Initial Environmental Examination

Document Stage: Draft
Project Number: 53067-004
January 2021

IND: Inclusive, Resilient and Sustainable Housing for Urban Poor Sector Project in Tamil Nadu (IRSHUPSP) – Vallam Subproject

Prepared by the Tamil Nadu Slum Clearance Board for the Asian Development Bank.

CURRENCY EQUIVALENTS

(as of 1 June 2020)

Currency Unit	–	Indian rupees (₹)
₹1.00	–	$0.015
$1.00	=	₹72.18

ABBREVIATIONS

ADB	–	Asian Development Bank
ASI	–	Archaeological Survey of India
CPCB	–	Central Pollution Control Board
CtE	–	Consent to Establish
CtO	–	Consent to Operate
EA	–	Executing Agency
EAC	–	Expert Appraisal Committee
EARF	–	Environmental Assessment and Review Framework
EC	–	Environmental Clearance
EHS	–	Environmental Health and Safety
EIA	–	Environmental Impact Assessment
EMP	–	Environmental Management Plan
ESS	–	Environmental and Social Safeguards
GoI	–	Government of India
GoTN	–	Government of Tamil Nadu
GHG	–	Greenhouse Gases
GRM	–	Grievance Redress Mechanism
IA	–	Implementing Agency
IEE	–	Initial Environmental Examination
MOEFCC	–	Ministry of Environment, Forests and Climate Change
NOC	–	No Objection Certificate
PMU	–	Project Management Unit
PCR	–	Physical Cultural Resources
PID	–	Project Implementation Division
PPE	–	Personal Protective Equipment
REA	–	Rapid Environmental Assessment
ROW	–	right-of-way
RF	–	Resettlement Framework
SEIAA	–	State Environmental Impact Assessment Authority
SPS	–	Safeguard Policy Statement
STP	–	Sewage Treatment Plant
TNPCB	–	Tamil Nadu Pollution Control Board
TNSCB	–	Tamil Nadu Slum Clearance Board
WHO	–	World Health Organization

WEIGHTS AND MEASURES

°C	–	degree celsius
km	–	kilometer
LPCD	–	litrers per capita per day
m	–	meter

Mgd	–	Million gallons per day
MLD	–	million litrers per day
mm	–	millimeter
Nos	–	numbers
km^2	–	square kilometer
m^2	–	square meter
dBA	–	A-weighted decibels
LAeq	–	equivalent continuous sound pressure level
$\mu g/m^3$	–	micrograms per cubic meter
KLD	–	kiloliters per day

NOTE

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

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EXECUTIVE SUMMARY

Project Background. Tamil Nadu is one of the largest states in India with an acute housing shortage. It has 5.8 million slum residents, most slum residents come from the EWS and the LIG. Slum areas are prone to disaster, environmental degradation and health risks. In Tamil Nadu, TNSCB has been identified as the entity responsible for implementing Pradhan Mantri Awas Yojana (PMAY-Urban). As per the recent study the actual demand for affordable housing is 1.4 million units. Affordable housing also needs to be made accessible to low-income migrant workers, working women and female-headed low-income households for sustainable urban development. In view of this, the proposed project will promote access to an inclusive, resilient, and sustainable housing and urban development in Tamil Nadu. The project covers 3 proposed components as follows.

- Output 1: Affordable Housing for Vulnerable Communities
- Output 2: Affordable Housing for Urban Poor and Migrant Workers
- Output 3: Regional Planning

This subproject proposed under Output 1 is for (i) the construction of 969 residential housing units and associated facilities at the resettlement site at Vallam (Ayyanar Koil Phase 2) in Thanjavur district; (ii) demolition of 969 structures located in the encroachment sites (Big Temple Moat) identified for relocation to Vallam resettlement site; and (iii) restoration of a water body/ canal. It is estimated that 969 households will be relocated to Vallam resettlement site.

Executing and implementing agencies. The Government of Tamil Nadu through the Housing and Urban Development Department (HUDD) will be the executing agency (EA) and responsible for overall project management and compliance with loan assurances. The Tamil Nadu Slum Clearance Board (TNSCB) will be the Implementing Agency for Output 1. TNSCB will also be responsible for the management, coordination and execution of all subproject activities funded under IRSHUPSP. The TNSCB will set up a Project Management Unit (PMU) that will be responsible for overall supervision and coordination during subproject implementation. The PMU will be supported by Project Implementation Circle located at Salem and three Project Implementation Divisions (PIDs) are located at Madurai, Salem and Villupuram and they will be responsible for day-to-day activity and compliance with safeguards during project implementation. The PMU will be headed by Joint Managing Director/ Project Director and will be assisted by the Chief Engineer and the Superintending Engineer. They will be supported by technical, financial, safeguards and administrative staff. It is proposed to have 3 PIDs under the PMU. An Executive Engineer will head each PID. PIDs will be responsible for the implementation, management and monitoring of the subprojects.

Subproject Scope. The Vallam subproject scope of work includes (i) construction of 969 residential housing units, (ii) demolish 969 housing units identified for relocation across 4 encroachment sites in the Big Temple Moat, (iii) Regeneration of water body/ canal, which were encroached by the people to be relocated. The subproject scope of work is enclosed in Table 1.

Table 1: Details of Subproject Scope

Sl.no	Subproject	Subproject Interventions
1	Construction of 969 residential units and supporting services	• Residential Units • Internal Roads • Vehicular Parking • Ration Shop • Convenient Shop

Sl.no	Subproject	Subproject Interventions
		• Milk Booth • Library • Security Office • Motor Room • Anganwadi centre • Community Hall • Health sub centre • Open Space Reserve • Sewage Treatment Plant • Electric Power supply • Water Supply • Solid Waste Management • Rainwater Harvesting • Solar Powered Street Lights
2	Demolishing structures in the encroachment sites (prone to flooding)	• Demolition of 969 structures in the 4 encroachment sites (Big Temple Moat) • Providing fencing to prevent further encroachment
3	Water body restoration	• Re-greening / re-vegetation of banks / land along water bodies and channels • New plantations with native species • Implementation of site-specific plans in close coordination with ULBs or Public Works Department (PWD) e.g. waste management plan, sewerage collection and management plan, etc. • Repair any structure that has been inadvertently damaged

Project Categorization. The due diligence has confirmed the project Environment Category is "B" requiring an Initial Environmental Examination (IEE) including Environmental Management Plan (EMP) in accordance with ADB Safeguard Policy Statement (SPS, 2009) and requirements of the Environmental Assessment Review Framework for IRSHUPSP – Table 1.3 (Key Exclusion Criteria) and Table 1.4 (Environmental Guidelines for Subproject Selection under Output 1). Based on the project activities, a consolidated IEE and 4 EMPs (i) EMP for construction phase (C-EMP), (ii) EMP for operation phase, (iii) EMP for demolishing works (D-EMP) and (iv) EMP for regeneration works (R-EMP) cover environmental impacts and associated risks in the project area of influence. The IEE and EMPs have been prepared based on the detailed engineering designs and will be updated where necessary to further meet the final detailed engineering designs. This subproject mandates Environmental Clearance (EC) as per the EIA notification 2006 (under category B2 and project schedule 8(a) for Building and Construction Projects and accordingly the Form 1 and Form 1A have been submitted to the State Environment Impact Assessment Authority (SEIAA) and the EC for the same is in the progress. Other statutory requirements include (i) addressing the conditions (General and Specific Conditions), as given in the Environmental clearance for Vallam Resettlement Site; (ii) Update of IEE and EMP based on the water source sustainability study report (including water quality) from TWAD; and (iii) Consent to Establish and Consent to Operate under air and water act for the hot mix plant /batching plant, Construction (workers) camps and proposed STP. Other project-related permissions/consents to be obtained by the Contractor are detailed in the IEE report.

Project Benefits. The key objective of this project is to provide affordable housing for the people who are living in the encroached areas (encroached water bodies), which is prone for seasonal flooding. This project also benefits, the low-income families, female-headed households. Based on the climate risk assessment and heat modelling, the building plan has been developed to withstand the climate change including the high temperature. The proposed infrastructures including provision of toilets, water supply arrangement, electric connection, community hall, play area shall provide an improved standard of living.

Description of the Environment. The Vallam subproject site (10°43'29.56"N, 79°4'14.25"E) is located in the Thanjavur District. The elevation of the site ranges between 86 to 88m AMSL. Alluvial soil in the Cauvery delta and Sandy soil in Coastal area are the predominant soil types. The soil type, the climate and rainfall best suit the paddy crop and so the district stands as the rice bowl of Tamil Nadu since ancient days. The maximum temperature is 37.0°C in the month of May and minimum is 20.0°C in the month of January. The annual rainfall varying between 500 mm to 1500 mm. The wind direction is predominantly towards North and West in the mornings and South and East in the evenings. The subproject site is in Low Damage Risk Zone II. Grand Anaicut canal (surface water body) is located at a distance of 3 km from the Vallam resettlement site, which is a potential source for water supply. The water quality in Grand Anaicut has been classified under class E, which is suitable for Irrigation, Industrial cooling and potable after water treatment. As per the CGWB groundwater analysis, the groundwater quality of phreatic aquifers in Thanjavur district is, in general, colourless, odourless, and slightly alkaline nature. The ambient air quality in Vallam resettlement shows the oxides of sulphur and nitrogen is well below the ambient air quality standards, however, particular matters (PM_{10} and $PM_{2.5}$) are above the standard level, this is due to the dry weather conditions and moving traffic. There are no protected areas, eco sensitive zones or ecologically sensitive areas notified by MoEF&CC within a radius of 10 km from the Vallam resettlement site. Vaduvoor Bird Sanctuary is the nearest protected area to the project area, which is located at a distance of 26.4 km from the resettlement site. According to the 2011 Census, the Vallam Special Grade Town Panchayat has a population of 16,758 of which 7,812 are males while 8,946 are females. There are no cultural or heritage sites near the Vallam resettlement site, however the Brihadeeswarar temple, which is an ASI and UNESCO Heritage site is located at a distance of 575m from Sekkaditheru encroachment site. The subproject site is well connected by the Railways, Highways (National Highways and State Highways).

Potential Environmental Impacts and Mitigation Measures. The subproject is unlikely to cause significant adverse impacts that are irreversible, diverse or unprecedented because: (i) the components will involve straightforward construction and operation, so impacts will be mainly site specific and localized; and (ii) there are no significant sensitive environmental features in the subproject sites although careful attention needs to be paid to minimize disruption to the community. Land acquisition related issues are not envisaged in this project, because the proposed resettlement site belongs to TNSCB. The primary areas of impact are (i) sites for proposed project components; (ii) main routes/intersections which will be traversed by construction vehicles; and (iii) quarries and borrow pits as sources of construction materials. The secondary areas of impact are: (i) other than the delineated primary impact area; and (ii) new resettlement site (Vallam) and the 4 encroachment sites (Big Temple Moat) in terms of over-all environmental and socioeconomic improvement.

Pre-construction impacts are associated with: (i) shifting of utilities (including water supply, electricity, etc.) in the 4 encroachment sites (Big Temple Moat), which is chosen for relocation. Utility shifting is not envisaged in the resettlement site (Vallam) due to lack of habitation in the surrounding areas. (ii) Site selection for the source of construction materials have to be

identified before construction commences with a proposed mitigation measure to procure construction materials from the government authorised / permitted quarries and vendors. This will significantly reduce environmental impacts. (iii) Demolition of 4 encroachment sites (Big Temple Moat) that is chosen for resettlement, will generate significant quantity of construction debris, which shall be disposed in the authorised areas or in low-lying areas (as long as it does not impede water flow or cause flooding) as per the direction of the PID. (iv) Site selection of construction work camps, stockpile areas, storage areas, and disposal areas, should be located 500m away from the nearby settlements. Residential areas will not be considered for setting up construction camps to protect the human environment (i.e., to curb accident risks, health risks due to air, water and noise pollution, social conflicts and shortage of amenities). (v) Construction traffic will utilise existing roads, which may lead to increase in traffic, however most of the work areas are accessible from the existing roads, potential impacts will be of short duration, localized and can be mitigated.

Construction related impacts are standard and site specific to the construction activities and not expected to be significant. Key impacts during construction are envisaged on the following aspects: (i) transportation of materials, (ii) dust generation, air and noise pollution from construction activities, (iii) sourcing of water for construction activities, (iv) handling of construction materials at site and, (v) adoption of safety measures during construction. There are no water bodies surrounding the resettlement site at Vallam and hence impact due to runoff from the construction site is not envisaged. However, the demolition site (Big Temple Moat encroachments) is surrounding water body/ canal and hence demolishing activity and runoff from the site will have significant impact to the water body. Hence a mitigation measure has been proposed to use silt trap to prevent pollution of water body. The presence of ASI Monuments (the big temple (Brihadeshwara Temple) and the Thanjavur palace) shall have marginal influence on the encroached sites, which has to be clarified in discussion with the Archaeological Survey of India (ASI) and as per their suggestions/ recommendations, the IEE and EMP will have to be updated and adopted during the demolishing and regeneration activities proposed in the encroachment sites. In addition to this within the Sekkaditheru encroachment site an old wall was observed during the site visit, as such prior to the tendering of any works, TNSCB and Thanjavur Municipal Corporation will consult with the ASI to seek further clarifications and suggestions, and will be required to prepare a heritage impact assessment and management plan in close consultation with ASI which has to be reincorporated into the IEE and EMPs. The relevant demolition and regeneration works contractor will adopt the suggested mitigation measures and relevant EMP.

Air quality impacts due to the construction activity in the resettlement site is not expected to have a major health impact to the surroundings, because of the lack of human habitat/ settlement in the project area. However, for the resettlement site at Vallam as well as the 4 encroachment sites (Big Temple Moat), the movement of construction vehicles transporting construction materials and debris/materials to be disposed may cause increase in air pollutants within the construction zone. These are inherent impacts which are site-specific, low magnitude, short in duration and can be easily mitigated.

For noise and vibration impacts, except the piling works, most of the construction activities (construction of residential units and demolishing works) shall be done manually with minimum use of machinery and equipment and with necessary safety precautions, for example, barricades around demolition sites, restricting pedestrian and vehicular movements. Noise from demolition works should not exceed the noise standards as set by CPCB. Any damage to surrounding buildings will require work to be stopped immediately and rectified before work can recommence. Hence noise and vibration impacts are not expected to be significant. However,

for the piling operation, a Piling Rig will be used, it will generate noise and vibration to the surrounding, since a small settlement is located at a distance of 20 m in the eastern side of the resettlement site, significant impacts are anticipated. The Contractor and the PID shall conduct an inspection to the nearby settlement and assess the anticipated impacts that are likely and accordingly mitigation measures (including provision of temporary noise barriers) shall be provided. For the structures that are weak, appropriate evidence (including video/ photograph) shall be collected from the site prior to the commencement of works, for which temporary structural support shall be provided till the completion of the piling works. The demolition activities shall not have any impact on the monument (Thanjavur Brihadeeswara Temple (ASI and UNESCO Heritage site), this is because it is located at a distance of 400 m (more than the 200 m stipulated distance for regulatory requirements as per the Ancient Monuments and Archaeological Sites and Remains Act, 1958). However, appropriate noise mitigation measures including provision for temporary noise barriers, manual demolishing methods shall be adopted to minimise the noise and vibration impacts.

During the project construction and operation, there is a moderate negative impact anticipated on the water resources. This is due to the utilisation of water for construction purposes and use of water for domestic purpose during operation, this activity will have a moderate stress on the available water resource. For construction purposes, the water shall be sourced from the ULB's/ Tamil Nadu Water Supply and Drainage Board (TWAD). During the operation phase of the project, TWAD will supply water to the Vallam resettlement sites. The estimated water demand of 676 KLD will be sourced from pumping main near Manakkarambai Village, which is located at a distance of 18 km from the Vallam resettlement site. To maintain the groundwater level, TWAD is implementing all the possible methods / procedures for groundwater recharge, which includes Check dams, Percolation ponds, Artificial recharge pits, Recharge trench, Ooranies (artificial lakes), Recharge shaft etc., Hence the anticipated impact on the groundwater shall be minimised. For the resettlement site rainwater harvesting structures including 13 rainwater collection pits and rainwater collection trench for a length of 1,111 m has been provided. It is estimated that 38.3 lakh litres of rainwater will be collected within the resettlement site.

Impact on the flora and fauna due to the project construction works and demolition works will be negligible. This is because tree cutting is not required in the Resettlement Site and there are no protected areas or environmentally sensitive areas surrounding the subproject sites. However, few trees are observed in the 4 encroachment areas (demolishing work sites), which shall be preserved and included in the landscaping design during the water body restoration works.

Impact on occupational, health and safety including exposure to work-related chemical, physical, biological and social hazards are likely to occur during proposed construction and demolishing works. Potential impacts are negative and short-term but reversible by mitigation measures including provision of PPEs, preparation of comprehensive site-specific health and safety (H&S) plan (including asbestos material management) provided with a management strategy (including training) and applying practices that are intended to eliminate or reduce fatalities, injuries and illnesses for workers.

Major post construction impacts are specific to site clean-up activities including backfill of any excavation and trenches; reuse of topsoil; re-establishing the drain pattern if impacted; and removal of all tools, equipment, barricades, surplus materials, debris and rubbish.

Major project operation impacts are specific to (i) municipal solid waste generation, and (ii) wastewater generation from the resettlement site. (iii) health and safety issues (including communicable diseases, fire hazard etc.) and (iv) operation of infrastructures/ amenities

including STP, rainwater harvesting structures and maintenance of lawn/ green belt. For the identified impacts the TNSCB has already obtained necessary permissions from the competent authority (Vallam Special Grade Town Panchayat) for handling the municipal solid waste (MSW) and the discharge of the treated sewage. Hence the impact anticipated during the project operation is negligible. TNSCB have obtained confirmation for the supply of water to the resettlement site from TWAD. Since water will be supplied by the TWAD, the IS 10500 drinking water standard shall be maintained. The supply of estimated water demand of 676 KLD shall not have detrimental impact on the total water supply estimated for the Vallam Special Grade Town Panchayat.

Other project risks include low institutional capacity of the PMU, PIDs and contractors and their failure to implement the EMP effectively during construction and operation stages. These risks will be mitigated by: (i) hiring of environmental specialists at PMU and PID level; (ii) providing training and capacity building on environmental and social safeguards to the PMU, PIDs, contractors and workers, (iii) developing and implementing site specific EMPs (C-EMP/ D-EMP/ R-EMP) and Standard Operation and Maintenance Plans (SOMPs), (iv) following appropriate project implementation, mitigation, monitoring and reporting arrangements, and (iv) adequate site supervision including audits of contractor's environmental, health and safety (EHS) performance. Monitoring parameters will be identified in the environmental monitoring plan to check the effectiveness of EMP measures and to ensure any unidentified impacts can be readily addressed. The project risks will also be mitigated through inclusion of environmental specifications in contracts, bids and tenders for contractors.

For the identified impacts, mitigation measures have been developed to reduce all negative impacts to acceptable levels for pre-construction, construction, post-construction and project operation phases. Mitigation will be assured by a program of environmental monitoring to be conducted during construction and operation phases. The environmental monitoring program will ensure that all mitigation measures are implemented and will determine whether the environment is protected as intended. It will include observations on- and off-site, document checks and consultation with workers and beneficiaries. Any requirements for corrective action will be reported to the ADB.

Relocated vulnerable population, especially low-income households will be the major beneficiaries of the project. The most noticeable net environmental benefits to the population will be observed for those residing surrounding the restored water bodies.

Environmental Management Plan. The identified potential environmental impacts can be managed through effective implementation of the Environmental Management Plan (EMP). An EMP is included as part of this IEE, which includes (i) mitigation measures for environmental impacts identified during the implementation stage; (ii) an environmental monitoring program, and the responsible entities for mitigating, monitoring and reporting; (iii) public consultation and information disclosure procedure; and (iv) grievance redress mechanism. A number of impacts and their significance have already been reduced by amending the designs. The EMP will be included in the civil work bidding and contract documents. The EMP Budget has been estimated to be ₹46,94,000 lakh (USD 65,032).

Consultation, Disclosure and Grievance Redress. During the course of preparing this IEE, meetings with departmental officials and other relevant government stakeholders have been conducted. The subproject components and associated clearances/ permissions/ NoCs requirement as well as the way forward for the project were discussed. Focus Group Discussions (FGDs) were also conducted with the affected people in the 4 encroachment sites

(Big Temple Moat). The conducted FGDs were informal but were attended by both women and men of the affected communities. Baseline socio-economic surveys were also undertaken with the affected people and have been incorporated into this report as required. Further consultations were hampered by the ongoing coronavirus (COVID-19) pandemic and as such additional formal consultations will be undertaken once it is safe to do so and before construction commences. The impacts associated with the construction activities shall be shared with the host communities before start of the construction works (including the noise and vibration impacts from the piling operation and also the tentative schedule/ time period for the construction activities). These additional consultations will be incorporated into the draft IEE. The feedback and suggestions from the consultations that were collected to date were utilised in the design of the project, environmental impact assessment and the resettlement plan preparation. Consultations will continue throughout the project implementation period. The draft and final IEE and EMP will be disclosed on TNSCB and ADB websites.

The IEE summary will be made available at public locations in the town and the Draft IEE report will be disclosed to a wider audience via the ADB and TNSCB websites. The consultation process will be continued and expanded during project implementation to ensure that stakeholders are fully engaged in the project and have the opportunity to participate in its development and implementation.

Grievance Redress Mechanism (GRM). GRM is described within the IEE to ensure any public grievances are addressed quickly. The PIDs (Environmental / Social Cell) will set up a 3-tier common GRM acceptable to ADB at project and divisional levels to address any environmental and / or social issues that arise due to subproject activity. The GRM will constitute a suitable systematic process to receive, evaluate and facilitate resolution of affected persons and other stakeholder's complaints and grievances about subproject environmental (and social) safeguards performance. It will aim to provide a time-bound, trusted and transparent mechanism to voice and resolve issues and concerns associated with the subproject implementation. The GRM will address concerns and complaints promptly via a transparent process. Complaints and their resolution will be documented and reported in quarterly project progress reports and annual safeguard reports to ADB.

Monitoring and Reporting. The key institutions involved in the IEE and EMP implementation will be the PMU and PIDs. To ensure effective implementation of environmental safeguards procedures, the PMU and PIDs will include designated and trained staff and focal point persons. The PMU will be responsible for the overall supervision and compliance with (i) environmental safeguards requirements including resubmission of revised documentation for ADB concurrence, (ii) coordinate the project GRM, (iii) coordinate with line departments to ensure smooth implementation of the project,[1] (iv) supervise the procurement process, and (v) report to the ADB. In particular, the PMU will ensure consistency of safeguard documents with government policy, legal and administrative framework across all jurisdictions national, state and local level. The PIDs will be responsible for day-to-day activity and compliance with safeguards during project implementation in the field including engaging in project GRM, meaningful consultations, and oversight of the contractors or any third-party consultants.

[1] The PMU will ensure that subproject activities are synchronized between the project Resettlement Plan and EMP implementation. The PMU will also ensure that no physical or economic displacement of affected persons will occur until: (i) compensation at full replacement cost has been paid to each affected person for subproject or sections of subprojects that are ready to be constructed; and (ii) other entitlements listed in the Resettlement Plan are provided to the affected persons.

The PMU will be responsible for overall safeguards reporting and monitoring, including final approval of the site-Specific Environmental Management Plan (SEMP) prepared by the contractors. The PIDs (Environment Cell) with support of the PMU (Environment Team) will conduct environmental monitoring for each subproject and provide the environment input into reporting based on site inspections, compliance checks and prepare the subproject Quarterly Progress Reports (QPRs) for submission to the PMU for final submission to ADB till the project completion report is issued. Monitoring will also encompass tracking progress on regeneration works undertaken by the PMU of previously encroached water bodies / channels and surrounding areas. The environmental monitoring report for submission to ADB shall be on a quarterly basis during construction and on an annual basis during operation. Environmental monitoring reports will be required to be submitted to ADB within 30 days from the end of the relevant period. The environmental monitoring reports will be publicly disclosed on ADB public website. Reporting to ADB will continue until a project completion report is completed.

The PIDs will be responsible for safeguards monitoring and implementation, including initial review of the contractor's SEMP before submission to PMU for final approval. The PIDs, will coordinate and interact with the PMU on compliance to ADB safeguards requirements and with relevant government agencies and local authorities on permits and clearances and update and finalize the IEE and EMP as needed. During the project implementation, the PIDs will conduct field visits and for the any identified noncompliance (with reference to EMP implementation) a suitable Action Taken Report (ATR) with a time bound corrective action plan will be prepared. The ATR will be shared with the Contractor for effective implementation of the EMP and included in the quarterly safeguard monitoring reports.

After completion of the construction stage, the facility operator/ contractor will continue to submit monthly progress reports to PIDs for the first year of the operation and quarterly progress reports thereafter; these will inform the annual safeguards monitoring reports.

Conclusions and Recommendations. The proposed subproject is unlikely to cause adverse environmental impacts. The potential impacts that are associated with design, construction and operation can be mitigated without difficulty through proper engineering design and the incorporation or application of recommended mitigation measures and procedures. Based on the findings of the IEE, there are no significant impacts and the classification of the subproject as Category "B" is confirmed. No further study or detailed environmental impact assessment (EIA) needs to be undertaken to comply with ADB SPS, 2009 or Government of India EIA Notification, 2006. This draft IEE is based on preliminary detailed design and will be submitted to ADB for concurrence and disclosure. However, this draft IEE will be updated based on final detailed design and will also need to be updated every time detailed design is changed or updated. The updated IEE will be submitted to ADB for final review and disclosure.

I. INTRODUCTION

A. Background

1. Tamil Nadu is one of the largest states in India with an acute housing shortage. According to the Tamil Nadu Slum Clearance Board (TNSCB), the State's housing deficit accounts for 6.66% of the national housing shortfall. Based on the income levels, the housing shortage mapping reveals that the Economically Weaker Section (EWS) adds to 56%, which is followed by Lower-Income Group (LIG) of 39% and Middle Income Group (MIG) by 4%. Tamil Nadu has 5.8 million slum residents, with the most slum residents from the EWS and the LIG. Slum areas are prone to disaster, environmental degradation and health risks. Informal settlements and slums are often situated in hazardous areas, which are congested and lack appropriate services (i.e., electricity, piped water supply, and sanitation/waste facilities).

2. As per National Urban Housing and Habitat Policy (NUHHP), several comprehensive urban initiatives have been undertaken. The most recent initiative is the Pradhan Mantri Awas Yojana-Housing for All (PMAY-HFA). In Tamil Nadu, TNSCB has been identified as the entity responsible for implementing PMAY (Urban). It aims to provide 1 million houses for slum families by 2022. In its recent survey, TNSCB estimated the total demand for affordable housing at 1.4 million units. Affordable housing also needs to be made accessible to low-income migrant workers, working women and female-headed low-income households for sustainable urban development.

3. In view of this, the proposed project will promote access to an inclusive, resilient, and sustainable housing and urban development in Tamil Nadu by supporting the state in (i) relocating vulnerable communities living in high-risk areas to safe shelter; (ii) providing affordable and proper housing for urban poor households as well as for migrant workers from the economically weaker section (EWS) and lower-income group (LIG); and (iii) in regional development planning. The project covers 3 proposed components as follows.

4. **Component 1: Affordable Housing for Vulnerable Communities**. The project will support the resettlement of slum households vulnerable to hazards to safe relocation sites. The project will work with government to introduce gradual changes in the delivery of affordable housing to the urban poor through: (i) improved design including robust O&M mechanisms including women's participation in design, (ii) increased beneficiary consultation and participation, and (iii) a graduation approach to sustain vulnerable relocated households.[2] The output will include protection of cleared waterways to restore ecological functions and prevent re-encroachment.[3]

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[2] The graduation approach is a holistic, time-bound, and carefully sequenced set of interventions to place households on an upward trajectory from poverty. This includes four key components: (i) social assistance to support immediate needs such as subsistence and health services during transition in the relocation site; (ii) livelihood promotion through localized market assessment and household-level enterprise/employment matching; (iii) financial inclusion through financial literacy and improving access to savings and financial services to promote economic resilience; and (iv) social empowerment by improving social dynamics, including gender relations, in the families and communities.

[3] Removing encroachments in waterways will have the benefit of restoring capacity to absorb water and reduce future flooding, recharge groundwater, and potentially be alternative sources of water in water-scarce areas. Regeneration of urban areas can also result from creating public spaces. Impacts of investing in the subsector can be further increased by improving TNSCB's design and implementation practices and policies, and further strengthening the institution. Protecting cleared areas ensures that it will not revert back to a slum. The works from protecting the cleared areas including the re-greening of banks can provide temporary construction employment for beneficiary households and provide an initial market for transport services.

5. **Component 2: Affordable Housing for Urban Poor and Migrant Workers**. The project will support the government's shelter fund by piloting a public-private partnership (PPP) structure and will provide industrial housing and working women's hostels for low-income and migrant workers. Financing will be deployed as Government of Tamil Nadu's equity into the shelter fund, which may be provided as catalytic first loss capital instrument. The shelter fund would leverage the Government of Tamil Nadu equity (including the loan proceeds from ADB that would be injected as equity into the fund) to attract private sector investment into specific special purpose vehicles (SPVs) that would be established to deliver affordable housing for working women and industrial workers.

6. **Output 3: Regional Planning**. The project will support regional planning that integrates existing and proposed development plans and makes provisions for economic development and affordable housing to balance growth throughout the State with regard to infrastructure development, environmental protection, and disaster risk management.[4]

B. Subproject Scope and Location

7. Tamil Nadu Slum Clearance Board (TNSCB) have taken initiatives to relocate vulnerable communities living alongside the water bodies across the state. In Thanjavur Taluk of Thanjavur District, TNSCB has identified 4 encroachment sites in the Big Temple Moat (refer
8. Table **1** and Figure 1) where the vulnerable communities are living under high risk due to the flooding of water bodies. Accordingly, a screening survey has been conducted and the number of households that would be affected were identified. It was estimated to relocate 969 households to a safe location. However, the actual number of households being affected will be assessed after the social survey. This draft IEE will be updated following this and submitted to ADB for final review and disclosure.

9. Based on the land availability (preferably government land) In Thanjavur Taluk, the TNSCB has selected Vallam site (Geo-coordinates: 10°43'29.56"N, 79° 4'14.25"E) as a potential resettlement site. Upon clearance of the old settlement sites/ encroachment sites, adequate measures shall be taken to prevent any encroachment and the water body catchment area shall be restored.

Table 2: Slums Identified for Relocation

Sl. No.	Location	No. of Households	Geo-coordinates
1	Mela alangam	240	10.79127 N, 79.127303 E
2	Vadakku alangam	218	10.79568 N, 79.133864 E
3	Kodimarathumoolai	489	10.79542 N, 79.137421 E
4	Sekkaditheru	22	10.79025 N, 79.127403 E
	Total	**969**	

Source: TNSCB

10. **Subproject Selection Criteria**. As per the Asian Development Bank (ADB) Safeguard Policy Statement (SPS) 2009 and prevailing rules and regulations, the subproject selection criteria have been prepared and included in the Environmental Assessment and Review

[4] Land use regulation plays an important part in determining the pattern of service land and housing occupation in urban areas. It should be ensured that housing is provided where it is needed, rather than supporting segregation (for example at the periphery of cities) is critical in policy. Policy should provide diversity of housing at scale, typology, and price.

Framework (EARF), which shall act as a guideline for subproject selection. The following table highlights the environmental guidelines for subproject selection.

Figure 1. Map Showing Relocation and Resettlement site

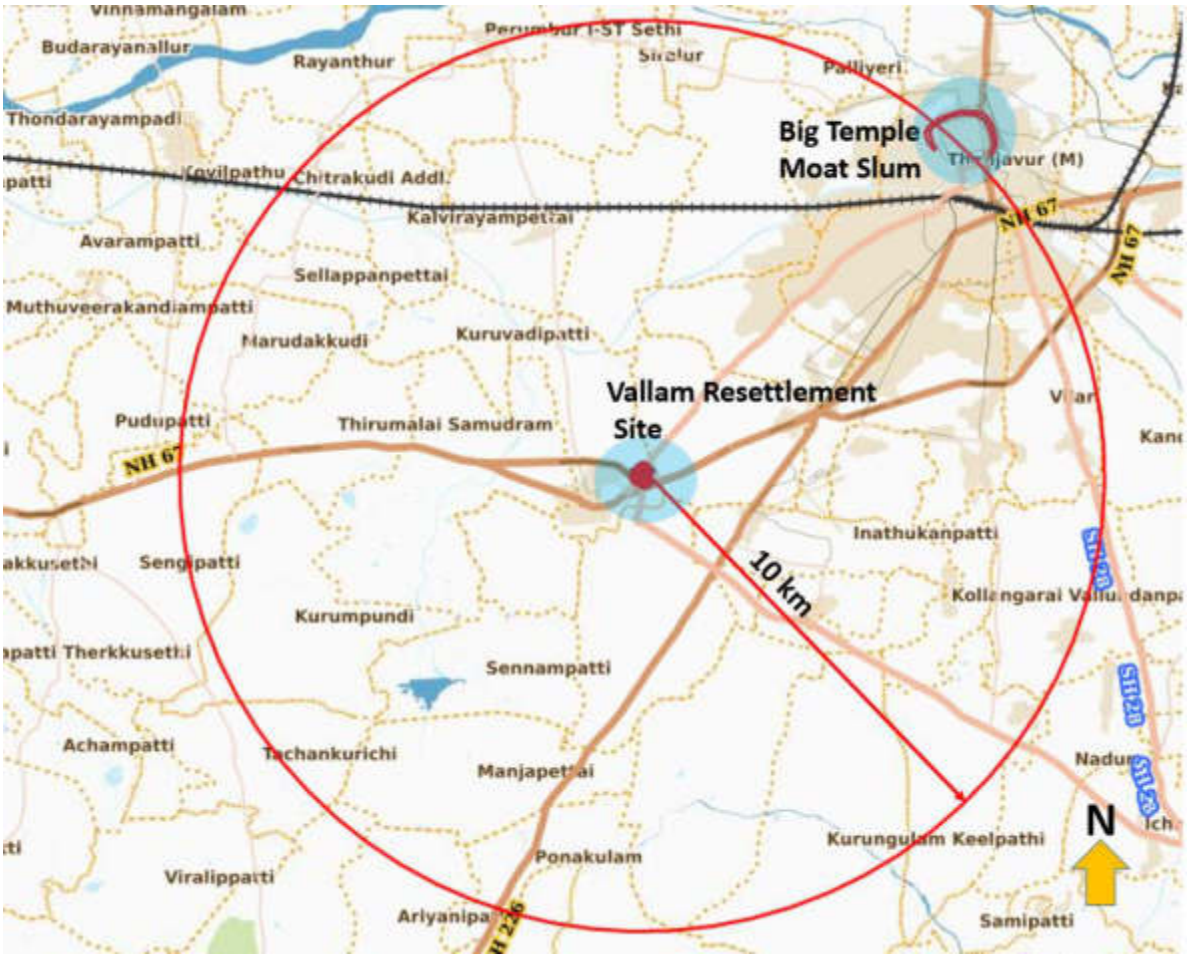


Table 3: Environmental Guidelines for Subproject Selection under Output 1

Guidelines for Subproject Selection	Remarks
I. All subprojects including supporting services	
Complies with key exclusion criteria[5]	The subproject activities proposed at the

[5] Subproject Exclusion Criteria

1. Environment Category A subprojects
2. No subprojects to be located within 10 km of a national park, sanctuary, wetland, mangroves, coastal zones, backwaters, recognized biodiversity hotspots and/or within reserved forests, village forests, protected forests.
3. Subprojects that involve activities in the ADB Prohibited Investment Activities List (ADB SPS, 2009, Appendix 5)
4. Subprojects that are highly complex and sensitive
5. Subprojects that are category A or have adverse impacts on indigenous people safeguards.
6. Subprojects which result in significant adverse impacts on any sensitive natural and human receptors e.g., species or habitat of high conservation value, significant number of trees of economic value (such as fruit bearing trees), water bodies (such as wetlands, backwaters, rivers, lakes or ponds), existing host communities / neighbourhoods, schools and/or Physical Cultural Resources (PCRs)

Guidelines for Subproject Selection	Remarks
	resettlement site (Vallam), 4 encroachment sites located in the Big temple moat (which is proposed to be demolished) and the water body/ canal proposed for restoration comply with the key exclusion criteria.
Complies with ADB SPS 2009, EARF and the national and state legal and regulatory framework	The subproject activities proposed at the resettlement site (Vallam), 4 encroachment sites in the Big temple moat and the water body/ canal comply with ADB SPS 2009, EARF and the national and state legal and regulatory framework.
The primary environmental criteria for selecting subproject sites to be relocated is vulnerability to flooding of targeted non-titled project beneficiaries without tenure security residing in encroachments (i.e., waterbodies / waterways). No new development sites in flood areas, areas with a history of flooding or areas zoned for coastal protection.	The 4 encroachment sites in the Big temple moat (to be demolished) are located on the banks of the water body/ canal. The resettlement site has no history of flooding. However, as per the certificate received from Thanjavur Collector Office, the encroachment sites are declared as flood prone areas (refer to Appendix 5).
The selected subprojects (new development / settlement sites) should have sufficient land for the accommodation of all project beneficiaries / resettled households and community members in line with housing space and design ratio considerations.	It is estimated to demolish 969 dwelling units across the 4 encroachment sites located in the Big temple moat and it is proposed to construct 969 residential units. The buildings are designed in line with housing space and design ratio considerations based on the TNSCB guidelines.
The selected subprojects (new development / settlement sites) should be within one-hour travel time on public transport from existing settlement sites / encroachments such that project beneficiaries / resettled households and community members have continued access to livelihood generation activities	The selected resettlement site (Vallam) is within 10km aerial distance from Big temple moat encroachment sites and it is within one-hour travel time on public transport.
The selected subprojects (new development/ settlement sites) should be within a 2.5 km radius of public amenities or be within prescribed social infrastructure access norms.	Public amenities are located within 2.5km radius of the resettlement site. The existing public amenities along with distance have been depicted in the **Error! Reference source not found.**.
The selected subprojects (new development/ settlement sites) are greenfield, therefore opportunity should be taken to ensure that these are connected to existing neighbourhoods / host communities, provide comprehensive infrastructure and supporting services, generate new optimally sited open spaces of adequate size, and community spaces.	The residential units are designed as per the building norms adopted by the TNSCB and they are located near an existing neighbourhoods. All required infrastructure and supporting services are proposed at the resettlement site. As per the proposed design, green spaces and open spaces comes around 26.49% (10.4% open spaces reserve and 16.45% green belt) which is in compliance as per the subproject selection criteria of open space / green zone.

7. Subprojects in unsafe proximity of electricity substations, high voltage transmission lines, underground cables, solid waste dumping yards, Oil /Gas pipelines, Coastal Regulatory Zone hazard line and/or polluting (heavy emissions / noisy) industrial activities
8. Subproject sites in flood prone areas, areas with a history of flooding
9. Subprojects that are not technically, financially, or economically viable

Guidelines for Subproject Selection	Remarks
The selected subprojects should have access to or include supporting services (within the scope of the EARF) at new development / settlement sites for project beneficiaries / resettled households and community members for better environmental outcome.	The resettlement site (Vallam) is proposed to have the following infrastructure facilities: • Residential Units • Internal Roads • Vehicular Parking • Ration Shop • Convenient Shop • Milk Booth • Library • Security Office • Motor Room • Anganwadi centre • Community Hall • Health sub centre • Open Space Reserve • Sewage Treatment Plant • Electric Power supply • Water Supply • Solid Waste Management • Rainwater Harvesting • Solar Powered Street Lights
If there is no access to supporting services, then the subproject shall integrate supporting services in the subproject detailed engineering design for the new development / settlement sites and for any other housing plans under consideration in the immediate vicinity of new settlement sites.	Currently there are no supporting services present at the site. Hence EHS audit in line with the ADB SPS is not required.
Resettlement of project beneficiaries shall only take place after all supporting services are available and operational at new development / settlement sites.	As per the TNSCB policy, the resettlement process shall start only after completion of the construction activities (including all the amenities/ infrastructure facilities). Before resettlement, appropriate meaning consultation shall be conducted.
Subprojects will conform to land use classification and relevant development control regulations and municipality approved master plan. Subprojects (new development / settlement sites) not covered by the master plan will require further due diligence for consideration for subproject selection as long as it meets the key exclusion criteria and prescribes to the environmental guidelines for subproject selection.	Landuse classification of the resettlement site is Government Poramboku Land (Government Waste Land). Land Alienation Certificate to TNSCB is enclosed in Appendix 1.
Will not involve the use or installation of hazardous materials including asbestos, PCBs, lead based paint	The implementation of the subproject Construction Environmental Management Plan (C-EMP) ensures that Asbestos, Mercury, PCBs and lead based paints are not used in this project. This includes asbestos cement, gaskets, lead pipe and solder, fluorescent tubes etc. The contractor shall prepare standard operating procedures (SOPs) for each material if potentially exposing workers to asbestos, PCB's and lead.
No new construction of landfills will be supported under this sector loan	There is no proposal for new landfill sites. The municipal solid waste shall be collected and disposed by Vallam Special Grade Town Panchayat.
No new electricity generation / electricity	Electricity shall be provided by Tamil Nadu

Guidelines for Subproject Selection	Remarks
substations will be supported under this sector loan	Generation and Distribution Corporation Limited (TANGEDCO).
Subprojects shall utilize water sources at sustainable levels of abstraction only (i.e. without significant reductions in the quantity or quality of the source overall), avoid polluted water sources, avoid water use conflicts by not abstracting water that is used for other purposes and ensure water quality provided complies with national drinking water standards at all times through regular monitoring.	During the construction phase, the contractor has been requested to procure water from the TWAD or the ULB, who is following various methods / procedures for groundwater recharge. During operation phase, water will be supplied by the TWAD to the resettlement site. The required quantity of water (676KLD) will be sourced from the pumping main near Manakkarambai Village, which is located at a distance of 18 km from the Vallam resettlement site. The supplied water shall meet the drinking water standard IS 10500. Hence the implementation of this subproject will not have significant impact on the available water sources. Based on the findings from the final water source sustainability study, this IEE has to be updated.
Subprojects should locate sewerage treatment plants as far as possible from inhabited areas, ensure sewerage is treated to national wastewater discharge standards, ensure no discharge of wastewater occur where it could be a hazard to downstream users and include measures for the safe disposal of sewage sludge.	It is proposed to install Sewage Treatment Plant (STP) for 0.6MLD capacity, the STP is designed to have the latest SBR technology to treat the sewage to the required disposal standard (PART A as per schedule VI of Environmental Protection Rules 1986) as stipulated by the CPCB. The treated sewage water shall be utilised for landscaping purpose as well as for RWH purposes. The STP is fitted with a Sludge digester which will treat sludge to reduce any pathogens level for safer disposal along with the organic waste to the authorized MSW disposal facility. The discharge of excess treated water from the STP will be managed by the Vallam Special Grade Town Panchayat (refer to Appendix 9).
II. Demolition works for all subprojects	
Demolition works at existing settlements / encroachments will • exclude religious structures e.g. chapels, temples, mosques, etc.; and if cannot exclude, then replace for the religious structures in consultation with the relevant stakeholders • involve clearance • avoid cutting of trees • avoid disturbance to PCRs • repair any structure that has been inadvertently damaged • fencing around the water body perimeter or along channel banks[6]	The EMP prepared for the demolishing works shall be implemented to minimise the impacts, further details shall be addressed in the subproject specific Social Impact Assessment (SIA) / Resettlement Action Plan (RAP). Retaining of the Physical Cultural Resources (PCRs) or shifting of the PCRs shall be based on public consultation.
III. Regeneration works for all subprojects	
Regeneration works[7] at cleared	The final plan for regeneration of the water bodies

[6] Fencing to ensure that re-encroachment of cleared spaces does not revert back to slums and is kept as green open space to realise ecological and public benefits from the cleared and restored waterways.

Guidelines for Subproject Selection	Remarks
encroachments will include at a minimum • re-greening / revegetation of banks along water bodies / channels, • clearing and preventing new solid waste / sewage disposal in water bodies / channels	will be decided by the Thanjavur Municipal Corporation with potential TNSCB input. However, based on the activities required for water body regeneration works, an EMP has been prepared and included in this IEE, which shall assist the Thanjavur Municipal Corporation in minimising the impacts during regeneration works. The IEE and EMP will need to be updated once detailed design is available and the relevant EMP will have to be adopted by the contractor. TNSCB will retain responsibility for clearing the site after demolition and fencing. These impacts are covered under the EMP prepared for demolition works.

C. Purpose/ Objectives of IEE[8]

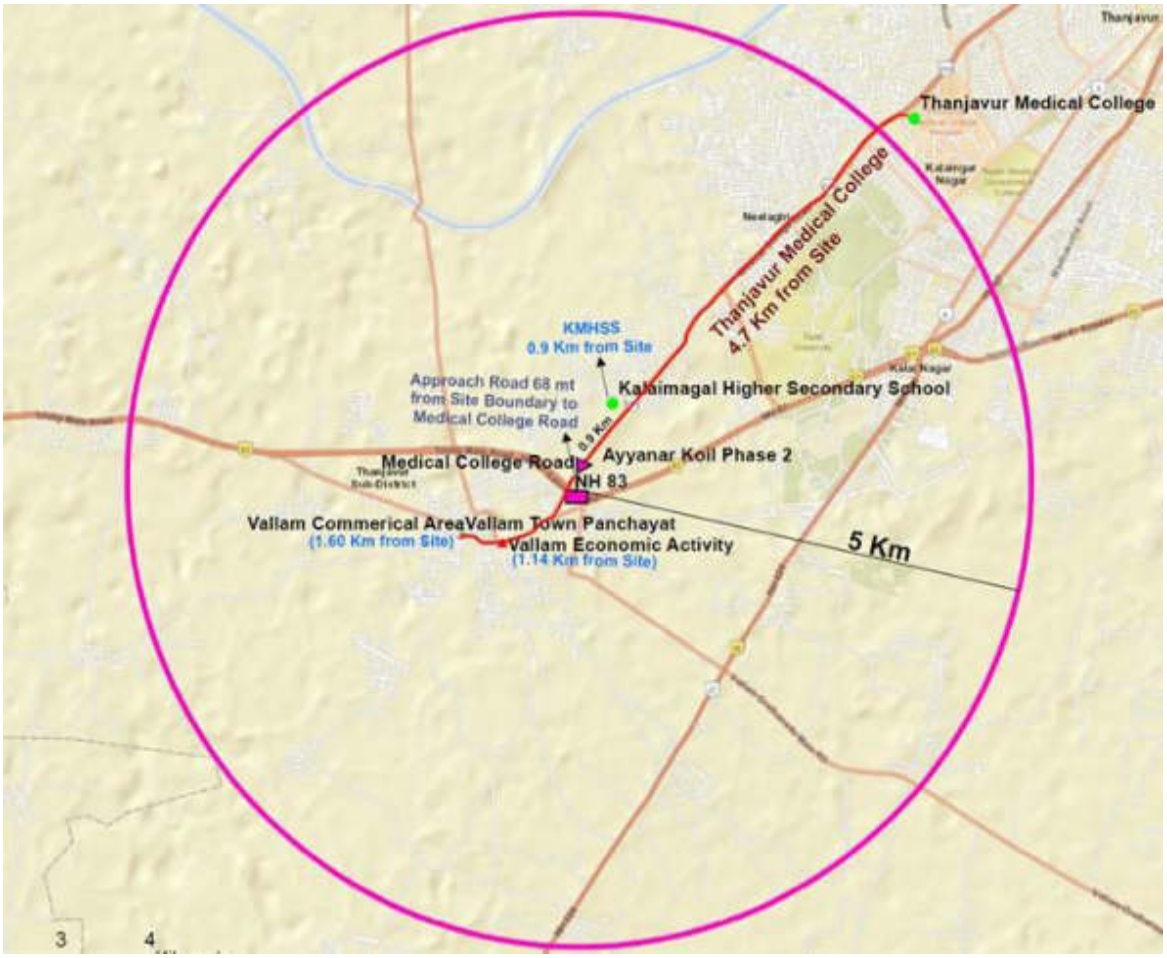
11. ADB requires the consideration of environmental issues in all aspects of the Bank's operations, and the requirements for environmental assessment are described in ADB's Safeguard Policy Statement (SPS), 2009. The potential environmental impacts of the subproject have been assessed using ADB rapid environmental assessment checklist for Urban Development Projects (Appendix 2). Then potential negative impacts were identified in relation to (i) pre-construction, construction and operation of the Resettlement Site (Housing Project), (ii) demolition of the structures in the relocated sites and (iii) restoration of water bodies in the relocated sites. The results of the assessment shows that the subproject is unlikely to cause significant adverse impacts that are irreversible, diverse or unprecedent. Thus, this initial environmental examination (IEE) has been prepared in accordance with the EARF and ADB SPS, 2009 requirements for environment category B projects.

12. This IEE is based on the Detailed Project Report (DPR) prepared by Tamil Nadu Slum Clearance Board (TNSCB). The IEE is based mainly on field reconnaissance surveys and secondary sources of information. No baseline environmental monitoring was conducted to prepare the IEE. However, the environmental monitoring program developed as part of the Environmental Management Plan (EMP) will require the contractor to establish the baseline environmental conditions prior to commencement of civil works. The results of which will be reported in the final IEE as part of the revision of the baseline environmental section and also as part of the environmental monitoring report. It will be the basis to ensure no degradation will happen during subproject implementation. Stakeholders consultation is an integral part of the IEE, due to the ongoing COVID 19 pandemic, planned stakeholders consultation has not been conducted and hence, there is a need to undertake further stakeholders consultation, when it is safe to do so.

[7] Regeneration works of the cleared encroachments will be undertaken such that it does not revert back to slums and is kept as green open space to realize ecological and public benefits from the cleared and restored waterways.

[8] This IEE is based on the preliminary detailed design for the construction of the resettlement site and demolishing & fencing works proposed for the relocated slum / encroachment sites. Hence this IEE have to be updated once the detailed design has been completed for both the subproject components (including resettlement site and demolishing and fencing works at slum / encroachment sites).

Figure 2. Map Showing Exiting Public Amenities around the Resettlement Site



D. Report Structure

13. This report contains the following eleven (11) sections including the Executive Summary at the beginning of the report:

(i) Executive summary;
(ii) Introduction;
(iii) Policy, Legal, and Administrative Framework;
(iv) Description of the Subproject;
(v) Analysis of Alternatives
(vi) Description of the Environment (Baseline Data);
(vii) Anticipated Environmental Impacts and Mitigation Measures;
(viii) Information Disclosure, Consultation and Participation
(ix) Grievance Redress Mechanism
(x) Environmental Management Plan
(xi) Conclusion and Recommendation

II. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

A. ADB Safeguard Policy Statement (2009)

14. ADB requires the consideration of environmental issues in all aspects of ADB's operations, and the requirements for environmental assessment are described in ADB SPS, 2009. This states that ADB requires an environmental assessment of all ADB investments.

15. **Screening and Categorization:** The nature of the environmental assessment required for a project depends on the significance of its environmental impacts, which are related to the type and location of the project; the sensitivity, scale, nature and magnitude of its potential impacts; the availability of cost-effective mitigation measures. Projects are screened for their expected environmental impacts and are assigned to one of the following four categories.

(i) **Category A.** a proposed project is classified as category 'A' if it is 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. An Environmental Impact Assessment (EIA) is required.

(ii) **Category B.** a proposed project is classified as category 'B' if its potentially adverse environmental impacts are less adverse than those of category 'A' projects. These impacts are site-specific, few of them are irreversible, and in most cases, mitigation measures can be designed more readily than for category 'A' projects. An Initial Environmental Examination (IEE) is required.

(iii) **Category C.** a proposed project is classified as category 'C' if it is likely to have minimal or no adverse environmental impacts. No environmental assessment is required although environmental implications needs to be reviewed.

(iv) **Category FI.** a proposed project is classified as category 'FI' if it involves an investment of ADB funds to or through a Financial Intermediary (FI). An Environmental and Social Management System (ESMS) is required.

16. **Analysis of Alternatives.** The best fit option should be identified for the implementation of the project in terms of location, design, technology and/or components that would avoid, and, if avoidance is not possible, minimize adverse environmental impacts and risks.

17. **Anticipated Adverse Impact Mitigation and Management**. When the potentially significant adverse impacts and risks cannot be avoided or prevented, appropriate mitigation measures and management actions have to be identified so that the project / subprojects are designed, constructed, and operated in compliance with ADB SPS, 2009.

18. **Environmental Management Plan (EMP):** An EMP, which addresses the potential impacts and risks identified by the environmental assessment, shall be prepared. The level of detail and complexity of the EMP and the priority of the identified measures and actions will be commensurate with the project's impact and risks.

19. **Public Consultation.** Carry out meaningful consultation with affected persons and facilitate their informed participation. Ensure women's participation in consultation. Involve stakeholders, including affected persons and concerned NGOs, early in the project preparation process and ensure that their views and concerns are made known and understood by decision makers and taken into account.

20. **Grievance Redress Mechanism (GRM).** Establish a grievance redress mechanism (GRM) to receive and facilitate resolution of the affected person's concerns and grievances regarding the project's environmental performance.

21. **Public Disclosure:** ADB will post the safeguard documents on its website as well as disclose relevant information in an accessible manner in local communities:

(i) Final or updated IEE upon receipt; and
(ii) Environmental monitoring reports submitted by the implementing agency during project implementation upon receipt.

22. The ADB guidelines, stipulate addressing environmental concerns, if any, of a proposed activity in the initial stages of project preparation. For this, the ADB Guidelines categorizes the proposed components into categories (A, B or C) to determine the level of environmental assessment required to address the potential impacts. This subproject under the IRSHUPSP has been categorized as "B" and accordingly this IEE has been prepared to address the potential impacts, in line with the recommended EARF/ IEE content and structure for Category "B" projects.

B. National and State Environmental Regulations

23. **Environmental assessment**. Government of India EIA Notification of 2006 (replacing the EIA Notification of 1994) sets out the requirement for Environmental Assessment in India. This states that Environmental Clearance is required for specified activities/projects, and this must be obtained before any construction work or land preparation (except land acquisition) may commence. Projects are categorized as 'A' or 'B' depending on the scale of the project and the nature of its impacts.

(i) **Category A** projects require Environmental Clearance from the central Ministry of Environment, Forests and Climate Change (MoEF&CC). The proponent is required to provide preliminary details of the project in the prescribed manner with all requisite details, after which an Expert Appraisal Committee (EAC) of the MoEF&CC prepares comprehensive Terms of Reference (ToR) for the EIA study. On completion of the study and review of the report by the EAC, MoEF&CC considers the recommendation of the EAC and provides the Environmental Clearance if appropriate.
(ii) **Category B** projects require environmental clearance from the State Environment Impact Assessment Authority (SEIAA). The State Expert Appraisal Committee (SEAC) categorizes the project as either B1 (requiring EIA study) or B2 (no EIA study) and prepares ToR for B1 projects within 60 days. On completion of the study and review of the report by the SEAC, the SEIAA issues the Environmental Clearance based on the SEAC recommendation. The Notification also provides that any project or activity classified as category "B" will be treated as category "A" if it is located in whole or in part within 10 km from the boundary of protected areas, critically polluted areas, eco-sensitive areas or interstate or international boundaries.

24. The proposed project involves construction of 969 residential units at Vallam (Ayannar Koil Phase 2). As per the conceptual site plan, the resettlement site shall have 13 blocks, with an average plinth area of 37.38 m^2. All the blocks shall have G+5 structure. The total built-up area is estimated to be 38,445.00 m^2. Other built-up area includes Ration shop, Convenient Shop, Milk Booth, Library, Security Office and Motor Room. The estimated built-up area is less

than the stipulated area (1,50,000 m^2) for the projects mandating EIA. Hence, the proposed project is classified as Category B2 and it does not warrant an EIA study. However, Environmental Clearance (EC) is required from the SEIAA.

Table 4. Environmental Regulatory Compliance

Law	Description	Requirement
Environmental Impact Assessment Notification, 2006	The Notification imposes restrictions and prohibitions on new projects or activities and also on the expansion or modernization of existing projects or activities based on their potential environmental impacts.	As per the EIA notification, this subproject is categorised as B2 and mandated Environmental clearance from SEIAA is necessary (Refer **Appendix 3**).
ADB's Safeguard Policy Statement 2009	Categorization of project components into A, B or C and developing required level of environmental assessment for each component.	This project has been "Categorized as B and accordingly this IEE has been prepared "
Central Ground Water Authority Notification, 1997	It provides for regulation and control of ground water development and management	Permission for the extraction of Groundwater from Central Groundwater Board (CGWB)
The Environment Protection Act, 1986 The Environment Protection Rules, 1986	Emissions and discharges from the facilities to be created or refurbished or augmented shall comply with the notified standards	To comply with applicable notified standards (including Water Act 1974, Air Act 1981 and acts relating to Biological Diversity)
Water (Prevention and Control of Pollution) Act of 1974, Rules of 1975, and amendments	Act was enacted to provide for the prevention and control of water pollution and the maintaining or restoring of wholesomeness of water. Control of water pollution is achieved through administering conditions imposed in consent issued under to this Act. All pollution potential activities will require consent to establish (CTE) from Tamil Nadu Pollution Control Board (TNPCB) before starting implementation and consent to operate (CTO) before commissioning.	To obtain CtE and CtO prior to the start of construction for (i) hot mix plant /batching plant; (ii) construction (workers) camps and (iii) proposed STP. Compliance to the conditions and effluent disposal standards stipulated in CtE and CtO
Air (Prevention and Control of Pollution) Act, 1981, amended 1987 and its Rules, 1982.	The Act was enacted to achieve prevention, control and abatement of air pollution activities by assigning regulatory powers to CPCB and SPCB's for all such functions. Establishes ambient air quality standards	To obtain CtE and CtO prior to the start of construction for (i) diesel generators; (ii) hot mix units / batching units; (iii) vehicles emitting air pollutants and (iv) construction (works) camps. Compliance to conditions and emissions standards stipulated in the CtE and CtO.
Noise Pollution (Regulation and Control) Rules, 2000 and further amended	It provides for regulations to control ambient noise levels in public places from sources such as industries/ construction works/ community events, etc.	To comply with the noise standards (refer **Table 8**).
The Hazardous Wastes	It provides for regulation and control of	Applicable for the subproject if it

Law	Description	Requirement
(Management, Handling and Transboundary Movement) Rules, 2008	indiscriminate disposal of Hazardous waste; and its sound management to reduce risks to environmental and human health	deals with generation/ handling/ storage/ processing of hazardous waste which should take cognizance of the provisions/schedules of these Rules and obtain authorization from the TNSPCB.
Municipal Solid Waste Management Rules, 2016	Rules to manage municipal solid waste generated; provides rules for segregation, storage, collection, processing and disposal.	Solid waste generated at the proposed facilities / construction camps / housing units shall be managed and disposed in accordance with the MSW Rules
Construction and Demolition (C&D) Waste Management Rules, 2016	Rules to manage construction and waste resulting from construction, re-modelling, repair and demolition of civil structure. Rules define C&D waste as comprising of building materials, debris resulting from demolition / re-modelling or repairs	Construction and demolition waste generated due to civil works at subproject construction site and/or demolition of existing civil structures at encroached areas shall be managed and disposed as per these Rules
The Ancient Monuments and Archaeological Sites and Remains Act, 1958, and the rules, 1959	Provide guidance for carrying out activities, including conservation, construction and reuse in and around the protected monuments.	The resettlement site at Vallam is not close to any of the archeological / protected monuments. However, the demolition sites (4 encroachment sites located in the Big Temple Moat) is located 400m from the Thanjavur Brihadeshwara temple, which is a UNESCO world heritage site as well as ASI protected monument and Thanjavur Palace, which is located at a distance of 182m from the nearest encroachment site Kodimarathumoolai and 250m from Vadakkualangam encroachment site (Refer figure 14). As per the Ancient Monuments and Archaeological Sites and Remains (AMASR) Act 2010, there is a ban on construction within 100 metres of a centrally protected monument and regulated construction needs to be carried out within 100-200 metres (totaling 300m buffer surrounding the ASI monument). The Act is silent on whether demolition and regeneration works constitutes construction.
Tamil Nadu State Ground Water (Development and Management) Act, 2003	This Act is to protect groundwater resources and provide safeguards against groundwater overexploitation, and to ensure its planned development and management; notifies areas for development, regulation and control of	Groundwater abstraction in any of the notified areas will be subject to the provisions of this Act.

Law	Description	Requirement
	groundwater; prohibits digging of wells and groundwater transport in notified areas without prior permission of the designated authority; requires all wells to be registered.	
Labor Laws	The contractor shall not make employment decisions based upon personal characteristics unrelated to job requirements. The contractor shall base the employment relationship upon equal opportunity and fair treatment and shall not discriminate with respect to aspects of the employment relationship, including recruitment and hiring, compensation (including wages and benefits), working conditions and terms of employment or retirement, and discipline. The contractor shall provide equal wages and benefits to men and women for work of equal value or type.	**Appendix 4** provides applicable labor laws including amendments issued from time to time applicable to establishments engaged in construction of civil works, which will need to be followed by the subproject.
Minimum Wages Act, 1948	The employer is supposed to pay not less than the minimum wages fixed by appropriate government agency as per the provisions of this Act if the employment is a "scheduled employment" such as construction of Roads, Runways, and Buildings.	All construction / operation and maintenance workers should be paid not less than the stipulated wages under this Act.
Equal Remuneration Act, 1979	The Act provides for payment of equal wages for work of equal nature to male and female workers and for not making discrimination against genders.	
Inter-State Migrant Workmen (Regulation of Employment and Conditions of Service) Act, 1979	Act is applicable to any establishment that employs 5 or more inter-state migrant workers through an intermediary (who has recruited workers in one state for employment at an establishment situated in another state).	Contractor for subprojects to register with the Labour Department in case of hiring of inter-state migrant workers. Adequate and appropriate amenities and facilities to be provided to workers including housing, sanitation, portable water, medical aid, traveling expenses from home to work place, etc.
Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996	It regulates the employment and conditions of service of building and other construction workers and provides for their safety, health and welfare.	The subproject shall comply with the provisions of this Act
Tamil Nadu Minor Mineral Concession Rules, 1959 (amended up to 31 March 2001)	Applicable for sand mining, quarrying and borrow areas	All projects/activities being implemented and/or funded under the sector loan shall take cognizance and comply with the

Law	Description	Requirement
		provisions of this Act
Tamil Nadu Protection of Tanks and Eviction of Encroachments Act, 2007	An Act to provide measures for checking the encroachment, eviction of encroachment in tanks which are under the control and management of Public Works Department, protection of such tanks and for matters incidental thereto.	Cleaning of encroachments / regeneration works
Tamil Nadu Building and Other Construction Workers' (Regulation of Employment and Conditions of Service) Act, 1996 and Rules, 2006	Regulates the employment and conditions of service of building and other construction workers and to provide for their safety, health and welfare measures; Provides various benefits for the registered workers	The subproject shall comply with the provisions of this Act

Source: MoEF&CC, CPCB, Govt of Tamil Nadu

25. **Clearance/Permissions to be obtained by the Project Management Unit (PMU)**. The following table depicts the statutory clearances/permissions (but not limited to) for the use of land, providing public utility services to the resettlement site. The PMU shall verify and support PIDs to ensure all necessary clearances/permission have been obtained prior to start of construction.

Table 5: Clearances and Permissions Required by the PMU for Project Construction

Sl.no	Permission/ Clearances/ Declaration	Competent Authority	Remarks	Status	Reference
1.	Land Alienation to TNSCB	Collector office Thanjavur District	Land alienation to TNSCB has been issued by the Collector office, Thanjavur District. This also includes land Classification, Enter Upon Permission, Ancient Monuments, Trees and buildings and NoC from Mines.	Obtained	**Appendix 1**
2.	Environmental Clearance as per the EIA notification 2006	State Environment Impact Assessment Authority (SEIAA)	As per the EIA notification, this subproject is categorised as B2 and mandates Environmental clearance from SEIAA is necessary. Accordingly Form 1 and Form 1A has been submitted to SEIAA	In progress (application has been submitted to SEIAA. It has to be obtained prior to the contract award	Include the EC in **Appendix 3**
3.	Confirmation on the encroachments located in the water body/ canal	Taluk Office Thanjavur	The Tashildar, Thanjavur have issued certificate indicating that the 4 encroachment sites	Obtained	**Appendix 5**

Sl.no	Permission/ Clearances/ Declaration	Competent Authority	Remarks	Status	Reference
			located in the Big Temple Moat have been encroached in the water body/ canal		
4.	Confirmation letter from the Tamil Nadu Generation and Distribution Corporation (TANGEDCO)	TANGEDCO, Thanjavur	TANGEDCO has accepted the request from TNSCB for electricity service connection after collecting fees	Obtained	**Appendix 6**
5.	Certificate indicating the Vallam resettlement site is not vulnerable for flooding	Taluk Office Thanjavur	Tahsildhar Thanjavur have issued certificate by indicating the Vallam resettlement site is not prone to flooding, not encroached on water body and drought free zone	Obtained	**Appendix 7**
6.	Acceptance letter for collection of Municipal Solid Waste	Special Grade Town Panchayat, Vallam	Vallam Special Grade Town Panchayat office has accepted for collection and transportation of Municipal Solid Waste generated from Vallam Resettlement site.	Obtained	**Appendix 8**
7.	Acceptance letter for Collection of Dry Sludge and discharge of Treated Sewage Water	Special Grade Town Panchayat, Vallam	Vallam Special Grade Town Panchayat office has given confirmation for discharge of treated sewage and collection of dry sludge	Obtained	**Appendix 9**
8.	Tamil Nadu Water Supply and Drainage Board (TWAD) acceptance/ acknowledge for the supply of water to Vallam resettlement site	TWAD	TWAD has confirmed the supply of water to the Vallam Resettlement site. The acknowledgement for the same has been included in the Appendix 10. Once detailed design for this associated activity is available a revised IEE and subsequent EMP for this activity should be submitted to ADB for concurrence.	Obtained	**Appendix 10**
9.	Land Use Certificate	Town Planning Area, Thanjavur	The Vallam resettlement site has been classified as Non Planning Area	Obtained	**Appendix 11**
10.	Submission of Compliance Matrix for the EC conditions	SEIAA/ TNPCB	Compliance matrix for the requested General conditions and Specific conditions have been prepared by the TNSCB, which will be submitted to the SEIAA/ TNPCB. Any	Ongoing	**Appendix 12** (update it accordingly)

Sl.no	Permission/ Clearances/ Declaration	Competent Authority	Remarks	Status	Reference
			comments/ changes given by the SEIAA/ TNPCB have to be incorporated in the modified compliance matrix and accordingly it has to be included in the IEE and relevant EMP.		
11.	Source sustainability study for supply of water to the Vallam resettlement site	TWAD	Study on the source sustainability has been conducted by TWAD to balance water demand against water source availability. The study includes testing the water quality	Ongoing	**Appendix 13** (update it accordingly)
12.	Clarification on the ancient wall like structure located in the Sekkaditheru encroachment site and encroachment sites proposed for demolition and regeneration (Vadakkualangam and Kodimarathumoolai) which is within the buffer zone of 300m.	Archaeological Survey of India (ASI)	TNSCB and Thanjavur Municipal Corporation has been requested to obtain clarification from ASI regarding the presence of an ancient wall like structure in the encroachment site.	To be obtained	**Appendix 20**

26. **Other Environmental Clearance Conditions Requirements**. TNSCB will have to obtain approval for the STP design by an Independent approved third party or by an independent expert/ reputed Academic institution for its adequacy and a report in this regard should be submitted to the SEIAA and incorporated into the IEE before contract award or commencement of construction.

27. **Clearances/Permissions to be obtained by the Contractor.** Following table shows the list of clearances/permissions (but not limited to) required for project construction. The contractor should ascertain the requirements prior to start of the construction and obtain all necessary clearances/permission prior to start of construction.

Table 6. Clearances and Permissions Required by the Contractor for Project Construction

Sl.no	Construction Activity	Statutory Authority	Statute under which Clearance is Required	Implementation	Supervision
1.	Tree Cutting	District Revenue Department	Clearances from the authorities as per the Tamil Nadu Timber Transit Rules, 1968 or latest.	Project Implementation Division (PID	Project Management Unit (PMU)
2.	Batching plants,	Tamil Nadu	Consent to establish and	Contractor	PID

Sl.no	Construction Activity	Statutory Authority	Statute under which Clearance is Required	Implementation	Supervision
	Crushers and Hot mix plants	Pollution Control Board (TNPCB)	consent to operate under Air Act, 1981		
3.	Discharges from Construction activities	TNPCB	Consent to establish and consent to operate under Water Act, 1974	Contractor	PID
4.	Storage, handling and transport of hazardous materials	TNPCB	Hazardous Wastes (Management and Handling) Rules. 1989 Manufacturing, Storage and Import of Hazardous Chemicals Rules, 1989	Contractor	PID
5.	Sand mining, quarries and borrow areas	Department of Geology and mining, Government of Tamil Nadu	Contractor to obtain material from the existing government licensed mines/quarries; Contractor will require prior approval of PID for obtaining material from a particular source. PID to review and approve only existing licensed mines	Contractor	PID
6.	Groundwater extraction	Public Works Department	Tamil Nadu Groundwater (Development and Management) Act (2003)	Contractor	PID
7.	Disposal of Construction and Demolition waste	TNPCB	Construction and Demolition (C&D) Waste Management Rules, 2016	Contractor	PID

Source: MoEF&CC, CPCB, Govt of Tamil Nadu

C. Applicable International Standards and Best Practices

28. During the design, construction and operation of the project the PMU and Project Implementation Divisions (PIDs) will apply pollution prevention and control technologies and practices consistent with international good practice, as reflected in internationally recognized standards such as the International Finance Corporation's (IFC) Environmental, Health and Safety (EHS) Guidelines Guidance Notes and standards of the World Health Organization (WHO). These standards contain performance levels and measures that are normally acceptable and applicable to projects. When Government of India regulations differ from these levels and measures, the PMU and PIDs will achieve whichever is more stringent. If less stringent levels or measures are appropriate in view of specific project circumstances, the PMU and PIDs will provide full and detailed justification for any proposed alternatives that are consistent with the requirements presented in ADB SPS, 2009.

29. The following IFC (World Bank Group) EHS and WHO Guidelines will be adopted in the EMP for the subprojects such as:

(i) WHO Guidelines on Air Emissions and Ambient Air Quality, Noise Management, Wastewater and Ambient Water Quality,
(ii) Guidelines for Construction and Decommissioning (2007)
(iii) Guidelines for Hazardous Material Management and Waste Management

(iv) Good Practice Note: Asbestos: Occupational and Community Health Issues, May 2009
(v) Guidance Note on Workers Accommodation: Processes and Standards, August 2006[9]
(vi) Guidelines on Occupational Health and Safety and Community Health and Safety (2007)

30. Comparison of national emissions standards and International Standards / Best Practices are provided in Table 7, Table 8 and Table 9. Due to different measuring conditions, the emission values are not directly comparable. However, IFC Guidelines / WHO standards are stricter than the national standards if converted to comparable values.

Table 7: National Ambient Air Quality Standards and WHO Guidelines

Parameter	Location [a]	National Ambient Air Quality Standards [b]	WHO Air Quality Guidelines (µg/m3)		Applicable Per ADB SPS (µg/m3) [e]
			Global Update 2005 [c]	Second Edition 2000 [d]	
Particulate Matter PM_{10} ($\mu g/m^3$)	Industrial	60 (Annual)	20 (Annual)	-	20 (Annual)
	Residential, Rural and Other Areas	100 (24-hr)	50 (24-hr)		50 (24-hr)
	Sensitive Area	60 (Annual) 100 (24-hr)	20 (Annual) 50 (24-hr)	-	20 (Annual) 50 (24-hr)
Particulate Matter $PM_{2.5}$ ($\mu g/m^3$)	Industrial	40 (Annual)	10 (Annual)	-	10 (Annual)
	Residential, Rural and Other Areas	60 (24-hr)	25 (24-hr)		25 (24-hr)
	Sensitive Area	40 (Annual) 60 (24-hr)	10 (Annual) 25 (24-hr)		10 (Annual) 25 (24-hr)
Sulfur Dioxide SO_2 ($\mu g/m^3$)	Industrial	50 (Annual)	20 (24-hr)	-	50(Annual)
	Residential, Rural and Other Areas	80 (24-hr)	500 (10-min)		20 (24-hr) 500 (10-min)
	Sensitive Area	20 (Annual) 80 (24-hr)	20 (24-hr) 500 (10-min)	-	20 (Annual) 20 (24-hr) 500 (10-min)
Nitrogen Dioxide NO_2 ($\mu g/m^3$)	Industrial	40 (Annual)	40 (Annual)	-	40 (Annual)
	Residential, Rural and Other Areas	80 (24-hr)	200 (1-hr)		80 (24-hr) 200 (1-hr)
	Sensitive Area	30 (Annual) 80 (24-hr)	40 (Annual) 200 (1-hr)	-	30 (Annual) 80 (24-hr) 200 (1-hr)
Carbon Monoxide CO ($\mu g/m^3$)	Industrial	2,000 (8-hr)	-	10,000 (8-hr)	2,000 (8-hr)
	Residential, Rural and Other Areas	4,000 (1-hr)		100,000 (15-min)	4,000 (1-hr) 100,000 (15-min)
	Sensitive Area	2,000 (8-hr) 4,000 (1-hr)	-	10,000 (8-hr) 100,000 (15-min)	2,000 (8-hr) 4,000 (1-hr) 100,000 (15-min)
Ozone (O_3) ($\mu g/m^3$)	Industrial	1 0 0 (8-hr)	100 (8-hr)	-	1 0 0 (8-hr)
	Residential, Rural and Other Areas	1 8 (1-hr)			1 8 (1-hr)

[9] IFC Guidance Note: Workers Accommodation

Parameter	Location [a]	National Ambient Air Quality Standards [b]	WHO Air Quality Guidelines (µg/m3)		Applicable Per ADB SPS (µg/m3) [e]
			Global Update 2005 [c]	Second Edition 2000 [d]	
		0			0
	Sensitive Area	1 0 0 (8-hr) 1 8 0 (1-hr)	100 (8-hr)	-	1 0 0 (8-hr) 1 8 0 (1-hr)
Lead (Pb) (µg/m3)	Industrial,	0.5 (Annual)	-	0.5 (Annual)	0.5 (Annual)
	Residential, Rural and Other Areas	1.0 (24-hr)			1.0 (24-hr)
	Sensitive Area	0.5 (Annual) 1.0 (24-hr)	-	0.5 (Annual)	0.5 (Annual) 1.0 (24-hr)
Ammonia (NH3) (µg/m3)	Industrial	10 0 (Annual)	-		1 0 0 (Annual)
	Residential, Rural and Other Areas	40 0 (24-hr)			4 0 0 (24-hr)
	Sensitive Area	10 0 (Annual) 40 0 (24-hr)	-	-	1 0 0 (Annual) 4 0 0 (24-hr)
Benzene (C6H6) (µg/m3)	Industrial	5 (Annual)	-	-	5 (Annual)
	Residential, Rural and Other Areas				
	Sensitive Area	5 (Annual)	-	-	5 (Annual)
Benzo(o) Pyrene (BaP) (ng/m3)	Industrial	1 (Annual)	-	-	1 (Annual)
	Residential, Rural and Other Areas				
	Sensitive Area	1 (Annual)	-	-	1 (Annual)
Arsenic (As) (ng/m3)	Industrial	6 (Annual)	-	-	6 (Annual)
	Residential, Rural and Other Areas				
	Sensitive Area	60 (Annual)	-	-	60 (Annual)
Nickel (Ni) (ng/m3)	Industrial	20 (Annual)	-	-	20 (Annual)
	Residential, Rural and Other Areas				
	Sensitive Area	20 (Annual)	-	-	20 (Annual)

[a] Sensitive area refers to Ecologically sensitive areas notified by the India Central Government
[b] http://cpcb.nic.in/uploads/National_Ambient_Air_Quality_Standards.pdf
[c] WHO Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulfur dioxide. *Global update 2005*. WHO. 2006.
[d] Air Quality Guidelines for Europe Second Edition. WHO 2000.
[e] As per ADB SPS, the government shall achieve whichever of the ambient air quality standards is more stringent. If less stringent levels or measures are appropriate in view of specific project circumstances, the executing agency of

the government will provide full and detailed justification for any proposed alternatives that are consistent with the requirements presented in ADB SPS.

Table 8: National Noise Standards and WHO Guidelines

Receptor/ Source	Noise Level Standards [a] (dBA)		WHO Guidelines Value For Noise Levels Measured Out of Doors [b] (One Hour LAeq in dBA)		Applicable Per ADB SPS [c] (dBA)	
	Day	Night	07:00 – 22:00	22:00 – 07:00	Day time	Night time
Industrial area	75	70	70	70	70	70
Commercial area	65	55			65	55
Residential Area	55	45	55	45	55	45
Silent Zone	50	40			50	40

[a] Noise Pollution (Regulation and Control) Rules, 2002 as amended up to 2010 (http://cpcb.nic.in/displaypdf.php?id=Tm9pc2UtU3RhbmRhcmRzL25vaXNlX3J1bGVzXzIwMDAucGRm)

[b] Guidelines for Community Noise. WHO 1999.

[c] As per ADB SPS, the project proponent shall achieve whichever of the ambient air quality standards is more stringent. If less stringent levels or measures are appropriate in view of specific project circumstances, the project proponent will provide full and detailed justification for any proposed alternatives that are consistent with the requirements presented in ADB SPS, 2009.

Table 9: National Drinking Water Quality Standards and WHO Guidelines

Group	National Standards for Drinking Water [a, b]			WHO Guidelines for Drinking Water Quality, 4th Edition, 2011[c]	Applicable Per ADB SPS [d, e]
	Parameter	Unit	Max. Concentration Limit		
Physical	Turbidity	NTU	1 (5)	-	1 (5)
	pH		6.5 – 8.5	None	6.5 – 8.5
	Color	Hazen Units	5 (15)	None	5 (15)
	Taste and Odor		Agreeable	-	Agreeable
	TDS	mg/l	500 (2,000)	-	500 (2,000)
	Iron	mg/l	0.3	-	0.3
	Manganese	mg/l	0.1 (0.3)	-	0.1 (0.3)
	Arsenic	mg/l	0.01 (0.05)	0.01	0.01
	Cadmium	mg/l	0.003	0.003	0.003
	Chromium	mg/l	0.05	0.05	0.05
	Cyanide	mg/l	0.05	None	0.05
	Fluoride	mg/l	1 (1.5)	1.5	1 (1.5)
	Lead	mg/l	0.01	0.01	0.01
	Ammonia	mg/l	0.5	none established	0.5
Chemical	Chloride	mg/l	250 (1,000)	none established	250 (1,000)
	Barium	mg/l	0.7	None	0.7
	Sulphate	mg/l	200 (400)	None	200 (400)
	Nitrate	mg/l	45	50	45
	Copper	mg/l	0.05 (1.5)	2	0.05 (1.5)
	Total Hardness	mg/l	200 (600)	-	200 (600)
	Calcium	mg/l	75 (200)	-	75 (200)
	Zinc	mg/l	5 (15)	none established	5 (15)
	Mercury	mg/l	0.001	0.006	0.001
	Aluminum	mg/l	0.1 (0.3)	none established	0.1 (0.3)
	Anionic Detergents	mg/l	0.2 (1.0)	None	0.2 (1.0)
	Phenolic	mg/l	0.001(0.002)	None	0.001(0.002)

Group	National Standards for Drinking Water [a, b]			WHO Guidelines for Drinking Water Quality, 4th Edition, 2011[c]	Applicable Per ADB SPS [d, e]
	Parameter	Unit	Max. Concentration Limit		
	Compounds				
	Residual Chlorine	mg/l	0.2	5	0.2
Microbial indicator	E-coli	MPN/100ml	Must not be detectable in any 100 ml sample	Must not be detectable in any 100 ml sample	Must not be detectable in any 100 ml Sample
	Total Coliform	MPN/100ml			

[a] http://cgwb.gov.in/Documents/WQ-standards.pdf.
[b] Bureau of India Standard 10500: 2012 (Indian Standard, Drinking Water — Specification (Second Revision).
[c] Health-based guideline values.
[d] As per ADB SPS, the government shall achieve whichever of the drinking quality standards is more stringent. If less stringent levels or measures are appropriate in view of specific project circumstances, the executing agency of the government will provide full and detailed justification for any proposed alternatives that are consistent with the requirements presented in ADB SPS, 2009.
[e] Figures in parenthesis are maximum limits allowed in the absence of alternate source.

31. Effluent Discharge Standards for Sewage Treatment Plants set by Central Pollution Control Board, Ministry of Environment, Forests and Climate Change, Government of India, Dated 15 April 2015 are provided in Appendix 15 of EARF.

32. The Guidelines for Reuse of STP effluent and sludge are provided in Appendix 16 of EARF.

33. The Central Pollution Control Board notifications and guidelines for operation of DG sets (that may be used for supporting services) are available at: https://cpcb.nic.in/genset-notifications/

34. **Core Labor Standards**. ADB is committed to due consideration of Core Labor Standards (CLS) in the design and implementation of subprojects. A CLS handbook has been developed by ADB with cooperation of International Labor Organization (ILO). The TNSCB PMU will ensure compliance to applicable CLS of ADB-ILO during project implementation including:

(i) Freedom of association and the effective recognition of the right to collective bargaining
(ii) Elimination of all forms of forced or compulsory labor
(iii) Effective abolition of child labor
(iv) Elimination of discrimination in respect of employment and occupation

D. International Treaties/Conventions/Declarations on Environment Management

35. India is a signatory to the following international treaties/ conventions/ declarations on environment, social, safety and occupational issues that are relevant for the subproject. The list of international agreements is provided in Table 10.

Table 10: International Treaties/ Conventions/ Declarations on Environment

Sl. no	International Treaties/ Conventions/ Declarations	Description
1.	United Nations Conference on the Human Environment - Stockholm 1972	To coordinate global efforts to promote sustainability and safeguard the natural environment

Sl. no	International Treaties/ Conventions/ Declarations	Description
2.	Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), 1975	Its aim is to ensure that international trade in specimen of wild animals and plants does not threaten their survival
3.	Ramsar Convention, 1971, 1975	The Convention on Wetlands is the intergovernmental treaty that provides the framework for the conservation and wise use of wetlands and their resources
4.	The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes, 1989	The Convention aims to protect human health and the environment against the adverse effects resulting from the generation, transboundary movements and management of hazardous wastes and other wastes
5.	Strategic Approach to International Chemicals Management (SAICM)	SAICM is an international non-binding policy framework to support efforts to achieve the Johannesburg Plan of Implementation (WSSD) goal for chemicals, notably “achieve by 2020 that chemicals are used & produced in ways that lead to the minimization of adverse effects on human health & the environment”
6.	United Nations Conference on Environment and Development (UNCED), 1992, 2002	The conference had three objectives (Agenda – 21, Rio Declaration and Millennium Development Goals), to secure renewed political commitment for sustainable development, to assess the progress and implementation gaps in meeting previous commitments, and to address new and emerging challenges
7.	United Nations Framework Convention on Climate Change (UNFCCC), 1992 • Kyoto Protocol, 1997	It operationalizes the United Nations Framework Convention on Climate Change by committing industrialized countries to limit and reduce greenhouse gases (GHG) emissions in accordance with agreed individual targets
8.	The Vienna Convention, 1985 • Montreal Protocol on Ozone depleting substances, 1992	It sets binding progressive phase out obligations for developed and developing countries for all the major ozone depleting substances, including chlorofluorocarbons (CFCs), halons and less damaging transitional chemicals such as hydrochlorofluorocarbons (HCFCs)
9.	Convention on Biological Diversity, 1992 • Cartagena Protocol on Biosafety, Ratified on 17th January, 2003	It is an international treaty governing the movement of living modified organism (LMO) resulting from modern biotechnology from one country to another
10.	Convention to Combat Desertification, 1996	It is the only binding international agreement linking environment and development to sustainable soil management
11.	Rotterdam Convention on Prior Informed Consent Procedure for certain Hazardous Chemicals in International Trade, 2002	It is a multilateral treaty to promote shared responsibilities in relation to importation of hazardous chemicals
12.	Stockholm Convention on Persistent Organic Pollutants (POPs), 2001	It aims to eliminate or restrict the production and use of Persistent Organic Pollutants (POPs)

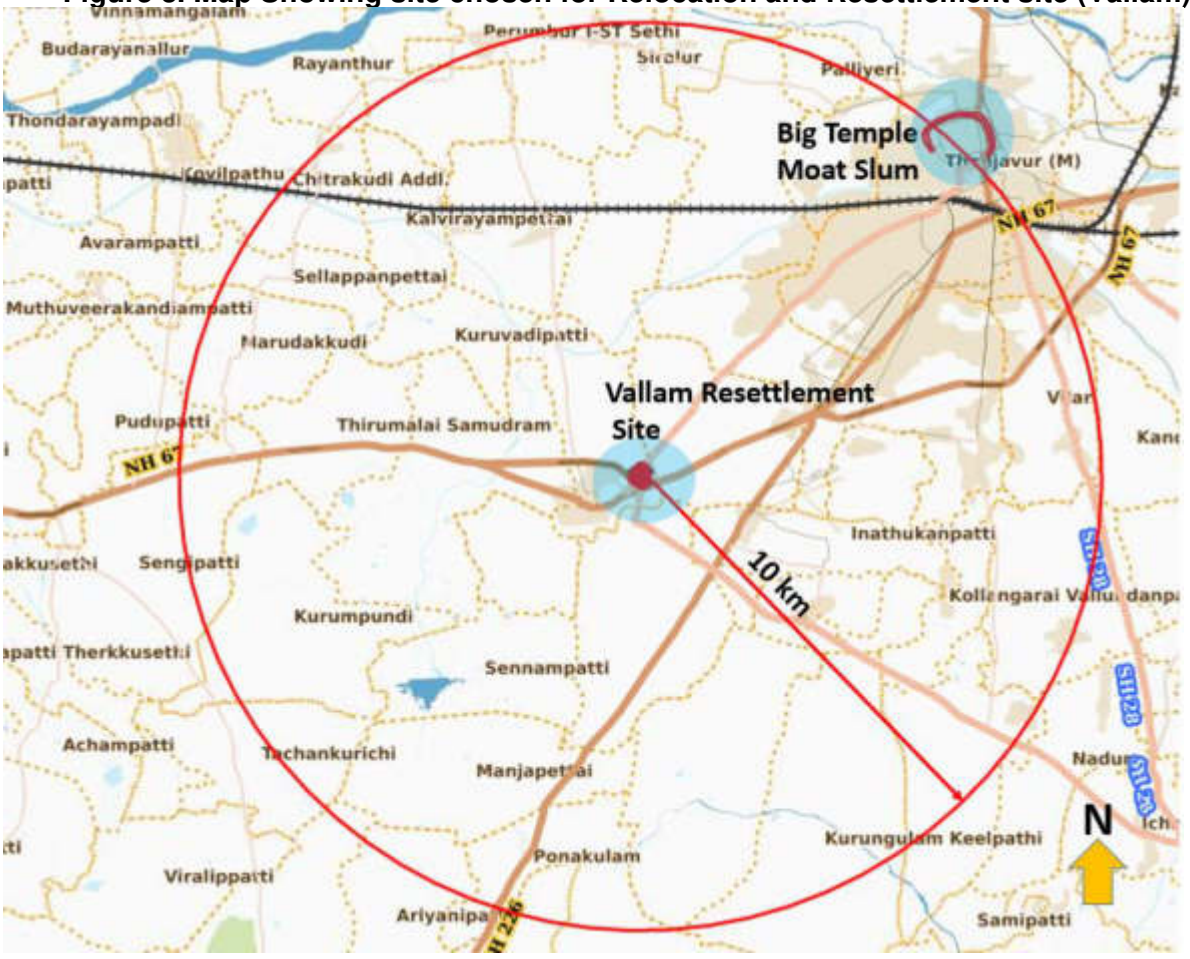
III. DESCRIPTION OF THE SUBPROJECT

A. Subproject Overview

36. In Thanjavur Taluk of Thanjavur District, TNSCB has identified Big Temple Moat site which has been encroached by vulnerable communities and observed that they are living under high risk due to the flooding. Based on the land availability In Thanjavur Taluk, preferably government land, the TNSCB has identified Vallam (10°43'29.56"N, 79° 4'14.25"E) in Thanjavur Taluk as a resettlement site to relocate the encroachers from Big Temple Moat site. The geo coordinates of the 4 encroachment sites located in the Big Temple Moat is presented in **Table 2** in Chapter 1.

37. **Figure 3** shows the map of the Big Temple Moat encroachment sites chosen for relocation, and location of the resettlement site at Vallam (Ayyanar Koil Phase 2). Area within 10 km radius of the resettlement site is also shown in the map. There are no environmental sensitive areas including protected areas, eco sensitive zones or ecologically sensitive areas notified by the MoEF&CC located within 10 km radius of the resettlement site.

Figure 3. Map Showing site chosen for Relocation and Resettlement site (Vallam)



38. The selection of site was based on the following ADB EARF screening criteria:

(i) **Key Exclusion Criteria**. Vallam resettlement site, 4 encroachment sites (located in the big temple moat) and the water body (proposed for regeneration) are not falling under the exclusion criteria as suggested in the EARF.

(a) None of the subproject activities (construction, demolition and regeneration) are falling under the Environmental category "A"
(b) The subproject areas are not located within the 10km radius national park, sanctuary, wetland, mangrove reserve, biodiversity hotspot, reserve ot protected forest area and CRZ zone.
(c) The subproject is not falling under the ADB Prohibited Investment Activities List (ADB SPS, 2009, Appendix 5)
(d) The subproject is not highly complex and sensitive[10]
(e) The subproject activity do not affect the PCRs e.g. local heritage sites / archaeological sites,[11] places of worship, etc.,
(f) The subproject is not located near electricity substations, high voltage transmission lines, underground cables, solid waste dumping yards, Oil /Gas pipelines, Coastal Regulatory Zone hazard line and/or polluting (heavy emissions / noisy) industrial activities
(g) The resettlement site is not in flood prone areas, areas with a history of flooding or in areas zoned for coastal protection.

(ii) **Environmental guidelines for Subproject Selection criteria**. The subproject activities including the Construction, Demolishing and Regeneration of water bodies are as per the following environmental guidelines for subproject selection criteria

(a) The encroachment sites chosen for relocation are vulnerable for flooding and occupied by the slum dwellers
(b) The resettlement site proposed at Vallam will host 969 dwelling units for the 969 HH to be evicted from the encroachment sites located in the big temple moat area, which is sufficient to accommodate project beneficiaries / resettled households and community members in line with housing space and design ratio considerations.
(c) New site should be within one-hour travel time on public transport from existing settlement sites / encroachments). The resettlement site at Vallam meets this criterion. Figure 1 in Chapter 1 shows that the Vallam is located at a distance of 10km from the big temple moat site, which is chosen for relocation and they are well connected by roads. Hence the travel time will be less than 1 hr.
(d) New site should be within a 2.5 km radius of public amenities or be within prescribed social infrastructure access norms. The resettlement site at Vallam meets this criterion. The existing public amenities around the resettlement site have been depicted in **Error! Reference source not found.** in Chapter 1.
(e) The subproject is designed to have 10% OSR and 15% green belt area
(f) New site should provide comprehensive infrastructure and supporting services, generate new optimally sited open spaces of adequate size, and community spaces including space for training and community enterprise.

[10] Projects that ADB deems as highly risky or contentious or involve serious and multidimensional and generally interrelated potential social and/or environmental impacts.

[11] ASI clarification is requested for the ancient wall like structure located near to the encroachment site. Based on the recommendations/ suggestions care shall be taken to preserve the wall from damages.

(g) Vallam resettlement site is in conformation to the land use classification, relevant development control regulations and DTCP approved master plan.

(h) No new construction of landfills, electricity generation/ electricity high voltage transmission line and distribution substations are proposed under this subproject.

(i) Water source sustainability is maintained through supply of water by TWAD and the quality of the water is as per the IS 10500 (drinking water standard), and a water source sustainability study will be completed.

(j) 0.6MLD capacity Sewage Treatment Plant is proposed to treat the sewage generated from the Vallam resettlement site, the treated water shall be utilised for gardening, rainwater harvesting and excess treated water shall be given to the Vallam Special Grade Town Panchayat for their uses. The sludge generated in the STP shall be further digested to remove the pathogens and the dried sludge is disposed along with the organic waste for bio-composting.

(k) Demolition works at 4 encroachment sites will
  (a) exclude religious structures e.g., chapels, temples, mosques, etc.
  (b) involve clearance and fencing around the water body / canal banks[12]
  (c) avoid cutting of trees; and
  (d) avoid disturbance to PCRs.

(l) Regeneration works at cleared encroachments includes
  (a) re-greening / re-vegetation along water body / canal banks; and
  (b) clearing and preventing new solid waste / sewage disposal in water bodies / channels.

39. The scope of this subproject covers (i) construction of 969 residential units and associated facilities at the resettlement site at Vallam; (ii) demolition of 969 structures located in 4 encroachment sites located in the Big Temple Moat identified for relocation to Vallam; and (iii) restoration of water body/ canal, which were encroached by the people needs to be relocated.

B. Proposed Subproject Interventions at the Resettlement Site

40. Salient Features of the resettlement site are presented in Table 11. Photograph of the resettlement site is presented as Figure 4.

Table 11. Salient Features of the Resettlement Site

Features	Description
Plinth Area	37,140.60 m^2
Built-up Area	38445.00m^2
Total Housing / Residential Units	969
Total Occupancy	5,102
Administration area	The proposed relocation site falls in Thanjavur Revenue Village and Vallam Special Grade Town Panchayat limits in Thanjavur Taluk of Thanjavur District
Topography	Site is an abandoned gravel quarry area.
Connectivity	It is well connected to NH 67 and SH 99A. The Thanjavur Old Bus Stand is located at a distance of 10.5 km. Thanjavur New Bus Stand is located at a distance of 5.37km. Thanjavur railway station is located at a distance of 9.3km.
Site nearby	North side of the site is residential area, east side is TNSCB Phase 1

[12] Fencing to ensure that re-encroachment of cleared spaces does not and to derive public benefits from the cleared and restored waterways.

Features	Description
	(residential units), and south and west sides are open land with Isolated residential houses.
Distance from new resettlement site to the slums	4 encroachment sites located in the Big Temple Moat (proposed for relocation) is located at a distance 10km (by road) from the new site (refer **Error! Reference source not found.**1).
Environmental sensitivity	No sensitive natural or human receptors in close proximity to the proposed relocation site.
ASI Monument	The nearest encroachment site (Sekkaditheru) in the Big Temple moat is located at a distance of 575m and for the Thanjavur Palace, the nearest encroachment site is Kodimarathumoolai, which is located at a distance of 182m and Vadakkualangam is located at a distance of 250m. This will require further consultation with the ASI on the requirements as per the AMASR) Act 2010 prior to the tendering of any works. In addition the presence of an ancient wall like structure needs clarity on the importance from the ASI prior to the tendering of any works.
Electricity	TANGEDCO have confirmed to provide electricity to the Vallam resettlement site for which transformers will be provided within the resettlement site
Health facilities	Thanjavur Medical College is located at a distance of 4.7 km from the proposed relocation site
Water supply	Water supply is proposed to be provided by Tamil Nadu Water Supply and Drainage (TWAD) Board. The estimated water demand of 676 KLD will be sourced from pumping main near Manakkarambai Village, which is located at a distance of 18km from the Vallam resettlement site.
Rainwater Harvesting Structures	As per the regulatory requirements, rooftop rainwater harvesting has been proposed for all the blocks. Accordingly, TNSCB have designed 13 RWH structures/pits and with rainwater harvesting trenches in the project area. Through this 38.3lakh litres of rainwater shall be collected.
Waste water treatment	0.6 MLD STP will be constructed within the resettlement site for treating waste water (grey water and black water) generated from the resettlement site. It is proposed to have Sequencing Batch Reactors (SBR) for treating waste water. SBR is a variant of Activated Sludge Process (ASP) technology and is essentially a batch treatment through the combination of primary settling, aeration, secondary settling and decanting the treated sewage in a series of sequences. The treated waste water quality will met the requirement of the CPCB waste water discharge standard. The treated water will be utilised for flushing, landscaping purposes and for groundwater recharge. The remaining excess treated water shall be used to recharge the groundwater through via the rainwater harvesting pits and rainwater harvesting trenches, and supplied to the Vallam Special GradeTown Panchayat (if needed).
Solid waste management	Vallam Special Grade Town Panchayat have agreed to provide Municipal Solid Waste (MSW) collection, transportation and disposal to the existing solid waste dumping site, which is owned and operated by the panchayat, for which a dedicated location will be provided for collection of MSW generated within the resettlement site. Segregation of waste at source will be adopted.
Treated Sewage Discharge	Vallam Special Grade Town Panchayat have agreed for collection and discharge of the treated sewage
STP sludge management	It is proposed to have sludge digester tank (anaerobic sludge digestion) in the STP to digest the sludge into dry sludge for further disposal. The treated sludge shall be stored in the sludge drying bed and when it reaches its full capacity, it shall be disposed along with the organic waste in the Vallam Town Panchayat MSW disposal facility, which will cause no harm to the surrounding environment.

41. The number of families to be relocated is 969 (refer **Table 2**), however, as a buffer to accommodate more families under unavoidable circumstances, 969 residential units has been proposed. This subproject will have 13 blocks of G+5 structures, the average plinth area is 37.38 m^2. Total Plinth area of the residential buildings is 37,034.60 m^2 and the total built-up of other amenities is 1410.40 m^2. The infrastructure built-up area is estimated to be 1410.40 m^2. Plinth area details of the residential units are presented in **Table 12** and built-up area details of the buildings at the resettlement site are presented in **Table 13**.

Table 12. Plinth Area Details of Proposed Residential Units at the Resettlement Site

Block Type	No. of Floors	Total No. of Units in each block	Plinth Area per Unit (m^2)	Plinth Area per Floor (m^2)	Total Plinth Area of the block (m^2)
A (A1 to A7)	5	96 (672 for 7 blocks)	38.46	4251.94	25846.80
B (B1 to B4)	5	48(192 for 4 blocks)	37.69	1190.16	7236.00
C	5	60	37.14	2204.58	2228.40
D	5	45	38.11	1821.42	1723.40
Total		**969**			**37,034.60**

Source: TNSCB Drawing

Figure 4. Photograph of the Resettlement Site

Table 13. Built-up Area Details of the Buildings at the Resettlement Site

Sl. No.	Building	Built-up Area (m^2)
1	Residential Buildings	37,034.60
2	Other Amenities	
2.1	Health sub centre	106.00
2.2	Community Hall	400.36
2.3	C-Shop and Milk Booth and Ration shop	428.98
2.4	Anganwadi and library	463.96
2.5	Security Office	7.50
2.6	Motor Room	3.60
Total		**1,410.40**

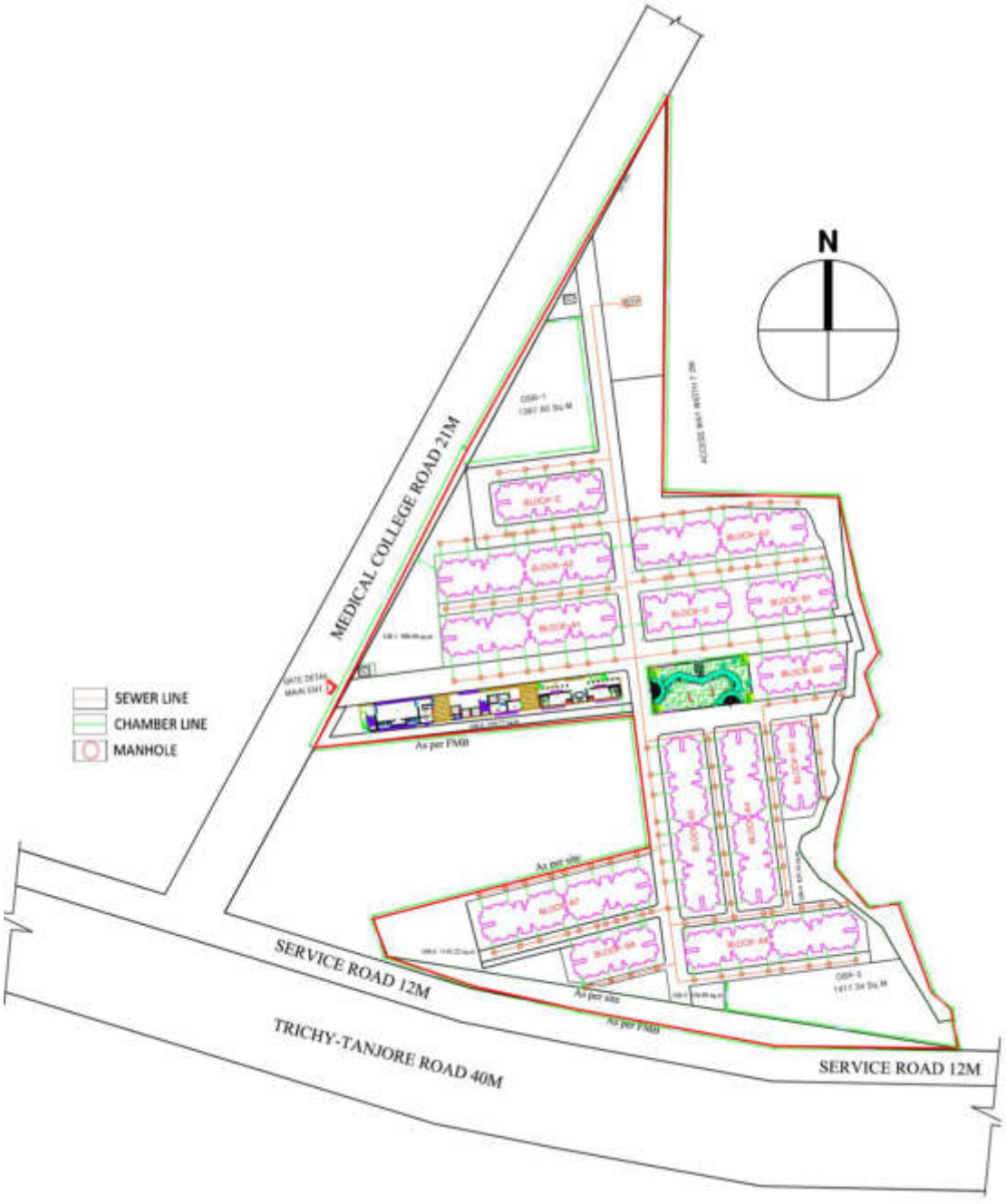
Source: TNSCB Drawing

42. Proposed conceptual site plan for the resettlement site is shown in Figure 5. Total area of resettlement site is estimated to be 2.90 ha. Split up of land use is given in Table 13.

Figure 5. Proposed Master Plan of Vallam Resettlement Site

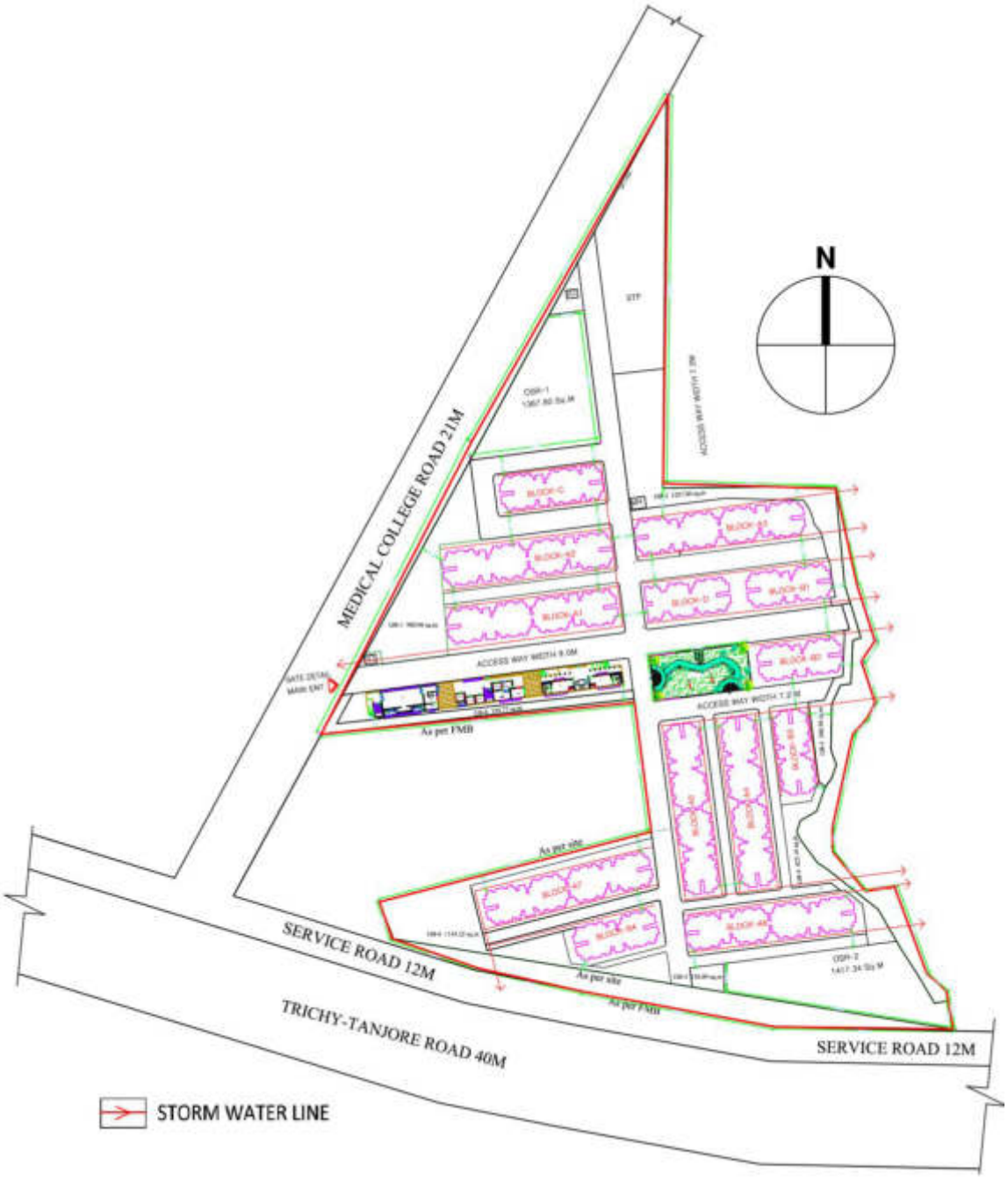
Source: TNSCB Drawing

Figure 6: Proposed Sewer Line and STP



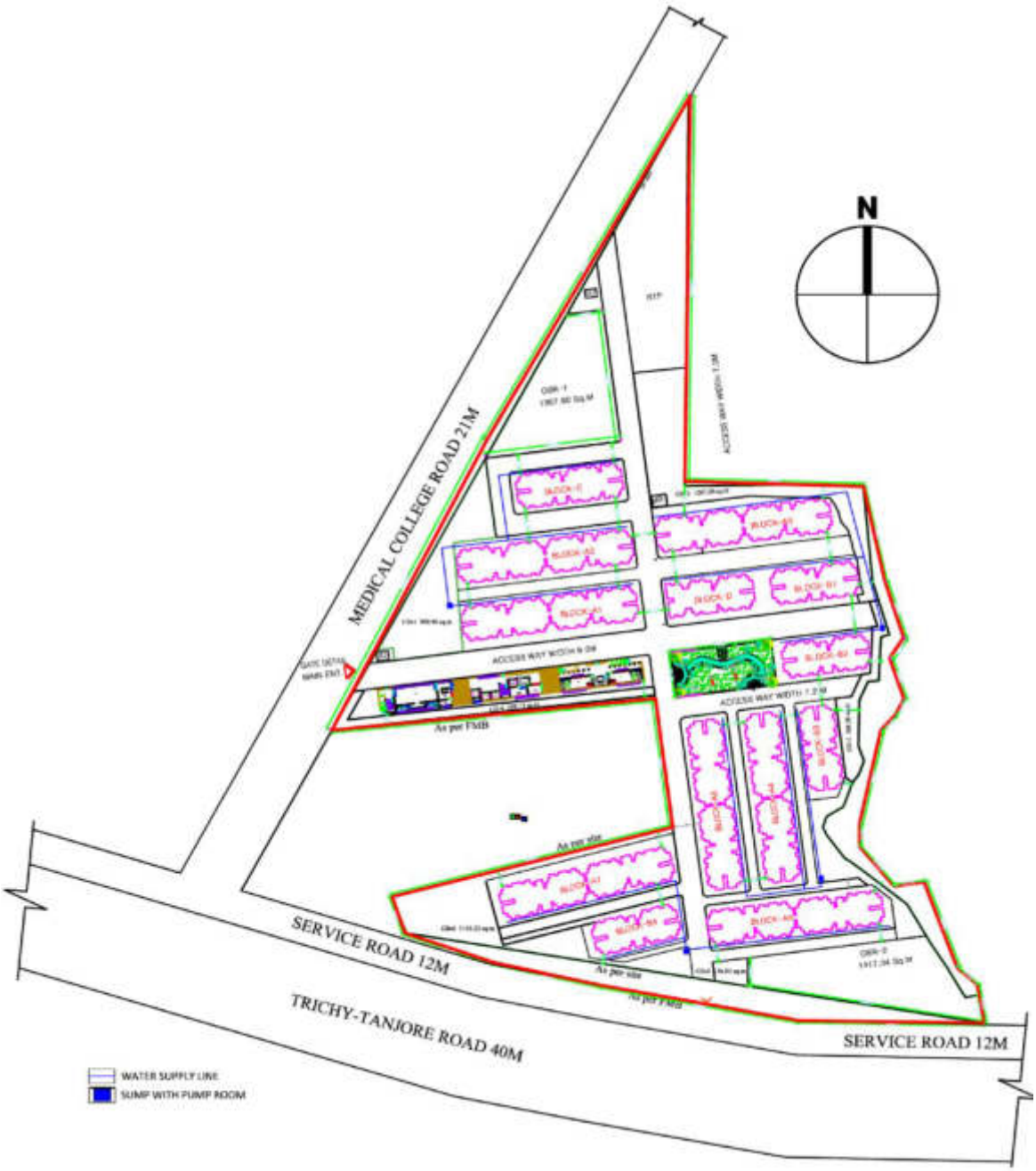
Source: TNSCB Drawing

Figure 7: Proposed Storm Water Drain



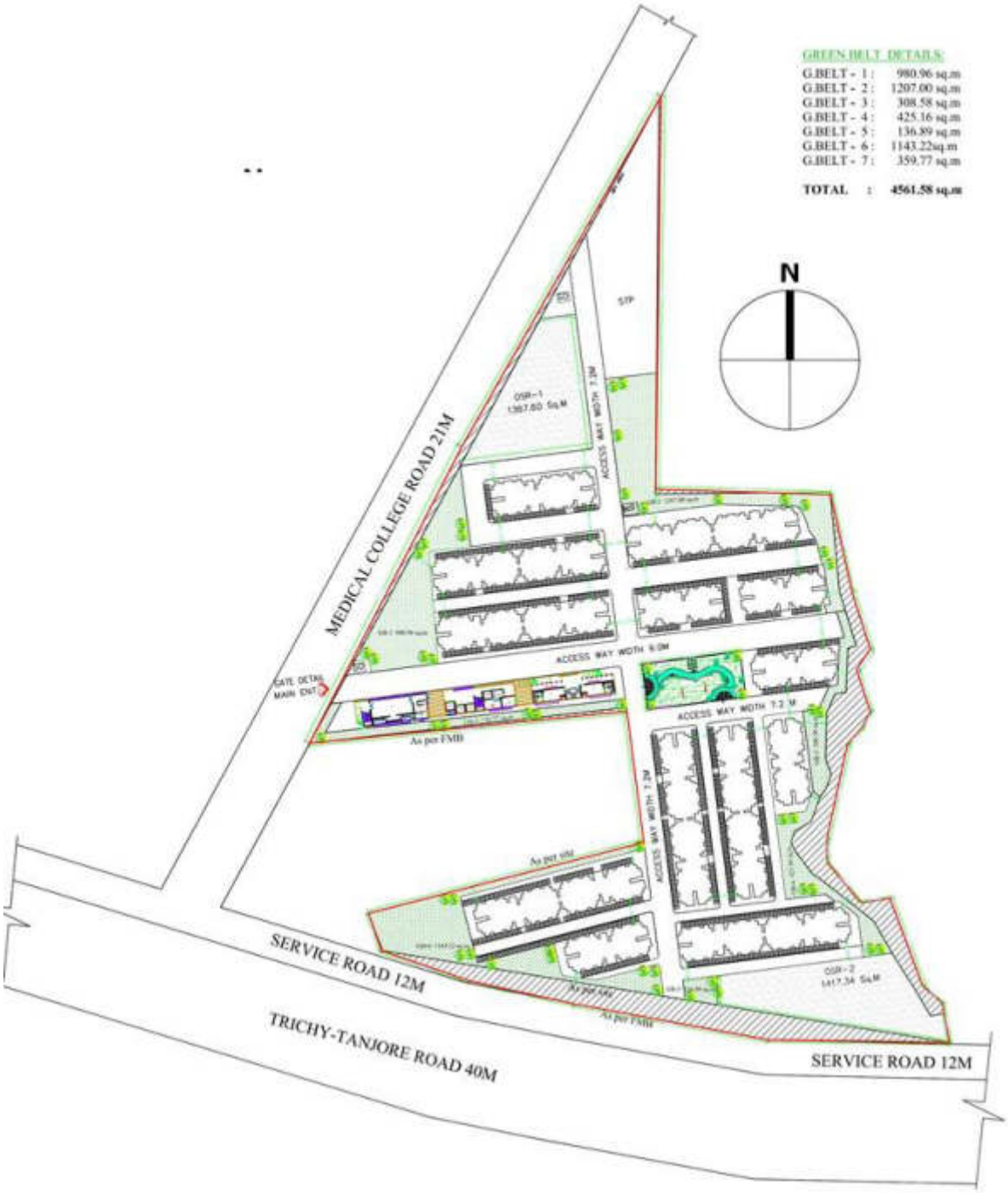
Source: TNSCB Drawing

Figure 8: Proposed Water Supply Line



Source: TNSCB Drawing

Figure 9: Proposed Green Belt Area



Source: TNSCB Drawing

Table 14. Proposed Land use of the Resettlement Area

Sl. no	Description	Area (%)	Area (m^2)	Area (ha)
1.	Residential	23.03	5845.62	0.584562
2.	OSR	10.04	2784.93	0.278493
3.	Green Belt	16.45	4561.58	0.456158

Sl. no	Description	Area (%)	Area (m^2)	Area (ha)
4.	Public Purpose	20.44	6212.48	0.621248
5.	Internal Roads	22.64	6280.61	0.628061
6.	Vehicular parking	7.4	2052	0.2052
	Total Area	**100.00**	**27737.22**	**2.77**

Source: TNSCB Drawings

43. Based on consultations, the design requirement for the communities have been identified and accordingly TNSCB with ADB assistance have engaged consultants in the preparation of master plan for the Vallam resettlement site. As per the concept master plan, the following infrastructure has been proposed at the resettlement site.

Table 15. Subproject Interventions at the Resettlement Site

Subproject Component	Subproject Interventions
Construction of 969 residential units and supporting services	• Residential Units • Internal Roads • Vehicular Parking • Ration Shop • Convenient Shop • Milk Booth • Library • Security Office • Motor Room • Anganwadi centre • Community Hall • Health sub centre • Open Space Reserve • Sewage Treatment Plant • Electric Power supply • Water Supply • Solid Waste Management • Rainwater Harvesting • Solar Powered Street Lights

Source: TNSCB Drawings

44. **Power Requirement.** The power requirement during the project construction will be met through power generators (ranging between 5kW to 200kW). The generators having emission under control certificates will be permitted in the construction site. The power requirement during operation is about 1063 KW and it will provided by Tamil Nadu Generation and Distribution Corporation Limited (TANGEDCO) (refer to Appendix 6 for Acknowledgement from TANGEDCO for the supply of electricity to the resettlement site) via 11 kV lines and the final electrification to buildings (including residential units) will be 11/0.4 kV distribution transformers within the premises with an end user connection voltage of 240V. Street lights will be solar powered, providing an energy saving of approximately 6 kW.

Table 16. Power Requirement at the Resettlement Site

Sl. no	Particulars	Quantity	Unit
1	**Residential Use**		
	No. of residential units proposed	969	Nos.
	Power requirement per residential unit (Assuming 1 kW per 1 residential unit)	969	kW
2	**Pump Room**		

Sl. no	Particulars	Quantity	Unit
	No. of Pump Rooms	3	Nos.
	Power requirement for the Pump Room (Assuming 6 kW per Pump Room)	18	kW
3	**STP**		
	Power requirement for STP in the range of 65 kW to 80 kW	70	kW
4	**Street Light**		
	No. of street lights	120	Nos.
	Power required for the street lights (Assuming 50 W per Street Lamp)	6	kW
Total Power Requirement		**1063**	**kW**

Source: Conceptual Plan

45. In the event of power outage, it is proposed to have a Diesel Generator (DG Set) of 80 KVA, 415V, 3 Phase, 50 Hz @ 1500 RPM. As per the TNPCB norms sufficient height for the stack shall be maintained. For 80 KVA DG capacity, the height of the stack should be 2 m from the height of the building (Height of the building +2 m).

46. **Water Requirement and Supply**. The total water requirement during construction is estimated to be 100L/Day, the source of water for construction shall be arranged by the Contractor through the Vallam Special Grade Town Panchayat or the TWAD. The total water requirement during operation is estimated to be 676 KLD (including a buffer), which shall be supplied by the TWAD and relevant calculations can be found in Table 17 (Refer Appendix 10 for the acknowledgement issued by the TWAD for the supply of water). The water will be sourced from pumping main near Manakkarambai Village, which is located at a distance of 18 km from the Vallam resettlement site.

47. The wastewater generation from the project is estimated to be about 580.8KLD, which will be treated in a proposed Sewage Treatment Plant (STP)[13] with a capacity of 676 KLD. Treated wastewater will be reused for flushing and gardening. The assumptions for estimating the water requirement is given in the following table.

Table 17: Water Requirement at the Resettlement Site

S. No.	Project Components	No. of Units	Occupancy Rate @	Total Occupancy (Nos.)
1	Residential unit	969	5 persons per unit	4845
2	Floating Population	-	10% of the Total Residential population	485
3	Convenience shop	2	5	10
4	Ration shop	1	5	5
5	ICDS	1	40	40
6	Staff & Visitors for ICDS	1	10% of the Total Residential population	4
7	Anganvadi & Milk Booth	1	40	40
8	Staff & Visitors for Anganvadi & Milk Booth	1	10% of the Total Residential population	4
9	Community hall	2	100 Persons per unit	200
10	Livelihood centre	2	75 persons per unit	150

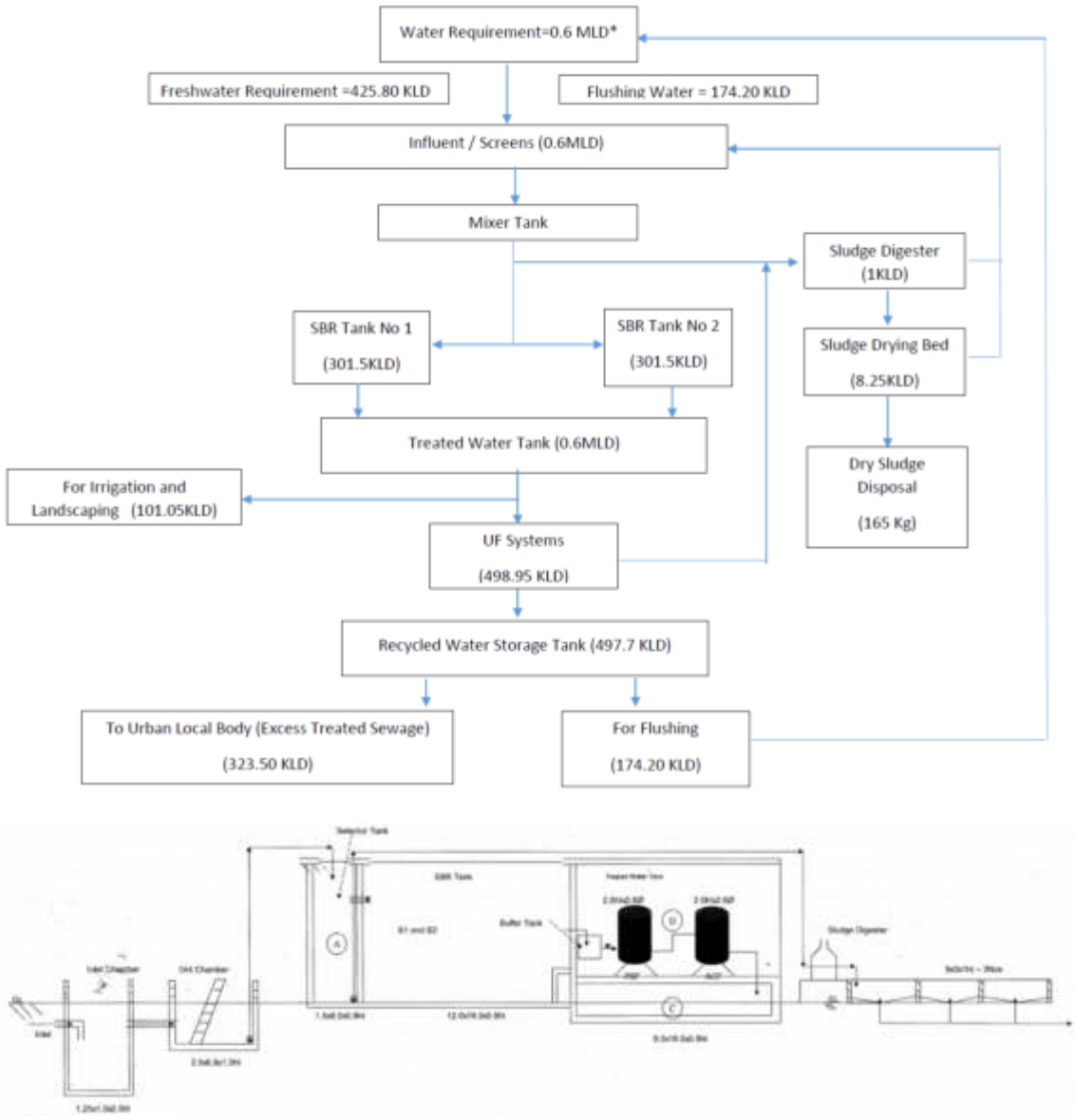
[13] The technology for the STP shall be selected based the suggestions from the SEIAA. However, it is proposed to have a STP having SBR technology.

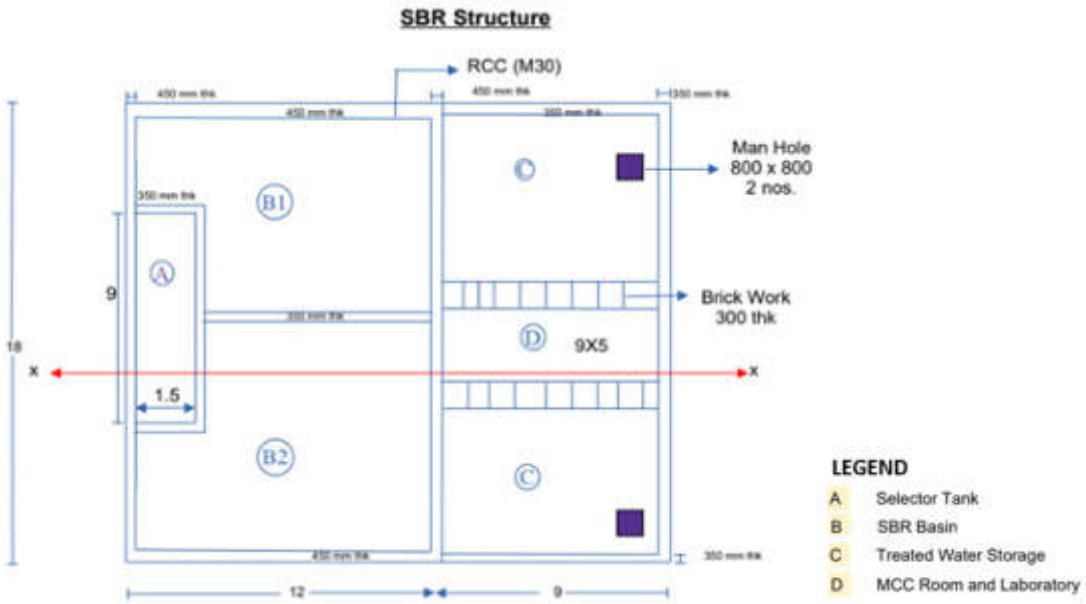
S. No.	Project Components	No. of Units	Occupancy Rate @	Total Occupancy (Nos.)
11	Library	1	20 persons	20
12	Health Care Centre	1	5	5
Total Occupancy				**5808**
As per the National Commission on Integrated Water Resources Development (**NCIWRD**) norms rural area shall be provided with 75 to 150 Litre Per Capita Per Day (LPCD) have been recommended for the year 2025 and 2050. For this subproject 100 lpcd has been proposed. Hence the estimated water requirement is 0.58 MLD.				**5808*100=5,80,800 Litres (580.8KLD)**
Green area Development/ landscaping				
Area for Green area development (4363.19 m^2) × 3.5 lts/ m^2			15271.16	15.27
			Rounded	15.5

Source: Conceptual Plan, TNSCB

48. The water supply for domestic purposes (676 KLD) shall be provided by the TWAD Board. For the wastewater generated from the resettlement site a 600 KLD (0.6 MLD) capacity STP with SBR technology has been proposed. The SBR will have two reactors for treating wastewater. The STP process flow chart and SBR structure is given in Figure 11. Nearly 100 KLD of treated water will be used for green belt area/ landscaping purposes. From the remaining 500 KLD, nearly 35% of the treated water (after ultra-filtration) will be recycled for flushing and gardening purposes with the remaining 65% to be disposed into the rainwater harvesting pits for groundwater recharge and Vallam Special Grade Town Panchayat has also given consent for collection and disposal of treated sewage water.

Figure 10: STP Process Flow Diagram and SBR Structure – Water Balance for Vallam Resettlement Site





49. **Rainwater Harvesting Structures**. As per the Government of Tamil Nadu requirements, amendments made to Section 215 (a) of the Tamil Nadu District Municipalities Act, 1920 and Building Rules 1973, have made it mandatory to provide Rainwater Harvesting (RWH) structures in all new buildings. In view of this, and as per the conditions given by the SEIAA on the Environmental Clearance obtained for the Vallam Resettlement site, TNSCB have designed 13 RWH structures/pits and with rainwater harvesting trenches in the project area. The following sections will detail the assumptions and estimations that underpin the design.

(i) **Rainwater volume estimation**

(a) As per the secondary information (refer Chapter 4 Description of the Environment) the project district receives annual rainfall of 939 mm

(b) The rainfall intensity has been estimated to be 2.57 mm / day

(c) The total built-up area is worked out to be 27410.70 m^2

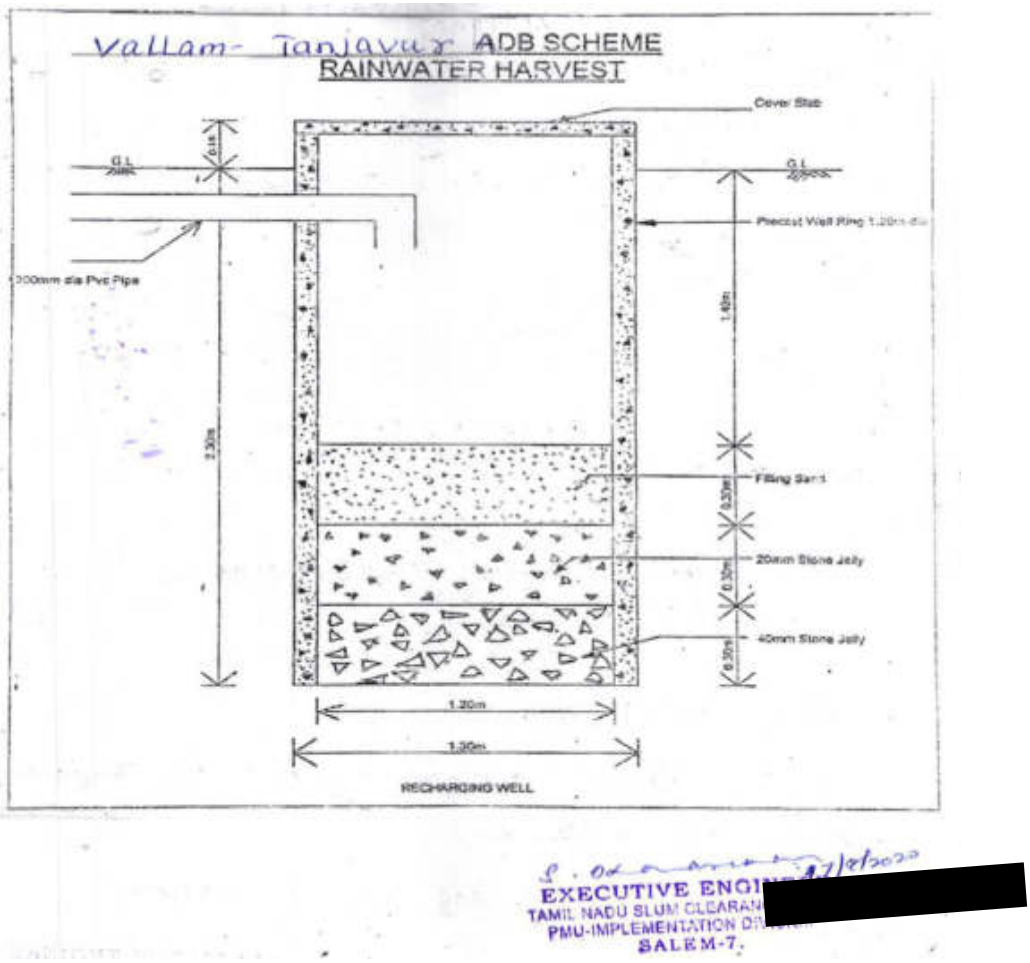
(d) Assuming the coefficient of runoff (c) to be 0.90 for concrete surface area, it is expected that Q = c.i.a = 0.90 x 2.57 x 27410.70= **62.87m^3/day**

50. Based on the estimated rainwater volume, 13 RWH structures / pits and 1,111 m of rainwater trenches are proposed. The design specifications for the RWH are as follows:

(i) **Rainwater Harvesting Structure**. It is proposed to construct 13 RWH structure/pits with a diameter of 1.2m (clear) and height of 2.40m. Each residential block will be connected to the RWH structure/pit.

(a) The total volume of rainwater that can be collected by a RWH structure/ pit is estimated to be 2.71 m^3, hence 13 RWH structures/ pits will collect 35.23 m^3 of rainwater. The structure of the RWH is shown in the Figure 11.

Figure 11: Rainwater Harvesting Structure



(ii) **Rainwater Harvesting Trenches**. The resettlement site will be provided with 1111m of rainwater harvesting trenches along the perimeter of the site. The trench will be 1 m wide by 1.5 m deep filled with pebbles. The volume of rainwater that can be collected in the trench is estimated to be 1666.50 m^3.

(iii) **Paver block all-around the buildings**. It is proposed to provide paver block for the walkway, parking area and surrounding the buildings above a filling of 45 cm. The gaps between the paver block will not be sealed, which will allow the rainwater to percolate further into the ground. The total area of the paver block is estimated to be 4726 m^2. The volume of rainwater that can be collected by this system is estimated to be 2126.70 m^3.

Sl.no	Infrastructure	Quantity	Volume of rainwater that can be Collected
1.	Rainwater Harvesting Structures/Pits	13 nos.	35.23 m^3
2.	Rainwater Harvesting Trenches	1111 m	1666.50 m^3
3.	Paver block all-around the buildings	4726 m^2	2126.70 m^3
Total			3828.43 m^3 = **38.3 Lakh Litres**

Source: TNSCB

51. **Green area development/ landscaping**. It is proposed to have landscaping in an area of around 4363.19 m^2, which constitutes 15.04% of the total area. The allocated green space is indicated in the following figure. It is estimated that 15.5KLD of water is required for landscaping purposes which shall be met through usage of the treated water. The master plan presented in Figure 5 shows the green areas proposed at the resettlement site.

52. **Solid Waste Management.** Wastes generated from the households will be segregated into bio-degradable waste and non-biodegradable waste at the source itself (by the occupants) in separate bins. The wastes from such bins will be collected separately on daily basis and taken to a separate centralized collection facility by the Vallam Special Grade Town Panchayat dealing with collection and disposal of garbage (refer Appendix 8). It is also estimated to generate 165kg of sludge waste per day from the STP. This sludge is considered a hazardous waste without treatment. Hence a sludge digester with a digestion tank will be provided in the STP. This will treat the sludge into a dry form, which will be pathogen free. A sludge drying bed with an area of 78.67 m^2 has been earmarked for drying and storage of treated sludge. The treated sludge from the STP will be stored in the sludge drying bed to its maximum capacity, once full capacity is reached, the sludge will be disposed along with the organic waste and it will be collected by the Vallam Special Grade Town Panchayat (refer Appendix 9). The following table illustrates the quantity of solid waste likely to be generated during the operation phase.

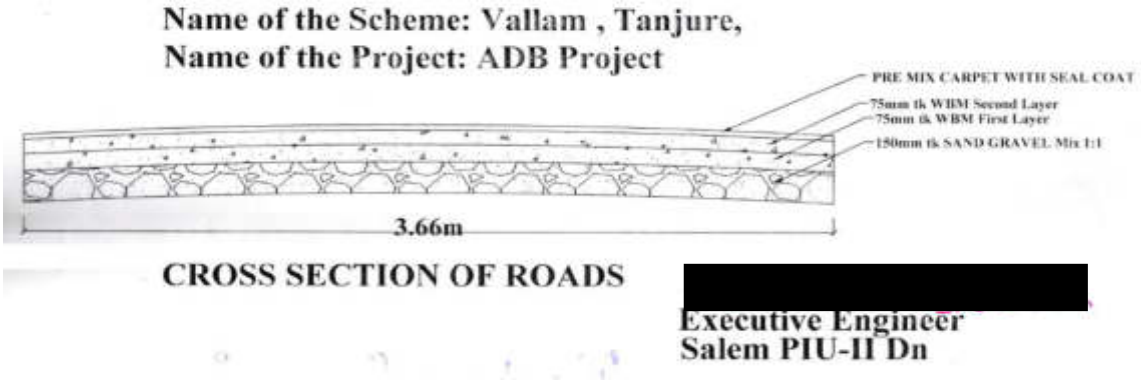
Table 18. Solid Waste Generation at the Resettlement Site

Sl. no	Solid water generation sources	Occupancy load	Per capita Generation (kg/day)	Total Solid waste generation (kg/day)	Total Biodegradable Waste (kg/day)	Total Non-Biodegradable Waste (kg/day)
1	Residential Units	4845	0.6	2907	1744	1163
2	Visitors/ floating population (including the staffs)	484	0.2	97	58	39
3	ICDS	40	0.2	8	4.8	3.2
4	Staff and Visitors (ICDS)	5	0.2	1	0.6	0.4
5	Ration Shop	5	0.2	1	0.6	0.4
6	Convenience Shop	20	0.2	4	2.4	1.6
7	Milk Booth	0.25	0.2	1	0.6	0.4
8	Community Hall	100	0.2	20	12	8
9	Livelihood Centre	80	0.2	16	9.6	6.4
10	Library	2	0.2	0.4	0.24	0.16
11	Health Care	5	0.2	1	0.6	0.4
12	Visitors (LC, LIB & HC)	20	0.2	4	2.4	1.6
13	STP Sludge	-	-	165.0	165.0	0
	Total			**3225.4**	**2000.84**	**1224.56**

Source: Conceptual Plan

53. **Approach Road.** The approach road and internal roads have been designed for 3.66 m width (two lane) which shall have earthen shoulders. The road configuration shall have sand gravel mix (150 mm thickness), Grade II and III water bound macadam (WBM) of 75mm each, which is followed by 20 mm premix carpet.

Figure 12. Typical Cross Section for Approach Road and Internal Roads



54. The proposed unit plan and details with respect to the blocks and other amenities are detailed in the conceptual site plan presented as Figure 5.

C. Proposed Subproject Interventions at the Encroachment Sites Identified for Relocation

55. The following table depicts the proposed interventions for the encroachment sites and the water bodies.

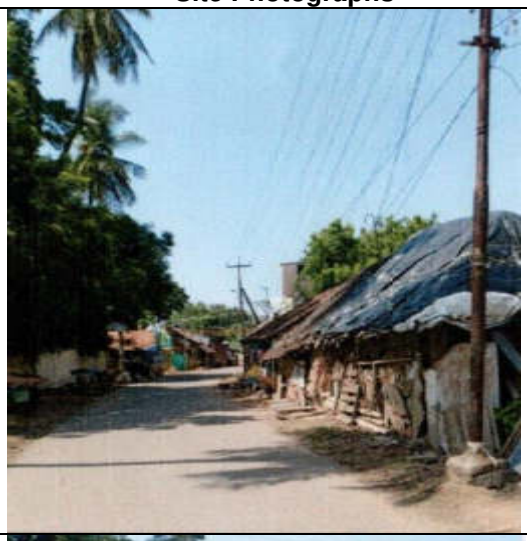
Sl.no	Subproject	Subproject Interventions
1	Demolishing structures located in the encroachment sites (prone to flooding)	• Demolition of 969 structures located in the 4 Encroachment sites (Big Temple Moat) • Fencing to prevent further encroachment • Clearance
2	Water body regeneration	• Clearance • Restoration of water body / Canal, which were encroached • Desilting of the water body/ canal to restore the water storage capacity • Restoring the catchment area • Provision for public parks/ recreation areas as per the community's requirement • Avenue plantation/ landscaping

56. **Existing condition of the encroachment sites identified for relocation.** All the identified encroachment sites (Mela alangam, Vadakku alangam, Kodimarathumoolai and Sekkaditheru) comes under Big Temple Moat site located in the embankment of the water body/ canal in Thanjavur Municipal Corporation. The water body/ canal is encroached by the slum dwellers. Coordinates of the encroachment sites are provided in Table 2 in Chapter 1. A survey

has been conducted at all the sites identified for relocation. The observations from the sites are presented in the following table.

Table 19. Existing Condition of the Slum Sites Identified for Relocation

Sl.no	Location	Observations	Site Photographs
1	Sekkadi theru, (10.79025 N, 79.127403 E)	(i) Encroachments are located closed to the water body/ canal in an unhygienic condition (ii) Encroachers are not having patta (iii) Filling materials has been used for extending the encroachment area in the water body/ canal (iv) Drinking water supply is provided by the Thanjavur Municipal Corporation (v) Thanjavur Municipal Corporation is removing municipal solid waste generated in the encroachment area (vi) Toilet waste water is directly let into the water body/ canal. (vii) Prone to Vector borne diseases (viii) It is informed by the locals that the area is not submerged/ flooded during rainy / monsoon season. However, the Taluk Office, Thanjavur, have declared the encroachment sites is vulnerable for flooding (ix) Public toilet facility is not available (x) Hospitals and schools are located at a distance of 2	 
2	Mela alangam (10.79127 N, 79.127303 E)		

Sl.no	Location	Observations	Site Photographs
3	Vadakku alangam (10.79568 N, 79.133864 E)	to 3km radius (xi) Thanjavur Municipal Corporation is supplying potable water. At some locations even bore well facility has been provided (xii) The nearest Eco sensitive locations are o Vaduvoor Bird sanctuary, which is located at an aerial distance of 26.4km o Karavetti Bird Sanctuary, which is located at an aerial distance of 27km (xiii) The resettlement site (Vallam) is located at a distance of 11.1km by road.	
4	Kodimarathu Moolai (10.79542 N, 79.137421 E)		

57. **Demolition Works.** The 4 encroachment sites are having 969 structures/ dwelling units, which will be demolished manually. The demolished waste shall be disposed in the location identified by the Thanjavur Municipal Corporation. The evicted area shall be fenced, and a monitoring mechanism will be in place to prevent further encroachment. Further revision in the estimated dwelling units in the encroachment sites or change in the approach toward the demolishing activities should be reflected in the IEE and accordingly the EMP also has to be revised.

58. **Regeneration Works.** The catchment area of the water body/ canal, which was encroached shall be regenerated and restored. In addition, the inlet to the water body shall be cleared of obstructions and deepening of the water body shall be done. Based on the assessment, enhancement measures like provision of walkway, recreation area, public park area, children play area shall be explored to make the water body usable to the public. The enhancement measures shall be identified based on the public consultations.

59. **Climate Resilience Measures.** A study on the Climate Change Risk and Vulnerability Assessment (CRVA) for the IRSHUPSP has been conducted for Climate Risks, Climate Adaptation and Climate Finance. As per the study the resettlement site (Vallam) does not have physical constraints such as river flooding, urban flooding and wildfire. This is due to the resettlement site being located away from major rivers and as the site is a dry open area that is

relatively flat with little or no vegetation. However, the site is vulnerable for tropical cyclones. As per the proposed layout, the Vallam resettlement site is designed to have more open space and includes: green belt (16.45%), Thermal building comfort, Energy infrastructure (proposed saving of 10 to 15% of energy), waste water recycling (around 34%), Rain water harvesting, storm water drainage and green belt around the site which contributes to sustainable building credentials. The suggested adaptation measures or mitigation measures are as follows:

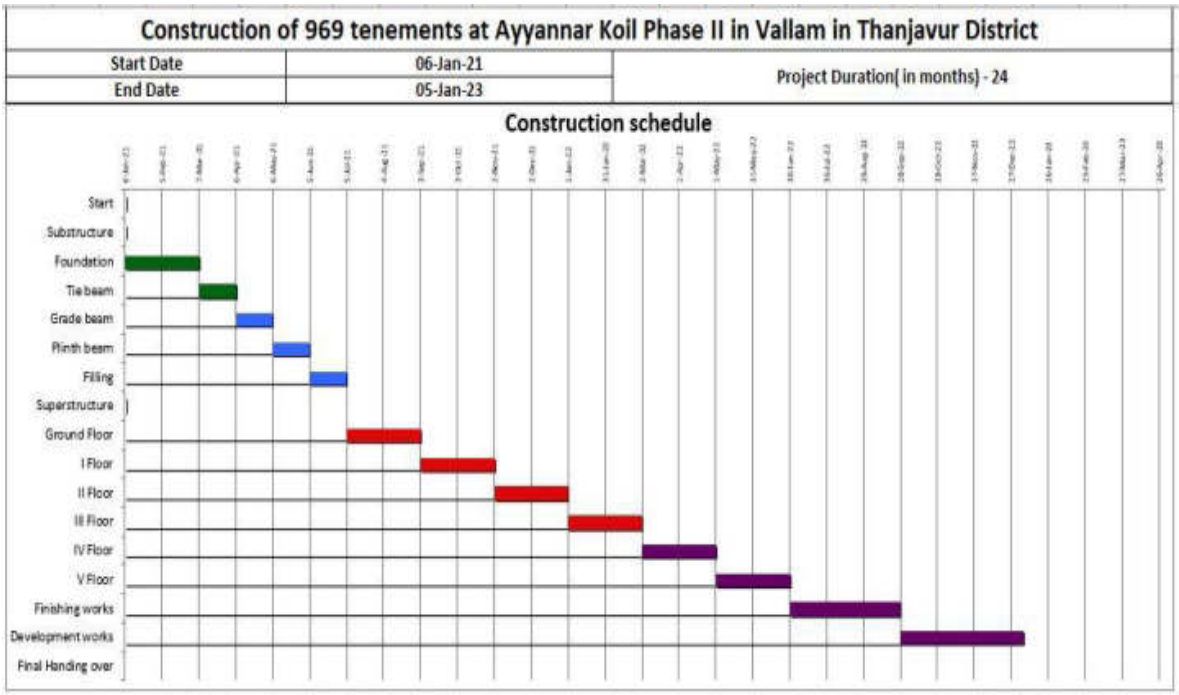
(i) Water Supply
  (a) Level of consumption of water may be lowered further using more water efficient appliances, taps, and showerheads;
  (b) Use drought-tolerant plants to reduce the need for watering the landscaping, increasing water efficiency;
  (c) Community-based messaging/campaigns to promote water efficiency;
  (d) To use swales and ponds on parts of the site for effective rainwater harvesting; and
  (e) To incorporate natural drainage channels and lakes into storm water management plan.

(ii) Provision of green space
  (a) Explore improved shading opportunities for community recreation areas, market and milk booth

(iii) Roads and pavement areas
  (a) Reduce area of impermeable surfaces to minimise run-off.
  (b) Use of pavement materials to ensure resilience to extreme temperatures.
  (c) Use of permeable materials that provide additional cooling benefits.

60. **Project Implementation Schedule.** The construction period for Vallam resettlement site is expected to take 24 months, which will be followed by 5 years of maintenance period. The expected construction schedule can be seen in Figure 13. For demolition works the scheduled time period will be 6 months and for water body regeneration works the scheduled timeframe varies with respect to the type of proposal (water body beautification, embankment strengthening, restoring the catchment area etc.), from the ULB or Municipality. However, based on standard routine activities for water body regeneration works it is expected to take between 6 months to 12 months.

Figure 13: Construction Schedule Bar Chart



IV. DESCRIPTION OF THE ENVIRONMENT (BASELINE DATA)

A. Area of impact

61. The primary areas of impact are (i) sites for proposed project components; (ii) main routes/intersections which will be traversed by construction vehicles; and (iii) quarries and borrow pits as sources of construction materials. The secondary areas of impact are: (i) other than the delineated primary impact area; and (ii) new resettlement site (Vallam).

B. Methodology used for Environment Baseline Study

62. **Data collection and stakeholder consultations.** Data for this study has been primarily collected through comprehensive literature survey, discussion with TNSCB, and field visits to the proposed subproject sites. The literature survey has broadly covered the following:

(i) Project details, reports, maps and other documents prepared by TNSCB;
(ii) Discussions with technical experts of the ADB team, TNSCB, and other relevant government agencies;
(iii) Secondary data from project reports and published articles; and
(iv) Literature on land use, soil, geology, hydrology, climate, socioeconomic profiles, and other planning documents collected from government agencies and websites.

63. **Ocular inspection.** Several visits to the project sites were made during IEE preparation to assess the existing environment (physical, biological, and socioeconomic) and gather information with regard to the proposed sites and scale of the proposed project. A separate socioeconomic study was conducted to determine the demographic information, existing service levels, stakeholder needs and priorities.

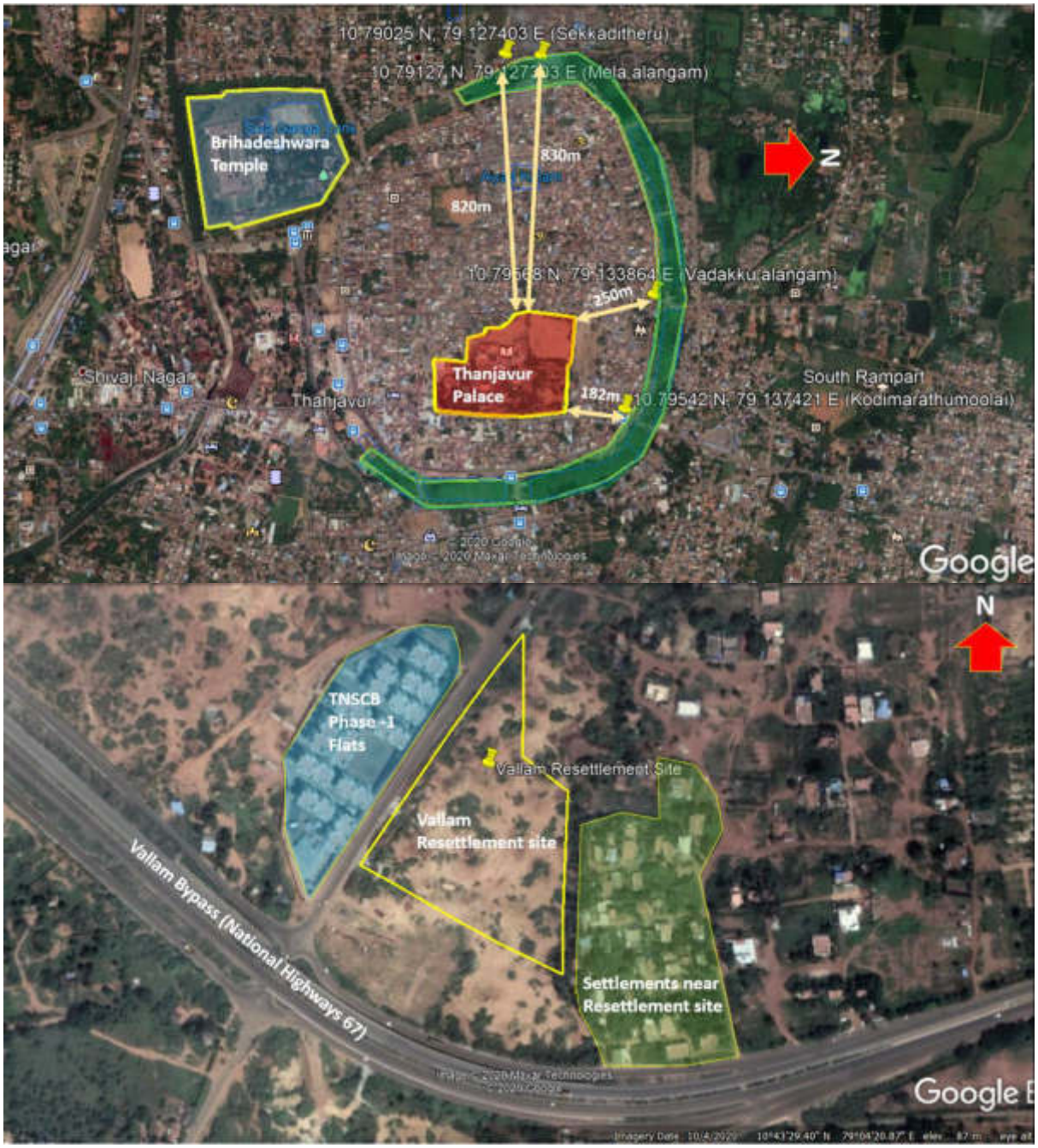
C. Physical Environment

a) Location, Area and Connectivity

64. Vallam (Ayyanar Koil Phase 2) resettlement site is located in Thanjavur Revenue Village of Thanjavur Taluk in Thanjavur District in Tamil Nadu. The geo coordinates of Vallam are 10°43'29.56"N, 79° 4'14.25"E. It is positioned in Vallam Special Grade Town Panchayat, in the outskirts of Thanjavur Town. The resettlement site is surrounded by vacant area in the northern direction, a small settlement (less than 50m) in the Eastern direction, vacant area and NH 67 in the southern direction and Phase – 1 TNSCB apartments in the Western direction (located at a distance of 20m). Total area of the resettlement site is 27,700 m^2 (2.77 ha). The land is owned by Revenue Department, GoTN. Enter Upon permission is given to the TNSCB (Appendix 1). The Big Temple Moat encroachment identified for relocation is located within the boundaries of Thanjavur Municipal Corporation. Coordinates of the slum is given in Table 2 in Chapter 1. Brihadeeswara Temple is located near to the encroachment sites.

65. The resettlement site is well connected by the presence of National Highway 67 (Tiruchirappalli to Nagapattinam) and State Highway 99A. Other interior roads also connect the Resettlement site with Thanjavur Town. The 4 encroachment sites (Big Temple Moat) to be relocated is located within the Thanjavur Town and hence well connected by road network. Thanjavur new bus stand is located 5.37km from the Vallam resettlement site. Nearest railways station to the resettlement site is Alakkudi, at a distance of 6.16 km, however, most of the train's stops at Thanjavur Railway station, which is located 9.3km away from the Vallam resettlement site. Nearest airport is at Tiruchirappalli, 38.2 km away.

Figure 14. Maps Showing Project Area, ASI Monument (Brihadishvara Temple and Thanjavur Palace) & Encroachment site and Vallam Resettlement Site



Source: Google earth Image

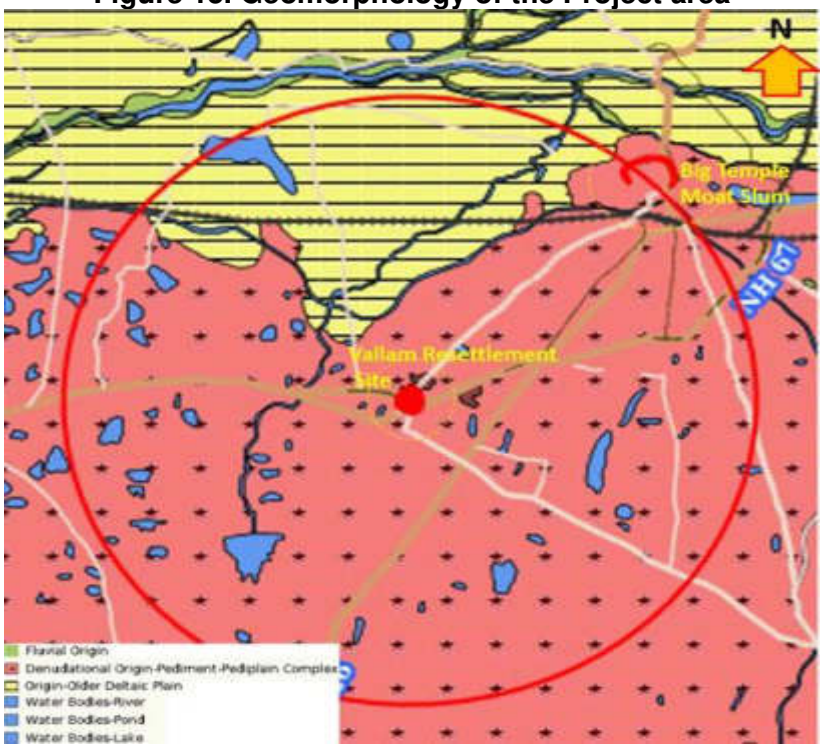
b) Topography, Soils and Geology

66. Thanjavur district is essentially a deltaic terrain with occasional residual hills ranging in elevation between 25 and 45 meters in the western part popularly known as the Vallam table land. It is sloping gently towards the east. The elevation in the resettlement site ranges from 26m to 28m. The various in the elevation is due to the quarry operations, which had led to an undulating terrain.

67. Alluvial soil in the Cauvery delta and Sandy soil in Coastal area are the predominant soil types. The soil type, the climate and rainfall best suit the paddy crop and so the district stands as the rice bowl of Tamil Nadu since ancient days.

68. The geological formation of Thanjavur district is made up of cretaceous, Tertiary and Alluvial deposits and the major area is occupied by the alluvial and tertiary deposits. The cretaceous formations occur as a small patch in West and South-West of Vallam. These formations have a very thick laterite cap consisting of impure lime stones and sand stones of silt, clay calcarious and argillaceous variety, in the coast, these formations are overlaid by Cuddalore sand stone of tertiary age. These sand stones are covered by a thin layer of wind brown sandy clays, unconsolidated sand, clay bound sands and mottled clays with the lignite seams. This tertiary formation is invariably capped by laterite. In the east, the alluvial deposits of the river Cauvery and its tributaries lie over the Tertiary sand stone. They consist of sands, gravelly sands, clays and sandy clays. The thickness of these formations ranges from 30 m to 400 m Sand and Red Earth is the major mineral found in Thanjavur District.

Figure 15. Geomorphology of the Project area



Source: Bhuvan

c) Climate and Rainfall

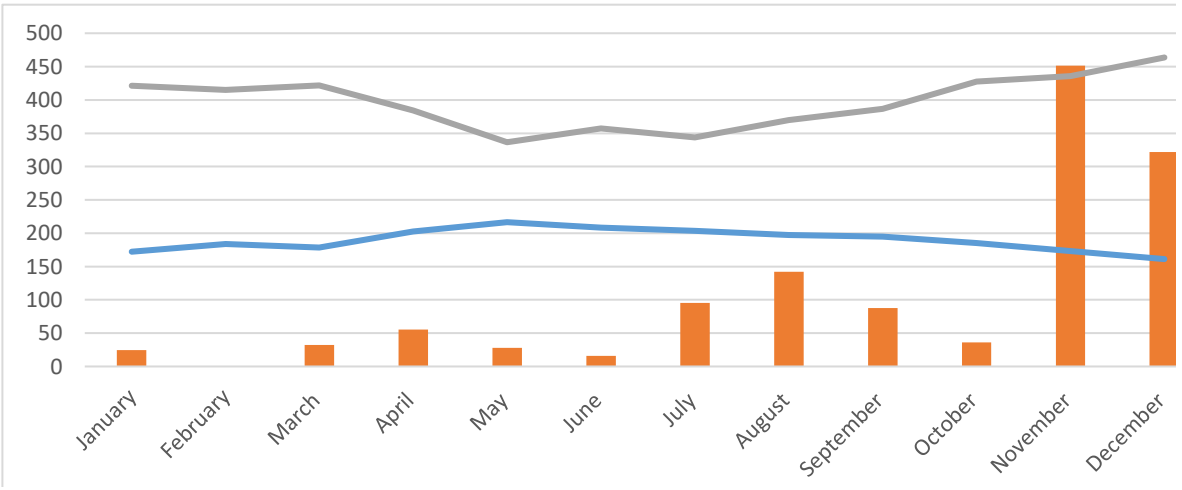
69. Thanjavur district enjoys a tropical, monsoon climate. According to International Zonal Classification by Rengranlous and Gaussen, the district falls under “Class 3 tropical bioclimate” which has been further classified by Legris and Virat under 36th medium tropical category is characterized by monthly temperature always above 27ºC with total annual rainfall varying from 500 mm to 1500 mm with a dry period of 5 to 6 months.

Table 20. Climate and Rainfall Information for Thanjavur District (2018)

Months	Temperature in (C)	Rainfall in (mm)	Humidity in (%)
January	31.0	24.5	75.8
February	33.1	0.03	74.7
March	32.1	32.1	75.9
April	36.5	55.2	69.2
May	39.0	27.9	60.6
June	37.5	15.8	64.3
July	36.6	95.5	61.9
August	35.5	142.1	66.6
September	35.1	87.9	69.6
October	33.3	36.1	77.0
November	31.2	451.4	78.4
December	29.0	322.0	83.5

Source: Department of Economics and Statistics, Chennai

Figure 16. Average Annual Temperature, Humidity and Rainfall



Source: Department of Economics and Statistics, Chennai

70. The temperature rises slowly to maximum during summer season in the month of May then it reduces gradually. The mean maximum temperature ranges from 30°C to 37°C, and the mean minimum temperature from 20°C to 28.45°C. The relative humidity varies between 70 and 85 percent, highest occurs during the months of December to January and the lowest during the month of June.

71. The annual normal rainfall varies partially from 1179 mm (Lower Anaicut) to 763 mm (Budalur). The rainfall is high on the eastern part of the district compared to the western part. The district receives major portion of its annual rainfall during north-eastern monsoon (October

to December). A moderate amount of rainfall is received during the southeast monsoon period (January to September). Since the northeast monsoon rainfall is dominating, its effect is felt on the eastern part of the district (Kumbakonam (698 mm), Aduthurai (611 mm), Lower Anicut (706 mm)). The intensity decreases gradually towards west and the western most part of the district (Thiruvaiyaru (387 mm), Budalur (377 mm)). The city of Thanjavur experiences heavy rain of about 111.37 cm during the rainy season. The rainfall in the coastal area is heavy because of cyclonic storms and depressions formed in the Bay of Bengal.

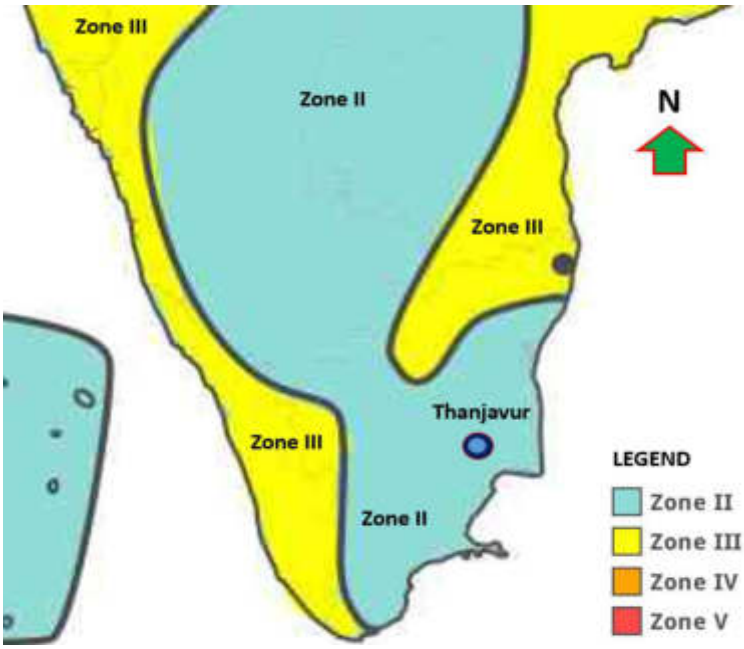
d) Drainage System

72. The district is a part of delta formed by Cauvery River. It has gentle slope towards east and southeast. The Kollidam River forms the northern boundary and flow from west to east. The Grand Anaicut is located at the western boundary, at this point Cauvery splits into Cauvery and Vennar. A regulator at Tirukkatupalli splits Cauvery into Cauvery and Kodamurti rivers. At Thenperumbur anaicut Vennar splits into Vennar and Vettar. In addition to these, the rivers split into many streams before reaching the Bay of Bengal.

e) Seismicity

73. Bureau of Indian Standards, based on the past seismic history, grouped the country into four seismic zones, viz. Zone-II, -III, -IV and –V. Of these, Zone V is the most seismically active region, while Zone II is the least. Vallam resettlement site and the 4 encroachment sites (Big Temple Moat) to be relocated are located in Low Damage Risk Zone II and as per the Modified Mercalli (MM) intensity scale, which measures the impact of the earthquakes on the surface of the earth, the project region is in MSK VI or less which indicates low intensity.

Figure 17. Project Area in Seismic Zones Map

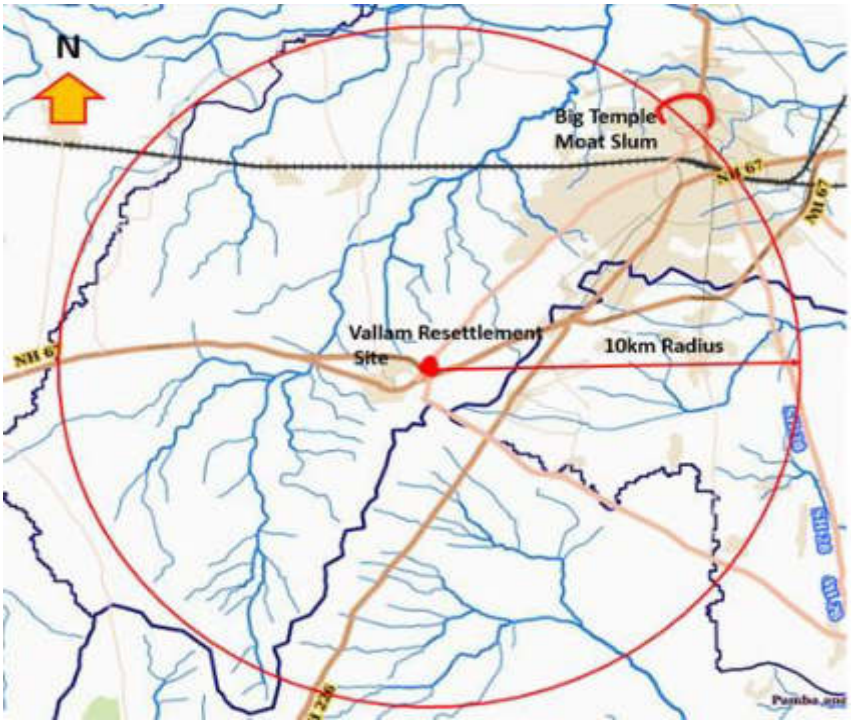


Source: bureau of Indian standards

f) Irrigation and Hydrology

74. Thanjavur district is essentially a deltaic plain comprising of old and new delta. The old delta has a network of canals and channels of the river Cauvery and Vennar. Upper portion of this new delta area is irrigated by Grant Anaicut canal. Tapping of ground water is done considerably in this area to advance the first cropping season Kuruvai to avoid damage due to North East monsoon and to accommodate the two crops namely Kuruvai and Thaladi. The drain pattern in the Vallam (resettlement site) shows a slope towards north direction, where the drains get connected with Vennar River.

Figure 18. Hydrology Map of the Project Area



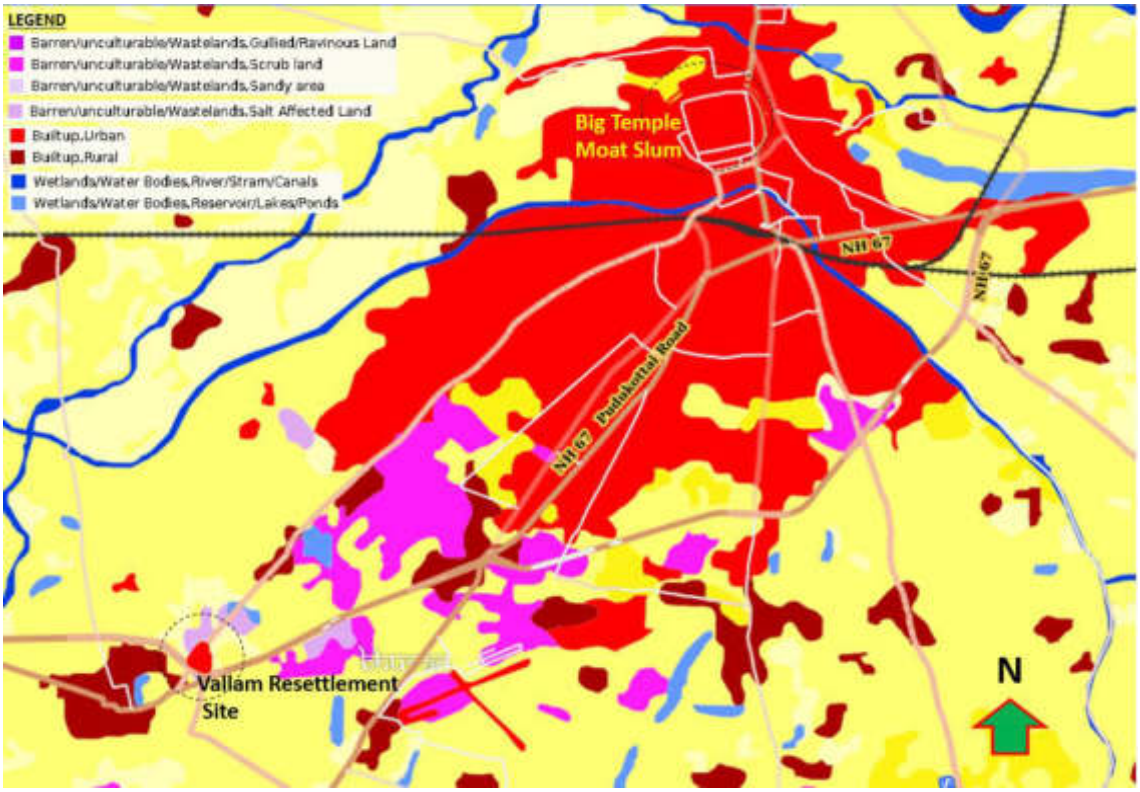
Source: Bhuvan

g) Land Use

75. The land use pattern of the project area (Vallam resettlement site and 4 encroachment sites in the Big Temple Moat to be relocated in Thanjavur Municipal Corporation) has been assessed using Bhuvan[14] landuse map. The slum is located in urban built-up area. The resettlement site is located in Barren\uncultivable\waste land.

[14] Bhuvan, is an Indian web-based utility which allows users to explore a set of map-based content prepared by Indian Space Research Organisation.

Figure 19. Landuse Pattern (Bhuvan Landuse map and Google earth image) of the Subproject Area



Source: Bhuvan

Source: Google Earth Image

h) Surface Water

76. Cauvery River traverses through Thanjavur District, as part of the routine surface water quality monitoring under the MINARS program, various sampling locations has been fixed across the river. The Grand Anaicut and Coleroon sampling locations falls within the Thanjavur District. The outcome of the analysis is given in the Table 21. In comparison with the surface water quality standard (IS 2296:1992), the water quality in Grand Anaicut has been classified under class E, which is suitable for Irrigation, Industrial cooling, controlled waste disposal and the water quality in Coleroon has been classified under class B, which is suitable for Outdoor bathing (organised). As a pre-construction requirement, the Contractor shall conduct surface water quality monitoring and the outcome/ results have to be included in the final IEE under the baseline chapter. The monitored results shall be taken as a benchmark for performing further monitoring during the construction and operation stages.

Table 21. Cauvery River Water Quality-(MINARS - January – 2019)

Sl. No.	Parameters	Units	Grand Anaicut	Coleroon
1.	DO	mg/l	2.5	6.5
2.	pH		8.1	8.3
3.	EC	mhos/ cm	815	10560
4.	BOD at 27°C	mg/l	17	<2
5.	Nitrate	mg/l	0.400	2.430
6.	Nitrite	mg/l	0.018	0.423
7.	Turbidity	NTU	16	20
8.	Total Alkalinity	mg/l	196	402
9.	Chloride	mg/l	110	3349
10.	COD	mg/l	48	352
11.	Nitrogen	mg/l	6	7
12.	Ammonia	mg/l	2	3
13.	$CaCO_3$	mg/l	232	1180
14.	Calcium Hardness	mg/l	46	100
15.	Magnesium Hardness	mg/l	28	226
16.	Sulphate	mg/l	30	214
17.	Total Dissolved Solids	mg/l	572	6144
18.	Total Suspended Solids	mg/l	24	40
19.	Phosphate	mg/l	0.412	0.796
20.	Boron	mg/l	<0.002	<0.002
21.	Potassium	mg/l	12	55
22.	Fluoride	mg/l	1.1	0.7
23.	Fecal Coliform	MPN/ 100 ml	350	110
24.	Total Coliform	MPN/ 100 ml	1600	260

MPN-Most Probable Number
DBU Class-Designated Best Use
A- Drinking Water Source without conventional treatment but after disinfection
B - Outdoor bathing (organised)
C - Drinking water source after conventional treatment and disinfection
D-Propagation of wild life and fisheries
E -Irrigation, Industrial cooling, controlled waste disposal
Below E Not meeting A,B,C,D & E Criteria

Source: Tamil Nadu Pollution Control Board.

i) Groundwater

77. The stage of groundwater development in the district is in the range of 18 to 160%. The groundwater development is minimum in Budalur block and it is maximum in Thiruvidaimaruthur block. The resettlement area (Vallam) is located near to Budalur block and the slum site Big temple moat), chosen for relocation is located in Thanjavur block. However, ground water development in various parts of the district is not uniform or homogeneous. The following table depicts the groundwater development in Thanjavur.

Table 22. Groundwater development in Thanjavur District

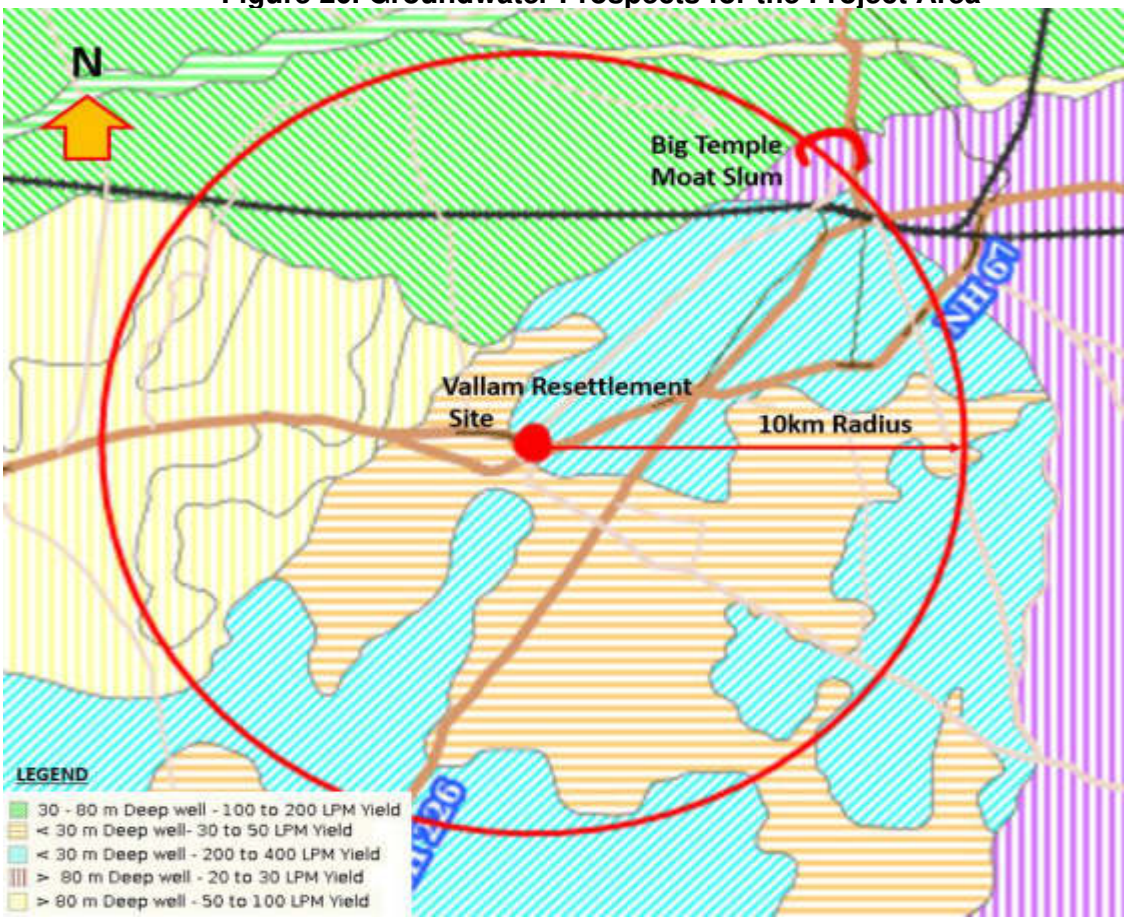
Blocks	Net Ground water availability (Ha. m.)	Existing Gross Draft for irrigation (Ha. m)	Existing Gross draft for domestic and industrial water supply (Ha. M)	Existing Gross draft for all uses (Ha. m)	Allocation for domestic and industrial requirement supply up to next 25 years (Ha. m)	Net ground water availability for future irrigation development (Ha. m)	Stage of ground water development (%)	Category of block
Budalur	7081.58	1094.35	186.18	1280.53	192.34	5794.89	18	Safe
Thanjavur	10453.48	4086.78	285.92	4372.7	295.38	6071.31	42	Safe

Source: CGWB, Thanjavur District Brochure

78. As per the information collected from the National Remote Sensing Centre (BHUVAN), Vallam resettlement site is located in SAFE zone, less than 30m deep well is sufficient to yield 300 to 400 LPM. The Big temple moat encroachment sites (site chosen for relocation) shows more than 80m deep well is required for 20 to 30 LPM yield of groundwater (Refer Figure 15). As an enhancement measure, rainwater harvesting structures for groundwater recharging are proposed at the resettlement site.

79. As per the CGWB groundwater analysis, the groundwater quality of phreatic aquifers in Thanjavur district is, in general, colorless, odorless, and slightly alkaline nature. The electrical conductivity of ground water in phreatic zone during May 2006 was in the range of 279 to 12250 µS/cm and major parts are having the electrical conductivity below 1500 µS/cm at 25°C. It is observed that the ground water is suitable for drinking and domestic uses in respect of all constituents except total hardness, sulphate and nitrate. Around 50 percent samples are having higher concentration of NO_3 than the BIS permissible limit. The incidence of high total hardness of attributed to the composition of lithounits constituting the aquifer in the district, whereas the nitrate pollution is more likely due to the use of fertilizers for agriculture. With regards to irrigation suitability based on specific electrical conductance and Sodium Absorption Ratio (SAR), it observed that ground water in the phreatic zone, may cause medium to high salinity and alkali hazard. Proper soil management strategies are to be adopted while using ground water for irrigation. As a pre-construction requirement, the Contractor shall conduct groundwater quality monitoring and the outcome/ results have to be included in the final IEE under the baseline chapter. The monitored results shall be taken as a benchmark for performing further monitoring during the construction and operation stages.

Figure 20. Groundwater Prospects for the Project Area



Source: Bhuvan

j) Ambient Air Quality and Noise Levels

80. Regular monitoring for ambient air quality and noise levels are not conducted by the TNPCB in Thanjavur. However, the air quality information given in the EIA report for the construction of the Vallam bypass (2014) and its surrounding areas, which is located at a distance of 100 m from the Vallam resettlement site has been taken for discussion. The data shows the oxides of sulphur and nitrogen in the ambient air is well below the ambient air quality standards, however, particular matters (PM_{10} and $PM_{2.5}$) are above the standard level. Dry weather conditions coupled with poor road surface and traffic contribute to the high particulate matter in ambient air. The observed values for particulate matter is higher in comparison with WHO air quality standard.

Table 23: Ambient Air Quality in Thanjavur

Sampling Location	Parameters, mg / m^3			
	PM_{10}	$PM_{2.5}$	NO_x	SO_2
Vallam Bypass	123	65	15	15
Sastra University	112	51	16	11
Assur Industrial Area	255	104	23	17
NAAQ Standard	**100**	**60**	**80**	**80**

Source: EIA – 6 lane widening in Trichy to Nagapattinam Highways (NH 67)

81. Ambient noise levels are observed to be within the noise quality standards. However, in comparison with World Bank Group's Environmental, Health and Safety Noise Level Guidelines, it is observed that the day time noise levels exceeds the stipulated limits of 70 (dB(A)) at Assur Industrial area.

Table 24: Ambient Noise Levels in Thanjavur

Sl.no	Location		Leq Day Time	Leq Night Time
1	Vallam Bypass (commercial)		62.4	53.2
2	Sastra University (Sensitive/ residential)		53.2	42.8
3	Assur Industrial Area (Industrial)		72.1	62.7
Noise quality Standard		Residential	55	45
		Commercial	65	55
		Industrial	75	70

Source: EIA – 6 lane widening in Trichy to Nagapattinam Highways (NH 67)

D. Biological Environment

82. Thanjavur district is very poor in forest wealth. The total forest area of the district is about 1255 ha which represents 0.38 per cent of total area of this district. The forest department have taken initiative for extending the forest areas. According to the latest figures (2015) of the Forest Department, the extent of forests is as follows:

Table 25: Forest Area in Thanjavur District

Sl.no	Forest Type	Forest area (ha)
1	Reserved Forests	3836.03
2	Unclassified Forests	Nil
3	Reserved Lands	68.545

Source: ENVIS, Thanjavur District

83. In Thanjavur district, there are no typical mangrove forests. The vegetation found along the coast comprises mostly Herbs and shrubs, the important species among them are given below.

Sl.no	Local Name	Binomial nomenclature
1	Umari	*Suaeda maritima*
2	Seetha pavalam	*Salicornia brachiata*
3	Yanai nerunji	*Pedalium murese*
4	Mookaratti	*Boerhavia diffusa*
5	Kalapaai kizhangu	*Gloriosa superba*
6	Kandan kathiri	*Solanum surattense*
7	Kudhirai kulambu	*Ipomoea pescaprae*
8	Ravanan misai	*Spinifex littoralis*

Source: ENVIS, Thanjavur District

84. Other common Flora and Faunal species observed in the forest areas are given in the following table.

Table 26: Common Flora and Fauna Species in the Forest Area

Sl.no	Scientific Name	Family	Local name
Trees			
1	*Cassia siamea*	Caesalpinaceae	Manjalkonrai
2	*Carica papaya*	Caricaceae	Pappalli
3	*Cocos nucifera*	Arecaceae	Thennai
4	*Delonix regia*	Fabaceae	Mayilkonrai

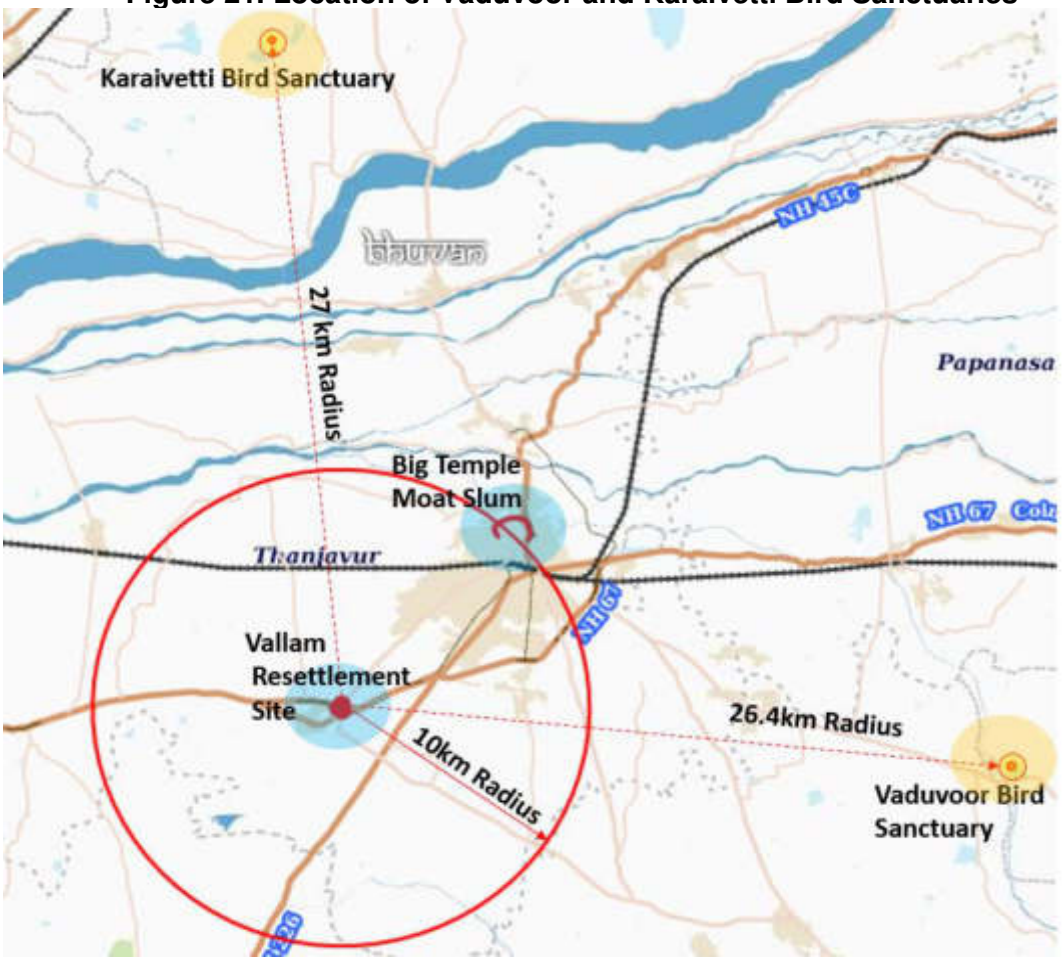
Sl.no	Scientific Name	Family	Local name
5	*Ficus religiosa*	Moraceae	Arasamaram
Herbs			
6	*Barleria prionitis*	Acanthaceae	Cem-mulli
7	*Boerheavia diffusa*	Nyctaginaceae	Pig weed, mukkarattaikeerai
8	*Bougainvillea spectabilis*	Nyctaginaceae	Kaakithapoo
9	*Alternanthera pungens*	Amaranthaceae	Ponnanganni
Shrub			
10	*Calotropis gingantea*	Asclepiadaceae	Erukku
11	*Cassia auriculata*	Fabaceae	Avarai
Climber			
12	*Cissus quadrangularis*	Vitaceae	Pirandi
13	*Cocculus hirsutus*	Menispermaceae	Broom, creeper, kattukkodi
14	*Cucumis sativus*	Cucurbitaceae	Cucumber
Mammals			
15	*Felis chaus*	Felidae	Katu Poonai
16	*Prionailurus rubiginosus*	Felidae	Pulli Poonai
17	*Funambulus palmarum*	Sciuridae	Anil
Reptiles			
18	*Hemidactylus flaviviridis*	Gekkonidae	Mara Palli
19	*Lissemys punctate*	Trionychidae	Maan Aamai
20	*Mabuya carinata*	Scincidae	Aranai
21	*Naja naja*	Elapidae	Nalla Phambu
Birds			
22	*Acridotheres fuscus*	Sturnidae	Myna
23	*Athene brama*	Strigidae	Andhai
24	*Psittacula Krameri*	Psittaculidae	Panchavarna Kili

Source: Thanjavur District Forest Report

85. There are no protected areas, eco sensitive zones or ecologically sensitive areas notified by MoEF&CC within a radius of 10 km from the Vallam resettlement site. Vaduvoor Bird Sanctuary is the nearest protected area to the project area, which is located at a distance of 26.4 km from the resettlement site. Next nearest protected area is Karaivetti Bird Sanctuary, which is located at a distance of 27 km from the resettlement site. Figure 21 shows the location of Vaduvoor Bird Sanctuary and Karaivetti Bird Sanctuary with respect to the project area. This figure also shows the landuse within 25 km of the subproject area.

86. **Vaduvoor Bird Sanctuary**. It is located in Vaduvoor Lake, Mannargudi Taluk, Thiruvarur District, Tamil Nadu. Total land extent of the sanctuary is 128.10-hectare area. The sanctuary is about 25km from Thanjavur and 14km from Mannargudi on the Thanjavur-Kodiakkarai State Highway 63 (SH-63). It was created in the year 1999. The irrigation tank receives water from November to April every year which attracts a numerous foreign bird from Europe and America. The sanctuary attracts more than 40 species of water birds like the White Ibis, Painted stork, Grey Pelican, Pintails, Cormorants, Teals, Herons, Spoonbills, Darters, Coots, Open bill Storks, Pheasant–tailed Jacana etc. The Sanctuary is a favourite spot for the migratory birds and during the months of November and December more than 20,000 birds' visits Vaduvoor Bird Sanctuary.

Figure 21. Location of Vaduvoor and Karaivetti Bird Sanctuaries



Source: Bhuvan

87. **Karaivetti Bird Sanctuary**. It is a 4.537 km^2 protected area located in the Ariyalur District, Tamil Nadu. The sanctuary is a large irrigation tank located in the northern alluvial plains of the Cauveri River. It is fed during the northeast monsoon by the Pullambadi canal. The sanctuary is about 25km from Thanjavur. This lake was declared as a sanctuary in the year 1999 by the Government of Tamil Nadu (Code No. IN268, Criteria: A1, A4i, A4iii). About 200 birds are species recorded from this sanctuary. Karaivetti Bird Sanctuary is home to migratory birds such as Bar-headed goose, Northern pintail, White Stork, Northern shoveler, Garganey, Blue-winged teal, Osprey and common sandpiper. During winter, the total number of birds recorded is between 20,000 and 60,000. Globally threatened species such as Greater Spotted Eagle, Oriental Darter, Black-headed ibis and Spot-billed Pelican were reported in this site. Karaivetti is one of the important active heronries in Tamil Nadu. Spot-billed Pelican, Black-headed ibis, Painted Stork, Oriental Darter, Eurasian Spoonbill are some of the bird's species breeding in this sanctuary. Other fauna inhabit this region are Golden Jackal, Black-naped hare, Indian grey mongoose and nearly 15 species of fish were reported.

88. The Integrated Biodiversity Assessment Tool (IBAT) study (refer Appendix 14) has been conducted for 5 km, 15 km and 25 km radius surrounding the resettlement site to assess the construction related impacts on the biodiversity. The outcome of the IBAT analysis shows the Gulf of Mannar as the nearest sensitive area. This has been cross verified using Google Earth

and observed that the Gulf of Mannar is located at distance of 180km and hence the IBAT outcome is not taken for further assessment.

E. Socio-economic Environment

a) Demographic Profile

89. Big temple moat encroachment sites is located in Thanjavur Municipal Corporation. As per Census 2011, Thanjavur Municipal Corporation has population of 222,943 of which 109,199 are males while 113,744 are females. Population of Children with age of 0 to 6 is 19,860 which is 8.91 % of total population of Thanjavur Municipal Corporation. Female Sex Ratio is of 1042 against state average of 996. Moreover, Child Sex Ratio in Thanjavur is around 940 compared to Tamil Nadu state average of 943. Literacy rate of Thanjavur city is 91.27% higher than state average of 80.09 %. In Thanjavur, Male literacy is around 94.8 % while female literacy rate is 87.92%. Schedule Caste (SC) constitutes 9.22% while Schedule Tribe (ST) were 0.21% of total population in Thanjavur Municipal Corporation. Out of total population, 78,005 were engaged in work[15] or business activity. Of this 60,532 were males while 17,473 were females. Nearly 91.14% were engaged in Main Work while 8.86% of total workers were engaged in Marginal Work.

90. The resettlement site at Vallam is located in Vallam Special Grade Town Panchayat. According to 2011 census. The Vallam Special Grade Town Panchayat has population of 16,758 of which 7,812 are males while 8,946 are females. Population of Children with age of 0 to 6 is 1619 which is 9.66 % of total population. Female Sex Ratio is of 1145 against state average of 996. Moreover, Child Sex Ratio in Vallam is around 846 compared to Tamil Nadu state average of 943. Literacy rate of Vallam Special Grade Town Panchayat is 89.02 % (Male literacy is around 93.51 % while female literacy rate is 85.21 %) higher than state average of 80.09 %. Out of total population, 5,374 were engaged in work or business activity. Of this 4,134 were males while 1,240 were females. Nearly 85.13 % were engaged in Main Work while 14.87 % of total workers were engaged in Marginal Work.

b) Socio-Economic Features

91. The economy of Thanjavur District is essentially from agriculture and allied sector. Above 75% of the workforce have been depending on agriculture. The district is a deltaic plain fed by Rivers Cauvery and River Vennar. Some portion is also fed by Grant Anaicut canal. Ground water has been regenerated considerably to advance the cropping season which may prone to damage during North East monsoon. The major crops cultivated here are Paddy, Pulses, Gingelly, Groundnut and sugarcane. Maize, Soya beans, Redgram are the minor crops grown here.

92. Thanjavur District is well known for its artistic activities like art making, painting, coin manufacturing and bell metal products. These are the major exportable items which also include musical instruments like Veena. The industrial growth in the district has been confined to agro-based industries. A large number of Rice mills, Oil mills and Sugar mills are spread over the district.

93. Thanjavur District is famous for many Handicrafts Items which are unique in characteristic at international level. The Handicraft skill is hereditary and confined to a few families in the

[15] In census survey, worker is defined as person who does business, job, service, and cultivator and labour activity.

District like Thanjavur, Swamimalai and Natchiarkoil. The Crafts include production of Handicraft items like Bronze Icons, Tanjore Art Plates, Tanjore paintings Bell Metal Lamps and Musical Instruments.

94. Bharat Heavy Electricals Limited (BHEL) is a major PSU nearby Thanjavur. Major industrial activities are BHEL ancillary units, Windmill power fabrication, Coir yarn and allied activity, Modern rice mills, Stainless steel vessels production, Brick works, Printing presses etc. Coconut and Fabrication based activity have good potential at present Handlooms, Handicrafts goods making, Carpentry, etc., form major skill-based activities.

c) Cultural and Heritage Sites

95. There is no cultural or heritage sites near the Vallam resettlement site. However, there are two heritage sites (Brihadeeswarar temple and a Place) located near to the big temple moat encroachment sites (site chosen for relocation). The Brihadeeswarar temple is located at a distance of 575 m from Sekkadi and the Thanjavur palace is located at a distance of 182 m from Kodimarathumoolai encroachment sites.

96. **Brihadeeswarar temple**. It is also called as Big Temple, is dedicated to Lord Siva. It was built by the great Chola King, Raja Raja I (985-1012 A.D). It is an outstanding example of Chola architecture. Recognizing its unique architectural excellence, UNESCO has declared it a World Heritage Monument. As per the AMASR Act 2010, the prevailing 300 m (100 m prohibited area and 200 m regulated area) restriction surrounding the ASI monument may not be applicable as the slum site is located at a distance of nearly 400 m. However, during the site visit an old brick wall has been observed, for which TNSCB shall seek help from ASI for further clarifications.

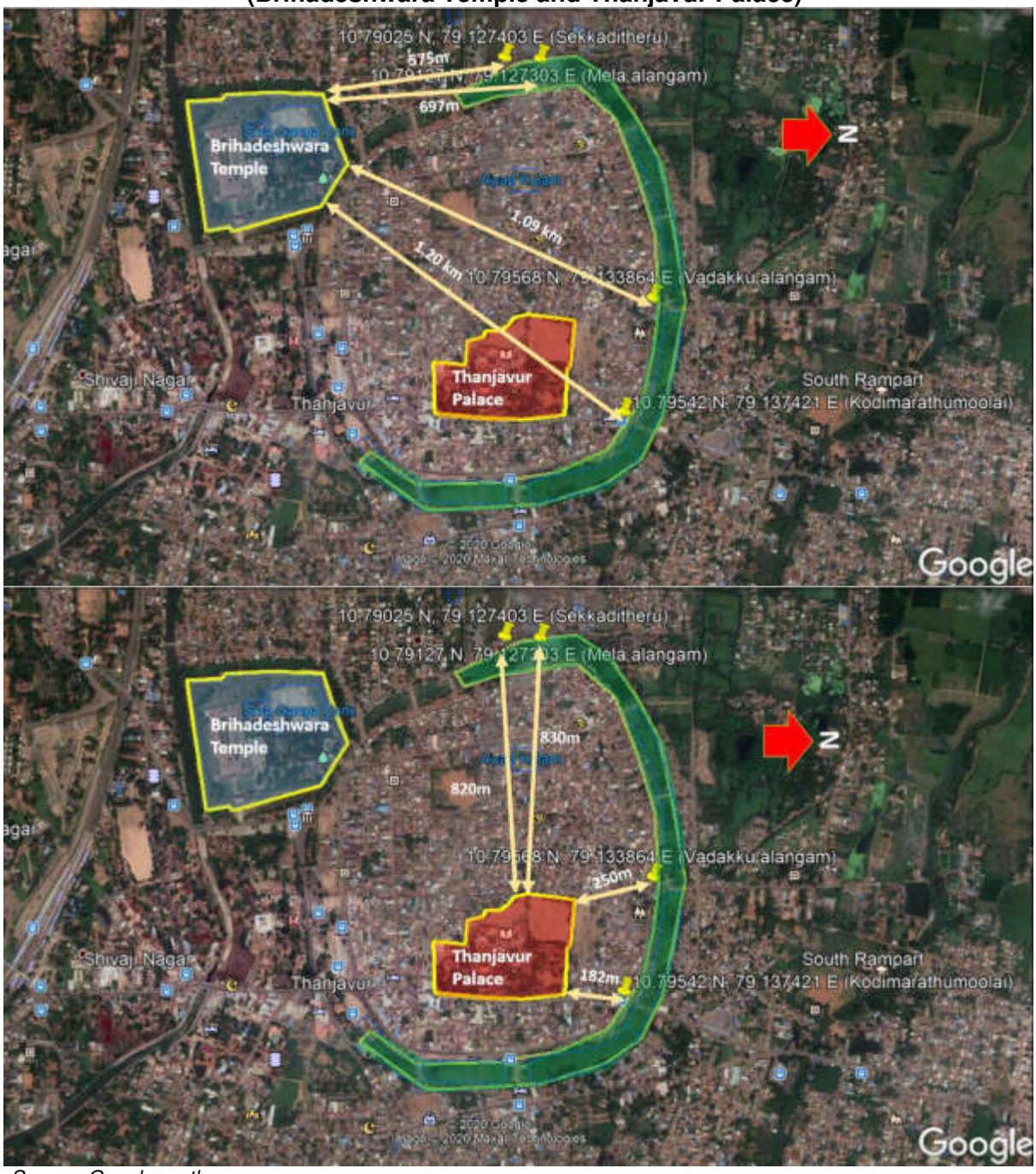
97. **Thanjavur Palace**. Just 1 km away from the Brihadeeswarar Temple is a magnificent palace, surrounded by huge fort walls. Dating back to the 14th century A.D., it was built partly by the Nayaks and partly by the Marathas. The Maratha royal family resided in this palace. It is a fascinating building with huge corridors, spacious halls, decorated rooms, tall observation towers, beautiful stucco works, wonderful fresco painted walls and ceilings, an underground tunnel and intricate carvings. The royal family's sacred "Chandramaulessshwarar Temple" is located within the palace walls.

Table 27: Details of Protected Monuments near the Subproject Sites

Sl. no	Protected Monument	Location	Distance from Resettlement site (in km)	Distance from closest encroachment site (in km)
Protected Monuments				
1	Sadayar Koil	Thiruchinam poondi	22.7	16.0
2	Thanjavur Palace	Thanjavur	10.3	0.18 (Koodimarathu moolai)
3	Brihadeshwara Temple	Thanjavur	8.9	0.57 (Sekkaditheru)
4	Giant granary	Tiruppalaithurai	31.6	22.8
5	Manora	Sarabendraraja pattinam	56.9	60.6
6	Arulmigu Naganathaswamy temple	Manampadi	52.9	63.3

a – nearest (first) encroachment site in the Big Temple Moat
Source: ASI and Department of Archaeology, Government of Tamil Nadu

Figure 22. Distance between encroachment sites (Big Temple Moat) and the Monuments (Brihadeshwara Temple and Thanjavur Palace)



Source: Google earth

98. It is evident from the given information, that none of the protected monuments are in near vicinity to the resettlement site. However, the presence of the big temple (Brihadeshwara Temple) and the palace shall have marginal influence over the encroachment sites, which has to be clarified in discussion with the ASI and as per their suggestions/ recommendations, the EMP have to be updated and adopted during the demolishing activities proposed in the 4 encroachment sites.

d) Infrastructure

99. **Water Supply**. Based on the population of Thanjavur, the demand of water supply is 30.05 MLD. Major sources of Water Supply is the Colleron River. The daily water supply is estimated to be 123 LPCD. The average distribution supply is 2 hours per day. There are 19 Nos of OHTs with 114.75 Lakh Liters Capacity, 142 Nos of Power Pumps and 219 Nos of Mini Power Pumps in Thanjavur Corporation Water Supply System. Thirumanur to Vennar Pumping Station Main Line Length is 19.00 km. The total Distribution Line of this town is 334.70 km. The number of House Service Connection 29,200.

100. **Sewerage.** Under Ground Sewage Scheme was sanctioned as per G.O. MS. No. 720 MAWS Department Dated 30th December 2000. It was commissioned and maintained by TWAD up to March 2015, then it has been handed over to Thanjavur Municipal Corporation. The Total Estimated Household Sewage Connection (HSC) is 30,000 sanctioned. Till date 27,889 connections has been provided. Sewerage Treatment Plant (STP) is located in Samuthiram eri at an area of 42 acres. This treatment plant is designed for 28.05 MLD (ASP method). There are 5 nos. of Pumping Stations, 12 nos. of Lifting Stations, 10,059 nos. of Manholes, 258.79 km Length of UGD Sewer Line and 6.030 km Length of Pumping Main are available in Thanjavur Municipal Corporation area.

101. **Roads.** Totally 302.441 km roads are being maintained by this Thanjavur Municipal Corporation consisting of 250.515 km of BT Road, 48.54 km of CC Road and 3.326 km of WBM Road. All the Roads are maintained by the Thanjavur Municipal Corporation under Tamil Nadu Urban Road Infrastructure Project (TURIP), SRP, Operation & Maintenance Global Financing Facility (GFF) and other Schemes.

102. **Solid Waste Management.** Total 124 MT garbage were generated per day in Thanjavur Municipal Corporation area/ zones. Out of which 116 MT garbage collected through Municipal Corporation Public Health Vehicles. The Corporation is having a compost yard with total area of 20.23 Acres for Solid Waste Management. 225 push carts were being engaged for primary collection of wastes and 20 heavy vehicle and 14 Autos were used for secondary collection. Construction of Sanitary Landfill project at compost yard is partially completed. Construction of New shed and windrows platform is completed. Bio-Methanitation project is completed and ready to put in use.

103. **Transportation.** The resettlement site (Vallam) is well connected to NH 67 and SH 99A. The Thanjavur Old Bus Stand is located at a distance of 10.5 km. Thanjavur New Bus Stand is located at a distance of 5.37km. Thanjavur railway station is located at a distance of 9.3km.

104. **Hospitals.** There are 37 hospitals and seven clinical labs in Thanjavur that take care of the health care needs of the citizens. Of which the Thanjavur Medical College is one of the prominent medical colleges in Tamil Nadu, India. It caters to the medical needs of districts of Thanjavur, Ariyalur, Nagapattinam, Tiruvarur, Perambalur and Pudukkottai.

105. **Educational Institutions.** Thanjavur has four universities including Tamil University and several colleges including the Thanjavur Medical College and RVS Agricultural College. There are also many research centres, including the Paddy Processing Research Centre (Now Indian Institute of Crop Processing Technology) and Soil and Water Research Centre and also have Agricultural college and research institute. Periyar Maniyammai University, Periyar Centenary Polytechnic College, Swami Vivekananda Institute of Management are located within 500m radius from the resettlement site.

V. ANALYSIS OF ALTERNATIVES

106. During project preparation, comprising of screening and design preparation, various alternatives were identified and analysed to help in decision making.

A. With and Without project alternatives

107. The “With” project scenario has positive beneficial impacts on the encroachers living conditions. It will remove encroachments on existing water body/ canal helping to improve the environment and also relocate vulnerable people into areas which are not flood prone and into appropriate housing helping to reduce their risk to disaster and improve their livelihood opportunities. In comparison, the “Without” project scenario can lead to further deterioration of the living conditions and quality of life of the present encroachers while adversely impacting the surrounding environmental conditions. Other factors like infrastructure development, and other project benefits were also taken into consideration in analysing the with and without project scenarios.

B. With Project Scenario

108. The proposed Vallam resettlement project shall have 969 residential units, which will accommodate encroachers from 4 encroachment sites located in the Big temple Moat, who are living at heightened risk of natural hazards due to their encroachment of existing water body/ canal. A number of resettlement sites were investigated with the ultimate location being determined due to its locational advantages and government ownership of land. Thanjavur Town is located at a distance of 11km, which is accessible via State highways (SH 83). There are a number of schools, hospitals and other commercial establishments located in the vicinity that can also be accessed. The resettlement site is designed to have all the essential amenities which includes:

(i) Internal Roads
(ii) Vehicular Parking
(iii) Ration Shop
(iv) Convenient Shop
(v) Milk Booth
(vi) Library
(vii) Security Office
(viii) Motor Room
(ix) Anganwadi centre
(x) Community Hall
(xi) Health sub centre
(xii) Open Space Reserve
(xiii) Sewage Treatment Plant
(xiv) Electric Power supply
(xv) Water Supply
(xvi) Solid Waste Management
(xvii) Rainwater Harvesting
(xviii) Solar Powered Street Lights

109. **Subproject benefits**. The proposed STP will treat the wastewater generated from the resettlement sites and has been designed to recycle the treated water for flushing and gardening purposes, which will reduce the actual water demand and have beneficial impacts on

the environment (through recycling and reuse). Solar powered streetlights have been proposed within the resettlement sites, which will marginally reduce the use of TANGEDCO power supply. Internal roads have been designed with storm water drains that will prevent flooding/ ponding of water within the resettlement site. It is proposed to have rainwater harvesting pits/ structures surrounding the residential blocks as well as in common areas to tap the rainwater to increase the groundwater recharge potential. It is planned to have native floral species in the green area/ landscaping areas. 5 years of periodic operation and maintenance has been proposed.

110. A graduation program shall be conducted for the relocated people to improve self-sustainability and to access to better economic opportunities that will help to improve living standards. This subproject also aims to improve the gender balance and women empowerment by assisting the women in the family, women headed households and elderly people through skill development training programs (under the Tamil Nadu Skill Development Corporation).

C. Without Project Scenario

111. As per the field visits undertaken as part of due diligence, some of the problems associated with encroachers are as follows:

(i) substandard housing and lack of hygiene.
(ii) significant health risks (due to mosquito breeding and spread of vector borne diseases).
(iii) They lack basic facilities like road, electricity and drinking water.
(iv) The illegal nature of housing makes encroachers susceptible to extortion.
(v) They are more prone to disasters like urban floods.

112. **Key Social issues**. It is evident from the site visits, that the 4 encroachment sites (Big Temple Moat) is not provided with a household connection to water supply as a common water tap is provided for the entire community of slum dwellers at a distance of 200m to 300m (min distance). This is a difficult situation especially for women. The 4 encroachment sites do not have basic infrastructure facilities. The quality of life is observed to be below average, as most of them are working as daily labours. The dwelling structures do not have strength to withstand climate hazards (including heavy rain, wind and increase in temperature). The approach roads are too narrow and some of them are without streetlights, which is not safe for the night time road users especially women.

113. **Key Environmental issues**. The catchment area of the water body/ canal has been encroached and as a result the natural drains are closed with the water body/ canal in a dilapidated condition. The water body/ canal area has been covered by wild thorny bushes (refer Table 19) and contains solid waste from the encroachers and the general public. Proper toilet facilities are not available and untreated sewage water is discharged into the water body/ canal which deteriorates water quality and indirectly causes groundwater contamination.

D. Alternate Technology Adopted for STP

114. In general, for regular TNSCB projects, the Decentralized Wastewater Management Systems (DEWATS) has been used for treating wastewater generated from resettlement tenements. Being a conventional treatment system with limitations, the proposed subproject proposes to use the advanced Sequential Batch Reactor (SBR) technology. The following section discusses the pros and cons of these two wastewater treatment technologies.

(i) **DEWATS**. Design uses physical and biological treatment mechanisms such as sedimentation, floatation, aerobic and anaerobic treatment to treat domestic wastewater. DEWATS is designed to be affordable, low maintenance, use local materials. The Typical DEWATS will have four components for treatment (i) Settler, (ii) Anaerobic Baffled Reactor, (iii) Anaerobic filter and (iv) Planted Gravel Filter. Though it has advantages in treating the waste with high efficiency, due to the land constraints for TNSCB in the resettlement sites, this system may not be feasible, because it requires more space, periodic maintenance and expensive.

Table 28: DWATS Salient Features

Sl.no	DWATS Components	Advantages	Disadvantages
1	Settler	simple, durable, underground	need regular de-sludging
2	Anaerobic Baffled Reactor	simple, durable, little permanent space, high treatment efficiency	required large space
3	Anaerobic filter	simple, durable, underground, high treatment efficiency	costly, filter blockage
4	Planted Gravel Filter	high efficiency, no nuisance, no wastewater on ground	need permanent space, requited intensive maintenance with expertise, relatively costly

(ii) **SBR Technology**. SBR aeration system is similar to an Activated Sludge Process (ASP). The major difference is that this SBR uses one tank for all the treatment steps, rather than using different equipment for each step. As the term "sequencing" suggests, SBR uses time, rather than space, to accomplish its wastewater treatment purposes.

The advantages of using SBR include its:

- ability to adapt to different volumes of influent;
- work with automated controls; and
- requiring less space than a system using multiple tanks

The disadvantages of this process are:

- that is necessitates sophisticated controls and timing units; and
- requires more maintenance than conventional systems.

E. Alternative Approaches to the Resettlement site design

115. The following table illustrates various improvements adopted in the design of the Vallam resettlement site.

Table 29: Alternative Approach in Building Plan

Key features	Traditional TNSCB Building Plan	Proposed TNSCB Building Plan (ADB funded)
URBAN DESIGN		
Overall Focus	Cost efficiency, number of units	Quality of life, people centric designs that are future ready (without compromising on cost and number of units)
Site Approach	Design assumes site to be an independent plot of land, often with minimal connection (spatial and programmatic) with the	Integrated, sustainable design solutions

Key features	Traditional TNSCB Building Plan	Proposed TNSCB Building Plan (ADB funded)
	surrounding context	
Environmental Sustainability	Minimal solutions created to respond to the context and environmental sustainability	Providing environmentally sensitive design solutions to ensure minimum carbon footprint, while creating a healthy and comfortable living environment
Inclusive Design	Inadequate consideration of different user groups.	Creating design strategies that focus on vulnerable groups within the community such as children, differently abled, the aged, youth and women
Spatial and Circulation Hierarchy	Hierarchy of spaces absent thereby making the open spaces monotonous	Creating a hierarchy of open and community spaces with appropriate density to support diverse forms of social interactions
	Vehicular movement typically prioritized; vehicular circulation paths also intersect with pedestrian paths creating unsafe environments for the residents	Promoting pedestrian circulation and networks over vehicular circulation in order to create safe spaces for all users; creating safe interactions
Open Space Design	Design approach typically treats open spaces as "left over spaces" rather than integrating them cohesively.	Spatial design that focuses on the design of shared public spaces to nurture harmony of collective action
Landscape Design	Inadequate focus on landscape design	Open spaces that integrate native, natural landscapes that are didactic, productive as well as recreational in their functions
Walkability	Lack of walkable spaces	Promoting Walkability- nodes typically within 3m, 5m and 7m walking radii
Block Arrangements	Standardised block patterns does not create unique identity to the communities	Enhancing a sense of identity and belonging through block design
	Closely placed blocks to optimize efficiency reduces privacy	Design allows for greater distance between blocks where possible and avoids the situation where the longer side of blocks face one another
	Blocks are designed close to each other with less focus on the human scale	Designing blocks that are perceivable for the human scale
Eyes on the Street	Design has leftover/ narrow alleyways/ spaces which are poorly maintained and end up being blighted unsafe regions of the community	Designing neighborhoods such that they avoid redundant areas away from sight which are prone to poor maintenance and blight; activating spaces between buildings and adding value through artwork and other design solutions
Promoting Physical and Mental Well Being	Inadequate attention to open space programming that promotes physical and mental well being	Creating programmatic interventions in open spaces that enable physical and mental recreation for different age groups
		Cater to the physical and emotional needs of different groups of people in the design of spaces
Visual Quality	Minimal visual quality features incorporated in the design	Emphasizing visual quality of spaces through the introduction of nodes, elevation design etc to name a few
BLOCK DESIGN		

Key features	Traditional TNSCB Building Plan	Proposed TNSCB Building Plan (ADB funded)
Block Orientation	Buildings are oriented without critical consideration of site features, daylight and wind paths	Building orientations to be responsive to the site conditions/ context, with a focus on improved interior thermal comfort
Façade Design	Minimal intervention on facade design and almost restricted to the same style across all sites	Enhancing the external appearance of buildings through innovative façade design, with a focus on optimizing O&M costs
Openings	Buildings are designed with minimal openings creating dark and long corridors and un-aesthetic built form; lack of adoption of passive surveillance	Visualising and designing blocks as a product of solids and voids to create spaces for interaction and enhance the quality of the common spaces
Block Length	Blocks accommodate large number of units creating long and dark corridors	Incorporating limited housing units within each block to ensure shorter corridors that help with way finding
Building Heights	Repetitive blocks that creates a sense of monotony	Creating modulated block forms with varying heights to add to the character of the community while adding vibrancy
UNIT DESIGN		
Efficiency	Units are maximised to have maximum efficiency	Carpet area maximised to create a healthy living environment
Space Segregation	Minimal spaces are designed within the units without segregation of spaces	Addition of ante space and balconies to create better circulation and segregation of activities in spaces
		Creating multi-functional spaces to enhance better usage of spaces while not compromising on the sizes
Storage Areas	Minimal storage facilities are provided within the units	Creating multiple storage facilities within the unit for residents to store their personal belongings

F. Outcome based on the analysis.

116. Based on the observation discussed in the earlier sections, the following matrix has been developed to indicate the initiation of this subproject shall bring positive impacts and benefits to the relocated encroachers. It not only fulfils the policy requirement (housing for all) it also increases the living standards of the encroachers (urban poor) and will help to improve environmental conditions for the encroached areas.

Table 30: Outcome of the Analysis of Alternatives

Sl.no	Infrastructure facilities and other amenities	With Project	Without Project
1.	Well-structured Residential Building	✓	×
2.	Internal Roads	✓	✓
3.	Vehicular Parking	✓	×
4.	Ration Shop	✓	×
5.	Convenient Shop	✓	✓
6.	Milk Booth	✓	✓
7.	Library	✓	×
8.	Security Office	✓	×
9.	Motor Room	✓	✓
10.	Anganwadi centre	✓	×

Sl.no	Infrastructure facilities and other amenities	With Project	Without Project
11.	Community Hall	✓	×
12.	Health sub centre	✓	×
13.	Open Space Reserve	✓	✓
14.	Sewage Treatment Plant	✓	×
15.	Electric Power supply	✓	✓
16.	Water Supply	✓	✓
17.	Solid Waste Management	✓	✓
18.	Rainwater Harvesting	✓	×
19.	Solar Powered Street Lights	✓	×

VI. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

117. This chapter on the anticipated environmental impacts and mitigation measures is based on the preliminary detailed design for the Vallam resettlement site and proposed demolition works and water body/ canal regeneration works are based on the consultations had with TNSCB officials. The given information will have to be updated/ revised once the detailed designs are finalized for resettlement site and plans for demolition at the encroachment sites and water body regeneration works are completed.

118. Screening of potential environmental impacts is categorized into four categories considering project phases: location impacts and design impacts (pre-construction phase), construction phase impacts and operations and maintenance phase impacts.

(i) **Location impacts**. Impacts associated with site selection, including impacts on environment and resettlement or livelihood related impacts on communities.
(ii) **Design impacts**. Impacts arising from project design, including the technology used, scale of operations etc.
(iii) **Construction impacts**. Impacts resulting from construction activities including site clearance, earthworks, civil works, etc.
(iv) **O&M impacts**. Impacts associated with the operation and maintenance of the infrastructure built in the project.

119. The proposal envisages (i) construction, operation and maintenance of 969 residential units and essential amenities (large scale construction activity), (ii) demolition of structures in the 4 encroachment sites (located in the Big Temple Moat) chosen for relocation and (iii) restoration of water body/ canal. The construction of residential units along with supporting urban infrastructure and services at Vallam and demolition works at the encroachment sites identified for relocation are located in the adjoining area of the existing buildings and hence this would result in some environmental impacts typical to the construction activities. The land identified for construction of residential units at Vallam belongs to the TNSCB (land alienated from revenue department) and hence it is free from any encumbrances.

120. The site identified for demolition (4 encroachment sites for relocation) are located within the settlement areas. Gaining free access and movement of workers, vehicles and other construction related machinery would be an issue that will be dealt with by obtaining requisite permissions, consultations with affected stakeholders and public information dissemination before commencement of works on site. Identity cards and vehicle permits shall be provided by the contractor for all such movement to and from the construction site. Traffic Management Plan (TMP) should be prepared by the Contractor in consultation with PIDs and affected stakeholders.

121. Other impacts related to construction activities such as generation of dust and noise, removal of construction debris and demolition wastes etc. are envisaged which shall be minimized and addressed by adopting safe engineering practices and appropriate methodology for demolishing works and water body restoration works. Caution will be exercised in planning for safe construction and operations phase to minimize disturbance to the adjoining existing activities. Provision for water for construction will be made through Vallam Special Grade Town Panchayat / TWAD or through mobile water tankers.

122. **Land Acquisition and Resettlement.** As indicated earlier, the land proposed for construction of residential units and associated services (2.77 ha) belongs to TNSCB, similarly the 4 encroachment areas (proposed for demolition) are owned by Thanjavur Municipal Corporation and hence land acquisition is not envisaged. As per the Resettlement Framework

(RF), the proposed categorisation for this subproject is Category “A”, for involuntary resettlement (IR) as it results in physical or economical displacement for 969 Households (HH).

123. **Design Considerations to Avoid Environmental Impacts** The following are design considerations to avoid environmental impacts:

(i) Incorporation of adequate drainage provisions
(ii) Provision for adequate cross ventilation
(iii) Adoption of design compatible with the natural environment and suitable selection of materials to enhance the aesthetic appeal and to blend with the natural surroundings.
(iv) Straight lines and simple geometry in the proposed landscape and architectural features.
(v) Natural tree species in the proposed landscape.
(vi) A separate area has been designated (away from the residential blocks) in the layout plan for managing municipal solid waste generated in the resettlement site
(vii) Ensure water demand can be met sustainably and reused wherever possible. The STP and treated water is proposed to be utilised for flushing and gardening purposes by reducing the water demand.

124. The results of interventions are unobtrusive and will be integral part of the ambience of the site. The physical components have been proposed with minimalist design treatment.

A. Assessment of Environmental Impacts

125. **Determination of Area of Influence**. The primary impact areas are (i) sites for proposed project components; (ii) main routes/intersections which will be traversed by construction vehicles; and (iii) quarries and borrow pits as sources of construction materials. The secondary impact areas are: (i) Other than the delineated primary impact area; and (ii) entire Thanjavur Municipal Corporation in terms of overall environmental improvement.

126. In the case of this subproject the components will involve straight forward construction and operation, and impacts will be mainly localized, short in duration and expected only during construction period.

B. Pre-construction Impacts and Mitigation Measures

127. **Consents, permits, clearances, no objection certificate (NOC), etc.** Necessary consents/NOC as per **Table 5** and **Table 6** will be required during pre-construction phase and before any civil works commence. A copy of Consent/Permission/Clearance/ NoC should be included in the monitoring reports and submitted to the PID and PMU. Failure in obtaining the same will result in delay of work and may lead to stoppage of works.

128. **Mitigation measures**. The following measures will be conducted during the detailed design phase prior to construction for the resettlement site, demolition and regeneration works:

(i) Obtain all necessary consents, permits, clearance, NOCs, etc. prior to start of civil works.
(ii) Acknowledge in writing and provide report on compliance of all obtained consents, permits, clearance, NOCs, etc.
(iii) Prior to the tendering of the demolition and regeneration works contract, TNSCB and Thanjavur Municipal Corporation should consult with ASI to discuss the presence of two encroachment site (Vadakkualangam and Kodimarathumoolai) falling within 300m from the ASI monument (Thanjavur Palace), which are

proposed for demolition and regeneration activities. The outcome of the consultation/ feedback / recommendation shall be minuted and re-incorporated into the IEE and EMP. The demolition and regeneration contractor will have to adopt the relevant EMPs.

(iv) In Sekkaditheru encroachment site, there is a presence of an ancient wall like structure, for which TNSCB should consult with the ASI to seek further clarifications and suggestions, and will be required to prepare a heritage impact assessment and management plan in close consultation and support of ASI which has to be incorporated into the IEE and EMPs prior to the tendering of demolition and regeneration works.

(v) Submission and approval of updated EMP/ SEMP prior to starting of work to the PID with final approval by PMU.

(vi) Include in detailed design drawings and documents all conditions (e.g. the location of the STP should be away from the settlement area and the treated water should meet the discharge standards as per the TNPCB) and provisions if necessary.

(vii) The demolished materials from the Big Temple Moat encroachments should be recycled to the maximum extent possible (3R concept should be adopted).

(viii) For asbestos material disposal, an appropriate inventory has to be carried out and proposed management measures implemented before any demolition activity occurs by the Asbestos Expert/ Environmental Specialist in the encroachment sites. Care should be taken in disposal of the asbestos materials (used as roofing materials) as per the relevant protocols/ hazardous waste management rules 2016 (refer EMP for Asbestos material management).

(ix) In compliance to the Noise Standards, the proposed construction activities should be implemented in a controlled manner, the dB(A) levels for residential area (day time noise level 55 dB(A) and night time noise level 45 dB(A)) should be maintained. In general overnight construction activities including piling works should be prohibited, however, under unavoidable situations, it may be permitted with prior permission from the PID

(x) Pre-construction environmental monitoring as indicated in **Table 36** will be conducted by the Contractor under the supervision of the PID. The outcome of the analysis shall be referred as baseline information for key environs (Air, Water and Noise).

(xi) Conduct consultation with the local communities and provide detail in the language that is understandable to the local community regarding project activities and the anticipated impacts as part of the project information dissemination (prior to the start of the construction and demolition activity).

129. **Utilities**. Interruption of services (water supply, electricity, toilets etc.) will be scheduled and intermittently related to localized construction activities. To mitigate impacts, PIDs will:

(i) Identify and include locations and operators of these utilities in the DPR to prevent unnecessary disruption of services during the construction phase.

(ii) Require contractors to prepare a contingency plan to include actions to be done in case of unintentional interruption of services.

(iii) Require contractor to obtain from the PIDs the list of affected utilities and operators;

(iv) If relocations are necessary, contractors along with PIDs will coordinate with the providers/line agencies to relocate the utility.

(v) Consult with the local communities if there is a need for interruption of services

(especially during the demolition activities)

130. **Social and Cultural Resources**. There is a risk that any work involving ground disturbance can uncover and damage archaeological and historical remains. Though the Big Temple Moat encroachments are located nearby to the Thanjavur Brihadeshwara Temple, which is historically and culturally important monument (It is also recognised as an ASI monument and UNESCO Heritage Site), the demolishing activities do not have an impact on the monument, because as per the AMASR Act 2010, the encroachments are located more than 200m (beyond the Regulated buffer zone). However, Vadakkualangam and Kodimarathumoolai encroachment sites do fall within 300m from Thanjavur Palace, an ASI monument. As such, the PIDs shall:

(i) Ensure the ADB SPS, 2009 requirements are met while dealing with physical cultural resources.
(ii) In Sekkaditheru encroachment site, there is a presence of an ancient wall like structure, for which TNSCB should consult with the ASI to seek further clarifications and suggestions, and will be required to prepare a heritage impact assessment and management plan in close consultation and support of ASI which has to be incorporated into the IEE and EMPs prior to the tendering of demolishing and regeneration works.
(iii) Prior to the tendering of the demolition and regeneration works contract, TNSCB with Thanjavur Municipal Corporation should consult with ASI to discuss the presence of two encroachment site (Vadakkualangam and Kodimarathumoolai) falling within 300m from the ASI monument (Thanjavur Palace), which are proposed for demolition and regeneration activities. The outcome of the consultation/ feedback / recommendation shall be minuted and re-incorporated into the IEE and EMP. The demolition and regeneration contractor will have to adopt the relevant EMPs.
(iv) Continually consult Archaeological Survey of India and/or State Department of Archaeology to obtain an expert assessment of the archaeological potential of the site.
(v) Consider alternatives if the site is found to be of medium or high risk.
(vi) Include state and local archaeological, cultural and historical authorities, and interest groups in consultation forums as project stakeholders so that their expertise can be made available.
(vii) Develop a chance find protocol for use by the construction contractors in conducting any excavation work, to ensure that any chance finds are recognized and measures are taken to ensure they are protected and conserved, this must include stopping work if any suspected cultural heritage item is found.

131. **Site selection of construction work camps, stockpile areas, storage areas, and disposal areas.** Priority is to locate these near the project location. However, if it is deemed necessary to locate elsewhere, sites to be considered will not promote instability and result in destruction of property, vegetation, irrigation, and drinking water supply systems. Residential areas will not be considered for setting up construction camps to protect the human environment (i.e., to curb accident risks, health risks due to air and water pollution and dust, noise, and to prevent social conflicts, shortages of amenities, and crime). Extreme care will be taken to avoid disposals near forest areas or in water bodies.

132. **Site selection of sources of materials**. Significant quantities of bricks, coarse aggregate and fine aggregate will be required for construction works (including the construction works in

the resettlement site as well as water body regeneration works). Contractor should procure these materials only from the quarries permitted/ licensed by Department of Geology and Mining. The contractor should, to the maximum extent possible, procure material from existing quarries, and creation of new quarry areas should be avoided as far as possible. If new quarries are required then the contractor will be responsible for obtaining all permissions and clearances, including environmental clearance for mining. Contractor should factor in the time required for obtaining clearances including conduct of EIA if required under the law. It will be the construction contractor's responsibility to verify the suitability and legal status of all material sources and to obtain the approval of Department of Geology and Mining and local revenue administration, as required.

133. **Erosion control.** Most of the impacts will occur due to excavation and earth movements during construction phase. Prior to commencement of civil works, the contractor will be required to:

(i) Develop an erosion control and re-vegetation plan to minimize soil loss and reduce sedimentation.
(ii) Minimize the potential for erosion by balancing cuts and fills to the extent feasible.
(iii) Identify and avoid areas with unstable slopes and local factors that can cause slope instability (groundwater conditions, precipitation, seismic activity, slope angles, and geologic structure).
(iv) Minimize the amount of land disturbed as much as possible. Use existing roads, disturbed areas, and borrow pits and quarries when possible. Minimize vegetation removal. Stage construction to limit the exposed area at any one time.

134. **Access**. Hauling of construction materials and operation of equipment on-site can cause traffic problems. Construction traffic will access most work areas from the existing roads therefore potential impacts will be of short-duration, localized and can be mitigated. The Contractor will need to adopt the following mitigation measures:

(i) Plan transportation routes so that heavy vehicles do not use narrow local roads, except in the immediate vicinity of delivery sites.
(ii) Schedule transport and hauling activities during non-peak hours.
(iii) Locate entry and exit points in areas where there is low potential for traffic congestion.
(iv) Keep the site free from all unnecessary obstructions.
(v) Drive vehicles in a considerate manner.

C. Construction Impacts and Mitigation Measures

135. The impacts during the proposed construction works are standard and site-specific to the construction activities and are not expected to be significant. The Environmental Management Plans (EMPs) specifies the necessary mitigation measures to be strictly followed by the contractor and supervised by the PIDs. Key impacts during construction are envisaged on the following aspects: (i) transportation of materials, (ii) dust generation, air and noise pollution from construction activities, (iii) sourcing of water for construction activities, (iv) handling of construction materials at site and, (v) adoption of safety measures during construction. However, the prepared EMPs (refer to chapter VIII) should be updated as construction EMPs based on the site conditions by the contractor under the supervision of the PIDs.

136. **Construction Schedule and Method**. As per the detailed design, construction activities in the resettlement site is expected to take approximately 24 months, demolition activities in the

4 encroachment sites shall take 6 months and the water body / canal regeneration works is expected to take 6 to 12 months for completion. The proposed interventions for the resettlement site will be constructed manually with minimum use of machinery and equipment and with necessary safety precautions, for example, barricades around demolition sites, restricting pedestrian and vehicular movements. Noise from demolition works should not exceed the noise standards as set by CPCB. Any damage to surrounding buildings will require work to be stopped immediately and rectified before work can recommence. The materials from the demolishing works will be reused to the maximum extent possible. Materials will be brought to site by trucks and will be stored on unused areas within the project site. The working hours will be 8 hours daily. Night works will be avoided except on an emergency basis or due to high day-time traffic as per prevailing conditions at the time of construction. This shall be further considered by the PID but only in consultation with the local communities.

137. There is sufficient space for a staging area, construction equipment, and stockpiling of materials. However, the contractor will need to remove all construction and demolition wastes on a daily basis.

138. **Erosion Hazards**. The resettlement site at Vallam is located in a gentle slope and hence the risk of erosion is moderate. For the demolition sites, they are located in built-up areas and therefore the risk of erosion is low. However, the contractor will be required to:

(i) Save topsoil removed during excavation and use to reclaim disturbed areas, as soon as it is possible to do so.
(ii) Use dust abatement such as water spraying to minimize windblown erosion.
(iii) Provide temporary stabilization of disturbed/excavated areas that are not active under construction.
(iv) Apply erosion controls (e.g., silt traps) along the drainage leading to the water drains.
(v) Maintain vegetative cover within unused land to prevent erosion and periodically monitor the area to assess erosion.
(vi) Clean and maintain catch basins, drainage ditches and culverts regularly.
(vii) Conduct routine site inspection to assess the effectiveness and the maintenance requirements for erosion and sediment control systems.

139. **Impacts on Water Quality**. There are no surface water sources near the Vallam resettlement site, however, the 4 demolition sites (Big Temple Moat encroachments) are located surrounding the water body/ canal. Therefore, impacts on water quality for the demolishing work site is high. Hence, the Contractors will be required to:

(i) The project sites (including the resettlement site and the water body regeneration sites) are in a water scarce area where the use of groundwater is prohibited for construction purposes, hence the contractor should arrange for water, which shall be either purchased from the Vallam Special Grade Town Panchayat or the TWAD or through mobile water tankers. The agreement and / or MoU has to be shared with the PID. For any other arrangements for the source of water, the evidence of the same has to be furnished to the PID.

(ii) Schedule civil works during non-monsoon season, to the maximum extent possible.

(iii) Ensure drainages within the construction zones are kept free of obstructions.

(iv) Keep loose soil material and stockpiles out of drains and flow-lines.

(v) Avoid stockpiling of excavated and construction materials (sand, gravel, cement, etc.) unless covered by tarpaulins or plastic sheets.

(vi) Conduct periodic Environmental Monitoring to check the water quality as indicated in the Table 36.

(vii) Use silt trap for the surface runoff to prevent sediments entering into the nearby irrigation tank/ water bodies.

(viii) Re-use/utilize, to maximum extent possible, excavated materials.

(ix) Dispose any residuals at identified disposal site (PID will identify approved sites).

(x) Dispose waste oil and lubricants generated as per provisions of Hazardous Waste (Management and Handling) Rules, 1989.

140. **Impacts on Air Quality**. There is potential for increased dust, particularly during summer/dry season due to various construction activities including stockpiling of construction materials. Emission from vehicles transporting construction materials and debris/materials to be disposed may cause increase in air pollutants within the construction zone. These are inherent impacts which are site-specific, low magnitude, short in duration and can be easily mitigated. The contractor will be required to:

(i) Conduct regular water spraying on earth piles, trenches and sand piles.
(ii) Conduct regular visual inspection in the construction zones to ensure that there are no excessive dust emissions.
(iii) Spreading crushed gravel over backfilled surfaces if re-surfacing of disturbed areas cannot be done immediately.
(iv) Maintain construction vehicles and obtain “Pollution Under Control” (PUC) certificate from Emission Testing Centres.
(v) Obtain CtE and CtO for batching plants, crushers, diesel generators, etc., if is to be used in the project from Tamil Nadu Pollution Control Board.
(vi) Conduct periodical environmental monitoring for ambient air as per the Environmental Monitoring Plan (Table 36).

141. **Noise and Vibration Impacts**. The resettlement site is located at a distance of 20 m to a small settlement, in the eastern direction, 50m from the phase 1 resettlement site in the western direction and 500m away from few academic institutions in the northern direction. Hence during the piling works, noise and vibration is expected to have significant impact to the structures. However as per the secondary information[16] on the pile driving on surrounding ground and structures, the vibration impact is expected to impact up to 15m from the core piling area. Hence significant impact on the structures are not envisaged. As much as possible construction shall be done manually with minimum use of machinery and equipment and with necessary safety precautions, for example, barricades around demolition sites, restricting pedestrian and vehicular movements. Noise from demolition works should not exceed the noise standards as set by CPCB. Any damage to surrounding buildings will require work to be stopped immediately and rectified before work can recommence.

142. For the encroached sites, though it is located nearby to the Thanjavur Brihadeeswarar Temple or Big temple (an ASI and UNESCO heritage site), it is located more than 200 m (beyond the regulated zone defined by the ASI), and hence noise and vibration impacts are not envisaged. However, the encroachment sites, Vadakkualangam and Kodimarathumoolai are located within the 300 m buffer from the Thanjavur Palace, which is an ASI monument. As per

[16] Swedish Geotechnical Institute (Effects of Vibrations from Pile Driving on Surrounding Ground and Structures)

the AMASR Act 2010, it limits new construction within 300m of the boundary of the protected monument or sites however it is silent on demolition and regeneration activities. In addition, the at the Sekkaditheru encroachment site, there is a presence of an ancient wall like structure which will require consultation with the ASI. The construction activities (with exemption to piling works at the resettlement site) shall be done manually at the 4 encroachment sites without involving heavy equipment. Nevertheless, the contractors will be required to:

(i) Prior to the tendering of the demolition and regeneration works contract, TNSCB will consult with ASI and any feedback / recommendations shall be minuted and re-incorporated into the IEE and EMP. The demolition and regeneration contractors will have to adopt the relevant EMPs.
(ii) The contractor and PID shall inspect the nearby settlement site located close to the Vallam resettlement site, to assess the likely impacts during the piling operation and based on the assessment, suitable mitigation measures like provision of temporary noise barrier and structural strengthening measures shall be provided.
(iii) For the structures that are weak, appropriate evidence (including video/ photograph) shall be collected from the site prior to any works commencing, for which temporary structural support shall be provided till the completion of the piling works
(iv) Plan activities in consultation with the PIDs so that activities with the greatest potential to generate noise are conducted during periods of the day which will result in least disturbance.
(v) Minimize noise from construction equipment by using vehicle silencers and fitting jackhammers with noise-reducing mufflers.
(vi) Create awareness among drivers not to use horns unless it is necessary to warn other road users or animals of the vehicle's approach.
(vii) Shut off idling equipment.
(viii) Night time construction activities should be avoided, and only be considered on an emergency basis or due to high day-time traffic as per prevailing conditions at the time of construction
(ix) Follow day time ambient noise levels as per Noise Pollution (Regulation and Control) rules and conduct periodical environmental monitoring for ambient noise as per schedules given in the EMP Table 36.
(x) Ensure vehicles comply with Government of India noise limits for vehicles. PUC should be available for every construction equipment and vehicles.

143. **Impacts on Flora and Fauna**. As per detailed design, tree-cutting is not required in the Vallam resettlement site. However, the 4 encroachment sites are observed with few trees, which shall be preserved and will be included in the master plan for the water body / canal regeneration works. This will be reassessed during pre-construction phase. There are no protected areas in the direct and indirect impact zones and no diverse ecological biodiversity is found within the project area (construction and demolition sites) thus there are no significant impacts on flora and fauna. But in general, the Contractor will be required to:

(i) Conduct site induction and environmental awareness.
(ii) Limit activities within the work area.
(iii) Do not remove or harm existing vegetation except those required under proposed contract.
(iv) Strictly instruct workers not to cut trees for fuel wood.
(v) Replant trees in the area using minimum ratio of 10 trees for every 1 tree cut, if

any. Replacement species must be approved by District Forest Department.

144. **Impact due to Waste Generation**. Excavated materials are anticipated in the construction site at Vallam. The materials will be tested for its suitability and it will be recycled as filling material. Similarly, the demolished structures will be reused to the maximum extent possible. Construction activities will produce excess excavated soils, excess construction materials, and solid wastes (such as removed concrete, wood, packaging materials, empty containers, oils, lubricants, and other similar items). These impacts are negative but short-term and reversible by mitigation measures. The contractor will need to adopt the following mitigation measures:

(i) Prepare and implement a Waste Management Plan.
(ii) Manage solid waste according to the following hierarchy: reuse, recycling and disposal. Include designated/approved disposal areas in waste management plan.
(iii) Coordinate with Municipal Authorities for beneficial use of demolished materials or immediately dispose to designated areas.
(iv) Recover used oil and lubricants and reuse; or remove from the sites.
(v) Avoid stockpiling and remove immediately all demolished materials, excess construction materials, and solid waste (removed concrete, wood, packaging materials, empty containers, oils, lubricants, and other similar items).
(vi) Prohibit disposal of any material or wastes (including human waste) into drainage, nallah, or watercourse.
(vii) Any waste that contains asbestos, or is contaminated with asbestos, must be double-bagged, labelled and placed in a covered, locked skip. This includes asbestos sheets, asbestos pipeline, asbestos cement etc. Care should be taken in disposal of the asbestos materials as per the relevant protocols/ hazardous waste management rules 2016 (refer EMP for Asbestos material management).

145. **Impacts on Occupational Health and Safety**. Workers need to be aware of occupational hazards which can arise during proposed construction activities. Exposure to work-related chemical, physical, biological and social hazard is likely to occur during proposed works. Potential impacts are negative and short-term but reversible by mitigation measures. Overall, the contractor should comply with all the mitigation measures as per best international practices which include but not limited to:

(i) Disallow worker exposure to noise level greater than 85 dB(A) for a duration of more than 8 hours per day without hearing protection. The use of hearing protection shall be enforced actively.
(ii) Develop a comprehensive site-specific health and safety (H&S) plan. The overall objective is to provide guidance to Contractor on establishing a management strategy and applying practices that are intended to eliminate, or reduce, fatalities, injuries and illnesses for workers performing activities and tasks associated with the project.
(iii) Include in H&S plan measures such as: (i) type of hazards during excavation works; (ii) corresponding personal protective equipment for each identified hazard; (iii) H&S training for all site personnel; (iv) procedures to be followed for all site activities; and (v) documentation of work-related accidents.
(iv) The working hours will be 8 hours daily. Night works should be avoided, however, it may be considered on an emergency basis or due to high day-time traffic as per prevailing conditions at the time of construction.

(v) Provide H&S orientation training to all new workers to ensure that they are appraised of the rules of work at the site, personal protective protection, and preventing injury to fellow workers.
(vi) Ensure that first aid kit is available at site and it should be easily accessible for all workers in terms of emergency.
(vii) Provide medical insurance coverage for workers.
(viii) Secure construction zone from unauthorized intrusion and accident risks through provision of barriers, guards and warning signs.
(ix) Ensure the core labour standards are adopted (i). Universal and indivisible human rights, (ii) Freedom from forced labour (iii) Freedom from child labour (iv) Freedom from discrimination at work
(x) Provide supplies of potable drinking water.
(xi) Provide clean eating areas where workers are not exposed to hazardous or noxious substances.
(xii) Provide visitor orientation if visitors to the site can gain access to areas where hazardous conditions or substances may be present. Ensure also that visitor/s do not enter hazard areas unescorted.
(xiii) Ensure the visibility of workers through their use of high visibility vests when working in or walking through heavy equipment operating areas.
(xiv) Ensure moving equipment is outfitted with audible back-up alarms.
(xv) Mark and provide sign boards in the construction zone, and areas for storage and disposal. Signage shall be in accordance with international standards and be well known to, and easily understood by workers, visitors, and the general public as appropriate.
(xvi) Prior to any demolition activity an asbestos walk-over will be required to mark any potential asbestos waste and a demolition and handling protocol will be developed. Demolition activity undertaken in these areas will require appropriate PPE to be worn. Any waste that contains asbestos, or is contaminated with asbestos, must be double-bagged, labelled and placed in a covered, locked skip. This includes asbestos sheets, asbestos pipeline, asbestos cement etc. Exposure to asbestos causes Asbestosis (chronic lung disease), hence care should be taken in disposal of the asbestos materials as per the relevant protocols/ hazardous waste management rules 2016 (refer to the EMP for Asbestos material management)
(xvii) **COVID-19.** WHO has declared COVID-19 as a pandemic which has affected the entire world including India. In view of the prevailing COVID-19 pandemic, the contractors and workers would need to take additional measures to avoid the spread of the disease and shall follow various guidelines/guidance notes issued by the national/state government, WHO, ILO, World Bank/IFC from time to time. As described in these guidelines, the contractors shall undertake a COVID risk assessment of project area and prepare a COVID Response and Management Plan (C-R&MP) and submit to TNSCB for approval. A brief guidance on “To Do” List prepared from these documents is provided in Appendix 15.

146. **Impact on Associated Infrastructure facilities**. The estimated water demand of 676 KLD of water shall be supplied by the TWAD. The water will be sourced from pumping main near Manakkarambai Village, which is located at a distance of 18 km from the Vallam Resettlement Site. It is arranged through gravity for which pipeline shall be laid for a distance of 18 km. The pipeline laying activities shall have direct air and noise impacts to the public. Being an associated activity to this subproject, once detailed design information is available, the PID environmental specialist shall prepare the EMP in accordance with ADB SPS with assistance

from the PMU environmental specialist. Accordingly, this IEE and EMPs will need to be revised and submitted to ADB for concurrence. The prepared EMP will need to be adopted by the contractor, who undertakes the pipeline laying works. This EMP shall be monitored and reported by both TWAD and PID. The key observations should be reflected in the quarterly project progress reports and quarterly safeguard reports to ADB.

D. Post-Construction Impacts and Mitigation Measures

147. **Site clean-up after construction activities (including resettlement site, demolishing sites and water body regeneration site)**. The Contractor will be required to:

(i) Backfill any excavation and trenches, preferably with excess excavation material generated during the construction phase.
(ii) Use remove topsoil to reclaim disturbed areas.
(iii) Re-establish the original grade and drainage pattern to the extent practicable.
(iv) Stabilize all areas of disturbed vegetation using weed-free native shrubs, grasses, and trees.
(v) Restore staging areas and temporary work areas.
(vi) Remove all tools, equipment, barricades, signs, surplus materials, debris, and rubbish. Demolish buildings/structures not required for O&M. Dispose in designated disposal sites.
(vii) Request in writing from PIDs that construction zones have been restored.
(viii) Solid waste (debris, excavated soils, etc.) from the demolishing sites and restoration of water body site should be disposed by the contractor as per the guidance of the Environmental specialist of PIDs.

148. **Operation and maintenance activities**. The PIDs in support from the service providers will operate and maintain the infrastructure facilities at the Vallam resettlement site and Thanjavur Municipal Corporation shall maintain the restored/ regenerated water body/ canal. The maintenance activities at Vallam resettlement site include:

(i) Rainwater Harvesting Pit management.
  (a) Regular inspection and cleaning of catchment, gutters, filters and tanks to reduce the likelihood of contamination.
  (b) Water from other sources should not be mixed with that in the tank.
  (c) TNSCB will carry out routine management of the RWH pits.

(ii) Management of the STP
  (a) For initial 5 years, the construction contractor shall maintain and operate the STP. Thereafter a separate Contractor shall be engaged for operation and maintenance of STP. During the operation, the STP will be operated by a skilled operator, who will be required to wear all the essential PPE's (including but not limited to gloves, masks, safety shoes and safety eyewear) to safeguard themselves from any hazards likely occurring from the STP.
  (b) TNSCB/ Vallam Special Grade Town Panchayat will carry out regular inspection of the STP to prevent any impacts, including pollution of ground water and nearby water courses.
  (c) The sludge generated from the STP shall be further treated in the sludge digester tank (anaerobic sludge digestion) in the STP to digest the sludge into dry sludge. The treated sludge shall be stored in the sludge drying

bed and when it reaches its maximum capacity it will be disposed of along with organic waste generated from the resettlement site. The treated sludge shall be as per compost quality standard given in the Solid waste management rules 2006 (schedule II A, standards for composting) for which the O&M contractor/ service provider shall perform scheduled monitoring as suggested by the Environmental specialist from PID.

(iii) Maintenance of sanitation facilities, solid waste collection and regular maintenance of constructed amenities. TNSCB/ Vallam Special Grade Town Panchayat will carry out maintenance of the sewer system (including the pipeline, collection system etc.), carry out the regular collection of wastes, and will also ensure that:

(a) Sanitation facilities do not result in pollution of groundwater.
(b) Sanitation facilities do not interfere with other utilities and block access to buildings, causing nuisance to neighbouring areas.
(c) Municipal Solid Waste will be segregated as organic waste and inorganic waste. Both organic and inorganic waste shall be collected by the Vallam Special Grade Town Panchayat, organic waste will be composted in the vermicomposting / biodegradation process and will be used a manure. The inorganic waste will be disposed off in the MSW dumping area.
(d) No spillage will happen during the transfer of waste and all wastes will be transported to a designated solid waste treatment site.
(e) Staff collecting the MSW will be provided with necessary PPE's (including gloves, masks and boots).

(iv) Fire fighting equipment's including the fire extinguisher and sand buckets has to be regularly maintained. Fire extinguishers have to be regularly checked for the expiry date and has to be refilled or replaced as required prior to the expiry date. Any wet sand (if any) in the bucket should be replaced with dry sand.

(v) Other amenities including landscaping, children play area and streetlights shall be handed over to Vallam Special Grade Town Panchayat for maintenance and operation

VII. INFORMATION DISCLOSURE, CONSULTATION AND PARTICIPATION

A. Consultation and Participation

149. The active participation of stakeholders including local community, NGOs/CMROs, etc., in all stages of project preparation and implementation is essential for successful implementation of the project. It will ensure that the subprojects are designed, constructed, and operated with utmost consideration to local needs, ensures community acceptance, and will bring maximum benefits to the people. Public consultation and information disclosure is a must as per the ADB policy.

150. Most of the stakeholders have already been identified and consulted during preparation of this IEE, and any others that are identified during project implementation will be brought into the process in the future. Primary stakeholders of the subproject include vulnerable communities/ residents, shopkeepers and petty shop business people living along the water bodies, government and utility agencies responsible for provision of various services in project area, community representatives, TNSCB and ADB.

151. COVID-19 has prevented further planned consultations with affected people at the 4 encroachment sites and around the resettlement site. Further formal consultations are expected to be held prior to construction and will be incorporated into the draft IEE.

B. Public Consultation

152. The public consultation and disclosure program is a continuous process throughout the project implementation, including project planning, design and construction.

a) Consultation during Project Preparation

153. Several formal/informal consultations with each stakeholder to understand issues and cross cutting themes have been conducted. The table below lists out various meetings/ discussions between various stakeholders conducted till date.

Table 31: Meetings/Discussions between various stake holders

Sl.no	Date	Stakeholder Department	Details
1	12th March 2019	Directorate of Town and Country Planning (DTCP)	Consultation was conducted with Mr. Krishna Moorthy, Deputy Director of Town and Country Planning. The following key points were discussed • Various planning options in determining the land use and its categorisation has been discussed in detail • The preparation of the landuse map across Tamil Nadu was explained to the ADB team
2	5th December 2020	Tamil Nadu Pollution Control Board (TNPCB)	Consultation was conducted with Dr. S. Selvan, Chief Environmental Engineer, TNPCB and Mr. R. Ramasubbu Joint Chief Environmental Engineer. The followings are the key outcome of the meeting. • Disposal of Construction and Demolition waste: Various policies and regulations adopted by the TNPCB has been discussed. It was informed that Permissions/ NoC from the TNPCB is required, if

Sl.no	Date	Stakeholder Department	Details
			the construction and demolishing waste (C&D) is equal to or greater than 20 tons per day or 300 tons per project in a month. • Environmental clearance for the subprojects: TNPCB informed that based on the built-up area the project will be categorised as either A or B. It was also indicated that since the built-up is less than 150,000 m^2, the Vallam subproject will be categorised as 8B, which requires an Environmental Clearance from the SEIAA. • Storage and handling of Hazardous materials: It was informed that a licence is not required for storing of Diesel, if the total quantity in possession does not exceed 2500 litres in non-bulk (i.e. drums) or 1000litres in a receptacle / tank (i.e. bulk) • Sewage Treatment Plant: TNPCB mandates the need for a STP in the resettlement site, it was informed that the project owner/ project proponent can choose any available technology for treating the wastewater, however the treated water quality parameter should met the stipulated limits prescribed by the CPCB. • Solid waste management: it was informed that all the corporations/ municipalities/ town panchayats are facilitated with appropriate waste collection, handling, transport and disposal system and hence it shall be managed by the ULB's. However, the handling of waste should be as per the Municipal Solid Waste Management Rules, 2016
3	5th December 2020	Adyar River Restoration Trust	Consultation was conducted with Dr. S. Viswanathan, Senior Environmental Scientist. The procedures/ methodology adopted in restoration of the Adyar River Estuary (Adyar Poonga) has been discussed in detail. • The resettlement issues in evacuating the encroachers from the estuary area and allocation of the resettlement sites for the project affected persons. • Compensation measures adopted including livelihood assistance, transportation allowances and other provisions are discussed in detail. • Restoration of the water body and its challenges. • Restoration of the mangroves in the estuary area. • Monitoring and reporting system for the biodiversity in the Adyar estuary area.
4		Archaeological Survey of India (ASI)	To be completed once meeting with ASI is conducted and meeting minutes are obtained.

b) Consultations with the Affected Community

154. Informal focus group discussions (FGDs) were carried out at encroached sites (sites chosen for relocation). At the time of FGD's the information pertaining to entitlement and

compensation were still under preparation. Hence information dissemination about the subproject was only partially done. It was planned to conduct further formal consultations along with the social surveys, however due to the ongoing COVID 19 pandemic, the planned consultation did not go ahead. As such, whenever the situation is under control and it is safe to do so, further planned consultation shall be conducted by the TNSCB at the 4 encroachment sites and around the resettlement site. Accordingly, this consultation section will be updated and the revised IEE should be submitted to ADB for concurrence. Some of the common concerns of the PAPs expressed during the FGDs have been outlined below:

(i) Lack of basic facilities including water supply, street lights and proper approach roads;
(ii) Flooding issues during monsoon season;
(iii) Encroachers have resided at the same place for 30 years;
(iv) Patta is not available for the encroachers;
(v) Proper toilet facilities (provided with septic tank) are not available;
(vi) Most residents work as daily labours and housemaid workers;
(vii) Schools/ educational institutions, hospitals are located in accessible distances;
(viii) Some of the houses are provided with bore well facility. Others have to depend on the water supply from Thanjavur Municipal Corporation;
(ix) Some encroachers showed willingness to relocate, but some have shown their unwillingness for relocation.

Snap Shots from the Consultations conducted at Big Temple Moat Encroachment sites

c) Consultation during construction

155. Prior to start of construction, PIDs will conduct information dissemination sessions and further consultations (that have been prevented due to COVID-19) at various places (including at 4 encroachment sites and around the vallam resettlement site) and solicit the help of the local community, leaders/prominent for the project work. Focus group meetings will be conducted to discuss and plan construction work with local communities to reduce disturbance and other impacts and also regarding the project grievance redress mechanism. Project information and construction schedule will be provided to the public via mass media (newspapers, television, ULB websites etc,). Attendee list and meeting outcomes will be recorded and included in the revised IEE to be submitted to ADB for concurrence. A constant communication will be established with the affected communities to redress the environmental issues likely to surface during construction phase. Contractor will provide prior public information (in Tamil and English) about the construction work in the area, once 7 days prior to the start of work and again a day before the start of work via pamphlets. At the work sites, public information boards will also be provided to disseminate project related information.

C. Information Disclosure and Future Consultations

156. Executive summary of the IEE will be translated in Tamil and made available at the offices of TNSCB, PIDs and also displayed on their notice boards. Hard copies of the IEE will be accessible to citizens as a mean to disclose the document and at the same time creating wider public awareness. Electronic version of the IEE in English and Executive Summary in English and Tamil will be placed in the official website of TNSCB after approval of the IEE by ADB. Stakeholders will also be made aware of grievance register and redress mechanism.

157. Public information campaigns to explain the project details to a wider population will be conducted. Public disclosure meetings will be conducted at key project stages to inform the public of the progress and future plans. Prior to start of construction, the PIDs will issue notification on the start date of implementation in local newspapers. Subproject information brochure/ pamphlets will be issued to the local communities for better understanding, the brochure/ pamphlets shall include the EMP cost. A board showing the details of the project will be displayed at the construction sites for the information of general public. Local communities will be continuously consulted regarding location of construction camps, access and hauling routes and other likely disturbances during construction.

VIII. GRIEVANCE REDRESS MECHANISM

158. The PMU will ensure that (a) local level project safeguards GRM acceptable to ADB is established in accordance with provisions and within timeframes specified in the EMP and RP to consider safeguards related complaints; and (b) a task force is functioning effectively to:

- (i) Review and document eligible complaints of project stakeholders;
- (ii) Proactively address grievances;
- (iii) Provide the complainants with notice of the decisions made;
- (iv) Prepare periodic reports to summarize:
  - (a) the number and types of complaints received and resolved at all levels;
  - (b) chosen actions and time required for resolution; and
  - (c) final outcomes of the grievances; and
  - (d) Make the reports available to ADB as part of the regular Safeguards Monitoring Reports.
- (v) Eligible complaints will include
  - (a) those related to the project activities,

(b) any of the service providers,
(c) any person responsible for carrying out the project,
(d) complaints on misuse of funds and other irregularities, and
(e) grievances due to any safeguards, labor and gender issues.

159. The PIDs (Environment / Social Cell) will establish a common GRM acceptable to ADB at divisional levels for addressing any environment and/or social issues that arise due to subproject activity. The GRM will constitute a suitable systematic process to receive, evaluate and facilitate resolution of affected persons and other stakeholder's complaints and grievances about subproject environmental (and social) safeguards performance. It will aim to provide a time-bound, trusted and transparent mechanism to voice and resolve issues and concerns associated with the subproject implementation.

160. Public awareness campaigns in the project area of influence will ensure that knowledge of the grievance redress procedures is generated. The PIDs (Environment / Social Cell) will conduct awareness campaigns to ensure that all affected persons and vulnerable households are made aware of grievance redress procedures, entitlements and anticipated environmental impacts.

161. Affected persons will have the flexibility of conveying grievances/suggestions by dropping grievance redress/suggestion forms in complaints/ suggestion boxes to be installed by the PIDs (Environment / Social Cell) or by writing in a complaint register in the PID office or by e-mail, or by registering complaints as per the PMU's existing grievance redress mechanism). Careful documentation of the name of the complainant, date of receipt of the complaint, address/ contact details of the person, location of the problem area, and how the problem was resolved will be undertaken. The PID (Environment / Social Cell) officers will have the overall responsibility for timely grievance redress on environmental and social safeguards issues and for registration of grievances, related disclosure, and communication with the aggrieved party. The proposed template of a grievance registration form is provided in Appendix 16. All the documents made available to the public will include information on the contact number, address and contact person for registering grievances, and will be disseminated throughout the project area of influence by the PIDs (Environment / Social Cell).

162. **Proposed GRM**.[17] In case of grievances that are immediate and urgent in the perception of the complainant, the on-site Contractor/Animator/Community Officer / Assistant Engineer / Junior Engineer from PID (Environment / Social Cell) will provide the most easily, accessible or the first level of contact for the quick resolution of grievances. Contact phone numbers and names of the concerned staff and contractors, will be posted at all construction sites in visible locations.

(i) **1st level grievance**: The on-site contractor/ Animator/ Community Officer/ Assistant Engineer or Junior Engineer of the PID (Environment / Social Cell) will receive and record the complaint at the subproject site. Alternatively, the complaint can be registered by phone call, message, email, or on the TNSCB website and this will be reverted to the onsite personnel for 1st level resolution. The complaint will be reviewed and on-site Contractor/Animator/Community Officer / Assistant Engineer / Junior Engineer of the PID (Environment / Social

[17] Any IRSHUPSP specific grievance which comes in through TNSCBs existing system (refer to Section 3) will be routed back to the project specific GRM to level 1.

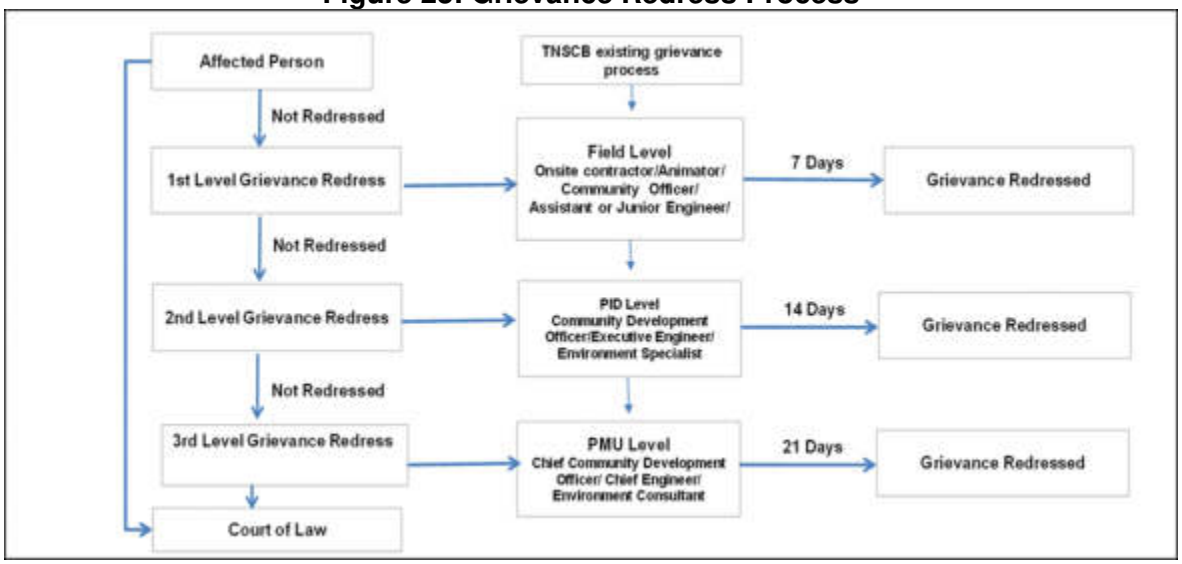
Cell) will try to resolve the issue on-site in consultation with the aggrieved party. This will be done within 7 days of receipt of a complaint/ grievance.

(ii) **2nd level grievance**: All grievances that cannot be redressed within 7 days at the field level will be brought to the notice of the Community Development Officer of the PID and the Environment Specialist of the Environment Cell and the Executive Engineer in the PID. The PID Community Development Officer / Environmental Specialist of the Environmental Cell / PID Executive Engineer (PID Head) will resolve the grievance within 14 days of receipt of a complaint/ grievance with support of the PIU Circle Superintending Engineer.

(iii) **3rd level grievance**: If the grievance is not resolved at PID Community Development Officer / Environmental Specialist/ Executive Engineer (PID Head) level, the grievance will be referred internally to Chief Community Development Officer / Environmental Consultant of PMU / the Chief Engineer of IRSHUPSP. The grievance at this level will be resolved within 21 days of its receipt. All resolutions shall be communicated to the aggrieved party / complainant(s).

163. The project GRM notwithstanding, an aggrieved person shall have access to the country's legal system at any stage. This can run parallel to accessing the GRM and is not dependent on the negative outcome of the GRM.

Figure 23: Grievance Redress Process



164. In the event that the established GRM is not in a position to resolve the issue, the affected persons can also use the ADB Accountability Mechanism by directly contacting (in writing) the complaint receiving officer at ADB headquarters or the ADB India Resident Mission. The complaint can be submitted in any of the official languages of ADB's Developing Member Countries. The ADB Accountability Mechanism information will be included in the project information document to be distributed to the affected communities, as part of the project GRM.

165. **Record-keeping**. The PID will keep records of grievances received, including contact details of the complainant, the date the complaint was received, the nature of the grievance, agreed corrective actions and the date these were affected and the final outcome. The number of grievances recorded and resolved and the outcomes will be displayed/disclosed in the PID

office, as well as reported in monitoring reports submitted to ADB on quarterly basis. All resolutions shall be communicated to the aggrieved party / complainant(s).

166. **Periodic review and documentation of lessons learned**. The PMU will periodically review the functioning of the GRM and record information on the effectiveness of the mechanism, especially on the program's ability to prevent and address grievances.

167. **Costs**. All costs involved in resolving the complaints (meetings, consultations, communication and reporting/ information dissemination) will be borne by the PID.

168. **Country legal procedure**. An aggrieved person shall have access to the country's legal system at any stage and accessing the country's legal system can run parallel to accessing the GRM and is not dependent on the negative outcome of the GRM.

169. **ADB's Accountability Mechanism**. If the established GRM is not in a position to resolve the issue, the affected person also can use the ADB Accountability Mechanism through directly contacting (in writing) the Complaint Receiving Officer (CRO) at ADB headquarters or the ADB India Resident Mission. The complaint can be submitted in any of the official languages of ADB's developing member countries. Before submitting a complaint to the Accountability Mechanism, it is recommended that affected people make a good faith effort to resolve their problems by working with the concerned ADB operations department (in this case, the resident mission). Only after doing that, and if they are still dissatisfied, they could approach the Accountability Mechanism. The ADB Accountability Mechanism information will be included in the project-relevant information to be distributed to the affected communities, as part of the project GRM.

IX. ENVIRONMENTAL MANAGEMENT PLAN

A. Environmental Management Plan

170. The Environmental Management Plan (EMP) has been developed to provide mitigation measures to reduce all negative impacts to acceptable levels. Unlike other projects, four EMPs have been prepared for various subproject activities, which are planned to be implemented under four different tenders.

(i) Environmental Management Plan for Construction Site
(ii) Environmental Management Plan for Operation/ Maintenance
(iii) Environmental Management Plan for Demolition Works
(iv) Environmental Management Plan for Regeneration Works

171. The EMP will guide environmentally-sound practices at the time of construction and operation of the subprojects and ensure efficient lines of communication between TNSCB PMU, PIDs, and contractors. The EMPs will (i) ensure that the activities are undertaken in a responsible non-detrimental manner; (ii) provide a pro-active, feasible and practical working tool to enable the measurement and monitoring of environmental performance on site; (iii) guide and control the implementation of findings and recommendations of the environmental assessment conducted for the subproject; (iv) detail specific actions deemed necessary to assist in mitigating the environmental impact of the subproject; and (v) ensure that safety recommendations are complied with. The EMPs includes a monitoring program to measure the environmental condition and effectiveness of implementation of the mitigation measures. It will include observations on- and off-site, document checks, and interviews with workers and beneficiaries. The IEE and EMP will be included in the bid and contract documents to ensure compliance to the conditions set out in this document.

172. The contractor will be required to submit to PIDs, for review and approval, a Site Environmental Management Plan (SEMP) including (i) proposed sites/locations for construction work camps, storage areas, hauling roads, lay down areas, disposal areas for solid and hazardous wastes; (ii) specific mitigation measures following the approved EMP; (iii) monitoring program as per EMP and (iv) prepare a COVID Response and Management Plan (C-R&MP). No works are allowed to commence prior to approval of SEMP. A copy of the EMP and approved SEMP will be kept on site during the construction period at all times.

173. Water supply is expected to be arranged through an 18km gravity pipeline and detailed design is still underway. This is an associated activity to this subproject and once enough information is available, the PID environmental specialist shall prepare the EMP for this activity in accordance with ADB SPS with assistance from the PMU environmental specialist. Accordingly, this IEE and EMP will need to be revised and submitted to ADB for concurrence prior to appointment of the contractor by TWAD. The prepared EMP will need to be adopted by the contractor, who undertakes the pipeline laying works, and it shall be monitored and reported by both TWAD and PID. The key observations should be reflected in the quarterly safeguard reports to ADB.

174. For civil works, the contractor will be required to (i) carry out all the mitigation and monitoring measures set forth in the approved SEMP; and (ii) implement any corrective or preventative actions set out in environmental monitoring reports that the employer will prepare from time to time to monitor implementation of this IEE and SEMP. The contractor shall allocate budget for compliance with these SEMP measures, requirements and actions.

The following table shows the potential environmental impacts, proposed mitigation measures and responsible agencies for implementation and monitoring.

Table 32: Environmental Management Plan for Construction Site - Vallam, Thanjavur District

Sl. no	Environmental Issues	Mitigation Measures	Indicators and Targets	Responsibility for Implementation	Responsibility for Supervision
1.	**Location Impacts**				
1.1	Location impacts pertain to siting of facilities for construction of new buildings/ dwelling units at Vallam, Thanjavur District • Clearing of wild vegetation • Maintain slope for natural drain • Excess earth disposal	• The siting of facilities will be in line with the DTCP approved Master Plan. • The site allotted for the construction of new buildings / dwelling units at Vallam belongs to Tamil Nadu Slum Clearance Board (TNSCB). Hence there are no land Acquisition Issues anticipated. • The land is an abandoned quarry area having gentle slope towards southern direction. Hence levelling operations have to be conducted for the construction purpose. By doing so it is anticipated to generate excavated excess earth/ soil (cut and filling), which has to be disposed in an authorised/ identified landfill or disposal area. If the site is a new disposal area, then it has to be approved by the PIDs. • There are a few trees identified in the project site, which have to be preserved through design considerations or it shall be transplanted to the designated landscaping area.	• List of tree species • Tree cutting permit / permission from the competent authority. • Identification of Disposal site for disposing debris and excavated soil	PID	PMU
1.2	Lack of sufficient planning to assure long term sustainability of the developments	• In accordance with the provisions in the sub-project selection criteria, the sub-project design shall include adequate provisions for ensuring effective maintenance and protection of the assets created so as to ensure the long-term sustainability of the sites. • The designs will be worked out and implemented in accordance with the provisions. • No construction activity of any kind shall	• DPR and designs Approved from competent authority • Work plan prepared and approved by PIDs	PID	PMU

Sl. no	Environmental Issues	Mitigation Measures	Indicators and Targets	Responsibility for Implementation	Responsibility for Supervision
		be taken up in the OSR area			
1.3	Land acquisition (Socio economic Impacts)	• No additional land will be required, the proposed project (construction of 969 residential units) at Vallam is designed to be implemented within the available 2.77 ha land area • Resettlement and/or land acquisition problems are not anticipated in the construction activities. • In case of any additional land acquisition, the compensation as per the Entitlement matrix given in the Resettlement Framework (RF) shall be adopted.	• Revenue records	PID	PMU
1.4	Clearing of trees/ Removal of vegetation	• All reasonable measures shall be undertaken to ensure that no native fauna is harmed or placed at risk during the course of the clearing activities • As per the proposed design, felling of trees is not envisaged at any stage of the project. However, under unavoidable conditions if any of the trees are required to be cut/ felled, then prior permission as per existing procedure from Forest department, ensuring appropriate compensation including compensatory plantation at 1:10 ratio as stipulated by the High Court of Madras (WP No 7811/2010 and MP No 1/2010 dated 25/06/2010).	• Tree count information and compensation ratio	PID	PMU
2.	**Design and Pre-Construction Impacts**				
2.1	Increased storm water runoff from alterations of the site's natural drainage patterns due to excavation works in the Vallam site, construction of residential units, Anganwadi, Community hall, Ration shop,	• Design of proposed building components will enable efficient drainage of the sites and maintain natural drainage patterns. The siting of the project components, involving physical construction shall be done to ensure no disruption of natural drainage patterns or flows into the nearby	• Site drainage plan to be prepared and applied • Construction of drains to prevent water logging at site	PID	PMU

Sl. no	Environmental Issues	Mitigation Measures	Indicators and Targets	Responsibility for Implementation	Responsibility for Supervision
	addition of paved surfaces and approach roads.	drain/nallah. • Construction activities (including excavation and trenching works) shall be restricted during the monsoon season. • The Contractor shall discuss with the PID to carryout necessary construction activities in the monsoon season by providing appropriate safety measures to the satisfaction of the PID.	during rains		
2.2	Consents, permits, clearances, NOCs, etc.	• All the necessary approvals/ permissions/ clearances/ NoCs as given in the Environmental Clearance (EC) for Vallam Resettlement Site should be obtained by the PID and verified by PMU before start of the construction activities or as per the conditions given in the EC. This includes STP design approval from a third party. • The findings and recommendations from the source sustainability study[18] has to be completed and incorporated into the IEE prior to a contractor being appointed by TWAD. • Meaningful consultations with communities to keep them informed of anticipated activities and associated impacts	• General Conditions and Specific Condition as mentioned in the Environmental Clearance • Source sustainability study • Consultation meeting outcomes and records	PID	PMU
2.3	Water supply pipeline laying activities shall have direct air and noise impacts to the public as well as other construction impacts.	• The impacts of the water supply pipeline will need to be assessed once enough information is available and this IEE and EMP should be revised and submitted to ADB for concurrence prior to a contractor	• Revised IEE and EMP • Contractor records	PID and TWAD	PMU

[18] The water source sustainability study should indicate the project shall utilize water sources at sustainable levels of abstraction only (i.e. without significant reductions in the quantity or quality of the source overall), avoid polluted water sources, avoid water use conflicts by not abstracting water that is used for other purposes and ensure water quality provided complies with national drinking water standards at all times through regular monitoring. This requires identification of all users of the water source and that the water source can be appropriately recharged. The water source sustainability study to be conducted should be incorporated into the relevant IEE and EMP.

Sl. no	Environmental Issues	Mitigation Measures	Indicators and Targets	Responsibility for Implementation	Responsibility for Supervision
		being appointed. • The contractor appointed for water supply will be required to adopt the EMP.			
2.4	Selection of materials and construction technologies, if not carefully chosen, will adversely impact the visual appeal of the buildings	• Designs to be worked out in such a manner that exposed steel and concrete structures are avoided • The design brief for all building components proposed will strictly conform to the TNSCB requirements. • Any new landscaping elements will only utilize native species to protect local biodiversity	• list of approved quarry sites and source of material • List of trees/ shrubs for landscaping • List of materials to be procured for construction works included in BOQ	PID	PMU
2.5	Integration of energy efficiency and energy conservation programs in design of building components	• The detailed designs for the building components shall ensure that environmental sustainability principles, including energy efficiency, resource recycling, waste minimization etc. are integrated, and designs accordingly worked out. • All the electrical and mechanical equipment used in the construction works shall be energy efficient and ISO certified as per BOQ provisions.	• DPR and designs approved from competent authority • Use of energy efficient and ISO certified equipment in construction works • PUC for all construction vehicles	PID	PMU
2.6	Odour / smell from Sewage Treatment Plant, Solid waste collection area	• The detailed design/ layout should have designated STP and the MSW areas, which should be located away from the settlement to prevent the odour nuisance	• DPR and designs approved from competent authority • MSW should be collected frequently • STP should be maintained	PID	PMU
2.7	Noise pollution from the pumps used for lifting water to the OHTs	• Pump house should be located away from the residential blocks and it should be acoustic proof	• Regular maintenance is required • conducting frequent Noise monitoring	PID	PMU
2.8	Sourcing of water for	• Contractor shall purchase water from	• Regular monitoring	Contractor and	PMU

Sl. no	Environmental Issues	Mitigation Measures	Indicators and Targets	Responsibility for Implementation	Responsibility for Supervision
	construction activities	Vallam Special Grade Town Panchayat or TWAD for the construction activities. The agreement/ MoU has to be shared with the PID. • Use of groundwater for construction purpose is prohibited • Water demand during construction should be reduced by use of premixed concrete, curing agents and other best practices prevalent. • Tapping of surface water from river sources should not affect the downstream water users (appropriate permission for the same from the TWAD/ PWD should be obtained) • Tapping of surface water from tanks/ ponds should be in consultation with the local communities and the same records should be submitted to the PID and PMU. • For any other arrangements for the source of water, the evidence for the same has to be furnished to the PID	is required • Feedback from the local communities	PID	
2.9	Installation of Diesel Generators	• As per the CPCB norms, place the Diesel Generators (DG's) in an acoustic enclosure or other sound insulation • Place the DG's at least 100 m from the nearest new building for housing • Low Sulphur Diesel shall be used for operating diesel generator • Ensure DG sets comply with the noise standards prescribed by the CPCB	• Standards prescribed by the CPCB • Conducting frequent noise monitoring	Contractor and PID	PMU
3.	**Pre-Construction Activities by Contractor**				
3.1	Submission of updated EMP / SEMP; EMP implementation and reporting	• Appoint Environment, Health and Safety Supervisor to ensure EMP implementation • Submission of updated EMP/ SEMP prior	Unsatisfactory compliance with EMP Contractor	Contractor and PID	PMU

Sl. no	Environmental Issues	Mitigation Measures	Indicators and Targets	Responsibility for Implementation	Responsibility for Supervision
		to starting of work, • Timely submission of monthly monitoring reports including documentary evidence on EMP implementation such as photographs and consultation records. • SEMP documents shall include information about site restoration, noise and dust control, wastewater management, spills response, community and site health and safety, traffic control, tree cutting, construction of labour camps, storage areas, hauling roads, regulatory permissions, disposal areas for solid and hazardous wastes, sensitive features like schools and hospitals • Provide project-related information to stakeholders, communities and/or affected people before and during construction works including at least 7 days prior to the start of works and again at least 1 day prior to works through issuing a pamphlet booklet to affected persons.	consultation records		
3.2	Consents, permits, clearances, NOCs, etc.	• Obtain all necessary consents, permits, clearance, NOCs, etc. prior to the award of civil works. • Ensure that all necessary approvals for construction to be obtained by the contractor are in place before the start of construction • Acknowledge in writing and provide a report on compliance of all obtained consents, permits, clearance, NOCs, etc.	All the project related clearances should be obtained as indicated in the **Table 5** and **Table 6**	Contractor/ PID	PMU
3.3	Sources of construction materials (Impact on natural land contours, vegetation, disturbance to natural	• Maximize the re-use of earth-cut materials, spoils, and construction & demolition debris / wastes • Specify materials that are recycled, have	Contractor to prepare a list of approved quarry sites and sources of materials	Contractor/ PID	PMU

Sl. no	Environmental Issues	Mitigation Measures	Indicators and Targets	Responsibility for Implementation	Responsibility for Supervision
	drainage patterns, water logging, and water pollution.)	recycled content or are from sustainable sources • Obtain construction materials only from government-approved quarries with prior approval of PID • PID to review, and ensure that proposed quarry sources have all necessary clearances/ permissions in place prior to approval • Contractor to submit to PID the documentation every month with the details of the material obtained from each source (quarry/ borrow pit) • Avoid the creation of new borrow areas, quarries, etc., for the project; if unavoidable, contractor to obtain all clearances and permissions as required under law, including Environmental Clearance (EC) prior to approval by PID	with the approval of PID before any construction commences		
3.4	Construction Camps – Location, Selection, Design and Layout	• The construction camps will be located at 500m away from settlements and water bodies. The construction camps including separate female and male sanitation facilities, shelter, electricity, canteen, potable water (as per IS 10500), first aid, health care, day crèche facilities must be adequately drained, and must not be subject to periodic flooding. • The camps must be located such that the drainage from and through the camps will not risk any domestic or public water supply. • All sites must be graded, ditched and rendered free from depressions such that water may not get stagnant and cause a nuisance. • The contractor shall provide the	• Location of construction camp approved by PID • Construction camp having all the basic amenities with proper sanitary conditions drainage and watery supply	Contractor and PID	PMU

Sl. no	Environmental Issues	Mitigation Measures	Indicators and Targets	Responsibility for Implementation	Responsibility for Supervision
		dispenser for the disposal of Sanitary Napkins • MSW and domestic sewage generated from the construction camp should be disposed on day to day basis. The collection of waste and sewage shall be done by Vallam Special Grade Town Panchayat for which the contractor should get approval from the Panchayat with the assistance from the PID. • Potable water (as per IS 10500 standard) to the labours/ construction workers should be provided by the Contractor • Comply with the ban on one time use and throwaway plastics under Tamil Nadu Government Order • First Aid Room shall be provided in the project site during the entire construction and operation phases of the project			
3.5	Stockpiling of materials	• Storage of construction material confined to work sites in a way to ensure that there is no obstruction to natural drainage pattern, efficient drainage is maintained • Stockpiles to be covered to reduce dust generation • Develop and implement the Materials Management Plan (including warehouses / storage)	• Location of construction camp approved by PID • Approved materials management plan	Contractor and PID	PMU
3.6	Establishment of baseline environmental conditions prior to start of civil works	• Conduct documentation of location of components, areas for construction zone (camps, staging, storage, stockpiling, etc.) and surroundings (within direct impact zones), locations of environmental monitoring Include photos and GPS coordinates • The monitoring parameters and the	• Baseline environmental profile including ambient air, noise, water quality as per the standards indicted in the monitoring plan (Table 36)	Contractor and PID	PMU

Sl. no	Environmental Issues	Mitigation Measures	Indicators and Targets	Responsibility for Implementation	Responsibility for Supervision
		frequency of the monitoring should comply with the Environmental Monitoring Plan (Table 36)			
3.7	Drinking water availability and water arrangement	• The contractor will be responsible for arrangement of water in every workplace at suitable and easily accessible place for the whole construction period. • Sufficient supply of cold potable water (as per IS 10500) to be provided and maintained. • If the drinking water is obtained from an intermittent public water supply then, storage tanks will be provided.	• Records of drinking water supply to workers • Feedback from workers	Contractor and PID	PMU
3.8	Identification of disposal sites	• Location of disposal sites will be finalized by the Environmental Specialist of the PID and he will confirm that disposal of the material does not impact natural drainage courses or surface water bodies or low-lying areas and that no endangered / rare flora is impacted by such materials • The disposal sites shall be identified in consultation with Vallam Special Grade Town Panchayat • Information on the disposal site should be included in the IEE (update/ revise it accordingly)	• Disposal site selected and approved by PID • Records of materials disposed at disposal site • Log book maintained for debris disposal	Contractor and PID	PMU
3.9	Shifting of Utilities	• Identify and include locations and operators of these utilities in the detailed design documents to prevent unnecessary disruption of services during the construction phase. • Require contractors to prepare a contingency plan to include actions to be done in case of unintentional interruption of services.	• List showing utilities to be shifted • Contingency plan for services disruption	Contractor and PID	PMU

Sl. no	Environmental Issues	Mitigation Measures	Indicators and Targets	Responsibility for Implementation	Responsibility for Supervision
		• Obtain from the PID the list of affected utilities and operators; • If relocation is necessary, Contractor will coordinate with the providers to relocate the utility and communicate the dates and duration in advance to affected communities / persons / businesses.			
3.10	Social and Cultural Resources	• No cultural properties or religious structures shall be removed or relocated without the knowledge and written consent of the concerned parties or communities and local administration as the case may be. Sites for the relocation of these religious structures shall be identified following the choice of the community • As far as possible, the architectural elements of the structure should be conserved/reflected/translated into the design of new structures following the wishes of the community • For any Chance find, consult Archaeological Survey of India (ASI) or Tamil Nadu Archaeology Department to obtain an expert assessment of the archaeological potential of the site. • Consider alternatives if the site is found to be of medium or high risk. • Include state and local archaeological, cultural and historical authorities, and interest groups in consultation forums as project stakeholders so that their expertise can be made available. • Develop a protocol for use by the construction contractors in conducting any excavation work, to ensure that any chance finds are recognized and	• Chance find protocol	Contractor and PID	PMU

Sl. no	Environmental Issues	Mitigation Measures	Indicators and Targets	Responsibility for Implementation	Responsibility for Supervision
		measures are taken to ensure they are protected and conserved.			
3.11	Circulation plan during construction in the densely populated areas	• Prior to mobilization and commencement of site activities, contractor has to prepare site work plan approved by Engineer[19] so that no works or activities shall interrupt safe passage of local residents/ road users during construction stage, including development of alternative access routes, traffic regulations, signage etc., during construction. • The sensitive receptors like residential settlements, schools and hospitals in the close proximity of the resettlement site have to be consulted to discuss the site work plan for their suggestions and feedback, accordingly the plan shall be modified. • The Contractor with support of the PID will carry out dissemination of these information	• Site work plan prepared by contractor and approved by PID • Traffic plan and records of road signage's	Contractor and PID	PMU
3.12	Access	• Traffic congestion near the entry and exit points from the roads adjoining the proposed project site must be avoided • Plan transportation routes (NH 67) so that heavy vehicles do not use narrow local roads, except in the immediate vicinity of delivery sites. • Schedule transport and hauling activities during non-peak hours. • Locate entry and exit points in areas where there is low potential for traffic congestion.	• Temporary Traffic management Plan	Contractor and PID	PMU

[19] Engineer refers to Project Implementation Division (PID)

Sl. no	Environmental Issues	Mitigation Measures	Indicators and Targets	Responsibility for Implementation	Responsibility for Supervision
		• Keep the site free from all unnecessary obstructions. • Drive vehicles in a considerate manner.			
3.13	Occupational health and safety	• Comply with IFC EHS Guidelines on Occupational Health and Safety • Develop comprehensive site-specific health and safety (H&S) plan. The overall objective is to provide guidance to Contractors on establishing a management strategy and applying practices that are intended to eliminate, or reduce, fatalities, injuries and illnesses for workers performing activities and tasks associated with the project. • Include in H&S plan measures such as: (i) type of hazards in the construction site; (ii) corresponding personal protective equipment for each identified hazard; (iii) H&S training for all site personnel (including labours); (iv) procedures to be followed for all site activities; and (v) Documentation of work-related accidents. • Provide medical insurance coverage for workers. • Contractor to nominate an on-site environment, health and safety officer. • Contractor shall undertake a COVID risk assessment of project area and prepare a COVID Response and Management Plan (C-R&MP) and submit to PID for approval	• Health and safety (H&S) plan	Contractor and PID	PMU
3.14	Site clearance activities including delineation of construction areas	• Commencements of site clearance activities shall be undertaken after	Construction and workers camp sites should be restored as	Contractor and PID	PMU

Sl. no	Environmental Issues	Mitigation Measures	Indicators and Targets	Responsibility for Implementation	Responsibility for Supervision
		permissions of PID to minimize environmental impacts. • All areas used for construction and camp activities shall be restored to their former conditions after project completion and no impact to the baseline environment indicators have been confirmed.	per the original situation		
3.14	Excessive disturbance to communities due to prolonged construction	• Meaningful consultations with communities to keep them informed of anticipated activities, in particular those that may result in disruption with respect to area access, utilities, and noisy or dust-generating activities that are likely to result in significant disturbance • Identify and adhere to strict construction schedule • Liaise with schools that are in close proximity to construction sites on school examination periods and scale down construction activities and avoid noisy activities (including piling) during such periods • Alert communities and residents if night time construction work shall occur nearby (no night time construction within 500 m of the nearest household) and ensure safe alternative access is provided • Ensure communities are aware of Grievance Redress Mechanism (GRM) entry points • Create awareness of health & safety risks of transmittable diseases (HIV/AIDs / COVID-19), child labor, bonded labor or forced labor • Develop and implement the Community Health and Safety Plan	Community Health and Safety Plan Contractor consultation records	Contractor and PID	PMU

Sl. no	Environmental Issues	Mitigation Measures	Indicators and Targets	Responsibility for Implementation	Responsibility for Supervision
3.15	Vibration Impact	• Precaution will be taken while using the machines and equipment, during demolition • Before any works commences, conduct situation analysis (including videos and photos) in the subproject area of influence to check the structural integrity of nearby buildings that may be affected by vibration during demolition works. • For the buildings having weak structure, temporary structural support shall be provided • Noise level measurements shall be taken once before the start of the demolition works to establish the baseline; and during the construction stage as per the Environmental monotiring plan (refer table 36) • Contractor will be responsible for creating awareness among the operators to ensure careful handling of machines and equipment and heavy vehicles like excavators and dump trucks during mechanical demolition • The contractor will inform the surrounding settlements/ residences and community in prior to operations that bear the risk of nuisance and accidents. • The contractor shall maintain the records of the consultations including dates, names and actions agreed to. • The contractor will be responsible for compensating if there are any damage to structures due to vibration resulting from demolition.	• maintenance record of construction vehicles and equipment • records of noise monitoring as per Table 36 • contractor site and consultation records	Contractor and PID	PMU
4.	**Construction Impacts**				

Sl. no	Environmental Issues	Mitigation Measures	Indicators and Targets	Responsibility for Implementation	Responsibility for Supervision
4.1	Improper stockpiling of construction materials cause impacts starting from obstruction of drainage, disturbance/ safety hazard etc.	• Adequate safety precautions will be ensured during transportation of quarry material from quarries to the construction site. • Vehicles transporting material will be covered to prevent spillage. • Operations to be undertaken by the contractor as per the direction and satisfaction of Engineer.	• Proper stockpiling of construction materials • vehicles transporting construction materials covered to prevent spillage	Contractor and PID	PMU
4.2	Impacts due to Batching Plant operation	• Batching plant shall comply with the requirements and specifications of the relevant current emission control legislation. • Batching plant shall be located within the project construction area and as far as possible from residential/settlements/commercial establishments, at least 300m in the downwind direction. • The Contractor shall submit a detailed layout plan for all such sites and seek prior approval of PID before entering into a formal agreement with a landowner for setting-up such sites. • Actions by PID against any non-compliance shall be borne by the Contractor at his own cost. • Arrangements to minimize dust pollution through the provision of windscreens, mist spray units, and dust encapsulation shall have to be provided at all such sites. • Specifications of batching plant shall comply with the requirements of the relevant current emission control legislation and Consent / NOC for such	Batching Plants should be kept/ stationed away from residential /settlements and at least 300m in the downwind direction from nearby sensitive receptors.	Contractor and PID	PMU