

EXECUTIVE SUMMARY

ENVIRONMENTAL IMPACT ASSESMENT CORRIDOR 4

1. Chennai, the capital city of the state of Tamil Nadu, is part of the Chennai Metropolitan Area (CMA) that is home to over 8.65 million people and plays a vital role in the economy of South India.¹ Like other metropolitan areas in the country, CMA is currently facing the challenges of accelerated urbanization growth that have considerably strained the area's transportation system. The increase in economic activities has boosted the regional economy and job creation, which in turn necessitates improvement in ease of travel and connectivity.

2. Chennai Metro Rail Limited (CMRL), a joint venture of the Government of India (GoI) and the Government of Tamil Nadu (GoTN) with equal equity ownership, is responsible for implementing, operating, and maintaining the city's metro system. CMRL developed the Comprehensive Mobility Plan for CMA in 2015 and identified three corridors (corridors 3, 4, and 5) for the second phase of the Chennai Metro Rail to alleviate CMA's transportation capacity constraints.

3. GoI requested the Multilateral Development Banks² (MDBs) to assist the implementation of the 26.1 km of Chennai metro corridor 4 up to depot entry, which consists of 16.1 km of elevated section and 10.0 km of underground section. This line has 4 stations (namely Alwar Thirunagar, Valasaravakkam, Karambakkam and Alapakkam) in common with Corridor 5, offers interchange with Corridor 3, Phase I Metro and MRTS; it connects with suburban railway system. This alignment has been finalized after examining alternatives. The total capital cost of Corridor 4 is estimated to be USD 1,575 million for December 2018 including taxes and duties. It is estimated that the project will be commissioned 5 years from the award of civil contracts (i.e. 2021). CMRL will take full responsibility for the implementation of Corridor 4.

4. As per provisions of the Environmental Impact Assessment (EIA) Notification 2006 and its subsequent amendments by the Ministry of Environment, Forests and Climate Change (MoEF&CC), Railways and Metro Rail Projects are exempted from requirements of Environmental Clearance. However, part of the Light House to Kutchery Road section is I fall in Coastal Regulatory Zone (CRZ) II & IV B for which permission is required from NCZMA & TNCZMA Vide F.No 11- 13/2022-IA.III dated 22.04.2022. Subsequently Six monthly compliance report on the conditions stipulated in CRZ clearance has been submitted to Regional Office, MOEF&CC (**copy enclosed in Annexure 13**) as per CRZ Notification 2011.

5. This EIA comprising baseline data on existing conditions of physical, ambient and ecological environment, together with the identified and anticipated environmental impacts and proposed mitigation measures, has been prepared in accordance with GoI's legislative framework and MDBs' environmental safeguard policies³. In accordance with proposed packaging of Corridor 4, underground stretch, elevated stretch, systems and depot will be financed by different MDB and constitute Associated Facilities to each package. The environmental impacts and mitigation measures of all 4 packages are analyzed in this report. Corridor 4 overall is expected to generate environmental and socio-economic benefits in terms of decreasing air pollution from traffic congestion and serving the growing travel demand. As

¹Indian National Census, <https://www.census2011> Based on the Second Master Plan, the current Metropolitan area is expected to have a population of 126 lakhs by 2026 (Source : Comprehensive Mobility Plan, 2019)

² Asian Development Bank (ADB), Asian Infrastructure Investment Bank (AIIB) and New Development Bank (NDB).

³ ADB's Safeguard Policy Statement (SPS) 2009, AIIB's Environmental and Social Framework (ESF), and NDB's Environmental and Social Framework (ESF).

per the MDB's Environment and Social policies, the Corridor 4 has been categorized as "Category A" due to the significant impacts anticipated during construction. The EIA report comprising baseline data on existing conditions of physical and ecological environment including , the identified and anticipated environmental impacts and proposed mitigation measures, has been prepared in accordance with the Govt's legislative framework and MDBs' Environmental Safeguard requirements. This EIA report has been updated covering environmental impacts and mitigation measures associated with the changes in design of the Corridor - 4

6. Corridor 4 consists of 8 underground stations (Excluding common station of C3-Thirumayilai metro) from Lighthouse to Kodambakkam Flyover, 18 elevated stations from Kodambakkam Power House to Poonamalle Bypass and one depot at Poonamalle Bypass. The depot will have capacity for 31 trains of 6 cars for maintenance and repairs of the operational rolling stock. Standard Gauge (1435mm) will be adopted with a minimum track center distance of 4000 mm, 16-ton maximum axle load capacity and a design speed of 80 kmph. The elevated station is generally located on the road median 140 m long and 24 m wide and is a three level structure, with a minimum vertical clearance of 5.50 m under the concourse. To reduce physical and visual impact of the elevated station, stations have been made transparent with minimum walls on the sides. The underground station is two- or three-level station with entrances and ventilation shafts at the ground level, a concourse with ticketing and automatic fare collection system (AFCs) at the mezzanine level and finally 140 m long and 12 m wide island platforms at the lowest level. 25 kV AC traction system and Communication Based Train Control (CBTC) Signaling system shall be adopted for Corridor 4. Rolling stock is of light weight stainless steel/aluminum body for energy efficiency. Universal accessibility has been reflected in the design following international best practices. Green building features like rainwater harvesting, solar energy panels at elevated stations' roofs, parking areas (wherever technically feasible), energy efficient air conditioning and lightning will be considered in station design.

7. The terrain along Corridor 4 alignment is primarily flat, no more than 3 m above mean sea-level. The Geotechnical Investigation is ongoing with the results showing that the soils are slightly alkaline with dominant types of sandy and clay. The section of alignment from Light House to Kutcheri Road is located in CRZ II (length – 1.53 Km) and the tunnels (Length - 0.03 Km) between Kutcheri Road to Thirumayilai station will be laid under 20m below the Buckingham canal falls under CRZ II & IVB. The total length of the CRZ area 1.56 Km and requires CRZ clearance from MOEF&CC. MoEF&CC issued CRZ clearance vide letter F.No 11-13/2022-IA.III dated 22nd April 2022 (**Copy enclosed in Annexure 13**). Further, the requisite 707 trees were felled and 361 trees are transplanted along the corridor up to Poonamalle Bypass(as of December 2023).187 trees were felled and 42 trees were transplanted along the Poonamalle depot (as of December 2023). Two assets, namely, Rosary Church and Our Lady of Light Shrine are located on the underground section at distance within 100m from Corridor 4.

8. Despite the seemingly abundant sources of water, Chennai suffers continuously from water stress since the entire basin is dependent on rainfall. Water quality was sampled at 9 locations. Most of the parameters are well within the prescribed permissible limits as per the Bureau of Indian Standards IS 10500:2012 except some parameters viz Turbidity, Total Dissolved Solids, Calcium, Total Hardness, and Chloride. Bacteriological contamination was found at 5 locations. Total Dissolved Solids (TDS) and Total Hardness at Santhome Church sampling location are higher than limits, this could be due to higher mineral content in the groundwater especially Calcium and Magnesium. The surface water in Porur Lake would be classified as 'D', propagation of wildlife and fisheries, because of high amounts of Zinc and a large Biological Oxygen Demand.

9. Results of the air monitoring show that air quality was moderate, while the parameters of Sulphur Dioxide (SO₂) and Nitrogen Dioxide (NO₂) were within the permissible level of National Ambient Air Quality Standards (NAAQS) and World Health Organization (WHO) guideline. Particulate Matter (PM₁₀ and PM_{2.5}) was within NAAQS but exceeded WHO guideline. The concentration of Carbon Monoxide (CO) exceeded the permissible level of NAAQS in all the monitoring locations but was generally within WHO guidelines. The noise levels monitored at 8 locations along the alignment were above the national and international permissible limits. Noise levels were also monitored at 30 sensitive locations belonging to the silence zone, with 60% slightly exceeding Ambient Noise Standard of 50dB the daytime limit (23.3% per WHO guideline of 55dB), and 1 out of 30 exceeding 40 dB the night-time limit. The peak particle velocity baseline values to demonstrate the vibration level at 11 out of 13 monitored locations are found to exceed acceptable criteria for ground borne vibration prescribed by Federal Transit Administration (FTA) USA and Railway Design & Standards Organization (RDSO) India which are more valid for operation of this project. However, the observed levels at all 13 locations are well below the construction vibration damage criteria for blasting which are relevant only if blasting is undertaken during construction as per Central Institute of Mining and Fuel Research (CMFRI) India.

10. Based on analysis of project and environmental settings, a detailed assessment of potential impacts due project location and design, construction and operation has been carried out. For each of these adverse impacts, mitigation measures have been proposed. The key positive environmental impacts of Corridor 4 include reduced use of private vehicle leading to reduction in pollutants; road safety improvements; increased accessibility and mobility, and a modest reduction in greenhouse gas emissions. The main residual negative impacts of Corridor 4 include fugitive and point source dust emission, surface noise and vibration from excavation and demolition, disturbance to road traffic, disposal of large quantities of construction and demolition wastes, and occupation and community health and safety, which are mainly temporary and localized. Initial noise and vibration modeling has been carried out under this EIA, during detailed design additional modeling will be conducted for each of the identified sensitive receptors.

11. The main mitigation measures proposed are as follows: (i) to plant twelve saplings for each tree to be cut as against ten saplings ordered for infrastructure projects by the Honorable Madras High Court, with estimated compensatory afforestation cost in place accordingly; (ii) noise reduction measures (i.e. noise barriers at sensitive receptor locations and residential locations); and (iii) reuse of excavated material where feasible and disposal of construction waste in a regulated manner. Corridor 4 will take into consideration the climate change effects of an anticipated continuous increase in ambient temperature, intensity of cyclones and storm surge, heavy precipitation events, and sea level rise in the future. Several climate change considerations to be integrated into Corridor 4 design include: (i) installation of floodgates at stations with flooding risks; (ii) improving adaptability to seasonal thermal variations in the stations through the use of large open spaces for unrestricted air movement, cross-ventilation and ensuring that enclosed areas are well ventilated; (iii) designing for better adaptability to rising sea level/high tide/heavy flooding through the use of higher plinth levels and check valves for sewer lines in flood-prone areas and the use of resilient materials that can get wet and then dry out with minimal damage; (iv) using solar panels on station buildings parking areas and station and roofs to reduce the extensive use of grid-generated electricity supplied to the station for its operation and maintenance; and (v) through better station roof design, providing for rainwater harvesting by channeling rainwater through gutters and pipes to either harvesting pits in the ground or to recharge groundwater and (iii) using head-hardened rails of 1080 grade steel rails will result in better mechanical properties in terms of stiffness, higher lateral resistance, and better transmission of thermal stresses, and higher durability; and reduced maintenance resulting from practically unchanged track geometry over time and at almost any operating speed.

12. Various alternatives such as modes of transport, alignment, proposed design etc. have been considered and analyzed for its likely impacts on various environmental parameters. Additionally, an evaluation of potential environmental impacts in terms of 'with' and 'without' project situation has been considered for the justification of Corridor 4.

13. Meaningful consultations were carried out with various stakeholders during EIA preparation and will continue throughout Corridor 4 implementation. Women felt that Corridor 4 will provide (i) better access to higher levels of education, health services (especially in emergencies), and social interactions; (ii) better transport option; and (iii) increase in leisure time. Concerns voiced by Project Affected Persons (PAPs) and stakeholders have been incorporated in Corridor 4 design. Individual consultation of PAPs will also be carried out during implementation. Information disclosure will follow the procedure for MDBs' Category A projects.

14. Grievance Redress Mechanism (GRM) has been proposed constituted for Corridor 4 which comprises the procedures to address grievances i) first at the Project Implementation Unit (PIU) level, ii) second at Grievance Redress Committee for Environment (GRC-E), to ensure grievances from PAPs and workers are addressed to facilitate timely project implementation. A GRC-E has been formed which have representatives from Contractor, General Consultant (GC), CMRL, assisting NGO and PAPs and representatives. Unsatisfied PAPs will have the option to escalate the grievances from PIU level to GRC at any point of time and the GRC will not bar them from approaching a Court of Law.

15. An Environmental Management Plan (EMP) with institutional arrangements, budgetary provisions, schedule for EMP implementation and its monitoring has been prepared, including appropriate mitigation measures, provisions related to occupational health and safety, labour camp and construction site management, and traffic and public utility management etc. to address all impacts during Project pre-construction, construction and operation phases. The EMP has been developed in conjunction with general safety, health and environment provisions (which are included in the standard bidding document) and it forms part of the contract document of the contractors. Semi-annual Environment Monitoring reports (EMR) will be prepared by GC and submitted to MDBs through CMRL. A third-party monitor will also supervise work independently and submit External Monitoring Report I (EMR) to CMRL and MDBs (ADB,AIIB,NDB). The preliminary estimated cost of the EMP including implementation and monitoring is USD 3.34 million (INR 243.62 million). This cost estimate is exclusive of land acquisition and resettlement & rehabilitation cost.

16. Benefits far outweigh negative impacts. Overall, the major social and environmental impacts associated with Corridor 4 are limited to the construction period and can be mitigated to an acceptable level by implementation of recommended measures and by best engineering and environmental practices. In addition, stringent monitoring requirements and actions on noise and vibration levels that will be generated during construction have been included in the Environmental Monitoring Plan (EMoP).. CMRL shall ensure that the EMP and EMoP are included in Bill of Quantity and forms part of bid document and civil works contract. The same shall be revised if necessary, during project implementation or if there is any change in the project design and with approval of MDBs.

17. This EIA report is structured as following: (i) Introduction of background, methodology of preparation of the report; (ii) Policy and legal framework within which environmental safeguards for Corridor 4 shall be recommended and implemented; (iii) Project description with enumeration of salient features of Corridor 4 which have bearing upon its environmental impacts; (iv) Environmental baseline of Corridor 4 in terms of physical, ambient, and ecological baseline (socioeconomic baseline will be presented in Social Impact Assessment Report); (v) Identification of negative and positive impacts arising from pre-construction, construction and operation of Corridor 4 and respective measures to mitigate negative impacts and where

feasible enhance generate positive impacts; (vi) Analysis of alternatives including its need and alternatives of technology and alignment; (vii) Consultations with stakeholders and plan for disclosure of project information; (viii) Mechanism for stakeholders to communicate grievances and suggestions and for their Redressal; (ix) EMP and institutional arrangement for implementation of environmental impact mitigation measures; and (x) Conclusion.