinates to participate Safety training, Courses and Seminars.
- s) Familiarize with the AFCONS INFRASTRUCTURE LTD Safety Policy, Safety Manual, Emergency and Evacuation Procedures and any other relevant Safety Programme. 'Lead by Example'

J. Position : Supervisor/Foreman

Reports To: Site Engineer

Responsibilities, Accountabilities and Duties

68. Supervisors are responsible to ensure that
- a) Employees are aware of the Project Health and Safety Plan, Construction Methods, Risk Assessment and Safety Requirements relevant to the individual's specific area of responsibility.
 - b) Employees under their direct supervision are working in compliance with the approved safe systems of working.
 - c) Respond to the recommendation or instructions of the HSE in-charge or designate immediately.
 - d) Report all accidents or incidents immediately to the HSE in-charge.
 - e) Conduct pre-task briefings to operational teams prior to commencing a task and record such briefings.
 - f) Ensure employees are provided with and are using equipment correctly and as per the manufacturer's recommendation.
 - g) Ensure that all tools, machinery and equipment used by the subcontractor are adequate for the job and meet satisfactory standard.
 - h) Ensure that housekeeping standards are maintained and arrangements for waste disposal are made.
 - i) Instruct the subcontractor's personnel under their control on the measures necessary to perform the work safely and without health risks.



- j) Ensure that all workers are familiarized with the Emergency and Evacuation Procedure and ensure compliance with the requirement of the above.

K. Position: Stores Manager.

Reports To: Project Manager

Responsibilities and Duties

69. The responsibilities and accountabilities shall include the following:
- a) Purchase of material as per standards and specifications.
 - b) Maintain specifications for various goods /material to be purchased.
 - c) Maintaining minimum inventory levels for Personal Protective equipment (PPE's)
 - d) Storage of oils, fuels, chemicals, compressed gases and safe handling of the same
 - e) Arrangement of fire extinguishing arrangement at oil, fuel, gas storage areas & site office.
 - f) Storage of heavy and bulky material in lower racks and vice-versa
 - g) Arrangement of safe loading and unloading of materials
 - h) Implementation of FIFO (First In First Out)
 - i) Evaluation of Contractors, their Inspections.
 - j) Emergency Prevention During Transportation, Motor Vehicles Rules, Vehicle Fitness,
 - k) Identify the Areas of Resource Loss and Planning for Improvement.

L. Position : Subcontractors

Reports To: Concern Department Head

70. Subcontractors who intend to carry out work on the Project Sites must comply with these requirements:
- a) Comply with all of the elements of the HSE Plan and any regulations applicable to the work
 - b) Comply with the Construction Method Statements and any document provided in the interests of Health, Safety and Environment.
 - c) Ensure that all of their employees designated to work on site are properly trained and competent



- d) Ensure that all plants and equipment brought on to site have been inspected and serviced in accordance with legal requirement and manufacturer's or suppliers' instructions
- e) Make arrangements to ensure that all employees designated to work or visits to the site present themselves for site induction prior to commencement of work
- f) Provide details of any hazardous substances to be brought on-site
- g) Submit all proposed HSE procedures and construction methods to AFCONS for review
- h) Ensure that a responsible person accompanies any of their visitors to site
- i) Sign and accept the contractor's Safety Agreement
- j) Understand the Disciplinary procedures and make their personnel aware of the same

M. Position: Workers

Reports To: Concern Supervisor

71. All workers, including subcontractor workers:
- a) Use the correct tools and equipment for the job and use safety equipment and protective clothing supplied, e.g. helmets, goggles, ear protection, etc. as instructed.
 - b) Keep tools in good condition.
 - c) Report to the Supervisor any unsafe or unhealthy condition or any defects in plant or equipment.
 - d) Develop a concern for safety for themselves and for others.
 - e) Prohibit horseplay.
 - f) Not to operate any item of plant unless they have been specifically trained and are authorized to do so.

N. Suppliers

72. The responsibilities and accountabilities shall include the following:
- a) Abide by all Safety Standards and - Codes applicable to the materials/products/goods (to be) delivered onto the project site;
 - b) Be aware of the Safety Rules, Regulations and Procedures in effect on the project site as prescribed in this Project H.S.E. Plan;
 - c) Comply with the established safety rules, regulations and procedures as well as safe working practices during operations on and visits to the project site;



- d) Be responsible for notifying in writing any adverse impact on Health, Safety & Environment of their materials/ products/goods delivered onto the project site;
- e) Deliver a Material Safety Data Sheet (MSDS) together with each chemical material or product;
- f) Check in with Consortium site supervision before entering the project site and/or commencing their operations

O. Persons representing Client, Employer's representative and Visitors

73. The responsibilities and accountabilities shall include the following:

- a) Be aware of the Safety Rules, Regulations and Procedures in effect on the project site as prescribed in this Project H.S.E. Plan;
- b) Abide by all safety rules, regulations and procedures established for the project site as well as safe working practices;
- c) Check in with one of the members of the Project Management team so that personal protective equipment will be provided such as hardhat, Safety shoe, eye protection and respirator, where necessary;
- d) Inform the Supervisor concerned before entering the workplace in operation under the supervision and responsibility of that Supervisor.

P. Visitors:

74. A visitor shall be accompanied by the Security guard to the place of visit. He should report to the concerned Activity in-charge or his representative for the purpose of his visit. A brief induction is given to this person and the Activity in-charge shall maintain the induction details and submit the same to the EHS manager for records.

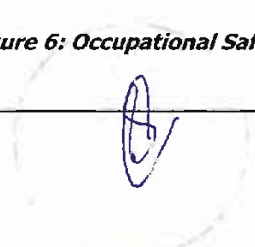
75. The Activity in-charge may send the visitor to the EHS manager for the EHS induction.

10.2 Context of the organization

76. AFCONS 6462 At Bhutan Project shall determine external and internal issues that are relevant to purpose and that affects its ability to achieve the intended outcome(s) of its OHSE management system. Internal & external issues can be positive or negative & include conditions, characteristics, changing circumstance that can affect the OHSE management system.

77. Examples of external& internal issues which can be relevant to the context of the organization include:

- i. Environmental conditions related to climate, air quality, water quality, land use, existing contamination, natural resource availability and biodiversity, that can either affect the organization's purpose, or be affected by its environmental aspects;
- ii. The external cultural, social, political, legal, regulatory, financial, technological, economic, natural and market competitive circumstances, whether national, regional or local;
- iii. The internal characteristics or conditions of the organization, such as its activities, products and services, strategic direction, culture and capabilities (i.e. people, knowledge, processes, systems)
- iv. New knowledge on products and their effects on health & safety.
- v. Introduction of new competitors, contractors, sub-contractors, suppliers, partners and providers, new technologies, new laws and emergence of new occupations.
- vi. Key drivers and trends relevant to the industry or sector having impact on the organization.
- vii. Relationships with, as well as perceptions and values of, its workers and external interested parties.
- viii. Governance, organizational structures, roles and accountabilities;
- ix. Policies, objectives and the strategies that are in place to achieve them;
- x. The capabilities, understood in terms of resources, knowledge and competence (e.g. capital, time, human resources, processes, systems and technologies);
- xi. Information systems, information flows and decision making processes (both formal and informal);
- xii. Introduction of new products, materials, services, tools, software, premises and equipment;
- xiii. The culture in the AFCONS project;
- xiv. Standards, guidelines and models adopted by the AFCONS 6462 at Bhutan project;
- xv. The form and extent of contractual relationships, including for example, outsourced activities
- xvi. Working time arrangements;
- xvii. Working conditions; Changes in relation to any of the above.
- xviii. An understanding of the context of AFCONS 6462 at Bhutan project is used to establish, implement, maintain and continually improve its OHSE Management System. The



internal and external issues that are determined can result in risks and opportunities to the organization or the OHSE management system. The organization determines those that need to be addressed and managed.

10.3 Needs & Expectations of Workers & Other Interested Parties

78. An organization is expected to gain a general understanding of the expressed needs and expectations of those internal and external interested parties that have been determined by the **AFCONS 6462 at Bhutan project** to be relevant. The organization considers the knowledge gained when determining which of these needs and expectations it has to or it chooses to comply with i.e. its compliance obligations.

79. In the case of an interested party perceiving itself to be affected by the organization's decisions or activities related to OHSE performance, the organization considers the relevant needs and expectations that are made known or have been disclosed by the interested party to the organization.

80. Interested party requirements are not necessarily requirements of the organization. Some interested party requirements reflect needs and expectations that are mandatory because they have been incorporated into laws, regulations, permits and licenses by governmental or even court decision. The organization may decide to voluntarily agree to or adopt other requirements of interested parties (e.g. entering into a contractual relationship, subscribing to a voluntary initiative). Once the organization adopts them, they become organizational requirements (i.e. compliance obligations) and are taken into account when planning the OHS management system.

10.4 Consultation & Participation of Workers

81. To ensure that pertinent HSE information is communicated to and from employees and other interested parties the following meetings are required in order to give instructions and consultation related to risk, accident prevention, safe work practices, safety performance and changes that could affect workplace Health, Safety and Environment.

Table 2: Consultation and Participation of workers

Activity	Responsible	Purpose	Participants	Interval	Remark
Monthly Safety Committee Meeting	Safety Dept.	Review of monthly safety issues, discussions on Accidents/incidents, corrective and preventive actions	Management team, section managers, safety department and contractor and employee	Every month on last Friday	To be communicated to all sections, sub-contractors



Activity	Responsible	Purpose	Participants	Interval	Remark
			representatives		
Tool Box Talk	Site Engineer	To highlight safe work practice	Construction staff, workers, sub-contractors	Every day Before start of work	Records to be maintained
Management Review	Chief HSE Manager	Functioning of HSE Plan in the Project	Top Management	Six Months	
Induction Training	Safety Dept.	To highlight Site safety rules and instructions of work area	New employees	At the time of joining	Records to be maintained

82. Workers shall participate in risk assessment and deciding on controls, incident investigation and review of policy and objectives.

83. The consultation and participation of workers, and where they exist, workers' representatives, can be key factors of success for AFCONS 6462 Bhutan project site OH&S management system.

84. Consultation implies a two-way communication involving dialogues and exchanges. Consultation involves the timely provision of the information necessary for workers, and where they exist, workers' representatives to give informed feedback to be considered by the management before making a decision.

85. Participation enables workers to contribute to decision-making processes on OH&S performance measures and proposed changes.

86. At AFCONS 6462 Bhutan project site, workers at all applicable levels are encouraged to report hazardous situations, so that preventive measures can be put in place and corrective action can be taken. Feedback on OH&S management system is dependent upon worker participation.

87. In order to ensure effective worker consultation & participation:

- a) The initial documents (Records & procedures) will be shared through email to all concerned workers, and, where they exist, workers' representatives for consulting their views to improve the OHSE management system. Clear, understandable and relevant information will be provided to all workers through emails and through intranet related



to OHSE management system. Necessary training and resources will be identified and provided in order to ensure effective consultation & participation.

- b) In order to encourage the participation of workers, AFCONS 6462 Bhutan project site ensures that wherever possible determine & remove obstacles and barriers to participation & minimize those that cannot be removed.
- c) The reception of suggestions will be more effective if workers do not fear the threat of dismissal, disciplinary action or other such reprisals when making them.

88. AFCONS 6462 Bhutan project site emphasizes Consultation of non-managerial workers on the following:-

- a) Determining the needs & expectations of interested parties.
- b) Establishing the OH&S policy.
- c) Assigning AFCONS 6462 project site employees' roles, responsibilities and authorities, as applicable.
- d) Determining how to fulfill legal requirements and other requirements.
- e) Establishing OH&S objectives and planning to achieve them.
- f) Determining applicable controls for outsourcing, procurement and contractors.
- g) Determining what needs to be monitored, measured and evaluated.
- h) Planning, establishing, implementing and maintaining an audit programme.
- i) Ensuring continual improvement.

89. AFCONS 6462 Bhutan project site emphasizes the participation of non-managerial workers in the following:-

- a) Determining the mechanism for their consultation and participation.
- b) Identifying hazards and assessing risks and opportunities.
- c) Determining actions to eliminate hazards and reduce OH&S risks.
- d) Determining competence requirements, training needs, training and evaluating training.
- e) Determining what needs to be communicated and how this will be done.
- f) Determining control measures and their effective implementation and use.
- g) Investigating incidents and non-conformities and determining corrective actions.



10.5 Competence, Training and Awareness

90. The Safety Department shall develop HSE-training programme for all employees including workers to create a general safety awareness and safe work practice.

91. Health and safety training shall be given:

- Upon being recruited
- Upon being exposed to new or increased risk

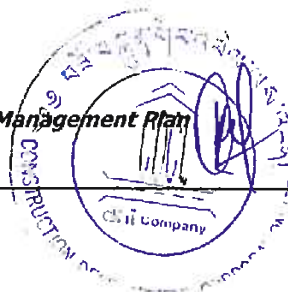


Table 3: HSE training program

Training Packages	For all new emp.	Lifting Supervisor Bank's men Operators and Riggers	All Engineers And Supervisors	All involved In confined space work activities	All employees including workers	All emp.	All Emp.	All	Periodicity
Trainer	Safety Officer	Safety Officer	Safety Officer	Consultant	Safety Officer	Fire SO	SO/ Site Engg	SO	
Basic HSE Induction Courses									At the time of Joining new employee
HEALTH BRIEFING STD/HIV AIDS training									Monthly
Safe slinging and rigging training									Monthly
Job hazard analysis and risk assessment training									Monthly
Confined space training									Monthly
Fire fighting training									Monthly
Emergency preparedness / evacuation and rescue Training(Mock Drill)									Six Months
Tool box Talks									Every Day
Job Specific									Every Day

92. HSE training shall be conducted at site by site safety department having sufficient qualification and experience. External HSE trainings will also be coordinated at site as and when

Annexure 6: Occupational Safety and Health Management Plan



such opportunities are there. Selection of external HSE trainer shall be ensured by top management for his competency in same field.

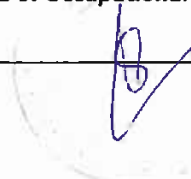
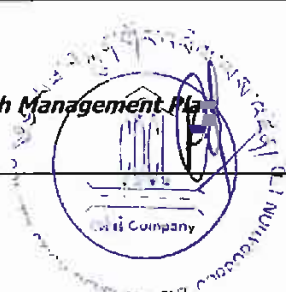
93. **OHS INDUCTION:** It is briefing about the available provisions/resources for the implementation of the CEMP as applicable to the inductee.

94. It covers topics that give information about the project; site OHSE Policy; battery limits; PPE zones; locations of emissions, discharges, noise generating activities; waste segregation and handling; about the organization; and environmental performance with significant environmental aspects and legal applicability.

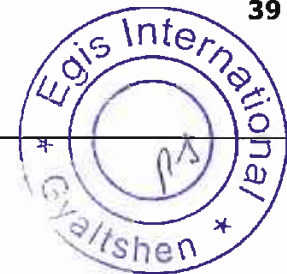
95. Every person who enters the site premises shall undergo the OHS Induction. The activity in-charge shall be responsible for his or any of his team members do not get inducted. Refer Appendix-2(HSE INDUCTION PROGRAM)

Table 4: HSE Training Details

1. The Law and Safety	2. Policy and Administration
Statutory requirement Appropriate regulations Effect of incentive on accident prevention Duties of employer and employee	Effect of incentive on accident prevention Duties of employer and employee Human relations Consultation Safety Officer: duties, aims, objectives
3. Safety and the Supervisor	4. Principles of Accident Prevention
Safety and efficient production go together Attitudes of management, supervision and operations Accidents affect morale and public relations	Attitudes of management, supervision and operations Accidents affect morale and public relations Methods of achieving safe operations Accident and injury causes
5. Site Inspection	6. Human Behavior
The role of management Hazard Identification Procedure Records results Follow-up procedures Feedback	Motivating agencies Individual behavior Environmental effects Techniques of persuasion
7. Site housekeeping	8. Health
Site organization Relationship of site housekeeping to accident Occurrence Site access Equipment storage	Medical examination Hazard to health on site Sanitation and welfare Protective clothing First Aid/CPR

Material stacking Materials handling	
9. Personal Protective Equipment	10. Electricity
Eye, face, hands, feet and legs Respiratory protective equipment Protection against ionizing radiation	Appreciation of electrical hazards Power tools Arc welding Low voltage system Lighting and power system on sites ELCB, RCCB, Grounding/Ground fault circuit interrupters (GFCIs)
11. Oxygen and Acetylene Equipment	12. Equipment
Cylinder storage and maintenance Condition and maintenance of valves, regulators, and gauges Condition and maintenance of hoses and Fittings Pressures	Accidents related to moving parts of machinery Appreciation of principles of guarding Importance of regular maintenance
13. Transportation	14. Excavations
Transport to and from site Hazard connected with site transport Competent drivers Dumpers Tipping trucks Movement near excavations	Method of shoring Precautions while shoring Precautions at edge of excavations Removal of shoring Sheet steel piling
15. Working platforms, Ladders, and Scaffolding	16. Cranes and other Lifting Machines
Hazards connected with the use of ladders Maintenance and inspection Type of scaffold Overloading Work on roofs Fragile material Openings in walls and floors Use of safety belts and nets	Licensing, certification and training required for operation of cranes Slinging methods Signaling Access to crane(s) Maintenance and examination Ground conditions Hazards and accident prevention methods connected with the use of different types of cranes/heavy equipment Crane Lift Plan for all lifts
17. Lifting Tackle	18. Fire Prevention and Control
Slings - single and multi-legged Safe working loads (SWLs)	Principle causes determining fire Understanding fire chemistry



Safety hooks and eyebolts Cause of failure Maintenance and examination	Firefighting equipment Firefighting training
19. Communications	20. Job Specific Activities
Effective methods of communication (particular interest to non-English speaking workers)	
Method and preparation of reports	
Safety committees	
Safety meeting	

96. P & A has been entrusted with the Role of Trainings and Human Resource Development in this direction. Training Plans shall be prepared and the designated agencies shall be contacted for such trainings to all concerned.

97. The Other Inputs in Effective understanding and implementation of the requirements is further elaborated in various Inspection Check Lists which further provide adequate inputs for effective functioning at all levels.

- a) HSE Policies.
- b) Root causes of Failures, Accidents and Non Conformances emerging out of Internal and External Audits.
- c) Legal and Other Requirements.
- d) Method Statements
- e) Design Inputs on HSE Requisites etc.
- f) Changing Requirements to the system if any.
- g) EMS and OHSAS Standards and their Applicability to Project.
- h) Fire Protection, General Measures for Personnel Hygiene and Health Protection
- i) Guide lines given by client

98. It will be ensured that the Sub Contractors and their workforce working on company's behalf are also included in the Training Process. The Records of Trainings shall be maintained by HSE Group.

99. The Operators, Drivers and attendants holding certificates of proficiency are employed to operate particular vehicles, lifting appliances and such other equipment.



10.6 Documentation

100. Documentation shall demonstrate compliance with specified requirements of the HSE Management System for maintaining efficiency of the system

10.7 Control of Documents

101. The identified HSE controlling documents are as follows:

Table 5: HSE controlling documents

Document	Location (Physical)	Issued By	Revised By	Approved By
HSE Policy	Main Office, All Sections	Chief HSE Manager	Chief HSE Manager	Project Manager
HSE Objectives	Safety Dept. (HSE Plan Document)	Chief HSE Manager	Chief HSE Manager	Project Manager
HSE Plan	Safety Dept.	Chief HSE Manager	Chief HSE Manager	Project Manager
HSE Management Records	Safety Dept.	Chief HSE Manager	Chief HSE Manager	Project Manager

10.8 Operational Control

102. The organization shall plan the activities for ensuring that they are carried out under specified conditions by maintaining the following documented procedures that could lead to non-conformities in the HSE Management System:

- a) HSE risk assessment / method statement
- b) Emergency preparedness and response
- c) Communication
- d) Legal and other requirements
- e) Recruitment and Training
- f) Internal Audits
- g) Control of records
- h) Corrective and Preventive Actions
- i) Control of Non-conformities
- j) Document and Data Control




- k) Requirement of PPEs
- l) Management Review

103. The project plan document is describing and controlling the operating procedures related to HSE issues occurring at Project level.

10.9 Maintenance and Inspection of plant and machinery

104. **Objective:** The objective of the maintenance regimes is to ensure that all equipment and machinery used at the site are in good condition and do not present any safety hazard due to inadequate repair and maintenance.

105. **Procedure:**

- a) A list of relevant details, test certificates and legal documents shall be submitted by plant dept. to the safety dept. for records
- b) All equipment and machinery that is to be used on site shall be inspected by mechanic to verify that it is in safe working condition. Relevant records will be maintained as per procedure.
- c) Competent or approved person as required by factories act must inspect all statutory equipment.
- d) Regular maintenance will be done as per manufacturer's requirement and company procedure. Records of it will be made available when asked for.
- e) Operators of heavy machinery will be issued competency certificate by plant in-charge after ascertaining his skill and experience.

10.10 Subcontractor Evaluation, Selection and Control

106. The objectives of subcontractor evaluation, selection and control are to assist the site management in selecting sub-contractors with respect to their ability to carry out work in conformance with AFCONS INFRASTRUCTURE LTD Project Safety Plan.

107. This Procedure is intended for use in the selection and installation of subcontractors. The Project Manager or any other persons appointed by him will be responsible for undertaking this evaluation and selection.

108. **Safety Requirement:** AFCONS INFRASTRUCTURE LTD Project Safety Plan shall be made available to subcontractors bidding work to AFCONS INFRASTRUCTURE LTD and bidding instructions shall include requirements that subcontractors comply with the Project to the above requirements.



109. In the tendering process the sub-contractor shall include in its cost estimating all the items necessary for it to comply with both the general and specific safety requirements.

110. **Selection of Subcontractor:** The Project shall select a sub-contract after evaluating their proposal taking into consideration its cost, quality, schedule and safety.

111. It is recognized that it is not simple to apply quantitative weighting to these considerations.

112. However the project shall avoid awarding of work to lowest bidder without regard to their Safety Management Plan and Performance record.

113. At the time of selecting a sub-contractor, the sub-contractor will be informed that in the event that they select the subcontract out part of its work to others, he shall ensure that its own subcontractors:

- Are aware of and understand their safety obligation described in AFCONS INFRASTRUCTURE LTD Project Safety Plan.
- Have the capacity and ability to perform the work in conformance with AFCONS INFRASTRUCTURE LTD Project Safety Plan.

114. The contractor shall be fully responsible for the actions of its selected subcontractors

11. EMERGENCY PREPAREDNESS AND RESPONSE

115. **Purpose and Scope:** The purpose of emergency planning is to document set of actions and guidelines to be carried out in the event of an emergency if it arises during the course of project operation in the project execution area. The likelihood emergency situations are as identified in risk assessment:

- a) Earthquake
- b) Excavation collapse
- c) Flood & Natural calamities
- d) Structural or Tunnel collapse
- e) Fire & Explosion
- f) Gas leakage
- g) Violence
- h) Storm and Cyclone

116. The Annexure 3: Emergency Preparedness and Response Plan can be referred for detailed information.



12. HSE COMPLIANCE AND MONITORING

12.1 Performance Monitoring Measurement

117. The general procedures are attached in the Project Plan document and shall include:

- a) Monitoring and measurement programme
- b) Monitoring and measurement results
- c) Amendment of monitoring and measurement schedule

12.2 Evaluation of Compliance

118. The organization shall maintain procedures to evaluate compliance on a regular basis and cover the following applicable categories:

- a) Regulatory Compliance
- b) Regulation on Occupational Health and Safety (OHS) in Construction Industry (2012)
- c) PTDP EMP guidelines

12.3 Incidents, Non-conformities and Corrective and Preventive Action

12.3.1 Incidents

119. The routines to be followed upon identification of accidents, incidents must ensure that corrective or preventive action is taken to eliminate the causes of actual or potential accidents or to reduce its re-occurrence.

Table 6: Responsibility and authority for the accident and incidents handling

Action	Responsibility	Support By
Report of accidents and incidents	Section Manager	Safety Department
Investigation Management of accidents and incidents	Section Manager	Safety Department
Mitigation of consequences	Section Manager	Safety Department
Initiation and completion of corrective and preventive actions	Section Manager	Safety Department
Effectiveness of corrective and preventive actions taken	Section Manager	Safety Department



120. The employer and the Employer's Representative shall be notified by the quickest possible means, for example by telephone of the following classifications of accidents and incidents and by subsequent written notification within twenty four hours on the Contractors Accident and incident form.(Appendix 5 FORMATS: Incident Report Form)

121. The Safety department is responsible for the record keeping and reporting of all accidents and incidents. Internal distribution of the accidents and incident reports on site shall be arranged by the Safety department and should include the Site Supervisors.

122. Every month, statistics of accidents and incidents will be submitted to the Client as and when demanded.

12.3.2 Non-conformities:

123. Non-conformities may follow within the following categories:

- a) Failure to the programme or procedures relating to specific applicableregulatory requirements
- b) Failure in the implementation of HSE System

124. The identification of the NC is made within the project, by means of visual inspections, tests or any other observation and control procedure.

125. If a part of the work is found not to conform with the contract, drawing and specification is or any other valid description or requirement (Project Plan, Quality, Environment and Safety procedures) the person responsible for the concerned part of work shall write a Non-conformity Report.

126. Any person, including the client, can alert about an element or action that does not fulfill the specified requirements.

127. Special investigation of HSE non-conformities shall be carried out considering repetitive failures and other recurrent and high potential problems. The types of non-conformities and the effectiveness of reporting and investigation will be assessed. The results of the investigation will be documented and analyzed.

12.3.3 Corrective and Preventive Actions

128. The procedure to define the responsibilities and authority for taking the appropriate corrective and/or prevention action(s) to ensure that these action(s) have been implemented and that there is systematic follow up to ensure their effectiveness are described below:

- a) An accident or major incident to persons or involving machinery / plant also requires corrective and/or preventive action. In such cases, an Accident Investigation shall be completed, and informed to the Safety Manager.

- b) The relevant supervisor, the safety officer and/or the staff member appointed by the Manager, shall analyze the operations and associated factors related to the occurrence of the accident / major incident (in conjunction with the relevant subcontractor if appropriate). The analysis shall identify and attend to the root cause of the event.
- c) Following identification of the root cause, the safety officer shall notify the safety manager of the proposed corrective and/or prevention action(s) by completing and returning the Control of Corrective Action Form to the safety manager for review and approval.

129. A copy of the record shall be retained by the person responsible for the corrective and/or prevention action(s), for reference until the specified corrective and/or preventive action(s) has been effected.

130. The status of corrective and/or preventive action(s) shall be monitored through a Verification Inspection to ensure that the specified action is taken and found to be effective in eliminating the cause(s) of the accident / major incident. In the event that corrective and/or preventive action(s) is not taken as specified, or if corrective and/or preventive action(s) taken is found to be ineffective, further requests for corrective and/or preventive action(s) shall be initiated until the action is taken and found to be effective.

131. Corrective and/or prevention action(s) shall be presented to the Tool Box meeting and the management review meeting. Elimination of the identified causes shall be implemented in accordance with this procedure

132. Conclusion shall be drawn and corrective and preventive actions taken, this analysis shall be presented to the senior management for review. Management of the identified causes shall be implemented in accordance with this procedure.

Table 7: Persons responsible for non-conformities, corrective and preventive actions

Action	Responsibility
Determination of the appropriate corrective and preventive action(s). Review and approval of corrective and/or preventive actions.	Relevant Site Supervisor /Sr. Engineer / Section Manager
Monitoring of the status of pending Corrective and preventive action(s).	Chief HSE Manager
Identification of suitable staff to determine corrective and preventive action.	Safety Officer / Section Manager Section Manager



12.4 Safety Promotion

133. The objective of safety promotion is to develop and maintain awareness among all personnel of the work sites commitment to safety and of the individual's responsibility to support that commitment.

12.4.1 Procedure

134. Posters and Signs: Posters and signs shall be adopted as visual aids for accident and fire prevention. Posters shall be written in English and will be conspicuously displayed. The following safety signage will be displayed wherever necessary at site:

- a) 'Hard Hat Area'.
- b) 'Wear Safety Footwear'.
- c) 'Wear Hearing protection'.
- d) 'Wear Eye protection'.
- e) 'Danger Electricity'.
- f) 'Deep Excavation'
- g) 'Danger Crane Overhead'.
- h) 'Stop, Look, Listen and proceed'.
- i) 'No Smoking'.
- j) 'First Aid'.
- k) 'No Entry sign'.
- l) 'Fire Precautions'.

135. The Appendix-1 (GENERAL SAFETY RULES & REGULATIONS) can be referred for detailed information

136. Safety Handbooks and brochures: To increase safety awareness and as part of personnel safety training, safety handbook or brochures will be issued.

137. Safety Talks: AFCONS Safety Department will conduct a Safety Talk (Minimum weekly) to the workforce for promotion of the safety and health of workers on site. The topic of the Safety Talk will be decided by the AFCONS INFRASTRUCTURE LTD based on the site activities. Record of attendance will be kept by the Safety Department. Respective AFCONS INFRASTRUCTURE LTD Department Head and Sub-contractors Management shall ensure the attendance of these personnel.

138. Penalties and Fines: AFCONS has implemented a policy whereby persons, both AFCONS and sub-contractor's staff, found violating safety rules are subject to fines. Persons are warned in advance and given the opportunity to correct their infractions. Persons with poor records of overall safety performance found to be in violation of safety rules and who fail to correct their offenses when verbally instructed to do so, will be fined. AFCONS safety staff can provide

additional information on which violations involve fines. Note that all funds collected through safety violation fines are channeled back into and used for safety promotion activities (Refer Appendix -3(DISCIPLINARY PROCEDURE)).

12.4.2 Safety Incentive Program

139. AFCONS INFRASTRUCTURE LTD will develop a procedure to recognize and acknowledge good safety performance by individuals, teams or the subcontractors. The development of the Safety Incentive Program, which includes how it should run and types of awards, will be developed with the consensus of the AFCONS INFRASTRUCTURE LTD Safety Committee. The Safety Incentive Program will be implemented within six months after the inauguration of the AFCONS INFRASTRUCTURE LTD Safety Committee.

12.4.3 HSE Committee

140. The HSE Committee shall be established and shall be chaired by the Project Manager. The safety Committee shall sit every month for the duration of the contract.

141. Member representation from all departments will be ensured. Representatives from the workmen category also will be included in the committee.

142. The Committee shall review the previous month's performance, to include, inspections and audits undertaken, accidents and incidents and any concerns or complaints that have been raised. Short term objectives and targets for improvement shall be set for completion by the next scheduled Committee meeting.

143. Minutes of the Committee meeting shall be issued within 2 days and promulgated to all members.

12.5 Control of Records

144. A system of control of HSE records shall be maintained by the Safety Department with the purpose of demonstrating the status and performance of the HSE Management Systems.

Table 8: Control of records

OH&S Reporting documents	Location	Maintained By	File No.
HSE Plan	All Sections and Safety Department	Section Managers	File numbers will be dedicated for each OHS document
Induction	Safety Department	Safety Department	
Training	Safety Department	Safety Department	




Tool Box Talks	Safety Department	Safety Department
Inspection	Safety Department	Safety Department
Accident / Incident	Safety Department	Safety Department
Risk Assessment	Safety Department	Safety Department
Safety Committee	Safety Department	Safety Department
Minutes of Meeting	Safety Department	Safety Department
Fire Extinguisher	Safety Department	Safety Department
Monthly Report	Safety Department	Safety Department
Weekly safety walk through report	Safety Department	Safety Department

12.6 Internal Audit

145. Internal audits are performed with a frequency of minimum six months in accordance with an Audit schedule. The scope and programme of internal audits shall be determined with regard to the relative importance of individual elements of the HSE System and the results of findings of previous internal audits. Emphasis is placed on those elements of the HSE System, which are least effective bearing on the achievement of objectives.

146. A summary of all audit results must be discussed on a monthly basis and recommendations made to company management on improving Health, Safety and Environment. The top management shall, at intervals, review the HSE Management System to ensure its continuing suitability, adequacy and effectiveness.

13. Management Review

- i. The organization's management shall, at intervals (that it determines), review the HSE Management system, to ensure its continuing suitability, adequacy, effectiveness and that necessary information is collected to allow the management to carry out this evaluation. The review will be documented.
- ii. The management review must address a range of specified issues about the overall performance of the HSE Management Systems and the possible need for changes to policy, objectives and other HSE elements in the light of audit reviews for continual improvement.
- iii. The results and findings of the Management Review are to be reported and appropriate actions must be completed (Appendix-4 Management Review)




APPENDIX 1: GENERAL SAFETY RULES & REGULATIONS

Entry Permit: Inside the premises of AFCONS INFRASTRUCTURE LTD. everybody must possess the entry permit / ID badge of the company. All vehicles entering inside the premises must have the vehicle entry permit.

Speed Limit: All vehicles shall follow the site traffic regulations. Vehicle shall not exceed the speed limit of 20 KMPH in construction site and work areas.

Misconduct: Fighting, gambling and possession or use of fire alarms, ammunition, alcoholic beverages and illegal drugs are prohibited.

No Smoking: Smoking is strictly prohibited in all office areas/sites except in designated areas.

Equipment: All necessary tools and equipment including personal protective equipment shall be properly maintained and shall be appropriate for the safe accomplishment of the task. Further only trained personnel shall use construction equipment.

Orderliness: Scrap, trash and other wastes shall be placed in the designated bins. Work area shall be cleaned up as the job progresses. All materials, tools or equipment shall be secured to avoid rolling or falling. A safe access shall be maintained to all work areas and emergency exits.

Inspections: All work areas shall be checked at the beginning of each shift to ensure safe conditions and at the end of each shift to ensure that all flames are extinguished and other hazards are properly contained.

Roads and Drains: All sub-contractors shall maintain the drains and roads in their area. No material should be unloaded on the road so as to obstruct the free movement of vehicles.

Medical

- i. First aid medical facilities in case of emergency are available at First Aid center. All injury/illness shall be reported. Fully equipped ambulance to be made available at site round the clock.
- ii. In case of emergency AFCONS INFRASTRUCTURE LTD shall send to the government hospital near the site. Inform the PIC and PIU if required
- iii. First aid unit is identified by a Red Cross on a white background and staffed by qualified personnel. Essential medicines are stocked in the first aid box which shall be periodically replenished.

Personal Protective Equipment

- i. Company must provide to their workers suitable Personal Protective Equipment (PPEs) required for their protection. Wearing of safety shoes & hard hat is mandatory on the site. However, charge hand and above may wear trouser and short while at work. All PPEs to be worn must be maintained in good condition and as per standard. Rings,

bracelet, ear rings, long neck chains shall not be worn near moving machinery or where electrical work is being carried out. Personal with long hair or beard with un-tucked long ties, loose clothing, unbuttoned or loose long sleeves shall not work near moving machinery. Complete arm protection may be required on some sites.

Table 9: Classification of PPE

Type of PPE :	Areas/Locations with risk of :
* safety shoes	standard rule in all areas
* working gloves	working with materials which may affect hand injury like wire ropes, rough timber, re-bars, paint
* safety helmet / hard hat	falling, dropping, toppling and flying objects as well as head bumping
* safety goggles / spectacles	Sparks, flying particles, dust, etc.
* ear muffs or plugs	Noise exceeding 85 dB (A).
* respiration protection filter/cap	Dust, fine gliding sand and the like.
* safety harness	Falling more than 2.00m at locations where no other safety devices minimize this risk.
*welding face shield	

Eyes and Ears

- i. Safety glasses shall be worn by everyone who is doing –
 - Mechanical / electrical work
 - Any work in an area where mechanical / electrical work is carried out
- ii. Side covered goggles or face protection shall be worn by cement feeders, concrete chippers, those involved in drilling operations above shoulder height or anyone who is doing any work in which foreign particles may enter the eyes.
- iii. Those who are performing grinding or abrasive cutting shall wear full face shields. Special eye protection devices shall be worn during sand blasting operation.
- iv. Eye protection with minimum required density of filter should be worn by welders and gas cutters.
- v. Hearing protection (e.g. Ear plugs, ear muffs) shall be worn in areas where noise level exceeding 90 dB (A) exposure exceeds eight hours a day, or where warning sign is posted.



Fingers, Hands and Wrists: Hand gloves suitable for the job must be worn unless the job cannot be done with gloves or unless wearing of gloves increases the hazard.

Respiratory Protection: Suitable respirators approved as per specifications shall be worn wherever necessary.

Feet and Legs: Proper safety shoes shall be worn by all at every work site. Rubber gumboots with toe protection shall be worn by masons / concreting gang or those working in wet area. Foot guards shall be worn for using jack hammers / backfill tampers and similar equipment.

Skin: If there is any possibility of skin irritation while handling or using any material, proper PPE shall be used as specified in the MSDS of that material


Excavation: Surface excavation may be relatively shallow excavations for the foundations of buildings, for civil engineering structures, for the laying of services and utilities such as water supply pipes, sewers, gas pipelines, electric cables, telephone cables, etc. The surface excavations may be in earth, soil, and clay or in rock. At times, there may be ground water intercepted by the excavations. The safety measures in surface excavations are, accordingly divided in two main groups viz.

- Those that are required to be observed during surface excavations in earth, soil, clay, sand, etc. and
- Those that are required to be observed during surface excavations in rock.

Open Excavation: Sides of every excavation (where there is danger of falling or dislodgment of earth, rock or other material forming the sides or adjacent to any excavation) shall be securely supported by adequately braced timber of suitable quality of other material unless the sides of the excavation are sloped to a safe angle. Safe angle should always be greater than angle to repose of the material when saturated.

Excavation of Trenches

- i. Excavation, if over 1.5 M in depth, unless in solid rock or hard shale shall be either shored, erected and braced or sloped to an angle greater than the angle of repose. All shoring and bracing shall extend to the bottom of excavation where necessary.
- ii. To hold banks of loose and unstable materials from sliding, adequate shoring shall be used and undercutting of banks shall not be permitted. The bracing and shoring of trenches shall be carried out along with the excavation. Additional precautions by means of bracing and shoring shall be taken to prevent slides, slips or cave-in where excavations are being carried out in the vicinity of source of vibration like Pile driving rigs.
- iii. Loose materials and loads shall be stored at a distance equal to depth or at 1.5m away from the edge of excavation whichever is more. During hours of darkness all public sidewalks and walkways shall be adequately illuminated and warning signs/lights around



the excavation shall be placed to ensure safety of pedestrians and the vehicular traffic. There should be proper means of access and egress to and from excavated area, at least from two sides

- iv. Adequate precautions shall be taken for underground pipelines, electrical/data cable, work permit is essential. In case dewatering is required prior arrangement shall be made.

Excavation in Earth, Soil, Clay

- i. Safe means of access and egress should be provided for the workers carrying out the excavation. Excavations should be kept free from water. The accessible part of all excavations should be protected by an adequate barrier and prominent hoarding to warn the public about the danger. No materials should be placed or stacked near the edge of any excavation. No load, plant or equipment should be placed or moved near the edge of any excavation where it is likely to cause a collapse of the side of the excavation and thereby endanger any person.
- ii. All struts, braces and waling in excavations should be adequately sourced so as to prevent their accidental displacement. Trenches in the built up areas should be fenced. Deep trenches and pits should be provided with adequate ladders, which should extend at least one meter above ground level. The ladders should be firmly fixed in position. Footboards and platforms supported by bracings should be adequately secured by brackets.

1) Safe Work Practice- Excavation.

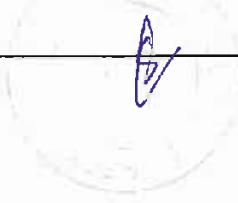
Excavation is one of the most important phases of any construction activity. All excavation works will be supervised by well-experienced Supervisors. Before carrying out any excavation one must follow:

A. PRIOR TO COMMENCEMENT.

- a) Obtain maximum information about the underlying services e.g. power cables, water supply & sewage pipelines, telephone cables, gas pipelines.
- b) Obtain excavation plans clearly showing side slopes, firm levels, widths, and shoring.

B. DURING EXCAVATION:

- a) Proper maintenance of side slopes of shoring.
- b) Barricade the area and display warning boards.
- c) Make catch drains around the area. Inspect these regularly and ensure that they are in good condition.
- d) De watering / lowering of groundwater table to be carried out as per specific instructions.
- e) Ensure stability of excavated materials at the disposal area.
- f) Do not go below bottom of foundation level. Unless specifically instructed.
- g) Do not load edge of the pit.



- h) Provide steps or ladder if depth is more than 1200mm.
- i) Entry to unsupported excavation shall be avoided.
- j) Never work ahead of support.

2) Safe Work Practice: Earth Filling

- a) Maintained the speed limit of 20 KMPH strictly.
- b) Vehicle must have reverse horn.
- c) Provide proper illumination while working at night.
- d) Do not allow any unauthorized person in working area.
- e) Signal man should be present when for vehicle movement in filling area.

3) Safe Work Practice: Soil Investigation

- a) Barricade the area and display sign board
- b) Keep good housekeeping around the drill rig.
- c) Pit should be made near drill area to accumulate slurry.
- d) Stability of tripod should be checked before starting the drilling.
- e) Do not keep fuel in open container
- f) Keep one fire extinguisher near working area.
- g) Ensure that only authorized trained operators operate drill rig.

4) Safe Work Practice: Form Construction And Concreting

- a) Formwork poses certain hazards due to poor housekeeping, leaving materials and tools where they may fall and cause injuries
- b) Those who are placing concrete should wear safety helmets and rubber boots
- c) Shirt sleeves should be rolled down, gloves should be worn and every precaution should be taken to prevent contact of skin with cement and concrete
- d) All mixture gears, chains and rollers should be guarded
- e) Concrete mixing plant/batching plant shall be adequately designed and precaution shall be taken to protect workmen from falling objects
- f) Suitable dust mask should be worn wherever necessary
- g) Workmen involved in handling bulk cement in confined spaces shall wear tight fitting goggles, dust masks and protecting clothing




5) Safe Work Practice: Cranes And Other Lifting Equipment:

- a) Safety during lifting and handling, requires careful consideration of all aspects
- b) All fabricated units should have a distinctive mark to ensure that structures are correctly assembled
- c) The necessity to work at height can be reduced by the assembly of all possible items and ground level
- d) Time spent at working at height should also be reduced by ensuring that bags of bolts are tied to rafters and beams adjacent to point of connections
- e) Regular maintenance of all crane and lifting equipment at offshore /onshore will be done on regular basis by CPE department and it will be verified by safety Officer. If any defect found will be attended by CPE Engineer and rectify before use.

Adverse Weather Conditions

Erection work should not take place in weather conditions which introduce an undue element of risk. Examples of these conditions include:

- a) High winds
- b) Heavy rain
- c) Poor visibility

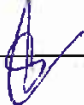
Safety Checklist

Conduct a site survey to identify all hazardous site features such as;

- a) Underground services
- b) Proximity to and condition of adjacent structures
- c) Has a satisfactory method statement been produced and agreed
- d) Have all persons involved in the works been briefed on the method statement
- e) Are people competent
- f) Are appropriate type and number of cranes employed
- g) Have anchor points been checked to ensure that they are able to resist any force likely to be placed upon them

The safety precautions are as follows:

- a) The electrode holder should have a fully insulated holder fitted with a shield



- b) The electrode holder should be unplugged when not in use
- c) The welding current must be returned from the welding piece to welding set by means of a separate welding lead
- d) The work piece must be connected to earth
- e) Welding earths and welding returns should be securely attached to the work
- f) Person assisting the welder, should also wear the protective eye wear
- g) A suitable approved fire extinguisher should be ready for instant use
- h) Areas below welding and cutting operation shall be barricaded

6) Safe Work Practice- Diaphragm Wall

- a) Grabbing machine shall be placed over firm base, by checking soil conditions.
- b) Do not erect grabbing machine close to live electric lines.
- c) All employees should wear necessary PPEs.
- d) Barricade the grabbing machine swing area so that workers cannot be drawn into them.
- e) Take adequate precaution for preventing overturning of grabbing machine.
- f) Provide stirrups or other effective means to prevent rope coming out from the top pulley.
- g) Ensure that only authorized trained operators operate grabbing machine.
- h) Use tag lines for holding cage and ensure that all workers and general public are kept away from the reach of cage.
- i) Bentonite, in no case is allowed coming over the road and create nuisance.
- j) During reinforcement cage insertion, its lifting shall not be done over at the site. A signalman/safety supervisor shall restrict traffic movement during this activity.
- k) Ensure that crane capacity is adequate.
- l) Minimize distance for traveling of crane with load of the rebar cage.
- m) Dispose of grabbed muck as early as possible.
- n) Provide barricade for grabbed area

7) Safe Work Practice- Material Handling

All lifting appliances, including synchronized mobile jacks, pit jacks, mobile cranes, tower cranes, gantry cranes, launching beams and lorry mounted cranes etc., prior to being are



allowed to work on site will be available for safety inspection at the site and should have certificates of safe operation. Load indicators/ charts shall be fitted with these equipment. All lifting appliances will be maintained in accordance with the manufacturer's instructions and will be subjected to the preventive maintenance programme. Fully trained and well-experienced operators will be allowed to operate the cranes

8) Safe Work Practice: Lifting Operations

One shall ensure that during the course of any lifting operations the following minimum requirements shall be followed:

- a) Only thoroughly trained and experienced persons are allowed to sling loads and give directions to crane operators.
- b) A standard code of hand signals shall be adopted for controlling the movements of the crane and both the driver and the signal man shall be thoroughly familiar with the signals.
- c) Before commencing any lifting operations the ground conditions on which the crane is to stand shall be investigated in order to ensure that the load bearing capabilities are adequate.
- d) No unauthorized persons are not allowed into the lifting zone.
- e) All crane hooks shall be fitted with an operable safety latch.
- f) Wherever practicable all load shall have tag lines attached in order to ensure that the load can be safely removed from the latch once they have been landed.
- g) All lifted loads and stacked materials shall be left in a secure and stable condition at all times.
- h) No close working to any live overhead power-lines is permitted without the operation of a strict Permit to Work System being in place.

9) Safe Work Practice-Heavy Plant and Machinery.

1. It shall be ensured that only safe and well-maintained plant and equipment shall be allowed to operate on any of the sites.
2. No unauthorized person shall be permitted to ride on plant.
3. The operators shall conduct daily inspections of their respective items of plant.

Crawler / Truck Crane




- i. Check daily that all ropes are correctly positioned on their Shelves and drums have not been displaced.
- ii. Visually check that no Electrical equipment is exposed to contamination by oil, grease, water or dirt and that no loss of fluids such as lubricating oil and coolant is apparent.
- iii. Check that the correct air pressure is maintained in pneumatic control system.
- iv. Check that lights operate efficiently.
- v. Visually check the security of wheels and the condition of tyres on wheel-mounted cranes.
- vi. Check correct function of all crane controls without load. Always lift loads gently to avoid swinging of loads. Do not pull a load sideways. Do not lift loads while the crane is on a slope.
- vii. Ensure that the signal man stands in a secure position where he can see the load and can be seen clearly by the driver.
- viii. Check satisfactory operation of all audible – warning devices

10) Safe Work Practice- Electrical Safety:

- a) A Graduate Electrical Engineer shall be appointed, under whose able supervision only, all electrical systems will function.
- b) Qualified and suitably categorized electricians shall execute rest supervisory works.
- c) All cabling shall be done at high level, wherever possible and firmly secured. Cables should not be kept lying on the ground and are protected from sharp edges of objects.
- d) Earthing and bonding shall be provided for all electrical installations.
- e) Plugs and fittings of weatherproof type shall be used.
- f) All DB shall be given numberings.
- g) RCCB/RCB/MCCB/MCB etc. may be used at site at required locations.
- h) Electrical engineer shall also carry out strict maintenance and regular checks. He will maintain the record of electrical maintenance schedule and inspections and will submit to the employer as and when required.
- i) Contact number of electrical engineer shall be given to all site engineers/supervisors to contact in case of emergency.
- j) All personnel engaged in electrical work shall be made familiar with method of giving artificial respiration.

- k) Current more than 50 m.a. are dangerous.
- l) Working under overhead lines shall be carefully inspected for required clearances.
- m) All personnel shall wear necessary PPEs.

Golden Rules for Electrical safety:-

- i. Use of correct size cable with right specifications.
- ii. Good insulation.
- iii. Correct rating of fuses.
- iv. Use of circuit breakers.
- v. Proper earthing.

Live high voltage line work

- i. Electrical work on exposed live high voltage conductors or exposed live parts of high voltage electrical equipment must not be carried out unless authorized in writing.
- ii. A person may be authorized to carry out live line work if
 - He/she has successfully finished a course of training approved by the electricity safety regulator and provided by a training provider approved by the electricity safety regulator;
 - Has been assessed (proof of which is required) by the training provider as competent to carry out the work and;
 - Is equipped with the necessary specialized Personal Protective Equipment to protect the worker from the risks of Arc Flash.
- iii. All workmen working on the Project shall ensure that all portable appliances, extension leads and flexible chords are tested. Records of such inspections/tests are to be kept and produced on request.

Reporting of Incidents:

- i. Persons witnessing an incident or near miss occurrence shall report same to the safety officer/his appointed representative. In the event of the incident, accident or near miss, persons on site shall assist safety investigators by providing security information in a timely manner. Persons found to have intentionally withheld requested information during a safety investigation will be subject to disciplinary action that may include dismissal from the project.
- ii. The safety officer/his or her appointed representative and duty supervisor/foreman/first aider shall administer first aid treatment to the injured person(s). If the injuries are minor, the safety officer/his/her appointed representative shall arrange for the injured to



see a doctor. For major injuries, the safety officer/his or her appointed representative shall call an ambulance and inform the next – kith & kin, statutory bodies and if necessary, the police. The duty supervisor/foreman shall accompany the injured person (S) to the hospital.

- iii. If the information is given to the safety officer or his/her appointed representative, he/she will inform the safety officer immediately. The safety officer shall inform the project manager of the accident as soon as possible. If the accident resulted is a major incident or serious injury than the project manager shall in turn report to the employer's representative.
- iv. For a major incident or serious injury, the safety committee members shall assemble to investigate the causes of the accident. The duty supervisor/foreman shall write an accident report within 24 hours of the accident occurrence and submit it to the project manager and safety officer.
- v. The Project Manager shall organize an extra-ordinary meeting of the safety committee to discuss the findings of their investigation and propose corrective and preventive measures to prevent recurrence of similar accident. All supervisors/foreman shall inform all workers of these measures and implement them.
- vi. The safety officer shall complete the accident/incident report and submit to CPM/client within 24 hours and compile the monthly accident statistics. For major accident, he shall submit a copy of the report to safety department/client as per requirement.
- vii. The safety officer shall investigate all the dangerous occurrence/accidents incidents as per the statutory requirement.

11) Safe Work Practice- Hot Works (Welding and Cutting)

- i. All equipment must be in good condition, properly installed and routinely inspected by a competent person.
- ii. Any Hot Works before starting of the work will get Permit to work for hot work weekly permit from concern person and get it signed from authorized person
- iii. Flexible hoses, cables and connections must be free from damage or risk of damage in service. Cables and hoses shall have adequate carrying capacity.
- iv. Welders shall wear the correct personal protective equipment, which includes the following:
 - Face and eye protection with approved make of shield.
 - Gloves.
 - Safety footwear.
- v. Safety guidelines –

- Remove combustible materials beyond the area of sparks and spatters.
- No tarpaulin shall be used as protection against sparks.
- Work site after completion of work shall be thoroughly checked to ensure that fire is not smoldering.
- A fire extinguisher shall be placed at each section (Location – Near DG).
- Heated surfaces should be cleaned, which may have tendency of emitting noxious fumes.
- Cylinder trolley use shall be enforced and cylinders be kept upright.
- Gas leakages should be checked routinely.
- Flash back arresters shall be utilized.

12) Safe Practice For Diesel Or Flammable Liquid Storage, Handling And Monitoring:

STORING

- i. Container shall be stored in a prefabricated structure made up of steel or block or masonry work.
- ii. Containment wall and floor shall be restricting any chance of rain water accumulation, fire and vehicle.
- iii. Stored in isolated place, minimum employees are exposed
- iv. Properly ventilated with designated walkways and non-slip floors
- v. Provided with spillage retaining arrangements
- vi. Free of source of ignition, such as unprotected electrical equipment, sources of static electric sparks, naked flames or smoking materials
- vii. Arranged so that incompatible chemicals do not be mixed together, even during fire emergency
- viii. Clear of from combustible materials
- ix. Firefighting arrangements such as foam type extinguishers should be made available

HANDLING

- a) The person handling diesel must be competent to consider the risk and the adequacy to control and other measures put in place
- b) The person handling must be provided with appropriate PPE and necessary instruction on personal hygiene and safety.
- c) Emergency contact numbers should be available to the person handling diesel

- d) The person handling diesel must be provided with procedures for avoiding and dealing with spillage
- e) The MSDS must be available with the person handling diesel
- f) Proper housekeeping to be ensured by handler of diesel
- g) Storing of inflammable material nearby diesel storage area avoided
- x. Sign boards shall be written in English and Dzongkha and Hindi and will be conspicuously displayed

MONITORING

- i. Housekeeping procedures (example keeping lids on container and avoiding contaminated rags)
- ii. Personal hygiene and information instruction and training to the handler
- iii. Drum shall be maintained with proper marking and tags...
- iv. Any new hazard and movement of unauthorized persons
- v. Lack of control, fault / weakness or omission in performance standard
- vi. Storing of inflammable material nearby diesel storage area
- vii. Sign boards shall be written in English and Dzongkha and Hindi and will be conspicuously displayed

MATERIAL SAFETY DATA SHEETS (MSDS)

- i. Materials from chemical origin often embody either physical or health hazards to a certain extent during use/operations. A Material Safety Data Sheet (MSDS) of that specific material and information on how to use, handle and store it safely shall be available. The MSDS also contains emergency and First Aid information for treating overexposure. The purchase of chemical materials, such as concrete mixtures, paints, solvents/thinners, silicone & other kits, adhesives/glues, must also include the supply of the MSDS of that specific material together with the delivery of the goods.

SAFE PRACTICE DURING WORK OVER WATER

HAZARDS: FALL IN THE WATER

WORK INSTRUCTION:

LIFE JACKETS- :

- a) Read the life jackets instructions.
- b) Adjust the life jacket according to the instructions
- c) Jumping from heights over 10 meters should be avoided. Because when one jumps the life jacket wants to go up while one are going down. This may result in serious injuries.
- d) Therefore one should keep One's life jackets in place by firmly holding it down. With the other hand one should protect one's nose against an injection of cold water.
- e) Swimming with a life jacket on, should be done on one's back, by using both the hands as raft.
- f) Never throw the life jacket away but take it with you in the raft.

LIFE BUOYS- :

- i. There should be minimum of 6 numbers of life buoys on the working platform. The buoys should be made of a solid buoyant agent. A lifeline should be fixed around the buoy to make it easier for the person in distress to hold on to it.
- ii. All the approved buoys should be either white and red or orange colored, carry a reflecting band & identification mark in working platform
- iii. The function of life buoys is not primarily to be used during abandonment but they are also provided for saving individuals in the water that are in danger of drowning.
- iv. One enters the life buoy by putting both the hands on the buoy & then pressing it down and away from you so that it tilts over your head. Then place the buoy under your arms and wait for assistance (Move as less as possible). This will reduce the heat loss.
- v. If you throw a buoy to a person in the water, you should throw it so that he can first seize the line. This is the easiest way.

Housekeeping:

- i. Adequate attention will be given for HOUSEKEEPING and it will be ensured that all scraps, wastes, etc. generated at work sites due to work activities will be removed from there and disposed-off at suitably identified locations as per statutory requirements.
- ii. It will also be ensured that proper access and egress will be maintained at work site while storing/D-wall the materials for the execution works and, no unwarranted materials will be kept abandoned at the work locations.

Manual Handling

- i. Prior to any manual-handling task a hazard assessment shall be conducted to determine:



- Does the load need to be moved?
 - Can it be handled by one person or is help required?
 - Can mechanical lifting aids be used?
 - Is the route and destination clear?
 - Are there stairs or grade involved in the move?
 - Required PPE utilized? (Gloves)
 - Has the worker been trained on manually handling procedures?
- ii. Mechanical lifting aids will be considered as the first option in moving any load. All manual lifting activities will be conducted by ensuring personnel have been trained in
- Proper lifting techniques. All personnel must ensure that they first consider mechanical lifting devices as primary option, and as the secondary option personnel should request assistance with the lift, planning the lift, ensuring the area of travel is clear of tripping hazards, lift with your legs and not with your back.

Critical Lifts

1. A critical lift is defined as one that:
 - Exceeds 20 tons;
 - Exceeds 75% of the crane's rated capacity;
 - Requires two or more cranes for critical lifts
 - Is conducted over operating or power plants;
 - Is conducted over electrical/instrument cable trays or within 10m of power lines;
 - Is conducted over live or sensitive operating equipment;
 - Is working over or near water;
 - Is over occupied quarters and buildings;
 - Involve personnel cages/work boxes.
2. All critical lifts will require lift plans signed and sealed by a professional engineer. They will also require a JSA specific to the work being carried out.

Operator Competency:

- i. All personnel that will operate a crane or other lifting and any other mobile equipment shall be required to submit photocopies of all appropriate qualifications and their employer shall be required to submit documented proof of a competency test prior to operating machinery on the site.



APPENDIX 2: HSE INDUCTION PROGRAM

- i. All new personnel will be given safety induction course on basic safety
- ii. Requirements of the project and significant features of the construction work relating to the safety when he or she arrives at site. The lesson shall be given by Safety Officer or his subordinates.
- iii. The primary objectives of the induction course are to:
 - Stress the important of safety
 - Teach how to avoid accidents
 - Contribute to developing Project Safety
 - Guide employee in exercising safe working condition
 - Stress the importance to meet the safety target
 - stress the importance of good housekeeping
 - Instruct on the proper use of personnel protective equipment
 - Inform employees of the Emergency Evacuation Procedure
 - Highlight main hazards/risks involved in the works
 - To explain safety Rules & Regulations implemented on the project
- iv. It is a mandatory that all employees attend the safety induction course prior to starting their work. No employee will be permitted to work on the construction site without having attended the safety induction course.
- v. The safety induction course will also serve to inform all personnel that failure to work safely and follow safe practice will result in disciplinary action, which may include expulsion from the site.

Safety Training for Managers

- i. Management training is intended to provide the knowledge, motivation, skill necessary to manage the safety and health programme. A two-day training programme on "Construction Safety" as per the content enclosed in table:9 above will be conducted to all Supervisors/Managers. Safety Officer in consultation with PM (Project Manager) / Dy.PM will identify who should attend a particular course relevant to his / her work.

Trade and Skill Training

- a) Safety officer, in consultation with the PM/ DY. PM, will determine that a jobholder is competent to do his job safely and ensure that appropriate training is given. Trade and skill training that is required in the construction industries are:
 - Lifting Supervisor
 - Crane operator
 - Scaffold Supervisors

- Excavation/Shoring/Piling Supervisor
 - Excavation Work
 - Welding/ gas cutting operator
 - Batching plant operator
 - Excavation/Shoring/Piling Supervisor.
 - Excavation work
 - Excavator/ dumper/ tipper operator
 - Electrical workers
- b) First- Aid training
- c) Emergency preparedness training
- d) Job specific training
- e) **AFCONS** and Sub-contractors shall ensure that such training is provided either by approved institutions or in-house.

Other safety training

- i. Other safety training such as emergency preparation, first aid training and firefighting training and Health briefing training STD/HIV AIDS Awareness will be developed and carried out by AFCONS or in conjunction with the relevant body or organization Safety training will be a continuous exercise and will be regularly imparted through refresher courses, seminars, talks, symposiums etc.
- ii. Refresher training shall be given once in every six months.

Safety Training Attendance Records

a) **Environmental Training**

Regular environmental training for both staff and workers will be conducted to increase environmental awareness. The details of the training given to employees will be maintained.

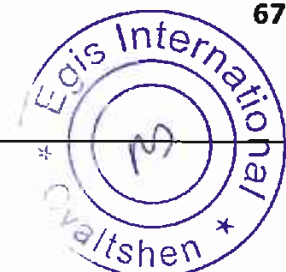
b) **Health checkup and Pest control**

Health checkup will be done once in a year for all the employees and workers and to find out HIV/AIDS and malaria and dengue fever and two week once fogging and chemical spraying will be done in and around office and camp area based on the requirement, the frequency will also be increased as per the requirement. All the workers and employees who are monitored regularly and who are in doubt for drugs will be out to drug test. All the workers and employees will only be allowed to join the duty after the normal medical screening.



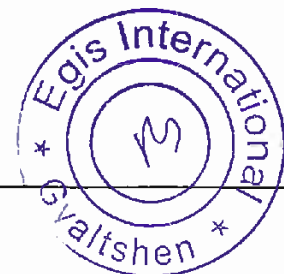
APPENDIX 3: DISCIPLINARY PROCEDURE

- i. AFCONS has implemented a policy whereby persons, both AFCONS and subcontractor's staff, found violating safety rules are subject to disciplinary actions.
- ii. Persons are warned in advance and given the opportunity to correct their infractions.
- iii. Persons with poor records of overall safety performance found to be in violation of safety rules and who fail to correct their offence when verbally instructed to do so, will be fined Nu.200/ per occasion- individually.
- iv. AFCONS safety staff can provide additional information on which violations involve fines. Note that all funds collected through safety violation fines are channeled back into and used for safety promotion activities.
 - Fines will be assessed for safety offence and infractions.
 - The fines will be deducted from the progress payments for the subcontractor's work.
 - The Safety Officer shall inform workers of safety offence and infractions that are subject to fines.
 - Severe actions will include removing the person from the project involved in repeated transgressions of Safety requirements.



APPENDIX 4: AGENDA FOR THE MANAGEMENT REVIEW MEETING

- I. Confirmation of the Minutes of Previous Meeting
- II. Overview of Site HSE Performance
- III. Accident/Incident Investigation/Dangerous Occurrence/near miss report
- IV. Report from CLIENT
- V. Internal Audit Findings
- VI. Risk assessment
- VII. Corrective and Preventive Actions
- VIII. Suitability of HSE Policy
- IX. Status of achievement of HSE Objectives and Targets
- X. Concerns of Interested Parties
- XI. Legal changes and their effect
- XII. Any other business





APPENDIX 5: FORMATS & CHECKLIST

Format no: F-HSE-01

INDUCTION TRAINING FORMAT

Date:

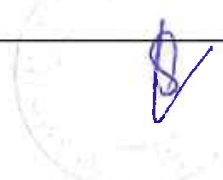
Topics:

Conducted By:

Sl.no	Name	Designation	Signature

Signature of Safety Officer _____

Annexure 6: Occupational Safety and Health Management Plan



TOOL BOX TALKS

Date: _____

Topics: _____

Conducted By: _____

Sl.no	Name	Designation	Signature

Site Engineer: _____

Safety Officer: _____



ACCIDENT/ INCIDENT REPORT FORM

Project:

Date and Time of the accident:

Location:

Name of sub- contractor if any:

Particulars

1. Equipment involved :

(b) Operator/ Driver:

(c) Supervisor/Engineer:

(d) Activity going on:

(e) Name of the injured:

(f) Damage to equipment:

(g) Damage to outsider's property:

Description of the accident

Causative Factors:

1. Unsafe conditions

(b) Unsafe Acts:

Action to be taken to prevent reoccurrence:

Project Manager

Safety In-Charge



CRANE OPERATION CHECKLIST

PROJECT :					
DATE :		TIME :			
No	ITEM	Compliance			ACTION
		Yes	No	N/A	
1	Has the crane been inspected by an approved within the past 12 months?				
2	Is the driver or operator of the crane certified crane driver?				
3	Is the crane provided with safe working load indicator visible to the operator, showing the radius of the jib and the corresponding safe working load and giving a warning signal when the crane is overloaded?				
4	Have all hooks, slings, shackles, rings, ropes, swivels/eyebolts etc. been inspected by an approved person during the past 6 months?				
5	Are the safe working loads of hooks, slings, shackles etc. clearly marked?				
6	Are lifting hooks provided with safety latches to prevent lodes from slipping off accidentally?				
7	Are the booms or jibs of the cranes and piling Machines during operation or at standstill position, orientated in such a manner as to prevent the possibility of a collapse across the carriageway, public area etc. ore against adjacent building/structures?				
8	Is the footing for the crane provided?				
9	Is the lifting operations supervised by a lifting Supervisor?				
10	Are crane lodes ,lifted vertically so as to prevent swinging during hoisting				
11	For loads, which have a tendency to swing or turn freely, is a tag line used to the load?				
12	Is any load lifted over personal? (this is not permitted)				
13	Are all 'loose' lifting gear e.g. wire ropes shackle etc. in good visible condition?				
14	Is the crane cabin locked when the crane is not in use and during meal breaks?				
15	Is the crane being operated where it can over swing public roads and have appropriated precaution been taken?				
16	Is the crane operated more than 3 meters away from any live power line and have appropriated precautions been taken?				
17	Is the crane operated more than 6 meters away from any rail line and have appropriated precaution been taken?				

CPE / SITE ENGINEER

SAFETY OFFICER




CHECKLIST FOR DIAPHRAM WALL

Safety Checklist for D-wall works

Contractor		AFCONS infrastructure Limited		Project Name		PTDP	
Location				Inspection Date			
Weather		Sunny Cloudy Rainy Typhoon		Inspection Time		Week day	
No	Items of Inspection	Status		Rectification			
		(Yes)	(No)				
1	Check for PPE, hardhat, used by the workers						
2	Check the Certificates of Plant, equipment and Operators are valid						
3	Warning Signboards around construction area						
4	Security/Traffic Marshal measures for prohibiting entry of Unauthorized personnel						
5	Work area free from high-voltage power lines						
6	Work area barricading						
7	Proper arrangement of equipment installation						
8	Competent supervisor is available at work location						
9	Crane swing area is cordoned for mucking operation						
10	Tool Box talk Meeting conducted prior to commencing of work						
11	Bentonite/Polymer Slurry plant has been properly placed and its operations checked w.r.t working plat form						
12	Work methodology of the activity explained to all the key personnel and workmen involved in that activity						
13	Availability of First Aider Facilities at site						
14	Utility services inside the construction area is protected						
15	Utility markers inside the construction area is provided						

Safety Checklist of D-wall works (contd.)

No.	Items of Inspection	Status		Rectification
		(Yes)	(No)	
Today's Work Status		Instructions by Construction Manager		
Inspected and signed by				
Site Engineer		Safety Officer		



Format no: F-HSE-12

CHECKLIST FOR EXCAVATION

Sr. No.	Item	Yes	No	Remarks
1	Prior to start, whether all existing utilities has been Identified& removed / isolated / protected?			
2	Whether the sides adequately supported by bracing and shoring for trenches more than 1.5 m depth in Loose soil / clay?			
3	Did all excavated or other materials store or retain at least 1m or more from the edges of the excavation?			
4	Barricades have been provided to all excavations?			
5	Are employees equipped with adequate PPE's i.e. Reflective jacket, safety helmet, safety shoes etc.?			
6	Are excavations inspected by a competent person after every rainstorm or other hazard increasing Occurrences?			
7	Is there an emergency control measure available in Case of side collapse?			
8	Whether adequate access has been provided to excavated pit i.e. ramp, ladder etc.?			
Inspected and signed by :				
Site In-charge :		Safety Officer		
Date:		Location:		



HOT WORK PERMIT

PERMIT NO ----- **INITIATION DATE:** -----
CONTRACTOR ----- *Name of the person doing Hot work*-----

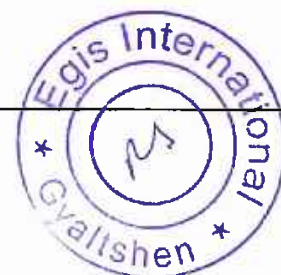
WORKDESCRIPTION-----
 --
LOCATION-----

DATE REQUIRED FROM ----- **TO** -----
VALIDITY -----

SAFETY PRECAUTIONS TO BE TAKEN

Sl. No.	PRECAUTIONS	YES	N.A	REMARKS IF ANY
1	Has the area immediately below or near by the work spot been cleared away or non-movable are covered from flammable materials?			
2	Has gas concentration been tested in case there is gas valve / gas line nearby?			
3	Have suitable fire extinguishers been kept handy at site?			
4	Has tin sheet/fire blanket been placed to prevent sparks from causing fire?			
5	Any fire watch personnel posted till 1 hrs. Of finishing the job?			
6	Has the supervisor informed the associated risks to the workforce? (Finding of risk assessment in form of TBT)?			
7	Gas cylinders fitted with a vertical position on a trolley and fitted with regulator and flash back arrestor?			
8	Are all required personnel protective appliances (Apron, welding sheets, gloves, etc.) provided?			
PERMIT INITIATOR				

I CONFIRM THAT THE SAFETY PRECAUTIONS SPECIFIED SHALL BE ADHERED TO



NAME: ----- **SIGNATURE:** -----

CONTRACTOR: ----- **DATE:** -----

I hereby authorize the operation to proceed subject to full compliance with the necessary precautions: -

AREA MANAGER / DEPUTY

PERMIT CONTROLLER

NAME: -----

NAME: -----

SIGNED: -----

SIGNED: -----

DATE: -----

DATE: -----

Note: -

1. Copy of the permit must be made available with the working crew and should be projected to safety representative.
2. Only certified welders are permitted to do the welding/hot work.
3. Carrying out HOT WORKS without having valid permit is not permitted.
4. Report any incident to your immediate authority at once.



APPENDIX 6: JOB SAFETY ANALYSIS



AFCONS INFRASTRUCTURE LIMITED

JOB SAFETY ANALYSIS

Assessment date:20-11-2018

Doc

No.JSA/6462/HSE/01

Job No: 6462 **Activity: Guide wall & D wall**

Revision: 0

Assessor: Ashok Kumar

Reviewed on:

Sl.No	Task/Activity	Potential Hazard	Hazard effect	Control Measures	Re- marks
1	Mobilization (Shifting of Material)	Fall of material while loading /unloading by manual and mechanical means.	Injury to persons Damage to property	a) Toolbox talks to be given before starting of the work b) Tested Cranes c) Tested lifting tools & tackles d) Standard lifting procedure e) Competent operator f) Use of PPE, Safety Helmet, Safety Shoes and safety vest	
2	Construction of Bentonite/Polymer tanks and installation of M.S water tanks with pumps and fitting	a)Fall of Person into the excavated pit from inside overhead tank b)Collapse of excavation	Injury to persons	a) Toolbox talks to be given before starting of the work b) All excavated area should have proper slope according to angle of response c) Barricades around excavated pits d) Use of PPE. Safety Helmet, Safety Shoes and safety vest	
3	Equipment/Vehicles	Failure due to	Injury to	a) Toolbox talks	



	movements	wrong signaling & absence of reverse horn on vehicles	persons	to be given before starting of the work b) An authorized signalman should control all lifting operations at site c) reversing procedure to be followed d) Use of reverse horns
4	Erection & Operations of crane	a) slipping of wire b) snapping of wire	Injury to persons	a) Toolbox talks to be given before starting of the work b) Use tested quality wire rope c) Use correct No. of dog clamps. d) wire to be inspected once a week e) personnel to be kept away from radius of operation of crane
		Failure of boom	Injury to persons Damage to property	a) inspect boom once a week for damages if any b) lift only with SWL c) Ensure that the area is barricaded and personnel kept away d) Limit switches to be in place
5	Guide wall Excavation	a) Collapse of excavation b) person fall in to excavated pit	Injury to persons	a) Toolbox talks to be given before starting of the work b) All excavated area should have proper slope according to angle of response c) Barricades



				around excavated pits d) Use of PPE. Safety Helmet, Safety Shoes and safety vest	
6	Grabbing of D wall	Non provision of grating and spillage due to Bentonite muck & boring mud in or around the trench	Chances of person to fall into the trench.	a) Toolbox talks to be given before starting of the work b) Fabrication of proper and good quality grating for covering the trench. As soon as boring is completed it should be covered immediately. c) Fully equipped ambulance to be made available at site round the clock	
		Removal of muck Slip/trip spillage of muck	Injury to persons	a) Toolbox talks to be given before starting of the work b) Provide bunds where muck is stored c) Dispose-off muck to low lying area fillings d) Removal of muck through trucks without any spillage e) Barricade the area by hoarding board f) use of PPE's Safety Helmet, Safety Shoe, and Safety vest	
		Collapsing of cage at	Injury to persons Damage to	a) Use standard slings b) Trained Signalmen/ bank's	



			property	man c) Certified lifting gear	
		Presence of person under the swing area of crane	Injury to persons	a) Mark the swing area of crane with caution tape and displaying signboard	
		Breaking of steel wire rope and falling on	Injury to persons	a) Steel wire rope to be checked for damage. b) Ensure operator shed is available	
			Damage to property		
7	Concreting	Tremmie pipe swing or fall	Injury to persons	a) Toolbox talks to be given before starting of the work b) Always use single guy rope while lifting and double guy rope while shifting of tremmie pipe	
		Reversing of transit mixer	Chances of person getting Struck- Injury of persons Run over by vehicle	a) Provision of banks man/helper and installation of reverse horn while reversing transit mixer.	
		Concrete pouring in concrete pump	Injury to persons Eye injury due to splash	a) Operator should always wear white goggles and hand gloves during concrete operation.	
8	River leveling	Collapse of soil Equipment unbalanced	Injury to persons Damage to property	a) Toolbox talks to be given before starting of the work b) check the ground condition provide proper support to the equipment c) Check the	

				<p>vehicle condition</p> <p>d) before starting of the work</p> <p>e) proper barricades should be done wherever required and sign boards</p> <p>f) Proper bank's man provided for vehicles</p>
9	Back Filling	<p>Un-leveled soil condition</p> <p>Unloading of materials for back fill</p>	<p>Injury to persons</p> <p>Damage to property</p>	<p>a) Toolbox talks to be given before starting of the work</p> <p>b) water sprinkling should be done</p> <p>c) proper barricades should be done wherever required and sign boards</p> <p>d) Proper bank's man provided for vehicles</p>



Annexure 7: HIV/AIDS/ STDs AWARENESS PROGRAMME

As per Clause 6.7 of Part-B- Specific Conditions under Particular Conditions of the Contract, the Contractor shall conduct awareness programme on HIV/AIDS and Sexually Transmitted Diseases (STDs) for the employees of contractors engaged under the project and to the members of the local communities surrounding the project area, particularly females on regular basis.

Objective:

- To raise awareness amongst construction workers and the local community of the risk of infection with the HIV virus and about the other Sexually Transmitted Diseases (STDs);
- To reduce the risk of transfer of the HIV virus and STDs between and among construction workers and the local community;
- To promote early diagnosis of HIV/AIDS and STDs; and
- To assist affected individuals to access care and counseling.

Activities during Awareness Camp:

The main activities during the camp will include the following:

- Awareness speech on HIV/AIDS and other sexually transmitted diseases,
- HIV/AIDS awareness posters Exhibition,
- Distribution of condoms,
- General health checkups and
- Encouraging voluntary diagnosis tests

Target Audience:

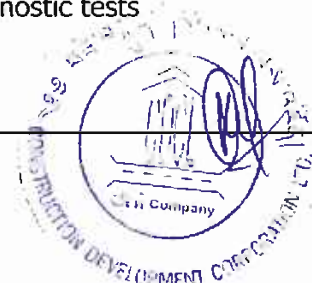
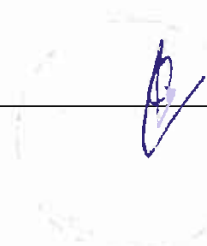
The target audience for awareness camp will mainly be the labourers, plant operators, drivers and other staff of contractors including those of subcontractor's staff and truck drivers making deliveries to sites. The interested local communities will also be involved in the awareness camps.

Process of Organising Awareness Camps:

The Afcons will identify and engage authorized service provider for conducting periodical HIV/AIDS/STDs awareness programme. The local Government health centre and District Hospital of Phuentsholing are authorized centre for organising such training programme related to different health issues. In general effort will be made to ensure presence of minimum 90% Contractor workers in the awareness camp.

The record of all the HIV/AIDS/STDs awareness camps will be maintained at camp site, which shall include:

- (i) Attendance Sheet of participants
- (ii) Photographic Records
- (iii) Record of condom distribution
- (iv) Record of voluntary diagnostic tests



Full confidentiality of record of diagnostic test will be maintained and will not be disclosed to any other person. In case of any case of HIV positive and STDs positive case is found then the affected person will be sent to the local health care department for treatment and counseling. In any case the affected workers will not be debarred from the employment and will may be given some other responsibility suitable for such persons in consultation with the doctor.

Schedule for Organising Awareness Camps:

As per the contract, the awareness programme is required to be conducted once in two months. So, in compliance to this, the HIV/AIDS/STDs awareness camp will be organized once in two months through authorized centres. However, the diagnostic tests will be carried out once in six months.

Presently, the establishment of Contractor's camp is under progress and is expected to be completed by end of January, 2019. It is planned to initiate such awareness program from February, 2019. Starting from February, 2019 the awareness camp will be organized in April, June, August, October and December every year till the contract period.



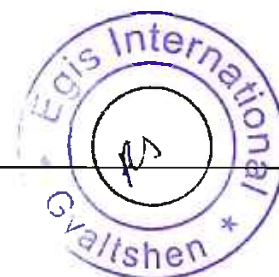
Annexure 8: Traffic Management Plan

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1. Contractor's Traffic Management Plan

1. The infrastructure development in Bhutan takes place with a balanced and environmentally sustainable development in its projects.
2. As such, Bhutan is located entirely within the Himalayan mountain range, and increasingly experiencing water induced disasters such as floods and flash floods. Such disasters occurred from Amochhu river have encroached the scarce agricultural land and unsafe terrain including steep hillsides and floodplains of Phuentsholing city.
3. In the process of prioritizing economic and infrastructure development, the Eleventh Five year plan identified Phuentsholing as a Regional growth centre that can be safely expanded through construction of flood protection works and planned Urbanization.
4. The Asia Development Bank after conducting due diligence on Technical, Financial, Environmental safeguards and other aspects had approved loan and grant for the project to be implemented by CDCL.
5. Subsequent to the funding to the project, AFCONS has entered into an Agreement with CDCL for the execution of certain Sections of the Works mentioned therein.
6. For performing those works in detail, under the Specific Provisions of the 'Particular Conditions of Contract', a Contractor's Construction Environmental Management Plan shall be prepared and submitted for approval and hence this document is established

2. Scope of the Document

7. The scope of this document is defined by the following reference documents:
 - a) Contract Document Sub-clause 4.18 of Contract Conditions
 - b) CLAUSE 6.7: HEALTH AND SAFETY
 - c) Terms and Conditions mentioned in the approvals granted by statutory authorities as applicable for this Project.
 - d) Standing Instructions of the Engineer as per the provisions of the Contract Document, if any during the works
 - e) Standards and Codes of Practices as applicable for certain activities.
 - f) RGoB standards stipulated by Environmental department (such as NEC) and HEALTH AND SAFETY
 - g) Road Safety And Transport Regulations (1999)



3. Terms & Definitions

A. Transport – It refer to all vehicles, plants or equipment used to transport personnel or Materials.

B. Roads – it refers to all routes used by transport, whether they are blacktop or gravels.

C. Light Vehicles – it refers to vehicles with maximum loaded weight up to 3500 kg.

E. Medium Vehicles – It refers to the vehicles with maximum loaded weight over 3500 kg and up to 7500 kg.

F. Heavy good vehicles – It refers to the vehicles with maximum loaded weight over 7500 kg or articulated vehicles consisting of prime mover and trailer or prime mover alone.

G. Traffic control supervisor– A person nominated by the contractor to approve journey arrangements and carry out the activities.

H. Onsite Traffic Management Plan – It aims to highlight the need to reduce the level of risk by prevention of unnecessary journeys, provision of training and adequate maintenance routine.

I. Working Zone – The Excavation, Chamber opening etc. at which workmen is working.

J. Working Space- The space around the work area that will need to store tools, excavated materials, equipment and plant. It is also the space to allow workers, movement and operation of plant (e.g. Swing of jibs, excavator arms) to move around to do the job. Material and equipment must not be stored in the working zone either. Workers will only need to enter the zone to maintain cones and other road signs.

K. Safety zone – The zone that is provided to protect workers from the traffic and to protect from them.

L. Approach Transition Zone-This will vary with the speed limit and the width of the works.

M. Longitudinal buffer zone – This is the length between the end of the lead –in taper of cones and the working space. It will vary with the speed limit.

N. Lateral buffer zone – This is the width between the working space and moving traffic. It will vary with the speed. The lateral buffer zone safety clearance is measured from the outside edge of the working space to the bottom of conical sections of the cones on the side nearest to the traffic.

O. Construction Zone- Construction Zones are an integral part of any road construction system. The safety practices in construction will, therefore, be oriented towards reducing unsafe conditions, which lead to hazards and consequent stress whereby risk of accident increases. Safety measures will be aimed at avoiding hazardous conditions especially in work sub zones where major construction activities are going on.

P. Signage's- The construction and maintenance of signage's fall into the three major categories such as regulatory, mandatory and Informatory signage's Some other signboards will also be used to regulate the traffic, which have not been standardized. However they confirm with the general requirement of shape and color, and their message is brief, legible and clearly understandable, i.e.

"CAUTION- Men at work and Machinery at work Go slow",

"CAUTION- Work in Progress Go Slow" etc.

8. The location, frequency and type of signboards will be governed by the kind of traffic situations arising during the construction. Signboards of 'men at work' and 'speed limit' will be provided at locations wherever required on a case-to-case basis.

4. Legal & Other Requirements

Road Safety and Transport Regulations (1999)

5. Purpose

9. The Purpose of this plan is to outline the requirements for road and transport during the construction In PHUENTSHOLING TOWNSHIP DEVELOPMENT PROJECT and it applies to all operation-utilizing roads or off road transportation, applicable to all contractor and subcontractors in this project.

10. However, the overall traffic management plan is also designed and intended to specify adequate safety measures against identified hazards and to stipulate implementation of safe traffic movement during construction as per contractual requirement.

11. The objective is to provide safe travel to the drivers of vehicles plying near to the project at all times and provide protection to the project workers when they are at work. The overall onsite traffic management plan delineates the safety standards in terms of Construction zones, Signage's and Safety measures in work zones and during normal operations. The onsite traffic management plan has been broadly dealt with-

- a) Traffic Management in Construction Zone.
- b) Safety in different activities while working on roads.

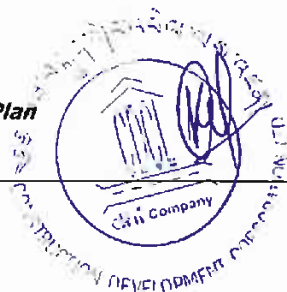
6. Terminology and Concepts

12. The purpose and function of components of a traffic management plan and their relationship to a traffic management strategy are explained.

6.1 Fundamental Definitions.

6.1.1 Proponent.

Annexure 8: Traffic Management Plan



13. The party directly constructing or maintaining works on Highways, Arterial Roads, Sub arterial roads, collector roads is responsible for obtaining authorization from the Thromde and Phuentsholing City Traffic police to work on the roadway, if the project area belongs to our client there is no need of permission to any traffic police and developing an acceptable traffic management plan, and for implementing the plan in accordance with statutory requirements. AFCONS Infrastructure Limited is the Proponent for the Traffic management in this project under the guidance of CDCL and EGIS.

6.1.2 Traffic Control Supervisor

14. Traffic Control supervisor is an individual tasked allocated by the contractor approved by the employer with the responsibility for preparing, implementing and managing the Traffic Management Plan

- a) Responsible for implementing all the necessary Traffic Management Safety measures on site.
- b) Direct the implementation of the Traffic Control Plan.
- c) Ensure that the Traffic Management Plan is up to date.
- d) Oversee modifications to the Traffic Management Plan required by construction schedule changes.
- e) Supervising and Training the Traffic marshals.
- f) Designing site basis Traffic Diversion Plan as per standards.
- g) Developing, regularly reviewing and, as appropriate, revising the project traffic management plan to ensure that it continues to meet the specific requirements of the project.
- h) Establishing a monitoring regime to ensure that unsafe systems, places are identified and remedied at the earliest.
- i) Attend regular meetings with the concern traffic department discuss performance, issues and plans with the concern with the client

6.1.3 Traffic Marshal

15. Persons who under the traffic control supervisor to execute and maintain the existing traffic management plan station wise.

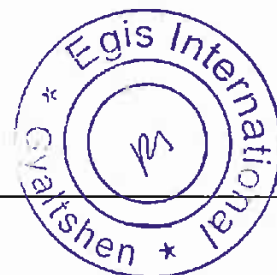
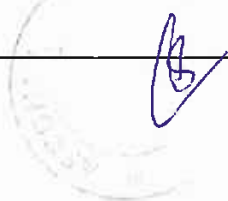
15.1.4 Onsite Traffic Management Strategy

16. Onsite Traffic Management Strategy (OTMS) is defined as follows:

17. Onsite Traffic Management Strategy defines the statutory requirements for traffic management for a project. Onsite Traffic Management Strategy identifies requirements the Onsite Traffic Management Plan made up of the following sub plans: Traffic Control Plan, Public Information Plan, Incident Plan and Implementation Plan. A strategy is developed to ensure that project needs are identified and that plans developed that address those needs over the project life cycle.

6.1.5 Onsite Traffic Management Plan (OTMP)

Annexure 8: Traffic Management Plan



18. Onsite Traffic management plan is an integral part in the delivery of traffic management and traffic control services.
19. Onsite Traffic Management Plan (OTMP) is defined as follows:
20. Onsite Traffic Management Plan details specific plan to implement the project's Traffic Management Strategy. Onsite Traffic Management Plan is comprised of sub-plans required by the strategy. Onsite Traffic Management Plan integrates these plans into a single document that demonstrates an understanding of site-specific issues and project requirements. A Traffic Management Plan shall make provision for updates and revisions throughout the project life cycle to address issues as they occur.

6.1.6 Authorization

21. This refers to the authorization given by CDCL, Phuentsholing Traffic Police, and Corporation of the city to proponents to work on a CDCL Project area, Traffic and city roads respectively where there may be impact to existing traffic. Normally there are conditions associated with such authorization, such as a requirement that the proponent must undertake traffic control in accordance with the Traffic Highway Manual, Road Safety and Transport Regulations (1999) and other statutory for Work on Roadways.

6.1.7 Approval

22. This refers to the approval of specific plans, drawings, layouts, etc. but the process will vary somewhat for different plans:

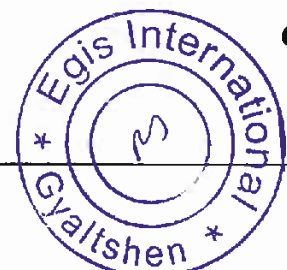
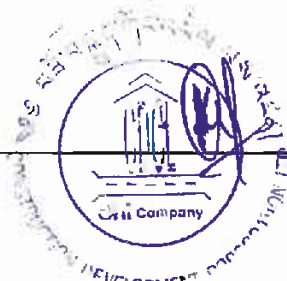
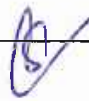
6.1.8 Responsibility

Driver

- a) Take the responsibility of the vehicle, the load and passenger being carried out.
- b) Daily checks log and reporting of defects.
- c) Understand travel plan.
- d) Ensure that all personnel in the vehicle are wearing seat belts if provision is there.
- e) Keep safe distance between its vehicle and the vehicle in front of him. Safe distance shall be increase while driving in wet condition.
- f) Notify traffic control supervisor before leaving site and after arriving to site.

Driving Requirement

23. The following guidelines apply to the qualification and requirement for driving on projects
 - a) Professional drivers shall undergo a medical examination and be certified fit before taking up a driver's job.
 - b) Hours of working, maximum work directions and minimum rest intervals.
24. Vehicles shall be registered as per local law and have construction standard. Vehicle owners shall keep all inspection /maintenance records.



Vehicle Registration Requirement

25. All vehicles movement shall be recorded in a register stating the vehicle type, registration number, and driver's name, number of passengers, Route details and planned stops.
26. All vehicles have to submit valid emission certificate issued by concerned department in Bhutan for engaging any vehicle.

Transportation

27. All vehicles convoy movement / major loads etc. shall be coordinated with Safety Representatives.

Driver Induction Training

28. All drivers must attend an induction course before being allowed to operate or drive.

Accident

29. In case of an accident the driver shall immediately
 - a) Inform the police for the accident and obtain survey report.
 - b) Inform Traffic control supervisor
 - c) Assist the police in enquiry.

28. In case of Accident driver shall not:

- a) Move the vehicle from the scene of the accident until the police orders.
- b) Leave the place of accident

Condition of vehicle

29. The driver is responsible for inspecting a vehicle before operating it as per checklist attached.

7.OTMP Preparation

7.1 Concerns of Local Community and Client, other contractor Limiting Traffic Movements

30. Proponent project concern for the local community of the working areas and the surrounding areas will be any disturbances caused by traffic. Therefore, we have developed our construction design and methodology to:
 - a) Minimize generation of traffic.
 - b) Safely manage pedestrians.
 - c) Endeavour to ensure that materials delivered by road travel as short a distance as possible.
 - d) Maintain access for site offices and stores.
 - e) Coordination with the Phuentsholing Chamkuna Road(PCR) regarding traffic control and if any diversion communication in regular intervals



- f) Outside materials Vehicles timings to be maintained from 2pm to 5pm to avoid heavy traffic in peak time
- g) If required major good vehicles called for late night and delivery in early morning avoid heavy traffic in peak time

7.1.1 Design

31. Throughout Phuentsholing Township Development Project of Proponent, Traffic Management has been an integral part of the proposed solution. Measures include:

- a) Use of concrete for civil construction by transit mixtures.
- b) Removal and Disposing of excavated soil from site.
- c) Material transporting vehicles.
- d) Visitor's vehicles.

7.1.2 Construction

32. The philosophy of minimizing road use as far as reasonably practicable has continued through the construction planning and the development of the OTMP. All planning and procurement relating to large items of plant and their usage has been based around keeping these items on site for the duration of an activity, rather than the normal practice of plant coming and going from site to keep hire rates/standing time to a minimum, this will be a greater cost to the project.

33. All abnormal (low loaders) movements will be planned in advance and, will be done in accordance with an appropriate risk assessment. Where such vehicles are brought onto site, a banks man will be utilized at all times.

34. A record of all materials and method of transportation will be kept, monitored, and made available for the Client at all times.

35. All the above measures for bringing vehicles on to site will be adhered to when vehicles are leaving the premises.

7.2 Control Measures

7.2.1 Access Control

36. The principal means of reducing traffic hazards on site is by effectively eliminating the presence of unnecessary vehicles. Vehicles may only access the site through specific gates/entry, and only then if the driver is in possession of an appropriate license. The issue of vehicle passes will be subject to continuing scrutiny.

7.2.2 Site Speed Limit

37. A speed limit of 10 KMPH has been established across the site. It is clearly indicated at entrances, and is further informed in the induction training to all the interested parties. Reversing of vehicles permitted with reverse alarm/horn or banks man to be deployed

Annexure 8: Traffic Management Plan



for reversing. Reversing of vehicles only at designated areas only where sign of reversing vehicle placed.

7.2.3 Interfaces between On-Site and Off-Site Road Movement

38. When necessary to minimize the spread of material from the area of the excavation. In addition, the site roads will be regularly cleaned. These steps will ensure that material will not be transferred to the public highway. Dust suppression measures will be implemented which will prevent the generation of fugitive dust.

7.2.4 Interfaces with Public

39. Pedestrian barriers will be erected at the site access to control the interface between public and site construction activities.

40. A crossing point for pedestrians over the site access will be established and clearly demarked and signed.

7.2.5 Visitors to Site

41. A security cabin and security personnel will be positioned at the site entrance. Access to the construction site is controlled and manned by a trained security guard at the site entrance. Visitors to site must sign in and out at security. The security guard will issue a copy of the visitor induction form to all visitors. All visitors must be accompanied at all times while on site.

7.2.6 Trespassing onto Site and project Area

42. It will be the duty and responsibility of site security to prevent unauthorized entry onto the site. The treatment works site will be completely monitoring and controlled trespassing by regular monitoring by securities and any trespasser found any activities like car washing initially verbal instruction provided and send them out. The relevant sign boards displayed around the project area

7.2.7 Parking on Site.

43. Proponent has designated parking & office area for the use of its employees, including subcontractors during construction phase. The traffic control supervisor will monitor the parking of all vehicles associated with the site works and he will apply the proponent disciplinary code as outlined in the OHS&E plan for breeches of the proponent site rules in relation to parking in prohibited area.

44. Depending on the stage the project and the number of employees on site, other options such as car, two wheeler, earth moving equipment and alternative parking will be utilized if parking becomes a problem.

45. Cones and/ or barriers to be used where necessary to prevent parking adjacent to the construction site and along the access roads towards the site. If required cones / barriers will be used to assist in the free flow of traffic on the surrounding road network to enhance traffic and pedestrian safety at all times.



46. On site Traffic management plan layout are shown in the Annexure A

7.2.8 Inspection or periodic inspection of Vehicle

- 47. Regular checking and recording of valid emission certificate.
- 48. Periodical checking of reverse horn and breaks

8. Review

- 49. This plan will be reviewed every six month depending upon hazardous condition of the project.

Annexure 8: Traffic Management Plan



9. Appendix -1

FIGURE1: PROPOSED SITE LAYOUT TRAFFIC DIVERSION

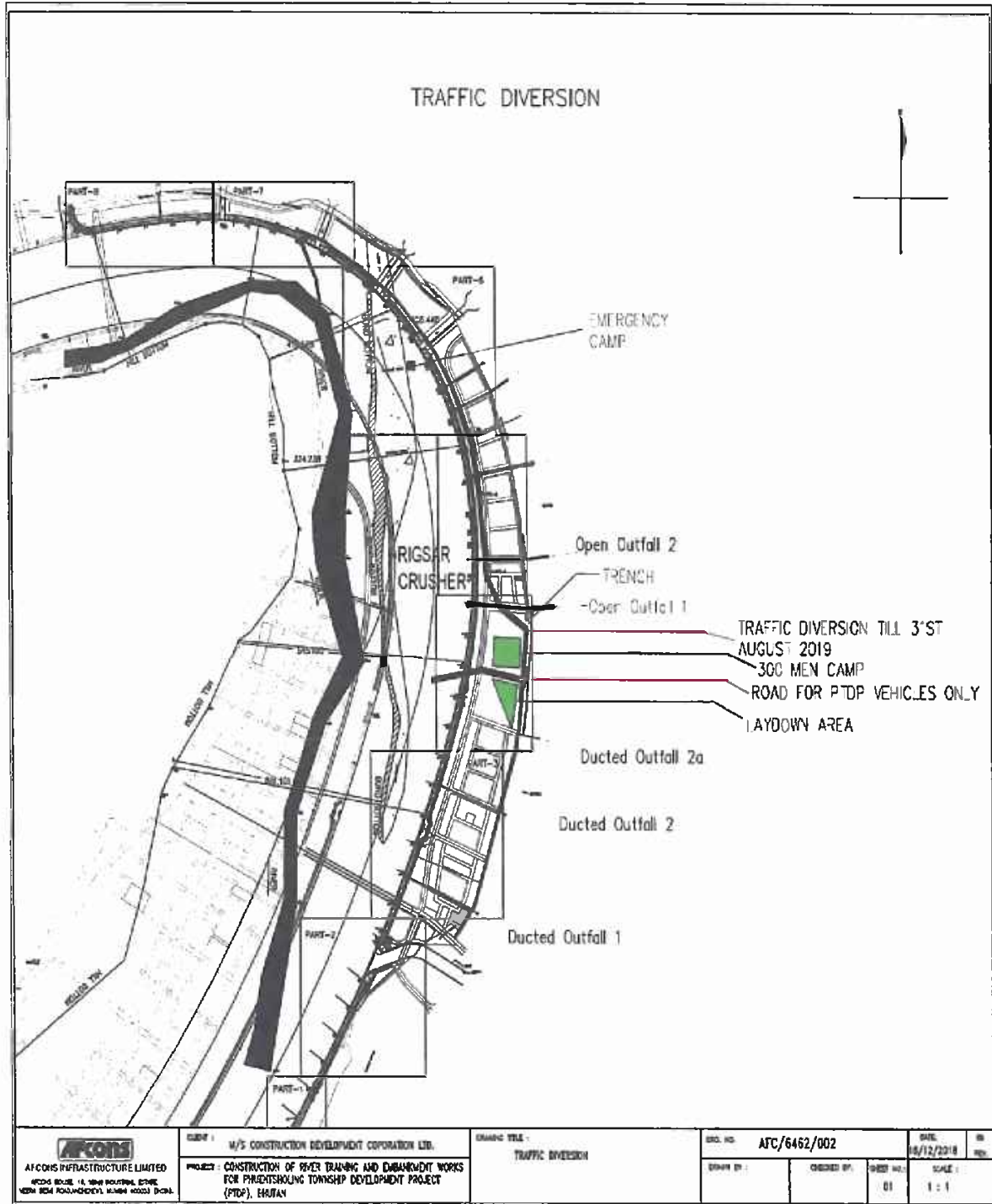



FIGURE 2: PROPOSED TRAFFIC SIGN BOARDS





Annexure 9: Construction and Demolition Waste Management Plan

1. During the project about 0.60 MT/Day constructions waste will be generated from various construction works and activities. According to the waste management hierarchy, waste reduction, reuse and recycling is most preferred than disposing it in landfill. The general construction waste that will be generated are:
 - a) Concrete Debris
 - b) Concrete blocks
 - c) Steel or metal
 - d) Wooden waste
 - e) Plastics
 - f) Tiles, bricks, etc.
 - g) Soil
 - h) Mortar
 - i) Cement Bags

Measures to manage the construction waste

2. The majority of construction and demolition waste that will be inert material and will be utilized or reused within site as filling material after proper testing.
3. Plastic is now considered a highly recyclable material; much of the plastic generated during construction will be diverted from landfill and recycled through local scrap dealer. The plastic will be segregated at source and stored in scrap yard.
4. There will be timber waste generation form the construction work as off-cuts or damaged pieces of timber. That timber will be reused for shuttering purpose.
5. Steel is highly recyclable waste material; the steel that will not be reused or recycled will be sold to authorized metal scrap dealers in Phuentsholing.
6. Proper waste management will be done only by proper segregation for that various waste categories are mentioned in **table 1**with its storage method along with their suitable disposal method.
7. Cements bags will not be generated in much quantity as the cement for batching plant will be taken from the manufacturer directly in bulkers and stored in silos.

Annexure 9: Construction and Demolition Waste Management Plan



Debris Management



1. Debris will be generated from the excavation or other construction activity will be used within designated project site for backfilling.
2. Debris will be stack with proper slope and proper height to avoid instability.
3. Debris will be place at distance away from the excavated area to avoid any hazard.

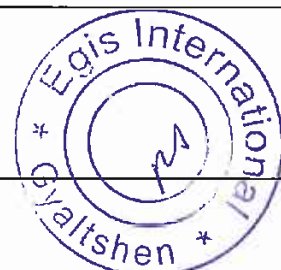
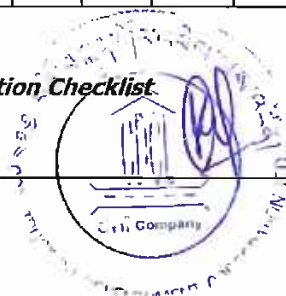
Table 1: Waste Segregation and Disposal Technique

S. No.	Types of Waste	Storage	Disposal Technique/Method
1.	Concrete waste, brick, tiles	Designated construction waste yard	Reuse at site as filling material
2.	Metal & Plastic waste	Scrap yard	Sold to scrap Dealer
3.	Wood waste	Scrap yard	Reuse for shuttering purpose
4.	Reused Bentonite	Designated area within Project area	Dried cake of Bentonite waste to be disposed at Designated landfill site of the Phuentsholing Thromde




Annexure 10: Weekly Environment Inspection Checklist

 <small>AFCONS INFRASTRUCTURE LIMITED</small>	 <small>Shapoorji Palsonji</small>	PHUENTSHOLING TOWNSHIP DEVELOPMENT PROJECT (6462) Environment Inspection Checklist		
Inspection Date:				
Inspected by:				
Environmental Protection Measure	Compliance?			Remarks/Comments (i.e. specify location, good practices, problem observed, possible cause of non-conformity and/or proposed corrective/preventative actions)
	Yes	No	N/A	
1. Air Pollution Control				
1.1. Are the construction sites watered to minimize dust generated?				
1.2. Are stockpiles of dusty materials (size with more than 20 bags cement) covered or watered?				
1.3. Cement debagging process undertaken in sheltered areas				
1.4. Are all vehicles carrying dusty loads covered/watered over prior to leaving the site?				
1.5. Are demolition work areas watered? (e.g. trimming activities by using breaker)				
1.6. Are dusty roads paved and/or sprayed with water?				
1.7. Are plant and equipment well maintained? (any black smoke observed, please indicate the plant/equipment and location)				
1.8. Is dark smoke controlled from plant?				
1.9. Is black smoke detected from DG sets?				
1.10. Are there enclosures around the main dust-generating activities?				
2. Water Pollution Control				
2.1. Is wastewater treatment system being used and properly maintained on site?				
2.2. Is on-site drainage adequate and working appropriately?				
2.3. Are all manholes on-site covered and sealed?				

3. Noise Control			
3.1. Do air compressors and DGs operate with doors closed?			
3.2. Is idle plant/equipment turned off or throttled down?			
3.3. Any noise mitigation measures adopted (e.g. use noise barrier / enclosure)?			
3.4. Are all vehicle and equipment properly maintained?			
4. Waste Management			
4.1. Is the site kept clean and tidy? (e.g. litter free, good housekeeping)			
4.2. Are Wastes segregated in designated containers?			
4.3. Are all waste containers suitably labelled and in good condition?			
4.4. Are construction wastes / recyclable wastes and general refuse removed off site regularly?			
4.5. Are chemical wastes, if any, collected and disposed of properly by licensed collectors?			
4.6. Are chemical wastes properly stored and labelled?			
4.7. Are oil drums and plants/equipment provided with drip trays?			
4.8. Are drip trays free of oil and water?			
5. Storage of Chemicals and Dangerous Goods			
5.1. Are chemicals stored and labelled properly?			
5.2. Are proper measures to control oil spillage during maintenance or to control other chemicals spillage? (e.g. provide drip trays)			
5.3. Are spill kits / sand / saw dust used for absorbing chemical spillage readily accessible?			
6. Resource Conservation			
6.1. Is water recycled wherever possible for dust suppression?			
6.2. Is water pipe leakage and wastage prevented?			

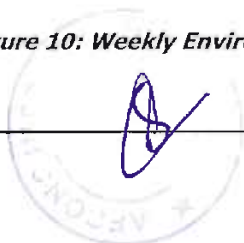


6.3. Are diesel-powered plants and equipment shut off while not in use to reduce excessive use?				
6.4. Are energy conservation practices adopted?				
6.5. Are metal or other alternatives used to minimize the use of timber?				
6.6. Are materials stored in good condition to prevent deterioration and wastage (e.g. covered, separated)?				

(HSE In-charge)

(Environment In-charge)

Annexure 10: Weekly Environment Inspection Checklist



Annexure 11: Monthly Environment Monitoring Report Outline

1. Introduction

1.1. Report Purpose

1.2. Project Update

2. Work in Progress

2.1. River Training Works

2.2. Embankment Works

2.3. General Earth Filling Works

2.4. Promenade Finishing

2.5. Irrigation and Landscape Works

2.6. Site Access and mobilization

2.7. Work Areas, Storage, Camps and office establishment

2.8. Environmental Monitoring and Assessments

3. Ambient Environmental Monitoring of the site

3.1. Details of monitoring

3.1.1. Air Quality

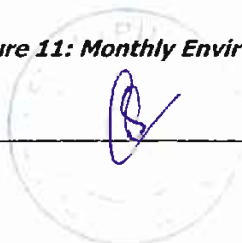
3.1.2. Water Quality

3.1.3. Noise

3.1.4. Soil

3.1.5. Weather

3.1.6. Biodiversity



3.2. Summary on status of the ambient environment

4. Waste Monitoring Program

4.1. Details of Monitoring conducted

4.1.1. Waste

4.1.2. Discharge

4.2. Results of monitoring

4.3. Assessment¹

5. Occupational Health and Safety Monitoring Program

5.1. Details of trainings, awareness and inductions carried out

5.2. Summary of Occupational Health and Safety Monitoring

5.3. Accident statistics of the month

5.4. Issues, Challenges and recommendations on OHS

¹ Discharge levels should be compared to the relevant discharge standards and/or performance indicators noted in the CEMP.

Any exceed should be highlighted for attention and follow-up. In addition, discharge levels could be compared to baseline conditions and described in qualitative terms or be evaluated based on a ranking system, such as the following:

1. Very Good (overall conditions are generally improved)
2. Good (conditions are maintained or slightly improved)
3. Fair (conditions are unchanged)
4. Poor (conditions are moderately degraded)
5. Very Poor (conditions are significantly degraded)

Additional explanatory comments should be provided as necessary.



5.5. Assessment²

6. Actions Tracking Report

6.1. Actions Identified from last month and Status

6.2. Additional issues and actions required for next month

7. Conclusion

7.1. Overall Progress of Implementation of Environmental Management Measures³

7.2. Problems Identified and Actions Recommended

Appendices

² Discharge levels should be compared to the relevant discharge standards and/or performance indicators noted in the CEMP. Any exceed should be highlighted for attention and follow-up. In addition, discharge levels could be compared to baseline conditions and described in qualitative terms or be evaluated based on a ranking system, such as the following:

1. Very Good (overall conditions are generally improved)
2. Good (conditions are maintained or slightly improved)
3. Fair (conditions are unchanged)
4. Poor (conditions are moderately degraded)
5. Very Poor (conditions are significantly degraded)

Additional explanatory comments should be provided as necessary.

³ Overall sector environmental management progress could be described in qualitative terms or be evaluated based on a ranking system, such as the following:

1. Very Good
2. Good
3. Fair
4. Poor
5. Very Poor





1. Site Inspection / Monitoring Reports (daily, weekly)
2. Ambient Monitoring Results
3. Photographs
4. Permits and clearances
5. Others

Annexure 11: Monthly Environmental Monitoring Report





བཟོ་བསྐྱུན་གོང་འཕེལ་ལས་འཛིན།
Construction Development Corporation Limited
Head Office
Thimphu: Bhutan.

CDCL/2019/PTDP/PIU/09/125

1st April 2019

Hon'ble Secretary,
National Environment Commission,
Thimphu Bhutan.

Subject: Submission of Detailed Implementation Plan (DIP) for Phuentsholing Township Development Project (PTDP)

Dear Dasho,

The Environmental Clearance for the Phuentsholing Township Development Project erstwhile named as *Amochhu Land Development and Township Project* was issued by your office vide letter no NEC/ESD/Dzo-Chukha/3496/2017/1245 dated September 2017. Accordingly, we are pleased to inform that the project has commenced as of November 2018. The first contract Package (CW-01) has been awarded to M/s Afcons Infrastructural Ltd., for the project duration of 30 months (till May 2021), which includes construction of river training and embankment works for Zone A.

As per the Environmental Clearance issued we are required to provide a Detailed Implementation Plan (DIP) of the project to NEC. In this regard, we are hereby submitting the DIP in the form of Contractors Environmental Management Plan (CEMP). This plan has also been endorsed by ADB and it provides an overall framework to ensure that the environmental mitigation measures are budgeted, an organizational structures and Grievance Redress Mechanism (GRM) are in place for use by affected stakeholders. Further CDCL will also be recruiting an Independent Environmental Monitoring Expert from mid of 2019 to provide guidance and advice on the environmental compliance in the implementation of PTDP.

We would like to thank Dasho for your continuous help and support.

Thanking You,


Sincerely,


(Phuntsho Gyeltshen)
Chief Executive Officer

Cc:


1. The Director, DoI, DHI for kind information
2. The Project Director, PIU, PTDP, CDCL, for information
3. PM/Dy. PM, PIU, PTDP, CDCL, for information
4. The Environment Manager, PTDP, for information and necessary submission.

Appendix III Emission Test Certificate for Vehicles



2009-
Capacity (cc) RPM
1 : 7.7 0
2 : 6.9 0
3 : 11.4 0
Avg : 8.0 (70.0)
Diff : 4.5 (5.0)
Result : Pass


YANGKI AUTO EMISSION CENTER
Government Approved Agency
YANGKI AUTOMOBILES
P.O. Box 384
VEHICLE EMISSION CERTIFICATE
Authorized by Royal Government of Bhutan Wide letter No. RSTA/RS-12/2016/2231-36



Vehicle #	165414	Tested Date	26/10/2018		
Make	BP-2-B9820	Registration Date	26/10/2018		
Chassis #	Mahindra	Type	Light Vehicle		
	MA1RC2VK2J36880	Engine #	VKJ4J11883		
		Fuel	Diesel		
Test Type	Test Value	Average/Spread	Result	Validity	Remarks
T1	7.7	8	PASS	26/10/2019	
T2	6.9				
T3	11.4				
Amount (Nu)					150.00

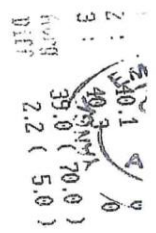
Maximum permissible HSU level = 75% for < 2005 Model & 70% for 2005 > Model
For queries contact @ 17666333 / 17177177, Email : yangkiauto@hotmail.com

Authorized Signatory



YANGKI AUTO EMISSION CENT
Govt. Approved Agent
YANGKI AUTOMOBILES
P. O. Box 384, Thimphu

4152
VEHICLE EMISSION CERTIFICATE
Authorized by Royal Government of Bhutan vide letter No. RS



2 : 54.0 (70.0)
3 : 39.0 (70.0)
Diff : 2.2 (5.0)

Emission REF :		Tested Date			
Vehicle No. :	BP-2B-9121	Registration			
Make :	Mahindra	Type :			
Frame No. :		Engine # :			
		Fuel :			
Test Type	Test Value	Average Spread	RESULT	Validity	RE M
T1	37.1	39.0	PASS	19-11-19	Govt Author YANGKI EMISS
T2	40.1				
T3	40.3				

* Maximum permissible HSU level = 4.5 < 2005 Model & 4.00 for 2005 > Model

For queries contact @ 00975-2-321184 (O), 17177177, 17666333
E-mail : yangkiauto@gmail.com

Light Vehicle
Heavy/Medium
Retest Fee Lig
Retest Heavy/Medium

POLLUTION UNDER CONTROL CERTIFICATE
(Under the West Bengal Motor Vehicles Rules, 1989)

Vehicle Registr. No. **WB70L4483** WB-01-D 5447053

Date of issue: **21-Apr-2019** Valid upto **20-Oct-2019**

Pollution Level
CO (%)
HC (ppm)
SD (HSU)

PUC Certificate issued at **Jaipoon Pollution Control Center**
for Diesel Vehicles
Licence No. **JAL/014**

License No. and Reg. No. **WB-01-D 5447053**

Vehicle Pass Certificate

OdoMeter: **0** OilTemp: **91** WB-01-D 5447053
Avg RPM MIN: **1058** Avg RPM MAX: **3665** SmokeMeter
MACHINE NAME

Passport: **JAL0000223**

Make: **TOYOTA**

Model: **INNOVA**

Vehicle type: **OTHERS**

Fuel: **DIESEL**

Reg. Year: **2019**

EngNo: **A278522**

ChassisNo: **1650772-011**

TEST TIME: **12:32:00 PM** Owner Name: **NEHA SHARMA**

TEST FEE: **100**

Flushing cycle					
Ava.	RPM Min.	RPM Max.	Temp.		
	1058	3665	109		
S.No.	RPM Min.	RPM Max.	K m-s	HSU %	Temp.
1	1051	3650	1.68	55.5	87
2	1053	3644	1.78	59.6	91
3	1065	3669	1.75	60.1	92
4	1063	3697	1.73	61.2	94
Mean	pass		1.735	59.1	

Dust Meter

2009-12-2 21:59:39

Free Acceleration Test

Opacity (%)

1 : 40.1

2 : 37.3

3 : 37.1

Avg 38.0 (70.0)

Result : Pass



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P.O. Box 384



VEHICLE EMISSION CERTIFICATE

Authorized by Royal Government of Bhutan Vide letter No. RSTA/RS-12/2016/2231-36

EMISSION REF #	215108	Tested Date	24/07/2019		
Vehicle #	BP-2-B0893	Registration Date	17/06/2011		
Make	Mahindra	Type	Light Vehicle		
Chassis #	MA1SS2BKCB2E80375	Engine #	BKB4E11250		
		Fuel	Diesel		
Test Type	Test Value	Average/Spread	Result	Validity	Remarks
T1	40.1	38	PASS	24/07/2020	
T2	37.3				
T3	37.1				
Amount (Nu)					150.00

Maximum permissible HSU level = 75% for < 2005 Model & 70% for 2005 > Model
For queries contact @ 17666333 / 17177177, Email : yangkiauto@hotmail.com

Govt. Authorized Agent
YANGKI AUTO EMISSION CENTER
P.O. Box 384

Appendix IV Calibration Certificate



CALIBRATION CERTIFICATE FOR MICRO DUSTEC - 5003 Report No: IPM-5003/2018-19/10013-01

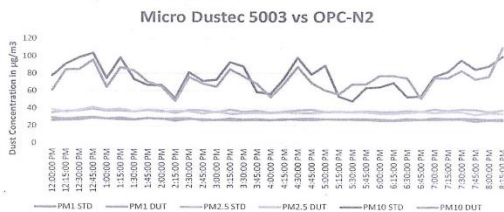
Name of the Client M/s. Bhutan Ecolab	Calibrated on: 28.01.2019	Calibration Due on: 27.01.2020	Environmental Details: Temperature : (25 ± 2)°C Relative Humidity : (68±10) %																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
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<table border="1"> <thead> <tr> <th rowspan="2">Time</th> <th colspan="3">PM1.0</th> <th colspan="3">PM2.5</th> <th colspan="3">PM10</th> <th colspan="3">Temperature</th> <th colspan="3">Humidity</th> </tr> <tr> <th>STD</th> <th>DUT</th> <th>% ERR</th> <th>STD</th> <th>DUT</th> <th>% ERR</th> <th>STD</th> <th>DUT</th> <th>% ERR</th> <th>STD</th> <th>DUT</th> <th>% ERR</th> <th>STD</th> <th>DUT</th> <th>% ERR</th> </tr> </thead> <tbody> <tr><td>12:00:00 PM</td><td>26.08</td><td>29.13</td><td>-11.05</td><td>34.94</td><td>38.53</td><td>-10.53</td><td>27.63</td><td>61.1</td><td>10.0438</td><td>27.4</td><td>27.9</td><td>-1.64675</td><td>41.1</td><td>42.8</td><td>-4.13625</td></tr> <tr><td>12:15:00 PM</td><td>27.83</td><td>-4.58</td><td>36.57</td><td>35.66</td><td>-6.87247</td><td>91.02</td><td>84.37</td><td>-3.52838</td><td>27.6</td><td>27.1</td><td>1.67444</td><td>40.3</td><td>42.1</td><td>-4.46655</td></tr> <tr><td>12:30:00 PM</td><td>28.29</td><td>28.99</td><td>-8.21</td><td>37.14</td><td>37.89</td><td>0.66854</td><td>98.48</td><td>84.9</td><td>-0.68224</td><td>27.6</td><td>27.2</td><td>1.58335</td><td>42.0</td><td>43.4</td><td>-3.33333</td></tr> <tr><td>12:45:00 PM</td><td>28.99</td><td>29.83</td><td>-2.93</td><td>39.3</td><td>41.36</td><td>-10.0642</td><td>103.57</td><td>95.76</td><td>-5.00091</td><td>27.8</td><td>27.7</td><td>2.08819</td><td>42.0</td><td>43.8</td><td>-4.26571</td></tr> <tr><td>1:00:00 PM</td><td>28</td><td>28.04</td><td>-0.14</td><td>36.9</td><td>37.88</td><td>-9.91242</td><td>74.62</td><td>64.34</td><td>-5.05801</td><td>28.0</td><td>27.6</td><td>1.3701</td><td>43.5</td><td>44.2</td><td>-2.75862</td></tr> <tr><td>1:15:00 PM</td><td>27.15</td><td>29.19</td><td>-7.51</td><td>37.2</td><td>39.25</td><td>-6.742</td><td>98.22</td><td>86.93</td><td>-2.90007</td><td>28.2</td><td>27.7</td><td>1.79678</td><td>43.1</td><td>44.1</td><td>-2.32019</td></tr> <tr><td>1:30:00 PM</td><td>28.84</td><td>27.32</td><td>1.79</td><td>36.15</td><td>36.23</td><td>0.11532</td><td>73.35</td><td>83.42</td><td>-1.18181</td><td>28.4</td><td>28</td><td>1.29448</td><td>44.0</td><td>45.2</td><td>-2.72727</td></tr> <tr><td>1:45:00 PM</td><td>28.52</td><td>28.7</td><td>-0.63</td><td>47.96</td><td>47.05</td><td>3.35889</td><td>66.7</td><td>70.54</td><td>-2.69565</td><td>28.5</td><td>28.1</td><td>1.34639</td><td>45.0</td><td>45.7</td><td>-1.55556</td></tr> <tr><td>2:00:00 PM</td><td>28.13</td><td>27.73</td><td>1.42</td><td>37.07</td><td>35.99</td><td>-4.81811</td><td>66.87</td><td>65.28</td><td>-2.48135</td><td>28.6</td><td>28.1</td><td>1.29215</td><td>44.6</td><td>45.1</td><td>-1.12104</td></tr> <tr><td>2:15:00 PM</td><td>27.75</td><td>28.46</td><td>-10.52</td><td>34.68</td><td>36.99</td><td>-12.461</td><td>51.98</td><td>48.59</td><td>-2.00197</td><td>28.8</td><td>28.3</td><td>1.68132</td><td>44.7</td><td>44.5</td><td>0.44241</td></tr> <tr><td>2:30:00 PM</td><td>27.7</td><td>28.23</td><td>-3.22</td><td>37.93</td><td>36.79</td><td>1.18592</td><td>81.52</td><td>76.27</td><td>-0.14167</td><td>29.0</td><td>28.4</td><td>2.00409</td><td>43.0</td><td>43.8</td><td>-1.86047</td></tr> <tr><td>2:45:00 PM</td><td>27.52</td><td>29.91</td><td>-9.85</td><td>37.63</td><td>33.99</td><td>3.35292</td><td>71.55</td><td>68.54</td><td>-0.87641</td><td>29.2</td><td>28.8</td><td>1.39215</td><td>42.6</td><td>43.2</td><td>-1.40845</td></tr> <tr><td>3:00:00 PM</td><td>26.36</td><td>26.76</td><td>-1.52</td><td>35.74</td><td>36.21</td><td>-8.73515</td><td>72.99</td><td>64.86</td><td>-3.63575</td><td>29.3</td><td>29</td><td>1.19183</td><td>42.6</td><td>43</td><td>-0.93827</td></tr> <tr><td>3:15:00 PM</td><td>28.4</td><td>26.27</td><td>7.50</td><td>38.6</td><td>33.76</td><td>7.7507</td><td>93.15</td><td>85.37</td><td>-0.11881</td><td>29.5</td><td>29.1</td><td>1.31545</td><td>41.7</td><td>42.7</td><td>-2.39808</td></tr> <tr><td>3:30:00 PM</td><td>28.4</td><td>26.27</td><td>7.50</td><td>38.6</td><td>33.76</td><td>7.7507</td><td>88.12</td><td>76.73</td><td>-2.00448</td><td>29.7</td><td>29.3</td><td>1.29131</td><td>42.1</td><td>42.4</td><td>-0.71259</td></tr> <tr><td>3:45:00 PM</td><td>27.68</td><td>26.53</td><td>4.15</td><td>37.28</td><td>34.85</td><td>6.96398</td><td>58.86</td><td>68.47</td><td>-3.25903</td><td>29.9</td><td>29.5</td><td>1.22184</td><td>41.6</td><td>42.1</td><td>-1.20192</td></tr> <tr><td>4:00:00 PM</td><td>28.71</td><td>26.47</td><td>0.90</td><td>35.2</td><td>34.48</td><td>-4.91743</td><td>56.65</td><td>52.91</td><td>-5.85391</td><td>30.1</td><td>29.6</td><td>1.81281</td><td>40.2</td><td>41.9</td><td>-4.22886</td></tr> <tr><td>4:15:00 PM</td><td>27.08</td><td>27.86</td><td>-2.88</td><td>36.51</td><td>35.64</td><td>-4.61518</td><td>74.98</td><td>68.91</td><td>-6.58132</td><td>30.6</td><td>30</td><td>2.07183</td><td>40.8</td><td>41.6</td><td>-1.96078</td></tr> <tr><td>4:30:00 PM</td><td>28.19</td><td>27.13</td><td>3.83</td><td>37.77</td><td>34.72</td><td>4.18278</td><td>98.23</td><td>87.70</td><td>-2.07589</td><td>30.9</td><td>30.3</td><td>1.87188</td><td>39.9</td><td>41.4</td><td>-3.7594</td></tr> <tr><td>4:45:00 PM</td><td>28.4</td><td>26.65</td><td>6.16</td><td>38.64</td><td>34.62</td><td>9.31331</td><td>76.24</td><td>69.43</td><td>-4.17237</td><td>31.4</td><td>30.9</td><td>1.68724</td><td>39.4</td><td>41.3</td><td>-4.82234</td></tr> <tr><td>5:00:00 PM</td><td>27.65</td><td>27.66</td><td>0.04</td><td>36.39</td><td>35.93</td><td>-2.47384</td><td>89.27</td><td>60.87</td><td>-2.30634</td><td>32.2</td><td>31.8</td><td>1.16304</td><td>39.6</td><td>41.1</td><td>-3.7828</td></tr> <tr><td>5:15:00 PM</td><td>27.85</td><td>27.34</td><td>1.87</td><td>36.83</td><td>35.68</td><td>10.4901</td><td>54.01</td><td>56.47</td><td>-5.01081</td><td>32.6</td><td>32</td><td>1.01841</td><td>40.6</td><td>41</td><td>-0.98527</td></tr> <tr><td>5:30:00 PM</td><td>27.92</td><td>27.12</td><td>2.87</td><td>36.3</td><td>35.8</td><td>5.65461</td><td>48.58</td><td>68.05</td><td>-2.85866</td><td>33.0</td><td>32.6</td><td>1.26777</td><td>39.8</td><td>40.9</td><td>-2.76382</td></tr> <tr><td>5:45:00 PM</td><td>27.99</td><td>27.12</td><td>3.11</td><td>37.03</td><td>35.8</td><td>-4.92104</td><td>63.92</td><td>68.05</td><td>-3.21117</td><td>34.0</td><td>33.7</td><td>0.89993</td><td>39.6</td><td>40.8</td><td>-3.0303</td></tr> <tr><td>6:00:00 PM</td><td>27.51</td><td>26.15</td><td>4.94</td><td>36.51</td><td>34.34</td><td>6.04</td><td>64.8</td><td>72.69</td><td>-4.45055</td><td>35.0</td><td>34.7</td><td>0.94417</td><td>39.6</td><td>40.8</td><td>-3.0303</td></tr> <tr><td>6:15:00 PM</td><td>27.71</td><td>26.15</td><td>4.94</td><td>36.51</td><td>34.34</td><td>6.04</td><td>64.8</td><td>72.69</td><td>-4.45055</td><td>36.0</td><td>35.7</td><td>1.34575</td><td>39.0</td><td>40.7</td><td>-4.35897</td></tr> <tr><td>6:30:00 PM</td><td>28.43</td><td>26.86</td><td>5.52</td><td>37.66</td><td>35.38</td><td>5.23861</td><td>53.53</td><td>75.2</td><td>-2.44449</td><td>38.0</td><td>37.6</td><td>1.09118</td><td>39.2</td><td>40.7</td><td>-3.02513</td></tr> <tr><td>6:45:00 PM</td><td>27.34</td><td>27.86</td><td>-0.65</td><td>36.55</td><td>36.11</td><td>-9.74688</td><td>54.33</td><td>51.78</td><td>-5.24059</td><td>38.6</td><td>38.1</td><td>0.7646</td><td>39.2</td><td>40.6</td><td>-3.57143</td></tr> <tr><td>7:00:00 PM</td><td>29.17</td><td>27.04</td><td>7.39</td><td>36.64</td><td>35.3</td><td>7.30282</td><td>76.84</td><td>75.17</td><td>-3.42905</td><td>39.1</td><td>39.3</td><td>-0.29397</td><td>39.2</td><td>40.6</td><td>-3.57143</td></tr> <tr><td>7:15:00 PM</td><td>28.34</td><td>27.91</td><td>1.52</td><td>37.66</td><td>36.27</td><td>-2.01751</td><td>82.5</td><td>75.43</td><td>-1.86368</td><td>39.3</td><td>39.6</td><td>-0.68752</td><td>39.3</td><td>40.7</td><td>-3.56234</td></tr> <tr><td>7:30:00 PM</td><td>28.95</td><td>27.22</td><td>4.25</td><td>39.51</td><td>36.39</td><td>7.42202</td><td>95.66</td><td>83.76</td><td>-3.68214</td><td>39.3</td><td>39.7</td><td>-1.10889</td><td>39.5</td><td>40.8</td><td>-3.29114</td></tr> <tr><td>7:45:00 PM</td><td>28.43</td><td>25.52</td><td>10.24</td><td>38.91</td><td>33.24</td><td>-9.01789</td><td>85.3</td><td>73.88</td><td>-2.21609</td><td>38.7</td><td>39.1</td><td>-0.91885</td><td>39.5</td><td>40.8</td><td>-3.29114</td></tr> <tr><td>8:00:00 PM</td><td>27.74</td><td>26.89</td><td>1.28</td><td>36.56</td><td>35.26</td><td>-0.17743</td><td>89.08</td><td>77.2</td><td>-0.08675</td><td>38.1</td><td>38.6</td><td>-1.28602</td><td>39.5</td><td>40.8</td><td>-3.29114</td></tr> <tr><td>8:15:00 PM</td><td>26.18</td><td>26.34</td><td>-0.58</td><td>38.27</td><td>34.51</td><td>5.23438</td><td>100.03</td><td>110.24</td><td>-1.88646</td><td>37.1</td><td>37.8</td><td>-1.7659</td><td>40.3</td><td>41.1</td><td>-2.00977</td></tr> <tr><td>AVERAGE</td><td>27.64</td><td>27.38</td><td>0.84</td><td>37.15</td><td>35.94</td><td>-2.29</td><td>76.63</td><td>73.41</td><td>-1.99</td><td>32.12</td><td>31.85</td><td>0.94</td><td>41.12</td><td>42.24</td><td>-2.75</td></tr> </tbody> </table>				Time	PM1.0			PM2.5			PM10			Temperature			Humidity			STD	DUT	% ERR	STD	DUT	% ERR	STD	DUT	% ERR	STD	DUT	% ERR	STD	DUT	% ERR	12:00:00 PM	26.08	29.13	-11.05	34.94	38.53	-10.53	27.63	61.1	10.0438	27.4	27.9	-1.64675	41.1	42.8	-4.13625	12:15:00 PM	27.83	-4.58	36.57	35.66	-6.87247	91.02	84.37	-3.52838	27.6	27.1	1.67444	40.3	42.1	-4.46655	12:30:00 PM	28.29	28.99	-8.21	37.14	37.89	0.66854	98.48	84.9	-0.68224	27.6	27.2	1.58335	42.0	43.4	-3.33333	12:45:00 PM	28.99	29.83	-2.93	39.3	41.36	-10.0642	103.57	95.76	-5.00091	27.8	27.7	2.08819	42.0	43.8	-4.26571	1:00:00 PM	28	28.04	-0.14	36.9	37.88	-9.91242	74.62	64.34	-5.05801	28.0	27.6	1.3701	43.5	44.2	-2.75862	1:15:00 PM	27.15	29.19	-7.51	37.2	39.25	-6.742	98.22	86.93	-2.90007	28.2	27.7	1.79678	43.1	44.1	-2.32019	1:30:00 PM	28.84	27.32	1.79	36.15	36.23	0.11532	73.35	83.42	-1.18181	28.4	28	1.29448	44.0	45.2	-2.72727	1:45:00 PM	28.52	28.7	-0.63	47.96	47.05	3.35889	66.7	70.54	-2.69565	28.5	28.1	1.34639	45.0	45.7	-1.55556	2:00:00 PM	28.13	27.73	1.42	37.07	35.99	-4.81811	66.87	65.28	-2.48135	28.6	28.1	1.29215	44.6	45.1	-1.12104	2:15:00 PM	27.75	28.46	-10.52	34.68	36.99	-12.461	51.98	48.59	-2.00197	28.8	28.3	1.68132	44.7	44.5	0.44241	2:30:00 PM	27.7	28.23	-3.22	37.93	36.79	1.18592	81.52	76.27	-0.14167	29.0	28.4	2.00409	43.0	43.8	-1.86047	2:45:00 PM	27.52	29.91	-9.85	37.63	33.99	3.35292	71.55	68.54	-0.87641	29.2	28.8	1.39215	42.6	43.2	-1.40845	3:00:00 PM	26.36	26.76	-1.52	35.74	36.21	-8.73515	72.99	64.86	-3.63575	29.3	29	1.19183	42.6	43	-0.93827	3:15:00 PM	28.4	26.27	7.50	38.6	33.76	7.7507	93.15	85.37	-0.11881	29.5	29.1	1.31545	41.7	42.7	-2.39808	3:30:00 PM	28.4	26.27	7.50	38.6	33.76	7.7507	88.12	76.73	-2.00448	29.7	29.3	1.29131	42.1	42.4	-0.71259	3:45:00 PM	27.68	26.53	4.15	37.28	34.85	6.96398	58.86	68.47	-3.25903	29.9	29.5	1.22184	41.6	42.1	-1.20192	4:00:00 PM	28.71	26.47	0.90	35.2	34.48	-4.91743	56.65	52.91	-5.85391	30.1	29.6	1.81281	40.2	41.9	-4.22886	4:15:00 PM	27.08	27.86	-2.88	36.51	35.64	-4.61518	74.98	68.91	-6.58132	30.6	30	2.07183	40.8	41.6	-1.96078	4:30:00 PM	28.19	27.13	3.83	37.77	34.72	4.18278	98.23	87.70	-2.07589	30.9	30.3	1.87188	39.9	41.4	-3.7594	4:45:00 PM	28.4	26.65	6.16	38.64	34.62	9.31331	76.24	69.43	-4.17237	31.4	30.9	1.68724	39.4	41.3	-4.82234	5:00:00 PM	27.65	27.66	0.04	36.39	35.93	-2.47384	89.27	60.87	-2.30634	32.2	31.8	1.16304	39.6	41.1	-3.7828	5:15:00 PM	27.85	27.34	1.87	36.83	35.68	10.4901	54.01	56.47	-5.01081	32.6	32	1.01841	40.6	41	-0.98527	5:30:00 PM	27.92	27.12	2.87	36.3	35.8	5.65461	48.58	68.05	-2.85866	33.0	32.6	1.26777	39.8	40.9	-2.76382	5:45:00 PM	27.99	27.12	3.11	37.03	35.8	-4.92104	63.92	68.05	-3.21117	34.0	33.7	0.89993	39.6	40.8	-3.0303	6:00:00 PM	27.51	26.15	4.94	36.51	34.34	6.04	64.8	72.69	-4.45055	35.0	34.7	0.94417	39.6	40.8	-3.0303	6:15:00 PM	27.71	26.15	4.94	36.51	34.34	6.04	64.8	72.69	-4.45055	36.0	35.7	1.34575	39.0	40.7	-4.35897	6:30:00 PM	28.43	26.86	5.52	37.66	35.38	5.23861	53.53	75.2	-2.44449	38.0	37.6	1.09118	39.2	40.7	-3.02513	6:45:00 PM	27.34	27.86	-0.65	36.55	36.11	-9.74688	54.33	51.78	-5.24059	38.6	38.1	0.7646	39.2	40.6	-3.57143	7:00:00 PM	29.17	27.04	7.39	36.64	35.3	7.30282	76.84	75.17	-3.42905	39.1	39.3	-0.29397	39.2	40.6	-3.57143	7:15:00 PM	28.34	27.91	1.52	37.66	36.27	-2.01751	82.5	75.43	-1.86368	39.3	39.6	-0.68752	39.3	40.7	-3.56234	7:30:00 PM	28.95	27.22	4.25	39.51	36.39	7.42202	95.66	83.76	-3.68214	39.3	39.7	-1.10889	39.5	40.8	-3.29114	7:45:00 PM	28.43	25.52	10.24	38.91	33.24	-9.01789	85.3	73.88	-2.21609	38.7	39.1	-0.91885	39.5	40.8	-3.29114	8:00:00 PM	27.74	26.89	1.28	36.56	35.26	-0.17743	89.08	77.2	-0.08675	38.1	38.6	-1.28602	39.5	40.8	-3.29114	8:15:00 PM	26.18	26.34	-0.58	38.27	34.51	5.23438	100.03	110.24	-1.88646	37.1	37.8	-1.7659	40.3	41.1	-2.00977	AVERAGE	27.64	27.38	0.84	37.15	35.94	-2.29	76.63	73.41	-1.99	32.12	31.85	0.94	41.12	42.24	-2.75
Time	PM1.0				PM2.5			PM10			Temperature			Humidity																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
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12:00:00 PM	26.08	29.13	-11.05	34.94	38.53	-10.53	27.63	61.1	10.0438	27.4	27.9	-1.64675	41.1	42.8	-4.13625																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
12:15:00 PM	27.83	-4.58	36.57	35.66	-6.87247	91.02	84.37	-3.52838	27.6	27.1	1.67444	40.3	42.1	-4.46655																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
12:30:00 PM	28.29	28.99	-8.21	37.14	37.89	0.66854	98.48	84.9	-0.68224	27.6	27.2	1.58335	42.0	43.4	-3.33333																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
12:45:00 PM	28.99	29.83	-2.93	39.3	41.36	-10.0642	103.57	95.76	-5.00091	27.8	27.7	2.08819	42.0	43.8	-4.26571																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
1:00:00 PM	28	28.04	-0.14	36.9	37.88	-9.91242	74.62	64.34	-5.05801	28.0	27.6	1.3701	43.5	44.2	-2.75862																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
1:15:00 PM	27.15	29.19	-7.51	37.2	39.25	-6.742	98.22	86.93	-2.90007	28.2	27.7	1.79678	43.1	44.1	-2.32019																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
1:30:00 PM	28.84	27.32	1.79	36.15	36.23	0.11532	73.35	83.42	-1.18181	28.4	28	1.29448	44.0	45.2	-2.72727																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
1:45:00 PM	28.52	28.7	-0.63	47.96	47.05	3.35889	66.7	70.54	-2.69565	28.5	28.1	1.34639	45.0	45.7	-1.55556																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
2:00:00 PM	28.13	27.73	1.42	37.07	35.99	-4.81811	66.87	65.28	-2.48135	28.6	28.1	1.29215	44.6	45.1	-1.12104																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
2:15:00 PM	27.75	28.46	-10.52	34.68	36.99	-12.461	51.98	48.59	-2.00197	28.8	28.3	1.68132	44.7	44.5	0.44241																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
2:30:00 PM	27.7	28.23	-3.22	37.93	36.79	1.18592	81.52	76.27	-0.14167	29.0	28.4	2.00409	43.0	43.8	-1.86047																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
2:45:00 PM	27.52	29.91	-9.85	37.63	33.99	3.35292	71.55	68.54	-0.87641	29.2	28.8	1.39215	42.6	43.2	-1.40845																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
3:00:00 PM	26.36	26.76	-1.52	35.74	36.21	-8.73515	72.99	64.86	-3.63575	29.3	29	1.19183	42.6	43	-0.93827																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
3:15:00 PM	28.4	26.27	7.50	38.6	33.76	7.7507	93.15	85.37	-0.11881	29.5	29.1	1.31545	41.7	42.7	-2.39808																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
3:30:00 PM	28.4	26.27	7.50	38.6	33.76	7.7507	88.12	76.73	-2.00448	29.7	29.3	1.29131	42.1	42.4	-0.71259																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
3:45:00 PM	27.68	26.53	4.15	37.28	34.85	6.96398	58.86	68.47	-3.25903	29.9	29.5	1.22184	41.6	42.1	-1.20192																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
4:00:00 PM	28.71	26.47	0.90	35.2	34.48	-4.91743	56.65	52.91	-5.85391	30.1	29.6	1.81281	40.2	41.9	-4.22886																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
4:15:00 PM	27.08	27.86	-2.88	36.51	35.64	-4.61518	74.98	68.91	-6.58132	30.6	30	2.07183	40.8	41.6	-1.96078																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
4:30:00 PM	28.19	27.13	3.83	37.77	34.72	4.18278	98.23	87.70	-2.07589	30.9	30.3	1.87188	39.9	41.4	-3.7594																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
4:45:00 PM	28.4	26.65	6.16	38.64	34.62	9.31331	76.24	69.43	-4.17237	31.4	30.9	1.68724	39.4	41.3	-4.82234																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
5:00:00 PM	27.65	27.66	0.04	36.39	35.93	-2.47384	89.27	60.87	-2.30634	32.2	31.8	1.16304	39.6	41.1	-3.7828																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
5:15:00 PM	27.85	27.34	1.87	36.83	35.68	10.4901	54.01	56.47	-5.01081	32.6	32	1.01841	40.6	41	-0.98527																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
5:30:00 PM	27.92	27.12	2.87	36.3	35.8	5.65461	48.58	68.05	-2.85866	33.0	32.6	1.26777	39.8	40.9	-2.76382																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
5:45:00 PM	27.99	27.12	3.11	37.03	35.8	-4.92104	63.92	68.05	-3.21117	34.0	33.7	0.89993	39.6	40.8	-3.0303																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
6:00:00 PM	27.51	26.15	4.94	36.51	34.34	6.04	64.8	72.69	-4.45055	35.0	34.7	0.94417	39.6	40.8	-3.0303																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
6:15:00 PM	27.71	26.15	4.94	36.51	34.34	6.04	64.8	72.69	-4.45055	36.0	35.7	1.34575	39.0	40.7	-4.35897																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
6:30:00 PM	28.43	26.86	5.52	37.66	35.38	5.23861	53.53	75.2	-2.44449	38.0	37.6	1.09118	39.2	40.7	-3.02513																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
6:45:00 PM	27.34	27.86	-0.65	36.55	36.11	-9.74688	54.33	51.78	-5.24059	38.6	38.1	0.7646	39.2	40.6	-3.57143																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
7:00:00 PM	29.17	27.04	7.39	36.64	35.3	7.30282	76.84	75.17	-3.42905	39.1	39.3	-0.29397	39.2	40.6	-3.57143																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
7:15:00 PM	28.34	27.91	1.52	37.66	36.27	-2.01751	82.5	75.43	-1.86368	39.3	39.6	-0.68752	39.3	40.7	-3.56234																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
7:30:00 PM	28.95	27.22	4.25	39.51	36.39	7.42202	95.66	83.76	-3.68214	39.3	39.7	-1.10889	39.5	40.8	-3.29114																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
7:45:00 PM	28.43	25.52	10.24	38.91	33.24	-9.01789	85.3	73.88	-2.21609	38.7	39.1	-0.91885	39.5	40.8	-3.29114																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
8:00:00 PM	27.74	26.89	1.28	36.56	35.26	-0.17743	89.08	77.2	-0.08675	38.1	38.6	-1.28602	39.5	40.8	-3.29114																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
8:15:00 PM	26.18	26.34	-0.58	38.27	34.51	5.23438	100.03	110.24	-1.88646	37.1	37.8	-1.7659	40.3	41.1	-2.00977																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
AVERAGE	27.64	27.38	0.84	37.15	35.94	-2.29	76.63	73.41	-1.99	32.12	31.85	0.94	41.12	42.24	-2.75																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		

Registered Office : 106, Ashish Udyog Bhavan, Opp. SNTD College, Liberty Garden, Malad (W), Mumbai - 400 064, India.

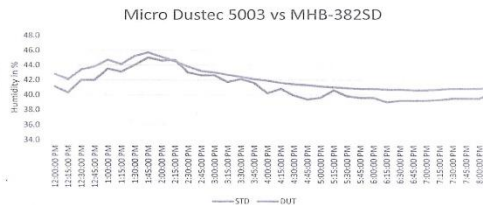
Tel: (01) 22 28443007 / 27473778 | E: info@instrumex.co.in | Website: www.instrumexindia.com



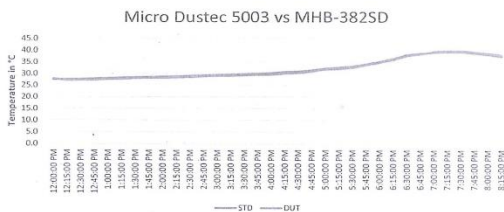
Calibration Curve for Particulates:



Calibration Curve for Humidity:



Calibration Curve for Temperature:



Remarks:

- Calibration Method - Comparison with standard device
- 8 hour test was performed on the Device Under Test (DUT) and the Standard Device (STD)
- The average percentage error of 8 hour run was within the acceptable limits.
- Results reported are valid at the time of and under the stated conditions of measurement

Calibrated by:	<i>Nesem K.</i>
Certificate Prepared by:	<i>Rishabh K.</i>
Certificate Checked by:	<i>Radheshyam K.</i>





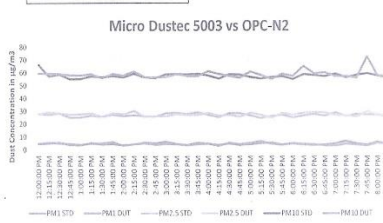
CALIBRATION CERTIFICATE FOR MICRO DUSTEC - 5003
Report No: IPM-5003/2018-19/10014-01

Name of the Client M/s. Bhutan Ecobab	Calibrated on: 28.01.2019	Calibration Due on: 27.01.2020	Environmental Details: Temperature : (25 ± 2)°C Relative Humidity : (68±10) %
Details of Device Under Calibration [DUT]: Description : Instrumex Micro Dustec Real Time Dust Monitor Model No. : 5003 Range : Particulates - 0 to 10,000 µg/m ³ Temperature - 0 to 60°C Humidity - 0 to 99.9% Serial No. : 11520		Details of Standard Instrument used for calibration [STD]: Description : 1) Alphasetense Dust monitor & 2) Temperature Humidity Sensor Model No. : 1) OPC-N2 2) MHB-3825D Range : Particulates - 0 to 10,000 µg/m ³ Temperature - 0 to 60°C Humidity - 0 to 99.9% Serial No. : 17688032 & Q20180132	

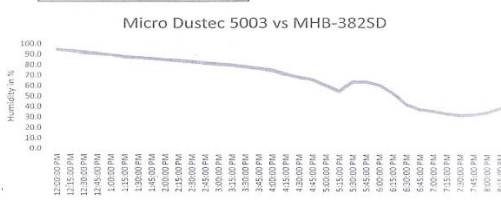
PM1.0				PM2.5				PM10				Temperature				Humidity			
Time	STD	DUT	% ERR	STD	DUT	% ERR	STD	DUT	% ERR	STD	DUT	% ERR	STD	DUT	% ERR	STD	DUT	% ERR	
12:00:00 PM	4.72	4.67	-1.0	27.96	27.5	-1.44	66.23	59.56	-10.04	27.4	27.9	1.06	95.3	94.1	-1.26	95.7	94.1	-1.69	
12:15:00 PM	5.05	5.06	0.12	27.21	29.08	6.64	57.25	59.27	3.02	27.6	27.1	-1.79	94.3	92.8	-1.57	94.3	92.8	-1.57	
12:30:00 PM	5.59	5.04	-9.84	28.42	28.23	-0.66	58.63	59.03	0.68	27.6	27.2	-1.45	92.8	91.3	-1.57	92.8	91.3	-1.57	
12:45:00 PM	4.79	4.66	-2.76	28.94	27.45	-5.15	58.13	58.09	-0.04	27.6	27.2	-1.45	92.8	91.3	-1.57	92.8	91.3	-1.57	
1:00:00 PM	3.57	3.94	10.36	25.12	27.61	9.12	55.16	57.95	5.05	28.0	27.6	-1.43	89.7	89.4	-0.305	89.7	89.4	-0.305	
1:15:00 PM	5.21	4.82	-7.49	26.55	28.34	6.74	57.29	58.9	3.21	28.2	27.2	-3.55	88.1	86.9	-1.34	88.1	86.9	-1.34	
1:30:00 PM	4.13	4.98	20.58	25.79	25.76	-0.03	56.86	55.83	-1.72	28.4	28	-1.41	87.2	86.4	-0.92	87.2	86.4	-0.92	
1:45:00 PM	4.52	6.04	33.63	27.39	28.31	3.35	57.5	59.05	2.65	28.5	28.1	-1.39	86.3	85.5	-0.92	86.3	85.5	-0.92	
2:00:00 PM	3.64	3.77	3.57	27.52	27.52	0	56.38	57.78	2.48	28.6	28.1	-1.75	85.1	84.4	-0.82	85.1	84.4	-0.82	
2:15:00 PM	4.32	4.31	-0.23	27.04	30.41	11.46	59.27	60.99	2.90	28.8	28.3	-1.70	84.6	83.5	-1.29	84.6	83.5	-1.29	
2:30:00 PM	5.59	5.08	-8.95	26.34	25.83	-1.89	56.47	56.55	0.16	29.0	28.4	-2.07	83.5	82.4	-1.33	83.5	82.4	-1.33	
2:45:00 PM	5.2	3.05	-41.92	25.87	26.22	1.35	55.91	56.4	0.89	29.2	28.8	-1.35	82.3	81	-1.55	82.3	81	-1.55	
3:00:00 PM	6.44	4.72	-26.71	28.62	26.12	-8.73	58.86	56.72	-3.63	29.2	29	-0.75	79.8	79.8	0	79.8	79.8	0	
3:15:00 PM	4.58	4.38	-4.37	28.72	27.93	-2.75	58.92	58.99	0.11	29.5	29.1	-1.33	80.3	79.1	-1.51	80.3	79.1	-1.51	
3:30:00 PM	3.89	3.35	-13.88	27.87	27.01	-3.07	58.65	57.43	-2.08	29.7	29.3	-1.34	78.6	77.5	-1.41	78.6	77.5	-1.41	
3:45:00 PM	5.41	4.3	-20.96	29.15	27.12	-6.96	59.22	57.29	-3.39	30.1	29.5	-2.00	77.0	75.9	-1.41	77.0	75.9	-1.41	
4:00:00 PM	4.83	4.83	0	27.25	28.59	4.91	57.93	61.3	5.70	30.1	29.6	-1.69	75.5	74	-1.94	75.5	74	-1.94	
4:15:00 PM	3.83	3.99	5.22	25.85	26.52	2.59	55.86	59.11	5.03	30.6	30	-2.29	73.7	73.1	-0.81	73.7	73.1	-0.81	
4:30:00 PM	5.05	5.46	8.12	28.45	27.26	-4.18	58.77	57.55	-2.07	30.9	30.3	-2.00	72.5	71.5	-1.37	72.5	71.5	-1.37	
4:45:00 PM	3.86	4.37	13.21	28.42	25.83	-9.13	58.48	56.04	-4.12	31.4	30.9	-1.62	71.3	70.2	-1.54	71.3	70.2	-1.54	
5:00:00 PM	4.44	5.12	15.32	26.76	28.76	7.89	56.8	60.95	7.07	32	31.8	0.61	69.9	69.6	-0.41	69.9	69.6	-0.41	
5:15:00 PM	5.38	6.79	26.21	24.69	27.28	10.49	55.48	58.26	5.01	32.6	32	-2.00	68.5	67.5	-1.45	68.5	67.5	-1.45	
5:30:00 PM	4.74	4.74	0	27.36	28.34	3.58	56.67	55.05	-2.85	33.0	32.6	-1.20	67.2	66.1	-1.66	67.2	66.1	-1.66	
5:45:00 PM	4.14	3.97	-4.11	27.23	28.57	4.92	57.3	59.14	3.21	34	33.7	-0.85	65.0	63.1	-2.92	65.0	63.1	-2.92	
6:00:00 PM	5	5.26	5.20	25	27.26	9.04	55.05	57.5	4.50	35.0	34.7	-0.85	63.8	62	-2.81	63.8	62	-2.81	
6:15:00 PM	4.18	4.65	11.24	26.65	28.77	7.95	58.79	65.09	10.76	35.4	35	-1.13	62.6	61.4	-1.93	62.6	61.4	-1.93	
6:30:00 PM	3.75	4.3	14.67	27.87	29.33	5.23	58.08	59.5	2.44	38.0	37.6	-1.05	61.5	60.5	-1.64	61.5	60.5	-1.64	
6:45:00 PM	4.18	3.82	-8.61	26.47	29.05	9.74	60.24	60.24	0	38.6	38.3	-0.78	60.4	59.4	-1.64	60.4	59.4	-1.64	
7:00:00 PM	5.03	3.33	-33.77	29.03	26.89	-7.57	59.2	57.17	-3.42	39.1	39.3	0.51	59.2	58.1	-1.89	59.2	58.1	-1.89	
7:15:00 PM	6.9	4.72	-31.59	26.27	26.8	2.03	56.34	57.39	1.86	39.3	39.6	0.75	58.5	57.2	-2.15	58.5	57.2	-2.15	
7:30:00 PM	4.91	4.14	-15.68	27.89	25.82	-7.22	58.15	56.01	-3.63	39.3	39.7	1.02	57.5	56.4	-1.94	57.5	56.4	-1.94	
7:45:00 PM	4.08	3.27	-19.85	27.39	29.86	9.01	59.43	62.4	5.01	38.7	39.1	1.03	56.5	55.4	-1.94	56.5	55.4	-1.94	
8:00:00 PM	6.17	5.35	-13.29	27.21	27.36	0.47	57.64	57.69	0.08	38.1	38.6	1.29	55.4	54.3	-1.94	55.4	54.3	-1.94	
8:15:00 PM	4.42	4.56	3.16	27.27	25.61	-5.72	56.19	57.5	2.30	37.8	37.8	0	54.3	53.2	-2.00	54.3	53.2	-2.00	
8:30:00 PM	4.75	4.55	-4.21	26.97	27.53	2.09	57.65	58.76	1.93	32.12	31.85	-0.84	67.81	66.76	-1.60	67.81	66.76	-1.60	

Registered Office : 106, Ashish Udyog Bhavan, Opp. SNDT College, Liberty Garden, Malad (W), Mumbai - 400 064, India.

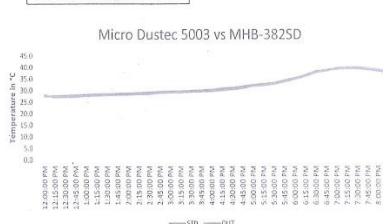
Calibration Curve for Particulates:



Calibration Curve for Humidity:



Calibration Curve for Temperature:



Remarks:

- Calibration Method : Comparison with standard device
- 8 hour test was performed on the Device Under Test (DUT) and the Standard Device (STD)
- The average percentage error of 8 hour run was within the acceptable limits.
- Results reported are valid at the time of and under the stated conditions of measurement

Calibrated by:	<i>Naem K.</i>
Certificate Prepared by:	<i>Rishabh K.</i>
Certificate Checked by:	<i>Rudreshyam K.</i>



CALIBRATION CERTIFICATE FOR MICRO DUSTEC - 5003

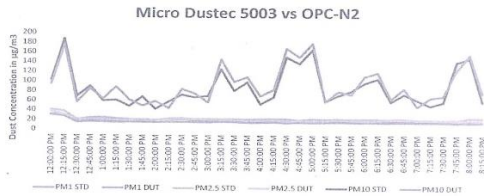
Report No: IPM-5003/2018-19/10015-01

Name of the Client		Calibrated on:	Calibration Due on:	Environmental Details:																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
M/s. Bhutan Ecolab		28.01.2019	27.01.2020	Temperature : (25 ± 2)°C Relative Humidity : (68±10) %																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
Details of Device Under Calibration [DUT]:			Details of Standard Instrument used for calibration [STD]:																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
Description : Instrumex Micro Dustec Real Time Dust Monitor			Description : 1) Alphasense Dust monitor & 2) Temperature Humidity Sensor																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
Model No. : 5003			Model No. : 1) OPC-N2 2) MHB-3825D																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
Range : Particulates – 0 to 10,000 µg/m3 Temperature – 0 to 60°C Humidity – 0 to 99.9%			Range : Particulates – 0 to 10,000 µg/m3 Temperature – 0 to 60°C Humidity – 0 to 99.9%																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
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<table border="1" style="width: 100%; border-collapse: collapse; font-size: small;"> <thead> <tr> <th rowspan="2">Time</th> <th colspan="3">PM1.0</th> <th colspan="3">PM2.5</th> <th colspan="3">PM10</th> <th colspan="3">Temperature</th> <th colspan="3">Humidity</th> </tr> <tr> <th>STD</th> <th>DUT</th> <th>% ERR</th> <th>STD</th> <th>DUT</th> <th>% ERR</th> <th>STD</th> <th>DUT</th> <th>% ERR</th> <th>STD</th> <th>DUT</th> <th>% ERR</th> <th>STD</th> <th>DUT</th> <th>% ERR</th> </tr> </thead> <tbody> <tr><td>12:00:00 PM</td><td>29.77</td><td>31.23</td><td>-4.90</td><td>37.58</td><td>1.64521</td><td>102.48</td><td>93.79</td><td>10.0438</td><td>27.4</td><td>27.2</td><td>0.72993</td><td>44.3</td><td>43.8</td><td>1.12867</td></tr> <tr><td>12:15:00 PM</td><td>27.71</td><td>30.1</td><td>-8.63</td><td>37.68</td><td>30.21</td><td>-6.87247</td><td>187.43</td><td>175.42</td><td>-3.52838</td><td>27.6</td><td>27.3</td><td>1.08696</td><td>44.1</td><td>43.8</td><td>0.68027</td></tr> <tr><td>12:30:00 PM</td><td>15.09</td><td>16.02</td><td>-6.16</td><td>20.43</td><td>21.07</td><td>-0.66854</td><td>68.6</td><td>56.45</td><td>-0.68224</td><td>27.8</td><td>27.5</td><td>1.07914</td><td>45.1</td><td>43.6</td><td>3.12594</td></tr> <tr><td>12:45:00 PM</td><td>16.87</td><td>16.58</td><td>1.72</td><td>23.93</td><td>21.19</td><td>-10.0642</td><td>89.95</td><td>88.83</td><td>-5.69091</td><td>27.9</td><td>28</td><td>-0.36852</td><td>45.2</td><td>43.6</td><td>3.31982</td></tr> <tr><td>1:00:00 PM</td><td>18.72</td><td>15.93</td><td>14.90</td><td>24.7</td><td>21.08</td><td>-9.91242</td><td>59.27</td><td>63.5</td><td>-5.05801</td><td>28.3</td><td>28.1</td><td>0.70671</td><td>44.8</td><td>43.7</td><td>2.45536</td></tr> <tr><td>1:15:00 PM</td><td>16.49</td><td>14.62</td><td>11.34</td><td>22.6</td><td>18.96</td><td>-6.742</td><td>61</td><td>88.53</td><td>-2.90007</td><td>28.9</td><td>29.2</td><td>-1.03806</td><td>45.5</td><td>44.7</td><td>1.95604</td></tr> <tr><td>1:30:00 PM</td><td>18.95</td><td>15.61</td><td>17.13</td><td>20.83</td><td>19.74</td><td>-0.11634</td><td>48.23</td><td>61.6</td><td>-1.11583</td><td>29.5</td><td>29.8</td><td>-0.55852</td><td>45.9</td><td>43.6</td><td>5.03083</td></tr> <tr><td>1:45:00 PM</td><td>15.82</td><td>15.32</td><td>3.16</td><td>20.85</td><td>10.38</td><td>-3.35889</td><td>68.03</td><td>49.18</td><td>-2.69565</td><td>29.8</td><td>30.1</td><td>-1.00671</td><td>46</td><td>43.6</td><td>5.21739</td></tr> <tr><td>2:00:00 PM</td><td>14.9</td><td>15.24</td><td>-2.28</td><td>19.54</td><td>19.77</td><td>-4.8381</td><td>42.37</td><td>58.64</td><td>-2.48315</td><td>30.7</td><td>30.4</td><td>0.9772</td><td>46</td><td>43.6</td><td>5.21739</td></tr> <tr><td>2:15:00 PM</td><td>18.95</td><td>15.61</td><td>17.13</td><td>20.83</td><td>19.74</td><td>-0.11634</td><td>48.23</td><td>61.6</td><td>-1.11583</td><td>29.5</td><td>29.8</td><td>-0.55852</td><td>45.9</td><td>43.3</td><td>5.66448</td></tr> <tr><td>2:30:00 PM</td><td>15.65</td><td>15.68</td><td>-0.19</td><td>20.99</td><td>23.55</td><td>-1.18592</td><td>72.26</td><td>84.28</td><td>-0.14167</td><td>31.6</td><td>31.5</td><td>0.31646</td><td>45.8</td><td>43.1</td><td>6.11564</td></tr> <tr><td>2:45:00 PM</td><td>16.93</td><td>14.94</td><td>11.75</td><td>21.93</td><td>21.7</td><td>-1.35292</td><td>66.22</td><td>74.51</td><td>-0.87641</td><td>32.0</td><td>31.8</td><td>0.625</td><td>45.6</td><td>43.1</td><td>5.48246</td></tr> <tr><td>3:00:00 PM</td><td>16.49</td><td>14.9</td><td>9.64</td><td>22.04</td><td>20.61</td><td>-8.23515</td><td>70.22</td><td>56.33</td><td>-3.63575</td><td>32.3</td><td>32.7</td><td>-1.23839</td><td>45.4</td><td>43.3</td><td>4.62555</td></tr> <tr><td>3:15:00 PM</td><td>16.73</td><td>16.08</td><td>3.89</td><td>21.88</td><td>21.76</td><td>-2.7507</td><td>125.47</td><td>145.56</td><td>-0.11881</td><td>32.4</td><td>32</td><td>1.23497</td><td>45.2</td><td>43.4</td><td>3.9823</td></tr> <tr><td>3:30:00 PM</td><td>16.76</td><td>15.54</td><td>7.28</td><td>21.61</td><td>20.44</td><td>-3.08576</td><td>80.73</td><td>99.37</td><td>-2.06344</td><td>32.1</td><td>31.8</td><td>0.94548</td><td>45</td><td>43.3</td><td>3.77278</td></tr> <tr><td>3:45:00 PM</td><td>16.02</td><td>14.79</td><td>7.68</td><td>21.3</td><td>19.3</td><td>-6.96398</td><td>58.33</td><td>109.27</td><td>-3.25903</td><td>31.8</td><td>32</td><td>-0.62893</td><td>44.8</td><td>43.3</td><td>3.34821</td></tr> <tr><td>4:00:00 PM</td><td>16.63</td><td>14.75</td><td>11.20</td><td>21.67</td><td>19.01</td><td>-9.91733</td><td>82.66</td><td>69.73</td><td>-5.85391</td><td>31.1</td><td>31.5</td><td>-1.28617</td><td>44.8</td><td>43.2</td><td>3.57143</td></tr> <tr><td>4:15:00 PM</td><td>16.74</td><td>15.2</td><td>7.29</td><td>22.72</td><td>20.27</td><td>-4.61538</td><td>67.49</td><td>82.94</td><td>-6.58112</td><td>31.6</td><td>31.9</td><td>-0.94937</td><td>44.6</td><td>43.1</td><td>3.36253</td></tr> <tr><td>4:30:00 PM</td><td>16.56</td><td>14.25</td><td>13.95</td><td>22.21</td><td>18.29</td><td>-4.18278</td><td>150.15</td><td>167.89</td><td>-2.0789</td><td>30.4</td><td>30.8</td><td>-1.33579</td><td>44.4</td><td>43</td><td>3.15115</td></tr> <tr><td>4:45:00 PM</td><td>15.03</td><td>15.41</td><td>-2.53</td><td>20.04</td><td>19.8</td><td>9.1133</td><td>136.83</td><td>149.85</td><td>-4.17237</td><td>30.7</td><td>31</td><td>-0.9772</td><td>44.3</td><td>42.8</td><td>3.386</td></tr> <tr><td>5:00:00 PM</td><td>16.11</td><td>14.78</td><td>8.26</td><td>22.32</td><td>18.57</td><td>-7.47384</td><td>165.88</td><td>178.49</td><td>-7.30634</td><td>31.2</td><td>31.5</td><td>-0.96154</td><td>44.3</td><td>42.6</td><td>3.81593</td></tr> <tr><td>5:15:00 PM</td><td>16.29</td><td>15.31</td><td>6.02</td><td>21.37</td><td>19.37</td><td>-10.4901</td><td>59.54</td><td>57.66</td><td>-5.01081</td><td>31.6</td><td>32</td><td>-1.26852</td><td>44.3</td><td>42.8</td><td>3.386</td></tr> <tr><td>5:30:00 PM</td><td>16.57</td><td>16.03</td><td>3.26</td><td>22.44</td><td>21.02</td><td>-5.6568</td><td>70.96</td><td>79.26</td><td>-2.85866</td><td>32.8</td><td>32.9</td><td>-1.85759</td><td>44.2</td><td>42.8</td><td>3.16742</td></tr> <tr><td>5:45:00 PM</td><td>16.04</td><td>15.46</td><td>3.62</td><td>23.41</td><td>20.02</td><td>-4.92104</td><td>80.09</td><td>73.28</td><td>-3.21117</td><td>32.8</td><td>33.3</td><td>-1.92439</td><td>44.2</td><td>42.6</td><td>3.61593</td></tr> <tr><td>6:00:00 PM</td><td>16.52</td><td>15.49</td><td>6.23</td><td>22.35</td><td>19.27</td><td>-9.04</td><td>96.39</td><td>110.48</td><td>-4.4505</td><td>33.0</td><td>33.7</td><td>-2.12121</td><td>44.2</td><td>42.5</td><td>3.84615</td></tr> <tr><td>6:15:00 PM</td><td>16.77</td><td>15.39</td><td>8.23</td><td>22.14</td><td>19.87</td><td>-7.95497</td><td>105.82</td><td>118.39</td><td>-10.7161</td><td>33.3</td><td>33.9</td><td>-1.8018</td><td>44.1</td><td>42.6</td><td>3.40136</td></tr> <tr><td>6:30:00 PM</td><td>16.87</td><td>15.36</td><td>9.07</td><td>22.05</td><td>21.24</td><td>-5.23801</td><td>57.98</td><td>63.21</td><td>-2.04439</td><td>33.6</td><td>34</td><td>-1.79641</td><td>43.9</td><td>42.6</td><td>2.96128</td></tr> <tr><td>6:45:00 PM</td><td>17.76</td><td>15.47</td><td>12.89</td><td>22.74</td><td>21.33</td><td>-9.74688</td><td>73.75</td><td>85.85</td><td>-5.24109</td><td>33.7</td><td>34.1</td><td>-1.18094</td><td>43.9</td><td>42.6</td><td>2.96128</td></tr> <tr><td>7:00:00 PM</td><td>15.91</td><td>15.47</td><td>2.77</td><td>20.81</td><td>21.28</td><td>-7.30782</td><td>61.9</td><td>48.17</td><td>-3.42905</td><td>33.1</td><td>33.8</td><td>-2.1148</td><td>43.9</td><td>42.6</td><td>2.96128</td></tr> <tr><td>7:15:00 PM</td><td>15.42</td><td>15.36</td><td>5.21</td><td>21.23</td><td>20.05</td><td>-2.01751</td><td>80.19</td><td>66.51</td><td>-1.86368</td><td>33.6</td><td>34</td><td>-1.19048</td><td>43.9</td><td>42.6</td><td>2.96128</td></tr> <tr><td>7:30:00 PM</td><td>15.75</td><td>15.75</td><td>0.00</td><td>20.33</td><td>21.34</td><td>-7.42202</td><td>57.47</td><td>70.34</td><td>-3.68014</td><td>33.9</td><td>34.9</td><td>-1.76991</td><td>43.9</td><td>42.5</td><td>3.18807</td></tr> <tr><td>7:45:00 PM</td><td>14.97</td><td>16.03</td><td>-7.08</td><td>20.74</td><td>21.18</td><td>-9.01789</td><td>140.63</td><td>124.24</td><td>-22.1605</td><td>34.2</td><td>34.8</td><td>-1.75439</td><td>43.8</td><td>42.3</td><td>3.19635</td></tr> <tr><td>8:00:00 PM</td><td>16.56</td><td>14.88</td><td>10.14</td><td>25.11</td><td>19.89</td><td>-0.47741</td><td>148.21</td><td>155.32</td><td>-0.08675</td><td>34.5</td><td>34.9</td><td>-1.15942</td><td>43.8</td><td>42.2</td><td>3.65297</td></tr> <tr><td>8:15:00 PM</td><td>16.29</td><td>15.95</td><td>4.54</td><td>25.35</td><td>20.33</td><td>-5.23438</td><td>58.87</td><td>76.05</td><td>-1.88646</td><td>34.6</td><td>35</td><td>-1.15627</td><td>43.8</td><td>42.1</td><td>3.82128</td></tr> <tr><td>8:30:00 PM</td><td>17.06</td><td>16.31</td><td>4.67</td><td>22.94</td><td>21.24</td><td>-2.29</td><td>86.28</td><td>91.85</td><td>-1.99</td><td>31.46</td><td>31.69</td><td>-0.67</td><td>43.04</td><td>43.04</td><td>3.63</td></tr> </tbody> </table>						Time	PM1.0			PM2.5			PM10			Temperature			Humidity			STD	DUT	% ERR	STD	DUT	% ERR	STD	DUT	% ERR	STD	DUT	% ERR	STD	DUT	% ERR	12:00:00 PM	29.77	31.23	-4.90	37.58	1.64521	102.48	93.79	10.0438	27.4	27.2	0.72993	44.3	43.8	1.12867	12:15:00 PM	27.71	30.1	-8.63	37.68	30.21	-6.87247	187.43	175.42	-3.52838	27.6	27.3	1.08696	44.1	43.8	0.68027	12:30:00 PM	15.09	16.02	-6.16	20.43	21.07	-0.66854	68.6	56.45	-0.68224	27.8	27.5	1.07914	45.1	43.6	3.12594	12:45:00 PM	16.87	16.58	1.72	23.93	21.19	-10.0642	89.95	88.83	-5.69091	27.9	28	-0.36852	45.2	43.6	3.31982	1:00:00 PM	18.72	15.93	14.90	24.7	21.08	-9.91242	59.27	63.5	-5.05801	28.3	28.1	0.70671	44.8	43.7	2.45536	1:15:00 PM	16.49	14.62	11.34	22.6	18.96	-6.742	61	88.53	-2.90007	28.9	29.2	-1.03806	45.5	44.7	1.95604	1:30:00 PM	18.95	15.61	17.13	20.83	19.74	-0.11634	48.23	61.6	-1.11583	29.5	29.8	-0.55852	45.9	43.6	5.03083	1:45:00 PM	15.82	15.32	3.16	20.85	10.38	-3.35889	68.03	49.18	-2.69565	29.8	30.1	-1.00671	46	43.6	5.21739	2:00:00 PM	14.9	15.24	-2.28	19.54	19.77	-4.8381	42.37	58.64	-2.48315	30.7	30.4	0.9772	46	43.6	5.21739	2:15:00 PM	18.95	15.61	17.13	20.83	19.74	-0.11634	48.23	61.6	-1.11583	29.5	29.8	-0.55852	45.9	43.3	5.66448	2:30:00 PM	15.65	15.68	-0.19	20.99	23.55	-1.18592	72.26	84.28	-0.14167	31.6	31.5	0.31646	45.8	43.1	6.11564	2:45:00 PM	16.93	14.94	11.75	21.93	21.7	-1.35292	66.22	74.51	-0.87641	32.0	31.8	0.625	45.6	43.1	5.48246	3:00:00 PM	16.49	14.9	9.64	22.04	20.61	-8.23515	70.22	56.33	-3.63575	32.3	32.7	-1.23839	45.4	43.3	4.62555	3:15:00 PM	16.73	16.08	3.89	21.88	21.76	-2.7507	125.47	145.56	-0.11881	32.4	32	1.23497	45.2	43.4	3.9823	3:30:00 PM	16.76	15.54	7.28	21.61	20.44	-3.08576	80.73	99.37	-2.06344	32.1	31.8	0.94548	45	43.3	3.77278	3:45:00 PM	16.02	14.79	7.68	21.3	19.3	-6.96398	58.33	109.27	-3.25903	31.8	32	-0.62893	44.8	43.3	3.34821	4:00:00 PM	16.63	14.75	11.20	21.67	19.01	-9.91733	82.66	69.73	-5.85391	31.1	31.5	-1.28617	44.8	43.2	3.57143	4:15:00 PM	16.74	15.2	7.29	22.72	20.27	-4.61538	67.49	82.94	-6.58112	31.6	31.9	-0.94937	44.6	43.1	3.36253	4:30:00 PM	16.56	14.25	13.95	22.21	18.29	-4.18278	150.15	167.89	-2.0789	30.4	30.8	-1.33579	44.4	43	3.15115	4:45:00 PM	15.03	15.41	-2.53	20.04	19.8	9.1133	136.83	149.85	-4.17237	30.7	31	-0.9772	44.3	42.8	3.386	5:00:00 PM	16.11	14.78	8.26	22.32	18.57	-7.47384	165.88	178.49	-7.30634	31.2	31.5	-0.96154	44.3	42.6	3.81593	5:15:00 PM	16.29	15.31	6.02	21.37	19.37	-10.4901	59.54	57.66	-5.01081	31.6	32	-1.26852	44.3	42.8	3.386	5:30:00 PM	16.57	16.03	3.26	22.44	21.02	-5.6568	70.96	79.26	-2.85866	32.8	32.9	-1.85759	44.2	42.8	3.16742	5:45:00 PM	16.04	15.46	3.62	23.41	20.02	-4.92104	80.09	73.28	-3.21117	32.8	33.3	-1.92439	44.2	42.6	3.61593	6:00:00 PM	16.52	15.49	6.23	22.35	19.27	-9.04	96.39	110.48	-4.4505	33.0	33.7	-2.12121	44.2	42.5	3.84615	6:15:00 PM	16.77	15.39	8.23	22.14	19.87	-7.95497	105.82	118.39	-10.7161	33.3	33.9	-1.8018	44.1	42.6	3.40136	6:30:00 PM	16.87	15.36	9.07	22.05	21.24	-5.23801	57.98	63.21	-2.04439	33.6	34	-1.79641	43.9	42.6	2.96128	6:45:00 PM	17.76	15.47	12.89	22.74	21.33	-9.74688	73.75	85.85	-5.24109	33.7	34.1	-1.18094	43.9	42.6	2.96128	7:00:00 PM	15.91	15.47	2.77	20.81	21.28	-7.30782	61.9	48.17	-3.42905	33.1	33.8	-2.1148	43.9	42.6	2.96128	7:15:00 PM	15.42	15.36	5.21	21.23	20.05	-2.01751	80.19	66.51	-1.86368	33.6	34	-1.19048	43.9	42.6	2.96128	7:30:00 PM	15.75	15.75	0.00	20.33	21.34	-7.42202	57.47	70.34	-3.68014	33.9	34.9	-1.76991	43.9	42.5	3.18807	7:45:00 PM	14.97	16.03	-7.08	20.74	21.18	-9.01789	140.63	124.24	-22.1605	34.2	34.8	-1.75439	43.8	42.3	3.19635	8:00:00 PM	16.56	14.88	10.14	25.11	19.89	-0.47741	148.21	155.32	-0.08675	34.5	34.9	-1.15942	43.8	42.2	3.65297	8:15:00 PM	16.29	15.95	4.54	25.35	20.33	-5.23438	58.87	76.05	-1.88646	34.6	35	-1.15627	43.8	42.1	3.82128	8:30:00 PM	17.06	16.31	4.67	22.94	21.24	-2.29	86.28	91.85	-1.99	31.46	31.69	-0.67	43.04	43.04	3.63
Time	PM1.0			PM2.5			PM10			Temperature			Humidity																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
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12:00:00 PM	29.77	31.23	-4.90	37.58	1.64521	102.48	93.79	10.0438	27.4	27.2	0.72993	44.3	43.8	1.12867																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
12:15:00 PM	27.71	30.1	-8.63	37.68	30.21	-6.87247	187.43	175.42	-3.52838	27.6	27.3	1.08696	44.1	43.8	0.68027																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
12:30:00 PM	15.09	16.02	-6.16	20.43	21.07	-0.66854	68.6	56.45	-0.68224	27.8	27.5	1.07914	45.1	43.6	3.12594																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
12:45:00 PM	16.87	16.58	1.72	23.93	21.19	-10.0642	89.95	88.83	-5.69091	27.9	28	-0.36852	45.2	43.6	3.31982																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
1:00:00 PM	18.72	15.93	14.90	24.7	21.08	-9.91242	59.27	63.5	-5.05801	28.3	28.1	0.70671	44.8	43.7	2.45536																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
1:15:00 PM	16.49	14.62	11.34	22.6	18.96	-6.742	61	88.53	-2.90007	28.9	29.2	-1.03806	45.5	44.7	1.95604																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
1:30:00 PM	18.95	15.61	17.13	20.83	19.74	-0.11634	48.23	61.6	-1.11583	29.5	29.8	-0.55852	45.9	43.6	5.03083																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
1:45:00 PM	15.82	15.32	3.16	20.85	10.38	-3.35889	68.03	49.18	-2.69565	29.8	30.1	-1.00671	46	43.6	5.21739																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
2:00:00 PM	14.9	15.24	-2.28	19.54	19.77	-4.8381	42.37	58.64	-2.48315	30.7	30.4	0.9772	46	43.6	5.21739																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
2:15:00 PM	18.95	15.61	17.13	20.83	19.74	-0.11634	48.23	61.6	-1.11583	29.5	29.8	-0.55852	45.9	43.3	5.66448																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
2:30:00 PM	15.65	15.68	-0.19	20.99	23.55	-1.18592	72.26	84.28	-0.14167	31.6	31.5	0.31646	45.8	43.1	6.11564																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
2:45:00 PM	16.93	14.94	11.75	21.93	21.7	-1.35292	66.22	74.51	-0.87641	32.0	31.8	0.625	45.6	43.1	5.48246																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
3:00:00 PM	16.49	14.9	9.64	22.04	20.61	-8.23515	70.22	56.33	-3.63575	32.3	32.7	-1.23839	45.4	43.3	4.62555																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
3:15:00 PM	16.73	16.08	3.89	21.88	21.76	-2.7507	125.47	145.56	-0.11881	32.4	32	1.23497	45.2	43.4	3.9823																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
3:30:00 PM	16.76	15.54	7.28	21.61	20.44	-3.08576	80.73	99.37	-2.06344	32.1	31.8	0.94548	45	43.3	3.77278																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
3:45:00 PM	16.02	14.79	7.68	21.3	19.3	-6.96398	58.33	109.27	-3.25903	31.8	32	-0.62893	44.8	43.3	3.34821																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
4:00:00 PM	16.63	14.75	11.20	21.67	19.01	-9.91733	82.66	69.73	-5.85391	31.1	31.5	-1.28617	44.8	43.2	3.57143																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
4:15:00 PM	16.74	15.2	7.29	22.72	20.27	-4.61538	67.49	82.94	-6.58112	31.6	31.9	-0.94937	44.6	43.1	3.36253																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
4:30:00 PM	16.56	14.25	13.95	22.21	18.29	-4.18278	150.15	167.89	-2.0789	30.4	30.8	-1.33579	44.4	43	3.15115																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
4:45:00 PM	15.03	15.41	-2.53	20.04	19.8	9.1133	136.83	149.85	-4.17237	30.7	31	-0.9772	44.3	42.8	3.386																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
5:00:00 PM	16.11	14.78	8.26	22.32	18.57	-7.47384	165.88	178.49	-7.30634	31.2	31.5	-0.96154	44.3	42.6	3.81593																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
5:15:00 PM	16.29	15.31	6.02	21.37	19.37	-10.4901	59.54	57.66	-5.01081	31.6	32	-1.26852	44.3	42.8	3.386																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
5:30:00 PM	16.57	16.03	3.26	22.44	21.02	-5.6568	70.96	79.26	-2.85866	32.8	32.9	-1.85759	44.2	42.8	3.16742																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
5:45:00 PM	16.04	15.46	3.62	23.41	20.02	-4.92104	80.09	73.28	-3.21117	32.8	33.3	-1.92439	44.2	42.6	3.61593																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
6:00:00 PM	16.52	15.49	6.23	22.35	19.27	-9.04	96.39	110.48	-4.4505	33.0	33.7	-2.12121	44.2	42.5	3.84615																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
6:15:00 PM	16.77	15.39	8.23	22.14	19.87	-7.95497	105.82	118.39	-10.7161	33.3	33.9	-1.8018	44.1	42.6	3.40136																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
6:30:00 PM	16.87	15.36	9.07	22.05	21.24	-5.23801	57.98	63.21	-2.04439	33.6	34	-1.79641	43.9	42.6	2.96128																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
6:45:00 PM	17.76	15.47	12.89	22.74	21.33	-9.74688	73.75	85.85	-5.24109	33.7	34.1	-1.18094	43.9	42.6	2.96128																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
7:00:00 PM	15.91	15.47	2.77	20.81	21.28	-7.30782	61.9	48.17	-3.42905	33.1	33.8	-2.1148	43.9	42.6	2.96128																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
7:15:00 PM	15.42	15.36	5.21	21.23	20.05	-2.01751	80.19	66.51	-1.86368	33.6	34	-1.19048	43.9	42.6	2.96128																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
7:30:00 PM	15.75	15.75	0.00	20.33	21.34	-7.42202	57.47	70.34	-3.68014	33.9	34.9	-1.76991	43.9	42.5	3.18807																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
7:45:00 PM	14.97	16.03	-7.08	20.74	21.18	-9.01789	140.63	124.24	-22.1605	34.2	34.8	-1.75439	43.8	42.3	3.19635																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
8:00:00 PM	16.56	14.88	10.14	25.11	19.89	-0.47741	148.21	155.32	-0.08675	34.5	34.9	-1.15942	43.8	42.2	3.65297																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
8:15:00 PM	16.29	15.95	4.54	25.35	20.33	-5.23438	58.87	76.05	-1.88646	34.6	35	-1.15627	43.8	42.1	3.82128																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
8:30:00 PM	17.06	16.31	4.67	22.94	21.24	-2.29	86.28	91.85	-1.99	31.46	31.69	-0.67	43.04	43.04	3.63																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				

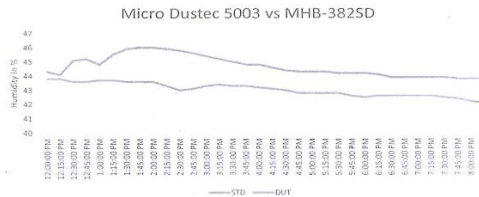
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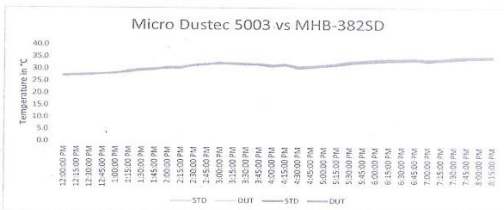
Calibration Curve for Particulates:



Calibration Curve for Humidity:



Calibration Curve for Temperature:



- Remarks:**
- Calibration Method - Comparison with standard device
 - 8 hour test was performed on the Device Under Test (DUT) and the Standard Device (STD)
 - The average percentage error of 8 hour run was within the acceptable limits.
 - Results reported are valid at the time of and under the stated conditions of measurement

Calibrated by: *[Signature]*
 Certificate Prepared by: *[Signature]*
 Certificate Checked by: *[Signature]*

Naorem K.
Rishabh K.
Radheshyam K.



ECOLOGICAL ANALYSIS
(First Quarter Report, 2019)

Phuntsholing Township Development
Project Area

BHUTAN ECOLAB CONSULTANT



Phuntsholing



PART A:

A study Report on Aquatic Ecological Survey along Amochhu River Basin within the Phuntsholing Township Development Project boundary, Chukha Dzongkhag



27th April – 1st May 2019

BHUTAN ECOLAB Consultant



Phuntsholing

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Part A: Aquatic Survey:

Introduction:

The Amochhu originate from the hills of Tibet and joins Brahmaputra River enriched with diverse aquatic lives and foraging habitats for terrestrial animals such as Otters and seasonal migratory birds. The river extremely swell up in the summer season and shrinks drastically in winter.

Our study area is limitedly focused within the Phuntsholing Township Development Project that stretches from Indian-Bhutan Border (upstream) along Ammo Chhu River basin till Purbay Bridge including all major tributaries and confluences falling within our study range. According to the information shared by the local residents natural river flow and behavior was under continuous disturb due to temporary dredging activities, embankment and surface boulders/sand as well as operation of stone crushing Plants are rampant along and above our study site before on-set of township development project by M/s Afcons Infrastructure Ltd.

The current township development project will continue to instill habitat disturbance of our native aquatic species as well as migratory ones and further aggravate their adaptability to cope up their changing micro-habitats.

Among the fishes of our study sites, Himalayan Golden Mahseer (*Tor Putitora*), an endangered, also found inhabiting in Ammo Chu River. Generally, Golden Mahseer inhabits both rivers and lakes, with most species found in fast flowing rivers/streams with rocky bottoms for breeding. They are omnivorous, eating not only algae, crustaceans, insects, frogs and other fishes but also fruits that falls from overhead. It is the largest member of the group and one of the largest cyprinids reaching in length ranging from 2.75 meters and 54 kilograms in weight. The juvenile are mostly found near the large and small boulders, where water is free flowing and well oxygenated. Among the golden Mahseer, Himalayan Mahseer, *Tor putitora*, is an endangered species of cyprinid fish that is found in rapid streams, riverine pools and lakes in Himalayan region and southern Asia. It is threaten by habitat loss, habitat degradation and overfishing. As per the research, its population has been declined drastically to more than 50 % as of today. Morphologically, its caudal, pelvic and anal fins show tint of reddish-golden color. While the body above its lateral lines is generally golden in color adulthood, the gold color might be absent in young ones.

The Scientific Classification of Himalayan Golden Mahseer:

KINGDOM: Animalia
PHYLUM: Chordata
CLASS: Actinopterygii
ORDER: Cypriniformes
FAMILY: Cyprinidae
GENUS: Tor
SPECIES: *T. putitora*

(F.Hamilton, 1822)

The routes and habitats conversation along the Ammo Chu River basin is pre-requisite for survival of Himalayan Golden Mahseer and shouldn't compromise with unscrupulous developmental projects and other activities such as boulder extractions from rivers that not only disturbs the fish habitats but also changes the sediment deposition as well as flow behaviors.

The economic development projects such ongoing Phunthsoling Township Development Project and activities like sand/boulders extraction along the Ammo Chu river basin must be strictly monitored and regulated to provide safe thriving habitats for *Tor putitora* and other aquatic lives.

The unregulated activities shall pose serious threats to its habitats and spawning route for migratory fishes as well as survival of terrestrial animals that depends on river. The current study was focus mainly on fish species diversity along Amochhu basin and its major tributaries and covered affected project site.

Study Objectives:

The objective of this fish study was as follow:

- To assess the fish species diversity along the Amochhu basin.
- Confirms the presence of Himalayan Golden Mahseer in the Ammo Chu and recommend conservation of its habitats;

Material and Methods

Sampling area

The selection of Study sites was based on project EIA report which they had already marked the fish sampling stations covering even distribution of sample area. Samplings station were divided as follows:

1. The main Amochhu River with six fish sampling station, start from Bhutan-Indo Border till Amochhu bridge (Phuntsholing - Samtse High Way Bridge).
2. The Omchhu –commonly known as Dortikhola with two stations, start from Amochhu - Omchhu Confluence till Crocodile farm.

3. The Loawrichhu which fall under SamtseDzongkhag also covered with one fish sampling station.
4. The Howrikhola also included for study, during the present study the tributary was found dried.

The detail of study sites was given the in **Figure 1**. The GPS coordinates were recorded in all sampling sites to provide distribution of species present as shown in (Table 1).

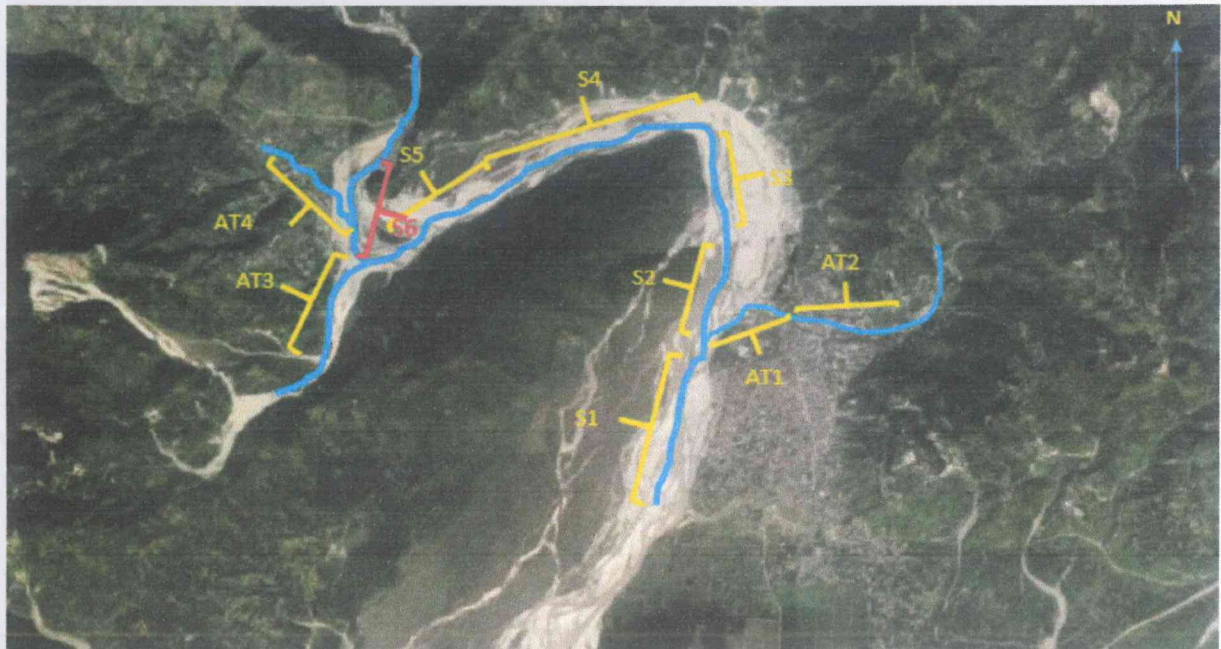


Figure 1 Study area with all fish sampling stations

FISH SAMPLING METHODS AND METHODOLOGIES:

The catch and Release method is applied during entire sampling period. Since, traditional drop-net sampling has rare chance of fish caught, we have used Electro-shocking method using petrol fueled generator to generate electric current as well as improvised 12 volts battery operated fishing equipments to pass electric current into water and catch fishes as well as other aquatic insects/micro-invertebrates by electric shocking. Once, the fish floats on the surface of the water, handy nets were used to trap the fishes.

The fishes trapped inside the nets were transferred to polythene buckets containing water, identified, measured and took photograph of each one of them using high resolution DSL camera and release back into the river.

BASIC WATER PARAMETERS:

During an assessment, the basic water quality parameters such as amount of dissolved oxygen, pH, temperature and electrical conductivity were measured using hand held portable multi-parameter on each sampling site.

The detail of the basic water parameters were given in (Table 2).

RESULTS/FINDING

During the study, a total of 27 fish species were found (*Badisbadis*, *BarilusBarna*, *Garragotyla*, *Channamelanostigma*, *Aborichthyssp.*, *Garraannandalei*, *Pethiasp.*, *Glyptothorax panda*, *Neolissochilushexagonalepis*, *Glyptothoraxsp.*, *Schisturabeavani*, *Crossocheilus latius*, *Chaguniuschagunio*, *Barilusbendelisis*, *Mastacembelusarmatus*, *Tor putitora*, *Semiplotussemiplotus*, *Pethiaticto*, *Oreichthyscrenuchiodes*, *Channagachua*, *.Bariliusvagra*, *Lepidocephalichthys guntea*, *Schizothoraxprogastus*, *Davarioaequipinnatus*, *Amblycepsarunchalensis*, *Psilorhynchusbalitora* and *Daniorerio*). During sampling period the most fish caught was *Garra*, *Barilius*, *Badis* and *Neolissochilushexagonalepis* in Amochhu River and its tributaries - Omchhu and Loawrichhu. The lists of the fish species wise found in each station were given (table 3).

Phytoplankton:

These are the free floating, microscopic algae that inhabit upper layer of most freshwater and marine environment, responsible for color and clarity of lakes, wetlands, rivers, streams and estuaries. They serve as primary producers to aquatic ecosystems, providing food sources for higher order organization such as zooplankton and small fishes.



Photo source: Bhutan Ecolab Team (An alga found along the bank of Ammo Chu River).

However, algal presence in the Omchu was comparatively less than in that of Ammo Chu and Loawri Chu.

ZOOPLANKTONS:

Zooplanktons are microscopic animals which are heterotrophic found both in freshwater and marine ecosystem. They serve as food source for small fishes.

Dragon Fly Larvae and abundant amphipods (Shrimps) were found in all sampling locations along Ammo chu whereas we could not find much in Omchu and Loawri Chu.



Shrimps (Photo Source: Bhutan Ecolab Team)

Conclusion

The 27 species of fish were found along Amochhu River basin with one endangered fish species (*Tor putitora*), beside aquatic biodiversity it were also found good feeding ground for terrestrial animal like different migratory birds.

The current river dredging, embankment and surface or sub-surface collection/mining of sands and boulders can affects the natural aquatic ecosystem of an Ammo Chu by habit loss and degradation. The fishes that depends their breeding and spawning like golden mahseer beneath the rocks and boulders will be severely affected by the boulders collection rampantly undergoing along the river bank by private firms.

STUDY RECOMMENDATION:

- (1) According to local resident, along the stretch of Ammo Chu river basin starting from Indo-Bhutan border till Purbay bridge, the fish habitats has been under continuous disturbance since 2016 due to river dredging works, collection of boulders/sand and operation of stone crushing plants at various location along the river bank. The boulders/sand collection in the river bank must be stopped to preserve fish habitats especially for Himalayan Golden Mahseers. The current river embankment project activities must be monitored so that further major disturbance must be minimized;
- (2) The Ammo Chu river basin must be designated as natural habitat for Himalayan Golden Mahseers and shall be protected from anthropogenic disturbance in the years to come;
- (3) Since our aquatic survey was rapid we recommend government for further research to on Ammo aquatic diversity assessment. The research on population of golden mahseer along the river basin must be carried out to implement conservation programs of this endangered species &
- (4) Aquaculture for Himalayan golden mahseer must be initiated to preserve and revive the population of this species.

Table 1 Details fish sample station with GPS co-ordinates

Statio n	Location/Name	Co-ordinates		Altitude (M)	Remarks
		Start Pint	End points		
S1	Amochhu -below Amochhu confluence	N26.86323,E089.36886	N26.86805,E089.37244	182	Indo-Bhutan Border
S2	Amochhu- Above Amochhu confluence	N26.86805,E089.37244	N26.87709,E089.37215	189	Development site
S3	Amochhu-Main Construction site	N26.87709,E089.37215	N26.88541,E089.37103	199	Main Office area (CDCL)
S4	Amochhu-Above ShivalayaMandir	N26.88541,E089.37103	N26.88544,E089.36548	200	Development site
S5	Amochhu-above shiv Mandir	N26.88544,E089.36548	N26.87501,E089.33882		Development site
S6	Amochhu-Below Amochhu Confluence	N26.87501,E089.33882	N26.88629,E89.33504	257	Development site
AT1	Amochhu-Omchhu Confluence	N26.86805,E089.37244	N26.86719,E089.77475	183	Below Samtse Highway bridge
AT2	Omchhu-crocodile farm to new high way bridge	N26.86719,E089.77475	N26.86381,E89.39029	217	Dortikhola
AT3	Howrikhola				
AT4	Loawrichhu-Amochhu confluence to below Tandinggup office Samtse	N26.87501,E089.33882	N26.87808,E089.32619	222	Tandinggewog, Samtse

Table 2 Basic Water parameter data

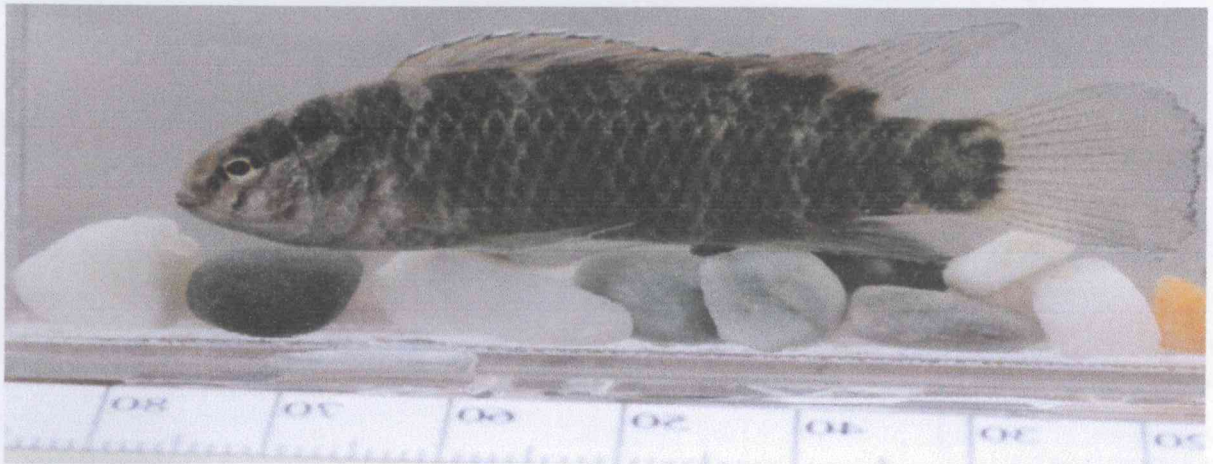
Station/Sites	Location/name	Temperature (°c)	pH	Dissolved Oxygen (DO)
S1	Amochhu -below Amochhu -Amochhu confluence	18.95	8.5	7.35
S2	Amochhu- Above Omchhu - Amochhu confluence	22.63	8.21	7.01
S3	Amochhu-Main Construction site	19.20	7.75	8.11
S4	Amochhu-Above ShivalayaMandir	18.10	7.99	7.70
S5	Amochhu-above shiv Mandir	18.35	8.25	7.90
S6	Amochhu-Below Loawrichhu-Amochhu Confluence	18.23	8.15	8.23
AT1	Amochhu-Amochhu confluence to crocodile farm	28.26	7.43	9.82
AT2	Omchhu-crocodile farm to new high way bridge	28.96	7.90	8.04
AT3	Howrichhu	Tributary dried up		
AT4	Lawrichhu-Amochhu confluence to below Tandangup office samtse	26.01	8.01	7.05

Table 3 Detail station with fish species distribution

Station	Location/Name	Fish Species
S1	Amochhu -below	Garragotyla, Daniorerio, Bariliusvagra, Bariliusbendelisis, Bariliusbarna, Garraannandalei, Aborichthy
	Amochhu confluence	- ssp.Amblycepsarunchalensis, Channagachua, Schisturabeavani, Channamelanostigma, Chaguniuschagunio, Aborichthyssp, Pethiaticto, Glyptothorax panda
S2	Amochhu- Above	Garragotyla, Daniorerio, Bariliusvagra, Bariliusbendelisis, Bariliusbarna, Neolissochilus hexagonalepis, Garraannandalei, Aborichthyssp. Amblycepsarunchalensis, Channagachua, Schisturabeavani, For putitora
	Amochhu - confluence	Channamelanostigma, Channagachua, Chaguniuschagunio, Aborichthyssp, Crossocheiluslatius, Pethiaticto, Mastacembelusarmatus, Glyptothorax panda
S3	Amochhu-Main	Garragotyla, Daniorerio, Bariliusvagra, Bariliusbendelisis, Bariliusbarna, Neolissochilus hexagonalepis, Garraannandalei, Aborichthyssp. Amblycepsarunchalensis, Channagachua, Schisturabeavani, For putitora
	Construction site	Channamelanostigma, Channagachua, Chaguniuschagunio, Aborichthyssp, Crossocheiluslatius, Schizothoraxproagustus, Pethiaticto, Psilorhynchusbalitora, Semiplotussemiplotus, Oreichthyscrenuchiodes, Lepidocephalichthys guntea, Glyptothorax panda, Glyptothoraxsp
S4	Amochhu-Above	Garragotyla, Daniorerio, Bariliusvagra, Bariliusbendelisis, Bariliusbarna, Neolissochilus hexagonalepis, ShivalayaMandr
		Garraannandalei, Aborichthyssp. Amblycepsarunchalensis, Channagachua, Schisturabeavani, Channamelanostigma, Chaguniuschagunio, Aborichthyssp, Crossocheiluslatius, Pethiaticto, Daniorerio, Mastacembelusarmatus, Glyptothorax panda, Glyptothoraxsp
S5	Amochhu-above shiv	Garragotyla, Daniorerio, Bariliusvagra, Bariliusbendelisis, Bariliusbarna, Neolissochilus hexagonalepis, Mandir
		Garraannandalei, Aborichthyssp. Amblycepsarunchalensis, Channagachua, Schisturabeavani, Channamelanostigma, Chaguniuschagunio, Aborichthyssp, Crossocheiluslatius, Schizothoraxproagustus, Daniorerio, Mastacembelusarmatus, Glyptothorax panda, Glyptothoraxsp

S6	Amochhu-Below	Garragotyla, Daniorerio, Bariliusvagra, Bariliusbendelisis, Bariliusbarna, Neolissochilushexagonalepis,
	Loawrichhu-Amochhu	Garraannandalei, Aborichthyssp. Amblycepsarunchalensis, Channagachua,
	Confluence	Schisturabeavani, Chaguniuschagunio, Aborichthyssp, Crossocheiluslatius, Semiplotussemiplotus, Lepidocephalichthys guntea, Glyptothorax panda
AT1	Amochhu-Omchhu	Garragotyla, Daniorerio, Bariliusvagra, Bariliusbendelisis, Bariliusbarna, Neolissochilushexagonalepis,
	confluence to below highway bridge.	Garraannandalei, Aborichthyssp. Amblycepsarunchalensis, Channagachua, Schisturabeavani, Badisbadis, Chaguniuschagunio, Aborichthyssp, Crossocheiluslatius, Devarioaequipinnatus, Psilorhynchusbalitora, Daniorerio, Oreichthyscrenuchiodes, Glyptothorax panda
AT2	Omchhu-crocodile farm to new high way bridge	Garragotyla, Daniorerio, Bariliusvagra, Bariliusbendelisis, Bariliusbarna, Neolissochilushexagonalepis, Garraannandalei, Aborichthyssp. Amblycepsarunchalensis, Channagachua, Schisturabeavani, Badisbadis, Aborichthyssp, Crossocheiluslatius, Devarioaequipinnatus, Lepidocephalichthys guntea, Pethia ticto, Psilorhynchusbalitora, Daniorerio, Glyptothorax panda
AT3	Loawrichhu	Garragotyla, Bariliusbarna, Garraannandalei, Neolissochilushexagonalepis, Aborichthyssp, Crossocheiluslatius, Semiplotussemiplotus, Daniorerio, Glyptothorax panda

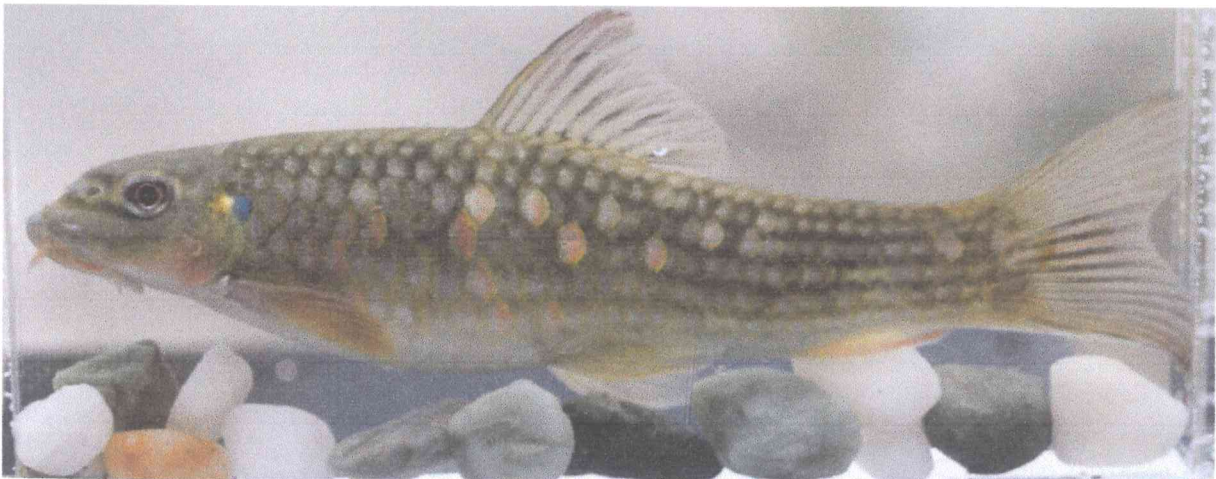
Figure 2. Detial list fish species found during study



1. *Badisbadis*



2. *Barilusbarna*



3. *Garragotyla*



4. *Channamelanostigma*



5. *Aborichthys* sp.



6. *Garra annandalei*



7. *Pethiasp.*



8. *Glyptothorax panda*



9. *Neolissochilus hexagonalepis*



10. *Glyptothorax* sp.



11. *Schisturabeavani*

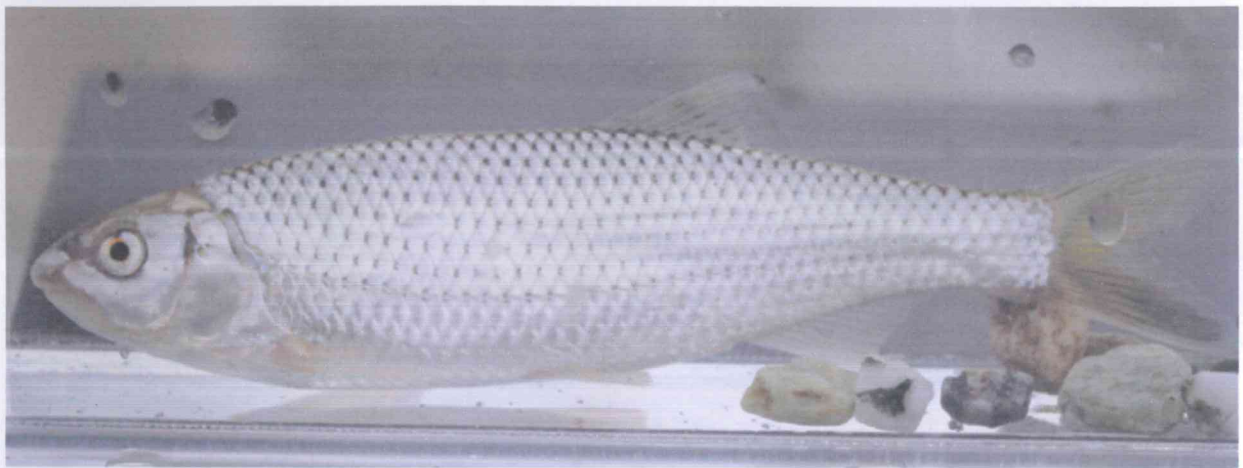


12. *Crossocheilus latius*





13. *Chaguniuschagunio*



14. *Barilusbendelisis*



15. *Mastacembelusarmatus*



16. *Tor putitora*



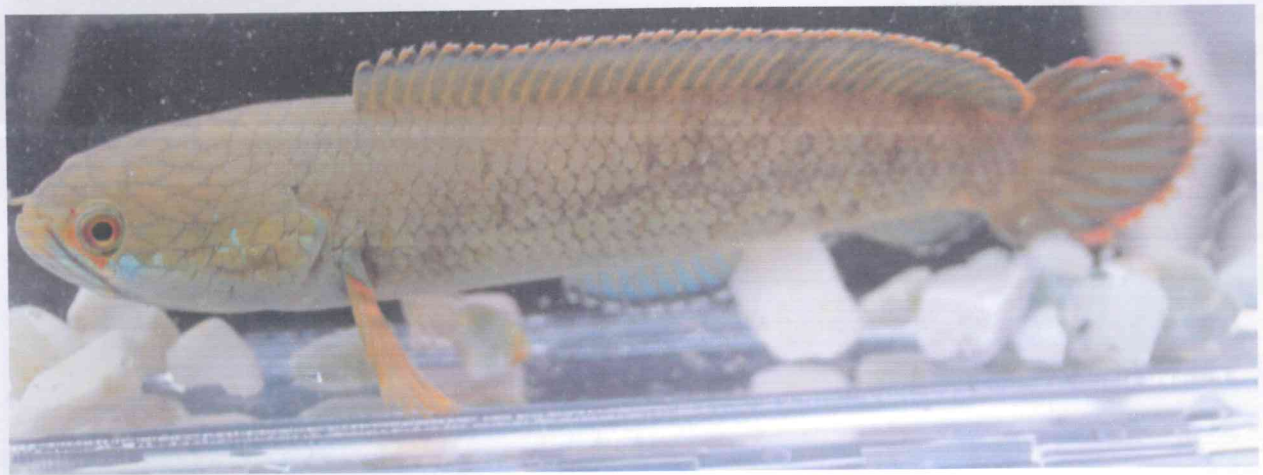
17. *Semiplotus semiplotus*



18. *Pethia ticto*



19. *Oreichthys crenuchooides*



20. *Channagachua*



21. *Barlius vagra*



22. *Lepidocephalichthys guntea*



23. *Schizothorax progastus*



24. *Davarioaequipinnatus*



25. *Amblycepsarunchalensis*



26. *Psilorhynchusbalitora*



27. *Daniorerio*

PART B: Terrestrial Ecological Analysis

Introduction:

Bhutan is a small landlocked country with its territorial size of 38394 sq.km (UNDP, Bhutan) situated between the world's two most populous countries, India to the south and China to the north. Despite the size and small population, the country places top priority towards preservation of rich natural biodiversity. The elevation rises from 200 m in southern foothills to more than 7000m to the north. This geographical diversity combined with equally diverse climatic conditions contributes towards an outstanding range of biodiversity and ecosystems. The developmental philosophy famously pronounced as 'Gross National Happiness' serves the guiding principle over the rapid developmental activities so that any development must take place in harmony with social, cultural, and environmental aspects. In order to facilitate effective guidance, the institution of Gross National Happiness Commission plays a pivotal role in screening of any developmental policies. Furthermore, Bhutan's Constitution also demands a minimum of 60% of forest coverage at all times.

Bhutan's territory supports more than 5600 species of plants, out of which 94% are native and 105 species are endemic. The diversity of other ecological components recorded so far are 350 species of fungi, 287 lichens and lichenicolous fungi, 200 species of mammals including 27 globally threatened species, 700 species of birds including 18 globally threatened, 61 species of amphibians, 124 species of reptiles, 800 to 900 species of butterfly, 1027 species of fresh water insects in different rivers and tributaries and diverse fish species (National Report, NECS).

Currently, Bhutan is geographically divided into twenty districts and 205 blocks. Our study area is located within Chukha district, Phuntsholing which is a gateway city to India. It is Bhutan's commercial and financial capital, housing more than 50 manufacturing industries as well as two hydro-power plants.

Description of Study Area:



Photo: ZONE A&B Project site.

Our study was focused within the Ammo Chu riparian zone falling under the on-going Township Development Project. The study objectives were to assess diversity of terrestrial ecological components (Flora and Fauna) of the project area and potential impacts of the project on the habitats of animal species.

The area was highly disturbed due to river dredging, surface boulder collection and ongoing project activity. Grass and vegetation covers along the river banks are sparse and in patches mostly found in Zone A and B of the project.



Photo: Ammo Chu River bank (disturbed from boulder collection and dredging)

Methods for Vegetation analysis:

Since there is no vegetation covers in most of the zones our study was conducted mostly in zone A and B where there are grasses and tree covers in patches.

Methodology:

The species diversity and density was carried out by randomly overlaying transect and quadrates, taking specific areas for trees and undergrowth covers.

For tree density assessment we have used 20 x 20 m² area of quadrates in zone B and 2x2 m² for undergrowth simultaneously. The number of tree and ground covers are identified, collected samples, took photos, tagged identification marks for unknown species samples and counted in each quadrates for analysis.

However, in Zone B we have taken more than three quadrates size of 10 x 10 m² alternatively within the 30 meter transect line and assessed the density. The tree and undergrowth coverage in Zone B is comparatively thicker than zone A. In the rest of project zones we have assessed the diversity rather than density since vegetation coverage is sparse and transect overlaying is not suitable.



Source: site photo of Ecolab team assessing tree density and diversity.

RESULT/FINDING:

List of Tree Species Found in the Amochu River Basin:

Sl. No.	Location Code	Coordinates	Description	Local Name	Scientific Name
1	TS01	26° 52'43"N 89° 20'21" E	ZONE B		<i>Micania micrantha</i>
				kari pata	<i>Murraya koenigii</i>
					<i>Lantana camera</i>
					<i>Solanum erianthum</i>
				Khair	<i>Acacia Catechu</i>
					<i>Grevia selurata</i>
					<i>Sterculia sp.</i>
					<i>Morus microura</i>
				Bass	<i>Bambusa balcooa</i>
2	TS02	26° 52'41"N 89° 20'19" E	ZONE B	Kari pata	<i>Murraya koenigii</i>
					<i>Lantana camera</i>
					<i>Solanum erianthum</i>
				Khair	<i>Acacia Catechu</i>
					<i>Grevia selurata</i>
					<i>Morus microura</i>
3	TS03	26° 52'43"N 89° 19'54" E	ZONE B	Kari pata	<i>Murraya koenigii</i>
					<i>Lantana camera</i>
				Khair	<i>Acacia Catechu</i>
					<i>Morus microura</i>
4	TS04	Zone A	ZONE A	Khair	<i>Acacia Catechu</i>
				Kari pata	<i>Murraya koenigii</i>
					<i>Lantana camera</i>
IUCN REDLIST STATUS: The species found in the study area were not found under the IUCN REDLIST.					
FNCA, 1995 & Forest and Nature conservation Rules and Regulations, 2017 LIST: None of the above species are found under the Forest and Nature Conservation Act, 1995 protected list.					



Source: Site Photo of rich regeneration of *Accacia catechu* (Zone B)



Source: Site Photo of *Lantana camera* Regeneration in the disturbed area (Zone B)



Source: *Accacia catechu* tree in Zone B



Source: dominant undergrowth Lantana camera at the peripheral of Zone B & Ecolab team assessing diversity of trees and undergrowths.

Density of tree species in Zone B			
Quadrat I			
SL.No.	Name of Species	No. of species present in Quadrat (10 x 10 m ²)	Density of species (No. of species/ Area of Quadrat)
1	Accacia Catechu (Khair)	12	0.12
2	boyar	5	0.05
3	Murraya koebigii (Kari Pata)	38	0.38
5	<i>Solanum erianthum</i>	172	1.72
Undergrowth Cover Density			
SL.No.	Name of Species	No. of species present in Quadrat (2 x 2 m ²)	Density of species (No. of species/ Area of Quadrat)
1	Lantana camera	62	15.5
2	Grass (bunch)	19	4.75
3	Khair regenerated sampling	25	6.25
4	lantana camera sampling	26	6.5

Density of tree species in Zone B			
Quadrat II			
SL.No.	Name of Species	No. of species present in Quadrat (10 x 10 m ²)	Density of species (No. of species/ Area of Quadrat)
1	Accacia Catechu (Khair)	14	0.14
2		5	0.05
3	Murraya koebigii (Kari Pata)	3	0.03
5	<i>Solanum erianthum</i>	203	2.03
Undergrowth Cover Density			
SL.No.	Name of Species	No. of species present in Quadrat (2 x 2 m ²)	Density of species (No. of species/ Area of Quadrat)
1	Lantana camera	91	22.75
2	Grass (bunch)	21	5.25
3	Khair regenerated sampling	18	4.5
4	lantana camera sampling	19	4.75

Density of tree species in Zone B			
Quadrate III			
SL.No.	Name of Species	No. of species present in Quadrate (10 x 10 m ²)	Density of species (No. of species/ Area of Quadrate)
1	Accacia Catechu (Khair)	4	0.04
3	Murraya koebigii (Kari Pata)	12	0.12
4	<i>Solanum erianthum</i>	28	0.28
Undergrowth Cover Density			
SL.No.	Name of Species	No. of species present in Quadrate (2 x 2 m ²)	Density of species (No. of species/ Area of Quadrate)
1	Lantana camera	52	13
2	Grass (bunch)	12	3
3	Khair regenerated sampling	11	2.75

LIST OF ANIMALS SIGHTED SO FAR BY THE LOCAL AND FOREST RANGE OFFICIALS, PHUNTSHOLING.

During our study we haven't sighted any of the animals mentioned below. The information was gathered from the local and forest range office from Phuntsholing.

SL.No.	Local Name	English Name	Scientific Name	IUCN STATUS	FNCA STATUS
1	Hati	Asiatic Elephant	<i>Elephus maximus</i>	Threatened Species	Totally protected
2	Mirga	Barking Deer	<i>Muntiacus sp.</i>	Not found	Not found
3	Ri Lang	Wild Buffalo	<i>Bulbalu bubalis</i>	Threatened Species	Totally protected
4		Wild boar	<i>Sus scrofa</i>	Not found	Not found

Source: Forest Range office Phuntsholing.

Common Domesticated Animals sighted nearby the study sites:

SL.No.	English Name	Local Name	Scientific Name
1	Cattle	guye	<i>Bos sp.</i>
2	Goat	Khashi	<i>Capra aegagrus</i>
3	Pig	Sungur	<i>Sus scrofa domesticus</i>
4	Chicken	kukhara	<i>Gallus gallus domesticus</i>

Source: Forest ranger, Phuntsholing.

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Source: Forest ranger, Phuntsholing.

SL.No.	English Name	Scientific Name	IUCN STATUS	FNCA,1995 STATUS
1	Cattle Egret	<i>Bubulcus sp.</i>	Not found	Not found
2	Heron	<i>Ardea sp.</i>	Not found	Not found
3	great heron	<i>Ardea modesta</i>	Not found	Not found
4	House Sparrow	<i>Passer domesticus</i>	Not found	Not found
5	Crow	<i>Corvus sp.</i>	Not found	Not found
6	Pigoen	<i>columba sp.</i>	Not found	Not found

Source: Forest Range office, Phuntsholing.

Conclusion:

The density of species such as Khair (*Accacia catechu*) and Kari patta (*Murraya koibigii*) are high in zone A & B but only in patches. Lantana camera and creepers are alien species that dominated the undergrowth in zone B and periphery of study area. Since there is no horizontal and vertical altitudinal variation in the study area, the species diversity is uniform. The impact by the flash flood in the site covered with dense Khair was found least compare to the site which has no khair plantation. We have also found rich undergrowth khair regeneration and recovery of soil within the site.

Study limitation:

- (1) Density of trees and undergrowths shall not represent the whole study area of vegetation as the coverage was in patches,
- (2) Study was conducted along the disturbed river bank area &
- (3) Needs additional study to understand the ecosystem along the riparian zone

References:

1. A.A Anbu & M. Arunachalum, 2018, *fresh Water fish Fauna of rivers of the southern Ghats*, Department of biotechnology, Karpagam Academy of Higher Education, Coimbatore, Tamil Nado, India;
2. Ayappan S and Birdar S R, *Enhancing Global Competition, Survey of Indian Agriculture (The Hindu) 2004,98.*
5. *International Consultation on Biological Diversity (SAARC, Asean and Other Regional Countries), Country Paper: India, Ministry of Environment and Forests, Government of India and United Nations Environment Programme, Bangalore, India, August 22-23 1994, page*
6. GadgilMadhav, Chandrasekhariah H N and BhatAnuradha, *Freshwater Fish: Out of sight, out of mind, Survey of the Environment (The Hindu) 2001,138-141. 5.*
7. Chalmers N R, *Monitoring and Inventorying Biodiversity: collections, data and training, Biodiversity, Science and development: Towards a New Partnership, F.diCatri and T. Younes (eds), (CAB International) 1996,171.*
8. Retrieved on 26/06/2019 from <https://www.iucn.org/resources/conservation-tools/iucn-red-list-threatened-species>
9. Retrieved on 26/06/2019 from <https://portals.iucn.org/library/sites/library/files/documents/RL-2018-001.pdf>
10. Retrieved on 26/06/2019 from <http://www.nrcri.gov.bt/?destination=o&type=o&s=>
11. *World Wildlife Fund, 2002: Waterway Transport on Europe's Lifeline, the Danube: Impacts, Threats and Opportunities, World Wide Fund for Nature, Gland, Switzerland.*
12. *Sayer.c etal. 2018, fresh water biodiversity in lake Victoria basin, guidance for species conservation, site protection, climate resilience and sustainable livelihoods, IUCN.*
13. *Forest and Nature Conservation Act, 1995, Kingdom of Bhutan.*

Appendix VI: Emergency Evacuation Plan: Flood

Emergency Evacuation Plan: Flood

Flood Forecasting and Warning Services:

Flood forecasting and Warning will be given to the Emergency Evacuation Team (EET) by the flood monitoring station officials of Dorokha and Doyagang (approx. 30 and 5 kilometers away from site, respectively).

Action Plan:

- On the notice from the flood monitoring stations, EET will immediately alarm and put on guard all the supervisors on site.
- Site supervisors will ensure that all workers are moved to the respective Assembly Point and then to the main site assembly point.
- The workers and officials will be transported to a safe zone following their accommodation at identified locations.

Consideration:

While formulating the evacuation plan the health status of the workers, officials and everyone on site has been considered. During the execution of the plan (in case of flood), to minimize the distress and to ensure the plans are followed accordingly, Safety Supervisors and Site Supervisors have been instructed to follow and maintain all safety protocols.

Prevention, Protection and Preparation:

1. Temporary flood protection Bund

Temporary Flood protection bunds have been made in part 8, part 7 and part 6 through part 3. To protect these existing bunds, a spur was built with one upstream and one downstream by using materials from the river bank scalping. Additionally, large drainage path connecting all the outfalls and Omchu till the Amochhu has been built to avoid any problematic backwatering during the monsoon.

2. Life Jackets and Boat

Life Jackets and life boat are in place in case of flooding.

3. Transportation

For the transportation, we have eleven vehicles i.e. two buses (31 seats each), six Boleros, one Ambulance, one SUV and a car.

Emergency Evacuation Team

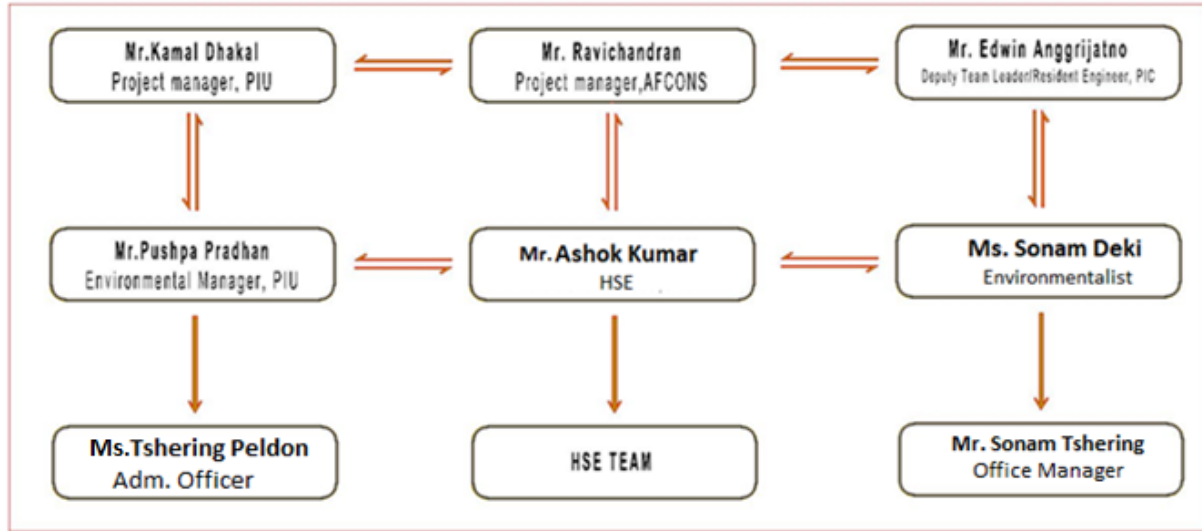


Figure 1: Emergency Evacuation Team

Table 1: List of focal person and their contact

Name	Contact Number	Office	Designation
Mr. Ravichandran	17309990	AFCONS	Project Manager
Mr. Ashok Kumar	17325971		HSE In-charge
Mr. Kamal Dhakal	17752610	PIU	Project Manager
Mr. Pushpa Pradhan	17951067		Environmental Manager
Ms. Tshering Peldon	17971478		Adm. Officer
Mr. Edwin Anggrijatno	17741164	PIC	Deputy Team Leader/ Resident Engineer
Ms. Sonam Deki	77893929		Environmentalist
Mr. Sonam Tshering	17971478		Office Manager
Ms. Namgay Lhamo Tenzin	17673505		Assistant Office Manager

Flood Warning

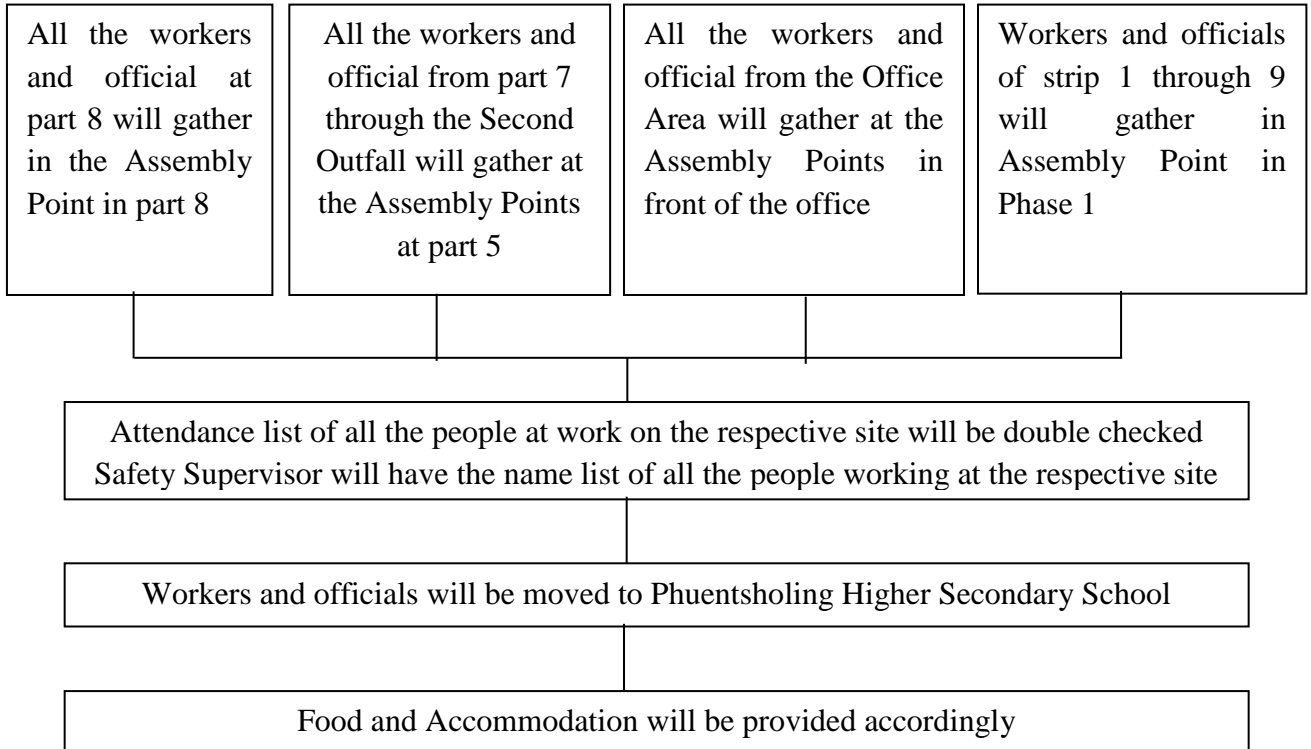
Flooding monitoring stations at Dorokha and Doyagang under the National Center for Meteorology and Hydrology have been contacted. In case of flood outburst noted, the station officials will contact the EET. Following the alert from the stations, alarm (range of 1-2 km) will be set on by the EET.

Table 2: List of persons for early warning up-stream of the project site

Sl. No.	Person	Designation	Location	Phone No.
1	Mr. Ganesh Pradhan	Hydro met station in-charge	Dorokha	77452031 (O) 17684833
2	Mr. Indra Bahadur Ghallay	Hydro met station in-charge	Doyagang	17551029
3	Mr. Paras Mani Suwar	Hydro met station in-charge	Doyagang	17448834
4	Dasho Dungpa	Dungpa	Sebjithang	77103536
5	Ms. Dorji Wangmo	Gewog Administrative Officer	Gakiling Gewog	17470592

Site Evacuation Procedure and Routes

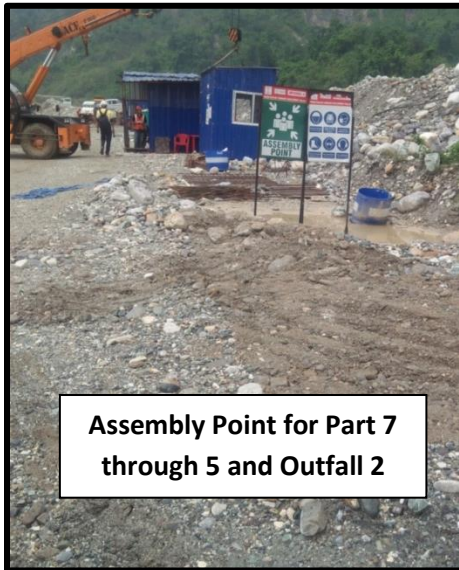
Following the onset of the alarm, workers and officials will be gathered and collected from their site assembly points and then taken to a safer location.



Assembly Points



Main Assembly Point in front of the Project Site

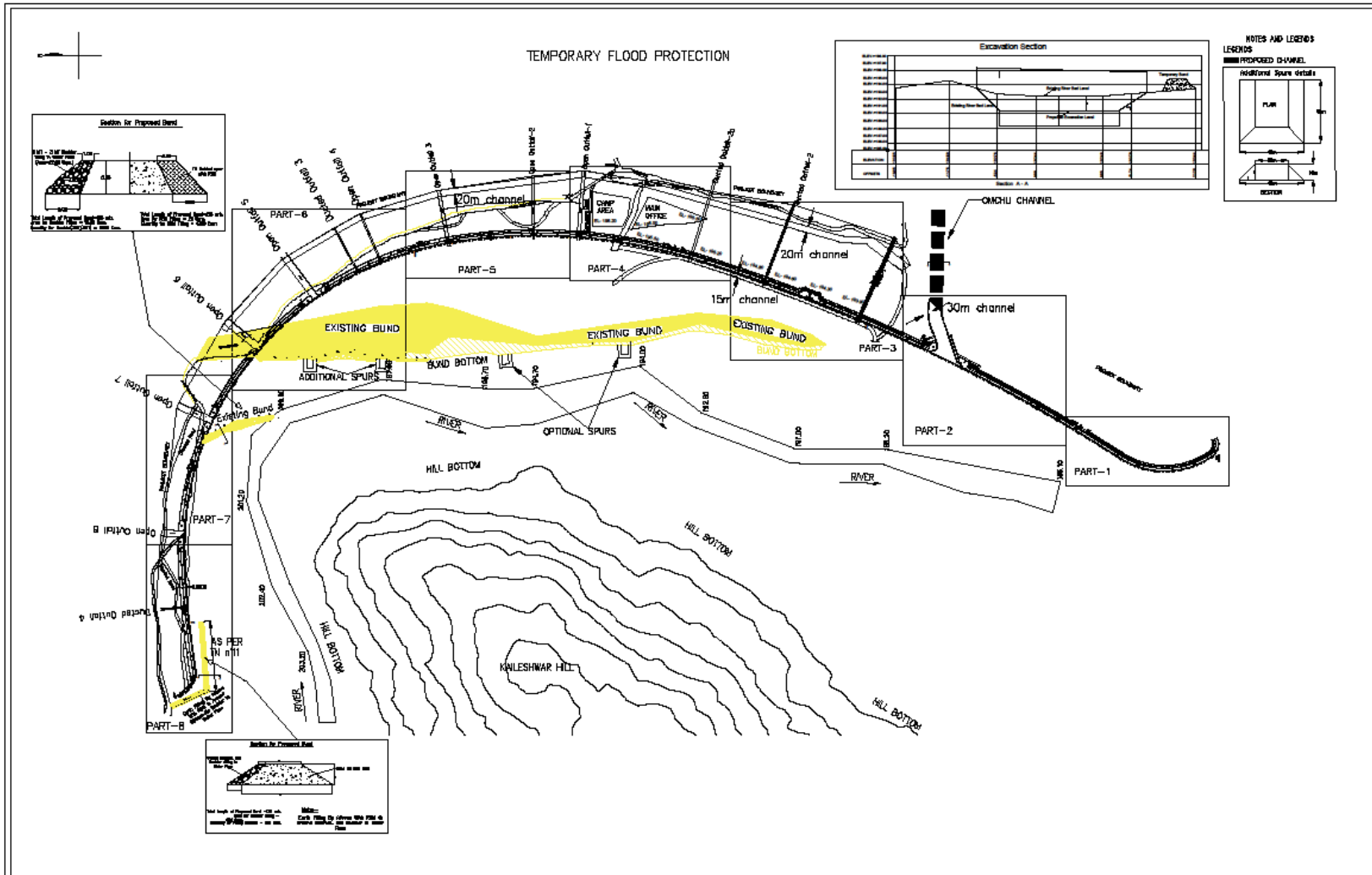


Assembly Point for Part 7
through 5 and Outfall 2



Assembly Point for Strip
1 through 9

Temporary Flood Protection works



AFCONS
AFCONS INFRASTRUCTURE LIMITED
 AFCONS HOUSE, 16, SHAH INDUSTRIAL ESTATE,
 NEERA DENVI ROAD, GANAKHERI(V), MUMBAI 400033 (INDIA).

CLIENT : M/S CONSTRUCTION DEVELOPMENT CORPORATION LTD.
 CONSULTANT: EGIS INTERNATIONAL IN J.V WITH EGIS INDIA.

DRAWING TITLE : FLOOD PROTECTION PLAN
 PROJECT : CONSTRUCTION OF RIVER TRAINING AND EMBANKMENT WORKS FOR PHUENTSCHOLING TOWNSHIP DEVELOPMENT PROJECT (PTDP), BHUTAN

DRG. NO. AFC/6462/PTDP/SD/DD115
 DRAWN BY : PRONAB ADHIKARI
 CHECKED BY : PRONAB ADHIKARI
 SHEET NO.:

DATE: 08/05/2019
 REV.
 SCALE : AS SHOWN