



Bangalore Electricity Supply Company Limited

Initial Environmental Examination

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India: Bengaluru Smart Energy Efficient Power Distribution Project

CURRENCY EQUIVALENTS

(as of 2020)

Currency Unit	–	Indian rupee (₹)
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\$1.00	=	₹73.80

ABBREVIATIONS

ADB	–	Asian Development Bank
BMAZ	–	Bangalore Metropolitan Area Zone
BESCOM	–	Bengaluru Electricity Supply Company Limited
CEA	–	Central Electricity Authority
CPCB	–	Central Pollution Control Board, Government of India
DPR	–	detailed project report
EA	–	executing agency
EIA	–	environmental impact assessment
EMoP	–	environmental monitoring plan
EMP	–	environmental management plan
EPC	–	engineering, procurement, and construction
ESC	–	environment and social cell
GHG	–	greenhouse gases
GRM	–	grievance redress mechanism
IA	–	implementing agency
ICC	–	Internal Complaints Committee
IEE	–	initial environmental examination
MOEFCC	–	Ministry of Environment, Forests & Climate Change, Government of India
PMU	–	project management unit
RoW	–	right of way
SF ₆	–	sulfur hexafluoride

WEIGHTS AND MEASURES

km	–	kilometer (1,000 meters)
kV	–	kilovolt (1,000 volts)
kW	–	kilowatt (1,000 watts)

NOTES

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Table of Contents

Executive Summary	i
I. INTRODUCTION	1
A. Background and Need for the Project	1
B. Scope of Initial Environmental Examination and Methodology Adopted	3
C. Report Structure	5
II. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK	6
A. National and State Environment, Health and Safety Framework	6
B. International Agreements Applicable to the Project	11
C. BESCO Environment and Social Policies	12
D. Asian Development Bank's Safeguards Policies	13
III. DESCRIPTION OF THE PROJECT	18
A. Project Components and Locations	18
B. Project Components and Construction Works	27
C. Existing and Associated Facilities	32
D. Route Selection and Installation Method Alternatives	33
E. Climate Risk Adaptation Measures	34
IV. DESCRIPTION OF THE ENVIRONMENT	35
A. Physical Setting	35
B. Ecological Setting	43
C. Cultural/Heritage Setting	47
D. Socioeconomic Setting	54
E. Characteristics of Project Affected Population	56
V. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES	65
A. Potential Impacts and Mitigation Measures during Pre-construction Phase	66
B. Potential Impacts and Mitigation Measures during Construction Phase	69
C. Potential Impacts and Mitigation Measures during Operation & Maintenance Phase	79
D. Climate Change Impact on Project Assets	82
E. Summary Environmental Impact Matrix	82
VI. CONSULTATIONS, PARTICIPATION, AND INFORMATION DISCLOSURE	82
A. Information Disclosure	85
B. Consultations	85
C. Consultation Findings	86
D. Ongoing Participation	88
VII. GRIEVANCE REDRESS MECHANISM	90
VIII. ENVIRONMENTAL MANAGEMENT PLAN	93
A. Environmental Management Plan	93
B. Impacts, Mitigation and Monitoring	93
C. Institutional Arrangements	102
IX. CONCLUSION AND RECOMMENDATIONS	109
ANNEXES	
Annex 1: Map of Sovereign and Non-Sovereign Components, Map of BESCO Subdivisions for Undergrounding and Field Photographs	111
Annex 2: Environmental Management Plan – Mitigation Plan	117
Annex 3: National Standards for Air and Noise	149
Annex 4: Details of Public Consultations	151
Annex 5: IBAT	165
Annex 6: Guidelines on COVID-19 Preparedness Measures	172
Annex 7: Environmental Monitoring Report Template	175
Annex 8: Environmental Safeguards Checklist and Consultation Proforma	177
Annex 9: BESCO undergrounding cable work and installing RMU	180
Annex 10: Environment Audit of Non-Sovereign and BESCO Contract Packages	182

LIST OF TABLES

Table 1: Technical parameters of the Ring Main Unit	32
Table 2: Bangalore Annual Rainfall (in mm)	36
Table 3: Total Estimated Emissions by Sector for Bangalore (tons/year)	38
Table 4: Sample Baseline Information Ambient Noise Quality at Project Location	39
Table 5: Sample Baseline Information Air Quality at Project Location	39
Table 6: Sample Baseline Information Soil Quality at Project Location	40
Table 7: Distance from Parks, Gardens, and Lakes to the Project Sites	46
Table 8: Distance from National Archaeological Sites to the Project Sites	48
Table 9: Heritage Zones	49
Table 10: Population Details for Districts, Bengaluru and Karnataka State	54
Table 11: BESCOM Accident Data	54
Table 12: Sample Selected	56
Table 13: Family Size	56
Table 14: Ownership Status of House	57
Table 15: HH Having Electricity Connection	57
Table 16: Type of Cooking Fuel Used	57
Table 17: Access to Communication Device	58
Table 18: HH Having Electric Appliances	58
Table 19: Type of Electric Connection	58
Table 20: Use of Electricity Connection	58
Table 21: HH Receiving Power Bills	59
Table 22: Frequency of Power Billing	59
Table 23: HH Paying Power Bills Regularly	59
Table 24: Location HH Pays Power Bills	59
Table 25: HH Facing Power Interruption/Cuts	60
Table 26: Frequency of Power Interruption/Cuts	60
Table 27: HH Getting Information About Power Cuts During Maintenance	60
Table 28: Source Through Which HH Received Information About Power Cuts During Maintenance	61
Table 29: HH Having Alternate Arrangements During Power Cuts	61
Table 30: HH Investment In Power Backup	61
Table 31: HH Using Power Saving Devices/Lighting	62
Table 32: Types of Power Saving Devices Used in House	62
Table 33: HH Satisfaction Regarding Use of Power Saving Lighting/Appliance	62
Table 34: HH Source of Knowledge About Use of Power Saving Devices	62
Table 35: Awareness About Power Saving By BESCOM	63
Table 36: HH Lodging a Complaint Regarding Power Supply	63
Table 37: Where HH Lodge Complaint	63
Table 38: Nature of Complaint	63
Table 39: Average Time Taken to Solve Complaint	64
Table 40: HH Average Monthly Expenditure	64
Table 41: HH Average Monthly Income	64
Table 42: Significance Factors	65
Table 43: Significance Determination	66
Table 44: Summary of Impact Assessment for Pre-Construction	69
Table 45: Risk of Transformers Containing Polychlorinated Biphenyls (PCBs)	71
Table 46: Sound Power Levels of Equipment Used	72
Table 47: Authorized Locations in Bengaluru for C&D Waste Disposal	74
Table 48: Summary of Impact Assessment during Construction	78
Table 49: ICNIRP Limit Values Concerning Electric and Magnetic Fields (50 Hz) for the Public and at Working Places	80
Table 50: Summary of Impact Assessment during Operation	81
Table 51: Environmental Impact Matrix	83
Table 52: HH Awareness About Proposed Underground Cabling Project	86
Table 53: HH Source of Information Regarding Underground Cabling Project	86
Table 54: Best Channel to Disseminate Project Information	87

Table 55: HH Perception about Benefits from Underground Cabling	87
Table 56: HH Opinion about Impacts during Implementation	88
Table 57: Constitution of Grievance Redress Committee	90
Table 58: Environmental Monitoring Plan (EMoP)	97
Table 59: Summary of Capacity Development and Training Activities	105
Table 60: Overall Project Implementation Schedule	107
Table 61: Estimated Environmental Costs for EMP Implementation	108

LIST OF FIGURES

Figure 1: Karnataka Map	i
Figure 2: Bengaluru Map	i
Figure 3: Overhead Distribution System	2
Figure 4: Project Coverage in Electricity Supply Chain	3
Figure 5: Project Concept	18
Figure 6: Overall Project Site Location Map	21
Figure 7: Location 1 – Part of Jaya Nagara Division – BMAZ South	22
Figure 8: Location 2 – Part of Shivaji Nagara Division – BMAZ North	23
Figure 9: Location 3 – Indira Nagara Division – BMAZ North.	24
Figure 10: Location 4 – Part of Kora Mangala Division – BMAZ South	25
Figure 11: Location 5 – Part of HSR Layout Division – BMAZ South	26
Figure 12: Location 6 – Part of White Field Division – BMAZ North	27
Figure 13: Medium Voltage Underground Distribution Cable	28
Figure 14: Low Voltage Distribution Cable	28
Figure 15: Optic Fiber Communication Cable	29
Figure 16: Image of Trenchless Technology for Installation of Cable	29
Figure 17: Picture of Drill Rig, Winch and Pit	31
Figure 18: Ring Main Unit	32
Figure 19: Pole Mounted Transformer	Error! Bookmark not defined.
Figure 20: Bengaluru Annual Temperature (Degrees Celsius)	35
Figure 21: PM10 concentration for Bengaluru ($\mu\text{g}/\text{m}^3$)	36
Figure 22: PM 2.5 concentration for Bengaluru ($\mu\text{g}/\text{m}^3$)	37
Figure 23: SO2 concentration for Bengaluru ($\mu\text{g}/\text{m}^3$)	37
Figure 24: NO2 concentration for Bengaluru ($\mu\text{g}/\text{m}^3$)	37
Figure 25: Sample Baseline Testing Points	39
Figure 26: Geology and Mineral Map	40
Figure 27: India Earthquake Zone Map	41
Figure 28: Arkavathi-Vrishabhavathi River Basin	42
Figure 29: Location of Bangergatta National Park	44
Figure 30: Location of Puttenahalli Lake (Conservation Reserve)	44
Figure 31: BESCOM Safety Pamphlet	54
Figure 32: Significance Factors	65
Figure 33: Process of Grievance Redressal Mechanism	92
Figure 34: Supervision and Monitoring Arrangement of BESCOM during Construction	95

Executive Summary

1. **Background.** Bengaluru, the capital city of Karnataka state, located in the southern part of India, is the center of the country's information technology industry and the so-called Silicon Valley of India (Figures 1 and 2). Bengaluru Electricity Supply Company Limited (BESCOM) is one of 5 state-owned distribution utilities in Karnataka state and is licensed to supply electricity to eight districts. The company has 4 operating zones – Bangalore Metropolitan Area Zone (BMAZ) North, BMAZ South, Bangalore Rural Area Zone and Chitradurga Zone; 9 circles, 32 divisions, 137 sub-divisions and 534 section offices. It covers an area of 41,092 m² and a population of over 20.7 million with around 93,527 circuit kilometers of medium 11 kV voltage lines and 165,246 circuit kilometers of low voltage 1.1kV lines. The project covers the zones of BMAZ North and South.

2. Quality and reliability of electricity supply in Bengaluru city is quite low. Technical and commercial losses occur due to a high number of unauthorized connections and overloading of conductors. The average outage duration is unacceptably high for a modern electrical distribution network. BESCOM's current practice of using overhead distribution lines means that its conductors frequently come into contact

with trees, animals, and human beings, causing not only power failure but also serious and fatal accidents. Utility poles on the sidewalks can also be obstacles for pedestrians. In case of natural hazards, such as storms, snapped lines and broken poles are often the cause of accidents, block emergency transportation and evacuation routes, and interrupt electricity supplies.

3. Reliable electricity supply is an essential infrastructure for a modern urban area and needed to sustain information technology industry operations in Bengaluru. Modernizing the distribution network will (i) reduce the distribution losses, thereby reducing additional consumption of fossil fuels and associated greenhouse gas (GHG) emissions and air pollutants; (ii) improve the reliability and quality of the electricity service to over customers; (iii) reduce accidents; and (iv) contribute to construction of a livable and disaster resilient city.

4. **Bengaluru Smart Energy Efficient Power Distribution Project.** The proposed project involves the conversion of high 11 kV and low voltage 1.1 kV overhead power distribution lines to underground lines, optic fiber communication cables, and the installation of distribution automation systems to monitor and control switchgear in the urban area of

Figure 1: Karnataka Map

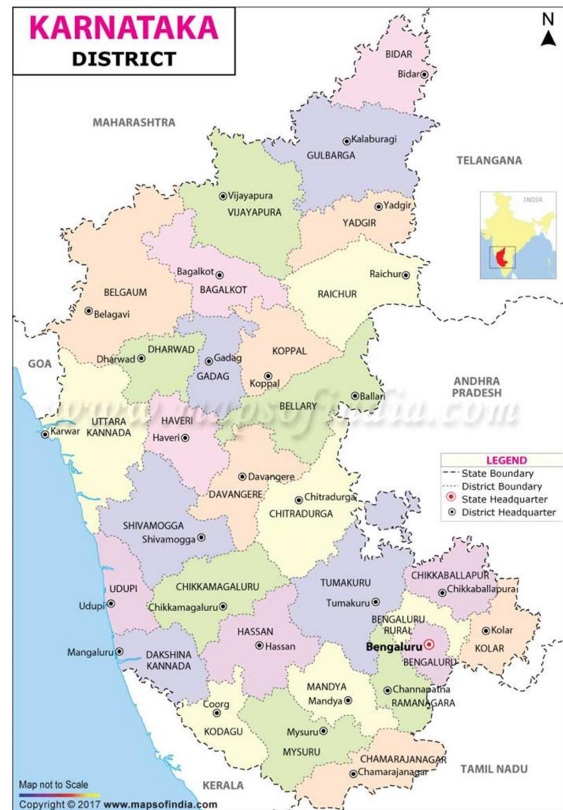
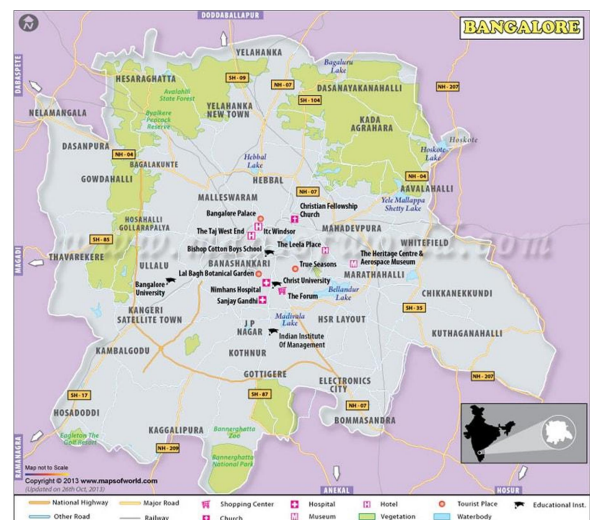


Figure 2: Bengaluru Map



Bengaluru city. The project cost is estimated at \$277.3 million, of which \$100 million loan is from ADB's ordinary capital resources, \$90 million loan is from ADB's resources on a non-sovereign basis, and \$87.3 million is from counterpart funds from BESCOM. The outcome of the proposed project is energy efficient, reliable, and safe power supply in urban areas of Bengaluru enhanced. The project will be aligned with the following impact: a livable Bengaluru city developed.

5. The proposed project will take place in six BESCOM divisions (Jaya Nagara, Shivaji Nagar, Indira Nagar, Kora Mangala, Hosur-Sarjapur Road (HSR) Division, and White Field) in Bengaluru city. The project components are the installation of around: (i) 2,393-km 11 kV lines for conversion from overhead to underground; (ii) 4,848-km 1.1 kV lines for conversion from overhead to underground; (iii) 1,638 distribution automation system ring main units (RMUs) in metal enclosed cabinets to enable BESCOM to monitor and control switchgear from their control center; and (iv) 2,983-km of optic fiber cable (OFC) to support distribution automation. There is no overlapping of the 11kV and 1.1kV cable lengths so the total km of cable installation is about 7,241-km. The details of components by each BESCOM division are described in Table 1.

6. Cable routings will follow the existing overhead line corridors within 17 subdivisions but actual alignments will be mapped and confirmed by the contractor during project implementation; maps showing the subdivisions involved in the project are included in Annex 1.

Table 1: Summary of Project Activities

Name of Division	Installation of 11 kV underground cable (km)	Installation of 1.1 kV underground and aerial bunched cable* (km)	Installation of 11 kV DAS RMU (unit)	Installation of OFC (km)
Indira Nagar	493	1,655	333	901
Jaya Nagar	358	1,090	265	361
Shivaji Nagar	311	391	162	306
Kora Mangala	301	340	386	392
HSR Division	650	855	349	653
White Field	280	517	143	370
Total	2,393	4,848	1,638	2,983

DAS = distribution automation system, HSR = Hosur-Sarjapur Road, km = kilometers, kV = kilovolt, OFC = optic fiber cable, RMU = ring main unit.

*Preference is for 100% replacement with underground, but in limited circumstances overhead aerial bunched cable may be required to replace overhead bare conductors if underground is not feasible to make the end user connection.

Source: Bengaluru Electricity Supply Company Limited.

7. **Environment Safeguards.** The Asian Development Bank's (ADB) Safeguard Policy Statement (2009) as well as the India and Karnataka state's environmental, health and safety laws and regulations apply to all components under the project. As per Government of India's environment impact assessment (EIA) Act 2009, power distribution projects are not listed as environmentally sensitive projects, and hence, no environmental clearance is required from the Karnataka State Pollution Control Board (KSPCB) or the Ministry of Environment and Forests & Climate Change (MoEFCC) for the proposed project. Given the highly modified, dense urban setting no components will be implemented in forest lands, and so no forest clearance is required.

8. Environmental, health and safety impacts are likely to result from the proposed project components, though potential impacts are site-specific, generally temporary during

construction works, and, cost effectively managed by following national requirements and international good practice per the International Finance Corporation (IFC) 2007 General Environmental, Health, and Safety (EHS) Guidelines and EHS Guidelines on Electric Power Transmission and Distribution. Construction works involve the laying of replacement cables underground, or in limited circumstances replacement with aerial bunched cables, plus the removal of obsolete overhead cables and poles and the installation of RMUs. Bearing in mind construction works will primarily take place along existing rights-of-way in the urban area, and as the installation technology used is primarily trenchless, avoiding cutting of any trees, the environmental and social impacts are limited. Existing overhead line corridors are to be used for the project purposes, and there are no ecologically protected areas or critical habitat present along them, as the project area is on urban streets in the highly modified, dense urban area of Bengaluru city; internationally or nationally important cultural heritage assets are also not present in the overhead line corridors. Given this, the environmental categorization under ADB's Safeguard Policy Statement (2009) is Category B. Therefore, an initial environmental examination (IEE), in accordance with ADB's Safeguard Policy Statement (2009), has been undertaken for the proposed project. The IEE will be reviewed once working drawings/maps of cable routes and RMU locations have been completed, to confirm no changes in alignments outside existing overhead line corridors and/or affecting environmentally sensitive areas before proceeding with works.

9. Potential impacts associated with undergrounding the distribution lines have been avoided or minimized through careful route selection by BESCOM. Generally following the alignment of existing overhead distribution line corridors, mainly along the sidewalk, the underground cables are routed to cause minimum inconvenience to the public during works. 90% of replacement cables will be installed using trenchless technology with an open trench method used only in areas of open space where there are no social safeguard constraints and less disruption will result. The underground cables will be connected to existing pole and plinth mounted transformers, the project does not involve any new or changes to old transformers but BESCOM is legally required to ensure it complies with the Government of India Regulation of Use, Handling and Disposal of Polychlorinated Biphenyls (PCBs) which permits the use of existing PCB containing equipment only up until 31 December 2025 on the proviso that it is within its certified lifetime and properly maintained without possibility of leakage or release of PCBs into the environment. Ring main units will be installed in a designated space of a few square meters of state-owned land, in a state-owned building or on the encumbrance-free street.

10. The impact assessment process identified that the proposed project would have the following potential environmental and social impacts and risks:

- (i) Increased noise, dust, erosion, solid waste, and wastewater generation, resulting in increased pollution risk during the construction works, temporarily disrupting and disturbing sensitive receptors present including shops and markets, hospitals and clinics, schools and libraries, private residences, etc.
- (ii) Increased traffic congestion and restrictions on vehicle and pedestrian movements during the construction works, temporarily disrupting and increasing health and safety risks for road and sidewalk users.
- (iii) Occupational health and safety risks for construction workers and BESCOM's maintenance staff, especially risks due to working with live electricity and in the street with running traffic.
- (iv) Accidental risk of damage to above or below ground property and utilities and increased public injury in respect of community health and safety during construction due to works being undertaken in the street. Once operational, risks to community health and safety are significantly reduced by undergrounding of distribution lines.

- (v) Increased use and risk of leakage of sulfur hexafluoride (SF6) a potent GHG with global warming potential of 22,800 kg carbon dioxide equivalent due to installation of RMUs.

11. To manage these potential impacts, mitigation measures will be required prior to the start of construction, as well as during the construction, and, operation and maintenance phases, as detailed in the mitigation plan in Annex 2. It reflects both national requirements and international good practice per the IFC EHS Guidelines. The environmental management plan (EMP) also includes an environmental monitoring program, including monitoring of health and safety incidents, and the institutional arrangements for its implementation which will be supervised and monitored by BESCO through an environmental and social cell reporting to the project management unit. In addition, BESCO will appoint a project management consultant and an independent environment consulting agency to support them with supervision and preparation of the periodic environmental monitoring reports which will be required semi annually until the completion of construction and then annually during operation. Environmental audit of the ongoing works (as existing facilities under construction) has been undertaken and BESCO and their contractors will address gaps identified between their current performance and the requirements of the final EMP as corrective action for immediate implementation.

12. **Meaningful Consultations.** A total of ten focus groups involving 103 persons (70% male and 30% female) were held between April to October 2019 with a sample of affected or beneficiary persons focusing on existing environmental conditions around the overhead distribution lines, the potential impacts of the project, and proposed mitigation measures. In addition, 718 household surveys were carried out along the project sites by the consultants between 4 May and 7 June 2019. The IEE consultants have visited about 400 km of alignment in the divisions, together with BESCO field staff, representing a sample of about 5.5% of alignment. While the participants of these consultations are supportive of the project, they suggested to further disseminate project information through various media including social media, television, and newspapers. Concerns during the project implementation such as (i) using quality materials; (ii) protection of other public utilities; (iii) avoiding damage to trees, drains and property; (iv) minimizing traffic jams and road accidents, (v) adequate health and safety including signage; (vi) minimizing noise and dust pollution; and (vii) avoiding damage from future road works will be managed by BESCO through the EMP. BESCO already have an existing Grievance Redress Mechanism as per ADB's Safeguard Policy Statement (2009) which was explained to participants of the focus groups. This will be used as the entry point for grievances related to the project, supplemented by grievance redress committees at division level.

13. **Conclusion.** Overall, potential impacts associated with undergrounding the distribution lines have been avoided or minimized through careful route selection by BESCO. Mitigation measures have been identified for the remaining potential impacts and risks and their implementation will be carefully monitored and reported for compliance to ADB by BESCO. If there are any unanticipated impacts or a need for corrective action during project implementation due to non-compliance with the EMP, these will be reported by BESCO to ADB and the IEE and EMP will be updated and cleared by ADB, as required.

I. INTRODUCTION

A. Background and Need for the Project

1. Bengaluru, the capital city of Karnataka state, located in the southern part of India, is the center of the country's information technology industry and the so-called Silicon Valley of India (Figures 1 and 2). In tandem with the economic growth of the city, the urban population increased from around 7 million in 2008 to over 10 million in 2018, and the population density is around 4,400 persons per square kilometer (km²), almost 50% increase in just 10 years, making it a megacity and the third most populous city, and fifth most populous urban agglomeration in India. Electricity demand has also increased by an average of 10% per year over the past 4 years.

2. Bengaluru Electricity Supply Company Limited (BESCOM) is one of 5 state-owned distribution utilities in Karnataka state and is licensed to supply electricity to eight districts. The company has 4 operating zones – Bangalore Metropolitan Area Zone (BMAZ) North, BMAZ South, Bangalore Rural Area Zone and Chitradurga Zone; 9 circles, 32 divisions, 137 sub-divisions and 534 section offices. It covers an area of 41,092 square meters and a population of over 20.7 million with around 93,527 circuit kilometers of medium 11 kV voltage lines and 165,246 circuit kilometers of low voltage 1.1kV lines. The project covers the zones of BMAZ North and South.

3. As of 31 May 2019, Karnataka state had an installed generating capacity of 29,143 megawatts (MW), which includes 15,133 MW from conventional energy sources and 14,010 MW from non-conventional energy sources such as wind, solar, biomass, etc.¹ BESCOM gets its power from this range of generation sources.

4. Quality and reliability of electricity supply in the city is quite low. Technical and commercial losses in 2017 were around 12%, compared to the international average of 5%, due to the high number of unauthorized connections and overloading of

Figure 3: Karnataka Map

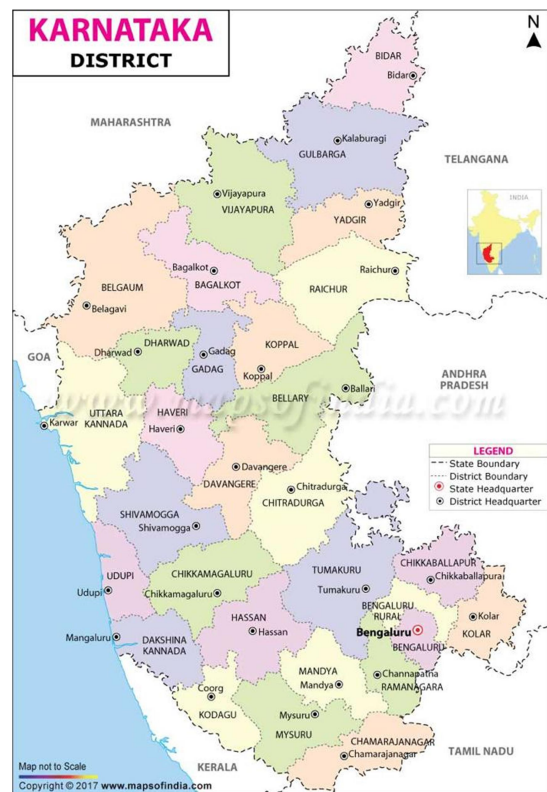
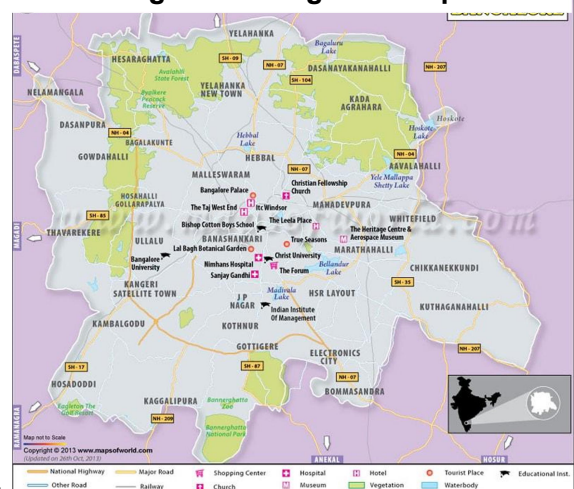


Figure 4: Bengaluru Map



¹ <https://www.karnataka.gov.in/energy/english/Pages/Functions.aspx>

conductors. The average outage duration was 112 hours per customer per year, compared to a median of 1.5 hours for North American utilities, and with 153 interruptions per customer per year, as compared to the median value for North American utilities in 2017 of approximately 1.10 interruptions, is unacceptably high for a modern electrical distribution network. BESCOM's current practice of using overhead distribution lines means that its conductors frequently come into contact with trees, animals, and human beings, causing not only power failure but also serious and fatal accidents. Figure 3 gives an illustration of the current overhead distribution system. Utility poles on the sidewalks can also be obstacles for pedestrians. In case of natural hazards, such as storms, snapped lines and broken poles are often the cause of accidents, block emergency transportation and evacuation routes, and interrupt electricity supplies.

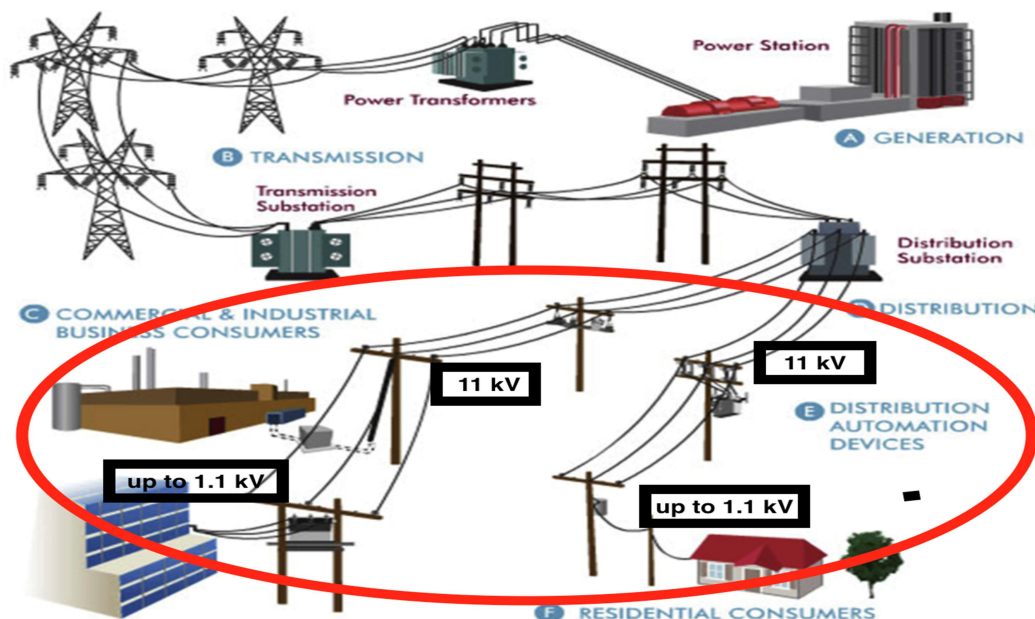
5. Reliable electricity supply is an essential infrastructure for a modern urban area and needed to sustain information technology industry operations in Bengaluru. Modernizing the distribution network will (i) reduce the distribution losses, thereby reducing additional consumption of fossil fuels and associated greenhouse gas (GHG) emissions and air pollutants; (ii) improve the reliability and quality of the electricity service to over customers; (iii) reduce accidents; and (iv) contribute to construction of a livable and disaster resilient city.

6. The proposed project is a conversion of high voltage 11 kV and low voltage 1.1 kV overhead power distribution lines to underground lines, optic fiber communication cables, and installation of distribution automation systems to monitor and control switchgear in the urban area of Bengaluru city. The project cost is estimated at \$277.3 million, of which \$100 million is from ADB's ordinary capital resources, \$90 million is from ADB's resources on a non-sovereign basis, and \$87.3 million is from counterpart funds from BESCOM. The outcome of the proposed project is energy efficient, reliable, and safe power supply in urban areas of Bengaluru enhanced. The project will be aligned with the following impact, a livable Bengaluru city developed. The project coverage in relation to the overall electricity supply chain is illustrated in Figure 4.

Figure 5: Existing Overhead Distribution System



Figure 6: Project Coverage in Electricity Supply Chain



7. BESCOM is both the executing agency (EA) and implementing agency (IA) for the project. BESCOM has already established a project management unit (PMU) overseen by the Director Technical for implementing the project. This PMU is staffed by corresponding personnel from various functions – Administration and Finance, Planning and Design, Procurement and Contracts, and Operations and Maintenance. It is headed by a Chief General Manager and Superintendent Engineer. This PMU will be supported internally by an environmental and social cell (ESC) reporting to a Deputy General Manager in the PMU who will take on the role Environment and Social Safeguards Manager. The PMU will also be supported by project management consultants (PMC) for engineering and environment who will help look after the design and supervision of the project, the environmental consultants helping the PMU/ESC to supervise EMP implementation. In addition to this, BESCOM will appoint an independent environment consulting agency to prepare the mandatory periodic Environmental Monitoring Reports of the project. The periodic environment monitoring reports will be submitted to the ADB.

B. Scope of Initial Environmental Examination and Methodology Adopted

8. Construction works involve the laying of replacement underground cables, or replacement with aerial bunched cables, plus the removal of obsolete overhead cables and poles and the installation of ring main units (RMUs). Bearing in mind construction works will primarily take place along existing rights-of-way (RoWs) in the urban area, and, as the installation technology used is primarily trenchless, avoiding cutting of any trees, the environmental and social impacts are limited. Existing overhead line corridors are to be used for the project purposes, and there are no ecologically protected areas or critical habitat present, as the project area is on urban streets in the highly modified, dense urban area of Bengaluru city; internationally or nationally important cultural heritage assets are also not present in the overhead line corridors. Since the proposed project does not involve components that will have significant adverse impacts that are irreversible, diverse, or unprecedented, accordingly, the

environmental categorization of the proposed project under ADB's Safeguard Policy Statement (2009) is Category B. This denotes *"the proposed project's potential adverse environmental impacts are site-specific, few if any of them are irreversible, and in most cases mitigation measures can be designed more readily than for category A projects"* and that an initial environmental examination (IEE) is required which has duly been prepared.

9. The IEE has been undertaken by BESCO consultants in accordance with ADB's Safeguard Policy Statement (2009) to assess the potential environmental and social impacts and risks of the proposed project and identify mitigation measures to be put in place to avoid, minimize, mitigate or compensate for them. The IEE also considers the environmental, health and safety requirements of India and Karnataka state.

10. The broad scope of the IEE was to:

- (i) identify any legislative and approval requirements under which project components must occur;
- (ii) conduct field visits and collect primary and secondary data so as to establish the existing environment of the project area, including identifying environmentally sensitive areas and the presence of any vulnerable groups;
- (iii) carry out meaningful consultation with affected persons and other stakeholders to identify their interests and concerns regarding the proposed project;
- (iv) assess the anticipated direct, indirect, cumulative, and induced environmental and social impacts due to the location, design, construction, and, operation and maintenance of the proposed project;
- (v) prepare an environment management plan (EMP) including a mitigation plan for managing the potential impacts of the proposed project during the pre-construction, construction, and, operation and maintenance phases; and
- (vi) identify as part of the EMP the environmental and social parameters to be monitored by BESCO during project implementation as well as the institutional arrangements for its implementation.

11. The IEE involved the collection of baseline data of existing conditions on physical, biological, socioeconomic aspects of the environment, together with an assessment of the potential impacts of the proposed project and the identification of the mitigation measures. The IEE consultant has visited about 400 km of alignment in the divisions, together with BESCO field staff, representing a sample of about 5.5% of alignment. Detailed review of the baseline environment was conducted at representative locations along the alignments in each of the six BESCO divisions [plus Hebbal division which has since been dropped from the project] during field visits between April to October 2019. Field visits included about 90 proposed locations for the installation of the RMUs - a factory assembled, compact set of switchgear (Chapter 3) enclosed in a metal cabinet which will be installed in a designated space of a few square meters of state-owned land, in a state-owned building or on the encumbrance free street, at the load connection points of ring-type distribution networks.

12. Data from secondary sources, including the internet and published Government of India 2011 census data, as well as from BESCO, Karnataka State Pollution Control Board (KSPCB), and other authorities, have been obtained to support the field survey findings. Sample air and noise tests, socio-economic surveys and focus group discussions were also undertaken to help determine the baseline environment. Focus groups were held between April to October 2019 with a sample of affected or beneficiary persons and the concerned BESCO officials focusing on existing environmental conditions around the overhead distribution lines, the potential

impacts of the project, and the proposed mitigation measures.

13. Given the nature of the proposed project which will take place in the dense urban environment of Bengaluru city, the project area of influence was limited to the immediate environs of the streets on which construction will occur. However, the distances to any internationally or nationally important biodiversity and cultural heritage assets supported by the wider study area of Bengaluru city were also checked.

14. The impact assessment was carried out for various environment components including ecology, soil, water, air, noise, socioeconomic aspects including occupational and community health and safety, and physical cultural resources. It is based on cable routings, following existing overhead line corridors, in the project subdivisions as given in Annex 1 but actual alignments will be mapped and confirmed by the contractor during project implementation. The IEE will be reviewed once working drawings/maps of cable routes and RMU locations have been completed, to confirm no changes in alignments outside existing overhead line corridors and/or affecting environmentally sensitive areas before proceeding with works. However, the IEE and EMP will only need to be updated by BESCO if there are any unanticipated impacts during project implementation, including a scope or design change such as a change in alignment away from the existing overhead line corridor.

C. Report Structure

15. In compliance with ADB's Safeguard Policy Statement (2009) requirements, this IEE has been structured and consists of 9 sections: (i) Introduction; (ii) Policy, Legal and Administrative Framework; (iii) Description of the Project; (iv) Description of the Environment; (v) Anticipated Environmental Impacts and Mitigation Measures; (vi) Consultations, Participation, and Information Disclosure; (vii) Grievance Redress Mechanism; (viii) Environmental Management Plan; and (ix) Conclusion and Recommendation. The executive summary of the IEE is also provided at the beginning of the report.

II. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

16. The project will be implemented in accordance with ADB's Safeguard Policy Statement (2009) requirements, and Government of India and Government of Karnataka's environment, health and safety acts and rules, including relevant international agreements, as well as BESCOM's environmental and social policies and procedures.

A. National and State Environment, Health and Safety Framework

17. The national environmental, health and safety framework defines the roles and responsibilities of ministries and government departments at central level. State boards/departments work under their guidance and overall coordination. The Ministry of Environment, Forest and Climate Change (MOEF&CC) is the apex body for environment and pollution control, KSPCB, together with Central Pollution Control Board (CPCB), provide the regulatory function for pollution prevention and control applicable to the proposed project. The Ministry of Labor and Employment (ML&E) is the apex body for occupational health and safety (OHS) with the Labor Secretariat, Government of Karnataka at state level. The Ministry of Power (MoP), together with the Central Electricity Authority (CEA) are the apex bodies for community safety in relation to the electrical distribution networks.

(a) Government of India Environment and Social Policies, Acts and Regulations

18. The major Indian policies, acts and rules relevant to all components funded by the project are the National Environment Policy (2006) and the Environment Protection Act (1986) for environment and pollution control; the National Policy on Safety, Health and Environment at Work Place (2009) for OHS; the National Policy on HIV/AIDS and the World of Work, 2014; and, the Electricity Act (1910) and its Amendments (2004) and (2007), and the Indian Telegraphic Act (1885) and its Amendments (2003) for community safety in relation to the electrical distribution networks. Table 1 gives a list of all relevant environment, health and safety acts and regulations and their applicability to the proposed project.

Table 1: Indian Acts and Regulations as Applicable for the Project

No	Name of Regulation	Applicability	Remark
ENVIRONMENTAL REGULATIONS			
1	The Environment (Protection) Act 1986 and Environment (Protection) Rules 1986 & its amendments	Yes	Umbrella Act to the Air, Water and Noise Acts.
2	Forest Conservation Act, 1980	No	Project operations are not in any forest area.
3	Wild Life (Protection) Act, 1972 (amended 2003)	Yes	Project operations are not in any protected area, but project will comply with provisions related to wild animals and specified plants in unlikely event any encountered during works.

No	Name of Regulation	Applicability	Remark
4	The Hazardous Waste (Management, Handling and Trans-boundary Movements) rules, 2016	Yes	Any hazardous waste created by project will be handled as per the provisions of the Act.
5	Regulation of Polychlorinated Biphenyls Order, 2016	Yes	Use of PCBs by project will be prohibited as per the provisions of the order, old transformers will be handled as per the provisions of the Act, and all existing transformers to be PCB free by 2025.
4	Batteries (Management and Handling) Rules, 2001 and further amendments	Yes	Any batteries used by project will be handled as per the provisions of the Act.
5	Ozone Depleting Substances (Regulation) Rules, 2000 as amended in 2005	Yes	Use of ozone depleting substances by project will be prohibited as per the provisions of the Act.
6	Construction and Demolition Waste Management Rules, 2016	Yes	Any such construction waste and debris will be disposed of at designated sites as per the provisions of the Act.
7	The Air (Prevention and Control of Pollution) Act, 1981 Including Rules 1982 and 1983	Yes	The project will take measures to reduce emissions to air and set up monitoring stations to periodically measure the air quality.
8	Noise Pollution (Regulation and Control) Rules, 2000 and the Noise Pollution (Regulation and Control) (Amendment) Rules, 2010	Yes	The project will take measures to reduce noise emissions and will set up monitoring stations to periodically measure the noise levels.
9	The Water (Prevention and Control of Pollution), Act, 1974 including Rules, 1975 (as amended up to 1988)	Yes	The project will take measures not to pollute surface and groundwater.
10	The Water (Prevention and Control of Pollution), Cess Act, 1977 including Rules 1978 and 1991	Yes	The project will take measures not to pollute surface and groundwater.
11	Central Ground Water Authority Notification no.21-4/Guidelines/CGWA/2009-832 dated 14th October 2009	Yes	The project will follow this for any extraction of water for project.
12	The National Environmental Appellate Authority Act, 1997	No	Only in case of any appeals, the project will reach out to this authority for any decisions related to environment.
SOCIAL REGULATIONS			

No	Name of Regulation	Applicability	Remark
1	Building and Other Construction Workers Act 1996	Yes	Key legislation providing guidelines for onsite labor and worker management and welfare
2	Interstate Migrant Workers Act 1979	Yes	In case workers and laborers working at the project sites are migrants from other states this legislation is to be followed for provisions to migrant labor.
3	The Indian Telegraph Act, 1885 and its Amendments (2003)	Yes	Community safety in relation to the electrical distribution networks. This act provides right of way to lay any overhead lines. Alignments follow existing overhead line corridors.
4	Indian Treasure Trove Act, 1878 (as modified up to September 1949)	Yes	All chance finds will be deposited with the government as per the provisions of this act.
5	The Antiquities and Art Treasures Act, 1972	Yes	All such finds will be deposited with the government as per the provisions of this act.
6	The Child Labour (Prohibition and Regulation) Act, 1986	Yes	The project will avoid child labor. No child will be employed. No adolescent (under 18 years) will be engaged in hazardous work.
7	The Bonded Labour (Abolition) Act 1976	Yes	The project will avoid bonded labor.
8	The Trade Union Act, 1926	No	The project will allow formation of labor unions as per the provisions of this act.
9	Minimum Wages Act, 1948	Yes	The project will ensure that wages are paid as per the provisions of this act.
10	Workmen's Compensation Act, 1923	Yes	This Act will be followed for providing compensation in case of disability or loss of limb or sight or life.
11	The Contract Labour (Regulation & Abolition) Act, 1970 and Rules	Yes	The project will ensure that the provisions of this Act are complied with by the contractors.
12	The Employees' Provident Funds and Miscellaneous Provisions Act, 1952	Yes	The project will ensure that the contractors will pay Employee Provident Fund as per the provisions of this Act.

No	Name of Regulation	Applicability	Remark
13	Indian Factories Act 1948 and State Rules	Yes	This Act becomes operational in case there are more than ten full time employees during the operations phase of the project. The project will follow the health and safety guidelines under this Act.
14	Employees State Insurance Act, 1948 (ESI)	Yes	The ESI Act and Workmen's Compensation Act are applicable to Bengaluru Electricity Supply Company Limited (BESCOM) and Contractors with regard to insurance and compensation.
15	Payment of Gratuity Act, 1972	Yes	The provisions of this act are applicable to BESCOM when paying gratuity.
16	Provisions of the Panchayats (Extension to the Scheduled Area) Act, 1996	No	The provisions of this act are only applicable to Tribal Areas.
17	The Right to Information Act, 2005	Yes	The project will provide information to those who apply for the same as per the provisions of this Act.
18	Employers' Liability Act no. 24 of 1938	Yes	The provisions of this Act are applicable with regard to the liability of the employers; IA and contractors.
19	The Shops and Establishment Act and State Rules	Yes	The project will follow the health and safety guidelines related to contractor's establishment under this Act.
20	The Petroleum Act, 1934 and the Petroleum Rules	Yes	The project will follow the health and safety guidelines related to use of petroleum under this Act.
21	Gas Cylinder Rules and Static and Mobile Pressure Vessels (Unfired) Rules, 1981	Yes	The project will follow the health and safety guidelines related to cylinders and pressure vessels under this Act.
22	Central Electricity Authority (Safety Requirements for Operation, Construction and Maintenance of Electric Plants and Electrical Lines) Regulations 2011	Yes	Detailed design, maintenance procedures (details in Section 2.1.4)
23	Indian Electricity Act, 2003	Yes	The project will follow the health and safety guidelines under this Act.
24	Electricity Act (1910) and its Amendments (2004) and (2007)	Yes	Community safety in relation to the electrical distribution networks.

(b) Technical Standards and Regulations for the Indian Power Sector

19. CEA is the technical agency making regulations consistent with the Electricity Act, 2003 under section 177 and carrying out the provisions of the Act. The following relevant regulations, which deal with health and safety requirements, are notified and published in the official gazette of the Government of India and available on the website of CEA:

- (i) CEA (Installation and Operation of Meters) Regulations, 2006 – notified on 17 March 2006
- (ii) CEA (Grid Standards for Operation & Maintenance of Distribution Lines) Regulations, 2010- notified on 26 June 2010
- (iii) CEA (amendment to the regulations on “Installation & Operation of Meters”) Regulations, 2010-notified on 26 June 2010
- (iv) CEA (Measures Relating to Safety & Electric Supply) Regulations, 2010- notified on 24 September 2010
- (v) CEA (Technical Standards for Construction of Electric Plants and Electric Lines) Regulations, 2010-notified on 20 August 2010
- (vi) CEA (Safety Requirements for Construction, Operation and Maintenance of Electrical Plant and Electrical Lines) Regulations, 2011-notified on 14 February 2011
- (vii) CEA (Technical Standards for Construction of Electrical Plants and Electric Lines) – Regulations 2010
- (viii) CEA (Technical Standards for Connectivity to the Grid) (Amendment) Regulations 2010

(c) Karnataka Specific Framework

20. MoEFCC, Government of India, vide its Notification Nos. S.O. 1533 dated 14 September 2006, reengineered the EIA process in India, and also decentralized some powers, making provision to constitute the State Level Environment Impact Assessment Authority (SEIAA) and the State Level Expert Appraisal Committee (SEAC) for performing functions under the said notification. For Karnataka state, the SEIAA and SEAC was constituted vide the MoEFCC, Government of India, Notification Nos. S.O. 1735 (E) dated 11 October 2007; however, both SEAC and SEIAA of Karnataka were reconstituted/re-notified on 21 March 2011 vide Nos. S.O. 608 (E).

21. The KSPCB's guidelines with regard to monitoring of environmental parameters for project proponents apply to all Karnataka state projects.

22. Karnataka Government policies, acts and regulations that are applicable to the proposed project are listed in Table 2.

Table 2: Karnataka Policies, Acts and Regulations as Applicable for the Project

No.	Name of Regulation	Applicability	Remark
1	Karnataka Land Preservation Act (LPA)	No	Only related to afforestation, restoration of land, so not required for project in urban area
2	The State Tree Preservation Act	Yes	The project is avoiding cutting of any trees by its use of trenchless technologies, but this will be followed in unlikely event that trees need to be cut

(d) National Environment Clearance

23. Under the Government of India's EIA Notification 2009, the environmental classification of environmentally sensitive projects included in Schedule 1 is determined by MoEFCC, Government of India, and there are two possible outcomes:

- **Category A:** A project is classified as Category A if it is likely to have significant negative impacts and is thus one of the types of project listed in this category in the EIA Notification. Such projects require EIA, plus environmental clearance (EC) from MoEFCC;
- **Category B:** A project is classified as Category B if it is likely to have fewer negative impacts and is listed in this category in the EIA notification. These projects require EC from the State Environment Impact Assessment Authority (SEIAA) who classify the project as B1 (requiring EIA) or B2 (not requiring EIA) depending on the level of potential impacts. Projects classified as B2 require no further assessment.

24. However, power distribution projects in urban areas are not even included as an environmentally sensitive project in Schedule 1 of the EIA Notification 2009. Therefore, no EC is required from the MoEFCC or SEIAA for the proposed project.

B. International Agreements Applicable to the Project

25. India is member of almost all major multilateral environmental agreements (MEAs)² under four clusters:

(a) Nature conservation:

- Convention Relative to the Preservation of Fauna and Flora in the Natural State (1933) - no direct relevance, but seek to avoid loss of natural flora and fauna
- International Plant Protection Convention (1951) - no direct relevance, but seek to avoid loss of natural flora and fauna
- Convention on Wetlands of International Importance, especially as Waterfowl Habitat (Ramsar, 1971) – potential impacts on Ramsar designated sites are avoided by virtue of the project location
- Convention concerning the Protection of World Cultural and Natural Heritage (Paris, 1972) – potential impacts on world cultural and natural heritage designated sites avoided by virtue of the project location
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (Washington, 1973) – no direct relevance, but seek to avoid loss of endangered species
- Convention on Migratory Species of Wild Animals (Bonn, 1979) – ensure potential impacts on any migratory species supported by the project area of influence assessed and managed
- Convention on Biological Diversity (Rio De Janeiro, 1992) - biodiversity conservation and sustainable usage, habitat preservation, and protection of indigenous people's rights, and intellectual property, no direct relevance, but seek to avoid loss of natural flora and fauna

² Ministry of Environment, Forest and Climate Change, Government of India. <http://www.moef.nic.in>

- (b) **Hazardous materials:** This is relevant, particularly in view of the usage of SF₆ in RMUs and PCBs in existing transformers. Usage of SF₆ will be minimized and RMUs properly sealed to avoid leakages and any leakages will trigger alarms at the nearest concerned operation and maintenance (O&M) unit for immediate arrest of leakages. Usage of PCBs in project equipment will be prohibited, the Regulation of Polychlorinated Biphenyls Order, 2016 requires BESCOM to ensure that all its existing transformers are confirmed PCB free by 2025.
- Cartagena Protocol on Biosafety
 - SAICM (Strategic Approach to International Chemicals Management)
 - Stockholm Convention on Persistent Organic Pollutants (POPs) - ensures the environmentally sound management and the disposal of POPs including PCBs. India has started using PCB free equipment, but existing equipment contaminated and cross contaminated with PCBs are also present. The convention gives governments until 2025 to phase out "in-place equipment" such as electrical transformers containing PCBs, as long as the equipment is maintained in a way that prevents leaks. It grants them another three years to destroy the recovered PCBs. The recovered PCBs must be treated and eliminated by 2028.
 - Basel Convention on the Control of Trans-boundary Movement of Hazardous Waste and their Disposal.
 - Rotterdam Convention on prior informed consent (PIC) for certain Hazardous Chemicals and Pesticides in International Trade - no direct relevance, but avoid use of hazardous chemicals and pesticides.
- (c) **Atmospheric emissions:**
- UNFCCC (United Nations Framework Convention on Climate Change) - stabilize GHG emissions³ in the atmosphere at a level low enough to prevent dangerous anthropogenic interference with the climate system, SF₆ is a potent GHG used in the RMUs funded by the proposed project
 - Kyoto Protocol
 - Montreal Protocol (on Ozone Depleting Substances)
- (d) **Marine environment:** n/a to the project as Karnataka state is a land locked state of India.

26. In addition, India is a signatory to the ILO Core Labour Standards with 47 conventions and 1 protocol ratified, this relates to ensuring core labor standards are upheld for construction workers. The ILO Asbestos Convention, 1986 (Convention No. C162) on exposure of workers to asbestos in the course of work has yet to be ratified by India.

C. BESCOM Environment and Social Policies

27. BESCOM currently has the following existing environmental and social policies and procedures which will need to be followed by the project:

³ The six greenhouse gases that form part of the Kyoto Protocol to the United Nations Framework Convention on Climate Change include carbon dioxide (CO₂); methane (CH₄); nitrous oxide (N₂O); hydrofluorocarbons (HFCs); perfluorocarbons (PFCs); and sulfur hexafluoride (SF₆)

- Safety Manual
- Training and HR Development Policy 2015
- Disaster Management Plan 2013
- Corporate Social Responsibility Policy

28. It is currently in the process of adopting an environmental and social policy 2020 which is imminently due to be published.

29. The Director (Technical) at the corporate level is responsible for BESCOM's environmental and social policies and procedures and the management of environmental, health and safety impacts and risks of all projects of BESCOM. The Quality Standards and Safety (QS&S) Section under Director (Technical) is responsible for BESCOM's Safety Manual, monitoring of accident statistics and analysis, the procurement of safety materials, monitoring rectification of hazardous situations, investigation of safety complaints, and safety awareness programs. The Administration and Human Resources wing is responsible for staffing, training, etc.

D. Asian Development Bank's Safeguards Policies

(a) ADB's Environment Categorization

30. ADB's Safeguard Policy Statement (2009) is applicable to all ADB-financed projects. Projects can be categorized as A, B, or C. Table 3 below provides a list of categorizations related to environment.

Table 3: Environment Safeguards Categorization: Definition

Category	Environment
A	Investments that are likely to have significant adverse environmental impacts that are irreversible, diverse, or unprecedented. These impacts may affect an area larger than the sites or facilities subject to physical works.
B	Investments with potential adverse environmental impacts that are less adverse than Category A. These impacts are site-specific, few if any of them are irreversible, and in most cases mitigation measures can be designed more readily than for Category A investments.
C	Investments that are likely to have minimal or no adverse environmental impacts.

31. The proposed project is Category B because it is unlikely to have significant adverse impacts that are irreversible, diverse or unprecedented.

(b) ADB's Prohibited Investment Activities List (PIAL)

32. Early on in project preparation, ADB's Prohibited Investment Activities List (Appendix 5 of ADB's Safeguard Policy Statement [2009]) was considered, and it was concluded that the proposed project did not fall under the Prohibited Investment Activities List. It will however be necessary to ensure that BESCOM's contractors and subcontractors are prohibited through their contract documentation from using harmful or exploitative forced and child labor. Construction sites are a hazardous work environment where the health and safety of young

persons could be jeopardized, the minimum age under the ILO Minimum Age Convention 1978 (C 138) for undertaking such work is usually 18. In addition, contracts will need to specifically prohibit the use of any polychlorinated biphenyls, any asbestos containing materials, and require that any hazardous waste is disposed of in an environmentally sound and safe manner in accordance with national regulations.

(c) ADB's Safeguard Policy Statement (2009) Policy and Requirements: Environment

33. ADB's Safeguard Policy Statement (2009) sets out the policy objectives, scope and triggers, principles, and requirements for the environmental safeguards and needs to be followed for the project.

Objectives: The objective of ADB required due diligence for the Project loan is that EA ensures the environmental soundness and sustainability of projects and to support the integration of environmental considerations into the project decision-making process.

Scope and Triggers: Environmental safeguards are triggered if a project is likely to have potential environmental risks and impacts.

Policy principles:

- Use screening process for each proposed project to determine the appropriate extent and type of environmental assessment so that appropriate studies are undertaken commensurate with the significance of potential impacts and risks.
- Conduct an environmental assessment for each proposed project to identify potential direct, indirect, cumulative, and induced impacts and risks to physical, biological, socioeconomic (including impacts on livelihood through environmental media, health and safety, vulnerable groups, and gender issues), and physical cultural resources in the context of the project's area of influence. Assess potential transboundary and global impacts, including climate change. Use strategic environmental assessment where appropriate.
- Examine alternatives to the project's location, design, technology, and components and their potential environmental and social impacts and document the rationale for selecting the particular alternative proposed. Also consider the no project alternative.
- Avoid, and where avoidance is not possible, minimize, mitigate, and/or offset adverse impacts and enhance positive impacts by means of environmental planning and management. Prepare an EMP that includes the proposed mitigation measures, environmental monitoring and reporting requirements, related institutional or organizational arrangements, capacity development and training measures, implementation schedule, cost estimates, and performance indicators. Key considerations for EMP preparation include mitigation of potential adverse impacts to the level of no significant harm to third parties, and the polluter pays principle.
- Carry out meaningful consultation with affected people and facilitate their informed participation. Ensure women's participation in consultation. Involve stakeholders, including affected people and concerned nongovernment organizations, early in the project preparation process and ensure that their views and concerns are made known to and understood by decision makers and taken into account. Continue consultations with stakeholders throughout project implementation as necessary to address issues related to environmental assessment. Establish a grievance redress mechanism to receive and facilitate resolution of the affected people's concerns and grievances regarding the project's environmental performance.
- Disclose a draft environmental assessment (including the EMP) in a timely manner, before project appraisal, in an accessible place and in a form and

language(s) understandable to affected people and other stakeholders. Disclose the final environmental assessment, and its updates if any, to affected people and other stakeholders.

- Implement the EMP and monitor its effectiveness. Document monitoring results, including the development and implementation of corrective actions, and disclose monitoring reports.
- Do not implement project activities in areas of critical habitats, 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 critically endangered species; and (iii) any lesser impacts are mitigated. If a project is located within a legally protected area, implement additional programs to promote and enhance the conservation aims of the protected area. 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. Use a precautionary approach to the use, development, and management of renewable natural resources.
- Apply pollution prevention and control technologies and practices consistent with international good practices as reflected in internationally recognized standards such as the World Bank Group's EHS Guidelines. Adopt cleaner production processes and good energy efficiency practices. Avoid pollution, or, when avoidance is not possible, minimize or control the intensity or load of pollutant emissions and discharges, including direct and indirect GHG emissions, waste generation, and release of hazardous materials from their production, transportation, handling, and storage. Avoid the use of hazardous materials subject to international bans or phase-outs. Purchase, use, and manage pesticides based on integrated pest management approaches and reduce reliance on synthetic chemical pesticides.
- Provide workers with safe and healthy working conditions and prevent accidents, injuries, and disease. Establish preventive and emergency preparedness and response measures to avoid, and where avoidance is not possible, to minimize, adverse impacts and risks to the health and safety of local communities.
- Conserve physical cultural resources and avoid destroying or damaging them by using field-based surveys that employ qualified and experienced experts during environmental assessment. Provide for the use of "chance find" procedures that include a pre-approved management and conservation approach for materials that may be discovered during project implementation

34. ADB's Environmental Safeguards: A Good Practice Sourcebook-Draft Working Document (November 2012) provides guidance on the further application of ADB's Safeguard Policy Statement (2009) to the project.

(d) Other Guidelines Relevant to ADB's Safeguard Policy Statement (2009)

35. IFC's General EHS Guidelines, 2007 set out international good practice related to environment, health and safety which the project should follow regarding assessment of potential impacts and applicable standards and management measures, performance indicators, and monitoring guidelines. In particular, the guidance in Section 4 on Construction and Decommissioning will be applicable for this project. When national requirements differ from

the standards and measures set out in these guidelines, then BESCO will need to ensure that it achieves whichever are more stringent.

36. In addition to the general guidelines, IFC's EHS Guidelines for Electric Power Transmission and Distribution, 2007 set out the sector specific potential impacts and applicable standards and management measures, performance indicators, and monitoring guidelines for transmission and distribution projects. It requires BESCO to give consideration to terrestrial and aquatic habitat alteration, electric and magnetic fields, hazardous materials, occupational health and safety and community health and safety.

III. DESCRIPTION OF THE PROJECT

A. Project Components and Locations

37. The proposed project is located in six BESCOM divisions (Jaya Nagar, Shivaji Nagar, Indira Nagar, Kora Mangala, Hosur-Sarjapur Road (HSR) Division, and White Field) of Bengaluru city. The project components are the installation of around: (i) 2,393-km 11 kV lines for conversion from overhead (Figure 5) to underground as illustrated in Figure 2; (ii) 4,848-km 1.1 kV lines for conversion from overhead to underground; (iii) 1,638 units of distribution automation system RMUs (Figure 18/Annex 9) enclosed in metal cabinets to enable BESCOM to monitor and control switchgear from their control center; and (iv) 2,938-km of OFC to support distribution automation. There is no overlapping of the 11kV and 1.1kV cable lengths so total km of installation is about 7,241-km. The details of components by each division are described in Table 4. Figure 6 gives the general location of the project components within Bengaluru city. Some of the key sensitive receptors such as schools, hospitals, temples, etc. are marked on the individual maps of the subdivision localities in Figures 7-12. Cable routings will follow the existing overhead line corridors within 17 subdivisions but actual alignments will be mapped and confirmed by the contractor during project implementation; maps showing the subdivisions involved in the project are included in Annex 1.

Figure 7: Project Concept

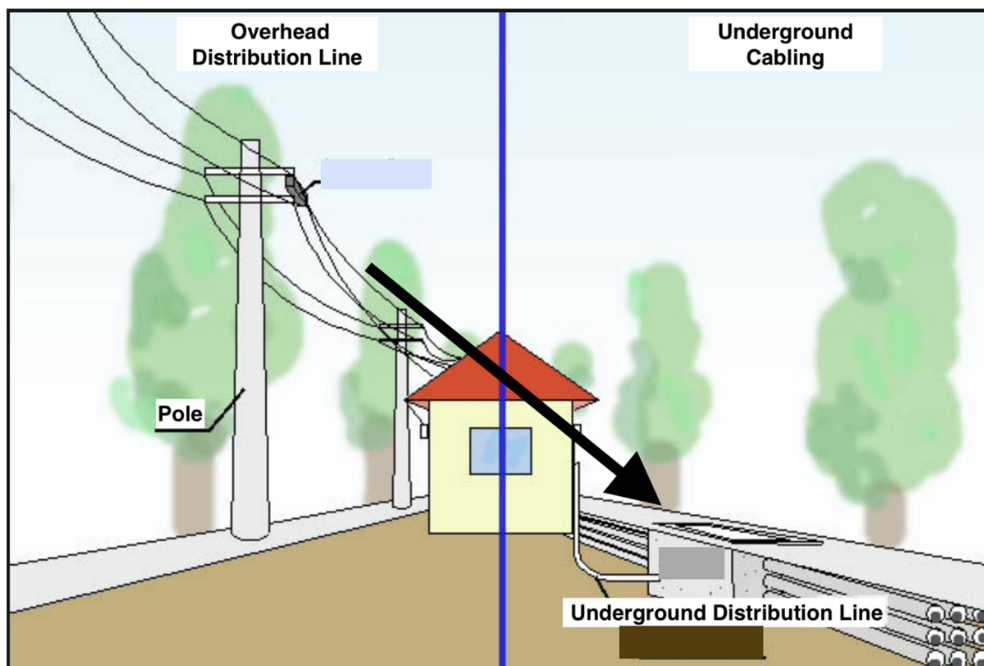


Table 4: Summary of Project Activities

Name of Division	Installation of 11 kV underground cable (km)	Installation of 1.1 kV underground and aerial bunched cable* (km)	Installation of 11 kV DAS RMU (unit)	Installation of OFC (km)
Indira Nagar	493	1,655	333	901
Jaya Nagar	358	1,090	265	361
Shivaji Nagar	311	391	162	306
Kora Mangala	301	340	386	392
HSR Division	650	855	349	653
White Field	280	517	143	370
Total	2,393	4,848	1,638	2,983

DAS = distribution automation system, km = kilometers, kV = kilo volt, OFC = optic fiber cable, RMU = ring main unit.

*Preference is for 100% replacement with underground, but in limited circumstances overhead aerial bunched cable may be required to replace overhead bare conductors if underground is not feasible to make the end user connection.

Source: Bengaluru Electricity Supply Company Limited.

38. Construction works will take place along individual streets, lanes and bylanes across the six BESCOM divisions of Bengaluru city (Figure 6) in order to convert the existing overhead distribution system to underground. The 17 subdivisions included within each of the six BESCOM divisions are detailed in Table 5.

Table 5: Summary of Subdivisions Included in Project

Name of BSECOM Division	BESCOM Subdivisions	Description
Indira Nagar (non-sovereign loan)	E6 E10 E11	This is an important residential and commercial hub located in east Bengaluru, it is one of the newer localities.
Jaya Nagar (BESCOM counterpart funds)	S1 S2 S6 S14 S15	This is an affluent residential and commercial neighborhood of the city.
Shivaji Nagar (non-sovereign loan)	E1 E5	It is well known as the city's major shopping spot and houses many government offices and an army camp.
Kora Mangala (sovereign loan)	S4 S7 S17	Situated in the south-eastern part of the city and planned as a suburb, post-independence, its location between Bangalore and Electronic City attracted migrants from across the country during Bangalore's tech boom of the late 1990s. Consequently, it has gradually developed into a commercial hub.

HSR Division (sovereign loan)	S8	Hosur-Sarjapur Road (HSR) Layout located in south-east Bangalore is a leading residential area being a gateway to Electronic City which is a major IT hub.
	S11	
	S12	
White Field (sovereign loan)	E4	Established in the late 1800s as a settlement for the Eurasians and Anglo Indians of Bangalore it remained a small settlement on the eastern periphery until the late 1990s when the local IT boom turned it into a major suburb.

39. The proposed project is structured into 8 contract packages; the total project cost including contingencies is \$277.3 million. This is broken down by division into (i) \$43 million for Jaya Nagar division – one contract package funded by counterpart funds of BESCOM; (ii) \$27 million for Shivaji Nagar division – one contract package funded by non-sovereign loan; (iii) \$63 million for Indira Nagar division – split between two contract packages funded by non-sovereign loan; (iv) \$27 million for Kora Mangala division – one contract package funded by sovereign loan; (v) \$49 million for HSR division – split between two contract packages funded by sovereign loan; and (vi) \$24 million for White Field division one contract package funded by sovereign loan, these costs include the approximately \$0.7 million costs of EMP implementation. In addition, \$20 million has been budgeted for contingencies and \$24 million for financial matters. Each contract package will have about 18 months contract duration.

40. Of the contract packages 4 (Kora Mangala, HSR Division, and White Field) will be financed by the sovereign loan, they are currently at bidding stage and so the EMP will be included in the contract documentation. However, 3 (Indira Nagar and Shivaji Nagar divisions) under the non-sovereign loan and 1 (Jaya Nagar division) financed by counterpart funds of BESCOM have already been awarded in mid-July 2019 to M/s. Larson & Toubro Limited, Chennai; M/s. Asian Fab Tech Limited, Bangalore – two contracts; and M/s. NCC Limited, Hyderabad. Thus, as well as being the subject of this IEE ongoing works under these subdivisions (as existing facilities under construction) have been the subject of environmental audit (Annex 10) with corrective action required to address gaps identified between their current performance and the requirements of the EMP.

Figure 8: Overall Bengaluru City Subdivision Location Map

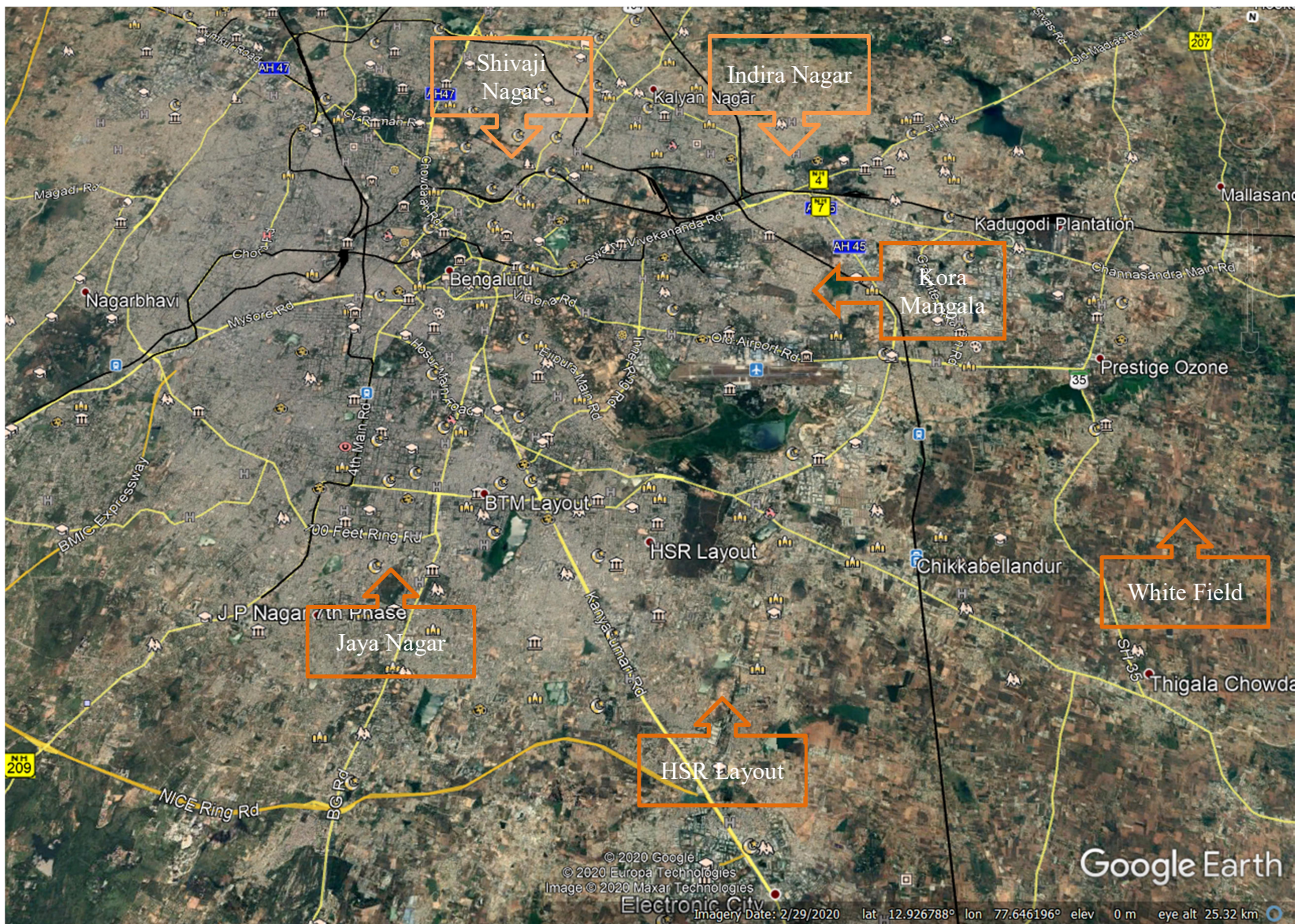


Figure 9: General Area of Subdivisions of Jaya Nagara Division – BMAZ South

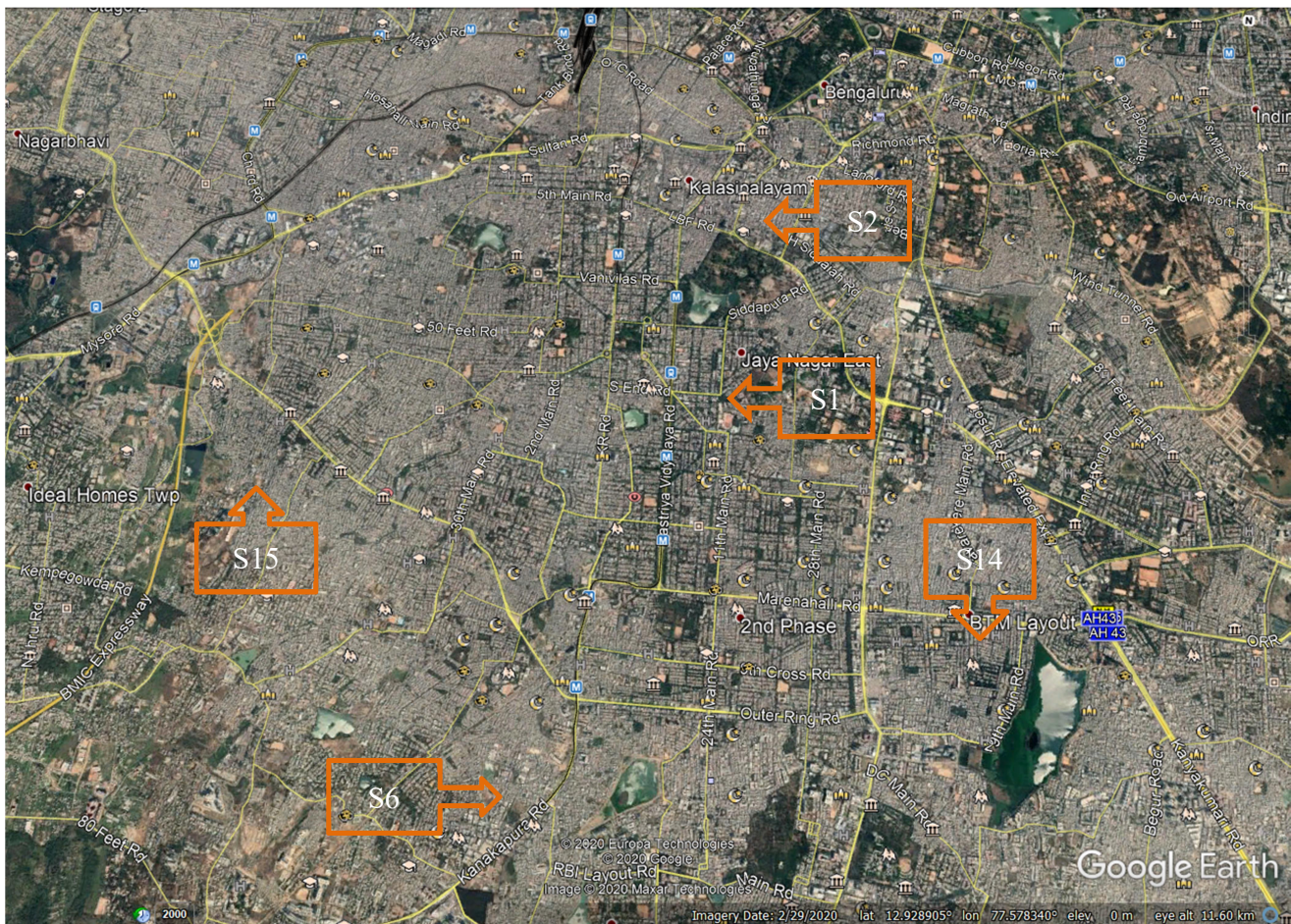


Figure 10: General Area of Subdivisions of Shivaji Nagara Division – BMAZ North

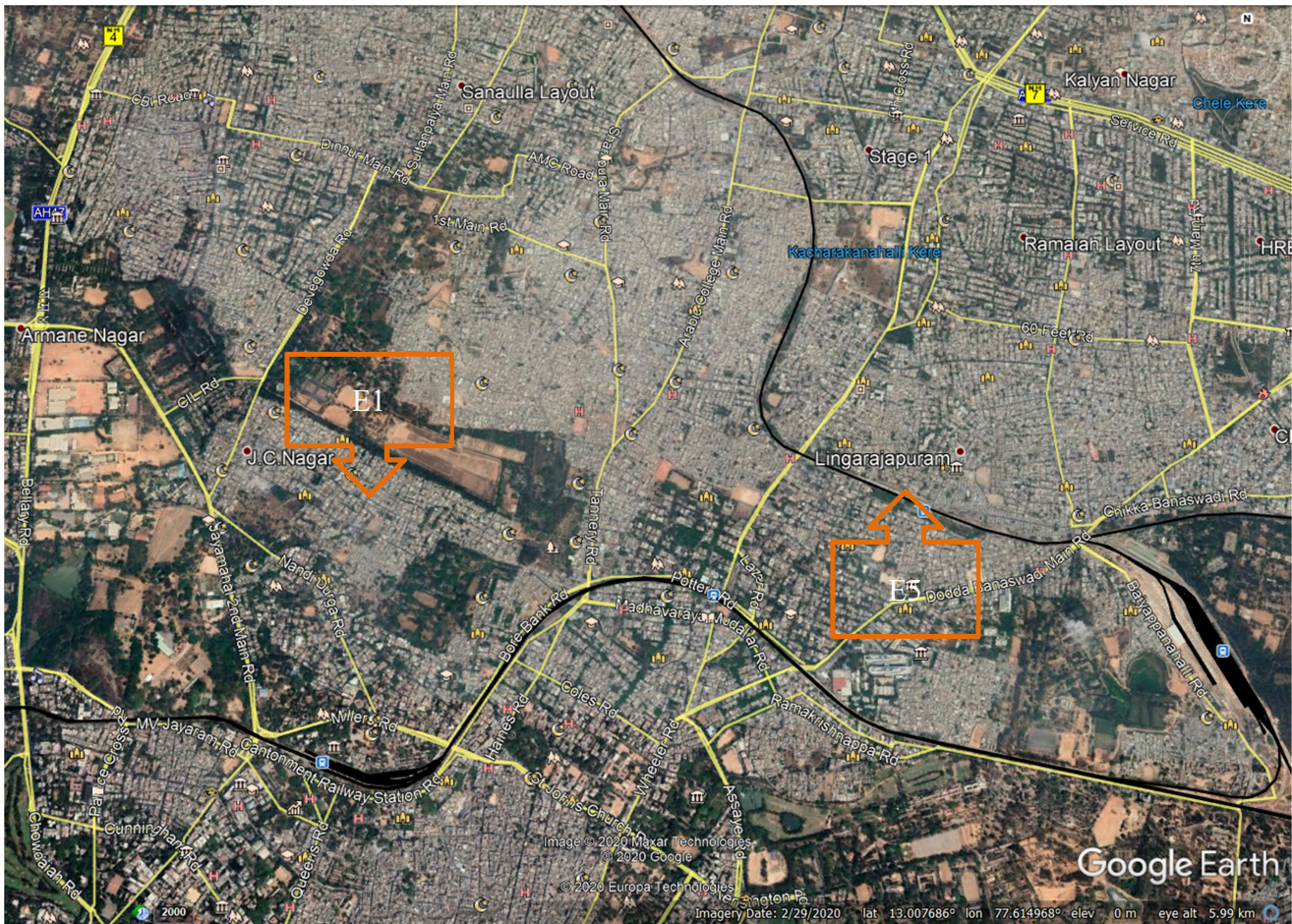


Figure 12: General Area of Subdivisions of Kora Mangala Division – BMAZ South

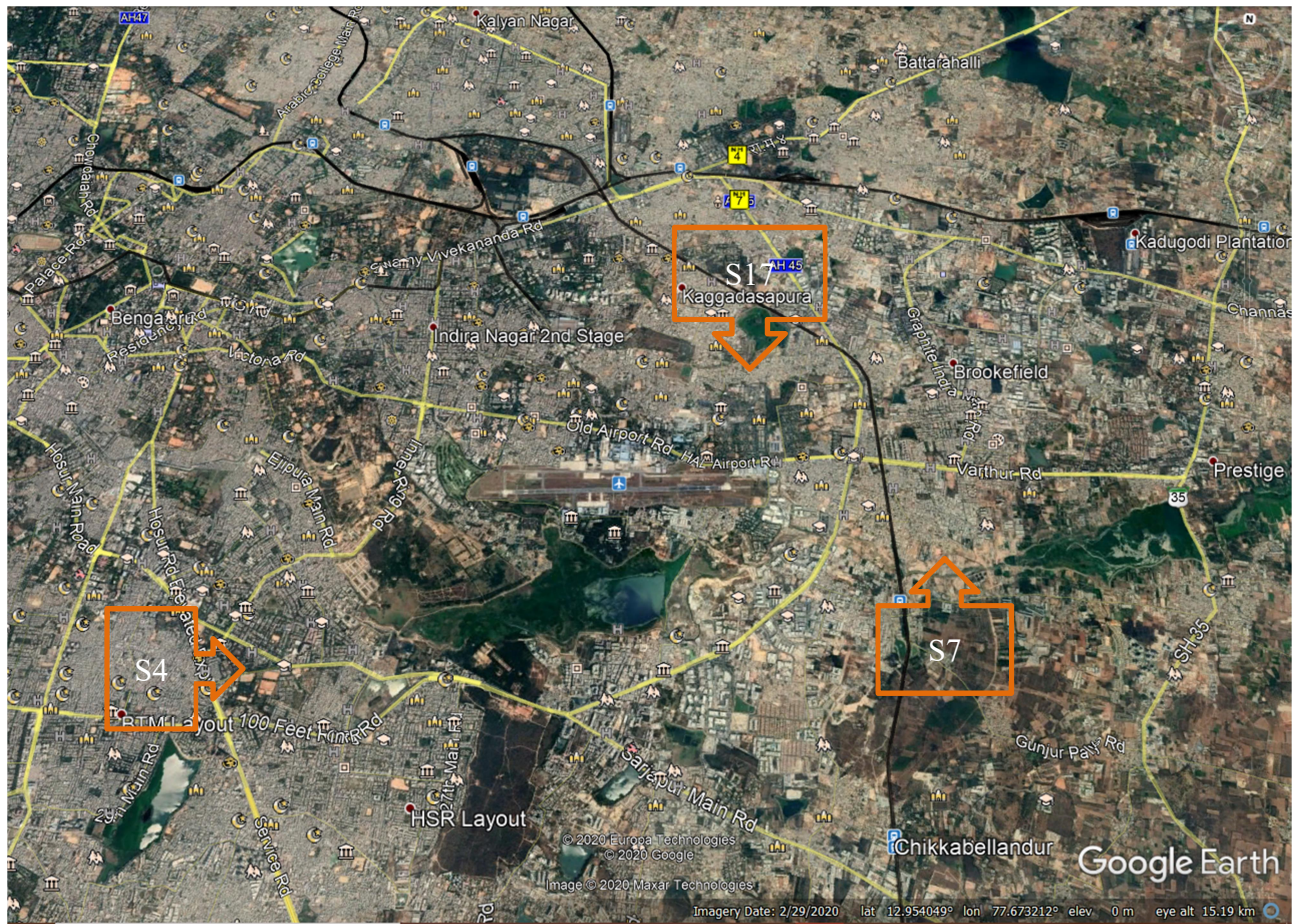


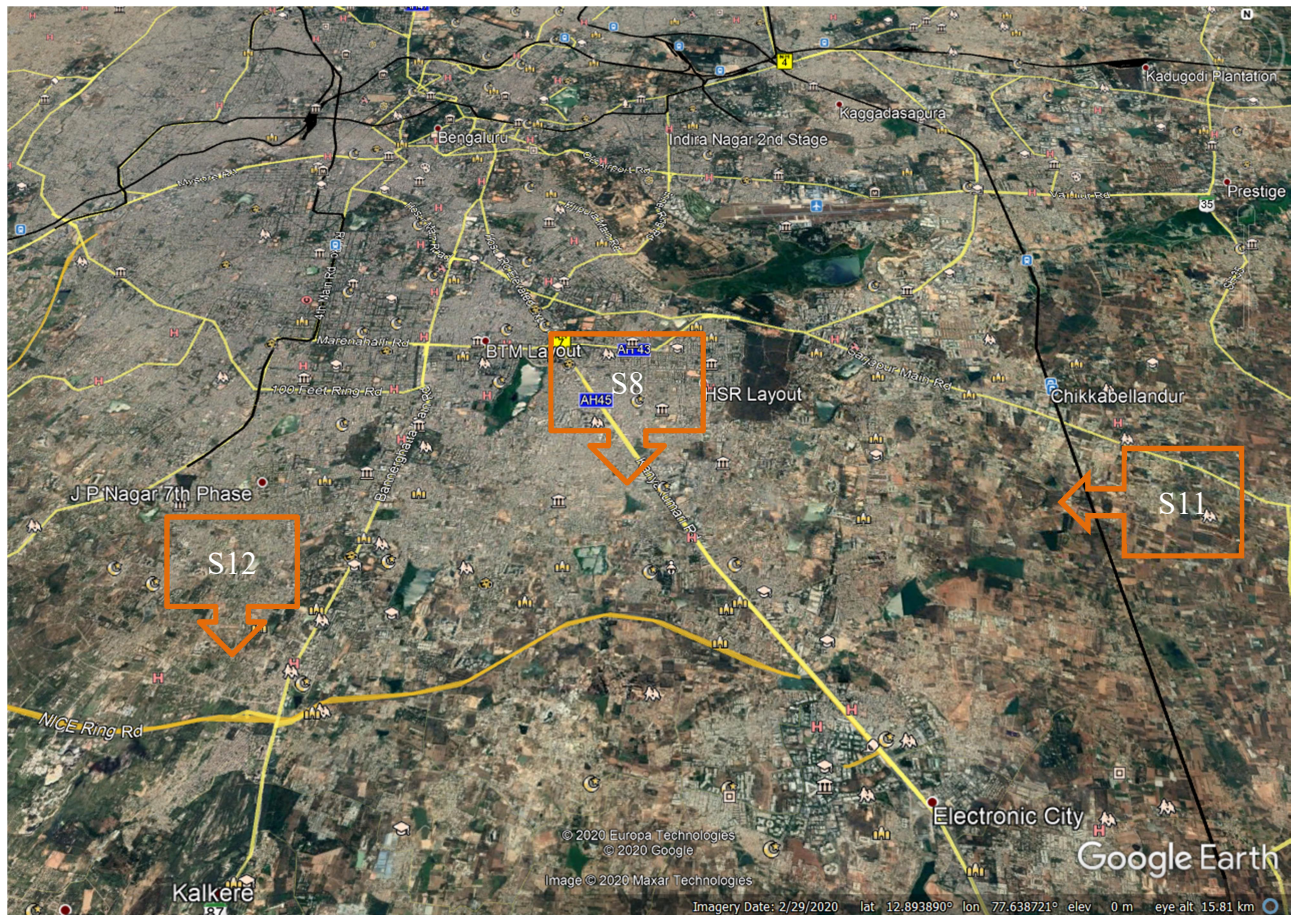
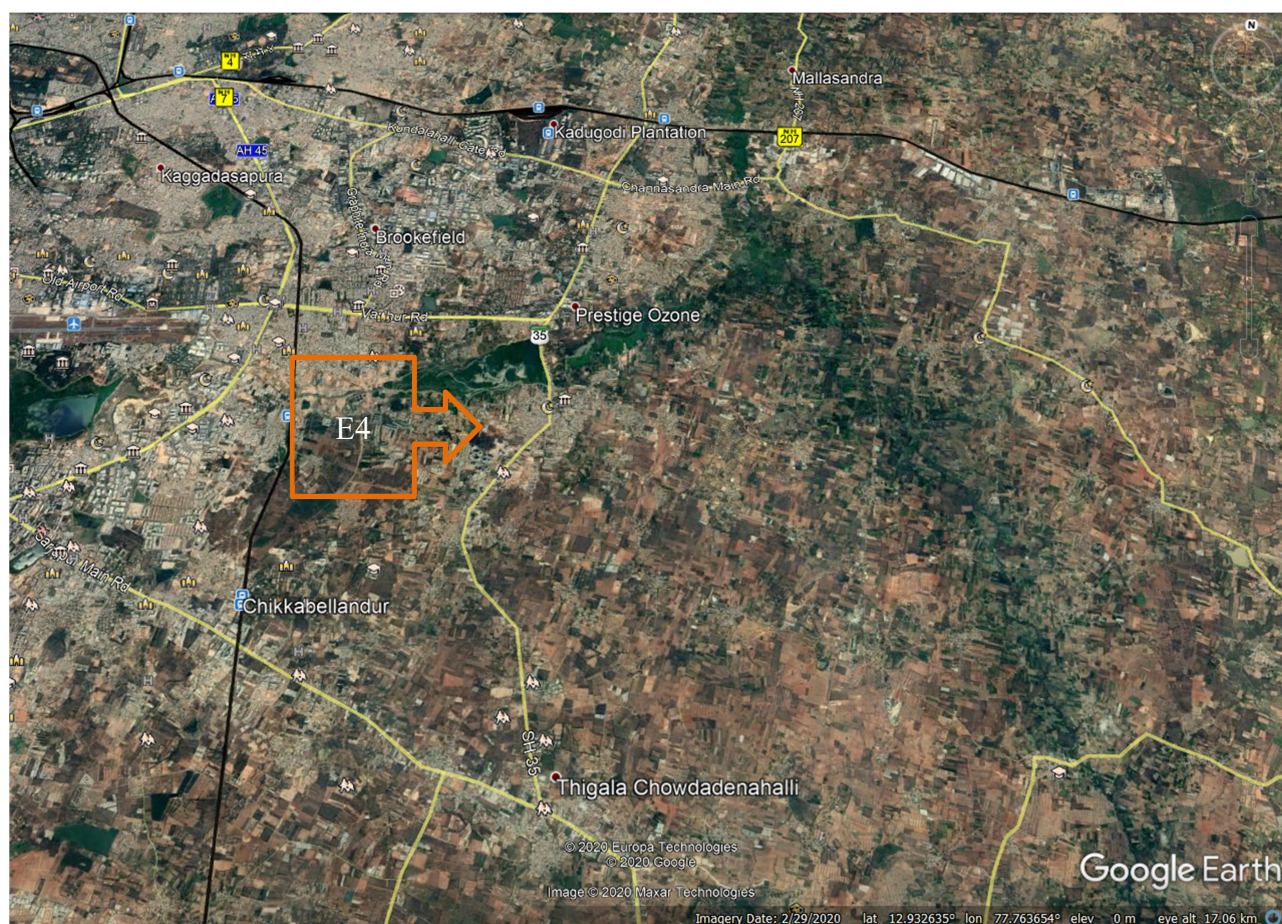
Figure 13: General Area of Subdivisions of HSR Layout Division – BMAZ South

Figure 14: General Area of Subdivisions of White Field Division – BMAZ North



B. Project Components and Construction Works

41. **Underground and aerial bundled distribution cables.** The technical parameters to be deployed for the project components involving the installation of underground cables are presented in Tables 6 and 7, and Figures 13 and 14. In addition, although the preference is for 100% undergrounding of the replacement cables aerial bunched cables will be used to replace bare conductors in some limited circumstances, restringing the existing overhead line instead of placing it underground.

Table 6: Technical Parameters of the Low and High Voltage Underground Distribution Cable

Rated voltage	1.1 kV (low) / 11 kV (high)
Conductor material	Copper
Size	3 x 15 mm ² (1.1 kV) / 3 x 400 mm ² (11 kV)
Armored	Double steel tape armored
Insulation screen	Semi-conductive compound
Insulation material	XLPE (cross-linked polyethylene)
Outer sheath	PVC (polyvinyl chloride)

Source: Bengaluru Electricity Distribution Company Ltd.

Figure 15: Medium Voltage Underground Distribution Cable**Table 7: Technical parameters of the Low Voltage Distribution Cable**

Rated voltage	1.1kV (low)
Conductor material	Aluminum
Size	3 x 15 mm ² , 1 x 10 mm ²
Armored	Double steel tape armored
Insulation screen	Extruded semi-conductive layer
Insulation material	XLPE (cross-linked polyethylene)
Outer sheath	HDPE (high-density polyethylene)

Source: Bengaluru Electricity Distribution Company Ltd.

Figure 16: Low Voltage Distribution Cable

42. **Optic fiber communication cable.** The assembly of optic fiber cable is like an electrical cable but instead of a metal conductor contains one or more optical fibers that are used to carry light. The optical fiber cable is to support distribution automation. The optical fibers consist of a core and a cladding layer, the cladding is then usually coated with a coating layer of acrylate polymer or polyimide to protect the fibers from damage. The coated fibers then have a

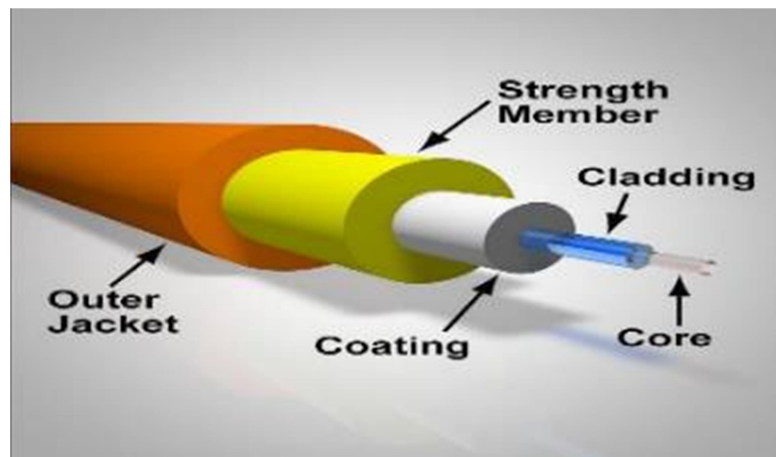
tough resin buffer layer extruded around them to form the cable, to which several layers of protective sheathing are added to protect it from environmental hazards, such as construction work or gnawing animals. The technical parameters to be deployed for the project are presented in Table 8 and Figure 15.

Table 8: Technical Parameters of Optic Fiber Communication Cable

Fiber count	288
Cable diameter	20 mm
Nominal cable weight	255 kg/m
Outer sheath	Black UV – and moisture-resistant polyethylene
Temperature operating performance	-40 C° to +70 C°

Source: Bengaluru Electricity Distribution Company Ltd.

Figure 17: Optic Fiber Communication Cable



43. **Installation method of cables.** Trenchless method of horizontal directional drilling (HDD) will primarily be used to install the cables to avoid interfering with surface-level activities, including traffic, businesses, residential areas, and people. For almost 90% of the alignment HDD will be used and for the remaining 10% open trenching (usually a trench of 0.6m wide x 1m deep) will be used where the open space is available to make this feasible. The trenchless technology is a form of underground construction that requires the use of only a few open trenches at surface or street level. The technology uses a drill and winch to install the underground cables without causing disturbance to the ground above. First, a small diameter hole is drilled along the path between entry and exit pits then the cable is pulled through the hole creating a continuous segment of cable underground exposed only at the entry and exit pits. Any underground barriers or obstacles are handled by identifying them in advance, adjusting the alignment suitably, planning for the location of entry/exit pits, etc. As the 1m depth of laying is shallow few obstacles are foreseen. Water is used as a drilling fluid to reduce noise and vibration.

Figure 18: Image of Trenchless Technology for Installation of Cable



44. The dimensions of the (i) winch to be used for the project; (ii) entry and exit pits; and (iii) depth of cable burial are provided in Table 9. Sample picture of winch and pit are provided in Figure 16. The length of the cable that can be fed is about 100m to 150m based on the terrain and alignment. For each contract package work will be ongoing in 6-7 discrete locations each day depending on the field conditions with deployment of 12-14 HDD machines in total being used to achieve an average 1 – 1.5 km of underground cabling laid per day assuming in 8-10 working hours.

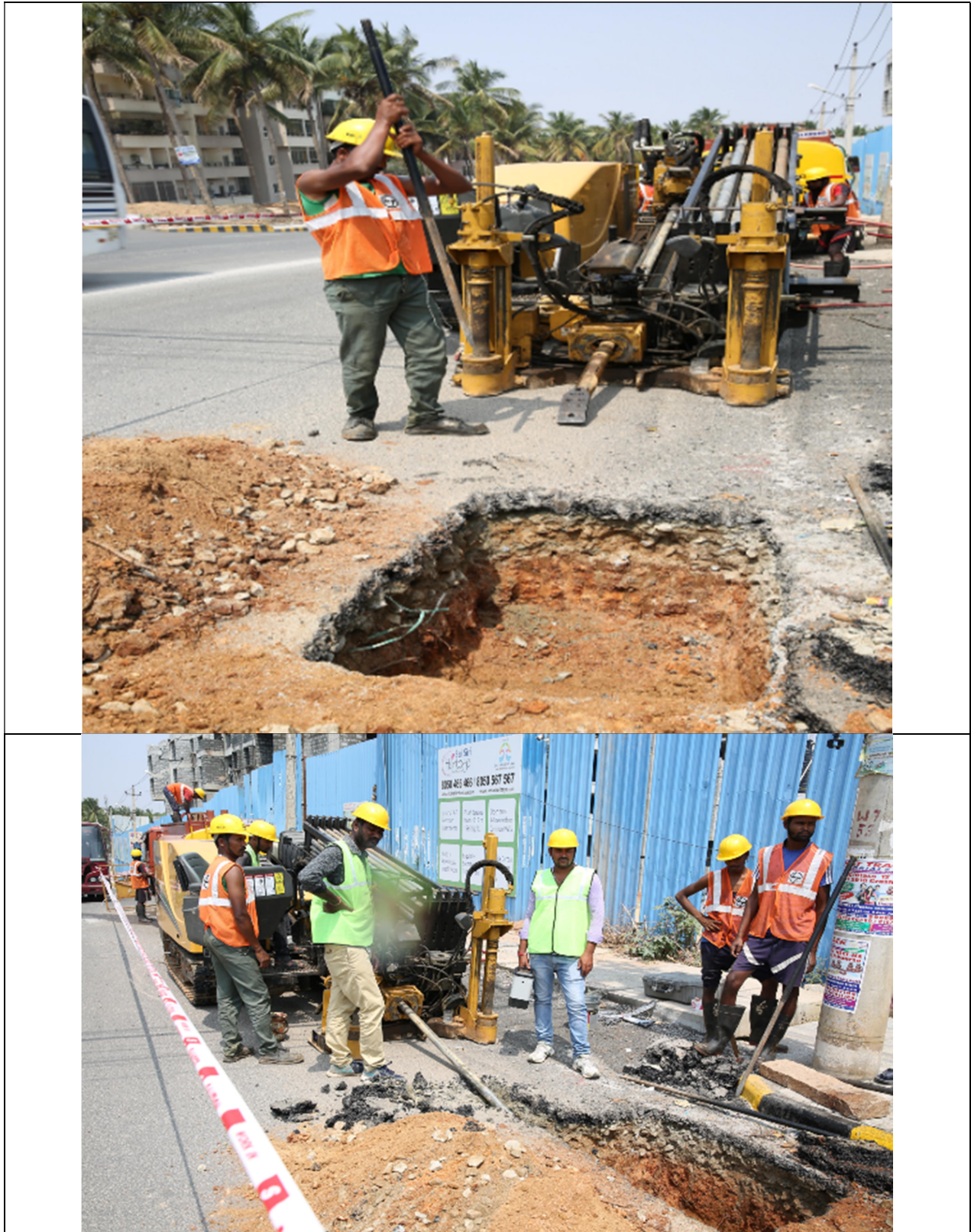
Table 9: Dimension of winch, pits, and depth of cable burial

Winch	
Length	6.1 meter
Width	2.26 meter
Height	2.59 meter
Weight	10 ton
Engine type	Diesel (to be mounted on drip tray)
Entry and exit pits	
Depth	1 meter
Width	1 meter
Height	1 meter
Depth of cable burial	
Depth	1 meter

Source: Bengaluru Electricity Distribution Company Ltd.

45. BESCOM has taken up underground cabling using trenchless technology on previous projects in Bangalore under their own funding. The implementation was successful with proper coordination of BESCOM and local people including local businesses, traffic control, etc. As per the experience of BESCOM, the length of cable that can be inserted using trenchless technology in one day could be about 1 km.

Figure 19: Picture of Drill Rig, Winch and Pit



45. **Ring Main Units (RMU).** This is a factory assembled, compact set of switchgear, enclosed in a metal cabinet, which is installed at the load connection points of a ring-type distribution network. Ring main conductors (cables) enter and leave the cabinet, inside are switches that can connect the load to one or both of the conductors, a circuit breaker, and a switch that connects to the distribution transformer, usually with a cable. RMUs are available in different voltage ratings and are suitable for both indoor and outdoor installation. For this project, the RMUs will be installed

on the ring-type distribution network in a designated space of a few square meters of state-owned land, in a building or on the street.

46. Installation of RMUs will reduce outage times by detecting faults early and automatically reconfiguring the network. Fitted with intelligent electronic devices and communication capabilities, the RMU is integrated with distribution automation systems as part of building a smart grid solution and can be installed in a couple of days when the plinth/platform on which to install it has been constructed.

Table 10: Technical parameters of the Ring Main Unit

Rated value up to	12kV, 21kA, 3 phase
Rated frequency	50 Hz
Busbar current up to	630 A
Feeder current up to	630 A
Insulation	Gas insulated (SF6)
Switchgear vessel	Hermetically enclosed
Panel width	645 – 1575 mm
Panel height	1,620 mm
Panel depth	918 mm

Source: Bengaluru Electricity Distribution Company Ltd.

Figure 20: Ring Main Unit



C. Existing and Associated Facilities

47. Since 4 of the 8 contract packages under the project (non-sovereign and counterpart funded components) have already been awarded and construction commenced these components are considered as “existing facilities under construction” under ADB’s Safeguard Policy Statement (2009). They have therefore been the subject of environmental audit (Annex 10) with corrective action required to address gaps identified between their current performance and the requirements of the EMP.

48. No existing facilities are involved for the sovereign contract packages. Underground cables will be connected to existing pole and plinth mounted transformers (Figure 19) in place of the overhead cables that currently connect into these transformers, but the project does not involve any new or changes to old transformers. Existing transformers may contain PCBs however legally BESCO is required to ensure it complies with the Government of India Regulation of Use, Handling and Disposal of Polychlorinated Biphenyls which permits the use of existing PCB containing equipment only up until 31.12.2025 on the proviso it is within its certified lifetime and properly maintained without possibility of leakage or release of PCBs into the environment. Thus, by virtue of BESCO having a legal responsibility to prepare an inventory of and replace any existing transformers which contain PCBs on completion of the project at end of 2025 all project-related transformers should be PCB free.

49. No associated facilities are foreseen at this juncture.

Figure 21: Pole Mounted Transformer



D. Route Selection and Installation Method Alternatives

48. Preliminary route selection for the underground distribution lines is done by BESCOM based on (i) geographical information system (GIS) based distribution network assets maps; (ii) city maps; (iii) maps of other public utilities; and (iv) walk over surveys. As the project is a conversion of existing overhead distribution lines to underground, the routing of the underground cables will generally follow the route of existing overhead distribution lines. In addition, the routing of the underground cables seeks to (i) follow the existing RoW of roads and sidewalks to the extent possible; (ii) minimize disturbance to the traffic; (iii) minimize the period of public disturbance, in relation to noise, dust, and other public utilities, especially for sensitive receptors; and (iv) minimize the need for soil excavation.

49. Methodology for route selection (environmental aspects). For selection of the optimum routing of underground cables relevant to the project, the following points are taken into consideration by BESCOM:

- (i) avoidance of environmentally sensitive areas, such as, eco sensitive zones, national parks, wildlife sanctuaries, biosphere reserves, etc.;
- (ii) avoidance of physical cultural resources, areas of archaeological or historical significance;
- (iii) avoidance of community assets, such as, playgrounds, hospitals, schools, or places of worship etc.;
- (iv) minimization of the number of crossings of rivers/railway lines, national and state highways, overhead high voltage power lines, other communication lines, etc.; and
- (v) keeping away from existing underground utilities, to the extent possible.

50. **Methodology for installation (environmental aspects).** There are two possible methods of laying the distribution cable underground: (i) open cut trench excavation method; and (ii) trenchless method. To minimize the (i) disturbance to the traffic; (ii) period of public disturbance; and (iii) need for soil excavation, BESCOM will primarily adopt the trenchless method as discussed in para 43.

51. **Technology for switchgear.** Use of alternative insulation mediums for the RMUs needs to be considered, the options are air, gas, and oil. The use of gas insulated switchgear has several technical advantages over air and oil, notably its compact size and its insulating and fire

extinguishing properties.

52. SF₆, a potent GHG, is currently used in gas insulating switchgear, although research is ongoing the power industry has yet to develop a widely accepted alternative to SF₆ and so, given the urban environment, on technical, health and safety grounds it is the preferred option. SF₆ emissions are caused by leakages and waste handling of old equipment which will need to be managed by BESCOM. Depending on its design, an RMU generally contains between 1-5 kg of SF₆. To minimize the use of SF₆ as well as its potential to leak, options that contain less than 2 kg of SF₆ and which have been tested and guaranteed by the supplier at less than 0.1% leakage rate will be preferred. Any leakage that does occur will trigger an alarm at the nearest concerned O&M Unit, helping the O&M staff to seal and rectify the leakage and take appropriate action to prevent it happening again.

53. **No project alternative.** In a no project situation, although there will be no additional impacts on the environment, including use of SF₆ as a GHG, the beneficiary population will be in the present situation where they undergo the disadvantages of the overhead distribution system, being exposed to the health and safety issues as well as being subjected to blackouts/brownouts and economic losses.

E. Climate Risk Adaptation Measures

54. Power distribution networks are vulnerable to storms and extreme weather events. Improving the overall condition and efficiency of the power delivery system can serve to improve the resiliency of the system and help hasten recovery from weather-related outages that are likely to increase in severity and/or frequency with climate change.

55. The project itself has been designed to adopt underground cabling to mitigate the climate risk related to power outage from storms and extreme weather events experienced in Bengaluru. However, underground cables are sensitive to ambient conditions of the soil (temperature and moisture), especially the extreme ones; increases in ground temperature, which could reduce ratings; and summer droughts and consequent ground movement can lead to mechanical damage. XLPE cable, which is widely used for underground distribution cable in the world, is waterproof and will not be affected by increased rainfall or increased soil moisture. By selecting appropriate size of cable in the design stage considering the ambient conditions and planned current, the temperature of the cable can be kept within the allowed range. The project has capacity to accommodate extreme increases in soil temperature with the optic fiber cables being operational up to 70°C.

IV. DESCRIPTION OF THE ENVIRONMENT

56. Bengaluru city (also known as Bangalore and the Silicon Valley of India) is the landlocked capital of the state Karnataka, India, and is located in the south-eastern part of the state at 12.97° N 77.56° E. It is the 3rd most populous city and the 5th most populous urban agglomeration in India, having a population of over 10 million in 2018.

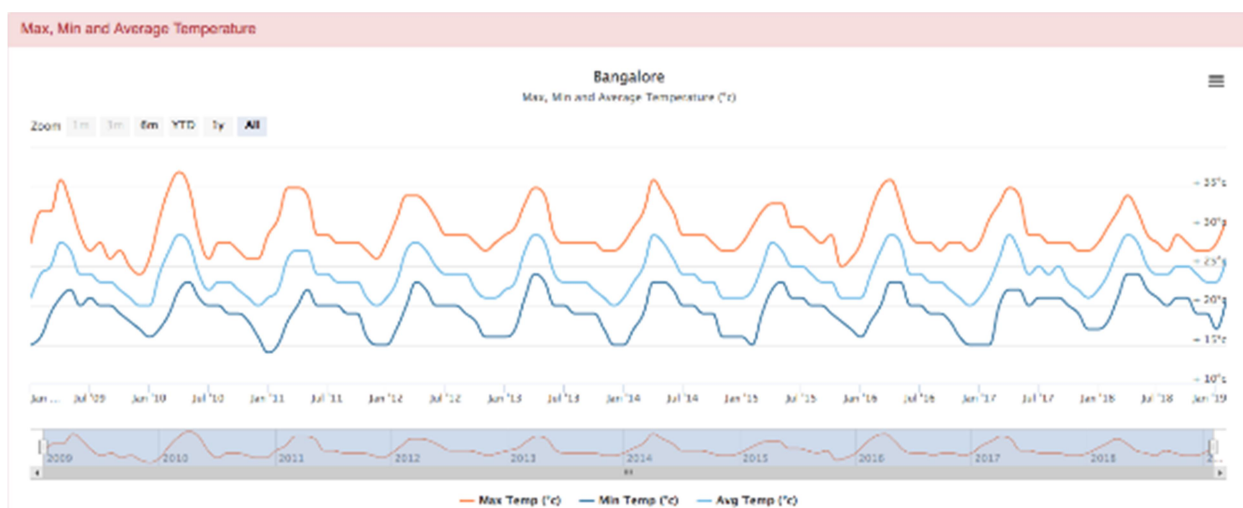
A. Physical Setting

57. **Geographical location.** Bengaluru city is situated at the heart of the Mysore Plateau, a region of the larger Deccan Plateau, at an elevation of about 900m. It is situated in the administrative area of Bangalore Urban district which has an area of 2,196 km² and is surrounded by the Bangalore Rural district to the east and north, the Ramanagara district to the west and the Krishnagiri district of Tamil Nadu to the south. The district has five talaks or subdivisions: Yelahanka, Bangalore North, Bangalore East, Bangalore South and Anekal. It has 20 hoblies or clusters of villages forming an administrative unit, 588 villages and 6 urban local bodies.

58. **Land Use.** Around 40% of land in the city is used for residential purposes. Transport uses around 24% of the land, while land used for industrial, and commercial purposes comprises around 7% and 3%. As the urban area of the city expands, it is expected that the percentage of land used for industrial purposes will decrease, while it is expected the percentage of land used for residential, commercial and public and semi-public purposes will increase.

59. **Climate/climate hazards.** Bengaluru is often referred to as the Pensioner's Heaven due to its dry tropical savanna climate. It has moderately hot summers between the months of February to May and comfortably cold winters from December to February (Figure 20) -- it does experience occasional heat waves when maximum temperatures can go up to 36° Celsius but temperatures do not fall below 12° Celsius.

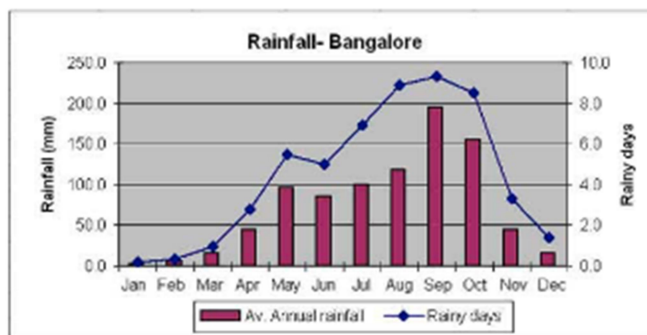
Figure 23: Bengaluru Annual Temperature (Degrees Celsius)



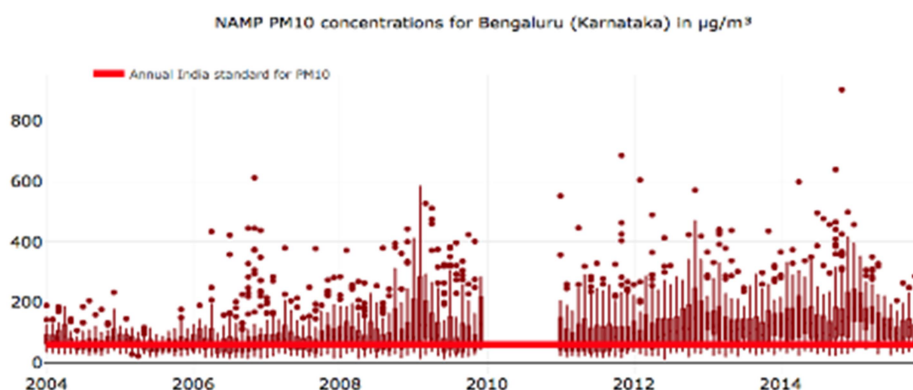
60. The annual rainfall records for 1901-2000 vary from as low as 500 millimeters (mm) to as high as 1,350 mm but it is usually around 900 mm (Table 11) with rainfall peaking during the pre-monsoon in May and again in September-October. The monsoons between July and September bring longer spells of recurring rains when the city often gets flooded as storm water drainage gets overwhelmed.

Table 11: Bengaluru Annual Rainfall (in mm)

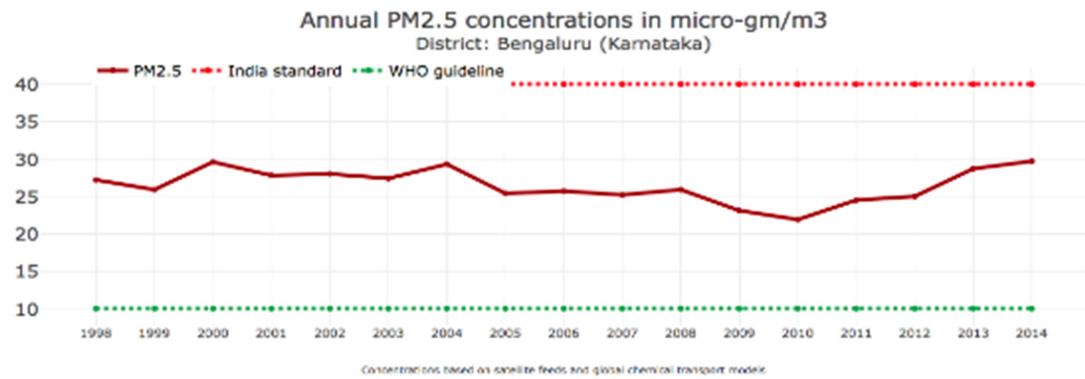
Months	Av. Annual Rainfall (mm)	Rainy Days
Jan	2.3	0.2
Feb	6.4	0.3
Mar	16.0	1.0
Apr	44.5	2.8
May	96.0	5.5
Jun	85.7	5.0
Jul	100.3	6.9
Aug	117.8	8.9
Sep	194.6	9.3
Oct	154.5	8.5
Nov	43.9	3.3
Dec	15.8	1.4
Total	877.8	53.2



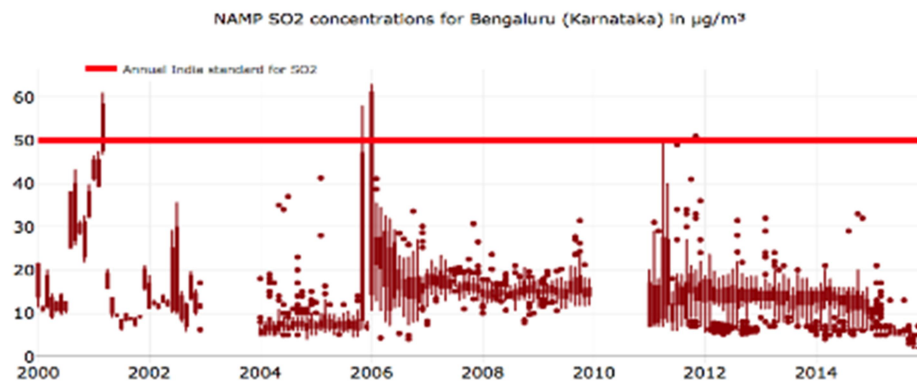
61. **Baseline air quality and noise levels.**⁴ Figures 21, 22, 23 and 24 provide a summary of the ambient air quality monitoring data available under the National Ambient Monitoring Program (NAMP) operated and maintained by the Central Pollution Control Board (CPCB, New Delhi, India). In Bengaluru, there are 5 continuous monitoring station reporting data for all the criteria pollutants and 7 manual stations reporting data on fine particulate matter less than 10 micros (PM₁₀), sulfur dioxide (SO₂), and nitrogen dioxide (NO₂). Data shows that around 62% of the PM₁₀ concentration is attributed to dust and 20% by transport. The annual average concentration is around 300 micrograms per meter cubed (µg/m³), which is far above the annual Indian standard and the WHO guidelines. The airshed is therefore considered to be degraded for PM₁₀ and given the main source is dust it will be necessary to keep further dust generation as a result of the project to a minimum. However, around 40% of the PM_{2.5} concentration is attributed to transport, 20% to dust, and 12% to open waste burning. The average concentration is around 27 µg/m³ within the annual Indian standard, but still exceeding the WHO guidelines.

Figure 24: PM10 concentration for Bengaluru (µg/m³)

⁴ National Air Quality Monitoring Programme – cpcbenviis.nic.in

Figure 25: PM 2.5 concentration for Bengaluru ($\mu\text{g}/\text{m}^3$)

62. Data shows that around 32% of the SO_2 concentration is attributed to emission from industry, 27% to the brick industry, and 25% to transport. The annual average concentration is around $20 \mu\text{g}/\text{m}^3$, below the annual Indian standard.

Figure 26: SO_2 concentration for Bengaluru ($\mu\text{g}/\text{m}^3$)

63. Data shows that around 42% of the NO_2 concentration is attributed to transport, 28% to emission from industry, and 21% to diesel generator sets. The annual average concentration is around $50 \mu\text{g}/\text{m}^3$ which is above the annual Indian standard.

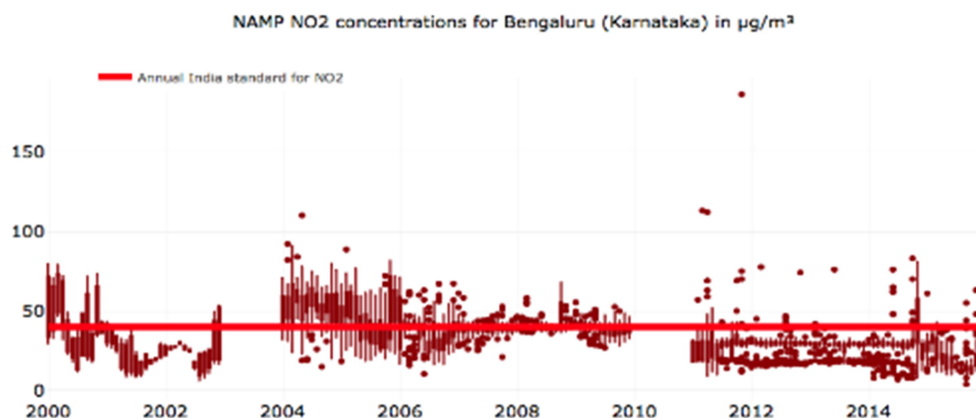
Figure 27: NO_2 concentration for Bengaluru ($\mu\text{g}/\text{m}^3$)

Table 12: Total Estimated Emissions by Sector for Bangalore⁵ (tons/year)

	PM2.5	PM10	BC	OC	NOx	CO	VOC	SO2	CO2
TRAN	12,550	13,200	5,100	4,050	24,100	237,300	70,650	1,300	6.68
RESI	2,050	2,050	700	800	1,400	20,300	2,350	750	1.60
INDU	2,650	2,700	1,750	200	16,050	20,600	2,900	1,650	1.23
DUST	6,400	41,200	-	-	-	-	-	-	-
WAST	3,500	3,700	250	2,100	100	16,800	3,400	100	0.02
DGST	1,250	1,350	750	250	11,950	3,150	300	100	0.54
BRIC	2,900	2,900	800	1,050	3,300	37,400	3,900	1,400	0.34
	31,300	67,100	9,350	8,450	56,900	335,550	83,500	5,300	10.42

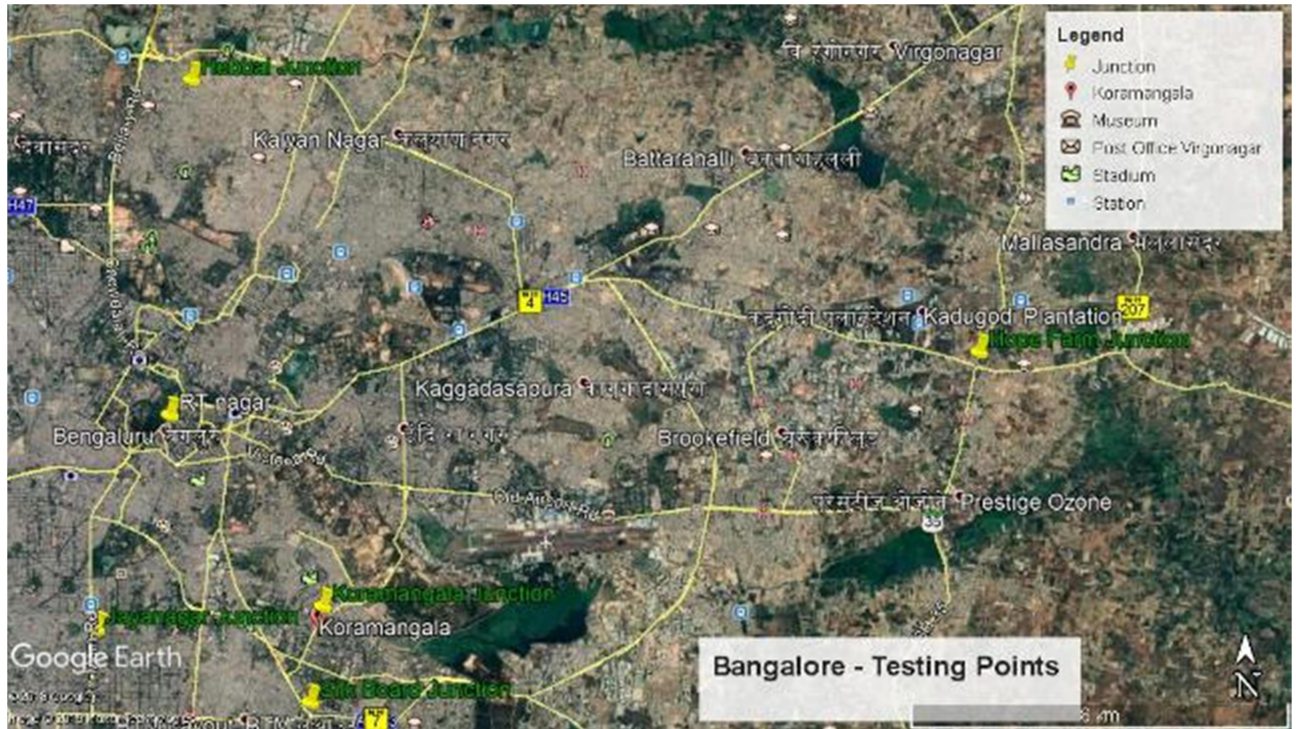
TRAN = transport emissions from road, rail, aviation, and shipping (for coastal cities); RESI = residential emissions from cooking, heating, and lighting activities; INDU = industrial emissions from small, medium, and heavy industries (including power generation); DUST = dust emissions from road re-suspension and construction activities; WAST = open waste burning emissions; DGST = diesel generator set emissions; BRIC = brick kiln emissions (not included in the industrial emissions)

64. Tests have also been conducted for the project at five representative project sites (Hope Farm, Koramangala and Silk Board on 15 June 2019, Hebbal on 26 September 2019 and Jayanagara on 27 September 2019), during June and September 2019.⁶ These locations were selected in consultation with BESCO as they were central to the project areas. These locations are shown in Figure 25 with results in Tables 13 and 14.

65. The noise standard set by the Central Pollution Control Board (CPCB) in commercial areas for the daytime (6 am to 10 am) is 65 A-weighted decibels (dB (A)) and 55 dB (A) for the night time (10 pm to 6 am) (Annex 3) but for residential areas it is 55dB(A) during the daytime and 45dB(A) during the nighttime, equivalent to the WHO guideline noise levels for residential properties. Table 13 shows that both levels are generally exceeded within the urban area. Therefore, additional noise contribution should be kept to a minimum, project noise levels should avoid exceeding 3dB(A) above background as a 1hr equivalent continuous sound pressure level (LAeq).

⁵ Urbanemissions.info

⁶ These are measured in three different directions (120°, 240°, 360°) on the date mentioned in the table. Subsequent to the sample tests, Hebbal was removed from the scope of the project but is still presented here as representative of other locations.

Figure 28: Sample Baseline Testing Points**Table 13: Sample Baseline Information Ambient Noise Quality at Project Location**

Location	Daytime	Night time
Hope Farm	68.14 dB (A)	58.43 dB (A)
Koramangala Junction	75.54 dB (A)	60.87 dB (A)
Silk Board Junction	70.37 dB (A)	67.82 dB (A)
Jayanagar Junction	72.57 dB (A)	58.21 dB (A)
Hebbal Junction	63.09 dB (A)	55.55 dB (A)

Source: Foreign Sciences Private Limited, Bangalore.

Table 14: Sample Baseline Information Air Quality at Project Location

Parameter	Unit	Hope Farm	Koramangala	Silk Board	Jayanagar	Hebbal	CPCB Standard
Temperature	°C	34.4	25.2	26.2	31.7	29.4	n/a
Velocity	m/sec	0.90	0.87	0.96	1.08	1.48	n/a
Particulate Matter (PM ₁₀)	µg/m ³	81	83	89	80	86	100 (24hr)
Particulate Matter (PM _{2.5})	µg/m ³	21	22	26	23	25	60 (24hr)
Sulphur dioxide (SO ₂)	µg/m ³	5.93	6.06	6.33	6.80	7.05	80 (24hr)
Nitrogen dioxide (NO ₂)	µg/m ³	11.34	11.79	12.13	12.58	13.25	80 (24hr)
Carbon Monoxide (CO)	mg/m ³	2.05	1.98	2.26	2.19	2.41	4.0 (1hr)
Carbon Dioxide (CO ₂)	ppm	165	159	154	142	126	n/a
Ozone (O ₃)	µg/m ³	4.93	5.08	5.20	4.74	4.97	n/a
Oxygen (O ₂)	%	18.2	17.7	17.8	18.0	17.2	n/a
Relative Humidity	%	82.3	81.5	80.5	76.4	67	n/a
Total Volatile Organic Compound	µg/m ³	BDL	BDL	BDL	BDL	BDL	n/a

BDL-below detectable limit (below 1 µg/m³)

Source: Foreign Sciences Private Limited, Bangalore.

66. **Topography and geomorphology.** Bengaluru city has two unique terrains – to the north is rocky upland with a relatively level plateau lying between an elevation of 839 to 962 m whilst to the south is an uneven undulating landscape with intermingling flat-topped hills and valleys formed by granite and gneissic masses and covered by a layer of red loamy soil of varied thickness. The North Bangalore subdivision has a prominent ridge running north-northeast to south-southwest on which the highest point in the city, Doddabettahalli, sits. There are gentle slopes and valleys on either side of this ridge.

67. **Geology and soils.**⁷ The prevalent rock types belong to the Saugar, Charnokite and Peninsular Gneissic Complex (PGC) groups including granites, gneisses and migmatites. Figure 26 presents the Geology and Mineral Map. The soils in Bengaluru vary from red laterite to clayey soils. Soil sample tests were conducted on 15 June 2019 at the project sites (Table 15).⁸

Table 15: Sample Baseline Information Soil Quality at Project Location

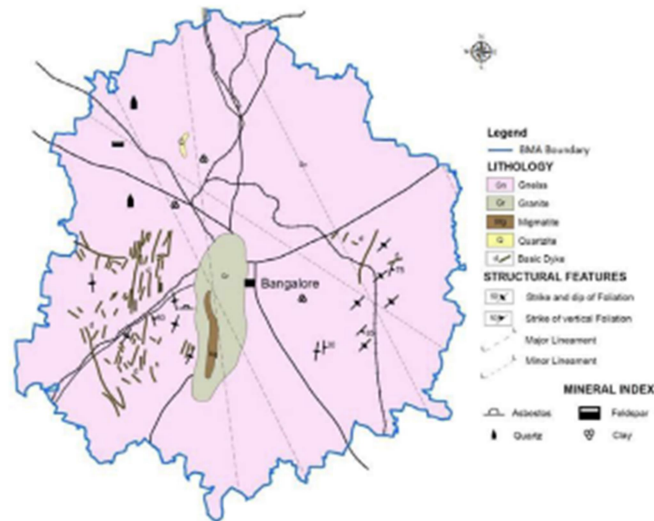
Parameters	Unit	Hope Farm	Koramangara	Silk Board	Jayanagar	Hebbal
Colour	-	Dull orange	Orange	Dull orange	Dull Yellowish Brown	Grayish Yellow Brown
Texture	-	Loamy sand	Loamy sand	Loamy sand	Sandy Loam	Sandy loam
Organic matter	%	0.69	0.19	0.49	0.39	0.29
Bulk density	g/cc	1.69	1.54	1.59	1.53	1.03
Particulate density	%	2.44	2.44	2.50	2.13	2.08
Moisture content	%	2.96	5.04	2.53	22.83	18.74
pH	-	7.38	7.05	6.65	7.14	7.50
Electrical conductivity	µs/cm	634	192.3	227	130.9	145.1
Magnesium	mg/l	1.00	0.4	1.10	1.80	0.9
Calcium	mg/l	8.5	8.20	4.82	14.80	13.0
Sodium absorption ratio	-	2.43	0.66	1.61	0.75	1.48
Chloride	mg/l	1.47	1.17	0.98	0.63	1.12
Sodium	mg/100gm	12.17	3.19	6.38	4.98	8.98
Organic carbon	%	0.40	0.11	0.28	0.23	0.17
Available potassium	kg/ha	403.20	761.6	322.56	179.2	250.88
Available phosphorus	kg/ha	395.69	341.99	234.59	128.22	103.61
Sand	%	78.96	74.96	80.96	64.96	66.96
Available nitrogen	kg/ha	246.30	243.66	243.1	195.12	159.12
Slit	%	9.28	17.28	9.28	25.28	21.28
Clay	%	11.76	7.76	9.76	9.76	11.76
Soil salinity	µs/cm	625	116.3	217.0	98.6	130
Boron	mg/100gm	0.42	4.4	2.4	1.53	0.65
Available sulphur	mg/100gm	2.11	1.9	0.84	3.27	2.13
Permeability	cm/hr	0.52	0.48	0.31	0.53	0.40
Water holding capacity	%	25.74	38.41	33.24	21.04	27.76
Porosity	%	30.73	36.88	36.4	28.16	50.48
Zinc	mg/kg	22.7	13.9	28.2	33.3	32.7
Manganese	mg/kg	219.8	106.4	143.3	174.9	148.6
Copper	mg/kg	13.5	4.9	4.4	14.5	9.4

Source: Foreign Sciences Private Limited, Bangalore.

Figure 29: Geology and Mineral Map

⁷ http://cgwb.gov.in/District_Profile/karnataka/2012/BANGALORE_URBAN-2012.pdf

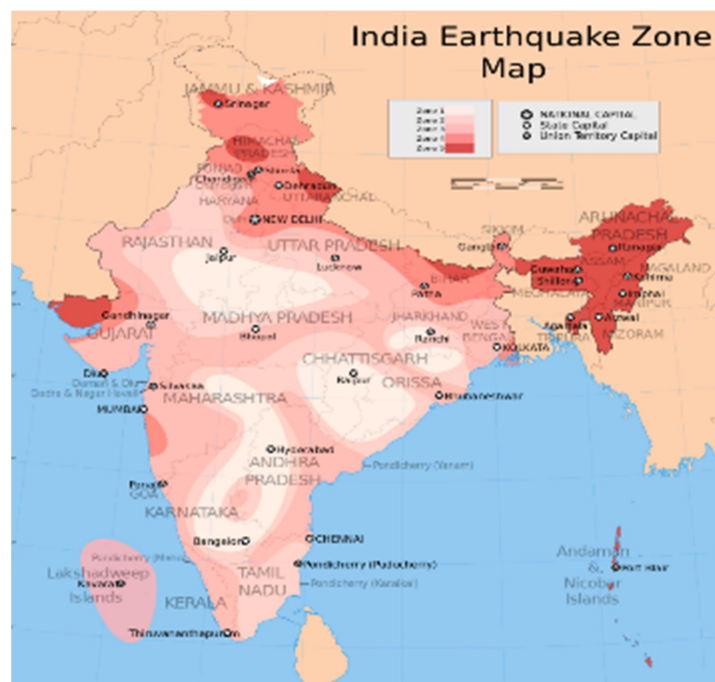
⁸ Sample test has been conducted at five locations: (i) Hope Farm, (ii) Koramangala Junction, (iii) Silk Board Junction, (iv) Jayanagar and (v) Hebbal. These are measured in three different directions (120°, 240°, 360°) on the date mentioned in the table. Subsequent to the sample tests, Hebbal was removed from the scope of the project but is still presented here as representative of other locations.



Source: District Resources Map, Geological Survey of India (2000)

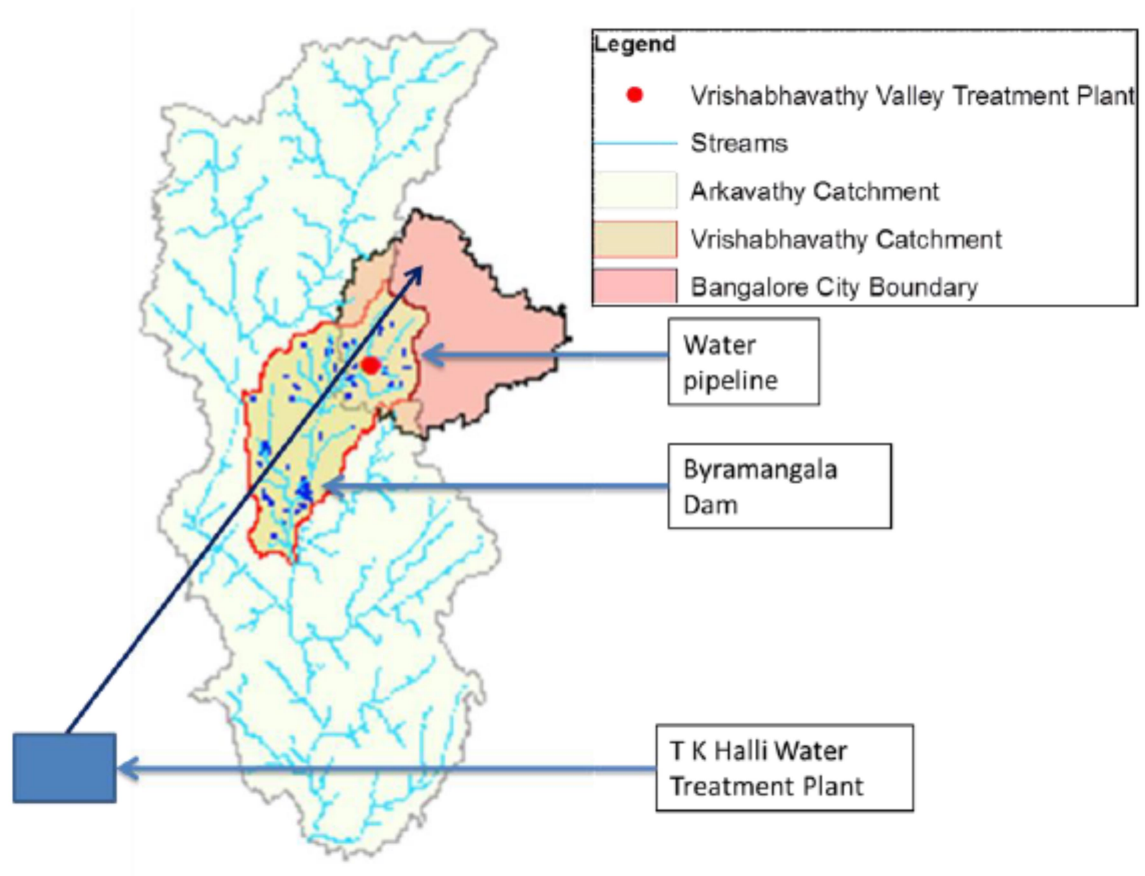
68. **Seismology of the state/geological hazards.** Bangalore is not an earthquake prone city because it is very far from plate boundaries, is isostatically in equilibrium, with no mid oceanic ridge, active volcano, or major faults nearby. Bangalore is located in Zone 1 which is the lowest level of seismicity (Figure 27) with a maximum intensity estimated at MM V or less equating to a very low damage risk zone.

Figure 30: India Earthquake Zone Map



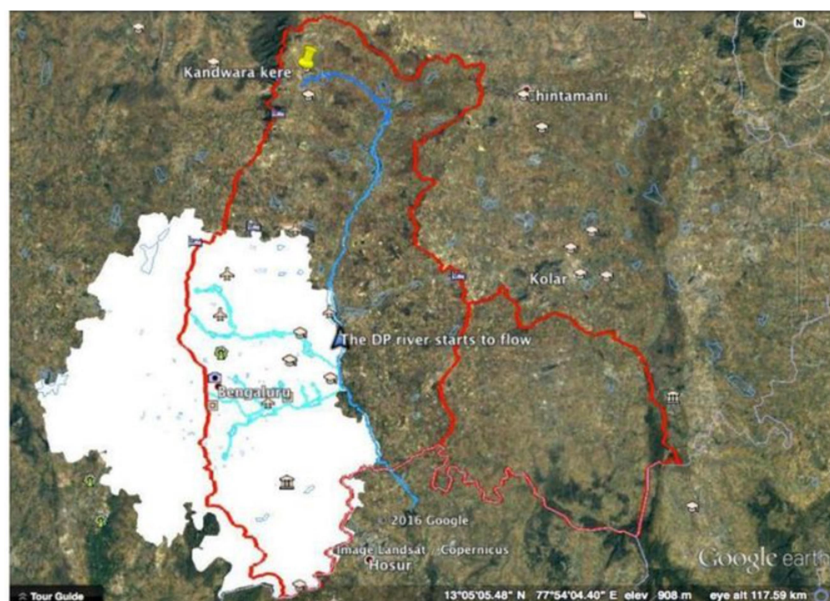
69. **Surface water.** There are no major rivers flowing through Bengaluru city but which straddles two river basins split by the ridge line: the Arkavathi-Vrishabhavathi basin (Figure 28) on the west, and the Pinakini (or Ponnaivar) basin to the east. One of seven main river systems of Karnataka, the River Kaveri (or Cauvery) is joined by the River Arkavathi, in the proximity of Mekedatu, which lies 60 km south. The River Vrishabhavati, a minor tributary of the River Arkavathi, with a catchment of 560km² arises within Bengaluru city at Basavanagudi and flows for a small stretch through the Bangalore North subdivision. It acts more like a drain to carry the city's sewage; it is therefore highly polluted as a result. The city has a handful of freshwater lakes, including the Bellandur and Varthur, and water tanks in its low lying parts, such as, Madivala tank, Hebbal tank, Ulsoor lake and Sankey tank. The outflow from the lake valleys on the outskirts of the city together with part of its sewage feed the Pinakini river, which acts as a second drain for the city's wastewater and then flows onwards towards Hosur.

Figure 31: Arkavathi-Vrishabhavathi River Basin



Source:

['Addressing Water Stress Through Waste water Reuse Complexities and Challenges in Bangalore India'](https://www.researchgate.net/publication/262816627)



Source: <https://slideplayer.com/slide/13668906/>

70. Rapid urbanization, the IT boom, related economic activities, trade and commerce has increased the sewage waste flowing into the lakes despite 14 sewage treatment plants being under operation in the city. Improper environmental planning has given room for the establishment of new residential layouts without proper sewerage systems and even if such systems have been provided, the same have not been connected to trunk sewers of Bangalore Water Supply and Sewerage Board (BWSSB). The municipal effluents from such natural drains leading to lakes and tanks deteriorates the quality of the surface water.

71. **Groundwater.**⁹ Groundwater occurs in silty to sandy layers of alluvial sediments of limited thickness (20-25m) and aerial extent along the river courses with the granites and gneisses of the PGC constituting the major aquifers. Groundwater occurs in phreatic conditions or unconfined conditions in the weathered zone and under semi confined to confined conditions in fractured and jointed rock formations. Generally, the depth of weathering varies, being more in the valleys, and often extending up to 30 m in dug wells.

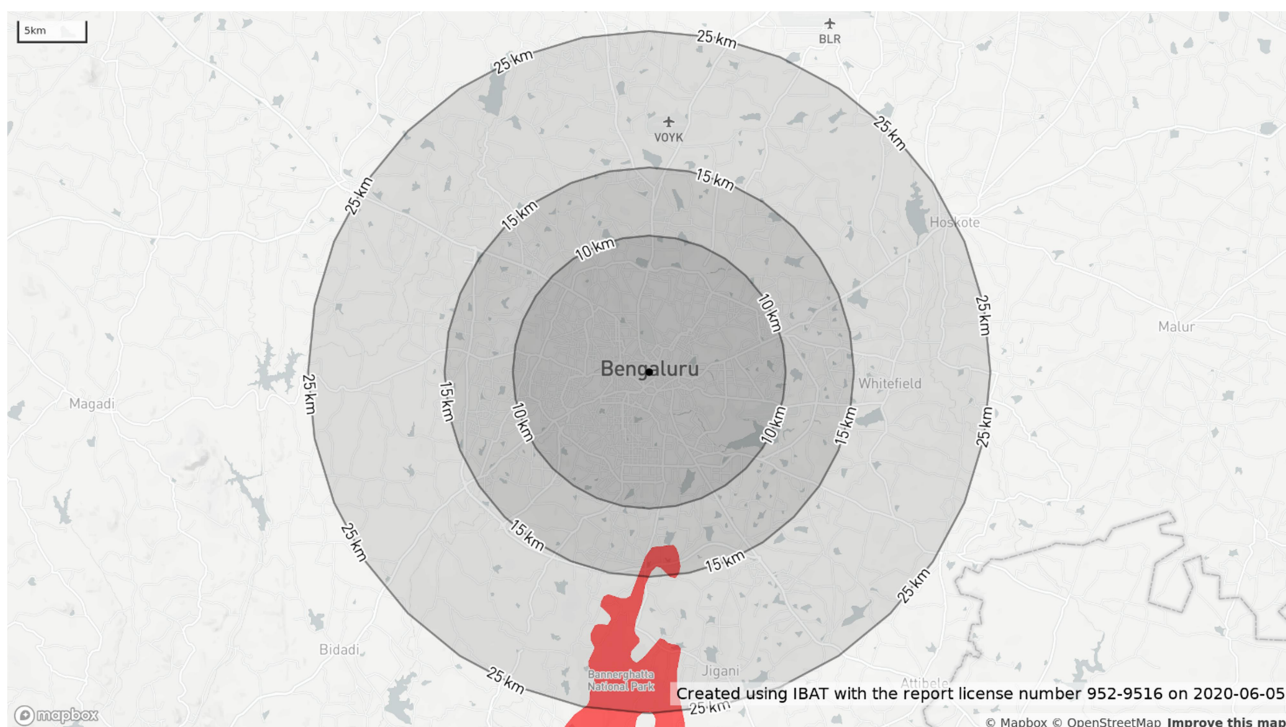
72. The quality and quantity of groundwater is a problem for Bengaluru city due to (i) sewage and industrial pollution; (ii) high nitrate concentration; and (iii) over exploitation of resources. This is further attributed to factors like urbanization which has increased rapidly in the last two decades paving the way for commercial buildings, and industries. Green cover, lakes and tanks have been diminished leading to depletions in groundwater level. Sedimentation of pollutants has not only reduced the surface area of lakes, which in turn has increased evaporation rate, but has also reduced ground water levels on account of poor permeability with more and more silt, clay deposits, trash and toxic waste accumulation in the lakes year after year. Efforts are being made by Bruhat Bengaluru Mahanagara Palike (BBMP) – a municipal corporation, to conserve and rejuvenate major tanks in Bengaluru city.

B. Ecological Setting

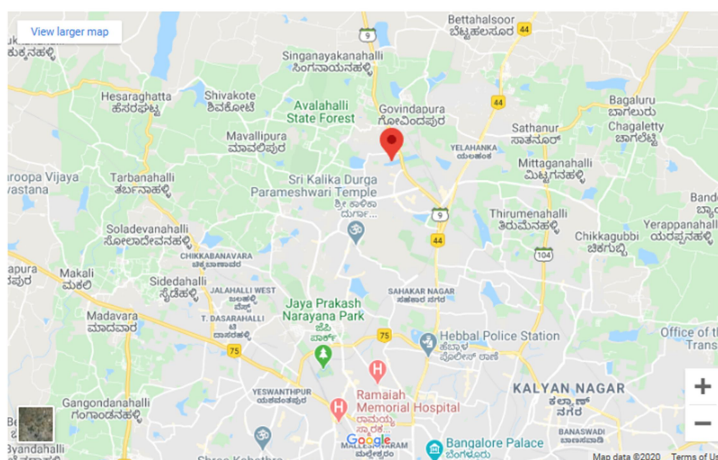
73. **Protected Areas and Forests.** IBAT has been run for Bengaluru city (Annex 5) and there are no internationally and nationally designated biodiversity sites in the project area, the nearest being Bangargatta National Park to the south within a 1km buffer zone of the urban area but outside the concerned subdivisions (Figure 29). There is a state designated Conservation Reserve at Puttenahalli Lake, Doddaballapur Road, Yelahanka in Bangalore North¹⁰ (Figure 30) also outside the concerned subdivisions. This is a 10-hectare freshwater lake (overall site is 15 hectares) of interest for its birdlife, although it suffers from similar pollution issues as other waterbodies within Bengaluru.

⁹ http://cgwb.gov.in/District_Profile/karnataka/2012/BANGALORE_URBAN-2012.pdf

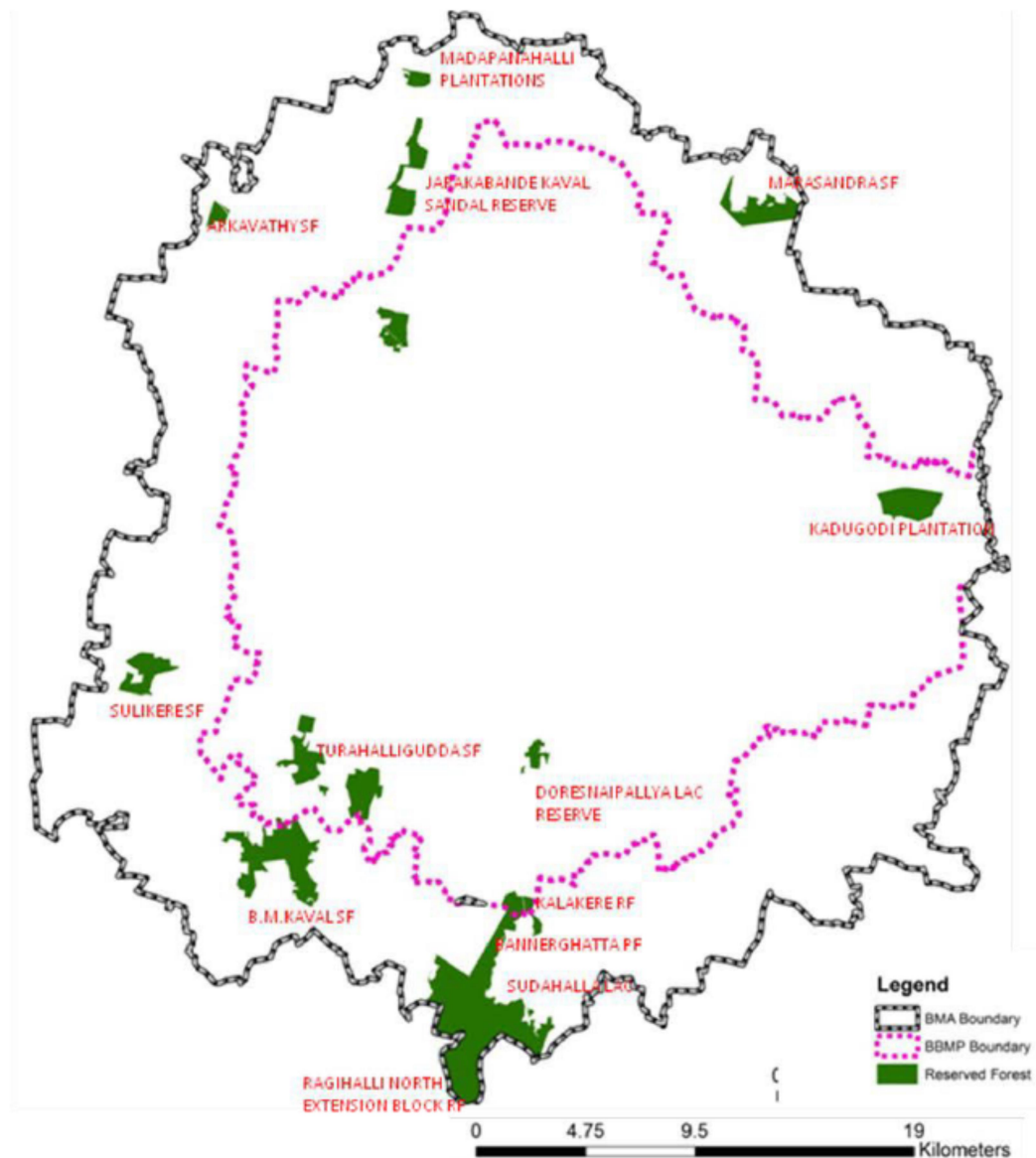
¹⁰ <https://aranya.gov.in/aranyacms/downloads/latestNews/Puttenahalli%20Notification.pdf>

Figure 32: Location of Bangergatta National Park

Source: IBAT

Figure 33: Location of Puttenahalli Lake (Conservation Reserve)Source; <http://www.puttenahalli.org/contact.html>

74. The Bangalore Urban Districts have a geographical area of 2,190 m² out of which the area under forest is 122.26 m² or 5.5% of total land area. With the Bengaluru metropolitan area (BMA) the percentage of forest comes to only 2.28% of total land area. BMA falls under the Bangalore Urban Forest Division of the Karnataka Forest Department (KFD) which has 3 subdivisions, namely, Bangalore North Subdivision, Bangalore South Subdivision and the Lakes Subdivision. Most of the forests in and around Bengaluru now stand degraded due to biotic factors and they are classified as Dry Deciduous Scrub type (DS1). Kadugodi in White Field E4 subdivision, and Doresanipalya in Jaya Nagar subdivision S14 are in the project subdivisions providing green space within the urban environment. Other forests are found at Govindapura, Mandur, B.M. Kaval, Turaligudda, Jarakabande, Jarakabande Sandal Reserve, Marasandra, Kumbaranahalli, and Madappanahalli. In most of these places, monoculture plantations of *Eucalyptus* and *Acacia Auriculiformes* have been raised in the past.



Source: KFD and RMP2031 Analysis, 2015

75. **Flora.** The Bangalore Urban Districts are endowed with a variety of trees, shrubs, grasses, and climbers. In the urban area few patches of remnant natural vegetation exist, fragmentation of vegetation connectivity is also high with most ecosystems in the city extensively modified by human influence. Bangalore has a relatively high tree diversity but relatively low tree density. Older streets and parks tend to be dominated by large-canopied, slow growing long lived tree species that provide shade, biodiversity support, pollution reduction and microclimatic buffering while recent planting focused more on ornamental species and short stature, small canopied, relatively short lived species that are easier to maintain.¹¹ In addition to the above mentioned varieties of trees found in Bengaluru, *Adenanthera pavonina* (Red Bead Tree), *Aristolochia indica* (Larval Host Plant), *Calophyllum inophyllum* (Alexandrian Laurel), *Clerodendrum paniculatum* (Pagoda Plant), *Clitoria arborea*, *Costus pictus* (family of ginger), *Guazuma ulmifolia*, *Lantana*, and *Neolamarkia cadamba* can be found.

76. **Fauna.** Typical of an urban area common species occur such as feral cats, dogs, pigeon, crow etc. However, a faunal checklist compiled in 1999 documented the presence of 40 species of mammals, over 340 species of birds, 38 species of reptiles, 16 species of amphibians, 41 species of fishes and 160 species of butterflies within 40 km of the city centre.¹² Pockets of native

¹¹ <https://core.ac.uk/download/pdf/81286693.pdf>

¹² <https://core.ac.uk/download/pdf/81286693.pdf>

vegetation cover persisting in academic institution campuses and botanical gardens contribute significantly to this biodiversity. The freshwater lakes and tanks, such as Puttenahalli Lake, can provide habitat for migratory roosting birds.

77. **Urban Habitats.** There are 1,288 parks providing urban green space in Bengaluru the major ones being Cubbon Park, Lalbagh Botanical Garden, Coles Park, M.N. Krishna Rao Park, Jayamahall Park, Cariappa Memorial Park, Nandanavana Park, Jayanagar, Kuvempu Park, BTM Layout, R.V. Road Children's Park etc.¹³ Table 16 shows the relationship of major parks, gardens, and lakes to the project subdivisions.

Table 16: Major Parks, Gardens, and Lakes in Relation to Project Subdivisions

Present in Project Subdivisions						
	Jaya Nagar	Shivaji Nagar	Indira Nagar	Kora Mangala	HSR	White Field
Major Parks and Gardens						
Bannerghatta Butterfly Park	x	x	x	x	x	x
Bannerghatta National Park	x	x	x	x	x	x
BTM Layout	within S14	x	x	x	x	x
Bugle Rock Park	x	x	x	x	x	x
Cariappa Memorial Park	x	x	x	x	x	x
Coles Park	x	within E1	x	x	x	x
	x to north	x to south				
Cubbon Park	S2	E1	x	x	x	x
Freedom Park	x	x	x	x	x	x
Jayamahall Park	x	within E1	x	x	x	x
Jayanagar	within S1	x	x	x	x	x
JP Park	x	x	x	x	x	x
Kuvempu Park	within S14	x	x	x	x	x
Lalbagh Botanical Garden	within S2	x	x	x	x	x
M N Krishna Rao Park	350m from S1	x	x	x	x	x
Nandanavana Park	within S15	x	x	x	x	x
R.V. Road Children's Park	within S1	x	x	x	x	x
Major Lakes						
Agara Lake	x	x	x	x	x	x
Akshayanagara Lake	x	x	x	x	x	x
Allalasandra Lake	x	x	x	x	x	x
Amrutahalli Lake	x	x	x	x	x	x
Begur lake	x	x	x	x	x	x
Bellandur Lake	x	x	x	x	forms N boundary S11	x
Benniganahalli Lake	x	x	within E10	x	x	x
Chele kere	x	x	x	x	x	x
Devasandra Lake	x	x	x	x	x	x
Doddabommasandra Lake	x	x	x	x	x	x
Doddanekundi Lake	x	x	x	within S17	x	x
Doddakallasandra Lake	within S6	x	x	x	x	x
Hebbal Lake	x	x	x	x	x	x

¹³ <http://bbmp.gov.in/documents/10180/634514/parks.pdf/3eeb4470-abee-4f89-a8c2-a07168242de3>

Horamavu Lake	x	x	x	x	x	x
Hosakerehalli Lake	within S15	x	x	x	x	x
ISRO Layout Lake	x	x	x	x	x	x
Jakkur Lake	x	x	x	x	x	x
Jaraganahalli lake	x	x	x	x	x	x
Kaggadasapura Lake	x	x	within E10	x	x	x
Kaikondrahalli Lake	x	x	x	x	within S11	x
Kalkere Lake	x	x	x	x	x	x
Kalena Agrahara lake	x	x	x	x	within S12	x
Kammasandra lake	x	x	x	x	x	x
Kempambudhi Lake	x	x	x	x	x	x
Kothnur Lake	x	x	x	x	within S12	x
KR Puram Lake	x	x	within E11	x	x	x
Lalbagh lake	within S2	x	x	x	x	x
Madiwala Lake	within S14	x	x	x	x NW boundary S8	x
Maragondanahalli Lake	x	x	x	x	x	x
Mathikere Lake	x	x	x	x	x	x
Munnekolala Lake	x	x	x	within S7	x	x
Nagavara Lake	x	x	x	x	x	x
Puttenahalli Lake, JP Nagar	x	x	x	x	within S12	x
Puttenahalli Lake, Yelahanka	x	x	x	x	x	x
Rachenahalli Lake	x	x	x	x	x	x
Thirumenahalli Lake	x	x	x	x	x	x
Sankey Tank	x	x	x	x	x	x
Sarakki Lake	within S6	x	x	x	x	x
Ulsoor Lake	x	forms S boundary E1	x	x	x	x
Varthur Lake	x	x	x	x	x	within E4
Vibhutipura Lake	x	x	x	within S17	x	x
Yele Mallappa Shetty Lake			forms NE boundary E11			

Source: Information compiled by consultant from Google map.

78. Some of the parks, gardens, and lakes are located within or immediately adjacent to the project subdivisions with others a sufficient distance away from the subdivisions to not be impacted. However, the cable alignments are along existing overhead line corridors hence whilst they may be on the roads directly bordering them undergrounding of lines will not enter into any parks, gardens, and lake areas – this will be reconfirmed on site following actual alignments being mapped and confirmed by the contractor.

79. The project area of influence is considered to be highly modified habitat, no natural or critical habitat is present.

C. Cultural/Heritage Setting

80. No world heritage sites exist in Bangalore. There are 207 onuments of National Importance designated by the Archaeological Survey of India in the state of Karnataka (Bengaluru circle), of which 2 of them (Old Dungeon Fort and Gates, and Tipu Sultan's

Palace) are located in urban Bengaluru. Table 17 shows the distance the relationship of the project subdivisions to these archaeological sites.

Table 17: National Archaeological Sites (ASI) in Relation to the Project Subdivisions

Name of archaeological site	Present in Project Subdivisions					
	Jaya Nagar	Shivaji Nagar	Indira Nagar	Kora Manga la	HSR	White Field
Old Dungeon Fort and Gates	x west of S2	x	x	x	x	x
Tipu Sultan's Palace	x west of S2	x	x	x	x	x

81. None of the nationally important archaeological sites are located within the project subdivisions and they and the buffer zones are sufficiently far away from the works as to not to be impacted.

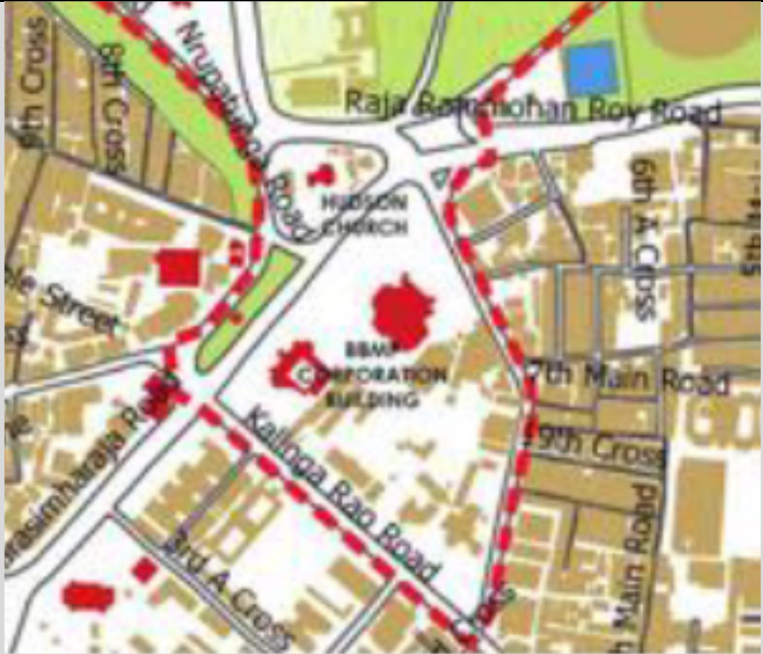
82. Modern Bengaluru was founded in 1537 with the urban settlements – old city and cantonment – which had developed as independent entities merged into a single urban center in 1949. Several buildings, parks, and tanks remain from the historical development of Bengaluru. In 1905 it was the first city in Asia to use electricity for street lighting in KR Market, the “B” and “C” substations on MG Road and near Cantonment Railway Station are Bangalore’s earliest substations. The Revised Master Plan 2031, not yet adopted, identifies several areas as heritage zones (Table 18) with heritage structures located within them and 321 heritage structures situated outside of these zones.¹⁴

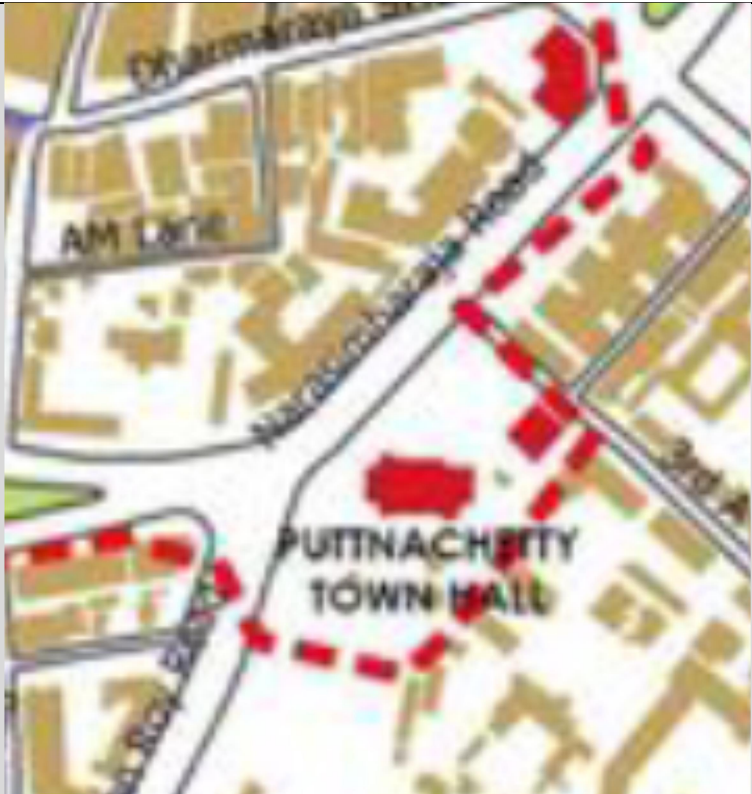

83. The cable alignments are along the existing overhead line corridors, hence, while they may be on the roads directly within the heritage zones, undergrounding of lines will not cross into any private areas that may be supporting locally important cultural resources – this will be reconfirmed on site following actual alignments being mapped and confirmed by the contractor. The power supply to any locally important heritage buildings is provided at a designated point on the boundary of the compound and from that point the concerned department (such as Archaeological Department or Endowments Department, etc.) will do the internal electrification works through certified electrical contractors.

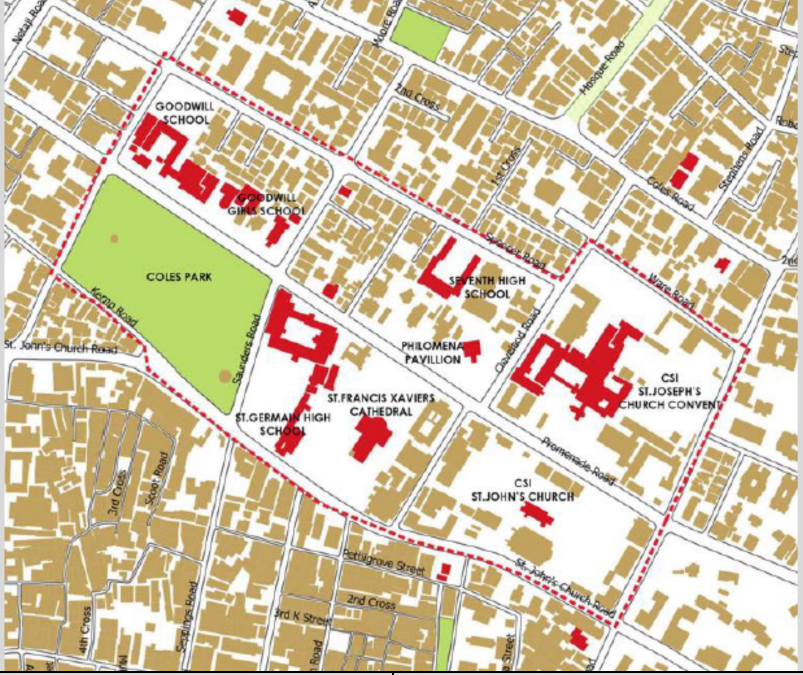
84. If any roads in the heritage zones shown in Table 18 are involved, no objection of BBMP will be sought. It will also be confirmed by the contractor that the roads involved do not fall within the 200m regulation zone of the state protected monuments of band stand of Lalbagh gardens, Venkataramaneswami Temple and Kempegowda Watch Tower, as shown in Table 18, otherwise regulatory permission will be sought to undertake the works before they commence and requirements of that permission followed. BESCOM will be able to use HDD technology in such areas to avoid any open trenching and undergrounding will improve the visual appearance of the heritage zones.

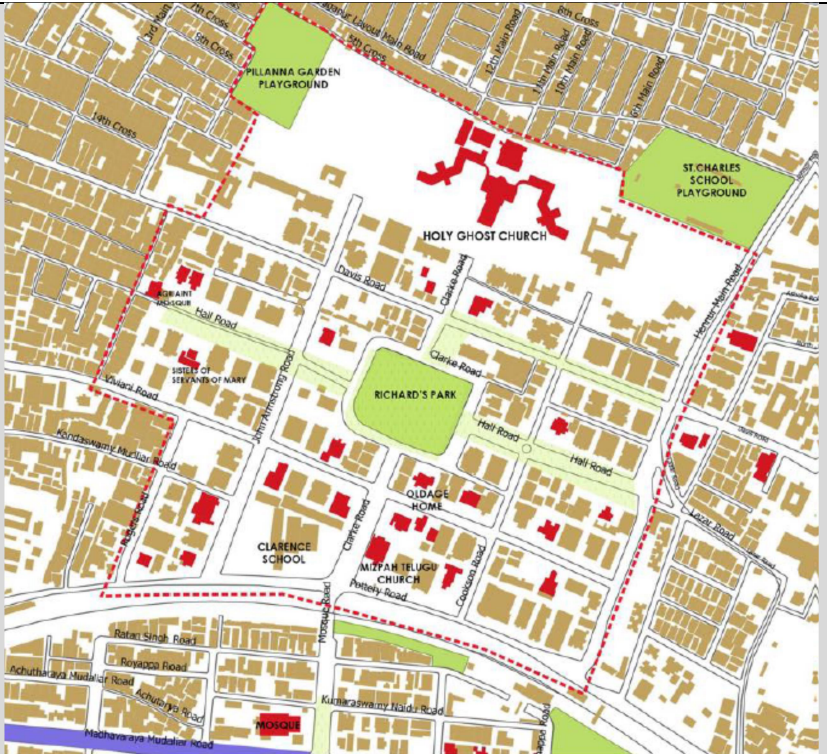
¹⁴ <https://opencity.in/documents/bda-revised-master-plan-2031-zoning-regulations>

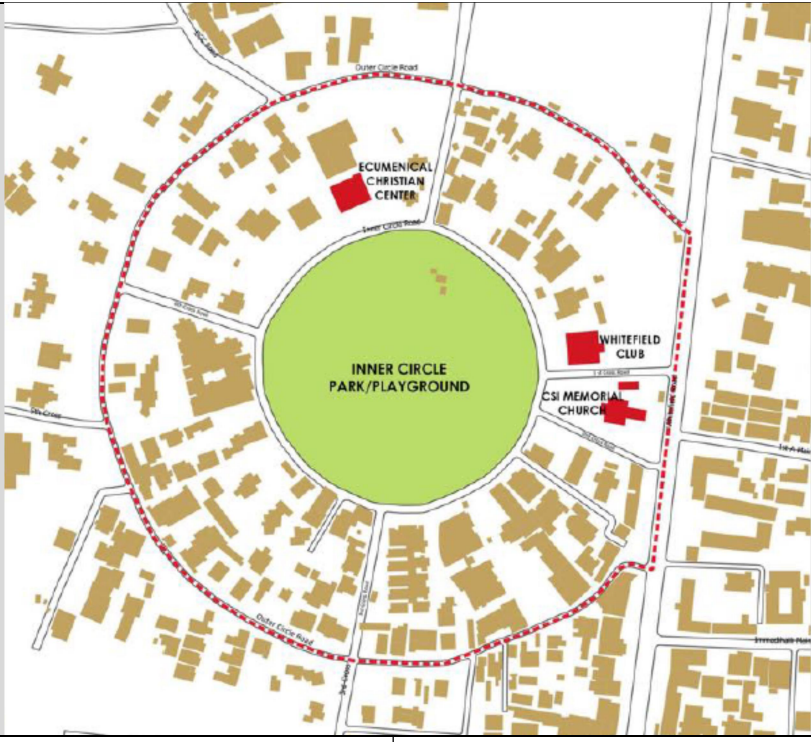

Table 18: State Protected Monuments and Locally Important Heritage Zones in Relation to the Project SubDivisions

Heritage Zone	Heritage Interest	Heritage Zone in Subdivisions	State Protected Monument in Subdivision
Central Administrative	Traditional link between the Petta and Cantonment tied together by large green open space of Cubbon Park	Small part of zone falls in Jaya Nagar - S2, NW corner, formed by the roads bounding BBMP corporation compound supporting 2 locally important heritage buildings. In this heritage zone laying of utility lines allowed only with prior no objection.	None
			
Petta and Bangalore Fort	Petta is the traditional settlement founded by Kempegowda I in 1537 AD which was initially a mud fort, of which only a segment of Fort Wall remains	Small part of zone falls in Jaya Nagar - S2, NW corner, formed by roads bounding Puttanchetty town hall which is a locally important heritage building	None

			
Gavipuram, Basavanagudi and VV Puram	<p>Bull temple, the Gavi Gangadhareshwara Temple established in Basavanagudi in the 16th century and cultural significance of the annual Kadalekai Parish of the Peanut festival on Bull temple road. Heritage zone also includes the Lalbagh gardens founded by Hyder Ali and Tippu Sultan, which is a green lung space for Bangalore, hence classified also as natural heritage.</p>	<p>Small part of zone falls in Jaya Nagar - S2, which includes Lalbagh gardens. In this heritage zone laying of utility lines allowed only with prior no objection.</p>	<p>Prohibited and regulated zone of band stand of Lalbagh gardens State Protected Monument, the 100m prohibited zone is within the park but roads fall in 200m regulated zone</p> <p>Roads fall in 200m regulated zone of Venkataramaneswami Temple State Protected Monument (monument itself outside subdivision)</p>
			
MG Road	<p>Planned using British planning principles of creating linear axis and a vista between two focal points; the</p>	None	None

	cathedral and church		
Shivajinagar	Mixed use zone supporting markets, bazaars, religious places and neighborhoods. Multicultural communities have been residing in these areas historically and are reflected through various processional streets.	None	None
Cleveland Town	Promenade road is treated as an axis with major educational and religious church institutions on either side, bounded by a Coles Park at its corner, shaded by avenue trees along the roads.	In Shivaji Nagar – E1 covering Coles Park and locally important heritage buildings of schools and churches. In this heritage zone laying of utility lines allowed only with prior no objection.	None
			
Richard's Town	Grid-pattern roads with centrally located Richards Park, and the monumental Holy Ghost Church culminates along the axis of Clarke road. This zone has mostly residential units with avenue plantation along the roads.	In Shivaji Nagar – E1/E5 covering Richards Park and locally important heritage buildings. In this heritage zone laying of utility lines allowed only with prior no objection.	None

			
Malleshwaram	Historic 17th century heritage site of the Kadu Malleshwara temple, its temple tank, and the proximal flower market. Sampige road street character is of markets selling temple ritualist items.	None	
Ulsoor	15th century Ulsoor settlement was established by the Vijaynagar kings, is centered around the Someshwar temple complex including its processional car street near the Halasuru lake.	None; edge of heritage zone shares boundary round with Shivaji Nagar – E1 but heritage zone itself is to south	
Whitefield Inner Circle	Anglo-Indian settlement developed outside the city core in 1882 after granting of land by the Mysore State to the Eurasian and Anglo-Indian Association for the establishment of agricultural settlements.	In White Fields – E4 covering inner circle park and locally important heritage buildings	None

			
Begur Temple	8 th century Pancha Linga Nageshwara Temple complex of the Ganga dynasty period, is a State Protected monument.	None	
Bangalore Palace	Palace situated amongst large gardens and open space. Kempegowda Watch Tower, a State Protected Heritage Site is located in this heritage zone.	In Shivaji Nagar – E1 covering Bangalore Palace and grounds	Roads fall in 200m regulated zone of Kempegowda Watch Tower State Protected Monument (monument itself falls outside of the subdivision and will not be directly impacted but permission required for any works on road in regulated zone)
			

D. Socioeconomic Setting

85. **Population.** The population for the six BESCOM divisions, Bengaluru city, and Karnataka state is shown in Table 19. Bengaluru had an estimated population of 12.34 million in its urban area in 2018, up from 8.5 million in 2011. It is now the 24th most populous city in the world and the fastest-growing Indian metropolis behind New Delhi, growing by 38% to 6.54 million from 1991 to 2001. The city claims an area of 709 km², and with a population density marked in 2011 at over 4,000 per km² one can assume it has become denser.

Table 2: Population Details for Districts, Bengaluru and Karnataka State

Description	Karnataka	Bengaluru	Jaya Nagar	Shivaji Nagar	Indira Nagar	Kora Mangala	HSR	White Field	Total in Project Area
	2018	2018	2018	2018	2018	2018	2018	2018	2018
Number of Population	6,40,60,000	1,23,40,000	13,95,037	8,17,640	2,90,000	9,72,954	5,75,854	8,10,492	48,61,977
Number of Households	1,50,47,651	28,98,658	3,61,894	1,46,428	84,743	3,02,736	2,05,575	1,78,875	12,80,251
Male	3,33,11,200	64,16,800	7,25,419	4,25,173	1,50,800	3,02,736	2,05,575	4,21,456	22,31,159
Female	3,07,48,800	59,23,200	6,69,618	3,92,467	1,39,200	6,70,218	3,70,279	3,89,036	26,30,818

Source: Directorate of Economics and Statistics, Government of Karnataka

86. **Vulnerable Groups.** The sex ratio for Bengaluru (i.e., the number of females per thousand males) is 908:1000. This is the lowest in the state and lags far behind the state average of 968. The child population (0-6 years) is 10.75 % of total urban population. 80.29 % of the population in Hindi, with 12.97% Muslim, and 5.25% Christian and less than 1% of Sikh, Buddhist, and Jain. 13.21% of the city's inhabitants are from Scheduled Castes and Scheduled Tribes. In about 8% of blocks there are no Scheduled Castes and Scheduled Tribes, in 40% of blocks these communities make up less than 5% of residents with economic growth driving exclusion; conversely in about 6% of blocks, including in both the old and new areas of the city, more than 50% of residents are from Scheduled Castes and Scheduled Tribes. Bengaluru Urban area had a poverty rate of between 0-10% in 2012 with urban areas seeing an increase in consumption inequality.

87. Populations are vulnerable to electrocution from poorly installed and maintained distribution lines; BESCOM collate fatal and non-fatal accident data as shown in Table 20. Employees at BESCOM, such as lineman, are exposed to high occupational risk due to working with live electricity. On the community behavioral front, it is mostly children and uninformed people who are vulnerable to getting electrocuted. Children may come in contact with live wires while playing whilst women come close to them while drying clothes. In 2019, BESCOM undertook community awareness raising using social media and pamphlets (Figure 31).

Table 20: BESCOM Accident Data

Year	Fatal		Non-Fatal		Fatal Animals	Total
	Occupational	Community	Occupational	Community		
2015-16	7	125	57	42	52	283
2016-17	12	106	55	26	37	235
2017-18	10	104	45	34	46	239
2018-19	8	128	47	44	56	283

Figure 34: BESCOM Safety Pamphlet



88. **Education and Health.** Bengaluru houses a number of reputed engineering colleges producing high quality computer scientists as well as the Indian Institute of Management, Bangalore (IIMB), a top management Institute in India, the Indian Statistical Institute (ISI), the Indian Institute of Science (IISc), the Indian Institute of Astrophysics, the National Law School (NLSIU), the Indian Institute of Theoretical Sciences, and the National Institute of Fashion Technology (NIFT) and hence produces a diverse young talent in one city.

89. The overall literacy rate of Bengaluru was 76.5% (85.30% for males and 67.40% for females), which is much higher than the all-India literacy rate of 65.38%. Kannada is the official language of the state of Karnataka, as the native language of 66.54% of its population as of 2011 and is one of the classical languages of India. Urdu is the second most spoken language with 11% of the population mainly spoken by the Muslim community with Hindi and other minority languages spoken by the migrant population in Bangalore.

90. Bengaluru has 29 of large general hospitals, and 11 community health centers.

91. **Economy and Employment.** The economy of Bengaluru is an important part of the economy of India as a whole. It contributes over 87% of GDP of the economy of the State of Karnataka. The establishment and success of high technology firms in Bengaluru has led to the growth of the Information Technology (IT) sector in India. IT firms in Bengaluru employ about 35% of India's pool of 2.5 million IT professionals and account for the highest IT-related exports in the country. Estimates of the city's GDP are around \$110 billion, and it has been ranked as either the fourth- or fifth-most productive metro area of India. In addition to the IT industry, other key economic sectors in the city include real estate, aerospace, space, transportation, grocery, retail, beverages, biopharmaceuticals, consumer goods, healthcare, logistics, fitness, and agriculture.

92. The unemployment rate of Bengaluru is 4.8%, which is lower than the national average of 6.1% in 2018. The labor force ratio between male and female is 71:29 in 2018. Average gross salary of Bengaluru is INR1,384,322, which is higher than national average of INR1,230,725 in 2018.

93. **Road Network.** Bangalore's road network exceeds 3,000 km and consists of ring roads, arterial roads, sub-arterial roads and residential streets. The city's road network is mainly radial, converging in the center. Main roads coming into the city include Bellary Road in the

north, Tumkur Road and Mysore Road in the west, Kanakapura Road, Bannerghatta Road and Hosur Road in the south and Airport Road and Old Madras Road in the east. There are 1.6 million registered vehicles in the city – the second highest for an Indian city, after New Delhi. Development of the city road infrastructure has revolved around imposing one-way traffic in certain areas, improving traffic flow at junctions, constructing ring roads, bridges, flyovers and other grade separators.

94. **Public Utilities.** Electricity in Bengaluru city is supplied by BESCOM, the electrification is 100%. Telecommunication cables are laid overhead along the overhead power distribution lines.

95. There are underground pipelines for gas supply (limited), water supply, drainage, and sewage. Gas Authority of India Ltd (GAIL) is laying pipelines across the city to provide piped natural gas to households in Bengaluru and is targeted to lay 900 km of pipeline by 2021. BWSSB established in 1964 is the governmental agency responsible for water supply to Bengaluru. BWSSB currently supplies approximately 900 million liters of water to the city per day. They are responsible for water supply and sewer system in the city. Total length of water supply pipelines is 10,287.8 km and the total length of sewer system is 8,387.6 km. It is necessary to closely coordinate with GAIL and BWSSB to avoid possible damage of their underground facilities by the works under the proposed project. The depth of other utilities is generally more than 1 m below ground level.

96. Water for the city (with a population of 10 million) comes from a number of sources, with 80% of it coming from the Kaveri River and also the Arkavathy River. Other sources are borewells (groundwater wells are mapped at https://www.google.com/maps/d/viewer?fbclid=IwAR1g-xvZK_ckCR7t4LG1974jAqdN3qBD1VX8TM_wGruHv1QHbcWVuDjFT2Y&mid=1VfGG6kM2od_Qk_fB1piSPA73wrNojqJr2&ll=12.927361216740179%2C77.73454039089509&z=11) and tankers. The tap water may not meet drinking water standards due to pollution and breakages in pipelines.

E. Characteristics of Project Affected Population

97. A sample of 615 households were surveyed at a rate of about 100 households per division. A pilot-field tested and fine-tuned questionnaire by the consultants was used to collect beneficiary information and perceptions. The sample was primarily chosen on stratified random distribution basis geographically from the project area. The sampling details are below:

Table 21: Sample Selected		
	Frequency	Percent
HSR Layout	100	13.9
Koramangala	102	14.2
White Field	101	14.1
Indiranagar	102	14.2
Jayanagar	107	14.9
Shivajinagar	103	14.3
Total	615	100.0

98. The average family size of the project areas is 3.68.

Table 3: Family Size									
Range	1 - 3		3 - 5		5 - 7		More than 7		Total
Division	Freq	%	Freq	%	Freq	%	Freq	%	Freq
HSR Layout	54	54.0	46	46.0	0	0.0	0	0.0	100
Koramangala	51	50.0	51	50.0	0	0.0	0	0.0	102
White Field	52	51.5	46	45.5	3	3.0	0	0.0	101
Indiranagar	31	30.4	50	49.0	15	14.7	6	5.9	102

Jayanagar	43	40.2	62	57.9	2	1.9	0	0.0	107
Shivajinagar	60	58.3	37	35.9	3	2.9	3	2.9	103
Total	291	47.3	292	47.5	23	3.7	9	1.5	615

99. In the project area about 68% of the residents reside in their own houses, whereas about 31% reside in rented accommodation while the rest 3% have other arrangements.

Table 23: Ownership Status of House							
	Own		Rented		Others		Total
	Freq	%	Freq	%	Freq	%	Freq
HSR Layout	71	71.0	29	29.0	0	0.0	100
Koramangala	42	41.2	60	58.8	0	0.0	102
White Field	71	70.3	28	27.7	2	2.0	101
Indiranagar	97	95.1	5	4.9	0	0.0	102
Jayanagar	57	53.3	50	46.7	0	0.0	107
Shivajinagar	80	77.7	23	22.3	0	0.0	103
Total	418	68.0	195	31.7	2	.3	615

100. All the households interviewed had electric connections.

Table 24: HH Having Electricity Connection		
	Yes	
	Freq	%
HSR Layout	100	100.0
Koramangala	102	100.0
White Field	101	100.0
Indiranagar	102	100.0
Jayanagar	107	100.0
Shivajinagar	103	100.0
Total	615	100.0

101. The 615 households surveyed use multiple sources of energy for cooking, 97% use liquid petroleum gas, 41% of the household use induction stove and 22% use electric stove.

Table 25: Type of Cooking Fuel Used						
	LPG		Electric stove		Induction Stove	
	Freq	%	Freq	%	Freq	%
HSR Layout	100	100.0	48	48.0	75	75.0
Koramangala	97	95.1	5	4.9	54	52.9
White Field	100	99.0	37	36.6	73	72.3
Indiranagar	99	97.1	3	2.9	3	2.9
Jayanagar	106	99.1	22	20.6	21	19.6
Shivajinagar	93	90.3	18	17.5	22	21.4
Total	595	96.8	133	21.8	248	40.7

102. Of the 615 households, 98% have a cell phone, 14% have a land phone.

Table 26: Access to Communication Device

	Land phone	Cell phone
	%	%
HSR Layout	32.0	98.0
Koramangala	4.9	100.0
White Field	23.8	100.0
Indiranagar	0.0	93.1
Jayanagar	18.7	99.1
Shivajinagar	4.9	98.1
Total	14.1	98.1

103. The sampled households own an array of household electric appliances. They are television (81%), air conditioner (24%), electric stove (16%), induction stove (34%), electric cooker (34%), geyser (41%), direct-to-home cable (97%), refrigerator (90%), grinder (74%), air cooler (25%), electric Iron (50%) and water heater (46%).

Table 27: HH Having Electric Appliances

	Television	AC	Electric stove	Induction stove	Electric cooker	geyser	DTH	refrigerator	Grinder	Air cooler	electric iron	water heater
	%	%	%	%	%	%	%	%	%	%	%	%
HSR Layout	100.0	67.0	41.0	71.0	67.0	69.0	99.0	97.0	95.0	66.0	73.0	67.0
Koramangala	97.1	2.9	2.0	41.2	1.0	13.7	97.1	92.2	60.8	5.9	24.5	29.4
White Field	98.0	38.6	28.7	70.3	34.7	44.6	95.0	89.1	77.2	34.7	84.2	39.6
Indiranagar	76.5	12.7	1.0	1.0	9.8	11.8	92.2	77.5	58.8	15.7	13.7	9.8
Jayanagar	96.3	23.4	18.7	16.8	24.3	50.5	99.1	85.0	72.9	23.4	33.6	51.4
Shivajinagar	99.0	66.0	4.9	1.9	67.0	68.0	100.0	99.0	81.6	69.9	70.9	73.8
Total	80.7	24.3	16.1	33.6	34.0	41.3	97.1	90.0	74.4	24.5	50.0	46.0

104. Out of the sampled 615 households, 82% of the households have single phase electric connection and 18% of the households have three phase connection. About 78% of these use this connection for domestic purposes and 22% for commercial use as well. All the connected households receive power bills. The frequency of billing is 98% on a monthly basis and 2% on a quarterly basis.

Table 28: Type of Electric Connection

	Single phase		Three phase		Total
	Freq	%	Freq	%	Freq
HSR Layout	84	84.0	16	16.0	100
Koramangala	92	90.2	10	9.8	102
White Field	63	62.4	38	37.6	101
Indiranagar	85	83.3	17	16.7	102
Jayanagar	81	75.7	25	23.4	107
Shivajinagar	99	96.1	4	3.9	103
Total	505	82.1	110	17.9	615

Table 4: Use of Electricity Connection

	Domestic use		Commercial use		Total
	Freq	%	Freq	%	Freq
HSR Layout	63	63.0	37	37.0	100
Koramangala	50	49.0	52	51.0	102
White Field	59	58.4	42	41.6	101

Indiranagar	101	99.0	1	1.0	102
Jayanagar	102	95.3	5	4.7	107
Shivajinagar	103	100.0	0	0.0	103
Total	478	77.7	137	22.3	615

Table 30: HH Receiving Power Bills

	Yes		No		Total
	Freq	%	Freq	%	Freq
HSR Layout	100	100.0	0	0.0	100
Koramangala	98	96.1	4	3.9	102
White Field	100	99.0	1	1.0	101
Indiranagar	102	100.0	0	0.0	102
Jayanagar	107	100.0	0	0.0	107
Shivajinagar	102	99.0	1	1.0	103
Total	609	99.0	6	1.0	615

Table 31: Frequency of Power Billing

	Monthly		Quarterly		Total
	Freq	%	Freq	%	Freq
HSR Layout	99	99.0	1	1.0	100
Koramangala	101	99.0	1	1.0	102
White Field	99	98.0	2	2.0	101
Indiranagar	102	100.0	0	0.0	102
Jayanagar	102	95.3	5	4.7	107
Shivajinagar	101	98.1	2	1.9	103
Total	604	98.2	11	1.8	615

105. Out of the 615 households about 99% of the sample households pay their bills regularly and 1% of payments are erratic. Households use multiple payment options. About 83% of the households pay bills at the BESCOM office, 6% make online payments, about 11% pay at Bengaluru One (a government on-line portal for utility bill payment) and about 3% pay at other places.

Table 32: HH Paying Power Bills Regularly

	Yes		No		Total
	Freq	%	Freq	%	Freq
HSR Layout	100	100.0	0	0.0	100
Koramangala	100	98.0	2	2.0	102
White Field	99	98.0	2	2.0	101
Indiranagar	102	100.0	0	0.0	102
Jayanagar	107	100.0	0	0.0	107
Shivajinagar	101	98.1	2	1.9	103
Total	609	99.0	6	1.0	615

Table 33: Location HH Pays Power Bills

	At BESCOM Office		Online payment		BENGALURU One (Seva Kendra)		Others		Total
	Freq	%	Freq	%	Freq	%	Freq	%	Freq
HSR Layout	96	96.0	4	4.0	0	0.0	0	0.0	100

Koramangala	73	71.6	4	3.9	25	24.5	0	0.0	102
White Field	95	94.1	6	5.9	0	0.0	0	0.0	101
Indiranagar	94	92.2	3	2.9	3	2.9	2	2.0	102
Jayanagar	78	72.9	1	.9	28	26.2	0	0.0	107
Shivajinagar	72	69.9	17	16.5	14	13.6	0	0.0	103
Total	508	82.6	35	5.7	70	11.4	2	.3	615

106. Among the 615 households surveyed, 80% face power interruptions while 20% reported no interruptions. 43% say the interruptions are frequent while 43% say the interruptions are rare. About 14% believe the interruptions are due to maintenance.

Table 54: HH Facing Power Interruption/Cuts					
	Yes		No		Total
	Freq	%	Freq	%	Freq
HSR Layout	97	97.0	3	3.0	100
Koramangala	99	97.1	3	2.9	102
White Field	92	91.1	9	8.9	101
Indiranagar	79	77.5	23	22.5	102
Jayanagar	94	87.9	13	12.1	107
Shivajinagar	33	32.0	70	68.0	103
Total	494	80.3	121	19.7	615

Table 34: Frequency of Power Interruption/Cuts									
	Frequent		Rare		During maintenance		Others		Total
	Freq	%	Freq	%	Freq	%	Freq	%	Freq
HSR Layout	54	55.7	40	41.2	3	3.1	0	0.0	97
Koramangala	36	36.4	60	60.6	3	3.0	0	0.0	99
White Field	33	35.9	42	45.7	16	17.4	1	1.1	92
Indiranagar	10	12.7	58	73.4	11	13.9	0	0.0	79
Jayanagar	56	59.6	3	3.2	35	37.2	0	0.0	94
Shivajinagar	23	69.7	8	24.2	2	6.1	0	0.0	33
Total	212	42.9	211	42.7	70	14.2	1	.2	494

107. Of those households who experience power cuts, 61% receive information about power cuts during maintenance.

Table 35: HH Getting Information About Power Cuts During Maintenance					
	Yes		No		Total
	Freq	%	Freq	%	Freq
HSR Layout	62	63.9	35	36.1	97
Koramangala	45	45.5	54	54.5	99
White Field	48	52.2	44	47.8	92
Indiranagar	29	35.4	50	63.3	79
Jayanagar	93	98.9	1	1.1	94
Shivajinagar	26	72.7	7	21.2	33
Total	303	61.3	191	38.7	494

108. Of those who receive information, 81% receive through it through a newspaper, 14% through TV Scrolls and 5% by other means.

Table 36: Source Through Which HH Received Information About Power Cuts During Maintenance							
	Newspaper		TV scrolls		Others		Total
	Freq	%	Freq	%	Freq	%	Freq
HSR Layout	62	100.0	0	0.0	0	0	62
Koramangala	39	86.7	6	13.3	0	0	45
White Field	35	72.9	6	12.5	7	14.6	48
Indiranagar	16	57.1	7	25.0	5	17.8	28
Jayanagar	83	89.2	9	9.7	1	1.1	93
Shivajinagar	8	33.3	13	54.2	3	12.5	24
Total	243	81.0	41	13.7	16	5.3	300

109. Of the 615 surveyed households, 51% have alternate arrangements during power cuts (Battery Inverters/ Solar Panel/ Diesel Generator), while the remaining 49% do not have any alternate arrangements.

Table 37: HH Having Alternate Arrangements During Power Cuts					
	Yes		No		Total
	Freq	%	Freq	%	Freq
HSR Layout	67	67.0	33	33.0	100
Koramangala	51	50.0	51	50.0	102
White Field	52	51.5	49	48.5	101
Indiranagar	23	22.5	79	77.5	102
Jayanagar	82	76.6	25	23.4	107
Shivajinagar	39	37.9	64	62.1	103
Total	314	51.1	301	48.9	615

110. Of those who have back up power arrangements, 3% invested more than INR20,000/-, about 33% have invested between INR10,000/- to INR20,000/-, about 25% have invested less than INR10,000/- and about 40% do not know how much they invested.

Table 6: HH Investment In Power Backup									
	Don't know		Less than Rs 10000		Rs 10000- 20000		More than Rs 20000		Total
	Freq	%	Freq	%	Freq	%	Freq	%	Freq
HSR Layout	37	55.2	18	26.9	12	17.9	0	0.0	67
Koramangala	11	21.6	33	64.7	7	13.7	0	0.0	51
White Field	9	17.3	7	13.5	32	61.5	4	7.7	52
Indiranagar	8	34.8	0	0.0	15	65.2	0	0.0	23
Jayanagar	22	26.8	20	24.4	36	43.9	4	4.9	82
Shivajinagar	37	94.9	0	0.0	2	5.1	0	0.0	39
Total	124	39.5	78	24.8	104	33.1	8	2.5	314

111. Of the surveyed households, 92% are using multiple power saving devices; these are (i) Compact Fluorescent Lamp Lighting (11%); (ii) LED Lighting (37%); and (iii) other power saving appliances (52%). About 97% of them are satisfied with the performance of these devices.

Table 7: HH Using Power Saving Devices/Lighting					
	Yes		No		Total
	Freq	%	Freq	%	Freq
HSR Layout	100	100.0	0	0.0	100
Koramangala	102	100.0	0	0.0	102
White Field	96	95.0	5	5.0	101
Indiranagar	87	85.3	15	14.7	102
Jayanagar	107	100.0	0	0.0	107
Shivajinagar	76	73.8	27	26.2	103
Total	568	92.4	47	7.6	615

Table 40: Types of Power Saving Devices Used in House							
	CFL lighting		LED lighting		Power saving rated appliance		Total
	Freq	%	Freq	%	Freq	%	Freq
HSR Layout	4	4.0	97	97.0	99	99.0	100
Koramangala	14	13.7	92	90.2	102	100.0	102
White Field	28	29.2	80	83.3	96	100.0	96
Indiranagar	31	35.6	47	54.0	85	97.7	87
Jayanagar	39	36.4	65	60.7	83	77.6	107
Shivajinagar	1	1.3	0	0.0	76	100.0	76
Total	117	11.3	381	36.7	541	52.1	1,039

Table 41: HH Satisfaction Regarding Use of Power Saving Lighting/Appliance					
	Yes		No		Total
	Freq	%	Freq	%	Freq
HSR Layout	100	100.0	0	0.0	100
Koramangala	101	99.0	1	1.0	102
White Field	91	94.8	5	5.2	96
Indiranagar	76	87.4	11	12.6	87
Jayanagar	104	97.2	3	2.8	107
Shivajinagar	76	100.0	0	0.0	76
Total	548	96.5	20	3.5	568

112. Among these households, the knowledge about use of power saving devices is through multiple sources; these are (i) newspapers (50%); (ii) TV advertisements (15%); (iii) retail appliance sellers (20%); (iv) BESCOM (13%); and (v) friends or relatives (2%).

Table 42: HH Source of Knowledge About Use of Power Saving Devices											
	From Newspaper		TV ads		Appliance seller		BESCOM		Friends or relatives		Total
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq
HSR Layout	91	91.0	4	4.0	5	5.0	0	0.0	0	0.0	100
Koramangala	91	89.2	5	4.9	6	5.9	0	0.0	0	0.0	102
White Field	51	53.1	29	30.2	6	6.3	2	2.1	8	8.3	96
Indiranagar	6	6.9	44	50.6	9	10.3	27	31.0	1	1.1	87
Jayanagar	48	44.9	4	3.7	10	9.3	45	42.1	0	0.0	107
Shivajinagar	0	0.0	1	1.3	75	98.7	0	0.0	0	0.0	76

Total	287	50.5	87	15.3	111	19.5	74	13.0	9	1.6	568
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Table 43: Awareness About Power Saving By BESCOM

	Freq	%
Ad about CFL use	3	3.5
At BESCOM office ad about CFL/LED use	15	17.4
Paper Ad	41	47.7
SMS	27	31.4
Total	86	100.0

113. Of the surveyed households, 50% have lodged a complaint regarding power supply. Of these 61% lodged complaints at the BESCOM office, 38% with linemen and the remaining through on-line portal.

Table 8: HH Lodging a Complaint Regarding Power Supply

	Yes		No		Total
	Freq	%	Freq	%	Freq
HSR Layout	84	84.0	16	16.0	100
Koramangala	66	64.7	36	35.3	102
White Field	48	47.5	53	52.5	101
Indiranagar	63	61.8	39	38.2	102
Jayanagar	45	42.1	62	57.9	107
Shivajinagar	6	5.8	97	94.2	103
Total	312	50.7	303	49.3	615

Table 45: Where HH Lodge Complaint

	BESCOM office		Line men		Online		Total
	Freq	%	Freq	%	Freq	%	Freq
HSR Layout	54	64.3	30	35.7	0	0.0	84
Koramangala	26	39.4	40	60.6	0	0.0	66
White Field	37	77.1	10	18.8	1	2.1	48
Indiranagar	44	69.8	19	28.6	0	0.0	63
Jayanagar	26	57.8	18	37.8	1	2.2	45
Shivajinagar	1	16.7	1	16.7	1	16.7	6
Total	188	60.8	118	38.2	3	1.0	309

114. The nature of complaints relate to (i) frequent shut down (52%); (ii) regarding metering (18%); (iii) low voltage (29%); (iv) billing related (1%); and (v) hanging cables (1%).

Table 46: Nature of Compliant

	Frequent shut down		Regarding metering		Low voltage		Billing related		Hanging cables		Total
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq
HSR Layout	56	66.7	3	3.6	25	29.8	0	0.0	0	0.0	84
Koramangala	27	40.9	1	1.5	38	57.6	0	0.0	0	0.0	66

White Field	31	64.6	4	8.3	11	22.9	0	0.0	2	4.2	48
Indiranagar	19	30.2	42	66.7	2	3.2	0	0.0	0	0.0	63
Jayanagar	26	57.8	3	6.7	13	28.9	3	6.7	0	0.0	45
Shivajinagar	4	66.7	2	33.3	0	0.0	0	0.0	0	0.0	6
Total	163	52.2	55	17.6	89	28.5	3	1.0	2	.6	312

115. The average time taken to solve a complaint is 1 day for about 84%, within 3 days for 11% and 1 week for 6% of complaints.

Table 47: Average Time Taken to Solve Complaint							
	Within 1 day		Within 3 days		Within 1 week		Total
	Freq	%	Freq	%	Freq	%	Freq
HSR Layout	84	98.8	0	0.0	0	0.0	84
Koramangala	64	97.0	2	3.0	0	0.0	66
White Field	47	97.9	0	0.0	1	2.1	48
Indiranagar	22	34.9	26	41.3	15	23.8	63
Jayanagar	39	86.7	4	8.9	2	4.4	45
Shivajinagar	5	83.3	1	16.7	0	0.0	6
Total	261	83.7	33	10.6	18	5.8	312

116. The average monthly income of the surveyed households is INR24,133, and average monthly expenditure is INR19,485.

Table 9: HH Average Monthly Expenditure											
	No response		Less than Rs 5000		Rs 5000 - 10000		Rs 10000 - 20000		More than Rs 20000		Total
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq
HSR Layout	1	1.0	0	0.0	18	18.0	46	46.0	35	35.0	100
Koramangala	0	0.0	5	4.9	25	24.5	39	38.2	33	32.4	102
White Field	2	2.0	3	3.0	26	25.7	23	22.8	47	46.5	101
Indiranagar	5	4.9	5	4.9	20	19.6	41	40.2	31	30.4	102
Jayanagar	3	2.8	0	0.0	11	10.3	70	65.4	23	21.5	107
Shivajinagar	17	16.5	5	4.9	37	35.9	30	29.1	14	13.6	103
Total	28	4.6	18	2.9	137	22.3	249	40.5	183	29.8	615

Table 10: HH Average Monthly Income											
	No response		Less than Rs 5000		Rs 5000 - 10000		Rs 10000 - 20000		More than Rs 20000		Total
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq
HSR Layout	3	3.0	0	0.0	20	20.0	54	54.0	23	23.0	100
Koramangala	0	0.0	1	1.0	5	4.9	63	61.8	33	32.4	102
White Field	5	5.0	2	2.0	16	15.8	41	40.6	37	36.6	101
Indiranagar	5	4.9	1	1.0	4	3.9	15	14.7	77	75.5	102
Jayanagar	15	14.0	1	.9	3	2.8	43	40.2	45	42.1	107
Shivajinagar	94	91.3	0	0.0	1	1.0	2	1.9	6	5.8	103
Total	122	19.8	5	.8	49	8.0	218	35.4	221	35.9	615

V. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

117. Environmental impacts and risks will result from both the location of the project components and the scope of the proposed project. The impact assessment is structured by the three development phases of the proposed project, defined by the (i) pre-construction; (ii) construction; and (iii) O&M phases. This structure is carried forward and used to structure the EMP for the project. Impacts and risks have been categorized as being of Maximum, High, Medium, Low or Minimal significance based on Figure 32 and Tables 50 to 51, this methodology has been developed by BESCOM consultants for the assessment. Impacts of Maximum or High significance require detailed assessment and/or quantification. However, mitigation is required for all potential impacts to ensure residual significance is reduced to the extent possible.

Figure 35: Significance Factors

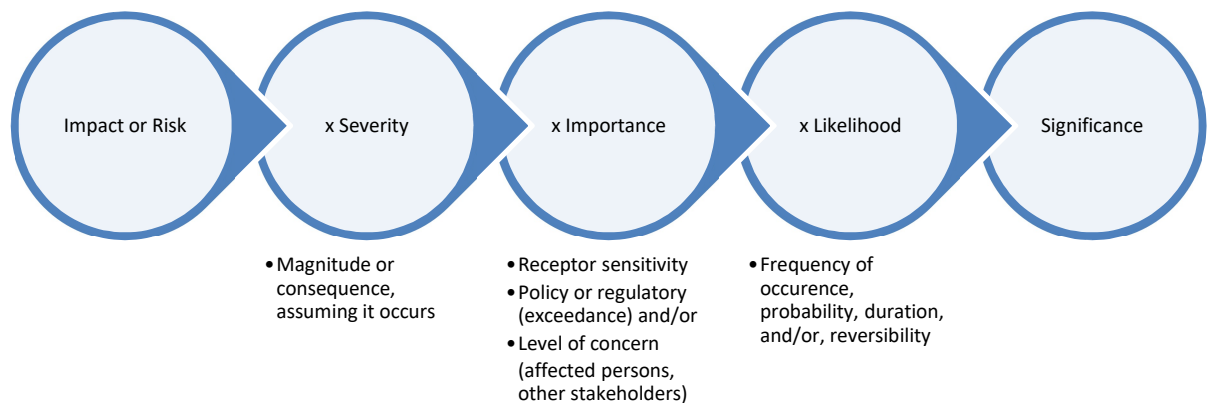


Table 50: Significance Factors

Category	Maximum	High	Medium	Low	Minimal
Severity Factors:					
Magnitude Change (quantified amount)	Very Large	Large	Medium	Small	Very Small (negligible)
Consequence	Critical (catastrophic)	Major	Moderate	Minor	Minimal (negligible)
Importance Factors:					
Receptor Sensitivity	International	National	State	Local/Community	Individual
Policy or Regulatory (exceedance)	Large	Medium	Small	None	Not Regulated
Level of Concern	Global/National	Regional/State	Division/District	Community/Block	Individual
Likelihood Factors:					
Occurrence	Continuous	Frequent	Occasional	Infrequent	Rare
Probability	Certain	Likely	Possible	Unlikely	Improbable
Duration	Very long term, > 3 years	Long term, > 1 year	Medium term, < 1 year	Short term, < 1 month	Very short term, < 1 week
Other Factors:					
Reversibility	Irreversible	Reversible with effort in long term	Reversible with ease in long term	Reversible with effort in short term	Reversible with ease in short term

Table 51: Significance Determination

<u>Severity Importance or Likelihood</u>	Maximum	High	Medium	Low	Minimal
Maximum	Maximum	Maximum	High	Medium	Medium
High	Maximum	High	Medium	Medium	Low
Medium	High	High	Medium	Low	Low
Low	High	Medium	Low	Low	Minimal
Minimal	Medium	Medium	Low	Minimal	Minimal

A. Potential Impacts and Mitigation Measures during Pre-construction Phase

118. Preparations for construction, including establishing the contractor's environment, health and safety management arrangements to mitigate construction related impacts, as discussed in Section 5.2 and detailed in Annex 2, will occur during pre-construction. This will include the development of a construction environmental management plan (CEMP) to provide details on how they plan to implement the project EMP and relevant parts of the IFC EHS Guidelines on Construction and Demolition. The CEMP will identify the temporary construction facilities required for the construction package e.g. laydown area, stores, temporary workers facilities etc. There will also be some final planning of the cable alignment and transportation of equipment and materials to the site ready for their installation.

119. Inappropriate planning and design during the pre-construction phase could lead to disruption and disturbance of residents, businesses, and other members of the community using the projects streets during construction. In particular, existing above and below ground assets, including other public utilities (telecoms, gas, water, supply, drains and sewerage) and locally important biodiversity or physical cultural resources may be damaged. However, potential impacts associated with undergrounding the distribution lines (or providing aerial bunched cables where retaining overhead lines) will be avoided or minimized as far as possible through careful route selection by BESCO during the design stage as discussed in Section 3.7. In particular, given community concerns attention will be paid to ensuring that drainage channels (underground sewers and surface water drains) are protected by appropriately setting back the trenches from them in consultation with BWSSB and BBMP.

120. The underground cables generally follow the existing alignments of overhead distribution lines and the existing RoW of roads and sidewalks to cause minimum inconvenience to the public. Hence, no additional land will be required for undergrounding cables. The RMUs will have a very small footprint. The contractor will be required to consult adjacent residents, businesses, and community facilities prior to any construction works.

121. There are no ecologically protected areas or critical habitat present, as the project is on urban streets in the developed urban area of Bengaluru city. The main habitat and vegetation types encountered, if any, given the highly modified and dense urban environment, are verges or embankments with grasses bordering sidewalks and herb like plants in the urban landscape of local/community importance. There are almost no mature trees along the underground cable route, as it uses the same corridor as the present overhead lines for which safety clearances to trees already need to be maintained through regular tree trimming by BESCO, and any cutting of trees in the urban area for project purposes will be avoided by the use of trenchless technology. To further mitigate any impacts, excavation pits will be placed to avoid the area beneath tree crowns (zone for root protection) and other vegetation. No trees are to be cut unless at risk of causing a public safety hazard due to root damage, and any that are cut will be replaced by native species near the same location. The contractor will monitor the progress of any replacement planting to ensure the same number of trees remains established after two years so "no net loss of biodiversity" is achieved.

122. The contractor will be required to undertake some final planning of the cable alignment.¹⁵ While BESCO has already sought to avoid above ground assets, use of trenchless technology means it is not possible to see what is being drilled through, so without mitigation it is likely some damage to below ground assets would be caused. The contractors will need to determine where below ground assets are located through consultations with concerned agencies and underground utility scanning of the proposed alignments. Informed by the survey results the excavation pits can be placed to avoid them, or if it is not possible to avoid, then the relevant permits and/or clearances will be obtained in advance. Completing pre-construction surveys will enable the contractors to document the presence and condition of above and below ground property and substantially reduce the possibility that telecoms services could be interrupted, or there could be a breakage in gas, water supply, drain, or sewerage pipe with knock on environment, health and safety consequences on the local community as well as interruption in supplies. Then, in the event they cause any unforeseen damage to property they will be required to repair the damage and/or compensate it, for example, by providing an alternative clean drinking water source to customers if a water pipeline is damaged.

123. Transportation of equipment and materials to the site and other site preparation activities could cause minor traffic disruption to road and sidewalk users, particularly if poor traffic controls are put in place, and/or these activities are conducted during the rush hour, although any such disruption will be of short duration. To mitigate the impacts, the contractor will be required to develop and comply with a traffic management plan in consultation with relevant local authorities to ensure proper execution of traffic controls including that highly visible guides, advance warning signs, or flag persons are in place to direct pedestrian and vehicular traffic around the works area as required. Further the contractor will schedule transportation to the site and conducting of any site preparation activities during non-rush hour (i.e. avoid the hours of 6 am to 8 am and 4pm to 6 pm) and in conjunction with other construction works to minimize the cumulative impacts they may cause traffic congestion.

124. The most significant impact related to the project design relates to use of SF₆ in the RMUs of which there will be 1,638 installed. SF₆ is a non-toxic but potent GHG with a long atmospheric lifetime. 1kg has a global warming potential of 22,800 carbon dioxide equivalent (CO₂e). Depending on its design, an RMU generally contains between 1-5kg of SF₆. In the event of a major leak, up to 114 tons CO₂e could therefore be released from one unit, 186,732 tons CO₂e in total for this project. This is a worst case scenario and, although climate change is a global concern, the environmental impact of this release of SF₆ from the project is small in percentage terms compared to the 36 billion annual global CO₂e emissions (<0.001%) and 2,202 million tons annual Indian CO₂e emissions (<0.01%).

125. By further reducing the amount of SF₆ in the RMUs to less than 2kg the CO₂e of the project can be reduced below 100,000 tons which ADB's Safeguard Policy Statement (2009) (footnote 10, Appendix 1) defines as a significance threshold. Further, the SF₆ emissions are not continuous but only in the event of leakages or poor waste handling of old, end-of-life equipment which can be managed by BESCO. To minimize leakages the RMU will need to be sealed pressure "sealed for life" units, tested and guaranteed by the supplier at less than 0.1% leakage rate so that there is a total leakage of less than 100 tons CO₂e/annum total. The RMU will be designed such that any leakage of SF₆ will trigger an alarm at the nearest concerned O&M Unit requiring O&M staff to rectify the leak immediately.

¹⁵ Prior to any pre-construction consultations and survey works being undertaken, since surveyors are at medium risk of exposure due to potential public interaction, BESCO and Contractor to develop procedures to ensure that national COVID-19 requirements and WHO workplace and hand hygiene guidelines are followed, including providing awareness raising activities for surveyors, minimizing travel requirements, undertaking screening health checks to confirm those going in the field are not symptomatic, providing surveyors with adequate supplies of personal hand sanitizer and masks, ensuring social distancing of at least 1m, that masks are worn at all times during consultations, and that a register of all contacts is maintained etc. Annex 6 provides guidance for BESCO and the contractor to follow during such activities.

Table 52: Summary of Impact Assessment for Pre-Construction

Potential impact	Factors	Significance	Include Mitigation Measures in EMP?	Residual Significance
Land take and changes in topography required because of project design for the undergrounding of cables and installing RMUs	Very small impact, local receptor, community concern, very short term, reversible with ease in short term	Minimal	No	Minimal
Release of SF ₆ as greenhouse gas resulting in climate change impact due to purchase of RMUs	Small impact, global concern, infrequent but likely without mitigation, unlikely with, very long term, irreversible	Medium	Yes	Medium
Disturbance of urban trees and other vegetation (if any) during construction works because of the project design	Very small impact, local receptor, community concern, unlikely with mitigation, reversible with ease in long term	Low	Yes	Low
Damage to above ground property and other public utilities' underground assets during construction works because of the project design	Moderate impact, local receptor, community concern, likely without mitigation, unlikely with, reversible with effort in short term	Medium	Yes	Low
Traffic disturbance during transportation of equipment and materials to the site	Minor impact, local receptor, community concern, likely without mitigation, unlikely with, short term duration	Medium	Yes	Low

B. Potential Impacts and Mitigation Measures during Construction Phase

126. The main impacts of this phase are incurred from the excavation of roads and sidewalks for the entry/exit pits for installation of underground cables using trenchless technologies, excavation of open trenches in the 10% of cases where adequate open space with no social safeguards constraints allows this more basic construction methodology to be used, and the presence of construction work and workers at project sites across the city. BESCOM needs to coordinate with the Bruhat Bengaluru Mahanagara Palike (BBMP) (municipal corporation) during fixing the alignment and construction method to be used and seek their no objection. The potential impacts include:

- (i) **Pollution incident affecting soils, surface water, and groundwater** – Per Table 16, some major water bodies (lakes) are in the project subdivisions, cable alignments are along existing overhead line corridors, hence, while they may be on the roads directly bordering them undergrounding of lines will not directly affect the lakes, although this will be reconfirmed on site by the contractor. However, the quality of surface water runoff entering the surface water drainage system, and thus waterbodies connected to it, may be affected by the discharge of water from the project sites, mainly used as drilling fluid and for spraying around the entry and exit pits to prevent diffusion of dust from excavation and drilling activities. The amount of water to be used during installation of the underground cables is small, about 4m³/day/drilling site. Most of this water will be directly absorbed into the ground and the amount of surface water runoff generated will be very small, as per BESCOM experience it will be approximately 1% of the water supplied to construction or 0.04 m³ or 40 liters per day discharged to the surface water drainage. Undertaking works particularly for installation of open trenches will be during monsoon season will be avoided, so as prevent the need to pump out water.

The (a) accidental leakage or spillage of inappropriately stored fuel, oil, or chemicals used during works; and (b) inappropriate disposal of sanitary wastewater generated by the presence of construction workers (290 people in total

across the entire project area, generating between 26–61 liters per day of wastewater each, or 7,540–17,690 liters per day) could also affect the quality of surface water runoff or result in infiltration of pollutants to soils and groundwater. Impacts will be more likely if pollution control measures are not adopted. Since the installation work of underground cable will take place in the urban area, and engineers and laborers can be hired locally, the need for the establishment of temporary residential labor camps by contractors is not envisaged. No pumping of any wastewater is involved.

To minimize the occurrence or consequences of a pollution incident, the CEMP developed pre-construction will include a pollution prevention plan (PPP) supported by training of workers covering environmentally sound and safe storage and use of all fuels, chemicals and oils used on site and management of excavations to avoid sediment laden surface runoff, reflecting the mitigation measures detailed in Annex 2, national requirements and the IFC EHS General Guidelines with an emergency preparedness and response plan in the event of any leaks or spills. Plant containing oil and diesel is also to be mounted on drip trays to catch leaks. If not in use oil/fuel/chemicals to be stored in drums under lock and key on drip trays. Spill equipment materials (sorber pads, loose sorber material, etc.) will be kept on hand at each project site for immediately soaking up any leaks or spills that do accidentally occur.

For each project site, the contractor will provide an adequate number of self-contained portable toilets with sinks for construction workers for later disposal of wastewater off-site to existing wastewater treatment facilities or access to alternative sanitary facilities (e.g. existing public toilets) that do not allow the untreated disposal of sewage to adjacent water bodies. Use of pit latrines will be prohibited as will be open defecation and urination and uncivil use of roads or private premises by construction workers.

No new transformers are envisaged but if required they will need to be certified PCB free;¹⁶ further no asbestos containing materials must be used during the construction.

PCB oils being non-biodegradable and carcinogenic are subject to international phase out of use under the Stockholm Convention. The Project does not include for the replacement or rehabilitation of existing transformers to which the underground cables will connect but the risk such transformers may still contain PCBs needs to be considered by BESCO in relation to national regulations. Under normal operating conditions loss of oil containing PCBs to the environment should not occur if transformers are well maintained. Thus, Government of India Regulation of Use, Handling and Disposal of Polychlorinated Biphenyls permits the use of existing PCB containing equipment up until 31.12.2025 provided it is within its certified lifetime and properly maintained without possibility of leakage or release of PCBs into the environment with disposal of waste PCBs or contaminated equipment by 2028 in accordance with the Stockholm Convention.¹⁷

BESCO has a legal responsibility to replace any existing transformers which contain PCBs. However, health and safety risks to contractors and communities need to be considered in the short term if transformers are in a poor state of repair

¹⁶ In India, insulating oil in transformers is usually required to meet Indian Standard 335:2018 (<https://bis.gov.in/wp-content/uploads/2018/12/PM-IS-335-final.pdf>) – such mineral oil is flammable and also poorly biodegradable.

¹⁷ In decommissioning and disposing of old transformers BESCO will be required to follow the Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 for transport, storage, and disposal of potentially PCB oil containing transformers. Disposal should involve facilities capable of safely transporting and disposing of hazardous waste containing PCBs.

and leaking oil. PCBs were not manufactured in India although transformers containing PCBs were made by a couple of companies up until 2004-2006 and their import was only banned in 2016. Since that was only 3 years ago and equipment nameplates and maintenance records may have also been altered during retrofits it cannot be assumed that any transformers in the project area are PCB free. In the absence of documentary evidence (e.g. contract specification or certification for supply of original transformer, maintenance records for oil replacement including material safety data sheet, or transformer oil test results etc.) for given transformers confirming they are PCB-free, all old transformers must be considered by the contractor at risk of containing PCBs. However, the risk is significantly lower for transformers manufactured post-2003 since by that time Indian regulations on reprocessing and recycling of used oil limiting PCB content had been introduced (Table 53).

Table 53: Risk of Transformers Containing Polychlorinated Biphenyls (PCBs)

Risk of containing PCBs	Date of manufacture
High	No date, tampered rating plate, or dating pre-1994 (ceased global manufacture) Brand listed by UNIDO in Table 5 of their 2014 Guidelines for PCB Waste Identification, Tracking and Recording ¹
High-Medium	Pre-2004 (reuse of waste oils 20.5.03)
Medium-Low	Post-2003 (reuse of waste oils 20.5.03)
Low	Post-2016 (national ban import 6.4.16)

- (ii) **Generation of dust and exhaust emissions** – the installation work for the cables is close to crowded residential and commercial areas, including sensitive receivers such as residential households, schools, hospitals, temples etc. There may be a worsening of the ambient air quality due to (a) dust from soil excavation for the entry and exit pits for the cable, and (b) emissions from the operation of diesel-fueled equipment (excavator, drill and winch) and construction vehicles. Further, as the project is in a degraded airshed for PM10 and NOx national ambient air quality regulations are already breached.

Dust will likely be diffused around the excavation pits if preventative measures are not taken. Excavation is limited to 1 m x 1 m x 1 m for each entry and exit pit for trenchless technology, two of them per 150m section and the majority of dust is anticipated during the surface cutting of the sidewalks and roads (maximum 1 hour of work per section) so any impact will be small and for only a very short duration. However, when open trenches of 0.6 m x 1 m are used greater amount of dust will be generated although still only for a short duration. Good housekeeping will be required with stockpiles of dusty materials kept to a minimum and covered with a canvas or tarpaulin. The contractor will frequently need to spray water using specialized water tankers of 4.5m³ at the project sites and along the transport routes where sensitive receptors are located to minimize dust. During dry and windy days, they will need to spray a minimum of twice a day but more often if needed. Dust emissions will be further minimized by adopting a rolling construction method and immediately restoring the surface of excavated pavements once construction activities are completed on a 150m section.

For running the equipment (maximum 5 hours per section) a maximum of 35 liters of diesel fuel per 150-meter section will be used, or about 1.7 million liters in total

for 7,241 km. Pollutants (PM, NO_x, SO₂) in the diesel exhaust gas will affect the quality of ambient air to a degree in the immediate vicinity of the works, and for a short time period but in an already degraded airshed for PM₁₀ and NO_x. Equipment and vehicles should meet national emissions requirements, obtain a pollution under control (PUC) certification and be maintained in good working order.

Generation of noise and vibration – the installation work for the cables is close to crowded residential and commercial areas, including sensitive receivers such as local residential households, schools, offices, hospitals, temples etc. There may be noise and vibration created around the installation section (150m per section) due to the operation of equipment (excavator, drill, and winch) and vehicles.

The contractor will be required to comply with the Noise Pollution (Control and Regulation) Rules, 2000 – in the vicinity of residential properties noise levels must be limited to 55dB(A) as 1 hour LAeq during the daytime and if night-time work is permitted, although it should seek to be avoided, it must be limited to 45dB(A) as 1 hour LAeq to comply with the WHO noise guidelines that are property not area based. Given these levels may already exceeded (Table 54) any increase in noise levels because of the project should be <3dB(A) which is barely noticeable to the human ear. If these requirements cannot be met, the contractor will be required to implement additional noise mitigation measures such as adjusting the working methods, minimizing the duration of noisy activities, or placing temporary noise barriers around equipment to ensure that they are.

During the installation work for the cable, noise will increase in an already noisy environment as seen from Table 13. The noisiest activity (Table 54) is drilling resulting in a noise level of about 92dB(A) compared to the quietest daytime noise level of 63dB(A) and night time level of 55dB(A) recorded in Table 13 resulting in an increase of >3dB(A) during the day for a distance of up to 20m, and during the night for a distance of up to 50m.

Table 54: Sound Power Levels of Equipment Used

Equipment Used	SPL at 1m (dB)
Excavator	80
Drill	100
Winch	80

Noise pollution from the sidewalk and road surface cutting for entry and exit pits (1 x 1 x 1 meter each) will be for a maximum of 1 hour per section, and from equipment operation will be for a maximum of 5 hours intermittent per section so any increase in noise levels will be of very short duration. Further, HDD equipment will use water as a drilling fluid to reduce noise levels. However, noise pollution will most affect the sensitive receivers located within up to about 50m if they are not informed in advance of the works and the scheduling of installation is not properly organized, the best timing depends on the condition of sensitive receivers i.e. night time work will be best for commercial and school areas, and day time and office hours will be best for residential areas, and noisy activities should be avoided during exam periods, prayer times, religious or cultural events near any sensitive receptors. If works that result in an increase of >3dB(A) cannot be timed to avoid disturbing sensitive receptors temporary noise barriers will be placed around equipment. Temporary noise barriers are available that can theoretically reduce noise levels by up to 30dB(A) which would be sufficient to mitigate the noise impact of drilling at any sensitive receptors within up to 20m given a quietest daytime noise level of 63dB(A) although night time work may need to be avoided due to the quieter background.

- (iii) **Waste generation** – inert, solid and hazardous wastes will be generated from (a) soil excavation of entry and exit pits i.e. sidewalk and road surface excavation; (b) plastic and paper garbage from meals and drinks of construction workers at installation sites; (c) operation and maintenance of construction equipment such as waste oil, oily cloths, or, lubricants; and (d) about 7,241 km of removed overhead electric cables and old poles which will be taken down.¹⁸

Construction wastes including soil, concrete, and/or asphalt may be generated by excavation activity for the entry and exits pits. The estimated amount of such waste per section would be a maximum 1.5 m³ so for 7,241 km of cable this equates to 72,410m³ of inert waste. If not properly collected/stored by the contractors and recycled or disposed of by licensed waste operators within 48 hours the wastes will be likely left on site or dumped without authorization in the urban area to pollute the local neighborhood. This construction waste will be inert and can preferably be reused/recycled for aggregates although Bengaluru does not yet have a construction and demolition waste processing plant, or, if not possible, disposed of at an authorized location in Bengaluru for construction and demolition waste (Table 55) following the applicable regulations. It must be ensured that this inert waste is not contaminated with solid and hazardous waste by maintaining good housekeeping for collection/storage.

The removed overhead line cable and poles (especially any wooden poles which may contain preservatives and so be hazardous waste) will also have to be properly recycled or disposed of by an authorized waste disposal and recycling company¹⁹ following the applicable regulations. Unwanted cables and poles will be stored in BESCO's existing stores and auctioned to authorized and approved bidders with appropriate KSPCB approvals.

¹⁸ Existing poles will be removed, but some may be retained for street lighting or where 1.1 kV aerial bundled cables are used instead of undergrounding them.

¹⁹ Details of metal recyclers in Karnataka state available at https://kspcb.gov.in/other%20waste%20&%20corrugated%20boxe_24-11-2018.pdf

Table 55: Authorized Locations in Bengaluru for C&D Waste Disposal

Sl No.	Name of the location	Address	Extent of area in acres	Nearby zone
01.	Mallasandra	Sy. No. 33, Mallasandra grama, Yeshwanthpur hobli Bangalore, North Taluk	30	R.R. Nagar/West
02.	Kadu Agrahara	Sy. No. 34, Kadu Agrahara grama, Bidhrahalli hobli, Bangalore East Taluk	18	Mahadevpura
03.	Srinivasapura & Kogilu	Sy No. 15, Srinivasapura & Kogilu grama, Yelahanka Hobli, Bangalore North Taluk	10	Yelahanka
04.	Gollahalli	Sy No. 58, Gollahalli grama, Uttarahalli Hobli, Bangalore South Taluk	60	Bommanahalli & South
05.	Kannur	Sy. No. 50, Kannur grama, Bidhrahalli hobli, Bangalore East Taluk	50	East
06.	Guddadahalli	Sy.No. 43, Guddadahalli grama, Hesarahatta hobli, Bangalore North Taluk	46.31	Dasarahalli
07.	Mittaganahalli	Sy.No. 02, Mittaganahalli grama, Bidhrahalli hobli, Bangalore East Taluk	10	East/Mahadevpura

Source:

<http://bbmp.gov.in/documents/10180/452630/Guidelines+For+Construction+And+Demolition+%20Waste+Management.pdf/5c9699ff-0f2e-45ce-b17f-413aca3b0b8e>

The number of workers in total will be about 290 people in total covering all 17 subdivisions. Since the installation work of underground cable will take place in the urban area, and engineers and laborers can be hired locally, the need for the establishment of temporary labor camps is not envisaged. Therefore, there will be no additional solid waste from camps and no domestic wastewater for camps. However, there will be some garbage disposed of by construction workers during the installation work such as plastic bottle/can of drink, and disposable food containers (plastic and/or paper) and organic food matter used for lunch etc. This waste will likely pollute the neighborhoods if not properly collected/stored by the contractors and recycled or disposed of by licensed waste operators but left on site or dumped without authorization in the urban area. It must therefore be recycled or disposed of at an authorized facility²⁰ with the capability of handling solid waste following the applicable regulations.

Some hazardous waste may be generated from operation and maintenance of equipment such as waste oil, oily cloths, and lubricants. This waste will likely pollute the neighborhoods if not properly collected/stored by the contractors and disposed of by licensed waste operators but left on site or dumped without authorization in the urban area. It must therefore be recycled or disposed of at an authorized facility (incinerator) with the capability of handling hazardous waste²¹ following the applicable regulations.

²⁰ Details of secured landfill in Karnataka state available at https://kspcb.gov.in/Land%20fill%20sites_09-08-2019.pdf

²¹ Details of hazardous waste facilities in Karnataka state available at https://kspcb.gov.in/commonHWincinerators_2962019.pdf

In the first instance the contractor must seek to minimize the amount of waste generated, for example, by reusing excavated soil for filling the entry and exit pits, and recovering any recyclable wastes that could be reused or sold to recyclers, such as old overhead electric cables and poles, to the extent possible. The CEMP developed pre-construction will include a construction waste management plan (CWMP) supported by training of workers covering environmentally sound and safe storage, collection, reuse/recycling and disposal of all the types of waste generated by the project reflecting the mitigation measures detailed in Annex 2, national requirements and the IFC EHS General Guidelines. For transparency records of all wastes generated and transfer records to the licensed waste operators will be kept by the contractor. Burning and dumping of wastes on the side of the road, in drains etc. will be prohibited.

- (iv) **Damage to property and temporary outages** – installation of the underground cable may cause damage to local property including roads, sidewalks, and other above or below ground public utilities. Pre-construction surveys will reduce the risk that telecoms services will be interrupted, or a breakage in gas, water supply, drain, or sewerage pipe will occur. To further minimize the risk of damage the contractor will demark on site the working area, follow design drawings, avoid encroachment outside the agreed corridor of impact, and implement careful construction practices. However, in the event of an accidental occurrence this could have knock on environment, health, and safety consequences on the local community as well as interruption in supplies. For example, a break in a sewer pipe could lead to spillage of raw sewage. The consequences will be higher if appropriate emergency preparedness and response plans are not in place at the sites to immediately deal with any accident scenario. For unknown physical cultural resources, a chance find procedure as per national regulations and ADB's Safeguard Policy Statement (2009) requirements for physical cultural resources will be developed pre-construction.

For any planned temporary outages, the contractor will provide 1 week advance notice to the public through notices or pamphlets about the time and the duration of the utility disruption and restore immediately after all necessary works are carried out to minimize the public inconvenience.

- (v) **Occupational health and safety (H&S)** - accidents are likely to occur during the installation of the underground cables without adequate health and safety management, due to construction works being involved and since almost all the entry and exit pits will be on busy streets leading to the risk of a traffic vehicle hitting workers on the site. The risk of exposure is short term, as the maximum working hours per section is 5 hours; about 241,500-man hours for 7,241 km of cable. However, the probability of an accident risk would be higher if appropriate health and safety measures (e.g. warning boards for on-going construction, works boundary fence, and traffic management) are not enforced at the sites. Also, there would be risks to the construction workers from dust emission, noise exposure, exposure to communicable diseases, such as COVID-19, while working with others and in local communities, and working with live electricity during the connection of electrical cables. The consequences will be higher if appropriate emergency preparedness and response plans are not in place at the sites to immediately deal with any incident that occurs.

Based on their working methods the contractor will need to undertake a contract-specific risk assessment considering the nuances of site-specific risks and develop an occupational H&S plan in accordance with the mitigation measures in Annex 2, national laws and regulations, the BESCOM Safety Manual and the EHS Guidelines supported by training of workers. For residual risks, contractor will check the health condition of all workers on a daily basis and equip them with task-appropriate

personal protective equipment (PPE) such as hard hats, safety gloves, safety belt, ear protection to protect from noise exposure, dust masks with additional PPE provided as needed for any ongoing COVID-19 risks,²² and ensure that it is worn at all times during construction. For project-specific risks the contractor must only allow suitably trained and qualified workers to be allowed to work on electrical equipment, in relation to connecting the underground cables to the grid and the RMU installation, and, at height, in relation to removing old overhead electric cable, with strict adherence to safety and insulation standards including those listed in the BESCOM Safety Manual and IFC EHS Guidelines on Electric Power Transmission and Distribution. The contractor will need to designate and train and designate safety responsibilities to a capable team member in each gang who will be tasked with ensuring all relevant safety measures are implemented and supervising high risk tasks.

Since PCBs are toxic and bioaccumulate, unless transformers have been certified PCB free all workers must avoid all exposure of transformer oil to skin and eyes and avoid any potential for accidental ingestion by wearing suitable chemical and/or oil resistant gloves, goggles, and protective clothing even under normal working conditions if there is a risk of coming into contact with transformer oil. If oil meets the skin, the workers should immediately rinse the affected area with large amounts of running water. This may be done in a sink if the hands are the only portion of the body contacted or under a safety shower if the exposure area is more extensive. If large parts of the skin met with the oil, the workers should remove contaminated clothing while under the shower for a minimum of 15 minutes. Hand wash, safety shower and eyewash stations are therefore required at the construction sites.

For emergency scenarios a qualified first aider and trained fire marshal will always be available on-site with an appropriately equipped first aid kit and appropriate fire extinguisher and other firefighting equipment immediately available for use; first aid and fire procedures should be displayed on-site. The contractor will provide access to an ambulance for any more serious cases to transport the patient to the hospital for treatment and plan with the nearest health center and/or hospital for the necessary emergency care of workers. Contact details for these to be posted on notices on-site. Procedures will be established for monitoring safety performance and the reporting and investigation of any incidents.

To ensure their welfare during their shifts the construction workers will need to have access at the project site to a clean source of drinking water that meets national drinking water standards, toilet and hand washing facilities, a clean eating area, and shaded rest area. If an authorized supplier of canned water is not used the drinking water source must be regularly tested to confirm it meets the drinking water standards. The working schedule will need to be developed to allow enough breaks and enough rest time in-between the shifts.

- (vi) **Community H&S** - construction activities are likely to result in (i) dust and noise generation, which will affect the health and wellbeing of residents, businesses, and other community members in close proximity to the project sites; (ii) safety risks, particularly to pedestrians and road users, associated with the presence of construction works within the heart of local communities; (iii) conflict between

²² COVID-19 national restrictions for containing the spread of COVID-19 must be complied with and in developing the health and safety management plan Government of India (<https://www.mygov.in/covid-19> and <https://www.mohfw.gov.in/>) and World Health Organization guidance (<https://www.who.int/emergencies/diseases/novel-coronavirus-2019/technical-guidance>) should be followed ensuring adequate sanitation and welfare facilities including for hand washing and personal protective equipment are provided on-site and at accommodation to construction workers. Given the specialist nature of responding to COVID-19 public health officials/experts to be consulted. Medical insurance should be provided for all workers with sick leave allowance to ensure symptomatic workers do not attend site due to no work-no pay policies. Further details of measures are provided in Annex 6.

workers and local people; and (iv) exposure of passers-by to communicable diseases from workers such as COVID-19 and vice versa.²³ The risks are very short term given the rolling construction method being used with works concentrated on each short section (about 150 m) - when one section is finished the following section will just be started; and construction activities being for a relatively short time (maximum 5 hours per section). However, they will be greater if communities are not informed in advance about works and appropriate health and safety measures (e.g. noise and dust management, community awareness, hazard warning boards for on-going construction activities, temporary works boundary fence, and traffic management) are not enforced at the project sites.

Based on their working methods the contractor will need to undertake a contract-specific risk assessment considering the nuances of site-specific risks and develop a community H&S plan in accordance with the mitigation measures in Annex 2, national laws and regulations, the BESCOM Safety Manual and the EHS Guidelines supported by training of workers. If works are not completed within the day the contractor must not leave any hazardous conditions (e.g. unsigned, unfenced, and unlit open excavations without means of escape and emergency contacts in case an accident occurs) overnight unless absolutely no access by public can be ensured. Community awareness raising with concerned local government authorities and media dissemination about the community health and safety risks will be needed for all communities living and working near the project sites, so they know what to expect. Communication channels and protocols with local and regional emergency and health authorities will need to be established in case of an incident.

Construction workers including subcontractors will be given awareness raising in HIV/AIDS, other communicable diseases including COVID-19, and sexual, exploitation, abuse, and harassment with strict penalties (e.g. immediate removal from site) for any non-compliance to an agreed code of practice. Conflict situations should be avoided by early consultation before the start of work and keeping open communication channels throughout.

Loss of access to residences, businesses and community facilities, and traffic congestion – the underground cable routes are generally following the alignment of existing overhead distribution corridors within which BESCOM ensures safety clearances are maintained. In accordance with national regulations, the establishment of any structures beneath the overhead lines is restricted. In relation to loss of access and community H&S the most significant risk relates to pedestrians and other road users due to (i) temporary disruptions and disturbance during the installation of cables, as a result of diversions, more traffic jams, and blocking of access; and (ii) potential accident due to temporary occupation of roads and sidewalks, especially on routes where there is a complicated arrangement of other existing infrastructure to work around or the cables pass through road intersections. Use of trenchless technology will substantially minimize traffic congestion and disruption and disturbance to livelihoods, residences, businesses, and community facilities. Excavation is limited to 1 m x 1 m x 1 m for each entry and exit pit, so will not entirely prevent access, and, based on the occupation period of the part of road and/or sidewalk for underground cable installation work, any diversions or restrictions on activities being undertaken in the street should be very short, a maximum of 5 hours per 150m section. Repaving of the excavated area will be done manually immediately once

²³ Particular attention to be paid to COVID-19 given construction is directly within the community and the transient nature of the construction workforce who could pass it to the community (especially those with existing medical conditions such as diabetes, heart and lung disease) and vice versa. Risk assessment to consider distribution and number of cases in India, Karnataka, and Bengaluru in relation to home base of construction workers, options for travel to work – public or private transport, and the location of works. Particular attention will need to be paid to the ability of communities to comply with protective measures such as regular handwashing and for the local health care facilities capacity to deal with any infections. Given the specialist nature of responding to COVID-19 public health officials/experts to be consulted. Further details of measures are provided in Annex 6.

the installation of the cable is complete. This reinstatement work should last one day or less.

Impact on traffic congestion would be greatest if installation work is conducted during the morning and evening rush hour with greater probability of accidents occurring if traffic controls are poor. The contractor will implement in close coordination with the local traffic authority the traffic management plan,²⁴ avoid rush hour (6am to 8 am, and 4pm to 6 pm) where works affect roads and sidewalks. They will ensure safe access to property and roads/sidewalks is maintained wherever possible by provision of checkered steel plates or stone slabs and diversions and alternative access provided and clearly signed where there are temporary blockages that are a health and safety risk. Road safety and warning signs for footpaths and road blockages are to be posted at 500m, 100m, and immediately in advance of the works at least one week prior to the works commencing to inform the public of the temporary blockage. Safety guides should be provided where works are on sidewalks or in locations of pedestrian crossings to help guide pedestrians, especially vulnerable persons, safely around the working area. For road blockages flag men are to be utilized during works to control the traffic flow and protect construction workers and the road users. Stockpiling of spoil and cable reels shall be away from properties and only in designated areas where no access will be blocked.

Before the start of construction, the contractor will be required to inform any informal street vendors or other informal users along the alignment, if any, to shift their locations temporarily e.g. to the other side of the street for the day to avoid any loss of their livelihoods. In the event that access to an area will be impeded for more than 8 hours, the contractor will provide for alternative safe access for formal and informal users. Planning of works will be done in conjunction with other construction works in the city to minimize the cumulative impacts they may cause to the local community.

- (vii) **Employment.** The number of workers in total will be about 290 people in total covering all 17 subdivisions. Benefits to local people can be maximized if these construction workers are locally employed by the contractor and given the local in Bengaluru appropriate skill sets should be available. That said, precedence must be given to ensuring all workers are appropriately skilled given the hazardous nature of works over local employment. Wherever possible, the contractor should not discriminate and should proactively encourage the employment of suitably skilled women on the project.

Table 56: Summary of Impact Assessment during Construction

Potential impact	Factors	Significance	Include Mitigation Measures in EMP?	Residual Significance
Pollution incident occurs during construction	Minor impact, local receptor, possible occurrence, likely without mitigation, unlikely with, short term, reversible with effort in short term	Medium	Yes	Low
Increased noise levels and exhaust emissions during construction works	Moderate impact, local receptor, small exceedance, likely without mitigation, possible without, short term, reversible with ease in short term	Medium	Yes	Medium
Generation of dust during construction	Moderate impact, local receptor, small exceedance, likely without mitigation, possible with, short term, reversible with ease in short term	Medium	Yes	Medium

²⁴ Including details of (i) temporary road and sidewalk diversions, (ii) arrangements for construction under trafficked conditions, (iii) traffic arrangement after cessation of work each day, (iv) safety measures for transport of hazardous material (if applicable) and arrangement of flagmen.

Inappropriate disposal of solid and hazardous waste generated by construction works and workers	Minor impact, local receptor, likely without mitigation, unlikely with, reversible with effort in short term	Medium	Yes	Low
Inappropriate disposal of inert soil waste generated by construction	Minor impact, local receptor, likely without mitigation, unlikely with, reversible with effort in short term	Medium	Yes	Low
Damage to above ground property and other public utilities' underground assets during construction	Moderate impact, local receptor, likely without mitigation, unlikely with, reversible with effort in short term	Medium	Yes	Low
Inappropriate working conditions and interaction of workers with local communities during construction works	Minor impact, community receptor, likely without mitigation, unlikely with, reversible with effort in short term	Medium	Yes	Low
Occupational and community health and safety incident during construction	Minor impact, individual receptor, possible without mitigation, unlikely with, very short term, irreversible - death of an individual as worst case	Medium	Yes	Medium
Occupational or community health and safety incident associated with electricity during construction	Minor impact, individual receptor, possible without mitigation, unlikely with, very short term, irreversible - death of an individual as worst case	Medium	Yes	Medium
Interference with pedestrian and vehicle traffic during construction	Minor impact, local receptor, likely without mitigation, possible with, very short term, reversible with ease in short term	Medium	Yes	Low
Loss of any unknown physical cultural resources found during construction works	Minor impact, state or local receptor, rare occurrence, irreversible – once damage caused asset may be lost	Low	Yes	Low
Loss of power supply to the local community when overhead distribution lines are switched off	Moderate impact, local receptor, community concern, likely without mitigation, possible with, very short term, reversible with ease in short term	Medium	Yes	Low
Probability of loss of livelihoods and access to residences/businesses	Very small impact, local receptor, community concern, very short term, reversible with ease in short term	Minimal	Yes	Minimal

C. Potential Impacts and Mitigation Measures during Operation & Maintenance Phase

127. The potential impacts during operational and maintenance of the project include:

- (i) **Global warming impact by SF₆ leakage.** Switchgear in the RMUs is insulated by SF₆ gas. But as per the pre-construction measures these will be enclosed hermetically to ensure leakage will be minimal during operation. The RMUs will be designed and operated so that any leakage will trigger an alarm at the nearest concerned O&M Unit requiring O&M staff to rectify the situation immediately. However, it will be necessary to monitor leakage rates to confirm this is the case, provide training to O&M staff on SF₆ management, and at end of life ensure that the RMUs are appropriately disposed by a certified industrial waste management company who will need to remove SF₆ and treat the equipment prior to disposal in

accordance with International Electrotechnical Commission (IEC) standard 61634 to ensure SF6 is not released to atmosphere.

- (ii) **Cable break incident.** It is a common practice to place warning marks above ground or over the cable to avoid others digging into the underground cable which can result in cable break incidents. BESCO through its contractor will install such markings to protect the safety of cables. They will also freely share the information of the routing of all underground cables to the relevant authorities so when underground works need to be done by others, the location of the cables would be known and can plan to be avoided by their contractors.

The underground cables are armored by steel wires to protect the cores which are live. In case the armor is broken by a third party and the core is damaged, protection relays in the substation detect this and stop sending electricity to the feeder immediately by automatically opening switchgear in the substation to prevent a live shock to the person. Therefore, the consequences of a cable break incident are reduced.

In the event of such an incident BESCO staff/community must immediately notify the nearest BESCO incident coordinator for handling measures: power cuts, technical O&M staffing to inspect and repair. The O&M team will repair the cable break as soon as possible with repair works similar to construction, during which the construction mitigation measures should be followed especially in relation to occupational and community health and safety during works. Cross linked polyethylene insulated aluminium conductor armoured cable will be used for underground cable, which is waterproof and will not be affected by increased rainfall or increased soil moisture. However, BBMP will need to regularly maintain the existing storm water drainage to avoid water puddles that may cause water percolating into cable.

- (iii) **Electric and magnetic field (EMF).** The frequency used in the distribution system of BESCO is 50 Hertz. The impact of EMF is dependent on the duration of exposure but provided the International Commission for Non-Ionizing Radiation Protection (ICNIRP) guidelines for public exposure (Table 57) are met by the distribution lines in the project there should be a minimal impact.

Table 57: ICNIRP Limit Values Concerning Electric and Magnetic Fields (50 Hz) for the Public and at Working Places

Source	Electric Field Strength [kV/m]	Magnetic Flux Density [μ T]
Occupational exposure	10	500
General public exposure	5	100

In the case of underground cable, the 3-core cables are covered by semi-conducting compound and wrapped with copper tape. As the copper tape is earthed, electric field only exists between the core and copper tape, and the electric field does not propagate outside the periphery of the cable. Therefore, the health impact of the electric field is negligible. Further, as the three cores for three different phases are installed closely in one cable, magnetic field generated by each core will be offset by the magnetic fields from two other cores. Therefore, almost no magnetic field is generated by the cable and the health impact by magnetic field is negligible.

In general, EMF is the strongest closest to the source and diminishes with distance. Since the cables are installed about 1 m below the ground level, health impacts to the community will be negligible. For O&M staff occupational health and safety measures include ensuring they are not exposed to excess EMF.

- (iv) **Occupational and community health and safety including fire and electrocution risk.** On all electrical equipment visual and written warning signages including the ISO 7010 Hazard Type: Electrical Symbol warning of the risk of electrocution will be installed by the contractor as part of the works, and any transformers to which the underground distribution lines connect are to be, if not already the case, fenced with locked gate (if ground-mounted) or similar deterrent for pole-mounted transformers. Similarly, all RMU will be kept locked with warning signs as they are being installed on the public street. There is a risk of fire associated with RMU although use of SF₆ gas insulation minimizes this. Nonetheless, it will be necessary to ensure emergency procedures are posted and fire extinguishers available at the location of the RMUs in the event of a fire.

Table 11: Summary of Impact Assessment during Operation

Potential impact	Factors	Significance	Include mitigation measures in EMP?	Residual Significance
Leakage of SF ₆ gas a potent GHG causing climate change impacts due to operation of RMUs	Small impact, global concern, unlikely with mitigation, very long term, irreversible	Medium	Yes	Medium
Cable break incident during lifetime of the project resulting in loss of power supply to the local community	Moderate impact, local receptor, community concern, likely without mitigation, possible with, very short term, reversible with ease in short term	Medium	Yes	Low
EMF exposure due to electrical equipment	Minimal impact, individual receptor, unlikely without mitigation	Minimal	No	Minimal
Occupational or community health and safety incident associated with electricity during operation	Minimal impact, individual receptor, unlikely without mitigation, irreversible - death of an individual as worst case	Medium	Yes	Medium

D. Climate Change Impact on Project Assets

128. A climate risk screening and assessment has been conducted identifying that underground cabling is sensitive to:

- (i) ambient conditions of the soil (temperature and moisture), especially extreme ones;
- (ii) increases in ground temperature, which could reduce ratings; and
- (iii) summer droughts and resulting ground movement, which can lead to mechanical damage.

129. Cable conductors exceeding the allowed design temperature will damage their insulation layers and hasten insulation ageing. To mitigate this risk, the project incorporated in the project design the following adaptative measures:

- (i) XLPE (cross-lined polyethylene) cable, which is widely used for underground distribution cable worldwide, is waterproof and will not be affected by increased rainfall or increased soil moisture.
- (ii) The temperature of an underground cable depends on the (a) ambient conditions (temperature and thermal resistance of soil, and status of other cables on the same route), (b) size of the cable, and (c) current in the cable. By selecting appropriate size of cable in the design stage considering the ambient conditions and planned current, the temperature of the cable can be kept within the allowed range. The temperature increase can also be considered and managed during design stage. Furthermore, the temperature of the cable can be also controlled by adjusting the current during the operation stage.
- (iii) Capacity building will be conducted for staff of BESCO under the project to introduce the international good practices in the design, operation and maintenance of underground distribution cables.

130. These factors lower the risks of the system and the project in general to climate change.

E. Summary Environmental Impact Matrix

131. The summary environmental impact matrix in Table 59 has been prepared for the project to discuss the anticipated impacts, mitigation measures, and monitoring requirements, with respect to the following stages: (i) pre-construction; (ii) construction; and (iii) operation and maintenance. Detailed, site-specific mitigation measures and monitoring plans were developed (Section 9) and will be implemented during the project implementation phase.

Table 12: Environmental Impact Matrix

Environmental Attribute	Potential Impacts	Nature of Impact	Residual Significance				Mitigation Measures	Quantitative Monitoring Requirements*		
			Minimal	Low	Medium	High				Maximum
Physical Resources										
Land Use and Topography	Land take and changes in topography required because of project design for the undergrounding of cables and installing RMUs	Direct/Site Specific/Irreversible	X					No		No
Climate	Release/leakage of SF6 as greenhouse gas resulting in climate change impact due to purchase of RMUs and their operation	Direct/Cumulative/Irreversible			X			Yes		Once operational
Air Quality and Noise	Increased noise levels and exhaust emissions during works	Direct/Site Specific/Reversible			X			Yes		During pre-construction and construction activity
	Generation of dust during construction	Direct/Site Specific/Reversible			X			Yes		During pre-construction and construction activity
Soil, Surface Water and Ground Water Quality	Pollution incident occurs during construction	Direct/Site Specific/Reversible		X				Yes.		No
	Inappropriate disposal of solid and hazardous waste generated by construction works and workers	Direct/Site Specific/Reversible		X				Yes		During construction activity
	Inappropriate disposal of inert soil waste generated	Direct/Site Specific/Reversible		X				Yes		During construction activity
Biological Resources										
Terrestrial Ecology	Disturbance of urban trees and other vegetation (if any) during construction works because of the project design	Direct/Site Specific/Reversible		X				Yes		During construction activity
Human Environment										
Interference with communities	Damage to above ground property and other public utilities' underground assets during construction works because of the project design	Direct/Site Specific/Reversible		X				Yes		Pre-construction surveys
	Loss of power supply to the local community when overhead distribution lines are switched off	Direct/Site Specific/Reversible		X				Yes		No
	Cable break incident during lifetime of the project resulting in loss of power supply to the local community	Indirect/Site Specific/Reversible		X				Yes		No
Occupational and	Inappropriate working conditions	Direct/Site		X				Yes		No

Environmental Attribute	Potential Impacts	Nature of Impact	Residual Significance					Mitigation Measures	Quantitative Monitoring Requirements*
			Minimal	Low	Medium	High	Maximum		
Community Health and Safety	and interaction with local communities	Specific/Reversible							
	Occupational and community health and safety incident during construction	Direct/Site Specific/Irreversible			X			Yes	During construction
	Occupational or community health and safety incident associated with electricity during construction	Direct/Site Specific/Irreversible			X			Yes	During construction
	EMF exposure	Direct/Site Specific/Irreversible	X					No	No
	Occupational or community health and safety incident associated with electricity during operation	Direct/Site Specific/Irreversible			X			Yes	During operation
Physical Resources	Cultural Loss of unknown physical cultural resources found during construction works	Direct/Site Specific/Irreversible		X				Yes	No
Traffic and Transportation	Traffic disturbance during transportation of equipment and materials to the site	Direct/Cumulative/Site Specific/Reversible		X				Yes	No
	Interference with pedestrian and vehicle traffic during construction	Direct/Cumulative/Site Specific/Reversible		X				Yes	No
Livelihoods Access	and Probability of loss of livelihoods and access to residences/businesses	Direct/Cumulative/Site Specific/Reversible	X					Yes	No

* Implementation of the EMP actions will be monitored qualitatively for all potential impacts

VI. CONSULTATIONS, PARTICIPATION, AND INFORMATION DISCLOSURE

A. Information Disclosure

132. BESCOM will submit to ADB the following documents for disclosure on ADB's website:
- (i) the final IEE;
 - (ii) any new or updated IEE and corrective action plan prepared during project implementation, as applicable; and
 - (iii) all environmental monitoring reports.

133. BESCOM will provide relevant environmental information, including information from the above documents in a timely manner, in an accessible place and in a form and local language(s) understandable to affected people and other stakeholders in accordance with the ADB's Safeguard Policy Statement (2009). BESCOM has already disclosed the draft IEE on its website and will keep printed copies at the district offices for review by interested parties. For illiterate people, other suitable communication methods can be used such as audio version of a summary of the report prepared in local language.

134. Final IEE findings including the EMP will be communicated to the local community before commencement of construction through posting of the draft IEE on the website of BESCOM publicised through social media and a mechanism will be provided for the receipt of any comments. The PMU with the assistance of the PMC and the contractor will undertake pre-construction communication.

B. Consultations

135. During the project formulation stage, BESCOM conducted reconnaissance surveys for the proposed project. Accordingly, prior to public consultation sessions, dialogue had been held between BESCOM representatives, individuals, and groups from the community to make them aware of the project. The IEE consultants and BESCOM staff have held focus group discussions with groups and individuals to make them aware of the compensation procedures, impacts of lines, as well as proposed project timelines.

136. BESCOM and the consultant team have carried out public consultations through a total of ten focus groups involving 103 persons (70% male and 30% female) were held between April to October 2019 with a sample of affected or beneficiary persons focusing on existing environmental conditions around the overhead distribution lines, the potential impacts of the project, and proposed mitigation measures. The IEE consultants have visited about 400 km of existing alignment in the divisions, together with the BESCOM field staff, representing a sample of about 5.5% of alignment. Incorporation of environmental concerns of members of the community in the project area as a result of the public consultation will help avoid or minimize and mitigate conflict situations and enable stakeholders to provide meaningful inputs into the project design and implementation process. The focus groups were carried out in all the divisions (Jaya Nagar, Shivaji Nagar, Indira Nagar, Koramangala, HSR Layout, White Field and Hebbal – Hebbal was subsequently dropped from the project) within the vicinity of the alignment of the project's distribution lines. The discussions were started with a moderator informing the people of the proposed project. Annex 4 lists the attendees and detailed discussions during public consultations. Table 60 gives their general perceptions on the proposed project.

137. In addition, 718 household surveys were carried out by IEE the consultants along with BESCOM along the project sites between 4 May and 7 June 2019. where the heads of the households were interviewed to collect the data.

138. The project-affected communities residing beside the proposed project had already gained a reasonable knowledge about the potential grievances that could arise in the future. The community were informed during the public consultation sessions and household survey participants about the grievance redress mechanism (GRM), which will be followed by BESCOM

as per Section 8, including the place and the responsible person to contact in this regard.

C. Consultation Findings

139. **Current power supply situation.** Participants in focus groups from White Field and HSR layout districts experience regular power blackouts for 3-4 hours both in the afternoon and evening whilst participants from other districts also experience regular power blackouts for 1 hour in the afternoon or the evening.

140. Awareness of the proposed project. All participants in focus groups from White Field, and HSR Layout districts, and some of the participants from Hebbal district came to know about the project for the first time through this public consultation; participants from other districts had previously been made aware of it through (i) the newspaper; or (ii) maintenance staff of BESCOM. For the household survey, of the surveyed 718 households, 58% were aware of the project, while the remaining 42% are not aware of it. Majority of households from White Field and Hebbal were not aware of the proposed project.

Table 60: HH Awareness About Proposed Underground Cabling Project					
	Yes		No		Total
	Freq	%	Freq	%	Freq
HSR Layout	98	98.0	2	2.0	100
Koramangala	102	100.0	0	0.0	102
White Field	28	27.7	73	72.3	101
Hebbal	26	25.2	77	74.8	103
Indiranagar	71	69.6	31	30.4	102
Jayanagar	92	86.0	15	14.0	107
Shivajinagar	1	1.0	102	99.0	103
Total	418	58.2	300	41.8	718

141. The source of information regarding the awareness of the project were multiple: these were television (18%), newspaper (68%), government officials (2%), neighbors or relatives (10%), and internet and social media (2%).

Table 61: HH Source of Information Regarding Underground Cabling Project											
	Television		Newspaper		Govt. official		Neighbors or relatives		Internet and social media		Total
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq
HSR Layout	9	9.2	89	90.8	0	0.0	0	0.0	0	0.0	98
Koramangala	6	5.9	96	94.1	0	0.0	0	0.0	0	0.0	102
White Field	5	17.9	21	71.4	0	0.0	2	7.1	0	0.0	28
Hebbal	8	30.8	6	15.4	0	0.0	8	30.8	4	15.4	26
Indiranagar	35	49.3	13	15.5	8	11.3	15	21.1	0	0.0	71
Jayanagar	11	12.0	62	67.4	0	0.0	15	16.3	4	4.3	92
Shivajinagar	0	0.0	1	100.0	0	0.0	0	0.0	0	0.0	1
Total	74	17.7	287	67.5	8	1.9	40	9.6	8	1.9	418

142. **Suggested method for information dissemination.** All participants in the focus groups suggested to disseminate project related information through television, newspaper, and social media. For the household survey, the preferred channel to disseminate information regarding the project are multiple: television (55%), newspaper (41%), government officials (1%), and internet and social media (3%).

Table 62: Best Channel to Disseminate Project Information									
	Television		Newspaper		Govt. official		Internet and social media		Total
	Freq	%	Freq	%	Freq	%	Freq	%	Freq
HSR Layout	11	11.0	89	89.0	0	0.0	0	0.0	100
Koramangala	7	6.9	95	93.1	0	0.0	0	0.0	102
White Field	55	54.5	43	42.6	1	1.0	2	2.0	101
Hebbal	86	83.5	3	2.9	0	0.0	14	13.6	103
Indiranagar	88	86.3	9	8.8	4	3.9	1	1.0	102
Jayanagar	56	52.3	50	46.7	1	.9	0	0.0	107
Shivajinagar	94	91.3	6	5.8	1	1.0	2	1.9	103
Total	397	55.3	295	41.1	7	1.0	19	2.6	718

143. **Perceived benefit of the project.** Most participants in the focus groups are supportive to the proposed project as underground cabling will (i) decrease accident due to hanging cables; and (ii) improve the quality of the electricity supply. For the household survey, households perceive several benefits from the underground cabling; these are (i) avoidance of loose hanging cables (87%); (ii) uninterrupted power supply (84%); (iii) dedicated and quality power supply (84%); (iv) reduction in power tapping (theft) (83%); (v) reduction in accidents due to cable hanging (87%); and (vi) reduction in short circuits during rains (86%).

Table 63: HH Perception about Benefits from Underground Cabling

HH perception about benefits from underground cabling																		
	Avoid loose hanging cables			Uninterrupted power supply			Dedicated and Quality power supply			Will stop reduce power tapping			Avoid accidents due to cable hanging during rainy season			Avoid short circuit during rainy season		
	Yes	No	Don't Know	Yes	No	Don't Know	Yes	No	Don't Know	Yes	No	Don't Know	Yes	No	Don't Know	Yes	No	Don't Know
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
HSR Layout	100.0	0.0	0.0	100.0	0.0	0.0	99.0	0.0	1.0	99.0	1.0	0.0	100.0	0.0	0.0	100.0	0.0	0.0
Koramangala	100.0	0.0	0.0	99.0	1.0	0.0	100.0	0.0	0.0	99.0	1.0	0.0	100.0	0.0	0.0	100.0	0.0	0.0
White Field	98.0	0.0	2.0	84.2	2.0	13.9	85.1	1.0	13.9	90.1	2.0	7.9	94.1	2.0	4.0	87.1	4.0	8.9
Hebbal	42.7	8.7	48.5	45.6	5.8	48.5	41.7	9.7	48.5	36.9	14.6	48.5	44.7	6.8	48.5	45.6	7.8	46.6
Indiranagar	97.1	2.0	1.0	97.1	2.0	1.0	98.0	2.0	0.0	96.1	2.9	1.0	98.0	2.0	0.0	98.0	2.0	0.0
Jayanagar	99.1	.9	0.0	90.7	9.3	0.0	94.4	5.6	0.0	86.0	14.0	0.0	96.3	3.7	0.0	98.1	1.9	0.0
Shivajinagar	73.8	1.0	25.2	69.9	4.9	25.2	72.8	1.0	26.2	71.8	1.0	27.2	72.8	1.9	25.2	70.9	2.9	26.2
Total	87.2	1.8	11.0	83.7	3.6	12.7	84.4	2.8	12.8	82.6	5.3	12.1	86.5	2.4	11.1	85.7	2.6	11.7

144. **Concerns during the project implementation.** Participants in the focus groups raised concerns such as:

- (i) damage to other facilities like cable networks, telephone lines, internet cables, roads, and drainage;
- (ii) increased traffic jams in narrow roads, junctions, and market areas;
- (iii) increased noise and dust from drilling; and
- (iv) tree felling and cutting.

145. For the household survey, major concerns are (i) noise during drilling (80%); (ii) disruption of utilities (77%); and (iii) increase in accidents during implementation (70%) with lesser concerns being related to loss of livelihood and access to houses/businesses.

Table 64: HH Opinion about Impacts during Implementation

	Temporary loss of livelihood		Difficult to access house/business		Noise during drilling		Increase in accidents during implementation		Disruption of utilities	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
	%	%	%	%	%	%	%	%	%	%
HSR Layout	59.0	41.0	59.0	41.0	67.0	33.0	59.0	41.0	65.0	35.0
Koramangala	47.1	52.9	48.0	52.0	50.0	50.0	48.0	52.0	50.0	50.0
White Field	50.5	49.5	51.5	48.5	93.1	6.9	45.5	54.5	52.5	47.5
Hebbal	35.9	64.1	4.9	95.1	98.1	1.9	72.8	27.2	40.8	59.2
Indiranagar	3.9	96.1	32.4	67.6	34.3	65.7	30.4	69.6	95.1	4.9
Jayanagar	48.6	51.4	65.4	34.6	100.0	0.0	82.2	17.8	100.0	0.0
Shivajinagar	30.1	69.9	4.9	95.1	79.6	20.4	69.9	30.1	76.7	23.3
Total	39.3	60.7	38.0	62.0	74.8	25.2	58.5	41.5	68.8	31.2

146. **Recommendations for Project Implementation.** Most participants were supportive of the proposed project as underground cabling will address issues in relation to overhead power lines such as (i) accidents due to hanging cables; and (ii) poor electricity supply. Participants suggested to further disseminate project information through various media, and to inform other utilities well in advance to avoid service disruptions, and this will be implemented by BESCO during the project implementation. Concerns during the project implementation such as (i) completing the project on time, using modern construction methods/techniques; (ii) using quality materials to avoid regular maintenance; (iii) protection of other public utilities; (iv) avoiding damage to trees, drains and property; (v) minimizing traffic jams and road accidents; (vi) adequate health and safety including visible public notices/signage and adequate measures to control risks around the entry and exit pits; (vii) minimizing noise and dust pollution; and (viii) avoiding damage from future roadworks have been addressed and incorporated in the EMP. The transcript of these discussions helps BESCO and the contractor conduct a proper needs assessment to ensure the issues raised by people are addressed appropriately.

D. Ongoing Participation

147. During implementation, the following will be undertaken by the PMU and contractor to ensure ongoing participation of communities:

- Prior to approving any works in a subdivision, BESCO to undertake and document in the environmental monitoring reports additional meaningful consultations in all 17 subdivisions of the project, informing residents of the scope of works in order that any concerns raised can be reflected in the choice of alignment and construction method, a template for final safeguards checks and this additional consultation is included in Annex 8.
- Provide at least one-month advance notice to local community through television, newspaper, social media, notices, or pamphlets posted in the project area about the schedule of, location plan, and details of planned construction works.
- Undertake community awareness raising programme one month prior to construction regarding the scope of the project, procedure of construction activities, identified impacts and mitigation measures. These awareness programmes will help the community to raise any problems, and clarify their distrust related to the project before construction starts. During this the community should be informed about the GRM, which is already established as per BESCO and Government of Karnataka procedure for making complaints, including the place and the responsible person to contact in this regard.

- Coordination with the concerned local government authority and media to disseminate knowledge about health and safety to households and businesses located near areas of the temporary cable entry and exit pits
- Continue to undertake consultation with affected persons especially those with properties within 5 meters of temporary cable entry and exit pits or open trenches to keep them fully informed of the nature of works and latest schedule at least two weeks prior to the start of construction.
- Local communities to be consulted by contractor when selecting sites for temporary construction facilities prior to finalization of their location.

148. Any periodic consultations undertaken by BESCO and their contractors during the course of construction will be accompanied by timely disclosure of relevant information that is understandable and readily accessible to all affected groups and individuals, in particular women; will be undertaken in an atmosphere free of intimidation or coercion; will be gender inclusive and responsive, and tailored to the needs of disadvantaged and vulnerable groups; and shall enable the incorporation of all relevant views of affected people and other stakeholders into decision making, such as project design, mitigation measures, the sharing of development benefits and opportunities, and implementation issues. Periodic consultations will be documented and reported in the periodic environmental monitoring reports. In relation to undertaking consultations during COVID-19 pandemic, guidance in Annex 6 will be followed.

VII. GRIEVANCE REDRESS MECHANISM

149. BESCOM has an established GRM comprising (i) a General Manager as Customer Relations Officer (CRO) who serves as the nodal officer for all grievances; (ii) a web-enabled grievance registration and redressal system on the BESCOM website; (iii) a dedicated phone number (1912) for grievance registration; (iv) a dedicated SMS number 58888 for filing grievances; and (v) a Consumer Grievance Redressal Forum (CGRF). This is a well-functioning system and was explained to participants of the focus groups.

150. As per ADB's Safeguard Policy Statement (2009), the project will need to address grievances and concerns and complaints promptly, using an understandable and transparent process that is gender responsive, culturally appropriate, and readily accessible to them at no cost. The project will use the existing GRM of BESCOM. The grievances related to the project will be received through and handled in accordance with this system. They will be filtered, documented and a report on them sent to the ADB as a part of the mandatory periodic environmental monitoring reporting.

151. In addition, BESCOM will constitute Grievance Redress Committees (GRC) at division level and nominated Contractor officers, ESC officers and PMC environment consultants will act as GRM focals to receive any complains on the ground. Grievances received through the existing BESCOM system or by the GRM focals will be channeled to the contractor to address in the first instance and then the PMU/ESC to help resolve. The GRCs will consist of the members as listed in Table 65. A gender balance will be ensured. It will function as an open forum for hearing complaints and exploring quick resolutions to resolving any conflicts that could not be resolved at the contractor or PMU/ESC level.

Table 65: Constitution of Grievance Redress Committee

1	PMU Chief General Manager for ADB Project
2	Representative of BBMP
3	Representative of local NGO/CSO (Female)
4	Representative of Contractor
5	Project ESC Officer for Subdivision
6	Representative of Community (Female)

152. The General Manager as CRO and PMU with the support of the ESC, PMC and contractor shall implement the GRM procedures of taking/recording all complaints, handling on-the-spot resolution of minor problems, taking care of complainants paying particular attention to vulnerable groups and provision of responses to project affected persons. A global complaint register would be maintained by the PMU/ESC at project level with the support of the PMC and at contract package level a contract specific compliant register will be maintained by the contractor for each contract package under the project. The PMU/ESC with the support of the PMC and contractor will keep records of all grievances received, however minor and easily dealt with, including contact details of complainant, date that the complaint was received, nature of their grievance, agreed corrective actions, and date these were agreed and implemented, and the final outcome.

153. At field level, project affected persons would be encouraged to first discuss their grievances with the contractor. For instances where the complainant meets the contractor's representative on site or lodges a complaint or phones up or sends an email to contact details given by the contractor the contractor's GRM focal will log the grievance and immediately inform the PMU/ESC and PMC. The contractor will send the logged grievance with all details for maintaining the database at project level to the PMU/ESC and PMC.

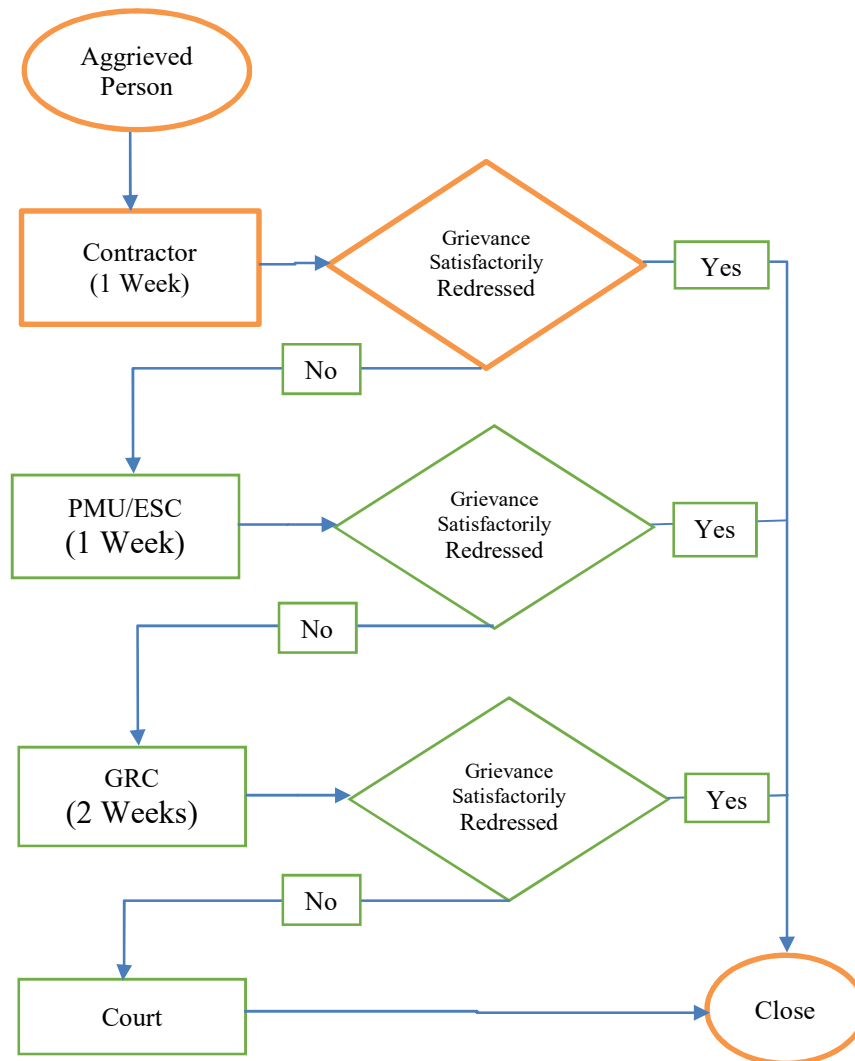
154. The ESC of the PMU supported by the PMC would be responsible for management of complaints pertaining to environmental aspects. They will categorize the grievance as major (accidents, power outages, utility disruption, construction related major inconveniences, etc.) or minor (loss of partial access, construction related minor inconveniences, etc.). All grievances will

be brought to the attention of the Chief General Manager of the PMU. The Chief General Manager will review all the grievances received and those which are outstanding during monthly review meetings. Grievance redress review will be a specific part of the agenda of the monthly review meetings.

155. Once received, if the contractors fail to resolve the issue within one week or the resolution is not to the satisfaction of the affected person, then the grievance will be escalated to the PMU/ESC for resolution who will have a further period of one week, at which point the affected person must be informed of the outcome. Grievances not redressed by the PMU/ESC to the satisfaction of the affected person will be brought to the Chief General Manager PMU set up to monitor project implementation for resolution who will convene the GRC at division level, again informing the project affected person of its status and inviting them to send a representative. Each GRC meeting will record its deliberations and inform the concerned parties of a resolution within two weeks of its findings and recommendations. The GRM will resolve grievances within a maximum time limit of one month of receiving the complaint.

156. Communities will be informed about the GRM through the outreach of BESCOB such as notices in the local urban body offices; project sign board providing names and contact details of persons from BESCOB and the contractor with whom complaints could be lodged etc. Options must be available to submit complaints verbally or in writing in-person, by phone, social media, email, or letter. Any documentation relating to submitting and feeding back on grievances should be in Kannada and other appropriate local languages. After receiving grievance, the complainant should be provided with acknowledgement of the grievance receipt. The GRM will be open to both the local community and workers who are employed on the project.

157. The GRM does not impede access to the country's judicial or administrative remedies. The affected persons have the right to refer the grievances to appropriate courts of law if not satisfied with the redress at any stage of the process. They may also refer grievances to ADB (India Resident Mission) including ADB's Accountability Mechanism. The flow chart showing the GRM is presented in Figure 33.

Figure 36: Process of Grievance Redressal Mechanism

VIII. ENVIRONMENTAL MANAGEMENT PLAN

A. Environmental Management Plan

158. Based on the environmental assessment of the project activities set out in the IEE, an environment management plan (EMP) has been developed for the project setting out the mitigation measures to avoid, minimize, mitigate or compensate the predicted adverse environmental impacts identified by the IEE. The EMP is a management tool and the management measures are accordingly addressed with regard to the sequence of operations, i.e., those activities that apply to the pre-construction, construction, and O&M phases. The EMP contains the following components which are crucial to effective environmental management of the project:

- (i) Plan for mitigation of impacts and risks (during pre-construction, construction, and O&M) including performance standards – Annex 2. The EMP will form part of the contract documents (in the case of sovereign contract packages which are still to be awarded) and during the pre-construction and construction phases relevant mitigation measures will be implemented by PMU and the contractors who are appointed by BESCOM for the eight contract packages under the supervision and monitoring of staff from the ESC established for the project and supported by the PMC for environment. During operation and maintenance, the relevant mitigation measures will be implemented by the relevant BESCOM division O&M unit and supervised by the PMU/ESC.
- (ii) Monitoring plan and performance indicators – Table 66. This includes the proposed quantitative monitoring requirements and performance indicators for implementation of the project. This table is in addition to general supervision of the mitigation plan. During pre-construction and construction, specific monitoring activities defined in the environmental monitoring plan (EMoP) will be carried out by the contractors, supervised by the PMU/ESC supported by the PSC. During operation and maintenance, the monitoring activities will be carried out by the relevant BESCOM division O&M unit supervised by the PMU/ESC.
- (iii) Corrective action plan (CAP) for “existing facilities under construction” – Annex 10. The CAP will be implemented by PMU and the contractors who are appointed for the 4 of the 8 contract packages that were already awarded and are currently under construction (non-sovereign and counterpart funded components) to address gaps identified between current performance and the requirements of the EMP under the supervision and monitoring of staff from the ESC established for the project and supported by the PMC for environment.
- (iv) Implementation arrangements, including organizational roles and responsibilities, budgets, and capacity development requirements for various aspects of EMP implementation.
- (v) Grievance redress mechanism – Section VII of the IEE with roles and responsibilities for the contractor and BESCOM.

B. Impacts, Mitigation and Monitoring

(a) Critical Environmental Review – Impacts and Mitigation

159. **Loss of irreplaceable resources:** The project is located in the dense urban area of Bangalore and does not involve any land take, as it will follow the overhead line corridors. It does not encroach upon legally protected areas or internationally or nationally important biodiversity areas or physical cultural resources. There will be no loss of irreplaceable resources, but the mitigation plan includes measures to avoid, minimize, mitigate, or compensate for the loss of any locally important resources such as trees etc.

160. **Accelerated use of resources for short-term gains.** The project will import all materials for construction and not use any natural resources occurring in the project area during the construction or O&M phases. The mitigation plan requires construction material such as cables, sand etc., shall come from licensed factories and quarries. The excavated soil shall be used for backfilling to restore the surface wherever possible. If infertile and rocky material needs to be taken off site, then it will be disposed of by a licensed waste management operator at designated disposal area suitable for accepting inert waste. Thus, the project shall not cause any accelerated use of resources for short-term gains.

161. **Endangering of species.** The project does not encroach upon any legally protected areas or internationally or nationally important biodiversity areas. No reserve forest will be affected. The project will take place within the urban environment of Bangalore supporting only highly modified habitat. No International Union for Conservation of Nature red list endangered or critically endangered species of flora and fauna have been reported in the project area. Thus, there is no risk of endangering species as a result of the project.

162. **Health and Safety Issues.** There are occupational health and safety issues associated with the construction and O&M phases that will need to be managed by BESCOM and their contractor. Risks to the community in which the project is located will occur during construction and will need to be managed by the contractor, but during the O&M phase health and safety risks from distribution lines will be significantly reduced by the undergrounding of them. BESCOM formulated its Safety Manual which will need to be followed by the contractor and the relevant BESCOM O&M unit. In addition, BESCOM and their contractor will follow national regulations, such as safety clearances, and international good practice²⁵ during construction and O&M to ensure that health and safety risks are managed to an acceptable level.

163. Overall, the project will have direct, indirect, cumulative, and induced environmental impacts that are mostly minor, temporary and of short duration, primarily during construction works, and that can be easily managed.

(b) Supervision, Monitoring and Reporting

164. BESCOM are required to implement the mitigation and monitoring requirements set out in the EMP as well as to supervise and monitor its implementation by the PMU and their contractors. During construction, the contractor is required supervise and monitor their own activities, such as, the excavation of pits or placing of traffic signals, to ensure these are undertaken in accordance with the EMP and potential environmental impacts and risks are avoided or minimized to the extent possible. Quantitative monitoring required during the construction stage (e.g. air and noise samples) as set out in the EMO in Table 66 is the responsibility of the contractor to budget for and undertake under the supervision of BESCOM.

165. Figure 34 sets out the simplified environment, health, and safety (EHS) supervision and monitoring arrangement for BESCOM during the pre-construction and construction phases. The Managing Director and Director (Technical) are ultimately responsible for ensuring the PMU, PMC and contractors adhere to and comply with the mitigation and monitoring requirements; they will be supported by the ESC in doing so. The contractors' activities on-site will be supervised day to day by site supervision staff from the PMU at O&M division unit level. Regular on-site supervision and monitoring of the contractors' EMP implementation will also be carried out by staff from the ESC who should carry out at least weekly checks of all ongoing works with overall detailed review of safeguards compliance on a monthly basis by the Environmental and Social Safeguards Manager. The PSC will support BESCOM in relation to day to day supervision and monitoring with an independent environment consulting agency to support them with the periodic environmental monitoring reports. The ADB Transaction Technical Assistance Consultant will support BESCOM in relation to capacity development trainings.

166. During O&M, as the work will be done by BESCOM division O&M units the PMU/ESC will monitor EMP implementation.

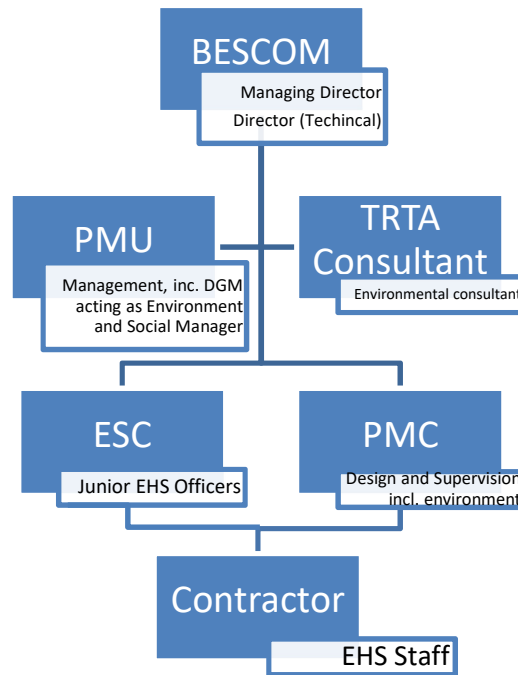


Figure 37: Supervision and Monitoring Arrangement of BESCOM during Construction

167. BESCOM will establish a system for supervision and monitoring and preparing periodic environmental monitoring reports for the project. The contractors will submit monthly reports to the PMU/ESC and PMC on EMP implementation and the results of any quantitative monitoring undertaken during the period. Similarly, the on-site supervision staff of the ESC and PMC will report monthly to the Environmental and Social Safeguards Manager in PMU on their supervision activities.

168. Periodic environmental monitoring reports will need to be submitted for ADB's review and disclosure on the ADB website which will be prepared by the independent environment consulting agency following semiannual/annual audit of the project safeguards performance. BESCOM will be responsible for local disclosure of the environmental monitoring reports through publication on their website, copies of reports available at offices, and notices at construction sites.

169. Environmental monitoring reports will include an update on the project activities and their status during the period in question and document (i) all planning and management activities related to environment safeguards; (ii) progress on EMP implementation (environmental performance) based on BESCOM supervision activities, including progress on corrective action for BESCOM counterpart funded and non-sovereign packages (Annex 10) and feedback provided and action taken; (iii) the results of quantitative monitoring as defined in Table 66; (iv) records of training activities, emergency drills etc.; (v) details of ongoing consultations with project beneficiaries and affected persons, as and when needed; (vi) project-related environmental grievances and their resolution; (vii) compliance with the EMP and progress towards the desired outcomes; and (viii) the identification of corrective and preventative actions with corrective action plans, if needed, etc. The environmental monitoring plan is given in Table 66 and an outline report format is included in Annex 7.

170. BESCOM will carry out the following actions to supervise and monitor EMP implementation, not an exclusive list.

- (i) PMU staff to include a suitably qualified and experienced DGM as Environmental and Social Manager and Junior Environment, Health and Safety Officers forming the ESC, before the commencement of the contracts (or retrospectively if already commenced) to support EMP implementation and be responsible for regular on-site

- supervision and monitoring of the project together with the PMC.
- (ii) Nominate from the ESC at least one dedicated Junior Environment, Health and Safety Officer for each contract package (sovereign, nonsovereign and counterpart funded components) before the commencement of any construction works on it for regular on-site supervision and monitoring of the project together with the PMC.
- (iii) Junior ESC Officers to conduct and document the findings of at least weekly supervision visits using checklists for all ongoing construction works.
- (iv) Junior ESC Officers to undertake and document the findings of periodic “spot check” site visits for all ongoing construction works to confirm compliance with the EMP.
- (v) Environmental and Social Safeguards Manager to conduct and document the findings of monthly supervision visits involving detailed review of safeguards compliance using checklists for all ongoing construction works.
- (vi) ESC to confirm compliance of the PMU and the contractors with the EMP and progress toward the desired outcomes for ongoing measures; if necessary, identifying corrective actions for any non-compliance identified and developing corrective action plans.
- (vii) Implement or require the PMU and/or contractors to implement corrective action plans to ensure progress toward the desired outcomes.
- (viii) ESC to document monitoring findings for inclusion in the periodic environmental monitoring reports, including corrective actions for any non-compliance identified and corrective action plans – consolidating the findings of monthly reports from the contractors, PMC and their own supervision visits into the periodic environmental monitoring report to be prepared by the independent environment monitoring report consultant for submission to ADB.
- (ix) Submit the periodic environmental monitoring reports to ADB for review and disclosure on the ADB website; to be submitted semiannually up until the Project Completion Report is issued (or a later date agreed therein) for the sovereign component and then annually until project maturity of the nonsovereign component.
- (x) Locally disclose the findings of the environmental monitoring reports through publication on their website, copies of reports available at offices, and notices at construction sites informing of the main findings and the availability of the reports which should be shared in full upon request.
- (xi) Inform ADB of any changes to the design or scope of the project or other unanticipated impacts and any changes to the IEE/EMP that are required prior to implementing the changes.

171. ADB will carry out the following monitoring actions to supervise project implementation:

- (i) Conduct periodic site visits during the project implementation to confirm compliance with the EMP.
- (ii) If required, conduct supervision missions with detailed review by ADB’s safeguard specialists/officers or consultants.
- (iii) Review and comment on the periodic environmental monitoring reports submitted by BESCOM to ensure that adverse impacts and risks are mitigated as was planned and agreed with ADB.
- (iv) Work with BESCOM to rectify to the extent possible any failures to comply with their safeguard commitments, as covenanted in the loan agreement, and exercise remedies to re-establish compliance as appropriate.
- (v) Prepare a project completion report that assesses whether the objective and desired outcomes of the EMP has been achieved, considering the baseline conditions and monitoring results.

172. For this purpose, BESCOM and their contractors will provide ADB with access to the site and all requested information on the project.

173. For any ADB supervision missions to ongoing construction works BESCOM and their contractors will provide all ADB staff with a project site health and safety induction and adequate PPE in accordance with Table 2.7.1 of the IFC EHS General Guidelines - Occupational Health and Safety Section.

Table 66: Environmental Monitoring Plan (EMoP)

Environmental component	Project stage	Parameters to be monitored	Location	Frequency	Performance Standard	Estimated Rate (Rs.)	Implementation	Supervision
1. Air quality	A. Pre-construction (once assigned to contractor)	SPM, PM10, PM2.5, SO ₂ , and NO ₂ to be measured as 1-hour and 24-hour averages along with meteorological data-temperature humidity, wind speed, and wind direction-over a fortnight using professional, calibrated portable monitoring devices	Undertake at 4 locations per IEE: (i) Hope Farm, (ii) Koramangala Junction, (iii) Silk Board Junction, (iv) Jayanagar	One time for baseline establishment	National ambient air quality standards of CPCB must not be exceeded, or no increase above baseline if already exceeded	Per sample Rs. 24,000	Contractor by CPCB approved laboratory to submit results to BESCOM for inclusion in EMR	PMU/ESC supported by PSC IEC to check and document compliance semi-annually in EMR.
	B. Construction		Undertake at 4 locations as above and other locations on request if PMU/ESC are concerned contractor is not complying with the EMP measures at other locations or there are grievances raised related to air pollution additional sample locations to be included at direction of BESCOM	Once during active construction at sample location, ideally undertake during the dry season (if construction schedule allows this) or for other locations as directed by PMU/ESC			Contractor by CPCB approved laboratory to submit results to BESCOM for inclusion in EMR	PMU/ESC supported by PSC IEC to check and document compliance semi-annually in EMR.

2.Noise and vibration	A. Pre-construction (once assigned to contractor)	Noise level (dB(A) as 1hr LAeq over a 48-hour period using professional, calibrated portable monitoring devices	Undertake at 4 locations per IEE plus one additional location in each subdivision: (i) Hope Farm, (ii) Koramangala Junction, (iii) Silk Board Junction, (iv) Jayanagar	One time for baseline establishment	CPCB standards for Noise and Vibrations, noise level must be limited to 55dB(A) as 1hour LAeq day and 45dB(A) as 1hour LAeq at night at residential receptors or no more than 3dB(A) above baseline if already exceeded	Per sample Rs. 24,000	Contractor by CPCB approved laboratory to submit results to BESCO for inclusion in EMR	PMU/ESC supported by PSC IEC to check and document compliance semi-annually in EMR.
	B. Construction		Undertake 4 at locations as above and other locations on request if PMU/ESC are concerned contractor is not complying with the EMP measures at other locations or there are grievances raised related to noise and vibration additional sample locations to be included at direction of BESCO	Once during active construction at sample location, or for other locations as directed by PMU/ESC			Contractor by CPCB approved laboratory to submit results to BESCO for inclusion in EMR	PMU/ESC supported by PSC IEC to check and document compliance semi-annually in EMR.

3. Construction materials and waste	A. Construction	Materials used and waste generated during construction	Record all construction materials used and waste generated by construction (including type, volumes, sources, and disposal routes with copies of licenses if third parties are used)	Monthly	100% of materials used and waste generated sourced or disposed of in environmental sound manner	n/a	Contractor to keep records to submit to BESCOM for inclusion in EMR	PMU/ESC supported by PSC IEC to check and document compliance semi-annually in EMR.
4. Trees	A. Construction	Number of trees removed and replanted during construction	Record all (if any) trees removed during construction, and native species replacements planted (if any) (including species, size, and economic value)	Monthly	100% of trees removed compensated for or with 1:2 replacement by native tree species in suitable alternative location	n/a	Contractor to keep records to submit to BESCOM for inclusion in EMR	PMU/ESC supported by PSC IEC to check and document compliance semi-annually in EMR.
5. Property damage	A. construction	Pre-Photographic and/or structural pre-condition surveys of existing condition including utilities, structures, footpaths, roads and/or drains	For all property in or immediately adjacent to construction area	One time for baseline establishment	Damages avoided but if caused paid for by contractor	n/a	Contractor to keep records; to be agreed with PMU and property owner prior to works to provide baseline for any claims	PMU/ESC supported by PSC IEC to check and document compliance semi-annually in EMR.

6. Health and safety of workers and local community members	A. Construction	Health and safety incidents (near miss including fires, minor, lost time, and fatal) related to workers and local community members	Record all incidents and responses taken (including date, time, and details of incident, treatment given, and the outcome) During the COVID-19 pandemic, daily temperature checks to be carried out at entrance of the work site at start of shift, and records of all suspected and confirmed cases to be kept.	Monthly	Zero lost time or fatalities 100% lost time and fatalities/confirmed COVID-19 cases reported to BESCO ESC and ADB in 24 hours For 100% incidents/confirmed COVID-19 cases immediate action taken to avoid repeat	n/a	Contractor to keep records to submit to BESCO for inclusion in EMR	PMU/ESC supported by PSC IEC to check and document compliance semi-annually in EMR.
	B. Operation and maintenance						BESCO O&M units to keep records to submit to ESC for inclusion in EMR	PMU/ESC IEC to check and document compliance semi-annually in EMR.
7. PCB Use	A. Operation and maintenance	Existing transformers containing PCBs	Record PCB status of all project-related transformers in inventory based on documentary records or, if not available, sample tests ²⁶	Annually	100% of existing transformers related to project are confirmed as being PCB free by 31.12.2025	n/a	BESCO O&M units to keep records to submit to ESC for inclusion in EMR	PMU/ESC IEC to check and document compliance semi-annually in EMR.

²⁶ Following UNEP Guidance for the Identification of PCB and Materials Containing PCB (<https://wedocs.unep.org/bitstream/handle/20.500.11822/32457/PCB.pdf?sequence=1&isAllowed=y>) and a health and safety risk assessment and plan referring to

8. GHG emissions	A. Operation and maintenance	SF6 total volume and leakage rate	100% of ring main units containing SF6	Annually	CO2e of total volume of SF6 in all RMU must be significantly less than 100,000 tons CO2e (GWP = 22,800 kg CO2) with significantly less than 0.1% leakage rate per RMU with a total leakage of significantly less than 10,000 kg of CO2e/annum	n/a	BESCOM units to keep records to submit to ESC for inclusion in EMR	O&M for	PMU/ESC IEC to check and document compliance semi-annually in EMR.
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Abbreviations:

PMU = Project Management Unit at corporate level of BESCOM

PMC – Project Management Consultants

ESC – Environment and Social Cell of BESCOM

IEC – Independent Environment Consultation for Periodic Environmental Monitoring Report

SO₂ - Sulphur Dioxide; NO₂ - Nitrogen Dioxide; PM_{2.5} - Particulate Matter <2.5µm; PM₁₀ - Particulate Matter <10 µm; SPM - Total Suspended Particulate Matter

Source for Rates: MoEFCC (CPCB) New Delhi, Notification Dated 15 June 2008

Notes: Transport, accommodation and sample collection costs and VAT are included in estimated rate and will need to be budgeted for separately by contractor

Nearest Board's Laboratory: Central Laboratory, Karnataka State Environment Protection & Pollution Control Board

the measures in UNEP (2002) PCB Transformers and Capacitors: From Management to Reclassification and Disposal, a representative sample of conservator type transformers should be screened for containing PCBs and if positive should be tested for PCB in a laboratory, starting with those at highest risk of containing PCBs as indicated in Table 45. If any of these are found to contain PCBs then, taking a precautionary approach, the remaining conservator type transformers belonging to the same manufacturers batch should be labelled as positive for PCB and other conservator type transformers at risk should also be tested. It is not recommended to test hermetically sealed type transformers. If PCBs are found in existing transformers and any other project equipment they should be labelled as such. Workers must wear suitable chemical and/or oil resistant gloves, goggles, and protective clothing whilst sampling transformers etc.

C. Institutional Arrangements

(a) BESCOM Roles and Responsibilities

174. BESCOM is the state power distribution utility licensed to operate in Bengaluru metropolitan area of the state of Karnataka. BESCOM is both the EA and IA for the project. BESCOM management have ultimate responsibility for ensuring compliance with environmental, health and safety measures and progress towards the desired outcomes.

175. To help ensure this, BESCOM have established PMU overseen by the Managing Director and Director (Technical). The PMU will be staffed by corresponding personnel from various functions – Administration and Finance, Planning and Design, Procurement and Contracts, and O&M. The PMU is headed by a Chief General Manager and Superintending Engineer at corporate level who will be responsible for supervision, monitoring and approvals. A Deputy General Manager, PMU will take on the role of the Environmental and Social Safeguards Manager to which the Environmental and Social Cell established for the project will report. The PMU comprises the relevant O&M division units under the Chief Engineer O&M zone; there are six divisions headed by Executive Engineers, site supervision staff from these six O&M division units will form the PMU to support at corporate level including with day to day supervision and GRM implementation.

176. PMC will support the PMU and should have a suitably qualified and experienced Environmental Officer, Occupational Health and Safety Officer, and Community Liaison/GRM Officer.

177. Between them the PMU supported by the PMC have the following responsibilities, not an exclusive list:

- (i) Ensure that all environment safeguards requirements as given in ADB's Safeguard Policy Statement (2009), applicable laws and rules of the Government of India and Karnataka State, and BESCOM's environment and social safeguards policy are being fully complied with during all stages of the project.
- (ii) Ensure the final IEE and EMP are disclosed on the BESCOM website.
- (iii) Ensure that the draft EMP including staffing requirements and relevant mitigation and monitoring measures applicable to the contractor is included in the bidding document and that the final EMP cleared by ADB is included in the contract documentation prior to award of contract;
- (iv) Ensure that the contractor has access to the final IEE.
- (v) Ensure that the contractor understands their responsibilities to implement the EMP and to mitigate and monitor environmental impacts and risks associated with the pre-construction and construction phases and facilitate the provision of training to their staff as set out in Table 67.
- (vi) Obtain all necessary permits and/or clearances, as required, from relevant government agencies (except those which are to be obtained by contractor) ensuring that all the necessary regulatory clearances have been obtained before the contractor commences any construction works.
- (vii) Review the contractor's alignment mapping and confirm that there are no changes in alignments outside existing overhead line corridors and/or affecting environmentally sensitive areas [including lakes and heritage zone] as per the IEE.
- (viii) Review and approve the contractor's sub-plans e.g. Construction EMP plus Traffic Management Plan, Construction Waste Management Plan, Health and Safety Plan etc.
- (ix) Review and approve the contractor's emergency preparedness and response plan for any medical emergency or any other emergency circumstances during construction.
- (x) Liaise with the Bengaluru Mahanagara Palike and the public works department and seek their help to solve any environment related issues during project implementation.

- (xi) Undertake ongoing consultation and establish and implement the GRM ensuring effective implementation of the GRM and that all relevant concerns and complaints are being promptly and effectively addressed.
- (xii) Supervise and monitor in accordance with Section 8b that the EMP is being properly implemented on a day to day basis with at least weekly supervision visits to all ongoing construction works.
- (xiii) Ensure that the contractor submits their monthly reports; these reports will be included as part of the contractor's monthly progress report and will be consolidated for onwards submission to the independent environment consulting agency to inform preparation of the periodic environmental monitoring reports.
- (xiv) In case unanticipated environmental impacts occur during the project implementation stage, including design or scope changes, inform ADB, and, as required, update the IEE and EMP in consultation with relevant government agencies for clearance by ADB before any changes are implemented.
- (xv) In case of non-compliance, immediately inform ADB, and prepare in consultation with relevant government agencies and implement as necessary corrective action plan for clearance by ADB.

178. BESCO will ensure the project ESC is staffed by at least one dedicated Junior EHS Officer for each contract package (8no.) before the commencement of the contracts (or retrospectively if already commenced) to support EMP implementation and be responsible for regular on-site supervision and monitoring of the project as well as act as community liaison/GRM focal on the ground. These officers will have 2–3 years experience of environment, health, and safety supervision on similar types of project and hold an environment and/or health and safety bachelor's degree and/or post-graduate qualification. Ideally officers with a mix of environment, health and safety experience will be appointed so that they may assist one another with supervision activities.

179. The ESC for the project will report to the Deputy General Manager in the PMU who takes on the role Environment and Social Safeguards Manager. The ESC is responsible for ensuring implementation of the EMP for the project with the support of the PMC. They will provide advice to the PMU on environmental and social issues of route alignments at the pre-construction stage in order to avoid or minimize impacts and risks. The ESC is then required to conduct regular supervision and monitoring of EMP implementation on all components of the project, whether funded by the sovereign loan, nonsovereign loan, or BESCO to ensure compliance with loan covenants.

180. For this project, the nominated ESC staff has the following responsibilities, not an exclusive list:

- (i) Provide advise to the PMU on the inclusion of EMP requirements in the bidding and contract document.
- (ii) Supervise and monitor in accordance with Section VIII.b that the EMP is being properly implemented on all contract packages.
- (iii) Prepare and submit to the independent environment consulting agency BESCO's inputs to the periodic environmental monitoring reports for onwards submission to ADB.
- (iv) Provide training and advise to the PMU, PMC and contractors' staff on effective environment, health, and safety management.
- (v) Help the PMU supported by the PMC to review contractor's alignment mapping and confirm that there are no changes in alignments outside existing overhead line corridors and/or affecting environmentally sensitive areas [including lakes and heritage zone] as per the IEE.
- (vi) Help the PMU supported by the PMC to review and approve the contractor's sub-plans e.g. Construction EMP plus Traffic Management Plan, Construction Waste Management Plan, Health and Safety Plan etc.

- (vii) Help the PMU supported by the PMC to review and approve the contractor's emergency preparedness and response plan for any medical emergency or any other emergency circumstances during construction.
- (viii) Liaise with the Ministry of Power, CEA, MoEFCC, Government of Karnataka, and state and municipal agencies, such as, the Bengaluru Mahanagara Palike and the public works department and seek their help to solve any environment related issues during project implementation such as delays in processing of permits and/or clearances (during pre-construction stage) or significant grievances.
- (ix) Support the PMU to update the IEE and EMP in consultation with relevant government agencies for clearance by ADB before any changes are implemented.
- (x) Support the PMU to prepare in consultation with relevant government agencies and implement as necessary corrective action plan for clearance by ADB.

(b) Contractor Roles and Responsibilities

181. There are eight contract packages under the project, and so up to eight separate contractors will be employed by BESCOM. Implementation of the EMP during the construction phase is the responsibility of the contractors, the EMP will be included in the contract documents and they will be required to implement it in full. Contractors will have primary responsibility for environmental and social management, and the health and safety of workers and the local community at project construction sites under their control.

182. The contractors will be required to nominate for each contract package they are responsible for the following staff to receive trainings prior to the commencement of works and ensure compliance with the safeguard requirements (i) one appropriately qualified and experienced, dedicated Environment Officer designated with responsibility for ensuring implementation of the EMP; (ii) one appropriately qualified and experienced, dedicated Health and Safety Officer designated with responsibility for ensuring implementation of the health and safety requirements under the EMP given the relative importance of this issue with works being undertaken in a dense urban environment; (iii) one appropriately qualified and experienced, dedicated community liaison/labor officer who will also act as the grievance focal point for the contractor to undertake consultations and deal with any grievances received by the project; and (iv) appropriately qualified and experienced environment, health and safety site supervisors (several site supervisions will be required, the actual number depending on the location and scheduling of works) responsible for ensuring the contractor's day to day implementation of the EMP and thus will need to be based on site full-time.

183. The contractor has the following responsibilities, not an exclusive list:

- (i) Implement the EMP in respect of actions allocated to the contractor during pre-construction and construction.
- (ii) For each of the contract packages the Contractor will have full time Environmental Officer, Health and Safety Officer, and Community Liaison/Labor Officer to implement the EMP as well as ensuring appropriately qualified and experienced environment, health and safety site supervisors are on site full-time at each site.
- (iii) Ensure adherence to ADB's Safeguard Policy Statement (2009), applicable environment, health, safety and labor laws and rules of the Government of India and Karnataka State, and BESCOM's environment and social safeguards policy.
- (iv) Prepare sub-plans as specified the mitigation plan included in Annex 2, such as, Construction EMP plus traffic management plan, construction waste management plan, and health and safety plan for review and approval by the PMU /PMC prior to any construction works.
- (v) Develop an emergency preparedness and response plan for any medical emergency or any other emergency circumstances (e.g. earthquake, flood, oil spill etc.) during construction for review and approval by the PMU/PMC prior to any construction works.
- (vi) Ensure that construction workers, including all formal and informal subcontractors, understand their responsibilities to implement the EMP and mitigate and monitor

environmental impacts associated with their pre-construction and construction activities and with support of BESCOM provide training activities and tool box talks for construction workers.

- (vii) Support the PMU in undertaking ongoing consultation and implementing the GRM.
- (viii) Undertake quantitative environmental monitoring as set out in Table 66 during pre-construction and construction.
- (ix) Submit monthly environmental management reports to the PMU/PMC (these reports will be included as part of the contractor's monthly progress reports) to identify the work undertaken over the reporting period and document the environmental, health and safety measures including supervision activities and quantitative monitoring activities that have been carried out, problems encountered, and follow-up actions that were taken (or will be taken) to correct any problems.
- (x) In case unanticipated environmental impacts occur during the project implementation stage, including design or scope changes, inform the PMU, and as required, help them update the IEE and EMP for clearance by ADB before any changes implemented.
- (xi) In case of non-compliance, inform PMU, and help prepare and implement as necessary a corrective action plan for clearance by ADB.

(c) Review of BESCOM Capacity and Capacity Development Activities

184. BESCOM is responsive to the need to address environment, health and safety impacts and risks being about to update its environment and social safeguards policy. Therefore, BESCOM are in a position to supervise and monitoring EMP implementation with limited support. However, although BESCOM has worked with other development partners such as JICA this is the first intervention for ADB. Therefore, they will need to develop a good understanding of the similarities and differences of their own procedures to ADB's Safeguard Policy Statement (2009) requirements. To further improve their existing capacity the capacity development and training activities in Table 67 are recommended. BESCOM and the contractors will need to ensure that the requisite staff are identified, support and attend all trainings provided, and facilitate the provision of training venue, etc.

Table 67: Summary of Capacity Development and Training Activities

Item	Attendees	Delivered By	Total Cost (\$)
Development of EHS checklists for use on site	n/a	TRTA Consultant	Included in TRTA Contract
Supervising EMP Implementation and Preparing Environmental Monitoring Reports	ESC, PMU, PMC and contractor management team	Independent Environment Monitoring Consultants with support from TRTA Consultant	4,000
GRM operation	GRM Committee Members, GRM Focal Points of BESCOM, PMU, PMC, and contractor	ESC with support from TRTA Consultant	4,000
SPS, EHS Guidelines, EMP implementation for pre-construction and construction (including corrective action for existing facilities under construction)	PMU, PMC, and contractor management team	ESC with support from TRTA Consultant	4,000
SPS, EHS Guidelines, EMP for operation and	O&M unit management	ESC with support from TRTA	4,000

Item	Attendees	Delivered By	Total Cost (\$)
maintenance including PCB and SF6 awareness raising activities	team	Consultant	
Contingency	@ 10% contingency		1,600
		Total	17,600

(d) Implementation Schedule and Costs

185. The project will require survey and design work and the floating of tenders for the procurement of civil works, testing and commissioning related to the 11 kV and 1.1 kV underground cables together with optic fiber communication cables and ring main units. The project is expected to be completed in 60 months or 5 years. The overall project implementation schedule for the project is detailed in Table 68. Survey and design work have already been completed by BESCOM, so the project is now at the pre-construction stage. Eight contract packages will be bid out for the project – 4 are still to be awarded for the sovereign funded contract packages, 4 are already awarded. Contractors will be able to bid for multiple contract packages but there will be a maximum of eight contractors involved.

Table 13: Overall Project Implementation Schedule

	Year	2020				2021				2022				2023				2024				2025			
	Description	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4		
1	Jaya Nagara																								
1.1	Preparation of detail design and approval																								
1.2	Bidding																								
1.3	Preparatory works (survey, setting up of site store and etc.,) and mobilization																								
1.4	Supply and erection of equipment including civil works																								
1.5	Testing and commissioning																								
2	Shivaji Nagara																								
2.1	Preparation of detail design and approval																								
2.2	Bidding																								
2.3	Preparatory works (survey, setting up of site store and etc.,) and mobilization																								
2.4	Supply and erection of equipment including civil works																								
2.5	Testing and commissioning																								
3	Indira Nagara																								
3.1	Preparation of detail design and approval																								
3.2	Bidding																								
3.3	Preparatory works (survey, setting up of site store and etc.,) and mobilization																								
3.4	Supply and erection of equipment including civil works																								
3.5	Testing and commissioning																								
4	Kora Mangala																								
4.1	Preparation of detail design and approval																								
4.2	Bidding																								
4.3	Preparatory works (survey, setting up of site store and etc.,) and mobilization																								
4.4	Supply and erection of equipment including civil works																								
4.5	Testing and commissioning																								
5	H.S.R Division																								
5.1	Preparation of detail design and approval																								
5.2	Bidding																								
5.3	Preparatory works (survey, setting up of site store and etc.,) and mobilization																								
5.4	Supply and erection of equipment including civil works																								
5.5	Testing and commissioning																								
6	White Field																								
6.1	Preparation of detail design and approval																								
6.2	Bidding																								
6.3	Preparatory works (survey, setting up of site store and etc.,) and mobilization																								
6.4	Supply and erection of equipment including civil works																								
6.5	Testing and commissioning																								

Source:

Bengaluru

Electricity

Supply

Company

Limited.

186. Costs for EMP implementation will include:
- (i) contractor's cost of environment, health and safety staff to support EMP implementation;
 - (ii) contractor's cost for implementation of the mitigation plan during the pre-construction and construction phases as set out in Annex 2;
 - (iii) contractor's cost towards quantitative monitoring as set out in Table 66;
 - (iv) BESCO's internal cost of staff for resourcing the PMU and the ESC;
 - (v) costs of appointing the PMC and Independent Environmental Monitoring Reporting Consultants;
 - (vi) BESCO's internal cost of O&M EMP implementation; and
 - (vii) costs of running training events per Table 67.

187. From the total project cost of \$277.3 million, approximately \$0.7 million has been included as the cost for environment (which includes an estimate of the contractor's costs for EMP implementation and a lump sum to cover the various capacity development, supervision and monitoring activities) as shown in Table 69. The costs for EMP implementation have been arrived at by BESCO's environmental consultant based on an optimum and "least-cost" basis. Since the PMU and ESC are staffed by BESCO their internal staff costs are not included.

188. O&M EMP implementation will be done by BESCO, therefore environmental costs during O&M will be borne by them from their internal budget.

Table 69: Estimated Environmental Costs for EMP Implementation

Environmental Cost Element	Cost (\$) *
Estimated Cost EMP Implementation (Contractor's Costs)	400,000
EMP Capacity Development, Supervision and Monitoring (Lump Sum \$200,000 plus Independent Environmental Monitoring Consultants \$100,000) (excludes cost of project management consultant)	300,000
Total	700,000

*Costs of TRTA Consultant to deliver training and undertake independent audit of EMP implementation at the request of ADB are excluded from this table but approximately \$30,000 is included in the TRTA Contract to cover this aspect.

IX. CONCLUSION AND RECOMMENDATIONS

189. Environmental, health and safety impacts are likely to result from the proposed project components, though potential impacts are site-specific, generally temporary during construction works, and cost effectively managed by following national requirements and international good practice per IFC EHS Guidelines. Construction works involve the laying of underground cables, or in limited circumstances replacement with aerial bunched cables, plus the removal of obsolete overhead cables and poles and the installation of RMUs. Bearing in mind construction works will primarily take place along existing rights-of-way in the urban area, and, as the installation technology used is primarily trenchless, avoiding cutting of any trees, the environmental and social impacts are limited.

190. Potential impacts associated with undergrounding the distribution lines have been avoided or minimized through careful route selection by BESCO. Though generally following the alignment of existing overhead distribution line corridors, mainly along the sidewalk, the underground cables are routed to cause minimum inconvenience to the public during works. 90% of replacement cables will be installed using trenchless technology with an open trench method used only in areas of open space with no social safeguards constraints such that less disruption will result from this more basic construction method. The underground cables will be connected to existing pole and plinth mounted transformers, but the project does not involve any new or changes to old transformers but BESCO is legally required to ensure it complies with the Government of India Regulation of Use, Handling and Disposal of Polychlorinated Biphenyls which permits the use of existing PCB containing equipment only up until 31.12.2025 on the proviso it is within its certified lifetime and properly maintained without possibility of leakage or release of PCBs into the environment. Ring main units will be installed in a designated space of a few square meters of state-owned land, in a building or on the street.

191. The impact assessment process identified that the proposed project would have the following potential environmental and social impacts and risks:

- (i) Increased noise, dust, erosion, solid waste, and wastewater generation, resulting in increased pollution risk during the construction works, temporarily disrupting and disturbing sensitive receptors present including shops and markets, hospitals and clinics, schools and libraries, private residences etc.
- (ii) Increased traffic congestion and restrictions on vehicle and pedestrian movements during the construction works, temporarily disrupting and increasing health and safety risks for road and sidewalk users.
- (iii) Occupational health and safety risks for construction workers and BESCO's maintenance staff, especially risks due to working with live electricity and in the street with running traffic.
- (iv) Accidental risk of damage to above or below ground property and utilities and increased public injury in respect of community health and safety during construction due to works being undertaken in the street. Once operational, the risk to community health and safety is significantly reduced by undergrounding of distribution lines.
- (v) Increased use and risk of leakage of SF6 a potent GHG with global warming potential of 22,800 kg carbon dioxide equivalent due to installation of RMUs.

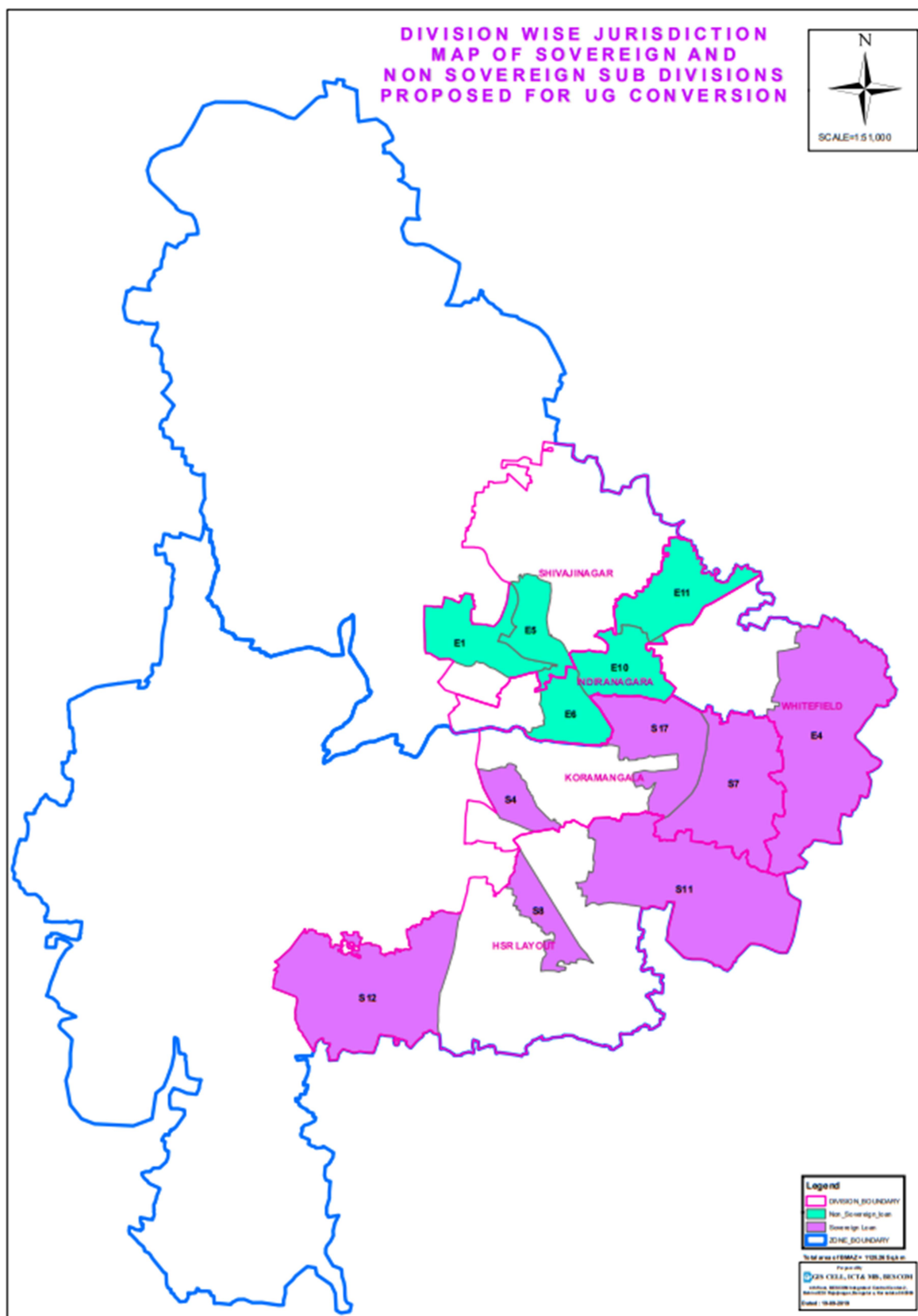
192. To manage these potential impacts mitigation measures will be required prior to the start of construction, as well as during the construction, and, operation and maintenance phases, as detailed in the mitigation plan in Annex 2. It reflects both national requirements and international good practice per the IFC EHS Guidelines. The EMP also includes an environmental monitoring program, including monitoring of health and safety incidents, and the institutional arrangements for its implementation which will be supervised and monitored by BESCO.

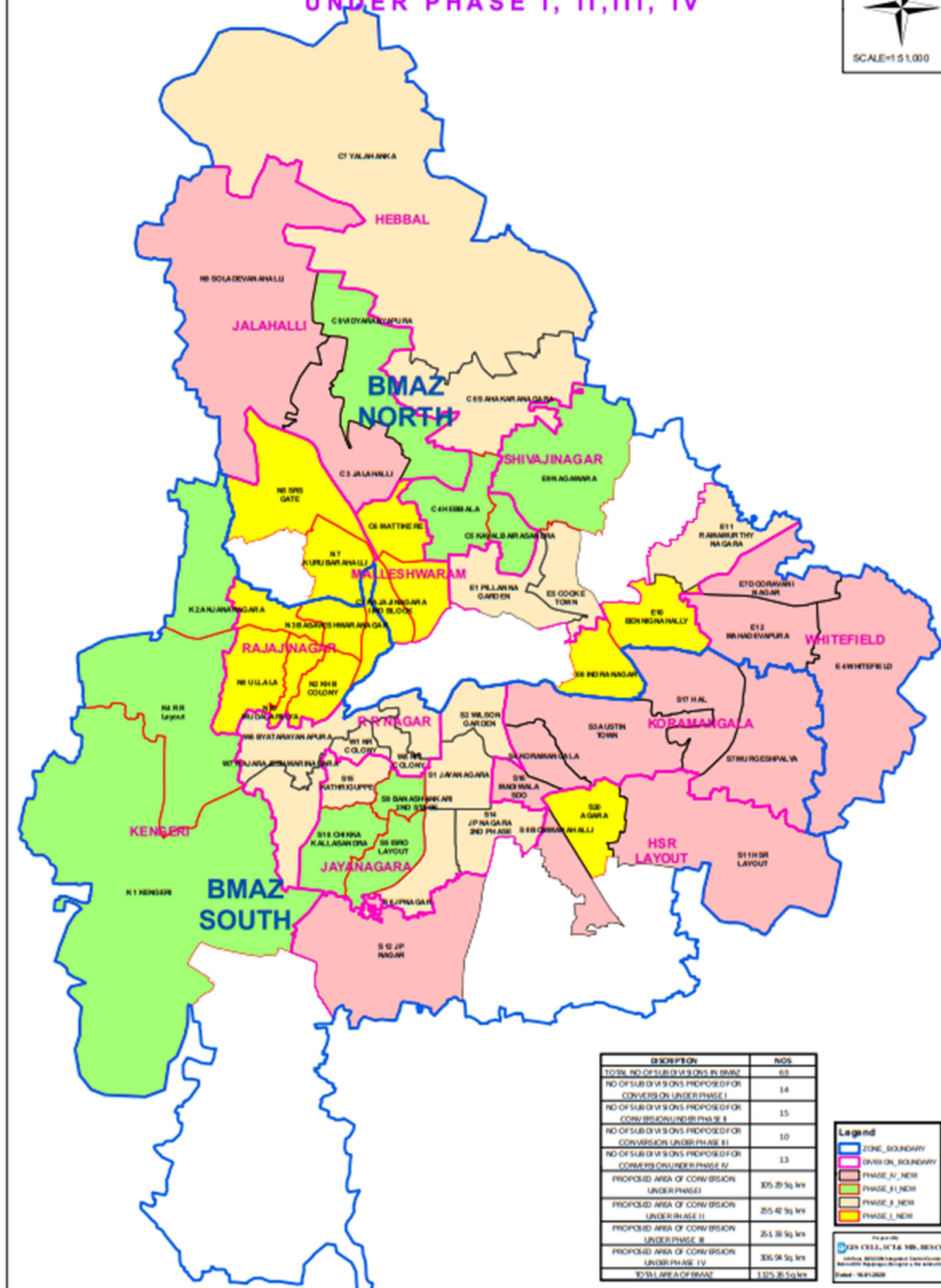
193. Overall, potential impacts associated with undergrounding the distribution lines have been

avoided or minimized through careful route selection by BESCO. Mitigation measures have been identified for the remaining potential impacts and risks and their implementation will be carefully monitored and reported for compliance to ADB by BESCO. If there are any unanticipated impacts or a need for corrective action during project implementation due to non-compliance with the EMP these will be reported by BESCO to ADB and the IEE and EMP will be updated and cleared by ADB as required. In particular, the IEE will be reviewed once working drawings/maps of cable routes and RMU locations have been completed, to confirm no changes in alignments outside existing overhead line corridors and/or affecting environmentally sensitive areas before proceeding with works.

194. Environmental audit of the ongoing works (as existing facilities under construction) has been undertaken and BESCO and their contractors will address gaps identified between their current performance and the requirements of the final EMP as corrective action for immediate implementation.

Annex 1: Map of Sovereign and Non-Sovereign Components, Map of BESCOM Subdivisions for Undergrounding and Field Photographs





DESCRIPTION	AVG
TOTAL NO OF SUBDIVISIONS BY RMAT	63
NO OF SUBDIVISIONS PROPOSED FOR CONVERSION UNDER PHASE I	14
NO OF SUBDIVISIONS PROPOSED FOR CONVERSION UNDER PHASE II	15
NO OF SUBDIVISIONS PROPOSED FOR CONVERSION UNDER PHASE III	10
NO OF SUBDIVISIONS PROPOSED FOR CONVERSION UNDER PHASE IV	13
PROPOSED AREA OF CONVERSION (UNDER PHASE I)	305.29 Sq. km
PROPOSED AREA OF CONVERSION (UNDER PHASE II)	25.42 Sq. km
PROPOSED AREA OF CONVERSION (UNDER PHASE III)	25.13 Sq. km
PROPOSED AREA OF CONVERSION (UNDER PHASE IV)	306.56 Sq. km
TOTAL AREA OF RMAT	1,125.36 Sq. km

Legend

- ZONE_BOUNDARY
- DIVISION_BOUNDARY
- PHASE_IV_NEW
- PHASE_III_NEW
- PHASE_II_NEW
- PHASE_I_NEW

GIS CELL, ICTA MB, RES CO



Latitude: 12.960063
Longitude: 77.641121
Elevation: 887.82 m
Accuracy: 12.0 m
Time: 30-07-2020 10:18
Note: Dommalur koramangala division

Powered by NoteCam

Dommalur Koramangala Division



Latitude: 12.960063
Longitude: 77.641121
Altitude: 803.66 m
Accuracy: 24.0 m
Time: 30-07-2020 10:23
Note: Dommalur koramangala division

Powered by NoteCam

Dommalur



Latitude: 12.958375
Longitude: 77.660774
Elevation: 889.65 m
Accuracy: 24.0 m
Time: 30-07-2020 10:09
Note: HAL koramangala division

Powered by NoteCam

HAL



Latitude: 12.955121
Longitude: 77.697913
Altitude: 826.1 m
Accuracy: 16.0 m
Time: 30-07-2020 09:59
Note: Marathahalli koramangala division

Powered by NoteCam

Marathahalli



Latitude: 12.956206
Longitude: 77.69539
Altitude: 796.57 m
Accuracy: 16.0 m
Time: 30-07-2020 10:03
Note: HAL koramangala division

Powered by NoteCam

HAL



Latitude: 12.955086
Longitude: 77.697959
Elevation: 902.29 m
Accuracy: 8.0 m
Time: 30-07-2020 09:54
Note: Marathahalli koramangala division

Powered by NoteCam

Marathahalli

 <p>Latitude: 12.955483 Longitude: 77.677655 Altitude: 799.95 m Accuracy: 8.0 m Time: 30-07-2020 10:07 Note: HAL koramangala division</p>	 <p>Latitude: 12.959182 Longitude: 77.660768 Elevation: 891.75 m Accuracy: 12.0 m Note: 1st cross 2nd main patel basappa road ,HAL Airport near ,koramangala division</p>
HAL	1 st Cross Main Patel Basappa Road HAL Airport
 <p>Latitude: 12.956923 Longitude: 77.674577 Altitude: 793.3 m Accuracy: 16.0 m Note: 2nd cross 1st main HAL Airport road ,koramangala division</p>	 <p>Latitude: 12.919401 Longitude: 77.747999 Altitude: 779.39 m Accuracy: 16.0 m Note: Tulasi theater main gate road, Marathahalli ,koramangala division</p>
1 st Cross Main Patel Basappa Road HAL Airport	Tulasi Theater Main gate Road Marathahalli
 <p>Latitude: 12.959336 Longitude: 77.657303 Elevation: 899.07 m Accuracy: 8.0 m Note: 1st main Pappaya reddy badavane road , Murugeshpalya Indira nagar division</p>	 <p>Latitude: 12.982138 Longitude: 77.603432 Elevation: 908.67 m Accuracy: 12.0 m Note: 1st cross 1st main Hospital road Shivajinagar division</p>
1 st Main Pappaya Reddy Badavana Road Murugeshpalya Indira Nagar	1 st Cross, 1 st main Hospital Road, Shivaji Nagar



Indian Express Road Shivaji Nagar

A N Krishnataya Road 4th main, HAL Airport

CT Streatham near Chowdeshwari Temple, Marathahalli



Shivaji Nagar



Shivaji Nagar



Shivaji Nagar



Shivaji Nagar



Shivaji Nagar



Shivaji Nagar



Indira Nagar



Indira Nagar



Indira Nagar

Annex 2: Environmental Management Plan – Mitigation Plan

Project Activity	Potential Environmental Impact	Mitigating Actions	Performance Standard	Budget/ Source	Institutional Responsibility		Schedule
					BESCOM	Contractor	
PRE-CONSTRUCTION PHASE							
A	General						
General	n/a	For non-sovereign and counterpart funded contract packages already awarded BESCOM and contractor to implement project-level corrective action plan to address gaps in current performance (Annex 10 of IEE)	Corrective action plan implemented as cleared by ADB	n/a	Comply with mitigating measures. PMU/ESC supported by PSC to check compliance. IEC to check and document compliance semi-annually in EMR.	Comply with mitigating measures	Through project implementation per schedule of corrective action plan
General	n/a	BESCOM and contractor to comply with the regulatory EHS framework as set out in the IEE including BESCOM Environment and Social Safeguards Policy and the EHS General Guidelines (April 2007) and EHS Guidelines for Electric Power Transmission and Distribution (April 2007) plus all other applicable national laws and regulations in force in addition to the mitigation set out in this plan	No breaches of compliance with specified requirements	Part of contract cost, include costs of implementing EMP as BOQ line	Comply with mitigating measures. PMU/ESC supported by PSC to check compliance. IEC to check and document compliance semi-annually in EMR.	Comply with mitigating measures	Through project implementation
Staffing	n/a	BESCOM to staff ESC with suitably qualified and experienced Junior Environment, Health and Safety Officers who will also act as Community Liaison/GRM Focals and nominate one suitably qualified and experienced Deputy General Manager in PMU as Environment and Social Safeguards Manager to help PMU to supervise and monitor the project. Contractor to appoint a suitably qualified and experienced dedicated Environment Officer, dedicated Health and Safety Officer, and a dedicated Community Liaison/Labor Officer/GRM Focal as well as	Specified staff on board	Part of contract cost, include costs of EHS staffing as BOQ line	Comply with mitigating measures. PMU/ESC supported by PSC to check compliance. IEC to check and document compliance semi-annually in EMR.	Ensure requisite staff are appointed to the project	Upon loan effectiveness for BESCOM, contract award for contractor

Project Activity	Potential Environmental Impact	Mitigating Actions	Performance Standard	Budget/ Source	Institutional Responsibility		Schedule
					BESCOM	Contractor	
		<p>an adequate number of EHS Site Supervisors as set out in Section 8.3.2 of the EMP</p> <p>Contractor should not discriminate and should proactively encourage the employment of suitably skilled women on the project.</p> <p>Employment of locally hired workers is encouraged to the extent possible whilst ensuring suitably qualified and experienced workers.</p> <p>No child will be employed, and no under 18s will be engaged on construction site (hazardous work)</p>					
Bidding and contract award	n/a	PMU to include draft EMP included in bidding documents and final EMP in contract documentation	Draft EMP and final EMP included as specified	n/a	Comply with mitigating measures. PMU/ESC supported by PSC to check compliance. IEC to check and document compliance semi-annually in EMR.	n/a	Prior to issue of bidding documents and contract award
GRM establishment	n/a	Establish effectively operating GRM and inform all affected persons of its existence and means of submitting project grievance to BESCOM by distributing verbally and through notices or pamphlets the contact details	GRM operationalized	n/a	Comply with mitigating measures. PMU/ESC supported by PSC to check compliance. IEC to check and document compliance semi-annually in EMR.	n/a	Prior to contractor mobilization on-site
Capacity development	n/a	Conduct training on EMP and GRM implementation for those with responsibilities under them as set out in Table 65 of the EMP	<p>100% of trainings provided</p> <p>100% of requisite staff have received training</p>	Part of contract cost, include costs of EHS staffing as	Provide training activities and ensure requisite staff attend, PMU/ESC supported by PSC to	Ensure requisite staff attend trainings provided	Prior to contractor mobilization on-site

Project Activity	Potential Environmental Impact	Mitigating Actions	Performance Standard	Budget/ Source	Institutional Responsibility		Schedule
					BESCOM	Contractor	
				BOQ line	check compliance. IEC to check and document compliance semi-annually in EMR.		
EHS management preparations	n/a	<p>Contractor to develop a construction environmental management plan (CEMP) for the contract package to BESCOM for approval, to provide details on how contractor plans to implement the construction mitigation measures specified in this EMP and relevant parts of the EHS Guidelines on Construction and Demolition. CEMP will identify the temporary construction facilities required for the construction package e.g. laydown area, stores, temporary workers facilities etc.</p> <p>CEMP will reflect the final cable alignments and construction methods as well as arrangements for material sourcing and transportation of equipment and materials to the site ready for their installation.</p> <p>Contractor to conduct training on CEMP and sub-plans implementation for contractors' management team including subcontractors.</p>	<p>CEMP approved</p> <p>100% of contractors' management staff including subcontractors have received training on CEMP and sub-plans</p>	Part of contract cost, include costs of implementing EMP as BOQ line	PMU to review and approve CEMP with support of ESC, PMU/ESC supported by PSC to check compliance. IEC to check and document compliance semi-annually in EMR.	Contractor to prepare and submit CEMP for approval, provide trainings, submit copies of training attendance sheets and photos to BESCOM	Prior to contractor mobilization on-site
Ongoing consultations	n/a	BESCOM to undertake and document meaningful consultations in all subdivisions of the project with affected people and concerned agencies including but not limited to relevant local authorities and utilities prior to approving any works in that subdivision in order that any concerns raised can be reflected in the choice of alignment and construction method – a template for this additional consultation is included in Annex 8 of the IEE.	<p>Consultations undertaken and documented in EMR</p> <p>Health and safety campaign for households and businesses undertaken</p> <p>No unresolved grievances from local</p>	Part of contract cost, include costs of implementing EMP as BOQ line	Comply with mitigating measures. PMU/ESC to undertake health and safety campaign. PMU/ESC supported by PSC to check compliance. IEC to check and document compliance semi-	Comply with mitigating measures; retain copies and photos of notices or pamphlets and records of consultation meetings on file	Prior to contractor mobilization on-site, ongoing consultation to continue throughout construction

Project Activity	Potential Environmental Impact	Mitigating Actions	Performance Standard	Budget/ Source	Institutional Responsibility		Schedule
					BESCOM	Contractor	
		<p>Provide at least one-month advance notice to local community through notices or pamphlets about the schedule of, location plan, and details of planned construction works, including anticipated traffic disruption (road closures, diversions etc.)</p> <p>Coordination with the concerned local government authority and media to disseminate knowledge about health and safety to households and businesses located near areas of the temporary cable entry and exit pits</p> <p>Continue to undertake consultation with affected persons especially those with properties within 5 meters of temporary cable entry and exit pits to keep them fully informed of the nature of works and latest schedule.</p> <p>Local communities to be consulted by contractor when selecting sites for temporary construction facilities prior to finalization of their location.</p>	community or relevant local authorities or utilities		annually in EMR.		
Final planning of cable alignments	n/a	Undertake safeguard check of the final cable alignments and construction methods through walkover, underground utility scanning and ongoing consultation to confirm (i) uses the existing overhead corridor, (ii) no park, garden, or lake areas are crossed, (iii) no heritage zones are affected, (iv) no regulated state monument zones are crossed and no impact on cultural resources as notified under the Ancient Monuments and Archaeological Sites and Remains Act, and (v) no trees or local physical cultural resources to be impacted	<p>Final safeguard checks completed</p> <p>Current IEE disclosed on ADB website reflects final project design and scope</p> <p>Final IEE locally disclosed by BESCOM</p>	n/a	Comply with mitigating measures. PMU/ESC supported by PSC to check compliance. IEC to check and document compliance semi-annually in EMR.	n/a	Prior to commencement of construction works, then as required during project implementation

Project Activity	Potential Environmental Impact	Mitigating Actions	Performance Standard	Budget/ Source	Institutional Responsibility		Schedule
					BESCOM	Contractor	
		<p>Review the final cable alignments and construction methods to confirm no change from the alignments described and the impacts and risks assessed in the IEE upon ADB Board approval, if any changes update the IEE and seek ADB's clearance prior to the commencement of construction works. A template that can be used for undertaking final safeguards checks of cable alignments is included in Annex 8 of the IEE.</p> <p>Final IEE and EMP to be posted on the BESCOM website, six division offices, and notices posted in the vicinity of construction works to inform of its availability – hard copy to be made available to view on-site free of charge on request.</p>					
B Physical Resources							
Procurement of ring main units (RMU)	Release of SF6 as greenhouse gas resulting in climate change impact	<p>In accordance with Kyoto Protocol and Paris agreement to minimize SF6 use alternative insulation medium to be considered. If no alternative use of SF6 in RMU must be minimized. RMU to be sealed pressure “sealed for life” units, contain less than 2 kg of SF6 and be tested and guaranteed by the supplier at less than 0.1% leakage rate.</p> <p>In addition to RMUs being properly sealed to avoid leakages, the detailed design will ensure the RMUs linked to alarms at the nearest concerned O&M Unit, these alarms will be triggered by any SF6 leak recorded.</p>	CO2e of total volume of SF6 in all 1,892 RMU must be less than 100,000 tons CO2e (GWP = 22,800 kg CO2) with less than 0.1% leakage rate per RMU with a total leakage of less than 100 tons CO2e/annum	Part of contract cost	Comply with mitigating measures. PMU/ESC supported by PSC to check compliance. IEC to check and document compliance semi-annually in EMR.	Comply with mitigating measures	Through project implementation
EHS management preparations	Pollution incident occurs during construction and construction waste inappropriately disposed of	Develop as part of the CEMP and in accordance with national laws and regulations and the EHS Guidelines: (i) pollution prevention plan (PPP) covering environmentally sound and safe storage	CEMP including PPP/CWMP approved	Part of contract cost, include costs of implementing	PMU to review and approve CEMP with support of ESC and PSC, PMU/ESC supported by PSC to	Contractor to prepare and submit CEMP including PPP/CWMP for	Prior to contractor mobilization on-site

Project Activity	Potential Environmental Impact	Mitigating Actions	Performance Standard	Budget/ Source	Institutional Responsibility		Schedule
		and use of all fuels, chemicals and oils used on site and an emergency preparedness and response plan in the event of (a) any leaks or spills, or (b) damage during installation to water or sewerage pipes; and (ii) construction waste management plan (CWMP) for dealing with all solid and hazardous waste generated in an environmentally sound and safe manner.		EMP as BOQ line	BESCOM check compliance. IEC to check and document compliance semi-annually in EMR.	Contractor approval	
Material sourcing	Use of natural resources and associated environmental impacts	Contractor will only procure construction materials from existing licensed sites/sources and authorized third parties; contractor will verify the legal status of the supplier's operation.	Records of materials sourced	Part of contract cost, include costs of implementing EMP as BOQ line	PMU/ESC supported by PSC to check compliance. IEC to check and document compliance semi-annually in EMR.	Contractor to comply with mitigating measures; keep records of materials purchased and sources	Through project implementation
C Biological Resources							
Final planning of cable alignment	Disturbance of urban trees and other vegetation (if any) during construction works	No works to be undertaken within the boundaries of forest, park, garden, or lakes. Excavation pits to be placed to avoid the area beneath tree crowns (zone for root protection) and other vegetation. Cable alignment placed to the extent possible to avoid tree crowns, especially for mature trees. Demarcate on site the working area and mature trees to be avoided. No tree to be cut unless at risk of causing a public safety hazard due to root damage. If any trees are to be cut, they are to be replaced 1:2 by native species in nearly the same location. The contractor will monitor the progress of any replacement planting to ensure the same number of trees remains	No trees cut, or any that are cut are replaced as specified	Part of contract cost, include costs of implementing EMP as BOQ line	Comply with mitigating measures. PMU/ESC supported by PSC to check records for compliance. IEC to check and document compliance semi-annually in EMR.	Comply with mitigating measures; record any tree cutting and replacement as per the EMoP	Before commencement of construction works

Project Activity	Potential Environmental Impact	Mitigating Actions	Performance Standard	Budget/ Source	Institutional Responsibility		Schedule
					BESCOM	Contractor	
		<p>established after two years so “no net loss of biodiversity” is achieved.</p> <p>Before any tree cutting ESC to check for presence of nesting birds unless undertaken outside the bird breeding season or roosting bats.</p>					
D Human Environment							
Final planning of cable alignment	Damage to above ground property and other public utilities' underground assets during construction works	<p>BESCOM to only plan for excavation of open trenches where adequate open space with no social safeguards constraints allows this more basic construction methodology to be used without disruption and disturbance to environment and public.</p> <p>BESCOM to coordinate with the Bruhat Bengaluru Mahanagara Palike (BBMP) during fixing the alignment and construction method to be used and obtain their no objection.</p> <p>Contractor to undertake photographic and/or structural pre-condition surveys of existing above ground property condition including utilities, structures, footpaths, roads and/or drains as per the EMoP to form the baseline for any future claims.</p> <p>Contractor to consult with relevant local authorities (electric, water, gas, telecoms) and carry out scans using Cable Avoidance Tool (CAT) or equivalent to identify known and unknown underground utilities prior to excavation.</p> <p>Excavation pits and cable alignment to be placed to avoid damage to above ground property and underground assets to the extent possible; if this is not possible</p>	<p>Survey records, consultations records, latest maps of underground assets, all required permits and/or clearances obtained and on file</p> <p>No unforeseen damage during construction works, or any damage that is caused compensated for by the contractor</p>	Part of contract cost, include costs of implementing EMP as BOQ line	Comply with mitigating measures, obtain any permits and/or clearances. PMU/ESC supported by PSC to check files for compliance. IEC to check and document compliance semi-annually in EMR.	Comply with mitigating measures; document all surveys and consultations undertaken and submit to BESCOM for record purposes	Before commencement of construction works

Project Activity	Potential Environmental Impact	Mitigating Actions	Performance Standard	Budget/ Source	Institutional Responsibility		Schedule
					BESCOM	Contractor	
		<p>BESCOM to obtain any permits and/or clearances consistent with the requirements of GoI and GoK from other public utilities that could be impacted and cover any compensation due to foreseen damages.</p> <p>In particular, given community concerns attention will be paid to ensuring that underground sewerage and surface water drainage channels are protected by appropriately setting back the trenches from them in conjunction with BWSSB and BBMP.</p> <p>If any unforeseen damages do occur during construction any compensation due is to be paid by the contractor.</p> <p>Before the start of construction, the contractor will be required to inform any informal street vendors or other informal users along the alignment, if any, to shift their locations temporarily e.g. to the other side of the street for the day to avoid any loss of their livelihoods. In the event that access to an area will be impeded for more than 8 hours, the contractor will provide for alternative safe access for formal and informal users.</p> <p>Planning of works will be done in conjunction with other construction works in the city to minimize the cumulative impacts they may cause to the local community.</p>					
Health and safety (H&S) risk	Occupational and community health and safety incident during	For all construction works contractor to undertake risk assessment and develop a H&S plan in accordance with national laws	H&S Plan approved	Part of contract cost, include costs	PMU/ to review and approve H&S Plan with support of ESC	Contractor to undertake risk assessment and	Prior to contractor mobilization on-

Project Activity	Potential Environmental Impact	Mitigating Actions	Performance Standard	Budget/ Source	Institutional Responsibility		Schedule
assessment and management planning	construction	and regulations, BESCOM Safety Manual and the EHS Guidelines, considering both occupational and community H&S risks during construction.		of implementing EMP as BOQ line	BESCOM	Contractor	site
		H&S plan to include an emergency preparedness and response plan with communication systems and protocols for reporting and responding to any medical emergency or any other emergency circumstances such as traffic accident during construction. Specifically, this will include measures to prevent and respond to COVID-19 cases ²⁷ plus natural hazards, earthquake, flood etc.			and PSC, PMU/ESC supported by PSC to check compliance. IEC to check and document compliance semi-annually in EMR.	prepare and submit H&S Plan for approval	
		Contractor to conduct trainings on health and safety risk, management, emergency preparedness and response in case of an occupational or community health and safety incident to (i) all contractors' management team including subcontractors, and (ii) all on-site workers including from formal and informal subcontractors before the commencement of any on-site works. This is to include training on how to use first aid and firefighting equipment provided on-site.					
		No new transformers are envisaged but if required they will need to be certified PCB					

²⁷ Particular attention to be paid to COVID-19 given construction is directly within the community and the transient nature of the construction workforce who could pass it to the community (especially those with existing medical conditions such as diabetes, heart and lung disease) and vice versa. Risk assessment to consider distribution and number of cases in India, Karnataka and Bangalore in relation to home base of construction workers, options for travel to work – public or private transport, and the location of works and overnight worker accommodation. Particular attention will need to be paid to the ability of communities to comply with protective measures such as regular handwashing and for the local health care facilities capacity to deal with any infections. Given the specialist nature of responding to COVID-19 public health officials/experts to be consulted regarding the risk. In developing the H&S plan Government of India (<https://www.mygov.in/covid-19>) and World Health Organization guidance (<https://www.who.int/emergencies/diseases/novel-coronavirus-2019/technical-guidance>) should be followed ensuring adequate sanitation and welfare facilities including for hand washing and personal protective equipment are provided to construction workers.

Project Activity	Potential Environmental Impact	Mitigating Actions	Performance Standard	Budget/ Source	Institutional Responsibility		Schedule
					BESCOM	Contractor	
		<p>free.</p> <p>In the absence of documentary evidence (e.g. contract specification or certification for supply of original transformer, maintenance records for oil replacement including material safety data sheet, or transformer oil test results etc.) for given transformers confirming they are PCB-free, all old transformers must be considered at risk of containing PCBs and appropriate health and safety management measures taken.</p> <p>No asbestos containing materials must be used during the construction.</p> <p>Community awareness raising with concerned local government authorities and media dissemination about the community health and safety risks will be needed for all communities living and working near the project sites, so they know what to expect.</p> <p>Communication channels and protocols with local and regional emergency and health authorities will need to be established in case of an incident.</p> <p>To reduce the consequences of a cable break incident during operation, the design of underground cables to be armored by steel wires to protect the live cores. In case the armor is broken by a third party and the core is damaged, protection relays in the substation will be designed to detect this and stop sending electricity to the feeder immediately by automatically opening switchgear in the</p>					

Project Activity	Potential Environmental Impact	Mitigating Actions	Performance Standard	Budget/ Source	Institutional Responsibility		Schedule
					BESCOM	Contractor	
		<p>substation to prevent a live shock to the person.</p> <p>So that when underground works need to be done by others, the location of the cables would be known and avoided, design of underground cables to include warning marks above ground or over the cable,</p>					
EHS management preparations	Loss of unknown physical cultural resources found during construction works	<p>If roads in heritage zones are involved obtain no objection from Bruhat Bengaluru Mahanagara Palike (BBMP) of the alignment and construction method before it is fixed.</p> <p>No works to be undertaken in 100m prohibited zone of state monument.</p> <p>If roads in 200m regulatory zone of state monument are involved obtain regulatory permissions and ensure requirements are followed in full during construction phase.</p> <p>Chance find procedure to be developed as part of CEMP for implementation in the event physical cultural resources are found, to include the following procedures: -If suspected physical cultural resources are encountered (including but not limited to fossils, coins, articles of value or antiquity, and remains of geologic or archeological interest), all works at the find site should be immediately halted. -The find should be assessed by a competent local District Office or Culture and Fine Arts official, and procedures to avoid, minimize or mitigate impacts to such physical cultural objects should be agreed in writing with them.</p>	CEMP including chance find procedure approved	Part of contract cost, include costs of implementing EMP as BOQ line	PMU to review and approve CEMP with support of ESC and PSC, PMU/ESC supported by PSC to check compliance. IEC to check and document compliance semi-annually in EMR.	Contractor to prepare and submit CEMP including chance find procedure for approval	Prior to contractor mobilization on-site

Project Activity	Potential Environmental Impact	Mitigating Actions	Performance Standard	Budget/ Source	Institutional Responsibility		Schedule
					BESCOM	Contractor	
		<p>-Work should not begin until the procedures to avoid, minimize or mitigate impacts to the physical cultural resources have been agreed and implemented in full.</p> <p>-If avoidance is not feasible, and no alternatives to removal exist, and the project benefits outweigh the anticipated cultural heritage loss from removal which is unlikely unless in case of resource of local value, following clearance of ADB the physical cultural resources should be removed and preserved using the best available technique in accordance with relevant provisions of national heritage protection laws and decrees.</p> <p>-Records should be maintained of all finds, including chain of custody instructions for movable finds.</p> <p>All construction workers to be made aware of the chance-find procedure and types of finds to be reported.</p>					
EHS management preparations	Interference with pedestrian and vehicle traffic during construction	<p>Develop as part of CEMP a Traffic Management Plan (TMP) in consultation with relevant local authorities to ensure proper execution of traffic controls including where temporary blockage of footpath or road during installation is required for health and safety purposes that highly visible guides, advance warning signs or flag persons are in place to direct pedestrian and vehicular traffic.</p> <p>Safe access to property (including schools, hospitals, clinics, places of worship (temples, mosques, churches, shrines) etc.) and footpaths and roads should be maintained wherever possible and diversions and alternative access provided and clearly signed where there are</p>	CEMP including TMP approved	Part of contract cost, include costs of implementing EMP as BOQ line	PMU to review and approve CEMP with support of ESC and PSC, PMU/ESC supported by PSC to check compliance. IEC to check and document compliance semi-annually in EMR.	Contractor to prepare and submit CEMP including TMP for approval	Prior to contractor mobilization on-site

Project Activity	Potential Environmental Impact	Mitigating Actions	Performance Standard	Budget/ Source	Institutional Responsibility		Schedule
					BESCOM	Contractor	
		temporary blockages that are a health and safety risk Planning of works will be done in conjunction with other construction works in the city to minimize the cumulative impacts they may cause to the local community.					
Equipment transportation and site preparation	Traffic disturbance	Comply with agreed traffic management plan (TMP) Transport equipment and conduct site preparation only during non-rush hours i.e. avoid the hours of 6am to 8 am and 4pm to 6 pm and in conjunction with other construction works to minimize the cumulative impacts they may cause traffic congestion.	Transportation and site preparation in compliance with TMP and avoids rush hour No unresolved grievances from local community or relevant local authorities	Part of contract cost, include costs of implementing EMP as BOQ line	PMU day to day supervision of transportation and site preparation activities supported by PSC. PMU/ESC to monitor and review records for compliance supported by PSC. IEC to check and document compliance semi-annually in EMR.	Comply with mitigating measures; record times of all deliveries and site preparation activities	Throughout on-site activities
CONSTRUCTION PHASE							
A General							
EHS management	n/a	Implement agreed CEMP and H&S Plan Provide prominent signage detailing site and office contacts in case of grievance Provide daily toolbox talk to all construction workers including subcontractors in relation to CEMP and H&S Plan implementation Develop training plan to provide regular one-off training events throughout the construction period on key topics related to the CEMP and H&S Plan implementation	CEMP and H&S Plan complied with by the contractors Contacts for grievances prominently displayed at construction sites Daily toolbox talks provided to 100% of construction workers on-site	Part of contract cost, include costs of implementing EMP as BOQ line	PMU day to day supervision supported by PSC. PMU/ESC supported by PSC to approve contractor's training plan and monitor compliance. IEC to check and document compliance semi-annually in EMR.	Comply with mitigating measures; submit training plan for approval, copies of toolbox talk and training attendance sheets and photos to be submitted to BESCOM	Throughout construction

Project Activity	Potential Environmental Impact	Mitigating Actions	Performance Standard	Budget/ Source	Institutional Responsibility		Schedule
					BESCOM	Contractor	
		<p>Ensure good housekeeping throughout construction.</p> <p>Once construction works are completed, return construction area and its surroundings to at least pre-project conditions.</p>	Regular one-off trainings delivered in accordance with agreed training plan				
B Physical Resources							
Use of fuel, oil and chemicals/excavation resulting in sediment laden runoff	Pollution incident risk	<p>Implement the agreed PPP and avoid the occurrence of pollution incidents as far as practicable.</p> <p>Follow General EHS Guidelines for the use and storage of fuel, oil, and chemical including prevention and control of hazards associated with spill prevention, emergency response, clean up and contaminated soil remediation</p> <p>Fuel, oil and chemicals used to be kept under lock and key and stored in labelled, sealed containers on drip trays to provide secondary containment, ideally these will be located on an impermeable surface</p> <p>Mounting of plant containing oil and diesel on drip trays to catch leaks.</p> <p>Refueling operations, equipment servicing and washdown to take place on an impermeable surface at least 50m from watercourses, springs and wells, with drainage directed through oil and grease interceptors before being discharged into a settling pond prior to discharge offsite</p> <p>Provide enough absorbent materials (e.g. sorbents, dry sand, sandbags) on-site for soaking up fuel, oil or chemical leaks/spills</p> <p>Undertaking works particularly for installation of open trenches during</p>	<p>PPP complied with</p> <p>Compliance with national laws and regulations</p> <p>No unresolved grievances from local community or relevant local authorities</p>	Part of contract cost, include costs of implementing EMP as BOQ line	PMU day to day supervision supported by PSC. PMU/ESC supported by PSC to monitor compliance and respond to any grievances raised. IEC to check and document compliance semi-annually in EMR.	Comply with mitigating measures	Throughout construction

Project Activity	Potential Environmental Impact	Mitigating Actions	Performance Standard	Budget/ Source	Institutional Responsibility		Schedule
					BESCOM	Contractor	
		monsoon season to be avoided to prevent the need to pump out and dispose of sediment laden water.					
Operation of construction vehicles, machinery and equipment (e.g. diesel generators)	Increased noise levels and exhaust emissions during works affecting air quality and adjacent communities and worker H&S	<p>Schedule works to minimize disturbance to local communities e.g. undertake unloading and nighttime work in commercial areas and in the vicinity of schools, and daytime unloading and work (office hours, 8am-6pm) in the vicinity of residential areas; undertake daytime unloading and works in the vicinity of schools only on weekends, and all unloading and works in residential areas only on weekdays.</p> <p>Noise generating construction-related activities will be avoided during exam periods, prayer times, religious or cultural events near any sensitive receptors.</p> <p>If nighttime unloading or works in residential areas cannot be avoided consult with ESC and obtain written permission from the concerned local authority before going ahead.</p> <p>Prohibit the use of horns in residential and other areas where sensitive receptors are located</p> <p>Limit engine idling to maximum 5 minutes</p> <p>Use of low noise generating machinery and equipment e.g. less than 55dBA sound pressure level at 1m wherever possible; even if permission is granted to work at night in residential areas no high noise generating machinery and equipment should be used at nighttime in residential areas</p> <p>Comply with the Noise Pollution (Control and Regulation) Rules, 2000 – in addition, in the vicinity of residential properties noise</p>	<p>Compliance with national laws and regulations including CPCB ambient air quality standards and noise levels as well as WHO noise standards for residential properties where more stringent than Gol area-based approach</p> <p>No unresolved grievances from local community, relevant local authorities, or construction workers</p>	Part of contract cost, include costs of implementing EMP as BOQ line	PMU day to day supervision supported by PSC. PMU/ESC supported by PSC to monitor compliance and respond to any grievances raised. IEC to check and document compliance semi-annually in EMR.	Comply with mitigating measures; keep required maintenance records and undertake noise and ambient air quality monitoring in accordance with the EMoP	Throughout construction

Project Activity	Potential Environmental Impact	Mitigating Actions	Performance Standard	Budget/ Source	Institutional Responsibility		Schedule
					BESCOM	Contractor	
		<p>levels must be limited to 55dB(A) as 1hour LAeq during the daytime and if nighttime work is permitted it must be limited to 45dB(A) as 1hour LAeq to comply with the EHS Guidelines that are property not area based. If these rules or noise levels are exceeded the contractor will be required to implement additional noise mitigation measures such as adjusting his working methods or placing of temporary noise barriers to ensure the noise standards are met.</p> <p>Construction vehicles, machinery and equipment to meet applicable national air and noise emission requirements and have passed emissions test and received certification for noise and air emissions as applicable to them.</p> <p>Fit all vehicles, machinery and equipment used in construction with exhaust silencers where the manufacturer's design allows this</p> <p>Maintain in good working order in accordance with the manufacturer's instructions all vehicles, machinery and equipment to minimize noise emissions and emissions to air</p> <p>Position any stationary emission sources (e.g. diesel generators) as far as practical from sensitive receptors (residences, shops, schools, clinics, temples, etc.)</p> <p>Ensure all construction workers exposed to the noise from the surrounding environment and the construction works exceeding >85dB(A) over 8 hours are provided with and wear acoustic ear plugs or earphones capable of reducing noise levels to 85dB(A)</p> <p>Ensure all construction workers exposed to</p>					

Project Activity	Potential Environmental Impact	Mitigating Actions	Performance Standard	Budget/ Source	Institutional Responsibility		Schedule
					BESCOM	Contractor	
		exhaust emissions in surrounding environment and due to construction works are provided with and wear the N95 masks					
Use of dust generating materials and soil excavation for laying underground cable	Generation of dust affecting air quality and adjacent communities	<p>Stockpiles of sand, soil and other dust generating materials to be kept to a minimum necessary to undertake works for the day and will be covered with a canvas or tarpaulin to minimize the release of dust</p> <p>Trucks transporting sand, soil and other dust generating materials will be covered with a canvas or tarpaulin to minimize the release of dust</p> <p>During the dry season or in windy conditions spray water at least twice a day at the construction sites and along transport routes where any sensitive receptors are located (residences, shops, schools, clinics, temples, etc.) but more often if needed during excavations, dry and windy conditions that enable dust to be easily mobilized and the dust to be visible using specialized water tankers of 4.5 cubic meters.</p> <p>Use rolling construction method and restore surface of pavement or road right after construction activities completed on that section.</p> <p>Repaving of the excavated area will be done manually immediately once the installation of the cable is complete.</p> <p>Stockpiles of sand, soil and other dust generating materials to be kept at least 10m away from drains and watercourses and as far as practical from sensitive receptors (residences, shops, schools, clinics, temples, etc.)</p> <p>Reduce the volume of excavation pit to the minimum feasible to reduce the amount of</p>	<p>Compliance with national laws and regulations including CPCB ambient air quality standards</p> <p>No unresolved grievances from local community or relevant local authorities</p>	Part of contract cost, include costs of implementing EMP as BOQ line	PMU day to day supervision supported by PSC. PMU/ESC supported by PSC to monitor compliance and respond to any grievances raised. IEC to check and document compliance semi-annually in EMR.	Comply with mitigating measures; air quality monitoring in accordance with the EMoP	Throughout construction

Project Activity	Potential Environmental Impact	Mitigating Actions	Performance Standard	Budget/ Source	Institutional Responsibility		Schedule
					BESCOM	Contractor	
		<p>soil disturbed, fill with excavated soil as soon as possible to reduce dust emissions.</p> <p>Soil scattered on paved pavements and roads shall be immediately swept up to avoid windblown dust.</p> <p>Impose speed limits on construction vehicles to minimize the spread of dust from roads along areas where sensitive receptors are located (residences, shops, schools, clinics, temples, etc.)</p> <p>Provide construction workers with N95 dust masks to be worn when dust generating activities take place</p>					
Generation of solid and hazardous wastes	Inappropriate disposal of solid and hazardous waste generated by construction works and the construction workers	<p>Construction material such as cables, sand etc., will be good quality materials and shall come from licensed factories and quarries</p> <p>Implement the agreed CWMP and avoid or minimize the generation of wastes by as far as is practicable.</p> <p>Comply with the (i) Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 and Hazardous and Other Wastes (Management and Transboundary Movement). Amendment, Rules, 2019 (ii) Bio Medical Waste Management Rules, 2016, (iii) Construction and Demolition Waste Management Rules, 2016, (iv) E-Waste Management Rules, 2016, and (v) Plastic Waste Management Rules, 2016 for the collection, storage, and disposal of solid and hazardous wastes.</p> <p>Collect and segregate construction wastes including scrap metal, oils, and solid waste; arrange garbage bins to collect these wastes during the construction wastes to they are not thrown on the floor</p> <p>Collect and segregate all domestic solid</p>	<p>Disposal of waste in accordance with agreed CWMP</p> <p>Compliance with national laws and regulations including CPCB norms</p> <p>No unresolved grievances from local community or relevant local authorities</p>	Part of contract cost, include costs of implementing EMP as BOQ line	PMU day to day supervision supported by PSC. PMU/ESC supported by PSC to monitor compliance and respond to any grievances raised. IEC to check and document compliance semi-annually in EMR.	Comply with mitigating measures; keep records in accordance with the EMoP	Throughout construction

Project Activity	Potential Environmental Impact	Mitigating Actions	Performance Standard	Budget/ Source	Institutional Responsibility		Schedule
					BESCOM	Contractor	
		<p>waste generated by construction workers; arrange garbage bins to collect these wastes during the construction wastes to they are not thrown on the floor</p> <p>Store all wastes in designated, labelled area in an environmentally sound manner e.g. oils to be stored in sealed drums on drip trays, solid wastes to be stored in an enclosed bin.</p> <p>It must be ensured that this inert waste is not contaminated with solid and hazardous waste by maintaining good housekeeping for collection/storage.</p> <p>Burning of wastes generated by project-related activities is strictly prohibited</p> <p>Dumping of solid and hazardous wastes on the side of the road, in drains etc. is strictly prohibited</p> <p>Recover recyclable wastes that could be reused or sold to recyclers to the extent possible.</p> <p>Unused overhead distribution lines and poles which are dismantled to be immediately removed off site for reuse or disposal by a licensed waste disposal company in compliance with the Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 with all waste transfer records retained, pay particular attention to wooden poles as they may contain preservatives and so need to be treated as hazardous waste</p> <p>Unless reused or sold, other wastes to be disposed of to a suitably licensed waste management facility (depending on if hazardous or non-hazardous) with all waste transfer records retained.</p> <p>Provision of adequate number of self-</p>					

Project Activity	Potential Environmental Impact	Mitigating Actions	Performance Standard	Budget/ Source	Institutional Responsibility		Schedule
					BESCOM	Contractor	
		<p>contained portable toilets with sinks for construction workers (generated wastewater to be disposed of to wastewater treatment plant) or access to alternative sanitary facilities (e.g. existing public toilets) that do not allow the untreated disposal of sewage to adjacent water bodies; use of pit latrines is prohibited (applies to both temporary work sites and any construction camps)</p> <p>Strict prohibition on open defecation and urination and uncivil use of the road or private premises as a toilet by construction workers.</p> <p>Minimize use of and wastage of clean water during construction.</p> <p>Provide weekly toolbox talk to remind of the importance of waste disposal, prohibition of disposal on the road, in drains etc., prohibition on burning of wastes, and open defecation and urination. Develop a procedure/system to penalize through escalating fines or similar any construction workers who breach these requirements.</p>					
Soil excavation for laying underground cable	Inappropriate disposal of inert soil waste generated	<p>Store and utilize salvaged excavated soil for filling the entry and exit pits used for the cable installation</p> <p>Collect and transport the excavated soil that cannot be reused to a disposal site agreed by the local authorities as suitable for accepting inert wastes ensuring no solid or hazardous wastes are comingled with the inert excavated soil</p> <p>Records of excavated soil, generated waste, and transfer records will be kept by the contractor.</p>	<p>Disposal of waste in accordance with agreed CWMP</p> <p>Compliance with national laws and regulations including CPCB norms</p> <p>No unresolved grievances from local community or relevant local authorities</p>	Part of contract cost, include costs of implementing EMP as BOQ line	PMU day to day supervision supported by PSC. PMU/ESC supported by PSC to monitor compliance and respond to any grievances raised. IEC to check and document compliance semi-annually in EMR.	Comply with mitigating measures; keep records in accordance with the EMoP	Throughout construction

Project Activity	Potential Environmental Impact	Mitigating Actions	Performance Standard	Budget/ Source	Institutional Responsibility		Schedule
					BESCOM	Contractor	
		Dumping of excavated soils on the side of the road, in drains etc. is strictly prohibited Comply with the Construction and Demolition Waste Management Rules, 2016					
D Human Environment							
Installation of underground cables	Damage to above ground property and other public utilities' underground assets	Demarcate on site the working area, follow design drawings, avoid encroachment outside the agreed corridor of impact, and implement careful construction practices to avoid damage to existing above ground property and the identified underground utilities. Repair and/or compensate for any unforeseen damage to at least original condition in conjunction with relevant local authorities or property owner at cost to the contractor.	100% of property left in same condition as prior to construction Damage caused repaired or compensated for Compliance with national laws and regulations No unresolved grievances from local community or relevant local authorities	Part of contract cost, include costs of implementing EMP as BOQ line	PMU day to day supervision supported by PSC. PMU/ESC supported by PSC to and monitor compliance and respond to any grievances raised. IEC to check and document compliance semi-annually in EMR.	Comply with mitigating measures	Throughout construction
Facilities for construction workers	Inappropriate working conditions and interaction with local communities	If workers are not local to the area ideally use should be made of existing accommodation facilities but if a construction camp is provided it must be adequately equipped with sufficient toilets, hand washing facilities, showers or baths, food preparation and clean eating area, etc., as per standards set by national and state regulations and international good practice. Check health condition of workers on daily basis, for example, through use of self-certification forms or temperature checks before being allowed on the construction site Ensure construction workers are able to take time off sick without being penalized,	Compliance with H&S Plan and agreed code of practice Compliance with national laws and regulations, including but not limited to, the Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 No unresolved grievances from local	Part of contract cost, include costs of implementing EMP as BOQ line	PMU day to day supervision supported by PSC. PMU/ESC supported by PSC to monitor compliance and respond to any grievances raised. IEC to check and document compliance semi-annually in EMR.	Comply with mitigating measures	Throughout construction

Project Activity	Potential Environmental Impact	Mitigating Actions	Performance Standard	Budget/ Source	Institutional Responsibility		Schedule
					BESCOM	Contractor	
		<p>including any self-isolation or quarantine requirements for COVID-19 to minimize risks to others.</p> <p>Provide construction workers with on-site access to self-contained portable toilets with sinks or an alternative existing functional toilet facility (toilets and hand washing area) -- enough toilet facilities should be provided for the number of workers on-site, segregated by gender. There should be an indication of whether the toilet facility is "in use" or "vacant". Toilets should be cleaned at least twice daily to ensure they are kept in a hygienic condition to avoid creating a health hazard to workers.</p> <p>.</p> <p>Toilet facilities to be provided with adequate supplies of hot and cold running water, soap, hand sanitizer, and hand drying device.</p> <p>Provide workers with access to a shaded rest area on-site.</p> <p>Provide workers with a clean eating area with a supply of drinking water for breaks and lunchtime.</p> <p>Enough supplies of clean potable drinking water meeting national standards should be provided to workers on-site.</p> <p>If an authorized supplier of canned water is not used the drinking water source must be regularly tested to confirm it meets the drinking water standards.</p> <p>The working schedule will need to be developed to allow enough breaks and enough rest time in-between the shifts.</p> <p>Prevent standing water as it may become a</p>	community or construction workers				

Project Activity	Potential Environmental Impact	Mitigating Actions	Performance Standard	Budget/ Source	Institutional Responsibility		Schedule
					BESCOM	Contractor	
		breeding habitat for mosquitoes etc. Construction workers including subcontractors will be given awareness raising in HIV/AIDS, other communicable diseases including COVID-19, and sexual, exploitation, abuse and harassment with strict penalties (e.g. immediate removal from site) for any non-compliance of workers to an agreed code of practice					
Installation of underground cables and RMU and dismantling of old distribution lines	Occupational and community health and safety incident	Implement the agreed H&S Plan and avoid the occurrence of any H&S incidents as far as practicable. Require all construction workers including subcontractors to confirm they have seen and understood the requirements of the H&S plan before proceeding with the work. Require workers to observe the EHS Guideline on Construction and Demolition Equip all workers with task-appropriate personal protective equipment (PPE) such as hard hats, safety gloves, safety belt, ear protection, protective footwear, etc.in accordance with Table 2.7.1. Summary of Recommended Personal Protective Equipment According to Hazard in EHS Guidelines on Occupational Health and Safety with additional PPE provided as needed for COVID-19 risks and ensure that it is worn during construction Develop and enforce strict disciplinary system (e.g. immediate removal from site) for non-compliance with PPE requirements Check the load of the vehicles before use, all drivers and passengers to fasten seatbelt and comply with all transportation-related H&S laws and regulations Examination of all equipment and tools' quality and the presence of operational	No fatalities or lost time incidents 100% of H&S incidents including near miss recorded, immediately investigated, and corrective action taken to prevent repeat Compliance with H&S Plan Compliance with national laws and regulations No unresolved grievances from local community or construction workers	Part of contract cost, include costs of implementing EMP as BOQ line	PMU day to day supervision supported by PSC. PMU/ESC supported by PSC to monitor compliance and respond to any incidents that occur. IEC to check and document compliance semi-annually in EMR.	Comply with mitigating measures; maintain records of health and safety incidents per the EMoP and maintain copies of training records	Throughout construction

Project Activity	Potential Environmental Impact	Mitigating Actions	Performance Standard	Budget/ Source	Institutional Responsibility		Schedule
					BESCOM	Contractor	
		<p>safety features before use</p> <p>Installation of barriers (a temporary fence ideally solid fence) at construction areas with hazard warning signs to deter people from accessing the construction site</p> <p>Implementation of safety measures while excavating the cable entry and exit pits to avoid collapse e.g. shoring if soil unstable</p> <p>Do not leave hazardous conditions (e.g. unfenced and unlit open excavations without means of escape) overnight unless no access by public can be ensured</p> <p>During construction works ensure qualified first aider and trained fire marshal is always available on-site with an appropriately equipped first aid kit and appropriate fire extinguisher and other firefighting equipment immediately available for use; first aid and fire procedures should be displayed on-site</p> <p>Provide an ambulance for more serious cases to transport the patient to the hospital for treatment</p> <p>Plan with the nearest Health Center and/or Hospital for emergency care of workers, contact details for these to be posted on notices on-site</p> <p>Since PCBs are toxic and bioaccumulate, unless transformers have been certified PCB free all workers must avoid all exposure of transformer oil to skin and eyes and avoid any potential for accidental ingestion by wearing suitable chemical and/or oil resistant gloves, goggles, and protective clothing even under normal working conditions if there is a risk of coming into contact with transformer oil. If oil meets the skin, the workers should</p>					

Project Activity	Potential Environmental Impact	Mitigating Actions	Performance Standard	Budget/ Source	Institutional Responsibility		Schedule
					BESCOM	Contractor	
		immediately rinse the affected area with large amounts of running water. This may be done in a sink if the hands are the only portion of the body contacted or under a safety shower if the exposure area is more extensive. If large parts of the skin met with the oil, the workers should remove contaminated clothing while under the shower for a minimum of 15 minutes. Hand wash, safety shower and eyewash stations are therefore required at the construction sites.					
Electrical work	Occupational or community health and safety incident associated with electricity	<p>Require workers to observe the EHS Guideline on T&D requirements for working with live power lines</p> <p>Only allow suitably trained and qualified workers to be allowed to work on electrical equipment and at height, these workers must have training record of attending suitable training course on electrical safety and working at height.</p> <p>Untrained workers will not be permitted to work with live electricity or at height.</p> <p>Ensure proper grounding and deactivation of live power lines during construction work or before any work near the lines and this will be checked and certified by Health and Safety Officer in advance</p> <p>Only suitably trained workers that meet the requirements set out in EHS Guidelines on Transmission and Distribution (T&D) to be allowed to work on live power lines with strict adherence to safety and insulation standards including those listed in the EHS Guidelines</p> <p>Require other workers to observe the minimum approach distances for</p>	<p>No fatalities or lost time incidents</p> <p>100% of H&S incidents including near miss recorded, immediately investigated, and corrective action taken to prevent repeat</p> <p>Compliance with H&S Plan</p> <p>Compliance with national laws and regulations</p> <p>No unresolved grievances from local community or construction workers</p>	Part of contract cost, include costs of implementing EMP as BOQ line	PMU day to day supervision supported by PSC. PMU/ESC supported by PSC to monitor compliance and respond to any incidents that occur. IEC to check and document compliance semi-annually in EMR.	Comply with mitigating measures; maintain records of health and safety incidents per the EMoP and maintain copies of training records	Throughout construction

Project Activity	Potential Environmental Impact	Mitigating Actions	Performance Standard	Budget/ Source	Institutional Responsibility		Schedule
					BESCOM	Contractor	
		<p>excavations, tools, vehicles, and other activities when working around power lines</p> <p>Unless transformers have been certified PCB free workers must wear suitable chemical and/or oil resistant gloves, goggles, and protective clothing whilst working with transformers.</p> <p>Eye wash station and water supply to shower to be provided during works due to risk of PCB encountering skin.</p> <p>Compliance of safety norms for installation of ring main unit</p> <p>Stopping all works and relocate all people not on duty to a safety area before switching on power to test the power grid</p> <p>Install on all electrical equipment visual and written warning signages to O&M staff and the public including the ISO 7010 Hazard Type: Electrical Symbol warning of the risk of electrocution.</p> <p>Ensure the base of all ground and pole mounted transformers to which the underground distribution lines connect are fenced with locked gate or similar deterrent with suitable warning signs.</p> <p>Ensure all RMU are securely locked with suitable warning signs.</p>					
Installation of underground cable	Interference with pedestrian and vehicle traffic	<p>Comply with agreed traffic management plan (TMP)</p> <p>Installation works affecting footpaths and roads to avoid rush hours i.e. avoid the hours of 6am to 8 am and 4pm to 6 pm</p>	<p>Compliance with TMP</p> <p>No unresolved grievances from local community</p>	Part of contract cost, include costs of implementing EMP as BOQ line	PMU day to day supervision supported by PSC. PMU/ESC supported by PSC to monitor compliance and respond to	Comply with mitigating measures; maintain log sheets of installation works	Throughout construction

Project Activity	Potential Environmental Impact	Mitigating Actions	Performance Standard	Budget/ Source	Institutional Responsibility		Schedule
					BESCOM	Contractor	
		<p>Safe access to property and footpaths and roads should be maintained wherever possible and diversions and alternative access provided and clearly signed where there are temporary blockages that are a health and safety risk</p> <p>Road safety and warning signs for footpaths and road blockages must be posted at 500m, 100m, and immediately in advance of the works at least one week prior to the works commencing to inform the public of the temporary blockage; for road blockages utilize flag men during works to control the traffic flow and protect construction workers and the road users</p> <p>Safety guides should be provided where works are on sidewalks or in locations of pedestrian crossings to help guide pedestrians, especially vulnerable persons, safely around the working area.</p> <p>Stockpiling of spoil and cable reels shall be away from properties and only in designated areas where no access will be blocked</p> <p>Traffic diversion works to be immediately dismantled on completion of works and the footpath and roads restored to their original condition.</p>			grievances raised. IEC to check and document compliance semi-annually in EMR.		
Installation of underground cables	Loss of unknown physical cultural resources found during construction works	Follow approved chance find procedure if physical cultural resources are found during construction works; if physical cultural resources are encountered, all works at the find site should be immediately halted.	<p>No damage to unknown physical cultural resources</p> <p>Compliance with GOI's Treasure and Trove Act</p>	Part of contract cost, include costs of implementing EMP as BOQ line	PMU day to day supervision supported by PSC. PMU/ESC supported by PSC to monitor compliance. IEC to check and	Comply with mitigating measures	Throughout construction

Project Activity	Potential Environmental Impact	Mitigating Actions	Performance Standard	Budget/ Source	Institutional Responsibility		Schedule
					BESCOM	Contractor	
					document compliance semi-annually in EMR.		
Temporary outage of the electricity	Loss of power supply to the local community when distribution lines crossing the new distribution line are switched off	Provide one-week advance notice to the public through notices or pamphlets about the time and the duration of the utility disruption Restore the utilities immediately after all necessary works are carried out to minimize the public inconvenience	Temporary outages kept to minimum No unresolved grievances from local community	Part of contract cost, include costs of implementing EMP as BOQ line	PMU day to day supervision supported by PSC. PMU/ESC supported by PSC to and monitor compliance and respond to grievances raised. IEC to check and document compliance semi-annually in EMR.	Comply with mitigating measures; maintain daily log of power disruption to houses and commercial premises	Throughout construction
OPERATION AND MAINTENANCE PHASE							
A Physical Resources							
Use of PCB in transformers	Existing transformers containing PCBs (if any) are not in compliance with national legislation	BESCOM to ensure all pole and plinth mounted transformers are within their certified lifetime and property maintained without possibly of oil leak or release into the environment. Regular and periodic preventive maintenance to prevent any oil leakages. BESCOM to prepare inventory or and replace any existing transformers which contain PCBs in accordance with the GOI's Regulation of Use, Handling and Disposal of Polychlorinated Biphenyls and at latest by 31.12.2025. In decommissioning and disposing of old transformers BESCOM will be required to follow the Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 for transport,	100% of project transformers are PCB free Compliance with GOI's Regulation of Use, Handling and Disposal of Polychlorinated Biphenyls	n/a	ESC to develop inventory of project transformers and to ensure legislative requirements met, copies of transfer notes for recycling and disposal of old transformers to be kept. IEC to check and document compliance annually in EMR.	n/a	By end of 2025 and throughout O&M

Project Activity	Potential Environmental Impact	Mitigating Actions	Performance Standard	Budget/ Source	Institutional Responsibility		Schedule
					BESCOM	Contractor	
		storage and disposal of potentially PCB oil containing transformers.					
		Disposal to involve facilities capable of safely transporting and disposing of hazardous waste containing PCBs.					
Operation of ring main unit (RMU)	Leakage of SF ₆ gas a potent GHG causing climate change impacts	<p>SF6 leakages will trigger an alarm at the nearest concerned O&M Unit from which staff at to immediately attend to stop the leakage.</p> <p>Regular and periodic preventive maintenance to prevent any SF6 leakages.</p> <p>Database of all RMU containing SF6 including total volume and annual leakage rate; annual monitoring of SF6 leakage from all RMU in accordance with the EMoP. If trend of lowering gas pressure observed investigate cause of leak and take action to rectify it in accordance with manufacturer's instruction.</p> <p>Training of all project and O&M staff on the climate change impact of SF6, alternatives, H&S risks during O&M due to presence of toxic byproducts, leakage minimization, and environmentally sound and safe disposal of old RMUs with SF6 by a certified industrial waste management company following International Electrotechnical Commission (IEC) standard 61634 to ensure SF6 is not released to atmosphere.</p>	<p>Database maintained, less than 0.1% leakage rate per RMU with a total leakage of less than 100 tons CO2e/annum</p> <p>100% of project and O&M staff have attended training on SF6 awareness raising</p>	n/a	ESC to develop database of RMU and implement an SF6 training plan for staff, copies of attendance records and photos to be kept on file. IEC to check and document compliance annually in EMR.	n/a	Throughout O&M
Disposal of RMU	Leakage of SF ₆ gas a potent GHG causing climate change impacts	Old RMUs shall be recycled and disposed by a certified industrial waste management company following the Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016. The company will need to remove SF6 and treat the equipment prior to disposal in	Compliance with Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 and International Electrotechnical	n/a	ESC to ensure procedures followed, certifications of company and transfer notes for recycling and disposal of old RMU	n/a	Throughout O&M

Project Activity	Potential Environmental Impact	Mitigating Actions	Performance Standard	Budget/ Source	Institutional Responsibility		Schedule
					BESCOM	Contractor	
		accordance with International Electrotechnical Commission (IEC) standard 61634 to ensure SF6 it contains is not released to the atmosphere.	Commission (IEC) standard 61634		to be kept. IEC to check and document compliance annually in EMR.		
B Human Environment							
RMU operation	Risk of fire causing H&S incident	Ensure emergency procedures are posted and provide fire extinguisher adjacent to RMU	100% of RMU have serviced fire extinguisher	n/a	ESC to ensure requirement followed. IEC to check and document compliance annually in EMR.	n/a	Throughout O&M
O&M activities	Occupational and community health and safety incident during O&M	<p>Share the information of the routing of all underground cables to the relevant authorities and include warning marks above ground or over the cable, so when underground works need to be done by others, the location of the cables would be known and avoided.</p> <p>In case of incident and cables are broken immediately notify the nearest BESCOM incident coordinator for handling measures with technical staff to inspect and repair.</p> <p>O&M team will repair the cable break as soon as possible with repair works similar to construction.</p> <p>For all O&M works undertake risk assessment and ensure H&S plan in place before works that accords with national laws and regulations and the EHS Guidelines, considering both occupational and community H&S risks during O&M.</p>	<p>No fatalities or lost time incidents</p> <p>100% of H&S incidents including near miss recorded, immediately investigated, and corrective action taken to prevent repeat</p> <p>Compliance with national laws and regulations</p> <p>No unresolved grievances from local community or O&M workers</p> <p>H&S plan in place and annual training plan for O&M workers developed and budget assigned</p> <p>100% of O&M workers</p>	n/a	ESC to ensure H&S plan in place and develop and implement an annual training plan for O&M workers; keep H&S records per EMoP and keep copies of attendance records and photos to be kept on file. IEC to check and document compliance annually in EMR.	n/a	Throughout O&M

Project Activity	Potential Environmental Impact	Mitigating Actions	Performance Standard	Budget/ Source	Institutional Responsibility		Schedule
					BESCOM	Contractor	
		<p>H&S plan to include an emergency preparedness and response plan with communication systems and protocols for reporting and responding to any medical emergency or any other emergency circumstances during construction. Specifically, this will include measures to prevent and respond to COVID-19 cases plus natural hazards, earthquake, flood etc.</p> <p>Training of O&M workers on health and safety risk, management, emergency preparedness and response in case of an occupational or community health and safety incident before the commencement of any on-site works with annual refreshers. This is to include training on how to use first aid and firefighting equipment provided on-site.</p> <p>On all electrical equipment visual and written warning signages including the ISO 7010 Hazard Type: Electrical Symbol warning of the risk of electrocution will be maintained.</p> <p>Transformers to which project components connect are to be fenced with locked gate (if ground-mounted) or with similar deterrent for pole-mounted transformers.</p> <p>RMU to be kept securely locked at all times.</p> <p>Liaise with BBMP to ensure the existing storm water drainage is</p>	<p>attended annual H&S trainings on health and safety risk, management, emergency preparedness and response per the plan</p>				

Project Activity	Potential Environmental Impact	Mitigating Actions	Performance Standard	Budget/ Source	Institutional Responsibility		Schedule
					BESCOM	Contractor	
		regularly maintained to avoid water puddles that may cause water percolating into cable					

PMU – Project Management Unit of BESCOM
ESC – Environment and Social Cell of BESCOM
PMC – Project Management Consultant
IEC – Independent Environment Consultant for periodic environmental monitoring reports

Annex 3: National Standards for Air and Noise

National Ambient Air Quality Standards

Pollutant	Time Weighted Average	Concentration in Ambient Air ($\mu\text{g}/\text{m}^3$)	
		Industrial, Residential, Rural and Other Areas	Ecologically Sensitive Areas
Sulphur Dioxide (SO_2)	Annual Average*	50	20
	24 hr**	80	80
Oxides of Nitrogen (as NO_2)	Annual Average *	40	30
	24 hr**	80	80
Particulate Matter: PM_{10} ($<10 \mu\text{m}$)	Annual Average *	60	60
	24 hr**	100	100
Particulate Matter: $\text{PM}_{2.5}$ ($<2.5 \mu\text{m}$)	Annual Average *	40	40
	24 hr**	60	60
Lead	Annual Average *	0.5	0.5
	24 hr**	1.0	1.0
Carbon monoxide mg/m^3	8 hr	2.0	2.0
	1 hr	4.0	4.0

* Annual Arithmetic mean of minimum 104 measurement in a year taken for a week 24 hourly at uniform interval.

** 24 hourly or 8 hourly or 1 hourly monitored values should be met 98 percent of the time in a year

National Ambient Air Quality Standards: Noise[#]

Area Code	Category of Area/Zone	Limits in dB(A) Leq *	
		Day Time	Night Time
(A)	Industrial area	75	70
(B)	Commercial area	65	55
(C)	Residential area	55	45
(D)	Silence Zone	50	40

Notes

1. Day time shall mean from 6.00 a.m. to 10.00 p.m.
2. Night time shall mean from 10.00 p.m. to 6.00 a.m.
3. Silence zone is defined as an area comprising not less than 100 meters around hospitals, educational institutions and courts. The silence zones are zones which are declared as such by the competent authority.
4. Mixed categories of areas may be declared as one of the four above mentioned categories by the competent authority.

*dB(A) Leq denotes the time weighted average of the level of sound in decibels on scale A which is relatable to human hearing.

A "decibel" is a unit in which noise is measured.

"A", in dB(A) Leq, denotes the frequency weighting in the measurement of noise and corresponds to frequency response characteristics of the human ear.

Leq: mean of the noise level, over a specified period.

ADB's Safeguard Policy Statement (2009) requires the more stringent of national and WHO noise 1hr LAeq guidelines to be adhered to, the latter apply on an individual receptor not area basis and for industrial receptors require a level of 70dBA daytime as well as nighttime limit to be met which is more stringent than national.

Indian Standard Drinking Water Specification: IS 10500:1991

Sl. No.	Substance/ Characteristic	Desirable Limit	Permissible Limit	Remarks
1	Color, Hazen units, Max	5	25	Extended to 25 if toxic substance are not suspected in absence of alternate sources
2	Odor	Unobjectionable		a) Test cold and when heated
				b) Test at several dilution
3	Taste	Agreeable		Test to be conducted only after safety has been established
4	Turbidity NTU, Max	5	10	
5	pH value	6.5 to 8.5	No relaxation	
6	Total Hardness (as CaCO ₃ mg/lit)	600	600	
7	Iron (as Fe mg/lit, Max	0.3	1.0	
8	Chlorides (as Cl mg/lit Max	250	1000	
9	Residual Free Chlorine, mg/lit Max	0.2		To be applicable only when water is chlorinated. Treated at consumer end. When protection against viral infection is required, it should be Min 0.5 mg/lit
10	Dissolved Solids mg/l, Max	500	2000	
11	Calcium (as Ca) mg/l, Max	75	200	
12	Copper (as Cu) mg/l, Max	0.05	1.5	
13	Manganese (Mn) mg/l Max	0.1	0.3	
14	Sulphate (As SO ₄), Max	200	400	May be extended up to 400 provided (as Mg) does not exceed 30
15	Nitrate (as NO ₃) mg/l, Max	45	100	
16	Fluoride (as F) mg/l, Max	1.0	1.5	
17	Phenolic Compounds (as C ₆ H ₅ OH) mg/l Max	0.001	0.002	
18	Arsenic (as As mg/l	0.05	No relaxation	To be tested when pollution is suspected
19	Lead (as Pb) mg/l	0.05	No relaxation	
20	Anionic Detergents (as MBAS) mg/l	0.2	1.0	
21	Chromium (as Cr) mg/l	0.05	1.0	To be tested when pollution is suspected
22	Mineral Oil mg/l	0.01	0.03	
23	Alkalinity mg/l	200	600	
24	Total Coliform	95% of the sample should not contain coliform in 100 ml. 10 coliform /100 ml		

Annex 4: Details of Public Consultations

S. No.	Division	Sub Division	Name of The Area	Date	Male	Female	Total Participants
1	White Field	E-4 White Field	Govt. High School Road, Vijaya Lakshmi Colony, Kadugodi	28.05.2019	11		11
2	White Field	E-4 White Field	1st Main Bethuru Colony, Kadugodi	28.05.2019	5	5	10
3	HSR Layout	HSR Layout	1st Cross 2nd Ma Ayyappa Temple Mangammanapalya	30.05.2019	8	6	14
4	Koramangala	S7 HAL	2nd Cross, KHB Near, Kundalahalli Gate	07.06.2019	8	4	12
5	Hebbala	C5 Kaval Byrasandra	Bhuaneshwari Nagara	29.05.2019	2	10	12
6	Hebbala	C5 Kaval Byrasandra	Bhuaneshwari Nagara	29.05.2019	5	3	8
7	Shivaji Nagara	E1	9th Main, Pillanna Garden, Bilal Masque	04.05.2019	7	3	10
8	Shivaji Nagara	E1	Pillanna Garden	04.05.2019	6		6
9	Jayanagara	S6	Sarakki, Oxford School, JP Nagara	05.06.2019	7		7
10	Indiranagara	E6	Tippasandra Road, Kempamma Devi Temple	03.06.2019	13		13
			Total		72	31	103

S No	1	Date	28.05.2019
Division	White Field	Sub Division	E-4 White Field
Road No	Govt. High School Road	Street Name	Vijaya Lakshmi Colony
Land Mark	Central Bank	Name Of The Area	Kadugodi

The discussion was started with the moderator informing the people of the proposed project and of the purpose for conducting the meeting, that is, to involve people right from planning and implementation and to address issues and concerns. There are regular power blackouts in the area for 3-4 hours. The participants generally lodge complaints with the Assistant Engineer for any supply related issues. Mostly the complaints are related to power disruptions and are solved within a given stipulated time. The residents are aware of energy efficiency measures and use power saving lighting like CFL, LED etc., and household appliances with power saving ratings. The participants have recollected that during rainy season, due to heavy wind, power lines were cut and there was loss of life (both human and animals). The residents were not aware about the proposed underground cabling. As per their opinion television and social media channels

are the best means to disseminate the project information as well as implementation information in the area. They are of the opinion that underground cabling will solve issues like hanging cables and can lead to quality and dedicated electricity supply. During underground cabling they think there will be traffic jams in narrow roads, junctions, and market areas. Finally, participants suggested that during implementation proper visible public notices / safety signs should be displayed.

S No	2	Date	28.05.2019
Division	White Field	Sub Division	E-4 White Field
Road No	1st Main	Street Name	Bethuru Colony
Land Mark	MWS	Name Of The Area	Kadugodi

The moderator informed the people of the proposed project. The participants from the area have domestic grid connection. There are regular power cuts in the area for 2-3 hours in two spells (morning and evening). The participants generally lodge complaints at BESCO office. Mostly the complaints are related to power disruptions, which are solved within given stipulated time. The residents are aware of energy efficiency measures and use power saving lighting like CFL, LED etc., and household appliances with power saving ratings. The residents were not aware about the proposed underground cabling. As per their opinion social media channel can be the best means to disseminate the project information as well as during implementation in the area. They are of opinion that underground cabling will solve issues like hanging cables and can provide a better quality of the electricity supply. They are of the opinion that the maintenance will be difficult, as unauthorized digging will damage the underground power cables and will be difficult to identify and rectify. Finally, participants suggested that during implementation proper safety measures need to be taken at drilling points. BESCO officials explained to participants that the alignment will follow the present overhead cable corridor using trenchless technology and no damage will be done to the trees and assets.

S No	3	Date	30.05.2019
Division	HSR Layout	Sub Division	HSR Layout
Road No	100	Street Name	1st Cross 2nd Main
Land Mark	Ayyappa Temple	Name Of The Area	Mangammanapalya

The discussion was started with the moderator informing the participants about the proposed project and objective of the consultation, that is, to collect peoples' concerns and issues to better implement and manage the project. The participants from the area have domestic connections. The participants generally lodge complaints with the Assistant Engineer at the BESCO office. The complaints are related to power disruptions, which are solved within given stipulated time. The residents are aware of energy efficiency measures and use power saving lighting like CFL, LED etc., and household appliances with power saving ratings. The residents were not aware about the proposed underground cabling. As per their opinion television and newspaper can be the best means to disseminate the project information prior to as well as during implementation in the area. They are of the opinion that underground cabling will improve the quality of power supply. The people are concerned that during implementation damage could be caused to the drainage. Finally, participants expressed apprehension concerning the works timely completion. BESCO official explained to participants that the alignment will follow the present overhead cable corridor using trenchless technology and no damage will be done to the trees and assets.

S No	4	Date	07.06.2019
Division	Koramangala	Sub Division	S7 HAL
Road No	2nd Cross	Street Name	KHB Near
Land Mark		Name Of The Area	Kundalahalli Gate

The meeting was started by the moderator who informed participants about the proposed project and objective of the consultation, that is, to collect peoples' concerns and issues to better implement and manage the project. The participants from the area have domestic connections. There were power shut downs in the area for a few hours for maintenance, which was later informed to them. The participants generally lodge complaints at the BESCOM office. The complaints are related to power disruptions. The participants recollected a transformer tripping six months back causing a long blackout. The residents are aware of energy efficiency measures and use power saving lighting like CFL, LED etc., and household appliances with power saving ratings. The residents have become aware of the proposed underground cabling through the newspaper. As per their opinion television, newspaper and social media can be the best means to disseminate the project information prior to as well as during implementation in the area. They are of the opinion that underground cabling will solve issues related to hanging cables. The people are concerned that during implementation the roads will be damaged. Finally, participants suggested to complete the project in time and to use quality material.

S No	5	Date	29.05.2019
Division	Hebbala	Sub Division	C5 Kaval Byrasandra
Road No		Street Name	Ln Bande,
Land Mark	MWS	Name Of The Area	Bhuaneshwari Nagara

The moderator informed the people of the proposed project. The participants from the area have domestic connections. There are regular power cuts in the area for one hour in the evening. The participants generally lodge complaints online and at the nearby BESCOM office. Mostly the complaints are related to power disruptions, which are solved within a given stipulated time. The residents are aware of energy efficiency measures and use power saving lighting like CFL, LED etc., and household appliances with power saving ratings. The residents were not aware about the proposed underground cabling. As per their opinion television, newspaper and social media channels can be the best source to disseminate the project information prior to as well as during implementation in the area. They are of the opinion that underground cabling will solve accidents due to hanging cables. They are concerned that during implementation other facilities like cable network, telephone line, internet cables will get damaged. The other utilities entities should be informed well in advance to avoid disruptions. Finally, participants suggested that quality materials should be used to avoid regular maintenance.

S No	6	Date	29.05.2019
Division	Hebbala	Sub Division	C5 Kaval Byrasandra
Road No		Street Name	Ln Bande,
Land Mark	MWS	Name Of The Area	Bhuaneshwari Nagara

The moderator informed the people of the proposed project and objective of the consultation, that is, to collect peoples' concerns and issues to better implement and manage the project. The participants from the area have domestic connection. There are regular power cuts in the area for one hour in the evening. The participants generally lodge complaints with the Assistant Engineer. The complaints are related to power disruptions, which are solved within a given stipulated time. The residents are aware of energy efficiency measures and use power saving lighting like CFL, LED etc., and household appliances with power saving ratings. The residents have been made aware about the proposed underground cabling by BESCO persons during their recent visit to restore power supply due to cable cut. As per their opinion television, newspaper and social media channels can be the best source to disseminate the project information prior to as well as during implementation in the area. They are of the opinion that underground cabling will solve accidents due to hanging cables. They are concerned that during implementation there may be traffic jams near junctions and market areas. Finally, participants suggested that to speed up the work modern methods and techniques should be used.

S No	7	Date	04.05.2019
Division	Shivaji Nagara	Sub Division	E1
Road No		Street Name	9th Main
Land Mark	Bilal Masque	Name Of The Area	Pillanna Garden

The moderator informed the people of the proposed project and the intention of the consultation to collect peoples' concerns and issues to better implement and manage the project. The participants from the area have domestic connections. There are regular power cuts in the area for one hour (evening). During rainy season there are unscheduled power cuts which the department informs about through whatsapp messages. The participants generally lodge complaints through toll free number and at the BESCO office. The participants recollected the incidence of a transformer bursting in the area and a resulting power cut. Generally, the complaints are related to power disruptions, which are solved within given stipulated time. The residents are aware of energy efficiency measures and use power saving lighting like CFL, LED etc., and household appliances with power saving ratings. The residents are aware of the proposed underground cabling. As per their opinion television, newspaper and social media channels can be the best source to disseminate the project information prior to as well as during implementation in the area. They are of the opinion that underground cabling will solve issues related to hanging cables and accidents due to this. They are concerned that any unauthorized digging would damage the underground cables and it would take time to fix the damage cables. Finally, participants suggested that to speed up the work modern methods and techniques should be used and regular monitoring of the works will help in timely completion.

S No	8	Date	04.05.2019
Division	Shivaji Nagara	Sub Division	E1
Road No	Tani Road	Street Name	9th Main
Land Mark	Bilal Masque	Name Of The Area	Pillanna Garden

The discussion was started with the moderator informing the participants about the proposed project and the objective of the consultation, that is, to collect peoples' concerns and issues to better implement and manage the project. The participants from the area have domestic connection. Recently there was power shut down in the area for two hours for maintenance. The participants generally lodge complaints at the BESCOM office. The complaints are related to power disruptions, which are solved within given stipulated time. The residents are aware of energy efficiency measures and use power saving lighting like CFL, LED etc., and household appliances with power saving ratings. The residents have been made aware of the proposed underground cabling through linemen during their visit to restore power supply. As per their opinion, television and newspaper can be the best source to disseminate the project information as well as during implementation in the area. They are of the opinion that underground cabling will solve accidents due to hanging cables. The people are concerned that during implementation drainage damage may occur, trees may need to be cut and damage may be caused to assets. BESCOM official explained to participants that the alignment will be follow the present overhead cable corridor using trenchless technology and no damage will be done to the trees and assets. Finally, participants suggested that to speed up the work modern methods and techniques should be used and regular monitoring of the works will help in timely completion.

S No	9	Date	04.06.2019
Division	Jayanagara	Sub Division	S6
Road No		Street Name	Sarakki
Land Mark	Oxford School	Name Of The Area	JP Nagara

The consultation was started with the moderator informing the participants about the proposed project and objective of the consultation, that is, to collect peoples' concerns and issues to better implement and manage the project. The participants from the area have domestic connections. There are regular power cuts in the area for one hour (evening). The participants generally lodge complaints at the BESCOM Assistant Engineer's office. The complaints are related to power disruptions, which are solved within a given stipulated time. The residents are aware of energy efficiency measures and use power saving lighting like CFL, LED etc., and household appliances with power saving ratings. The residents have become aware of the proposed underground cabling through linemen during their visit to restore power supply. As per their opinion, television and newspaper can be the best source to disseminate the project information prior to as well as during implementation in the area. They are of the opinion that underground cabling will solve issues related to hanging cables and power trips. The people are concerned that during implementation some trees need to be cut. They feel that during implementation there will drilling noise and dust in the area. Finally, participants suggested to complete the project in time otherwise the digging of roads will lead to accidents.

S No	10	Date	03.06.2019
Division	Indiranagara	Sub Division	E6
Road No		Street Name	
Land Mark	Kempamma Devi Temple	Name Of The Area	Tippasandra Road

The consultation was started with the moderator informing the participants about the proposed project and objective of the consultation, that is, to collect peoples' concerns and issues to better implement and manage the project. The participants from the area have domestic connections. There are regular power cuts in the area for one hour (afternoon). The participants generally lodge complaints at the BESCOM office. The complaints are related to power disruptions. The residents are aware of energy efficiency measures and use power saving lighting like CFL, LED etc., and household appliances with power saving ratings. The residents have become aware of the proposed underground cabling through linemen performing maintenance. As per their opinion, television, newspaper and social media can be the best source to disseminate the project information prior to as well as during implementation in the area. They are of the opinion that underground cabling will solve issues related to hanging cables. The people are concerned that during implementation there could be property damage like compound walls, Underground drainage etc. They feel that during implementation there will drilling noise and dust in the area. Finally, participants suggested to complete the project in time.

List of Participants

List of participants

S.No.	Name	Occupation	Contact Details (Mobile & Email ID)	Signature
1	Alla Balaiah	Business	9880449560	Alla Balaiah
2	Ramu	Rtd police	8792453706	Ramu
3	Parashuram	Labane	8971309373	Parashuram
4	Balubai	Business	9845641917	Balubai
5	R. V. N. G. B.	Business	8318629713	R. V. N. G. B.
6	M. S. S. S. S.	Business	9343145444	M. S. S. S. S.
7	Suman	Business	9916194666	Suman
8	H. M. S. Bama	Business	9448273271	H. M. S. Bama
9	Anjaneppa	Taxi Driver	9901514041	Anjaneppa
10	Shivaramaiah	Business	9632631616	Shivaramaiah
11	A. R. R. R.	Business	962007153	A. R. R. R.

(S No. 1) List of Participants – Vijaya Colony, Whitefield Sub-division, Bangalore

List of participants

No.	Name	Occupation	Contact Details (Mobile & Email ID)	Signature
	Jameela	H.W.	9945451380	- JAMEELA
	N. Govri	H.W.	9740529453	N. Govri
	Hemant Kumar	Teacher	9980844531	Hemant
	Rajendra Singh	SS & HIMS	9590351377	Rajendra
	Prasanna	H.W.		Prasanna
	G. S. S.	H.W.		G. S. S.
	Chandrashekar	H.W.	8892704001	Chandrashekar
	MOJJD	Driver	8722911426	MOJJD
	Markus	Driver	8971494151	Markus
	Venkaiah	Social Worker	8884091237	Venkaiah

(S No. 2) List of Participants – Belthur Colony, Whitefield Sub-division, Bangalore

List of participants

S.No.	Name	Occupation	Contact Details (Mobile & Email ID)	Signature
	Balaji	Postman		Balaji
	Laluprayad	Student		Laluprayad
	Alavclamma	Housewife	94496759.	Alavclamma
	Radhika	Housewife	9908953701	Radhika
	Hemavathi	Housewife		Hemavathi
	Ramagurthy	Postman		Ramagurthy
	TAMIKITHESWARAN	Worker		TAMIKITHESWARAN
	NILKITHA	Worker		NILKITHA
	DAMESHA	Pre-Reporter	9580028289	DAMESHA

(S No. 3) Ayyappa Temple Mangammanapalya HSR Layout Sub-division, Bangalore

List of participants

S.No.	Name	Occupation	Contact Details (Mobile & Email ID)	Signature
1	Harish	Welder	8261444192	[Signature]
2	Param	Welder		[Signature]
3	Mahmed	Welder		[Signature]
4	Anand	Welder		[Signature]
5	Naveen	Welder	8553477985	[Signature]
6	Param	Welder		[Signature]
7	Prasad	Welder		[Signature]
8	Prasanth	Welder		[Signature]
9				

(S No. 4) Kundalahalli, Koramangala Sub-division, Bangalore

List of participants

Name	Occupation	Contact Details (Mobile & Email ID)	Signature
Mr. G. Srinivas	Principal	9242107854	
Mrs. Geetha	Headmistress	9686775967	
Mrs. Manjula	Co-ordinator	897048487	
Mrs. Naveeda	Co-ordinator	7760216993	
Mrs. Chitra	Teaching staff	8971247219	
Mrs. Swarna Rai	Teaching staff	8553985777	
Mrs. Manitha	Teaching staff	8970663270	
Mrs. Divya	Teaching staff	9035172164	
Mrs. Sachin Prasad	Teaching staff	6296024698	
10. Mrs. Preethi	Teaching staff	9945562325	
11. Mrs. Ayesha	Teacher staff	9241211143	
12. Mr. Fayaz	Supervisor	7022292764	

(S No. 5) List of Participants – Gopapappa Layout, Hebbal Sub-division, Bangalore

List of participants

No.	Name	Occupation	Contact Details (Mobile & Email ID)	Signature
	Jameela	H.W.	9945451380	
	N. Geetha	H.W.	9740529453	
	Hemant Kumar	Titanic	9980844531	
	Rajendra Singh	SS & H.M.S	9590351377	
	Prathiba	H.W.		
	Girish	H.W.		
	Chiranjeev	H.W.	8892704001	
	Subodh	Dancer	8722911426	
	Markus	Dancer	8971494151	
	Venkatesh	Social worker	8884091237	

(S No. 6) List of Participants – Bhuvanewasinagar, Hebbal Sub-division, Bangalore

List of participants

S.No.	Name	Occupation	Contact Details (Mobile & Email ID)	Signature
01	SHWETHA C M	Job	9164710480 & shwethagautam629@gmail.com	Shwetha CM
02	Darveem Sheikh	H.W.	8861675146	
03	Ummu SAIMA	Job	8861436086 salma8886@gmail.com	
04		H.W.		
05	Shir/ fmi (Kamsuradi)			Shir/ fmi
06			8192457350	
07	Suresh K.	Electrician	9986707060	
08	Ramona Reddy	Contractor	9203109501	
09	MUKARAM PASHA Contractor		8792140962	
10	Siminur		9740555 973	

(S No. 7) List of Participants – Pillanna Garden, Shivajinagara Sub-division, Bangalore

List of participants

S.No.	Name	Occupation	Contact Details (Mobile & Email ID)	Signature
	M. Gopal	E. Contractor	9342821136	M. Gopal
	12atila	E. work	9902079886	
	NADEEM PASHA	Self-employed	9901667804	
	V. Sathyanarayana		8050661578	Sathyanarayana
	Mazheruddin	Rtd. from Group Seminar	9480452358	
	P. CHANDRASEKAR	Gen Secretary HRPG Assn	948021570	

(S No. 8) List of Participants – Pillanna Garden, Shivajinagara Sub-division, Bangalore

List of participants

S.No.	Name	Occupation	Contact Details (Mobile & Email ID)	Signature
	Pavan Kumar	Business	9895566747	Pavan
	Abhishek A	Business	9845131508	Abhishek
	Naveen	Business	8892686078	Naveen
	Satish	Business	984536224	Satish
	Dipu	Software	9880055366	Dipu
	Ragu	Business (Retail)	9445707006	Ragu
	Manglu	ITP Operator	9113519760	Manglu

(S No. 9) List of Participants – JP Nagara, Jayanagara Sub-division, Bangalore

List of participants

S.No.	Name	Occupation	Contact Details (Mobile & Email ID)	Signature
01.	Devaraj. K.	pro. workshop	9886287465.	Devaraj
02	Kumara	worker	9353238229	
03	Baskara	worker	9110641028	
04	Muhin	worker	8971505883	
05	Ali		9606581269	
06	Arjun	Social worker	7899718332	
07				
08				
09.				

(S No. 10) List of Participants Part 1 – Thippasandra, Indiranagara Sub-division, Bangalore

<u>List of participants</u>				
S.No.	Name	Occupation	Contact Details (Mobile & Email ID)	Signature
01	Sri ^o dhara.	Electrician	9972728665.	[Signature]
02	Praveen.		9060432815	[Signature]
03	Ambaretha.	-	8660709535.	[Signature]
04	Shelkar.		9986252001	[Signature]
05	Lokesh.	CLUMIX	7760884428	[Signature]
06	Khan	pro.xerox.	7019262622	[Signature]
07	Raju.		9741906980	
08				
09				

(S No. 10) List of Participants Part 2 – New Thippasandra, Indiranagara Sub-division, Bangalore

Photographs



(S No1) Kadagodi, Whitefield subdivision, Bangalore



(S No. 1) Kadagodi, Whitefield subdivision, Bangalore



(S No. 3) HSR Layout, Bangalore



(S No. 3) HSR Layout, Bangalore



(S No. 4) Kundalahalli, Koramangala
subdivision, Bangalore



(S No. 5) B E S School, Gopalappa Layout,
Kaval Byrasandra



(S No. 5) B E S School, Gopalappa Layout,
Kaval Byrasandra



(S No. 8) Pilanna Garden, Shivajinagara Sub-division



(S No. 8) Pilanna Garden, Shivajinagara Sub-division



(S No. 8) Pilanna Garden, Shivajinagara Sub-division



(S No. 8) Pilanna Garden, Shivajinagara Sub-division



(S No. 10) New Thippasandra Sub-division, Indiranagara

Annex 5: IBAT



Proximity Report BANGALURU

Country: India

Location: [13, 77.6]

Date of analysis: 05 June 2020

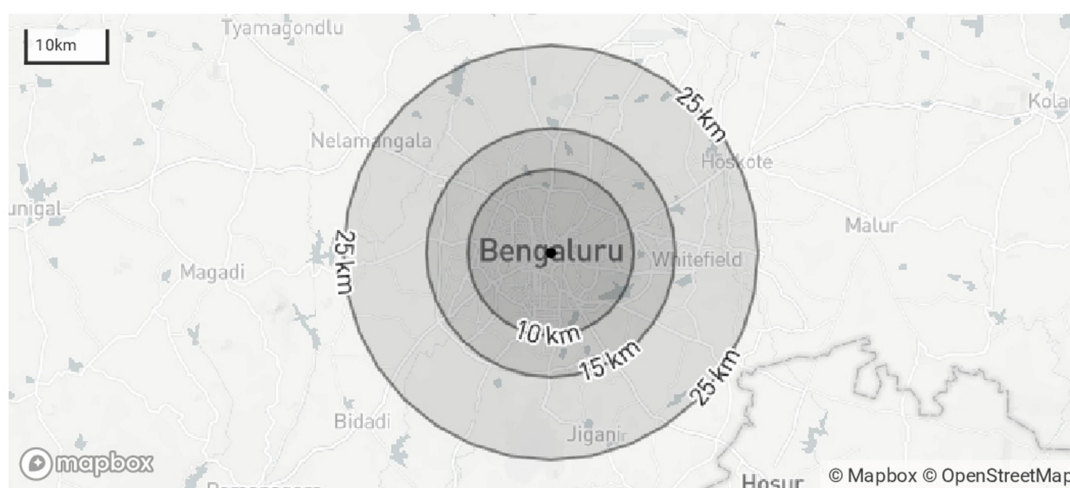
Buffers applied: 10.0 km | 15.0 km | 25.0 km

Generated by: Emma Marsden

Company/Subscriber: ADB

Overlaps with:

Protected Areas	1
Key Biodiversity Areas	4
IUCN Red List	42



Displaying project location and buffers: 10.0 km, 15.0 km, 25.0 km



About this report

This report presents the results of [952-9516] proximity analysis to identify the biodiversity features and species which are located within the following buffers: 10.0 km, 15.0 km, 25.0 km.

This report is one part of a package generated by IBAT on 05 June 2020 that includes full list of all species, protected areas, Key Biodiversity Areas in CSV format, maps showing the area of interest in relation to these features, and a 'How to read IBAT reports' document.

Data used to generate this report

- UNEP-WCMC and IUCN, 2020. Protected Planet: The World Database on Protected Areas (WDPA)[On-line], Cambridge, UK: UNEP-WCMC and IUCN. Available at: www.protectedplanet.net - May 2020.
- BirdLife International (on behalf of the KBA Partnership), 2019. Key Biodiversity Areas - October 2019.
- IUCN, 2020. IUCN Red List of Threatened Species - June 2020.



Protected Areas

The following protected areas are found within 10.0 km, 15.0 km, 25.0 km of the area of interest.
For further details please refer to the associated csv file in the report folder.

Area name	Within buffer of
Bannerghatta	15.0 km

Key Biodiversity Areas

The following key biodiversity areas are found within 10.0 km, 15.0 km, 25.0 km of the area of interest.
For further details please refer to the associated csv file in the report folder.

Area name	Distance
Bannerghatta National Park	15.0 km
Hesaraghatta Lake	25.0 km
Hoskote Kere	25.0 km
Thippagondanahalli Reservoir	25.0 km

IUCN Red List of Threatened Species

The following threatened species are potentially found within 50km of the area of interest.

For the full IUCN Red List please refer to the associated csv in the report folder.

Species name	Common name	IUCN Category	Taxonomic Class
Anacyclus pyrethrum	Atlas daisy	VU	Magnoliopsida
Aonyx cinereus	Asian small-clawed otter	VU	Mammalia



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Species name	Common name	IUCN Category	Taxonomic Class
<i>Aquila nipalensis</i>	Steppe eagle	EN	Aves
<i>Aquila rapax</i>	Tawny eagle	VU	Aves
<i>Ardeotis nigriceps</i>	Great indian bustard	CR	Aves
<i>Bos gaurus</i>	Gaur	VU	Mammalia
<i>Ciconia episcopus</i>	Asian woollyneck	VU	Aves
<i>Cirrhinus cirrhosus</i>	Mrigal carp	VU	Actinopterygii
<i>Clanga hastata</i>	Indian spotted eagle	VU	Aves
<i>Columba elphinstonii</i>	Nilgiri woodpigeon	VU	Aves
<i>Crocodylus palustris</i>	Mugger	VU	Reptilia
<i>Cuon alpinus</i>	Dhole	EN	Mammalia
<i>Elephas maximus</i>	Asian elephant	EN	Mammalia
<i>Gallinago nemoricola</i>	Wood snipe	VU	Aves
<i>Geochelone elegans</i>	Indian star tortoise	VU	Reptilia
<i>Gyps bengalensis</i>	White-rumped vulture	CR	Aves
<i>Gyps indicus</i>	Indian vulture	CR	Aves
<i>Hipposideros hypophyllus</i>	Kolar leaf-nosed bat	CR	Mammalia
<i>Hypselobarbus dubius</i>	Nilgiri barb	EN	Actinopterygii



Species name	Common name	IUCN Category	Taxonomic Class
Hypselobarbus kolus	Kolus barb	VU	Actinopterygii
Hypselobarbus mussullah		EN	Actinopterygii
Hypselobarbus thomassi	Red canarese barb	CR	Actinopterygii
Labeo potail	Deccan labeo	EN	Actinopterygii
Leptoptilos javanicus	Lesser adjutant	VU	Aves
Lutrogale perspicillata	Smooth-coated otter	VU	Mammalia
Macholophus nuchalis	White-naped tit	VU	Aves
Manis crassicaudata	Indian pangolin	EN	Mammalia
Melursus ursinus	Sloth bear	VU	Mammalia
Neophron percnopterus	Egyptian vulture	EN	Aves
Oryza malampuzhaensis		VU	Liliopsida
Panthera pardus	Leopard	VU	Mammalia
Panthera tigris	Tiger	EN	Mammalia
Puntius cauveriensis	Cauvery barb	EN	Actinopterygii
Pycnonotus xantholaemus	Yellow-throated bulbul	VU	Aves
Rusa unicolor	Sambar	VU	Mammalia
Sarcogyps calvus	Red-headed vulture	CR	Aves





Species name	Common name	IUCN Category	Taxonomic Class
Schismatorhynchus nukta	Nukta	EN	Actinopterygii
Sterna acuticauda	Black-bellied tern	EN	Aves
Sypheotides indicus	Lesser florican	EN	Aves
Tetracerus quadricornis	Four-horned antelope	VU	Mammalia
Tor remadevii	Hump-backed mahseer	CR	Actinopterygii
Wallago attu		VU	Actinopterygii



Recommended citation

IBAT Proximity Report, 2018. Generated under licence 952-9516 from the Integrated Biodiversity Assessment Tool on 05/06/2020. <http://www.ibat-alliance.org>

How to use this report

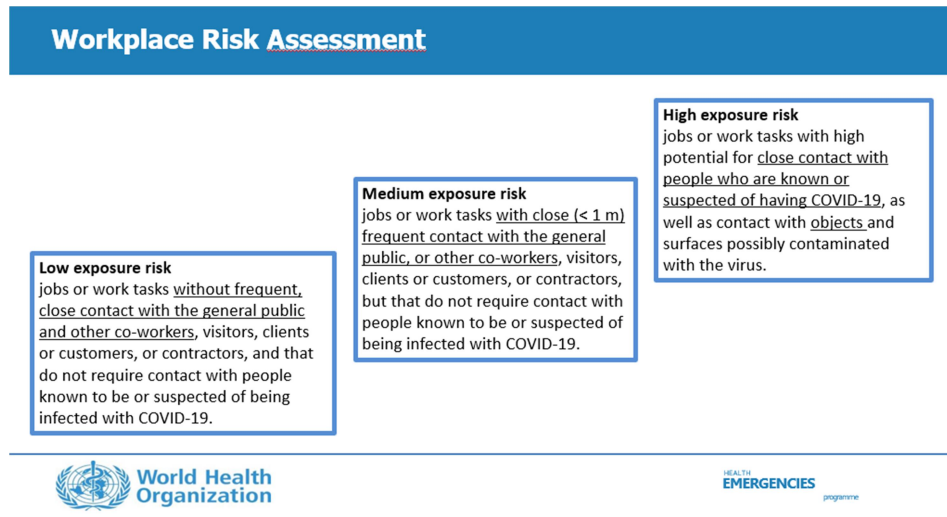
This report provides an indication of the potential biodiversity-related features - protected areas, key biodiversity areas and species - close to the specified location. It provides an early indication of potential biodiversity concerns, and can provide valuable guidance in making decisions. For example, this information can be helpful when assessing the potential environmental risk and impact of a site, categorising investments/projects, preparing the terms of reference for an impact assessment, focusing attention on key species of conservation concern and sites of known conservation value, and reviewing the results of an impact assessment.

The report does not provide details of potential indirect, downstream or cumulative impacts. Furthermore, the report should be regarded as a "first-step", providing a set of conservation values sourced from global data sets, and is not a substitute for further investigation and due diligence, especially concerning national and/or local conservation priorities.

Annex 6: Guidelines on COVID-19 Preparedness Measures

Risk of Exposure

1. The World Health Organization (WHO) notes that COVID-19 is transmitted primarily through respiratory droplets or contact with contaminated surfaces such that the risk of occupational exposure depends on the probability of coming into (i) close, less than 1m, or frequent contact with people who may be infected and (ii) contact with contaminated surfaces.
2. The nature of pre-construction consultations and surveys and construction works required for the project mean that the WHO occupational exposure risk will be low to medium:



3. The following factors will increase the risk of exposure if COVID-19 is circulating in either the local community where workers live/travel from or where the project will be implemented,

- Poor sanitation and welfare facilities on-site, in accommodations and for local communities
- Transient workforce; moving frequently between the local communities
- Construction workers likely from outside local community and/or state
- Construction workers likely to be residing within the local communities
- Underlying health conditions; asthma, chronic kidney or lung disease, diabetes, liver disease, serious heart conditions, serious obesity etc.
- Distribution line works taking place along public roads and in dense urban area

4. However, the national government is monitoring incidences of COVID-19 including identifying hotspots designated as containment zones and has various requirements (SOP) to be followed by companies and the public as well as a tracking app Aarogya Setu. The first case of the COVID-19 pandemic in Karnataka State was confirmed on 9 March 2020 and since then there have been about 250,000 confirmed cases with about 95,000 being in Bengaluru urban with several containment zones designated. In Bengaluru there have been problems with large numbers of persons testing positive not being accounted for in the healthcare system. BESCO call center itself has also had to shut due to positive cases of COVID-19.

5. These risks will need to be reviewed on an ongoing basis by BESCO and contractors as the COVID-19 pandemic evolves over the project implementation period.

COVID-19 Preparedness

6. To demonstrate how the project will address the above risks COVID-19 will be included as part of the health and safety plan. The health and safety plan will need to include details of the current risk, day to day measures to be taken on-site, trainings, roles and responsibilities, an emergency procedure to follow in the event anyone develops symptoms including flow chart and contact details for local health facilities,

screening checklists etc. It will need to demonstrate how government requirements will be followed by BESCOM and contractors. In addition to any government requirements applicable at the time the following measures should be considered:

- During pre-construction activities social distancing of at least 1m will be maintained by all those working in the field, in order to reduce the risk of exposure as far as possible.
- Check and follow the government advice for the local community where planning to undertake consultations, surveys, and/or construction works
- Confirm the local health authority and liaise with them in advance to identify the current status of COVID-19 in the local community and any advice to be followed.
- Develop an emergency procedure to follow in the event anyone in the field develops symptoms including flow chart and contact details of local health facilities; this is to cover self-monitoring of symptoms, isolation, testing and quarantine, and transfer and admittance to hospital as a situation requires.
- Provide awareness raising activities for those being deployed to the field to cover hand hygiene, symptoms, risk, and procedures to follow if symptoms occur – keep records of all trainings.
- Ensure those working outside their home location are provided with accommodation that allows social distancing of at least 1m, is regularly cleaned, and with adequate sanitation and welfare facilities to enable them to undertake hand washing etc.
- Ensure temperature and medical checks are undertaken before deploying anyone to the field, especially for anyone travelling from outside the local community and/or state.
- Provide those going in the field with adequate supplies of PPE including soap, hand sanitizer, paper tissues, masks, thermometer to check own temperature etc.
- For consultations consider if rather than one large public meeting a series of smaller focus groups or face-to-face consultations could serve the same purpose without compromising the requirement to undertake meaningful consultations.
- Clean and disinfect the venue including objects and surfaces before and after any event.
- Consider the use of outdoor venues in order to maximise ventilation, space chairs at least 1m apart and ensure there are no bottlenecks to avoid close contact.
- If health authorities advise COVID-19 is circulating in the local community then advise participants in advance that if they have any symptoms or feel unwell, they should not attend.
- On arrival at the public meeting check the temperature of participants and require them to self-declare free of COVID-19 symptoms and not in recent contact with anyone who has had symptoms before being allowed into the venue.
- Those that cannot attend should be given the option of a telephone consultation or similar if they have an interest or concern about the project, to avoid them feeling obliged to attend for their voice to be heard.
- Provide awareness raising posters and have a hand wash station at the entry equipped with clean water, soap and hand sanitizer for participants to use.
- Pre-order enough PPE, including soap, paper towels, paper tissues, hand sanitizer, and surgical masks for all participants to use; if not nationally mandated, at minimum, masks must be worn by all participants that cannot maintain social distancing or are elderly or otherwise medically vulnerable.
- If using microphones, ensure that they are wiped down with alcohol at least 70% concentration before passing it on.
- If food and drink is provided, try to provide pre-ordered individual packed food to avoid cross-contamination
- Identify an area where someone feeling unwell or has symptoms can be safely isolated, in case of serious case have a vehicle on call in which patient can be safely transferred to a local health facility with a driver who has full PPE and is trained to deal with potential cases and deep clean the vehicle afterwards.
- Emergency procedure to include for participants reporting symptoms and contacting other participants if anyone tests positive later, for contact tracing purposes ensure that all participants including support workers such as caterers or cleaners provide their contact details: telephone, address etc.
- Disposal of hygiene related waste in garbage bins with sealed lids lined with plastic bags, for onwards disposal in accordance with national regulations

7. During construction activities social distancing of at least 1m will be maintained by construction workers to members of the local communities in which they are undertaking work with awareness raising posters and notices so that local community members understand social distancing with them must be

maintained. However, it may not be possible to maintain social distancing of 1m with other construction workers given tasks to be undertaken. If the tasks cannot be reconfigured to enable this, additional measures must be taken to reduce the risk of transmission between them:

- Daily temperature reading and self-certification check to be undertaken by the construction workers before leaving accommodation to confirm fit for work and having no COVID-19 symptoms.
- Posters and signages to be displayed on-site and at accommodation with daily toolbox talks to provide COVID-19 reminders on hygiene, emergency procedures etc.
- Enhanced cleaning and disinfection (using sodium hypochlorite (bleach) of surface at concentration 0.1% or alcohol at least 70% concentration for surfaces which can be damaged by sodium hypochlorite) of objects and surfaces that are regularly touched on-site and in construction worker accommodation including materials and equipment, shared rooms, surfaces, floors, toilets, and, washing facilities etc.
- Minimizing face-to-face and skin-to-skin contact by construction workers, orientate tasks so working side by side or facing away from each other rather than face on, and always assign construction workers to the same small working gang and the same accommodation, so as to limit social interaction between them
- Enhanced hand hygiene - regular hand washing with soap and water or alcohol-based hand sanitizer, including before entering and on leaving accommodation, on arriving and leaving site, and before putting on and after taking off any PPE
- Provide appropriate PPE and training on its proper use – masks, gloves, eye protection as applicable
- Provide medical insurance for all construction workers and sick leave to avoid them turning up for work when symptomatic due to no work-no pay situation

Further Sources of Information

- ADB <https://www.adb.org/publications/safety-well-being-workers-communities-covid-19>
- Government of Karnataka <https://covid19.karnataka.gov.in/english>
- India Ministry of Health and Family Welfare <https://www.mohfw.gov.in/>
- WHO Advice for the Public <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/advice-for-public>
- WHO Technical Guidance <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/technical-guidance>
- WHO Guidance for Schools, Workplace and Institutions <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/technical-guidance/guidance-for-schools-workplaces-institutions>

Annex 7: Environmental Monitoring Report Template

BESCOM is required to prepare and submit to ADB semiannual monitoring reports until submission of the project completion report (or a later date agreed therein) for the sovereign element and then annually until project maturity for the nonsovereign element. The monitoring reports will describe compliance with environment safeguards loan covenants, PAM, contract, progress with implementation of the project EMP, quantitative monitoring results, environment, health and safety incidents and responses, grievances and responses, potential or actual non-compliance issues, and corrective actions. A sample Table of Contents that can be adapted as necessary is provided below.

TABLE OF CONTENTS

Part I – Introduction

- Project description, including organogram of relationships with Contractors, owner, lender, etc.
- Design, pre-construction, construction, and operational activities and project progress during previous 6 months
- Confirm if any changes in design and construction (e.g. alignment, construction methods) during previous 6 months
- Confirm if any changes in project organization and Environmental, Health and Safety management team during previous 6 months

Part II – Loan Covenants

- Status of compliance with environment safeguard loan covenants and further action to ensure ongoing compliance; if there is partial or no compliance recommendations for corrective action are required.

Clause	Covenant	Status of compliance to date (full, partial, none, ongoing)	Comment/further action required including timeline

Part III – PAM

- Status of compliance with environment safeguard/monitoring section of PAM and further action to ensure ongoing compliance; if there is partial or no compliance recommendations for corrective action are required.

Para	Details	Status of compliance to date (full, partial, none, ongoing)	Comment/further action required including timeline

Part IV – Contract

- Status of compliance with environment safeguard section of Contracts and further action to ensure ongoing compliance; if there is partial or no compliance recommendations for corrective action are required.

Contract Package	Details	Status of compliance to date (full, partial, none, ongoing)	Comment/further action required including timeline

Part V – EMP and CAP

- Site inspections and audits completed – summarize the number and type of site visits, persons involved, and checklists/reporting format used (sample of checklists and reports to be included as an appendix)
- Status of compliance with EMP measures and further action to ensure ongoing compliance; if there is partial or no compliance recommendations for corrective action are required.

- Copies of clearances, CEMP, construction method statements, and other documentation produced in accordance with EMP during the previous 6 months should be included as an appendix.
- Copies of training records related to EMP during the previous 6 months should be included as an appendix.

Item	Measure	Status of compliance to date (full, partial, none, ongoing)	Comment/further action required including timeline

Part VI - Environmental Monitoring

- Environmental monitoring results – summarize the previous six months quantitative monitoring activities and data obtained in accordance with the EMoP and provide explanations of any instances where performance standards were exceeded along with details of responses taken to rectify the exceedance once identified. Typically this section will include the results of:
 - Noise and vibration surveys
 - Air quality surveys
 - Health and safety incident records
- Corrective actions are required to ensure any exceedances will be prevented in the future.
- Graphs can be used in this section to show trends; however, large tables of data or multiple graphs should be attached as an appendix. Calibration and QA certifications of monitoring equipment and laboratories analyzing samples should be included as an appendix.

Part VII – Consultation and Grievances

- Consultation – report on any ongoing consultation undertaken, and main issues raised by consultees; detailed consultation records should be included as an appendix.

Date	Format/Venue	Participants (Occupation, M/F)	Main Issues Raised
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- Grievances - list any complaints received, however minor, and responses taken to them; detailed grievance records and response reports should be included as an appendix.

Part VIII - Environmental Management

- Report on any unanticipated impacts and updates to IEE/EMP that were required during the previous 6 months, status of delivery of documents, required amendments, consultation and disclosure undertaken etc.
- Environment, health and safety incidents – summarize details of the responses taken to incidents that arose; detailed response reports should be included as an appendix.
- Non-compliance notices – summarize details on the number of notices given out, the issues covered, and status of compliance with them.
- Corrective action plans – summarize non-compliances identified and if non-compliance, report on timeliness for the preparation and completion of corrective action plan if not already included in above.

Annexes

- Sample checklists and reports
- Clearances and documentation
- Training records
- Photographs
- Detailed monitoring data
- Calibration and QA certificates
- Consultation records
- Grievance records
- Environment, health and safety reports

Annex 8: Environmental Safeguards Checklist and Consultation Proforma

Table1 can be used as a proforma to help confirm that there have been no changes in alignments outside existing overhead line corridors and/or affecting environmentally sensitive areas before proceeding with works and attached to the periodic environmental monitoring reports and submitted together with a GIS file on completion of actual alignments being mapped by the contractor.

If the answer to any of the * questions were to be “yes” then the IEE should be reviewed in consultation with ADB to determine if it is necessary to update it.

Table 1: Environment Safeguards Checklist

Subdivision	
Section of line/km	
Cable remains in existing overhead corridor	Yes/No*
Temporary or permanent land acquisition required	Yes/No*
Structures demolished or involuntary resettlement	Yes/No*
Trees to be cut	Yes/No*
Environmentally sensitive areas related to final line alignment, see IEE baseline section for locations:	
Does alignment enter forest area?	Yes/No*
Does alignment enter park or garden?	Yes/No*
Does alignment enter lake area?	Yes/No*
Does alignment pass through regulatory zone of state monument?	Yes/No*
Does alignment pass through or on boundary of local heritage zone?	Yes/No*
Other sensitive receptors identified on same street to plan works around e.g. residential/temple/mosque/school/community facilities etc.	
Temporary blocking of access to an area for more than 8 hours for which an alternative safe access cannot be provided	Yes/No*

Meaningful environmental consultations must be conducted for all 17 subdivisions prior to the approval of any works with governmental and civil society representatives (as per bulleted list, but not an exclusive list) met for all subdivisions as well as public consultation through focus groups or similar. Focus groups should have good representation of the affected community and at least 20% representation of women excluding BESCO and Contractor representatives as well as vulnerable groups. If this is not possible then a separate focus groups must be held for them to ensure that the concerns of women and other vulnerable groups in community are heard. Tables 2 and 3 can be used as a proforma to help guide and document the consultation process.

- Political Representatives of Subdivision

- Bruhat Bengaluru Mahanagara Palike (BBMP)
- KSPCB Officers
- Temple/mosque head for undergrounding on streets on which works will take place supporting religious buildings
- School head for all undergrounding on streets where works will take place supporting schools

Table 2: Summary Record of Subproject Environment Meetings and Discussions with Government and Civil Society Representatives*

Date	Location	Name of the Person	Position or Title, Agency	Topics Discussed	Suggestions for Alignment and Mitigation	Contact Number	Signature

* Provide photograph of the meeting in progress

Table 3: Summary Record of Public Consultations and Focus Groups*

Subdivision		
Location		
Date, Time and Local		
Total Number of Participants	Male:	Female:
Names and Designations of Key participants		
BESCOM		
Contractor		
Governmental/CSO		
Topics Discussed and Findings		
Presence of sensitive receptors		
Presence of trees along alignment and if require cutting		
Presence of physical cultural resources along alignment		
Presence of schools or other community facilities along alignment		
Existing community H&S incidents and/or concerns with existing overhead lines		
Existing community H&S incidents or pollution (oil leak) and/or concerns with existing transformers		
Concerns of community related to H&S of undergrounded lines		
Concerns of community related to damage to property or utilities		
Concerns of community related to pollution and waste management during the works		
Concerns of community related to noise, vibration, dust, air pollution during the construction		
Concerns of community related to		

disruption and disturbance to their daily activities during works	
Concerns of community related to disturbance to ongoing access and traffic management issues during works	
Concerns of community related to incoming workers and their presence in community during the works e.g. COVID-19 risk	
Concerns of community related to local employment (jobs created for unskilled workers by construction are very minimal if any)	
GRM and types of grievances related to environment, health and safety that could be raised	
Suggestions for Alignment, Construction Method and Mitigation	

*Provide photographs of the public meeting and/or focus groups in progress and copy of sign in sheet

Annex 9: BESCOM undergrounding cable work and installing RMU

Note: Photos below are illustrative of BESCOM installations and ongoing works on the BESCOM distribution network in Bengaluru; exact locations not available.



Pic 1: Installed RMU



Pic 2: Installed RMU



Pic 3: Installed RMU



Pic 4: Installed RMU



Pic 5: Installed RMU



Pic 6: Installed RMU



Pic 7: Installed RMU



Pic 8: Installation of RMU



Pic 9: Installed RMU



Pic 10: Installed RMU



Pic 11: Installation of RMU



Pic 12: Underground cabling work



Pic 13: Underground cabling work



Pic 14: Trenching

Annex 10: Environment Audit of Non-Sovereign and BESCOM Contract Packages

Introduction

Current performance on the 3 non-sovereign and 1 counterpart funded contract packages which are under construction against the EMP has been reviewed by the IEE consultants through discussions with BESCOM and the respective contractors. In relation to the current status of works and pre-construction preparations, environment audit checklists were shared with BESCOM and their contractors for completion and followed up through telephone discussions. Due to COVID-19 restrictions it was not possible to validate all findings on site at this stage. The key findings of the environment audit are summarized here.

Project-Level Audit Findings

A generic EMP was included by BESCOM in the contract documents for all 4 contract packages, which has been compared against the project EMP included in the IEE, identified gaps have been reflected in Table 10.2. Contracts for all 4 packages were awarded on 15 July 2019 and the contractors started works between July and October 2019. Works started over a year ago (i.e. before the COVID-19 pandemic and subsequent slowdown of activities which will require extension of completion dates) but many of the activities required by the generic EMP are yet to be taken up by all 3 contractors. The key observations of the environment audit are as follows:

- All 3 contractors reported having completed their survey work and submitted their detailed designs to BESCOM, detailed designs were not shared with the audit team, but it is understood submissions sometimes only consisted of marked up survey drawings for approval by BESCOM.
- All 3 contractors reported following the ROW of existing distribution lines in their final alignments (although detailed map of distribution lines were not seen) and no work is reported to go through forest, park, garden, or lake or to pass through 200m regulated zone of state protected monuments nor heritage zone but this will need to be reconfirmed once detailed designs are made available.
- Except for Larson & Toubro Ltd who shared an EHS Plan and ESMP none of the contractors was able to share a Construction Environment Management Plan (CEMP) and associated plans. All contractors need to be sensitised to the CEMP requirement and on preparing one that accords with the project EMP for approval by BESCOM.
- BESCOM and Contractors are not fully aware of the environment, health, and safety regulatory framework that governs the contracts and the relevant provisions that are applicable; also they are not familiar with international good practice such as the IFC EHS guidelines and their awareness needs to be increased. Notifying the community of works being undertaken and the undertaking of community awareness raising activities needs attention. Ongoing consultation needs to be formalized per Section VI, Part D of the IEE, with the introduction of (i) meaningful consultation through community focus groups – Annex 8, (ii) use of television, newspapers and social media, posting of notices (in local area and on BESCOM website) and distribution of pamphlets regarding advance details of upcoming works – advance announcements using public address system could also be used as a means of dissemination, and (iii) popularizing grievance redress procedure and contact details, etc.
- GRM at BESCOM and contractor level is not clearly established for the project, BESCOM need to explain to contractors how their GRM is to be operationalized on the ground and efforts to disseminate this project-level GRM taken.
- Except for Larson & Toubro Ltd no monitoring through testing of environment parameters (e.g. air, noise, and water) is being undertaken, and that which is being taken is being done in random locations.
- Use of underground utility detection devices to avoid and ensure no damage to underground utilities is not being implemented by all contractors but needs to be made as a common practice in accordance with the project EMP.

- Contractors are not fully aware of their responsibilities under national labor law and requirements for workers accommodation and welfare facilities under the project. In particular, contractors need to send periodic reports on the labor and labor welfare to government with copies to BESCOM and should have set up an Internal Complaints Committee (ICC) specifically for use by women under national law on prevention of sexual harassment, to comply with national labour laws.

Further details on the performance of each contractor based on the information available to the auditor can be found below and in Table 10.1.

Table 10.1 – Details of Subprojects (Contract Packages) Underway

Contractor	Source of funds	Area	Subdivisions	Start of works	UGC trenchless (km)	UGC open trench (km)	ABC cables (km)	OFC (km)	RMUs (unit)
L&T Ltd	NS loan	Indira Nagar	E-6, E-10	04.08.2019	250		104	492	330
NCC Ltd	NS loan	Indira Nagar	E-11	15.07.2019	393.82	59.96	87.35	-	157
AFT Ltd	NS loan	Shivaji Nagar	E-1 & E-5	07.10.2019	260	-	230	-	140
AFT Ltd	BESCOM	Jaya Nagar	S-1, S-2, S-6, S-14 & S-15	11.10.2019	270	-	260	-	190

NS = non-sovereign, UGC = underground cable (11 kV and 1.1 kV), ABC = aerial bundle conductor, OFC = optic fiber cable, RMU = ring main unit.

Note: information on km of cables and number of RMU based on information provided by each contractor based on approved detailed designs as of Quarter 3 2020; the approved details vary from the subproject details held by BESCOM per their detailed project report for the project, as given in Table 10.2.

Table 10.2 – Details of Subprojects from Detailed Project Report

Subdivisions	11 kV UGC (km)	1.1kV distribution line conversion			OFC (km)	RMU (unit)
		1.1 kV UGC (km)	1.1kV ABC cables (km)	Total		
E-6 & E-10	233.08	704.01	280.02	984.03	523.51	116
E-11	260.28	146.30	524.68	670.98	377.55	217
E-1 & E-5	311.04	82.55	307.97	390.52	306.11	162
S-1, S-2, S-6, S-14 & S-15	358.16	33.20	1,056.86	1,090.06	360.99	265

M/s. Larson & Toubro (L&T) Limited – Capacity Building Needed to Comply with IEE

Documents shared by contractor to audit team to supplement questionnaire response: certification for ISO 140001:2015 and ISO 45001:2018, list of environment, health and safety legislation being followed, EHS Plan for Contract Package, ESMP for Contract Package, labor license, copies insurance policies, sample copy of employee screening check, sample medical checkup forms, EHS Code of Conduct for Subcontractors and sample subcontractor declaration of compliance, subcontractor staff record, sample survey drawings, completed utility register, template for utility damage register, copies of BBMP approvals, BESCOM notification of work scheduling request, template for grievance register, list of first aiders, list of fire extinguishers, fire

drill register and photos, water supplier vendor C&S Maintenance SF6 RMU Conditions, certificate, drinking water quality test report, sample of safety committee meeting minutes, template for traffic police register, guidelines for company owned motorcycle, COVID-19 Standard Operating Procedures, sample self-declaration forms for COVID-19, accident reporting flow chart, copy of workman camp inspection report by contractor, copy of office inspection report by contractor, PowerPoint presentation on EHS requirements being adopted for the project.

The contract was awarded on 15 July 2019 and works started on 4 August 2019. So far, about 18% of the undergrounding works, 26% of the ABC cabling and 10% of the optical fiber cabling has been carried out and 5% of RMUs installed. Survey works have been completed and detailed designs reportedly submitted to BESCOM, a sample survey drawing was shared with the audit team. So environmental impacts can be confirmed, sufficiently detailed map of distribution lines final alignments should be provided prior to first disbursement. Pre-condition surveys have been completed with evidence of completion of works shared. L&T have maintained a property damage register and have been promptly repairing any minor damage that has occurred during works. Although clearance from other utilities was obtained for the works and sites checked with underground utility detector prior to works execution, some utility damages have occurred. No private property was mentioned in the record as being damaged. When access to residences or businesses is restricted, it is for less than 24 hours and access is not blocked off completely.

EHS Plan and ESMP has been prepared specific to the project and the contractor who has ISO environment and health and safety certifications reported being familiar with the IFC EHS Guidelines. The contractor also has a code of conduct for subcontractors employed by them. If the EHS Plan and ESMP requirements are followed in full with some modifications and approval by BESCOM it should enable the contractor to achieve same environmental outcome/performance standard as the project EMP. A dedicated environment officer, health and safety (H&S) officer and community liaison officer (CLO) have been nominated as well as one EHS site supervisor, although it is not clear what their qualifications and experience are and whether these roles are their sole focus or shared with engineering responsibilities. L&T is the only contractor having conducted some testing of air, noise, and water parameters, at random locations although only evidence of vehicle and drinking water quality testing was shared with the audit team. Environmental monitoring must continue by following the environmental monitoring plan included in the IEE.

Permissions to undertake work were sought and records of BBMP report shared. Some consultations have been carried out and advance notice has been given on-site through megaphone but no written notice/signage has been reported. Consultations must continue throughout the works and advance noticing be strengthened. Content for community awareness raising campaign is still to be developed. A GRM has been set up with contact numbers displayed at working stations, but its effectiveness and community awareness could not be confirmed. So far, no grievance has been received by the contractor.

Some efforts to minimize noise, dust, emissions to air, soil, and water contamination are evident. The contractor reports works are being carried out early morning (6am-9am) in areas with high traffic, including but not limited to markets and commercial areas and works at road crossings is done at night manually (no machinery used) in order to avoid noise generation. Only PUC certified vehicles and machinery are being used, meeting national noise and emission standards, copies of certification shared to demonstrate compliance. Temporary construction facilities have been set up for stores and laydown area.

RMUs being supplied under contract reportedly contain less than 2 kg of SF6 and are being tested and guaranteed by the supplier at less than 0.1% leakage rate.

Labor license is obtained and some insurances for employees are provided. All workers are Indian males between 18 and 58 years old, some of them coming from outside Karnataka state. The contractor cannot advise on accommodation for workers not local to the area as they consider it is the responsibility of sub-contractors; awareness needs to be raised at contractor

and sub-contractor level on their responsibilities under ADB's Safeguard Policy Statement (2009) in relation to worker accommodation and welfare facilities. Drinking water tests show that drinking water supply meets national regulations. The contractor's EHS Plan and ESMP for all works sets out health and safety requirements to be followed for topics such as zero accident policy, toolbox talks, PPE, emergency response etc. If the EHS Manual requirements are followed in full it should enable the contractor to achieve same environmental outcome/performance standard as the project EMP. Some H&S trainings have been provided to staff, yet further training will be needed to fill in gaps identified in this audit to match the requirements of the project EMP. Task-related PPE is being provided to workers for their work activities; contractor's H&S officer and BESCOM supervision must ensure that PPE is always provided in appropriate quantity, of good quality and wearing of PPE is enforced on site at all times as there was evidence of workers not wearing any shoes. There is evidence that first aiders and first aid boxes are available and that fire safety trainings including demonstrations are carried out. There is evidence that the contractor put up warning signs in the vicinity of works and barricading to restrict access and prevent traffic and passers-by accidents. No accidents are reported to have occurred to date.

In the context of COVID-19 a SOP has been prepared, workers are subject to health checks and daily temperature checks, hand sanitizer is provided at key locations and workers are required to wear masks, although some are not worn properly by them; so far, no COVID-19 case has been reported amongst workers.

There is adequate evidence that satisfactory work processes and environmental management are in place, but some improvements are needed to be fully in accordance with the project EMP provided within this IEE.

M/s. NCC Limited – Intense Capacity Building and Handholding Needed to Comply with IEE

Documents shared by contractor to audit team to supplement questionnaire response: none.

The contract was awarded on 15 July 2019 and works in E-11 subdivision commenced shortly afterwards. So far, about 26% of the trenchless undergrounding works and 7% of the open-trenched undergrounding works have been carried out, as well as 19% of the ABC cabling and 2% of RMUs installed. Survey works have been completed and detailed designs reportedly submitted to BESCOM, but not made available to the audit team. So environmental impacts can be confirmed, sufficiently detailed map of distribution lines final alignments should be provided prior to first disbursement. Pre-condition surveys have been completed, but no evidence of completion. The contractor reported no property damage but there is no system to record it.

CEMP and sub-plans have reportedly been prepared but documentation was not shared. The contractor was not familiar with international best practice, such as, the IFC EHS Guidelines. A dedicated environment officer, H&S officer and CLO have been nominated but no EHS site supervisors; it is not clear what their qualifications and experience are and whether these roles are their unique responsibility or whether they also undertake engineering-related tasks. No environmental monitoring of environmental parameters such as noise, dust, emissions, soil, water contamination has been undertaken by the contractor.

Permissions to undertake work were sought although no evidence of having received them was shared. Some consultation has reportedly been carried out with the local community regarding the project in general. Consultations must continue throughout the works with advance notification by NCC to be strengthened. The contractor reported carrying out community awareness raising campaign, but no details were shared. A GRM has been put in place with contact details reportedly displayed at site although no evidence of dissemination has been seen. No grievances have been reported by the contractor.

No evidence has been provided regarding efforts to minimize noise, dust, emissions to air, soil, and water contamination or that vehicles and machinery are meeting national air/noise emission standards. Temporary construction facilities have been set up for stores and laydown area. Understanding and implementation of international good practices related to pollution prevention, handling of chemicals and other hazardous substances as well as waste management need to be strengthened, as well as contractor's awareness on SF6 requirements.

RMUs being supplied under contract reportedly contain less than 2 kg of SF6 and are being tested and guaranteed by the supplier at less than 0.1% leakage rate.

Labor license is not available to the audit team, and it is unclear if employee insurances are in place. The workers are all reportedly above 18 years old and local to Bangalore; no accommodation is reported as required, as workers are local to the area. However, no evidence of labor screening was provided to support this. Some H&S trainings are being provided to staff, yet no evidence was shared that demonstrated tool box talks were being undertaken etc. Further training will be needed to match the requirements of the project EMP. Task-related PPE is reportedly provided to workers; contractor's H&S officer and BESCOM supervision must ensure that PPE is always provided in appropriate quantity, of good quality and wearing of PPE is enforced on site at all times. No evidence has been provided regarding implementation of health and safety measures, e.g. maintenance records, emergency procedures, fire drills, etc. but no accidents are reported to have occurred to date.

Specific measures are reportedly in place in the context of the COVID-19 pandemic, no details shared; but, so far, no COVID-19 case has been reported amongst workers.

The work processes and environmental management must be upgraded to follow the project EMP provided within this IEE.

M/s. Asian Fab Tech (AFT) Limited – Intense Capacity Building and Handholding Needed to Comply with IEE

Documents shared by contractor to audit team to supplement questionnaire response: none.

The contract was awarded on 15 July 2019 and works started on 7 October 2019 for non-sovereign works (E-1 and E-5 subdivisions) and on 11 October 2019 for the work package under counterpart funding (S-1, S-2, S-6, S-14 and S-15), yet progress to date has not been confirmed by the contractor. Survey works have been completed and detailed designs reportedly submitted to BESCOM, but not been made available to the audit team. So environmental impacts can be confirmed, sufficiently detailed map of distribution lines final alignments should be provided prior to first disbursement. Pre-condition surveys have reportedly been completed, but no evidence of completion was shared. The contractor reported no property damage but then again there is no system to record it.

CEMP has not been prepared and no dedicated environmental and health and safety staff have been engaged nor their responsibilities delegated to engineering staff to date. No environmental monitoring of environmental parameters such as noise, dust, emissions, soil, water contamination has been undertaken by the contractor.

Permissions to undertake work were sought although no evidence of having received them was shared. No prior notice is being given to the local community regarding works, some awareness raising is reportedly done with them regarding electrical and construction safety although no details were shared. The advance notification by AFT needs to be strengthened. The contractor is not aware of the GRM requirements. No community grievance recorded by the contractor to date; however, workers are reported to convey their concerns to BESCOM regularly although it is not clear what these are.

Limited evidence has been provided regarding efforts to minimize noise, dust, emissions to air, soil, and water contamination or that vehicles and machinery are meeting national air/noise emission standards. Works are being executed between 10am-5pm. Workers are being engaged to keep the sites clean. Temporary construction facilities have been established in Peenya industrial area. Understanding and implementation of international good practices related to pollution prevention, handling of chemicals and other hazardous substances as well as waste management for which no system is in place need to be strengthened, as well as contractor's awareness on SF6 requirements.

RMUs being supplied under contract reportedly contain less than 2 kg of SF6 and are being tested and guaranteed by the supplier at less than 0.1% leakage rate.

Labor license is not available to the audit team, and it is unclear if employee insurances are in place. The contractor was not fully aware of their requirements under national labor law e.g. ICC for women. The workers are reportedly all local to Bangalore, yet evidence of labor screening was not shared to confirm this; the company employs some staff below 18 years of age under supervision although it is not clear if this is the case at project sites, and if so what activities they are engaged in and the level of supervision being provided. Going forward it must be ensured that no under 18s are employed on construction sites under the ADB project. Municipal toilets are being used by workers (no project toilets provided for them) and mineral water provided. The contractor does not provide workers with an induction before being allowed on site although toolbox talks and job-related trainings are provided. Inductions and further training will be needed to fill in gaps identified in this audit to match the requirements of the project EMP. Task-related PPE is being provided to workers; contractor's H&S officer and BESCOM supervision must ensure that PPE is always provided in appropriate quantity, of good quality and wearing of PPE is enforced on site at all times. Limited evidence has been provided regarding implementation of health and safety measures, but no accidents are reported to have occurred to date.

Specific measures are in place in the context of the COVID-19 pandemic, including temperature monitoring, use of masks & sanitizers. So far, no COVID-19 case has been reported amongst workers.

The work processes and environmental management must be upgraded to follow the project EMP provided within this IEE.

Conclusion and Recommendations

Table 10.3 presents a gap analysis of overall current performance on the 3 non-sovereign and 1 counterpart funded contract packages which are under construction, and the time-bound corrective action that is required by BESCOM and their contractors.

BESCOM is to implement and require their contractor to immediately implement this project-level corrective action plan to bring current performance in line with environmental outcome/performance standards of the project EMP and then continue to follow project EMP requirements for construction going forward, including operation and maintenance requirements which are solely the responsibility of BESCOM. Budget for implementing this corrective action plan is included as part of the project EMP budget.

Project-level corrective action will need to be implemented by BESCOM and their contractor prior first disbursement of the sovereign and non-sovereign loan. Prior to first disbursement, BESCOM with the support of its contractors will submit a report for each subproject (contract package) demonstrating compliance with the project-level corrective action to ADB for clearance, compliance may also be checked on the ground by ADB which BESCOM will facilitate. Ongoing compliance with corrective action plan will be confirmed by the independent environment monitoring agency appointed by BESCOM in the periodic environmental monitoring reports.

Table 10.3 – Gap Analysis and Project Corrective Action Plan

SPS Requirements	Consistent with Project Requirements	Corrective Action	Timing	Responsibility
Environmental Assessment	Yes. The project is categorized as B and this IEE has been undertaken which covers the non-sovereign and BESCOM contract packages; although work on the IEE commenced in April 2019 it was only finalized in August 2020 after contracts awarded in July 2019 and work started.	N/A	N/A	N/A
Planning and Management by BESCOM	Partial. Contract document prepared by BESCOM notes that an IEE and EMP is being prepared, includes details of all national environmental protection and labor laws and regulations that require compliance, includes a generic EMP and SMP, and requires the contractor to budget accordingly for implementation with penalties set out for non-compliance, as detailed in the tender documents. Since the generic EMP and SMP were not informed by the environmental assessment, a gap analysis of the measures included to the project EMP has been undertaken. Contract refers to the IEE and EMP being prepared whilst the generic EMP requires the contractor to "comply with the	In conducting training on the project EMP as set out in Table 67 existing contractors will be included, through this they will be informed that as an ADB project as well as national laws and regulations the General EHS Guidelines (2007) and EHS Guidelines for Electric Power Transmission and Distribution (2007) and project EMP are to be followed going forward.	For immediate implementation. Existing contractors training on the project EMP will be delivered prior to first disbursement. Compliance with corrective action to be cleared by ADB prior to first disbursement.	BESCOM PMU

	Financier's Environmental, Health and Safety Guidelines" as well as national laws and regulations so BESCO can require their contractors to address any gaps in current performance versus ADB's SPS requirements as set out in project EMP. The generic EMP also notes BESCO to provide orientation sessions throughout the project to be attended by contractors, giving the opportunity for them to attend trainings.			
Planning and Management by Contractors	Partial. Although works have started over a year ago, and contractors report having submitted their detailed designs to BESCO, these have sometimes been limited to marked up survey drawings; with the exception of L&T no CEMP or other plans were made available during the environmental audit; the L&T EHS Plan and ESMP also need to be updated in line with the project EMP requirements.	Final alignments to be completed by the contractors and approved by BESCO before works on new sections under the contracts start. Contractors to prepare a Construction Environmental Management Plan (CEMP) detailing how they will address gaps and comply with the project EMP going forward, for approval by BESCO and clearance by ADB upon loan effectiveness. Sufficiently detailed map of distribution lines included in contract to confirm final alignments, and evidence of pre-condition surveys being completed to be included in CEMP.	For immediate implementation. CEMPs approved by BESCO to be submitted for ADB clearance upon loan effectiveness. BESCO to submit report demonstrating subproject's compliance with the CEMP prior to the first disbursement; on this basis compliance with corrective action to be cleared by ADB prior to first disbursement.	BESCO PMU and contractors

		BESCOM with the support of their contractors will submit a report demonstrating each subproject's compliance with the cleared CEMP prior to the first disbursement.		
Information Disclosure, Consultation and Participation	Partial. IEE has been undertaken which will be disclosed on the ADB website and locally by BESCOM although after the contracts were awarded and work started. During IEE preparation, public consultations were undertaken for all six divisions as documented in the IEE, these were undertaken prior to contract award. From Table 60 of the IEE during the household surveys most participants in Jayanagar division were already aware of the project, similarly in Indira Nagara there was relatively good awareness of the project. However, there was no awareness of the undergrounding work among households in Shivaji Nagara which is one of non-sovereign contract packages although the survey process undertaken will have helped to raise awareness of the works in this division.	Before any further works under the contracts are pursued, IEE is to be locally disclosed and ongoing consultation and awareness raising requirements as set out in the project EMP (e.g. community focus groups, distribution of notices and pamphlets, announcements using public address system, ongoing consultations to seek community feedback, etc.) are to be followed by BESCOM and their contractors to ensure that all residents are aware of the scope of works and have received at least one month advance notice of them etc. Implementation of ongoing consultation and awareness raising are to be reflected in the contractor's CEMP for approval by BESCOM and clearance by ADB upon loan effectiveness. BESCOM with the support of their contractors will submit a report demonstrating each subproject's compliance prior to first disbursement.	For immediate implementation, before any works on new sections under the contracts start/existing works resume. Compliance with corrective action to be cleared by ADB prior to first disbursement.	BESCOM PMU and contractors

Grievance Redress	Partial. BESCOM have an existing GRM at corporate level that functions well, as discussed in IEE. Generic SMP also requires contractor to establish GRM for both labor and community grievances to be addressed. On the ground, environmental audit of ongoing works identified that the GRM for the project is not clearly established at BESCOM or the contractors' level.	Existing GRM to be supplemented with grievance redress committee for each division, as discussed in the IEE. Existing contractors are to clearly establish a GRM for labor and community complaints received at ground level, as discussed in the IEE. GRM contacts are to be prominently displayed at site and distributed verbally and through notices or pamphlets by BESCOM and their contractors so that residents are informed of its availability, the procedure, and contact details in case of any complaint they which to raise. Implementation of GRM requirements are to be reflected in the contractor's CEMP for approval by BESCOM and clearance by ADB upon loan effectiveness. BESCOM with the support of their contractors will submit a report demonstrating each subproject's compliance prior to first disbursement.	For immediate implementation. Compliance with corrective action to be cleared by ADB prior to first disbursement.	BESCOM PMU and contractors
Monitoring and Reporting	Partial. Generic EMP included in the contract documents includes	BESCOM to appoint junior EHS officers to ESC for each of these four contract packages to	For immediate implementation. Junior EHS officers,	BESCOM PMU and contractors

	<p>monitoring requirements with reference to supervision by BESCOM and their contractors; subprojects are required to undertake air, water, noise, soil quality monitoring through government established laboratory or a recognized agency, as well as monitoring the survival of trees, condition of water bodies, etc. However, the generic EMP plan was not informed by an environmental assessment, and just states that a monitoring plan will be prepared. Thus, there is no elaboration on the monitoring and reporting process to be followed by the contractors.</p> <p>On the ground, environmental audit of ongoing works identified supervision and monitoring by BESCOM needed to be strengthened to ensure their contractors are following national laws and regulations and international good practice provisions. Only one contractor (L&T) reported to be carrying out any air, noise, and water quality monitoring through testing of random locations. Contractors were not required to appoint dedicated persons to the roles of Environment Officer, Health and Safety Officer, and Community Liaison/Labor Officer/GRM Focal,</p>	<p>supervise and monitor the contractors and require them to take necessary corrective action when non-compliant.</p> <p>PMC to assist with supervision of works and independent environment monitoring agency to include these four contract packages in their scope of works reporting on them in the periodic environmental monitoring reports.</p> <p>Now EMoP (Table 66) has been prepared, BESCOM to require the existing contractors to follow it going forward and submit monthly reports in accordance with the project EMP – these monitoring requirements are to be reflected in the contractor's CEMP for approval by BESCOM and clearance by ADB upon loan effectiveness.</p> <p>Contractors were not required to appoint dedicated persons with suitable qualifications/experience to the roles of Environment Officer, Health and Safety Officer, and Community Liaison/Labor Officer/GRM Focal, or to ensure adequate number of EHS Site Supervisors in line with the size and scope of each sub-project; however where existing contractors have not already done</p>	<p>PMC, and independent environment monitoring agency to be appointed upon loan effectiveness. Compliance with corrective action to be cleared by ADB prior to first disbursement.</p>	
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	<p>or to ensure an adequate number of EHS Site Supervisors however most of them already have named persons taking on these roles.</p>	<p>so, BESCOM will require them to nominate existing staff to take on responsibility for ensuring project EMP implementation going forward – these staffing arrangements are to be reflected in the contractor's CEMP for approval by BESCOM and clearance by ADB upon loan effectiveness. BESCOM with the support of their contractors will submit a report demonstrating each subproject's compliance prior to first disbursement.</p> <p>If contractor staffing is inconsistent with the project EMP BESCOM to ensure their staffing for supervision and monitoring of contractor's work is adequate to fill any gaps in day to day supervision due to lack of contractor EHS staff.</p>		
Unanticipated Environmental Impacts	<p>Partial. Generic EMP allows for BESCOM to update the EMP and contract documents if it is required, although it does not explain the circumstances for doing so</p>	<p>BESCOM to ensure unanticipated environmental impacts (if any) going forward are addressed in accordance project EMP requirements BESCOM with the support of their contractors will submit a report demonstrating each contractor's compliance prior to first disbursement.</p>	<p>Follow project EMP requirements going forward, ongoing subproject compliance with corrective action to be cleared by ADB prior to first disbursement.</p>	<p>BESCOM PMU and contractors</p>
Biodiversity	Yes.	If any trees to be cut going	Follow project EMP	BESCOM PMU and

Conservation	Mitigation included in the generic EMP is adequate to address the impacts and risks identified subsequently by the IEE, in addition permission will need to be sought for any trees cut and forest department requirements followed. However, based on the final alignments, contractors report that no tree cutting is required.	forward, compensation for any private tree loss and replanting of public trees to ensure no net biodiversity loss need to be ensured as per project EMP BESCOM with the support of their contractors will submit a report demonstrating each contractor's compliance prior to first disbursement.	requirements going forward, ongoing subproject compliance to be cleared by ADB prior to first disbursement.	contractors
Pollution Prevention and Abatement	<p>Partial. National laws and regulations must be followed, and mitigation measures included in the generic EMP which should achieve same environmental outcome/performance standard given nature of works although the mitigation measures are not as comprehensive as the project EMP and some measures mentioned are not in accordance with the scope of works (e.g. allowing use of borrow pits and blasting activities) and international good practice. Key gaps at contract level are that other than following the national laws and regulations, there is no specific reference to the following bulleted items that need to be conducted by BESCOM and their contractors in accordance with the project EMP:</p> <ul style="list-style-type: none"> • Construction pollution 	<p>In conducting training on the project EMP BESCOM staff on these subprojects and all existing contractors will be included, through this they will be informed that as an ADB project as well as national laws and regulations the General EHS Guidelines (2007) and EHS Guidelines for Electric Power Transmission and Distribution (2007) and project EMP are to be followed going forward in respect of pollution risk management</p> <p>Contractor to prepare a Construction Environmental Management Plan (CEMP) detailing how they will address the identified gaps and comply with the project EMP going forward, for approval by BESCOM and clearance by ADB upon loan effectiveness.</p>	<p>For immediate implementation. Existing contractors training on the project EMP will be delivered prior to first disbursement. CEMPs approved by BESCOM to be submitted for ADB clearance upon loan effectiveness. BESCOM to submit report demonstrating subproject's compliance with the CEMP prior to the first disbursement; on this basis compliance with corrective action to be cleared by ADB prior to first disbursement.</p>	BESCOM PMU and contractors

	<p>prevention and waste management planning in addition to generic EMP requirements</p> <ul style="list-style-type: none"> • RMU specification for addressing SF6 • Most stringent of GOI or WHO noise levels – WHO is more stringent in industrial areas in daytime at 70dB(A) but consistent for commercial and residential areas; although it should be noted WHO guideline is receptor not area based • Toolbox talks/contractor trainings regarding pollution prevention, good housekeeping etc. • Environmentally sound hazardous materials storage • Keeping records of waste transfer • Environmentally sound hazardous waste disposal <p>On the ground, environmental audit of ongoing works identified supervision and monitoring by BESCOM needed to be strengthened to ensure their contractors are following national laws and regulations and international good practice provisions. For example, good housekeeping kept at all times; environmentally safe storage of</p>	<p>BESCOM with the support of their contractors will submit a report demonstrating each subproject's compliance with the cleared CEMP prior to the first disbursement.</p> <p>In supervising and monitoring implementation BESCOM to pay particular attention to adherence to pollution risk management measures in accordance with international good practice e.g. ensuring good housekeeping and enforcing corrective action if non-compliance by their contractors or any subcontractor is identified during the ongoing works.</p>		
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	<p>fuel, oil, other chemicals as well as handling of hazardous materials and waste to be strengthened and risks and responsibilities of contractor fully understood, e.g. use of drip trays to avoid contamination risks. Construction sites need to be immediately restored to pre-project conditions once the works are finalized, specifically resurfacing of the pavement with compacted material and asphalt/concrete as per original surface.</p>			
Health and Safety	<p>Partial. National laws and regulations must be followed, and mitigation measures included in the generic EMP and SMP which should achieve same environmental outcome/performance standard given nature of works although the mitigation measures are not as comprehensive as the project EMP and some measures mentioned are not in accordance with international good practice e.g. allows employment of 14 year old on construction site despite involving hazardous work with electricity etc. Traffic Control Plans have been required to be prepared. Key gaps at contract level are that</p>	<p>In conducting training on the project EMP BESCOM staff on these subprojects and all existing contractors will be included; through this they will gain awareness that as an ADB project, besides national laws and regulations the General EHS Guidelines (2007) and EHS Guidelines for Electric Power Transmission and Distribution (2007) and project EMP are to be followed going forward in respect of H&S risk management</p> <p>Contractors to prepare a Construction Environmental Management Plan (CEMP) detailing how they will address the identified gaps and comply</p>	<p>For immediate implementation. Existing contractors training on the project EMP will be delivered prior to first disbursement. CEMPs approved by BESCOM to be submitted for ADB clearance upon loan effectiveness. BESCOM to submit report demonstrating subproject's compliance with the CEMP prior to the first disbursement; on this basis compliance with corrective action to be</p>	BESCOM PMU and contractors

	<p>other than following the national laws and regulations, there is no specific reference to the following bulleted items that need to be conducted by BESCO and their contractors in accordance with the project EMP:</p> <ul style="list-style-type: none"> • H&S risk assessment and planning in addition to generic EMP and SMP requirements • Emergency preparedness and response planning • Recording and reporting of incidents • Community awareness activities in relation to construction and electrical safety including but not limited to (i) preparation and distribution of community awareness raising materials, and (ii) community awareness campaigns • Toolbox talks/contractor trainings for H&S • Specific H&S provisions for working with electricity • COVID-19 pandemic protocols given this is a recent event • Pre-condition surveys of existing above ground property condition <p>On the ground, environmental audit of ongoing works identified supervision and monitoring by</p>	<p>with the project EMP going forward, for approval by BESCO and clearance by ADB upon loan effectiveness.</p> <p>BESCO with the support of their contractors will submit a report demonstrating each subproject's compliance with the cleared CEMP prior to first disbursement.</p> <p>In supervising and monitoring implementation BESCO to pay particular attention to adherence to H&S risk management measures in accordance with international good practice e.g. ensuring wearing of PPE by their contractors and any subcontractor workers at all times, compliance with national labor laws and international good practice particularly in respect of ensuring no employment of under 18s on construction sites, provision of adequate welfare facilities etc., and enforcing corrective action if non-compliance by their contractors or any subcontractor is identified during the ongoing works.</p>	<p>cleared by ADB, prior to first disbursement.</p>	
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	<p>BESCOM needed to be strengthened to ensure their contractors are following national laws and regulations and international good practice provisions. PPE must not only be provided but it is critical that its use is enforced by contractors amongst their own and any subcontractor workers, to avoid accidents, as there was evidence of workers in bare foot. Additionally, the contractors need to be sensitized on the provision of adequate sanitation and welfare facilities, including when they provide accommodation for out of area laborers.</p>			
Physical Cultural Resources	<p>Yes. Mitigation included in the generic EMP is adequate to address the impacts and risks identified subsequently by the IEE, in addition permission will need to be sought for any works passing through 200m regulated zone of state protected monuments. However, based on the final alignments contractors report that this is not required, although it will need to be checked once detailed design are made available.</p>	<p>If chance find encountered ensure to follow chance find procedures set out in the project EMP BESCOM with the support of their contractors will submit a report demonstrating each subproject's compliance prior to first disbursement.</p>	<p>Follow project EMP requirements going forward, ongoing subproject compliance to be cleared by ADB prior to first disbursement.</p>	<p>BESCOM PMU and contractors</p>