

Initial Environmental Examination

(Enhanced Scope)

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Sanitation Subproject (Outside fort) (Tr-1)

Prepared by Local Self Government Department

For the Government of Rajasthan

Rajasthan Urban Infrastructure Development Project

The initial environmental examination is a document of the borrower. The views expressed herein do not necessarily represent those of ADB's Board of Directors, Management, or staff, and may be preliminary in nature.

ABBREVIATION

ADB	Asian Development Bank
CWR	Clear Water Reservoir
DSC	Design and Supervision Consultancy
EA	Executing Agency
EAC	Expert Appraisal Committee
FI	Financial Intermediary
GLSR	Ground Level Service Reservoir
GoI	Government of India
GoR	Government of Rajasthan
GSI	Geological Survey of India
IA	Implementing Agency
IEE	Initial Environmental Examination
IPMC	Investment Programme Management Consultancy
IPMU	Investment Programme Management Unit
JNNURM	Jawaharlal Nehru National Urban Renewal Mission
LPCD	Litre Per Capita per Day
LPS	Litre Per Second
LSGD	Local Self-Government Department
MFF	Multitranchise Financing Facility
MLD	Million litre Per day
MoEF	Ministry of Environment and Forests
NAAQS	National Ambient Air Quality Standards
OD	Outer Diameter
OHSR	Over Head Service Reservoir
OM	Operations Manual
PHED	Public Health Engineering Department
PMU	Project Management Unit
RCC	Reinforced Cement Concrete
ROW	Right of Way
RPCB	Rajasthan State Pollution Control Board
RSPM	Respirable Suspended Particulate Matter
RUIDP	Rajasthan Urban Infrastructure Development Project
RUSDIP	Rajasthan Urban Sector Development Investment Program
SPM	Suspended Particulate Matter
SPS	Sewage Pumping Station
STP	Sewerage Treatment Plant
ToR	Terms of Reference
UA	Urban Agglomeration
UIDSSMT	Urban Infrastructure Development Scheme for Small and Medium Towns
uPVC	Unplasticized Poly Vinyl Chloride
USEPA	United States Environmental Protection Agency
WC	Water Closets
WTP	Water Treatment Plant

WEIGHTS AND MEASURES

lakh	–	100 thousand = 100,000
crore	–	100 lakhs = 10,000,000
$\mu\text{g}/\text{m}^3$	–	micrograms per cubic meter
km	–	kilometer
lpd	–	liters per day
m	–	meter
mg/l	–	milligrams per liter
mm	–	Millimetre
ppm	–	parts per million

NOTE{S}

- (i) In this report, "\$" refers to US dollars.
- (ii) "INR" and "Rs" refer to Indian rupees

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EXECUTIVE SUMMARY

1. **Introduction and Regulatory Framework:** Rajasthan Urban Sector Development Investment Program (RUSDIP) is intended to optimize social and economic development in 15 selected towns in the State, particularly district headquarters and towns with significant tourism potential. RUSDIP Phase II to be implemented over a seven year period beginning in 2008, and will be funded by a loan via the Multitranche Financing Facility (MFF) of the ADB. RUSDIP will improve infrastructure through the design and implementation of a series of subprojects, each providing improvements in a particular sector (water supply, sewerage, drainage, road, solid waste etc) in one town.

2. The impacts of subprojects prepared according to ADB Environment Policy 2002 and Indian National Law. Projects are screened for their expected environmental impacts and are assigned to Category A, B, C and F1. RUSDIP has been classified by ADB as environmental assessment category B (some negative impacts but less significant than category A). The only type of infrastructure provided by the RUSDIP that is specified in the EIA Notification (2006) of Govt. of India is solid waste management, where Environmental Clearance (EC) is required for all Common Municipal Solid Waste Management Facilities. EC is thus not required for sewerage and sanitation sub-project and which is subject to Environmental Examination. This is the Initial Environmental Examination (IEE) report for the Jaisalmer sewerage and sanitation sector. It discusses the generic environmental impacts and mitigation measures relating to the location, design, construction and operation of physical works proposed under this subproject.

3. **Project Description:** The sub-project is located in Jaisalmer, the headquarters town of Jaisalmer district, in the western part of Rajasthan. The main components of the enhanced scope of work are Laying of Sub-Mains & laterals of sizes 200 mm to 500 mm dia. for a length of 17113 m, Construction of Intermediate Sewage pumping station at Gandhi Colony, Laying of pumping main of size 200 mm dia. for a length of 750 m. At present following work are under progress taken in tranche-I i.e Laying of Outfall Sewer & Trunk Mains of sizes 700 mm 1000 mm dia. for a length of 5384 m. Laying of Sub-Mains & laterals of sizes 200 mm to 600 mm dia. for a length of 44327 m. Construction of 10 MLD Sewage Treatment Plant based on WSP process near village Kishan Ghat.

4. **Description of Environment:** Jaisalmer District is located in the extreme west of both Rajasthan and India, and shares western and northern borders with Pakistan. It lies between the longitudes of 69° 29' to 72° 20' East, and latitudes of 26° 01' 20" to 28° 02' North, is at an average altitude of 242 m above MSL, and forms the major part of the Great Indian Desert (Thar Desert). Jaisalmer Town is the district headquarters and lies roughly in the centre, 550 km west of the State capital Jaipur and 300 km northwest of Jodhpur. According to the Vulnerability Atlas of India, most of Jaisalmer District, including Jaisalmer Town, is in an area of medium earthquake risk (Zone III). The climate is typical of a desert region, being hot and arid, with large day-night temperature extremes and sporadic and erratic rainfall. Winter extends from November to March, and the coolest period occurs in January when daytime temperatures average below 20 °C and often fall to freezing at night. Temperatures begin to rise in March and peak in May-June, when daytime values sometimes reach 48°C. Wind speeds may also increase at this time, and dust storms are common. The south-west monsoon arrives in July, causing a sudden drop in temperature, although the air remains dry as rain only falls on an average of six days per year. The long-term average rainfall is just 189 mm. The ambient air quality monitoring was carried out in Jaisalmer Town in June 2012. The result illustrates the high concentration of particulate matter (particle size of $\leq 10\mu\text{m}$) in the study area, which is due to the desert climate of the study area and particularly during summer dust storms driven by relatively

strong north-west to south-west winds. Traffic is the only significant source of pollutant in the town, so levels of oxides of sulphur and nitrogen are well within the National Ambient Air Quality Standards (NAAQS). There are no perennial rivers in Jaisalmer District, and no natural lakes or ponds, which is not surprising given the low rainfall. A few ephemeral streams appear on land outside the town during rainfall, and water accumulates in certain low lying areas, but the water is shallow and drains into the sand very quickly. Because of the sandy soils and lack of rainfall, the water table is very deep around Jaisalmer Town, ranging from 38-46 m below ground level. The main aquifer lies below this depth, comprising Lathi formations from the Lower Jurassic Age, composed of mainly sandstones and some lime stones in the upper levels. The aquifer is tapped by a number of wells, but the yield is reported to be low. Jaisalmer Municipal Board (JMB) has developed a well field at Dabla Village 12.5 km from the town, where the aquifer is around 85 m below the surface. The Public Health Engineering Department (PHED) regularly monitors the quality of water from the Dabla field, results shows that fluoride concentration is slightly above the acceptable level according to national quality standards, and Total Dissolved Solids are above the desirable level but below the acceptable level. Jaisalmer Town is an urban area located on a hard rocky substratum, surrounded by a harsh desert environment of wind-blown sand and dunes. The municipal area includes large swathes of uninhabited rocky hills and sand dunes, with alluvial soil and sand in the intervening valleys, which are cultivated where there is enough rain. There is no forest nearby the project area.

5. Located in the Thar Desert in the extreme north-west of India, Jaisalmer is an important urban centre for its vast desert hinterland, and is also of strategic importance because of its proximity to Pakistan. The current land use in the developed area, from recently conducted surveys, which indicates that the major uses are for residential areas, roads/transportation and public and semi-public land. There is also a significant military presence, with a number of defence installations both inside and outside the town. There is very little industrial development in Jaisalmer and the town is in fact classified as a “No Industries District” in State planning terms. Rajasthan Industrial Infrastructure Corporation (RIICO) has developed a small scale industrial area on 25 ha of land in the town, which currently houses 136 units, specialising mainly in light industry, such as manufacturing farm equipment, repairing automobiles and machinery, and furniture-making. There are also a number of stone polishing workshops, located here because of the vast amount of building material and decorative stone available from quarries in the surrounding hillsides. Agriculture is restricted by both climate and physiography, as the limited rainfall and desert soils mean that there are very few areas that are suitable for agriculture, and yields are limited to a maximum of one crop per year.

6. PHED provides a piped municipal water supply in Jaisalmer, which is sourced from the Dalba groundwater field (3 MLD) and from the Dewa Minor canal of the IGNP, 34 km away (5 MLD). The system supplies 80% of the population, but water is available for only 1-2 hours per day, mainly because of leakage losses (estimated at 40%) and low and unequal network pressure. There is a piped sewerage system only inside the fort, which serves 2% of the population. Developed in 1994, the system does not function well because of the undulating topography and blockages caused by solid waste, so leakages and overflows are very frequent. The solid waste management system is also ineffective, and refuse is mainly discarded in the streets and drains, and dumped on vacant plots of land. Jaisalmer generates an estimated 21 tons of solid waste per day and the Municipal Board (JMB) collects around 12 tons from its manual street sweeping operation (conducted inside the fort), and removes other waste from vacant plots irregularly. Transport in the city is mainly by personal vehicles (motorcycles and bicycles) and auto- and bicycle-rickshaws. The Rajasthan State Road Transport Corporation (RSRTC) runs public buses to neighbouring villages and towns and to larger towns farther afield,

such as Jodhpur, Bikaner, Barmer and Jaipur, with which there are good road connections. Jaisalmer is also connected to Jodhpur, Jaipur and Delhi by the national railway.

7. According to the national census the population of Jaisalmer was 38,735 in 1991 and 57,537 in 2001, which shows an annual increase of 4.9 % over the decade. Gross population density is very low (457 persons/km), but because so much of the municipal area is undeveloped there are locations of very high density, particularly in the fort and walled city. There are good educational facilities in Jaisalmer, which serve both townspeople and inhabitants of surrounding villages and towns in the hinterland. As the district headquarters town, Jaisalmer is the main centre for health facilities in the area and there is a district general hospital with 150 bed capacity, 4 dispensaries, a mother and child welfare centre and a government-run homeopathic hospital. There is also a private hospital of 25 bed capacity, and a number of private clinics. Tourism has risen in importance in Jaisalmer over the past 20 years, and in 2005 there were 280,000 tourists, almost double the number that visited in 2001 (150,000). Jaisalmer Fort, built in 1156 by the Rajput ruler Jaisala, rises over the city and provides magnificent views over the surrounding desert.

8. **Potential environmental impacts and mitigation measure:** All pre-construction (design), construction, and operation activities that are likely to cause environmental impacts were identified, and evaluated to assess their magnitude, duration, and potential receptors in consultation with the stakeholders. Most of the individual elements of the subproject are relatively small and involve straightforward construction and operation, so impacts will be mainly localised and not greatly significant during design phase.

9. There are no religious and historical sites and protected sites nearby, hence no impact anticipated.

10. During project implementation the impacts are consider on physical environment like water, air, soil, noise; on biological environment, like flora and fauna and socio-economic environment (which is positive in some extent) and sensitive receptors. All the impacts are temporary and for short duration. In all the cases mitigation measures i.e. control of air, dust pollution, checking of water and noise pollution, protection of biological environment and minimize the social impacts are taken care. Safety measures, both occupational and social are considered and those are depicted in IEE. During pipe laying traffic management plan will be applied. During operation phases there are few positive socio-economic impacts will be anticipated.

11. **Institutional responsibility and Environmental management and monitoring plan:** LSGD is the Executing Agency (EA) responsible for management, coordination and execution of all activities funded under the loan. Environmental issues will be coordinated by an Environmental Specialist within the IPMU/ IPMC, who will ensure that all subprojects comply with environmental safeguards. An Environmental Monitoring Specialist (EMS) who is part of the DSC team will implement the Environmental Monitoring Plan from each IEE, to ensure that mitigation measures are provided and protect the environment as intended.

12. Implementation of Environmental management plan and monitoring frequency will be taken care during construction phase. Most the mitigation activities are the responsibility of the Construction Contractors (CC) employed to build the infrastructure during the construction stage, or the O&M Contractors employed to conduct maintenance or repair work when the system is operating. Responsibility for the relevant measures will be assigned to the Contractors via the contracts through which they are appointed (prepared by the DSC during the detailed design

stage), so they will be legally required to take the necessary action. There are also some actions that need to be taken by LSGD in their role as project proponent, and some actions related to the design that will be implemented by the DSC. Mitigation measures are fairly standard methods of minimising disturbance from building in urban areas (maintaining access, planning work to avoid sensitive times, finding uses for waste material, etc), and experienced Contractors should be familiar with most of the requirements. Monitoring of such measures normally involves making observations in the course of site visits, although some require more formal checking of records and other aspects. There will also be some surveys of residents, as most of the measures are aimed at preventing impacts on people and the human environment. Environmental management and monitoring cost for the sub-project has been estimated as 1.58 million Rupees.

13. **Public consultation, information disclosure and grievance redress mechanism:** Public consultation with primary and secondary stakeholders has been conducted to understanding the local issues and public views regarding the possible impact. The group discussion meeting were conduct by RUIDP after advertising in Local NEWS papers. The issues like, awareness and extent of the project and development components, benefits of project for the economic and social upliftment of community, labour availability in the project area or requirement of outside labour involvement, local disturbances due to project construction work, necessity of tree felling etc. at project sites, water logging and drainage problem if any, drinking water problem, forest and sensitive area nearby the project site etc. On the basis of outcome of consultation the action plan has been developed. LSGD will extend and expand the consultation and disclosure process significantly during implementation of RUSDIP. They will appoint an experienced NGO to handle this key aspect of the programme.

14. The project authority will establish a mechanism to receive and facilitate resolution of affected persons' concerns, complaints and grievances about the project's environmental performance.

15. **Recommendation and Conclusion:** There are two straightforward but essential recommendations that need to be followed to ensure that the environmental impacts of the project are successfully mitigated. These are that LSGD should ensure that, all mitigation, compensation and enhancement measures proposed in this IEE report and in the Resettlement Framework for the RUSDIP are implemented in full, as described in these two documents and the Environmental Monitoring Plan proposed in IEE and the internal and external monitoring proposed in the Resettlement Framework are also implemented in full.

16. This initial environmental examination (IEE) ascertains that the subproject is unlikely to cause any significant environmental impacts. Few impacts were identified attributable to the proposed subproject, all of which are localized and temporary in nature and can be easily mitigated with minor to negligible residual impacts. There are no uncertainties in the analysis, and no additional work is required to comply with ADB procedure and national law.

I. INTRODUCTION

A. Purpose of the report

1. Rajasthan Urban Sector Development Investment Program (RUSDIP) is intended to optimize social and economic development in 15 selected towns in the State, particularly district headquarters and towns with significant tourism potential. This will be achieved through investments in urban infrastructure (water supply; sewerage and sanitation; solid waste management; urban drainage; urban transport and roads), urban community upgrading (community infrastructure; livelihood promotion) and civic infrastructure (art, culture, heritage and tourism; medical services and health; fire services; and other services). RUSDIP will also provide policy reforms to strengthen urban governance, management, and support for urban infrastructure and services. The assistance will be based on the State-level framework for urban reforms, and institutional and governance reforms recommended by the Government of India (GoI) through the Jawaharlal Nehru National Urban Renewal Mission (JNNURM) and Urban Infrastructure Development Scheme for Small and Medium Towns (UIDSSMT).

2. RUSDIP Phase II to be implemented over a seven year period beginning in 2008, and will be funded by a loan via the Multi-tranche Financing Facility (MFF) of the ADB. The Executing Agency (EA) is the Local Self-Government Department (LSGD) of the Government of Rajasthan (GoR); and the Implementing Agency (IA) is the Project Management Unit (PMU) of the Rajasthan Urban Infrastructure Development Project (RUIDP), which is currently in the construction stage.

3. RUSDIP will improve infrastructure through the design and implementation of a series of subprojects, each providing improvements in a particular sector (water supply, sewerage, solid waste etc) in one town. RUSDIP has been classified by ADB as environmental assessment category B (some negative impacts but less significant than category A). The impacts of subprojects prepared according to ADB's Environment Policy 2002 and Environmental Assessment Guidelines (2003).

B. Extent of the IEE study

4. Indian law and ADB policy require that the environmental impacts of development projects are identified and assessed as part of the planning and design process, and that action is taken to reduce those impacts to acceptable levels. This is done through the environmental assessment process, which has become an integral part of lending operations and project development and implementation worldwide.

1. ADB Policy

5. ADB's Environment Policy (2002) requires the consideration of environmental issues in all aspects of the Bank's operations, and the requirements for Environmental Assessment are described in Operations Manual (OM) 20: Section F1/BP (2006) Environmental Considerations in ADB Operations. This states that ADB requires environmental assessment of all project loans, programme loans, sector loans, sector development programme loans, financial intermediation loans and private sector investment operations.

6. The nature of the 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, and the availability of cost-effective

mitigation measures. Projects are screened for their expected environmental impacts and are assigned to one of the following categories:

- Category A: Projects that could have significant environmental impacts. An Environmental Impact Assessment (EIA) is required.
- Category B: Projects that could have some adverse environmental impacts, but of less significance than those for category A. An Initial Environmental Examination (IEE) is required to determine whether significant impacts warranting an EIA are likely. If an EIA is not needed, the IEE is regarded as the final environmental assessment report.
- Category C: Projects those are unlikely to have adverse environmental impacts. No EIA or IEE is required, although environmental implications are reviewed.
- Category FI: Projects that involve a credit line through a financial intermediary (FI) or an equity investment in a FI. The FI must apply an environmental management system, unless all subprojects will result in insignificant impacts.

7. The Bank has categorised this program as Category B and following normal procedure for MFF loans has determined that one Environmental Examination will be conducted for each subproject, with a subproject being the infrastructure improvements in a particular sector (water supply, sewerage, etc) in one town.

2. National Law

8. The GoI EIA Notification of 2006 (replacing the EIA Notification of 1994), sets out the requirement for Environmental Assessment in India. This states that Environmental Clearance (EC) 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 categorised as A or B depending on the scale of the project and the nature of its impacts.

9. Categories A projects require Environmental Clearance from the National Ministry of Environment and Forests (MoEF). The proponent is required to provide preliminary details of the project in the form of a Notification, after which an Expert Appraisal Committee (EAC) of the MoEF prepares comprehensive Terms of Reference (ToR) for the EIA study, which are finalized within 60 days. On completion of the study and review of the report by the EAC, MoEF considers the recommendation of the EAC and provides the EC if appropriate.

10. Category B projects require environmental clearance from the State Environment Impact Assessment Authority (SEIAA). The State level EAC 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 EAC, the SEIAA issues the EC based on the EAC 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, notified areas or inter-state or international boundaries.

11. The only type of infrastructure provided by the RUSDIP that is specified in the EIA Notification is solid waste management, where EC is required for all Common Municipal Solid

Waste Management Facilities (CMSWMF)¹. EC is thus not required for the sewerage sanitation sub-project that is the subject of this Environmental Examination.

12. The summary of environmental regulations and mandatory requirements for the proposed subproject is shown in **Table 1.1**

Table 1.1: Applicable Environmental Regulations & Legislations and its applicability

Acts/Guidelines	Purpose	Applicability to subproject
The EIA notification, 2006 (and its subsequent amendments in 2009) provides for categorization of projects into category A and B, based on extent of impact	This states that Environmental Clearance (EC) 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. Categories A projects require Environmental Clearance from the National Ministry of Environment and Forests (MoEF). Category B projects require environmental clearance from the State Environment Impact Assessment Authority (SEIAA).	Not applicable The sub project is not included in schedule of environmental impact assessment notification 2006 and its subsequent amendments till dates so it is not categories as either Category A or Category B. As a result, environmental clearance is not required, either from the state or the central Government.
The Wildlife Conservation Act, 1972,	Clearance from state and national wildlife boards, Central Empowered Committee of Hon'ble Supreme Court of India and the State Wildlife Department, as applicable.	Not Applicable
Rajasthan Forest (Conservation) Act, 1953	Clearance from Forest department for cutting of trees, if any.	Applicable
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.	Permission from the Archaeological Survey of India for carrying out any construction activities within the prohibited and regulated areas of the ancient monuments and archaeologically protected sites.	Not Applicable
Water (Prevention and control of pollution) Act,	Consent to Establish (CTE) and Consent to Operate (CTO) from the RSPCB for setting up	Applicable

¹ “For the purpose of EIA Notification, common municipal solid waste management facilities may be referred as centralized MSW facility for an given town, city, region. It is further to mention a common facility need not have surrounding ULBs included.”

(Technical EIA Guidance Manual for CMSWMF)

1974, as amended Air (prevention and control of pollution) Act, 1981, as amended and	of sewage treatment plant (STP) & hot mix plants, wet mix plants, stone crushers and diesel generators (if installed for construction). To be obtained by the Contractor, prior to construction.	
Water (Prevention and Control of Pollution) Cess Act, 1977 including Rules	Applicable to all activities, which discharge effluents as a result of process or operations	Applicable
Public Liability and Insurance Act 1991	Protection form hazardous materials and accidents.	Applicable
Noise Pollution (Regulation and Control Act) , 2000	The standards for noise for day and night have been promulgated by the MoEF for various land uses. DG sets at construction sites should be provided with acoustics enclosures.	Applicable
Central Motor Vehicle Act 1988 and Central Motor Vehicle Rules 1989	To check vehicular air and noise pollution. All vehicles in Use shall obtain Pollution Under Control (PUC) certificates by the contractor	Applicable
Child Labour Act 1986	No child shall be employed or permitted to work in any of the scheduled occupations	Applicable

3. Review and Approval Procedure

13. For Category B projects the Draft Environmental Status report and its summary (SIEE) are reviewed by ADB's Regional Department sector division and Environment and Social Safeguards Division, and by the Executing Agency, and additional comments may be sought from project affected people and other stakeholders. All comments are incorporated in preparing the final documents, which are reviewed by the Executing Agency. The EA then officially submits the IEE and SIEE reports to ADB for consideration by the Board of Directors. Completed reports are made available worldwide by ADB, via the depository library system and the ADB website.

4. Scope of Study

14. This is the IEE report for the Jaisalmer sewerage and sanitation sector. It discusses the generic environmental impacts and mitigation measures relating to the location, design, construction and operation of physical works proposed under this subproject.

II. DESCRIPTION OF THE PROJECT

A. Type, Category and Need

15. This is a sewerage and sanitation sub-project, and as explained above it has been classified by ADB as Category B, because it is not expected to have major negative environmental impacts. Under ADB procedures such projects require an IEE to identify and mitigate the impacts, and to determine whether further study or a more detailed EIA may be required. The sub-project is needed because there is no underground sewage system in Jaisalmer town at present. Only few households have covered with individual septic tank. The disposal of waste and effluent of septic tank is through the open drains. Presently the open drains, which have been constructed by Municipal Board, convey the sludge and sewage which is leading to unhygienic and unsanitary conditions.

16. From the demand gap analysis it is to be concluding that there is comprehensive need of UGD scheme for proper collection and treatment and disposal of sewage in the town.

B. Location, Size and Implementation Schedule

17. The sub-project is located in Jaisalmer, the headquarters town of Jaisalmer District, in the western part of Rajasthan (**Figure 2.1**). The infrastructure will extend throughout many parts of the town, where pipes for new secondary and tertiary sewer networks will be buried within or alongside roadways. Under Tranche 1 a new Sewage Treatment Plant (STP) of 10 MLD has already taken up at Kishan Ghat. Proposed sewerage zone is shown in **Figure 2.2**.

18. The general drainage of the Jaisalmer town is through open drains. Some soak pits of shallow depth and inadequate size are also in existence. These soak pits do not function properly and after some time is overflowing. Effluent from septic tank also flows directly in the road drains. There is no underground water carriage system and treatment works. The effluent from septic tanks partially treated and in some cases, even untreated sewage, being carried through street drains ultimately empties in low lying area or natural water channels flowing through the town.

19. Detailed design began in the last quarter of 2009 and completed with revised scope by mid of 2010. Construction of all elements will be beginning in early 2011. Construction of the sewer networks, intermediate pumping station and pumping main will take up to 1½ years, so all work should be completed by the middle of 2013.

20. Photographs of the project area are attached as **Annexure-I**

C. Existing Sewerage and Sanitation status of Jaisalmer

21. Currently, sewerage system exists only within the Jaisalmer fort area and was built in 1994. It covers a length of ~2.5 km and has around 400 sewer connections. The existing sewerage network in the fort area consists of mostly of PVC and AC pipes with diameters ranging from 3-6 inches.

22. Outside the fort area, in the areas that are heavily built – spreading 4 km eastwards from the railway station area, and stretching 2 km north-south between Malka Prol to the Bus stand area – there is a need for underground sewerage system as these areas do not have enough space for allowing functional on-site sanitation facilities. The absence of appropriate sanitation

facilities has led to gross contamination of *nallas* and surface water in and around the city, posing high risks through water borne diseases. Similarly the sewage from the fort area needs to be captured and treated properly.

D. Description of the Sub-project

Previous Scope of Work

23. One sub-project is under implementation from the year 2009. Subproject components covered under are as under:

- Construction of 10 MLD Sewage Treatment Plant based on Waste Stabilization Pond (WSP) at village Kishan Ghat
- Laying of Outfall Sewer & Trunk Mains of sizes 700 mm 1000 mm dia. for a length of 5384 m.
- Laying of Sub-Mains & laterals of sizes 200 mm to 600 mm dia. for a length of 44327 m.

24. The sub-project will be completed in the year 2011-12. In addition to the above mentioned work components now it is being planned to add some additional work components for covering new area and shortfall of the earlier work components.

Enhanced Scope of work

25. In addition to the above mentioned work components now it is being planned to add some additional work components for covering new area and shortfall of the earlier work components.

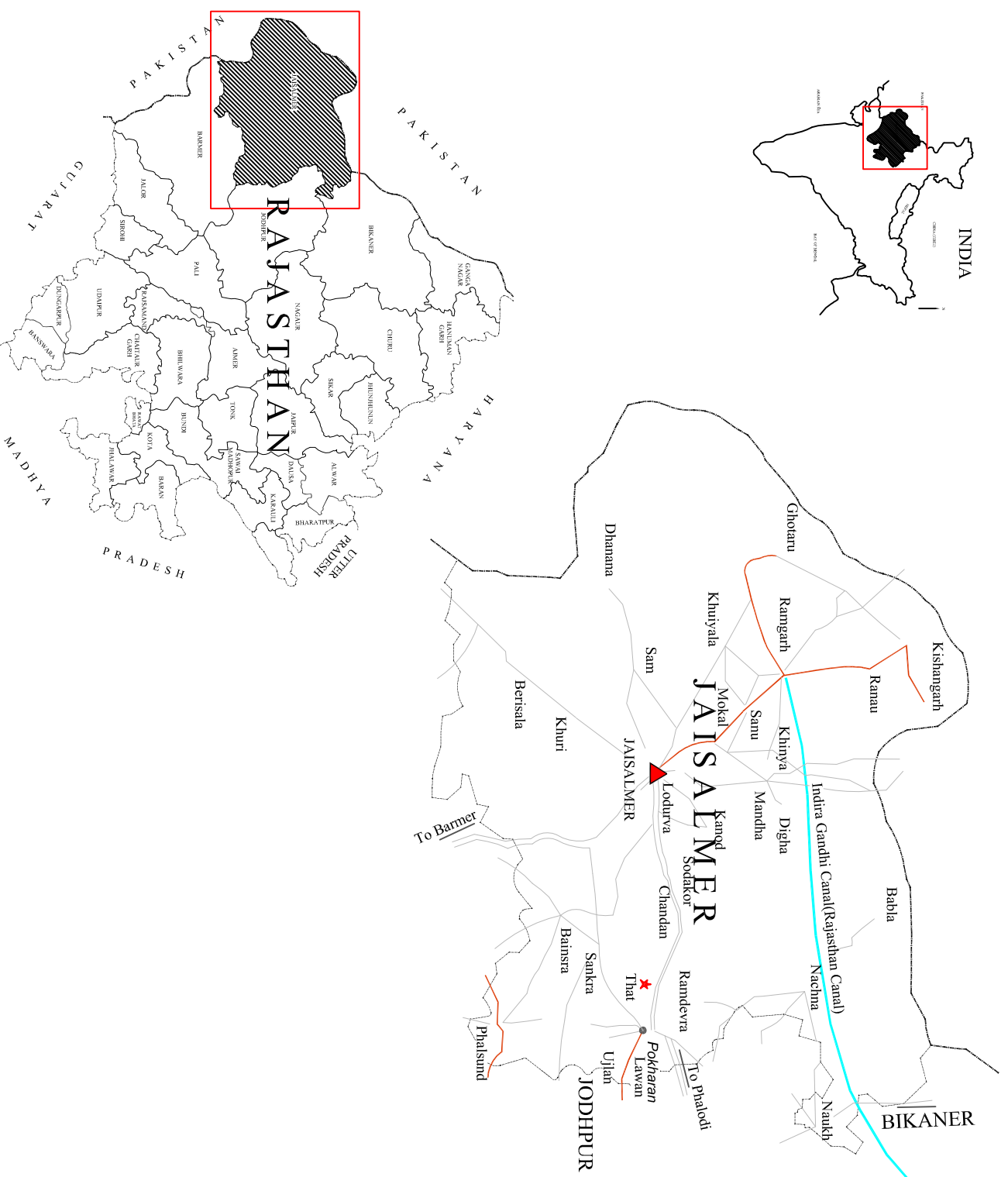
26. Under Enhanced Scope: The following components are being considered

- Sewage Pumping Stations of 2 MLD capacity proposed In at Gandhi Colony Jaisalmer Town
- Laying DI of pumping main of size 200 mm dia. for a length of 750 m.
- Laying of GRP & PVC-U Sub-Mains & laterals of sizes 200 mm to 500 mm dia. for a length of 17113 m.

27. **Table 2.1** shows the nature and size of the various components of the subproject. As indicated above there are two main elements: provision of a network to collect sewage from different city part; and an Intermediate pumping station with pumping main. The descriptions shown in **Table 2.1** are based on the present proposals, which are expected to be substantially correct, although certain details may change as development of the subproject progresses and in that case environmental reassessment will be done.

28. The network pipes are of RCC in earlier scope and will be of Glass Reinforced Pipes (GRP) & PVC-U in enhanced scope, and will be located alongside roads and streets, in the government-owned Right of Way (RoW). These sub-mains and laterals of 200-500 mm dia buried in trenches of around 1.5-2 m.

Figure 2.1: Map showing the location of the project



Rajasthan Urban Sector
Development Investment Program
ADB TA 4814-IND

Jalsalmer Regional Map

LEGEND:-

- [illegible]

OVERLAY LEGEND:-

GOVT. OF RAJASTHAN
ASIAN DEVELOPMENT BANK

DRAWN :-	CHECKED :-
----------	------------

DATE :-

APPROVED :-

SCALE :-

Figure :-



Figure 2.2: Sewerage network layout for Original Scope of work

SEWERAGE NETWORK IN JAISALMER TOWN

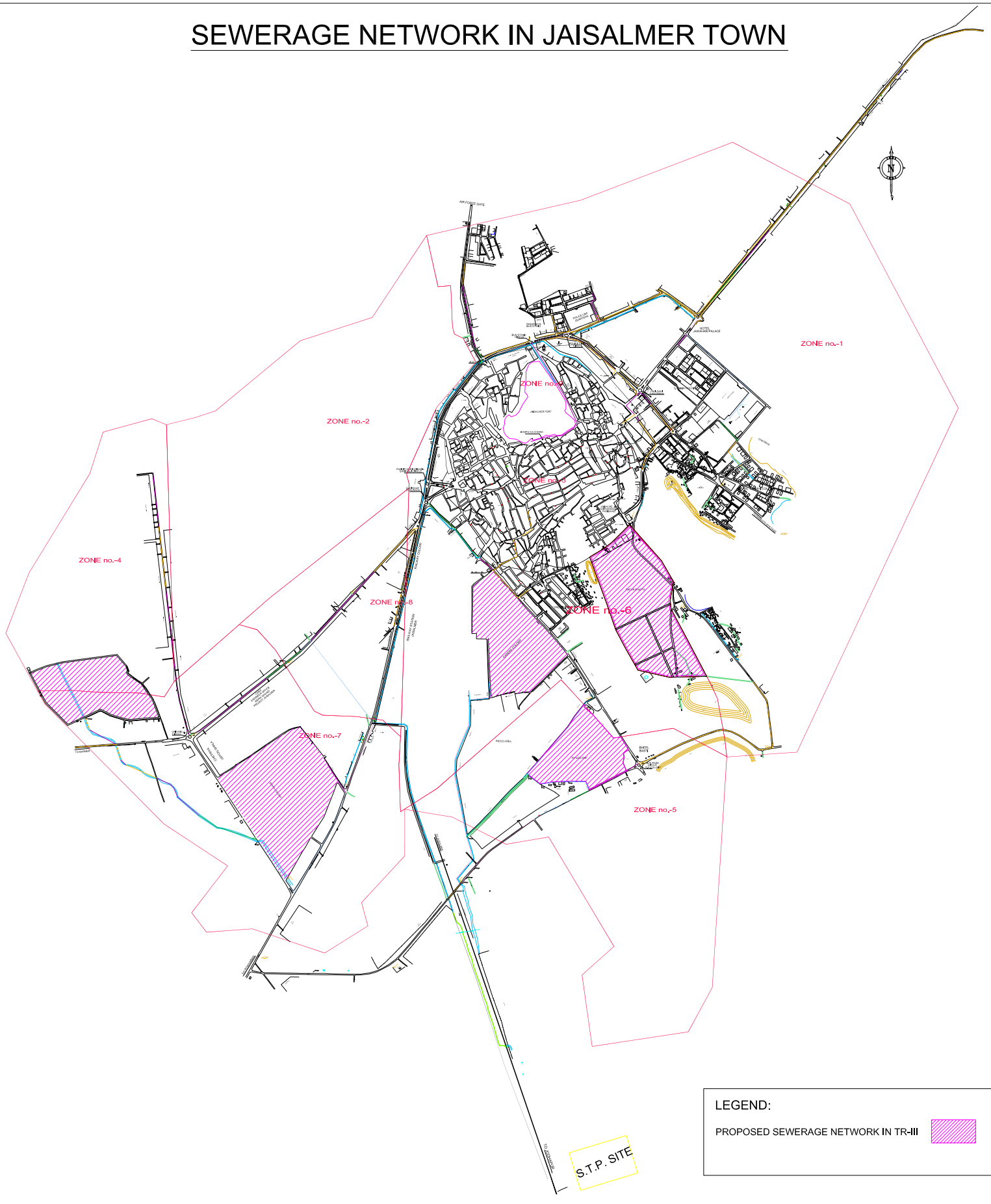
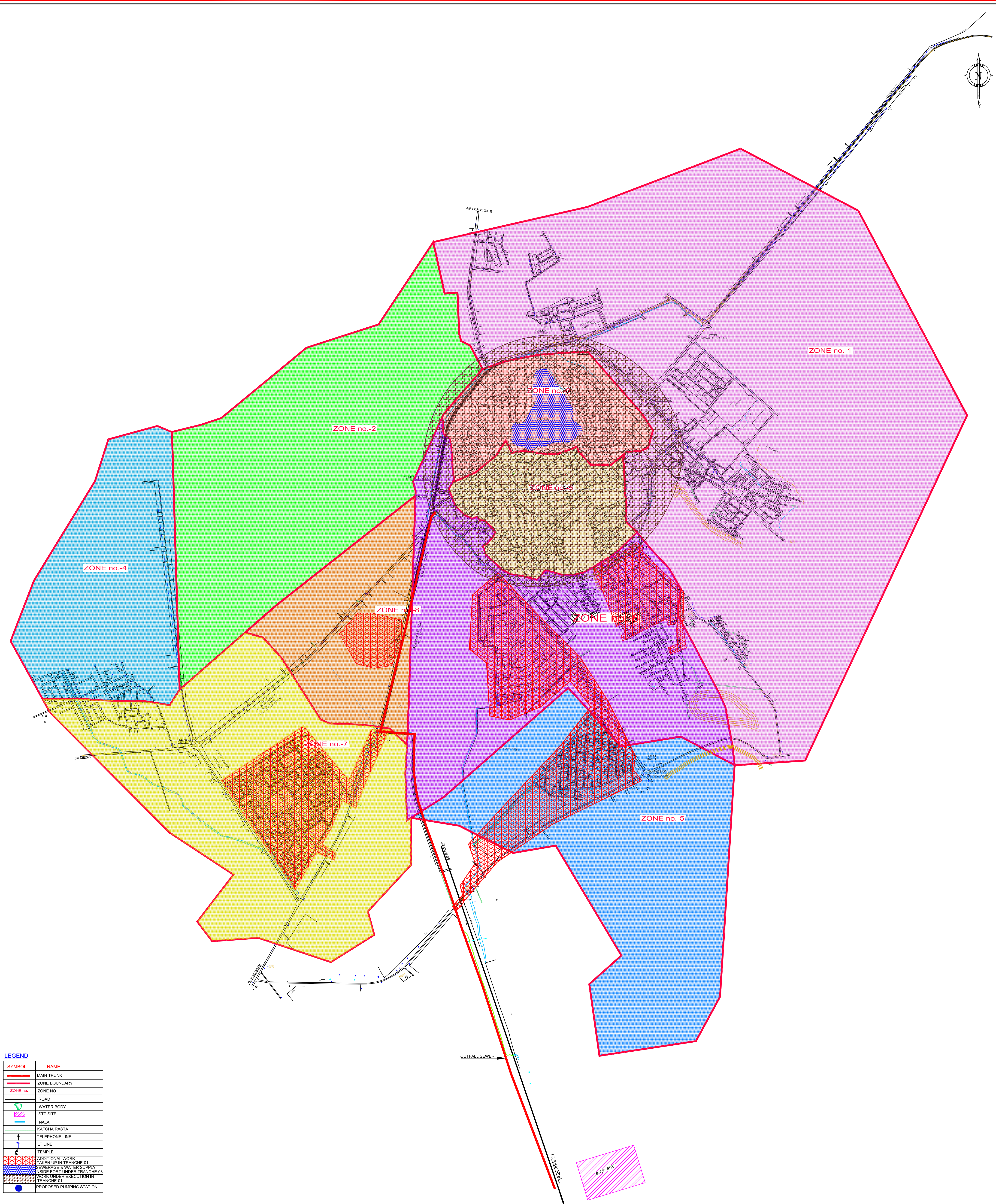


Figure 2.3: Sewerage network layout for Enhanced scope



LEGEND	
SYMBOL	NAME
	MAIN TRUNK
	ZONE BOUNDARY
	ZONE no.-4
	ZONE no.-5
	ZONE no.-6
	ZONE no.-7
	ZONE no.-8
	ROAD
	WATER BODY
	STP SITE
	NALA
	KATCHA RASTA
	TELEPHONE LINE
	LT LINE
	TEMPLE
	ADDITIONAL WORK TAKEN UP IN TRANCHE-01
	SEWERAGE & WATER SUPPLY INSIDE FORT UNDER TRANCHE-03
	WORK UNDER EXECUTION IN TRANCHE-01
	PROPOSED PUMPING STATION

Notes:	DEALT	RAVI SUTHAR	
	DRAWN	YOGESH VERMA	
	CHECKED	TEAM LEADER	
	APPROVED	IPIU, JAISALMER	
	DATE	10 JUNE 2010	

CLIENT : RUIDP, JAIPUR (RAJ.)	
C-781	JOB: DESIGN & CONSTRUCTION SUPERVISION CONSULTANCY (DSC) PACKAGE-II (NAGAU)
TITLE : SEWER ZONES OF JAISALMER TOWN	
DRG. NO. SCPL/C-781/RUSDIP/TR-01/JSL/WWW/02/01	
RELEASED FOR	☐ DPR ☒ Tender ☐ Information ☐ Approval ☐ Construction
SNC-LAVALIN Span Consultants Pvt. Ltd. (A Member of SNC-LAVALIN Group) MINDMILL Corporate Tower 4th & 5th Floor, Plot No. 24A, Sector 16A, Film City, NOIDA (U.P.) 201301	
SHEET 1 OF 1	REV-0

Table 2.1: Improvements in Sewerage Infrastructure Proposed in Jaisalmer under Tranche-I

Components	Location	Function	Description
Earlier Scope			
Sewage Treatment Plant (STP)	Village Kishangad(Total 75 Ha Government land)	Treatment of raw sewage of Jaisalmer town	Construction of 10 MLD Sewage Treatment Plant based on Waste Stabilization Pond (WSP) at village Kishangad
Trunk and lateral (secondary) sewers and tertiary network and house connection	In the phase 1. Zone no. 1, 2, 3, and 9. In addition to the phase sewer line is enhanced in Zone no. 5, 6, 7, and 8 that covers	Different diameter of sewer network and to connect with outfall sewer	Laying of Outfall Sewer & Trunk Mains of sizes 700 mm 1000 mm dia. for a length of 5384 m. Laying of Sub-Mains & laterals of sizes 200 mm to 600 mm dia. for a length of 44327 m.
Enhanced Scope			
Intermediate pumping station and pumping main	At Gandhi Colony	For intermediate sewage pumping	Sewage Pumping Stations of 2 MLD capacity proposed In at Gandhi Colony Jaisalmer Town Laying DI pipe of pumping main of size 200 mm dia. for a length of 750 m.
Sub-mains and laterals sewer	Outside the fort area, in the areas that are heavily built – spreading 4 km eastwards from the railway station area, and stretching 2 km north-south between Malka Prol to the Bus stand area. R.P. Colony, Gandhi Colony, Indra Colony, GAD Colony, DRDA colony and some part of Gafur Bhatta is proposed to cover.	Different dia. of sewer network and to connect with outfall sewer.	Laying of GRP & PVC-U Sub-Mains & laterals of sizes 200 mm to 500 mm dia. for a length of 17113 m.

III. DESCRIPTION OF THE ENVIRONMENT

A. Physical Resources

1. Location

29. Jaisalmer District is located in the extreme west of both Rajasthan and India, and shares western and northern borders with Pakistan. It lies between the longitudes of 69° 29' to 72° 20' East, and latitudes of 26° 01' 20" to 28° 02' North (Figure 2.1), is at an average altitude of 242 m above MSL, and forms the major part of the Great Indian Desert (Thar Desert). Jaisalmer Town is the district headquarters and lies roughly in the centre, 550 km west of the State capital Jaipur and 300 km northwest of Jodhpur. The municipal area covers 126.27 km² in total, in which there is a population of only 57,537 according to the 2001 census. Most of the area consists of rocky hillsides and uninhabited areas of sand.

2. Topography, soil and geology

30. Although Jaisalmer Town is situated in the heart of the Thar Desert with its characteristic large and mobile sand dunes, the town and its environs present a different physiography. The town is located in an area of elevated rocky ridges extending from the Barmer District Hills in the south-west, and separated by undulating alluvial and sandy valleys. This area is around 15-20 km wide and stretches for over 60 km to the north of the town, and generally slopes from the north-west to the south-east. Soils are stony, sandy, and relatively infertile.

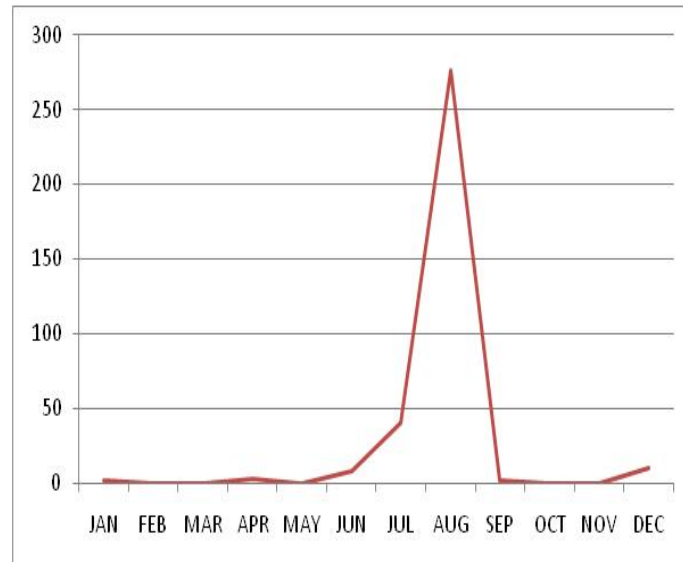
31. One of the most notable physical features of the town is Jaisalmer Fort, constructed in the 12th century, 75 m above ground level on a *trikuta* or triple-peaked hill. Two valleys run around the fort and meet in the south-east, and the surrounding land (on which the town subsequently developed) slopes towards the valleys, forming an overall bowl-like topography. There is little natural drainage and no permanent surface water, because of the very limited rainfall (see below).

32. According to the Vulnerability Atlas of India, most of Jaisalmer District, including Jaisalmer Town, is in an area of medium earthquake risk (Zone III). Although Rajasthan has not experienced a major earthquake in the recent past, there have been 37 events with a magnitude of 5-7 since 1720, with the most recent occurring in 2001. This measured 6.9 on the Richter scale, but because the epicentre was in neighbouring Gujarat, there was only limited damage in Jaisalmer, although "Salim Singh ki Haveli" and "Hawa Pol" in the fort were affected.

3. Climate

33. The climate is typical of a desert region, being hot and arid, with large day-night temperature extremes and sporadic and erratic rainfall. Winter extends from November to March, and the coolest period occurs in January when daytime temperatures average below 20 °C and often fall to freezing at night. Temperatures begin to rise in March and peak in May-June, when daytime values sometimes reach 48 °C. Wind speeds may also increase at this time, and dust storms are common. The south-west monsoon arrives in July, causing a sudden drop in temperature, although the air remains dry as rain only falls on an average of six days per year. The long-term average rainfall is just 189 mm. **Figure 3.1** shows monthly rainfall pattern during 2008. The monsoon ends in mid-September and air temperatures rise, only to fall again a few weeks later with the onset of winter. Winds are generally light in winter and moderate to strong in the monsoon, and blow mainly from the north-west and south-west, and from the south and

south west in the monsoon. **Figure 3.2** shows total rainfall variation from 2004 to 2008. Rainfall data for 2011 is as shown in below **Table 3.1**. Highest rainfall in 2011 was on 2nd September, 2011 i.e.89 mm.



Source: Official website 2009

Figure 3.1: Total Annual Rainfall in Jaisalmer 2008

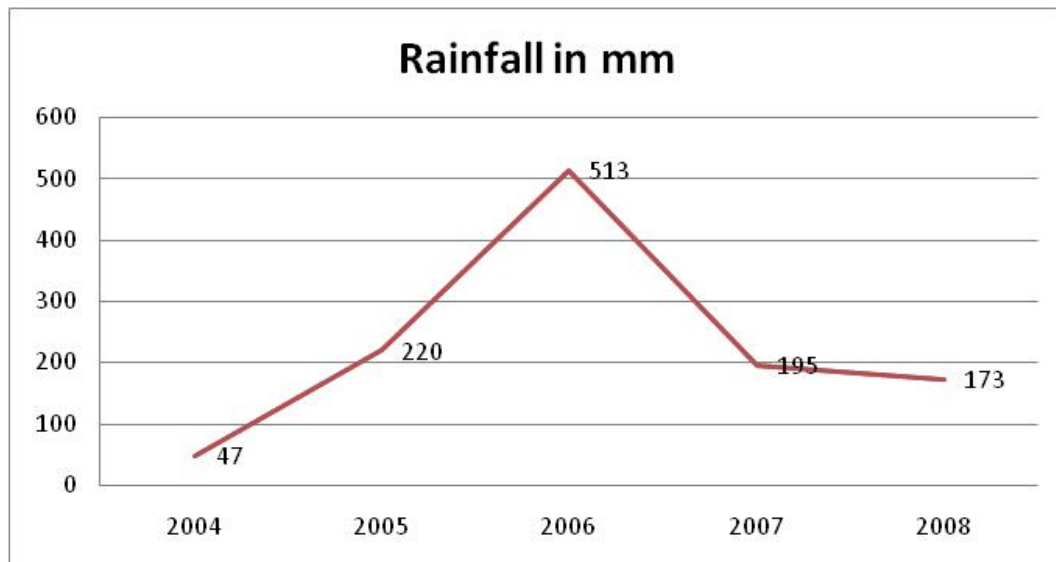


Figure 3.2: Variation of total rainfall from 2004 to 2008

Table 3.1: Rainfall at Jaisalmer in recent years (2011)

Sr. No	Months	Rainfall (mm)
1	January	0.0
2	February	2.0
3	March	0.0
4	April	1.0
5	May	0.0
6	June	0.0
7	July	44.0
8	August	62.0
9	September	138.0
10	October	0.0
11	November	0.0
12	December	0.0
13	Monsoon Rainfall	274.0
14	Non monsoon rainfall	3.0
15	Annual Rainfall	277.00

(Source: District Website, Govt. of Rajasthan, 2012)

4. Air and Noise Quality

34. Ambient Air Quality Monitoring was carried out at five locations in Jaisalmer town in June 2012. The results of air quality monitoring are shown below in **Table 3.2**. It may be observed from the Table 3.2 that levels of particulate matter (particle size $\leq 10\mu\text{m}$) are higher than the standards at three locations. The high concentrations of particulate matter in Jaisalmer town are due to arid climate of the area. Traffic is the only significant source of pollutant in Jaisalmer so levels of oxides of sulphur and nitrogen are within the National Ambient Air Quality Standards (NAAQS). Similarly Noise Level Monitoring was done in the June 2012, as shown in **Table 3.3**.

Table 3.2: Ambient Air Quality in Jaisalmer (Average value in $\mu\text{g}/\text{m}^3$)

Monitoring Station	Land use	PM ₁₀	PM _{2.5}	NO _x	SO ₂	CO mg/m ³
Office RUIDP (Loharvash)	Residential	99.7	25.9	11.2	6.6	<1.15
Gafurgattha	Residential	105.7	30.1	10.5	5.5	<1.15
Ramgarh Road	Residential	95.8	24.1	11.9	5.7	<1.15
Gajrup sagar pump house	Residential	144.4	22.7	10.8	5.8	<1.15
Gadisar circle	Residential	158.9	28.6	11.6	6.5	<1.15
Permissible limits as per CPCB Notification, New Delhi, 18 th November, 2009 for Industrial, Residential, Rural and Other area		100	60	80	80	02 [*] , 04 [#]

Where: * = Maximum limits for 8 hourly monitoring, # = Maximum limits for 1 hourly monitoring.

Source: Onsite Monitoring done by RUIDP

Table-3.3: Result of Noise Monitoring at Different Locations

Location Name	Land Use	Noise Level Leq in dB(A)	
		Day	Night
Office RUIDP (Loharvash)	Residential	55.1	47.5
Gafurgattha	Residential	49.9	42.7
Ramgarh Road	Residential	48.5	43.3
Gajrup sagar pump house	Residential	48.5	45.4
Gadisar circle	Residential	55.1	50.6
Standard Limits in dB(A) Leq, [THE NOISE POLLUTION (REGULATION AND CONTROL) RULES, 2000]		55	45

Source: -On site monitoring done by RUIDP (2012)

5. Surface Water

35. There are no perennial rivers in Jaisalmer District, and no natural lakes or ponds, which is not surprising given the low rainfall. A few ephemeral streams appear on land outside the town during rainfall, and water accumulates in certain low lying areas, but the water is shallow and drains into the sand very quickly. A few manmade reservoirs have been created by constructing simple bunds, such as Gadi Sagar Lake, which was built in the 14th century and was for some time the main source of water for the town.

6. Groundwater

36. Because of the sandy soils and lack of rainfall, the water table is very deep around Jaisalmer Town, ranging from 38-46 m below ground level. The main aquifer lies below this depth, comprising Lathi formations from the Lower Jurassic Age, composed of mainly sandstones and some lime stones in the upper levels. The aquifer is tapped by a number of wells, but the yield is reported to be low. Jaisalmer Municipal Board (JMB) has developed a well field at Dabla Village 12.5 km from the town, where the aquifer is around 85 m below the surface. There are 12 tube wells of 200 m depth providing an average yield of 18,000 l/h, producing a total of around 3 million litres per day.

37. The Public Health Engineering Department (PHED) regularly monitors the quality of water from the Dabla field, and the data (**Table 3.4**) shows that fluoride concentration is slightly above the acceptable level according to national quality standards, and Total Dissolved Solids are above the desirable level but below the acceptable level. The analysis of ground water was done from sample taken from the Tube well on Ramgarh Road. The results for which are shown in **Table 3.4**.

Table 3.4: Quality of groundwater from the Dabla field (2005)

Parameter	Units	Monitored Value	Drinking Water BIS Standard	
			Desirable Level	Acceptable Level
pH	-	7.6	6.5-9.0	NR
Chloride (Cl)	mg/l	190	250	1000
Total Dissolved Solids (TDS)	mg/l	980	500	2000

Parameter	Units	Monitored Value	Drinking Water BIS Standard	
			Desirable Level	Acceptable Level
Nitrate (NO ₃)	mg/l	4	45	100
Fluoride (F)	mg/l	1.6	1.0	1.5

Source: CDP Jaisalmer; BIS = Bureau of Indian Standards

Table 3.5: Quality of groundwater from the Tube well on Ramgarh Road

Parameter	Units	Monitored Value
pH	-	8.5
Chloride (Cl)	mg/l	966.4
Fluoride (F)	mg/l	1.6
Dissolved Oxygen	mg/l	3.1
Iron	mg/l	0.07
Total alkalinity	mg/l	400.0
Sulphates	mg/l	114.4
Total Hardness	mg/l	340.0

B. Ecological Resources

38. Jaisalmer Town is an urban area located on a hard rocky substratum, surrounded by a harsh desert environment of wind-blown sand and dunes. The municipal area includes large swathes of uninhabited rocky hills and sand dunes, with alluvial soil and sand in the intervening valleys, which are cultivated where there is enough rain. Natural vegetation is very limited, and consists of mainly sparse, scattered shrubs and grasses. The fauna of the town comprises mainly domesticated animals (camels, cows, goats, pigs and chickens), plus other species able to live close to man (urban birds, rodents and some insects). In the desert away from the inhabited area there is a more natural fauna, which includes hyaenas (*Hyaena hyaena*), desert fox (*Vulpes pusilla*), jackal (*Canis aures*) and chinkara gazelle (*Gazella gazella pallas*).

39. There is no forest area in the vicinity of the project area. The nearest protected area is the Desert National Park 40 km away, which is designated as an excellent example of the Thar Desert ecosystem. This area includes a wide range of desert environments, including sand dunes, craggy rocks, salt lake bottoms, intermediate areas and fixed dunes, and the fauna is more diverse than found around Jaisalmer. It includes blackbuck, wolf, Indian fox, hare and desert cat, in addition to those species noted above. Small numbers of the great Indian Bustard are also found which is an endangered bird species and is close to extinction.

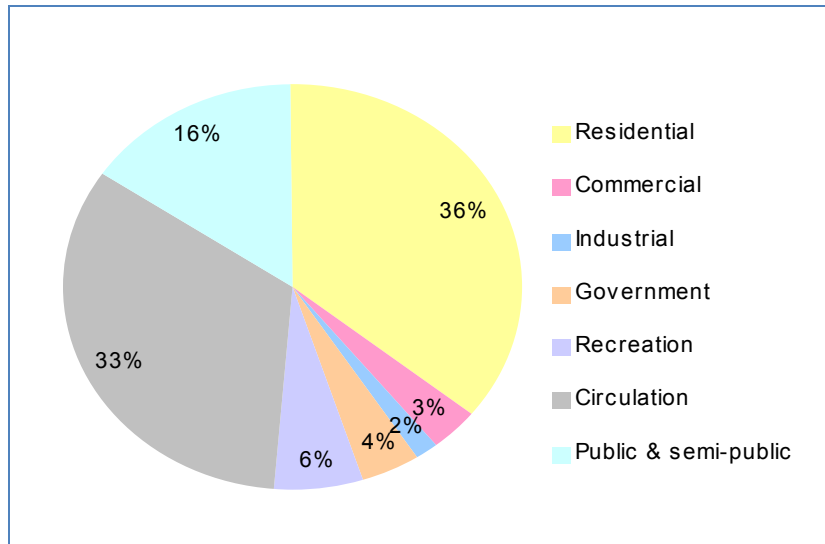
C. Economic Development

1. Land use

40. Located in the Thar Desert in the extreme north-west of India, Jaisalmer is an important urban centre for its vast desert hinterland, and is also of strategic importance because of its proximity to Pakistan. Traditionally a services and administrative town, it was not until the late 1970's that trade and commerce began to increase, mainly through growth in the tourism sector.

41. Jaisalmer however offers little potential for further development, mainly because of the harsh and inhospitable landscape and the remoteness of the town. Only around 10 % (1,247

ha) of the total municipal area is developed, mainly because the remainder of the land is rocky and hilly and unsuitable for inhabitation, industry or infrastructure. Figure 3.2 shows the current land use in the developed area, from recently conducted surveys, which indicates that the major uses are for residential areas, roads/transportation and public and semi-public land. There is also a significant military presence, with a number of defence installations both inside and outside the town.



Source: Jaisalmer Urban Improvement Trust

Figure 3.2: Current land use in Jaisalmer (developed area)

2. Industry and Agriculture

42. There is very little industrial development in Jaisalmer and the town is in fact classified as a “No Industries District” in State planning terms. Economic activities are growing steadily however, stimulated by development in the tourism sector, as increasing mobility and affluence means that people are able to visit more remote regions, to benefit from the dual attractions of beautiful scenery and a rich historical and cultural heritage.

43. Rajasthan Industrial Infrastructure Corporation (RIICO) has developed a small scale industrial area on 25 ha of land in the town, which currently houses 136 units, specialising mainly in light industry, such as manufacturing farm equipment, repairing automobiles and machinery, and furniture-making. There are also a number of stone polishing workshops, located here because of the vast amount of building material and decorative stone available from quarries in the surrounding hillsides. There are a number of small cottage industries in the town, manufacturing *khadi*, cotton and woollen garments and handicrafts (Photo 8), and this is one sector that has particularly benefited from the increase in tourism. There are also a number of hotels and restaurants, to serve the growing numbers of visitors.

44. Agriculture is restricted by both climate and physiography, as the limited rainfall and desert soils mean that there are very few areas that are suitable for agriculture, and yields are limited to a maximum of one crop per year. The main product is the fodder crop *jowar*, which is grown to feed the herds of camels, cattle, sheep and goats that are a feature of areas outside the town. Although the Indira Gandhi Nahar Project (IGNP) brings water for irrigation and domestic use

into Rajasthan (including Jaisalmer District) from the Ravi and Bias rivers, this does not reach Jaisalmer Town where agriculture remains limited.

3. Infrastructure

45. PHED provides a piped municipal water supply in Jaisalmer, which is sourced from the Dalba groundwater field (3 MLD) and from the Dewa Minor canal of the IGNP, 34 km away (5 MLD). The system supplies 80% of the population, but water is available for only 1-2 hours per day, mainly because of leakage losses (estimated at 40%) and low and unequal network pressure. The provision is also unequal, with un-served areas being mainly the slums and fringe or newly-developed areas. Profuse leaking from the network in the fort area is causing severe degradation of buildings and the fort walls and foundations.

46. There is a piped sewerage system only inside the fort, which serves 2% of the population. Developed in 1994, the system does not function well because of the undulating topography and blockages caused by solid waste, so leakages and overflows are very frequent. This contributes to the deterioration of the fort structures as well as detracting from the appearance of the fort (which is a major tourist attraction) and creating a public health hazard. There is no sewage treatment, and wastewater collected by the system accumulates in a low lying area near Gadisar Gate, which has become a major mosquito breeding ground. Most other households utilise pit latrines or septic tanks, and there are illegal connections through which sewage is deposited into open storm water drains. Because of the availability of large areas of vacant land, open disposal and open defecation are also prevalent.

47. There is also no proper system for storm water drainage in the town, and although this is not a major problem because of the limited rainfall, sudden storms (including one in 2006) can cause quite widespread flooding, damaging property and possessions. There are roadside drains in certain areas, but these are poorly designed with inadequate gradients, and are frequently clogged with solid waste and polluted by sewage.

48. The solid waste management system is also ineffective, and refuse is mainly discarded in the streets and drains, and dumped on vacant plots of land. Jaisalmer generates an estimated 21 tons of solid waste per day and the Jaisalmer Municipal Board (JMB) collects around 12 tons from its manual street sweeping operation (conducted inside the fort), and removes other waste from vacant plots irregularly. Collected waste is transported on open vehicles to the outskirts of the town and dumped on open ground. The Municipality has recently acquired a 76 ha plot of land with the intention of constructing a sanitary landfill, but at present waste is simply dumped on a part of this area.

49. Thermal power is the main source of energy in Rajasthan, contributing 89% of the electricity, compared to hydropower, which produces the remainder. State-level companies (Rajya Vidyut Utpadan Nigam Ltd, RVUN; and Rajya Vidyut Prasaran Nigam Ltd, RVPN) are responsible for power generation and transmission respectively, and distribution is provided by a regional company, the Jaipur Vidyut Vitran Nigam Ltd (JVVNL). Power is supplied from the central grid by overhead cables carried on metal and concrete poles, mainly located in public areas alongside roads. The power supply is erratic and there are frequent outages in warmer months, and large fluctuations in voltage.

4. Transportation

50. The fort area and the walled old city are characterised by very narrow roads that are frequently congested with traffic and pedestrians. In contrast the remainder of the town has a relatively good road system, particularly in the outer areas, where streets are wide and not heavily used by traffic. The total road length in the town is 157 km, of which 70% are surfaced with bitumen/tar, 15% are stone paved and 15% are WBM (Water-borne Macadam). Most of the roads are maintained by JMB and around 15% by the Public Works Department (PWD), and the condition is generally poor, with many roads in need of repairs and resurfacing. This plus the absence of parking spaces and pedestrian walkways leads to slow traffic and congestion.

51. Transport in the city is mainly by personal vehicles (motorcycles and bicycles) and auto- and bicycle-rickshaws. The Rajasthan State Road Transport Corporation (RSRTC) runs public buses to neighbouring villages and towns and to larger towns farther afield, such as Jodhpur, Bikaner, Barmer and Jaipur, with which there are good road connections. Jaisalmer is also connected to Jodhpur, Jaipur and Delhi by the national railway. The nearest airport is 300 km away at Jodhpur, although there is a military air strip in Jaisalmer, which is also used for civilian purposes.

D. Social and Cultural Resources

1. Demography

52. According to the national census the population of Jaisalmer was 38,735 in 1991 and 57,537 in 2001, which shows an annual increase of 4.9 % over the decade. Gross population density is very low (457 persons/km), but because so much of the municipal area is undeveloped there are locations of very high density, particularly in the fort and walled city.

53. Overall literacy is 74.9%, reported at 85.5% for males and 60.7% for females, which is considerably better than literacy in the state as a whole, which is 60.4% overall, and 75.7% for males and 44.0% for females. The sex ratio is however significantly below the natural 1:1 ratio, being 764 females per 1000 males, lower than both the state and national averages (879 and 929 respectively).

54. According to the census, in 2001 only 32% of the population was in paid employment, significantly lower than both the state and national averages (42.1 and 39.1% respectively). This indicates that most of the townspeople are engaged in the informal sector, earning a living where they can, from small trading, casual labour, etc. Of those that are employed, almost all (96%) are involved in the service and industrial sectors, with the remainder being engaged in agricultural activities and household and cottage industries (around 2% each).

55. Around 75% of the people are Hindus, 20% are Muslim, and the remainder are mainly Sikhs and Janis. The majority of the inhabitants are Yadav Bhatti Rajputs, who take their name from a common ancestor named Bhatti. The main language is Marwari / Rajasthani, the principal dialect of the state. Most people speak the national language of Hindi and a few also speak English. Other languages spoken include Khariboli, Godvari and Urdu (because Rajasthan borders Pakistan). About 4% of the population are from Scheduled Tribes (ST), but these are part of the mainstream population, and around 10% of the population belong to scheduled castes (SC).

2. Health and educational facilities

56. There are good educational facilities in Jaisalmer, which serve both townspeople and inhabitants of surrounding villages and towns in the hinterland. There are 41 primary schools, 27 secondary schools and 7 higher secondary schools, plus two general degree colleges and an industrial training institute (ITI).

57. As the district headquarters town, Jaisalmer is the main centre for health facilities in the area and there is a district general hospital with 150 bed capacity, 4 dispensaries, a mother and child welfare centre and a government-run homeopathic hospital. There is also a private hospital of 25 bed capacity, and a number of private clinics.

3. History, culture and tourism

58. Founded with the construction of the fort in 1156, the Golden City of Jaisalmer originally became wealthy from trade because of its position on the camel-train routes between India and Central Asia, and the merchants and townspeople built magnificent houses and mansions, intricately carved from wood and sandstone. Various occupied by Rajputs, Mughals and maharajas, the city rose again to prominence in the 17th century because of its links to Delhi, and this heralded another period of building, featuring many grand palaces and *havelis* (decorated residences). The city declined with the rise of shipping and the port of Bombay, but since partition and the conflicts with Pakistan, its strategic importance has once again become important, as well as more recently, its attraction to tourists.

59. Tourism has risen in importance in Jaisalmer over the past 20 years, and in 2005 there were 280,000 tourists, almost double the number that visited in 2001 (150,000). The most important features of the town in terms of both culture and tourism are:

- Jaisalmer Fort, built in 1156 by the Rajput ruler Jaisala, rises over the city and provides magnificent views over the surrounding desert. Carved from sandstone and featuring 99 bastions, hundreds of narrow streets, a palace and many beautiful *havelis* and temples, this is the second oldest fort in Rajasthan. It is however suffering greatly from tourism pressure and damage from the leaking water system and ineffective drainage, and is on the World Monuments Watch list of 100 endangered sites worldwide;
- Salem Singh, Patwon and Nathmal are the three most visited *havelis* (Photo 11) and are examples of merchants' houses from the 19th century grand architecture period;
- Temples abound both inside and outside the fort, and the most notable are the seven interconnected yellow sandstone Jain temples dating from the 12th to 16th centuries and the Laxminath Hindu temple with its brightly decorated dome;
- Gadi Sagar south of the city walls was excavated in 1367 by Rawal Gadsingh. Once the water supply for the city it is now a picturesque lake, with clusters of small temples, a museum, and flocks of visiting waterbirds, particularly during the winter months.

IV. ENVIRONMENTAL IMPACTS AND MITIGATION: LOCATION AND DESIGN

60. ADB Environmental Assessment Guidelines require that an IEE should evaluate impacts due to the location, design, construction and operation of the project. Construction and operation are the two activities in which the project interacts physically with the environment, so they are the two activities during which the environmental impacts occur. In assessing the effects of these processes therefore, all potential impacts of the project are identified, and mitigation is devised for any negative impacts. This has been done in Sections IV and V and no other impacts are expected.

61. In many environmental assessments there are certain effects that, although they will occur during either the construction or operation stage, should be considered as impacts primarily of the location or design of the project, as they would not occur if an alternative location or design was chosen. For example, if a STP produces an effluent that does not meet legally established standards, then this is an impact of the design as it would not occur if a more rigorous treatment technology had been adopted.

62. In the case of this subproject there are few impacts that can clearly be said to result from either the design or location. This is mainly because:

- The project is relatively small in scale and involves straightforward construction and low-maintenance operation, so it is unlikely that there will be major impacts;
- Most of the predicted impacts are associated with the construction process, and are produced because that process is invasive, involving trenching and other ground disturbance. However the routine nature of the impacts means that most can be easily mitigated;
- In one of the major fields in which there could be significant impacts (archaeology), those impacts are clearly a result of the construction process rather than the project design or location, as they would not occur if this did not involve trenching or other ground disturbance.

63. There is however only impact that could be said to be related to the location and design of the project, which is:

- The pollution of surface and groundwater from the release of treated wastewater into the adjacent *nallah*, which would not occur if the STP was located elsewhere, or if a treatment technology to remove nitrate and phosphate was adopted.

64. There is a possibility of controlling green house gas (GHG) and generation of power from sewage. Some attempts have already been made at Surat, in the state of Gujarat. The case study is being documented in **Annexure-II**. Now Surat Municipal Corporation (SMC) is gearing to earn about 50,000 units of carbon credit per year for the successful generation of the green gas. In fact SMC is producing 3.5 MW power from sewage at four places in the city.

V. ENVIRONMENTAL IMPACTS AND MITIGATION: INFRASTRUCTURE CONSTRUCTION

A. Screening out areas of no significant impact

65. From the descriptions given in Section III.C it is clear that implementation of the project will affect a significant proportion of the town as branches of the new sewerage network will be built alongside many roads and streets.

66. However it is not expected that the construction work will cause major negative impacts, mainly because:

- Most of the network sewer will be built on unused ground alongside existing roads and can be constructed without causing major disruption to road users and adjacent houses, shops and other businesses;
- The Pumping station will be located on government-owned land that is not occupied or used for any other purpose;
- Most network construction will be conducted by small teams working on short lengths at a time so most impacts will be localised and short in duration;
- The overall construction programme will be relatively short for a project of this nature, and is expected to be completed in 1.5 years.

67. As a result there are several aspects of the environment that are not expected to be affected by the construction process and these can be screened out of the assessment at this stage as required by ADB procedure. These are shown in **Table 5.1**, with an explanation of the reasoning in each case.

Table 5.1: Fields in which construction is not expected to have significant impacts

Field	Rationale
Climate	Short-term production of dust is the only effect on atmosphere
Geology and seismology	Excavation will not be large enough to affect these features
Fisheries & aquatic biology	No rivers or lakes will be affected by the construction work
Wildlife and rare or endangered species	There is no wildlife or rare or endangered species in the town or on the government owned areas outside the town on which facilities will be built
Coastal resources	Jaisalmer is not located in a coastal area
Population and communities	Construction will not affect population numbers, location or composition
Archaeological /Historical area	There are few such sites in Jaisalmer, but they are not coming in the vicinity of our project area

68. These environmental factors have thus been screened out presently but will be assessed again before implementation of the project.

69. **Annexure-III** shows Rapid Environmental Impact Assessment checklist (REA) for the said sub-project.

B. Sewage Treatment Plant and Sewage pumping station

1. Construction method

As explained above, there is provision of Sewage pumping station of 2 MLD capacities at Gandhi Colony. The provision of Sewage Treatment Plant on 31.78 ha of land outside Kishangad Village which will involve construction of the following structures.

- A series of oxygenation and waste stabilisation ponds, each approximately 50 x 100 m and 2-3 m in depth;
- Pump stations and pipes with valves to transfer material between ponds;
- An outfall to discharge the treated wastewater.

70. These elements of the project (STP and Pumping Station) involve the same kinds of construction and will produce similar effects on the environment, so their impacts are considered together.

71. Although the site is fairly large the construction will be straightforward, involving mainly simple excavation and construction of building. The ponds will be dug by backhoe diggers and bulldozers, and soil will be transferred into trucks for offsite disposal. Clay will then be applied to the floor and sloping sides of each pond and after watering will be covered with low density poly-ethylene (LDPE) sheeting. A thin layer of cement mortar is then added, and concrete tiles are embedded into the surface by hand, with more cement grouting applied to seal joints between tiles. The pumps at pumping station and also at STP will be brought in on trucks and placed inside the pump house by crane. The roof material will then be attached by hand.

72. Trenches for the pipe-work will also be dug by backhoe, and pipes will be brought to site on trucks, offloaded and placed into each trench by small cranes or pipe-rigs, after which soil will be replaced by hand to cover the trench.

2. Physical Resources

73. Although the impacts of constructing the STP and PS will be confined to a single location, because of its size and the invasive nature of the excavation work, physical impacts could be significant, so mitigation measures will be needed.

74. Ponds will be dug on around 80% of the STP site, and if these are excavated to a depth of 2.5 m, around 160,000 m³ of waste soil and stone will be generated. There will therefore be quite large physical changes at the construction site, and this quantity of waste could not be dumped without causing further physical impacts (on air quality, topography, soil quality, etc) at the point of disposal. The work will probably be conducted in the dry season, so there is also a lot of potential for the creation of dust, during excavation and when the waste is removed. In case of construction of pumping station this impact will be less significant because of comparatively small excavation.

75. Action will therefore be needed to reduce physical impacts at both the construction and disposal sites, by controlling dust and reducing the amount of material to be dumped. The Contractor should therefore be required to:

- Contact the town authorities to find beneficial uses for as much waste material as possible, in construction projects, to raise the level of land prior to construction of roads or buildings, or to fill previously excavated areas, such as brickworks;

- Prevent the generation of dust (which could affect surrounding agricultural land and crops) by removing waste material as soon as it is excavated, by loading directly onto trucks, and covering with tarpaulins to prevent dust during transportation.

76. Another physical impact that is often associated with excavation is the effect on drainage and the local water table if groundwater and surface water collect in the voids. However, this should not be a problem in this case, given the low rainfall and deep water table (>40 m) in this area, and the fact that the Contractor will almost certainly plan excavation work to avoid the monsoon season.

3. Ecological Resources

77. The site proposed for the STP and PS is characterised by sandy soil and a sparse desert-type of vegetation of halophytic bushes and small trees, which is of no special ecological interest. Construction should therefore have no adverse ecological impacts.

4. Economic Development

78. The site of the proposed STP and PS is owned by the government so there should be no need to acquire land from private owners, which might affect the income and assets of owners and tenants. The land is not farmed or used for any other purpose and there is no industry, housing or infrastructure in the vicinity so there should be no impact on income-generating activities.

79. The only aspect of the work that has any economic implications is the transportation of waste material from the site to locations where it can be put to beneficial use as recommended above. This will require a large number of lorry movements, which could disrupt traffic on the Jodhpur road, and particularly in Jaisalmer if such vehicles were to enter the town. The transportation of waste will be implemented by the Construction Contractor in liaison with the town authorities, and the following additional precautions should be adopted to avoid effects on traffic:

- Planning transportation routes so that heavy vehicles do not enter Jaisalmer town and do not use narrow local roads, except in the immediate vicinity of delivery sites;
- Scheduling transportation activities to avoid peak traffic periods.

5. Social and Cultural Resources

80. Rajasthan is an area with a rich and varied cultural heritage that includes many forts and palaces from the Rajput and Mughal periods, and large numbers of temples and other religious sites, so there is a risk that any work involving ground disturbance could uncover and damage archaeological and historical remains. Given that this particular location is uninhabited and shows no sign of having been used to any extent in the past, then it could be that there is a low risk of such impacts. Nevertheless this should be ascertained by consulting the appropriate authorities, and appropriate steps should be taken according to the nature of the risk. This should involve:

- Consulting historical and archaeological authorities at both national and state level to obtain an expert assessment of the archaeological potential of the site;

- Selecting an alternative location if the site is considered to be of medium or high risk;
- Including 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 to the project;
- Developing a protocol for use by the Contractor in conducting any excavation work, to ensure that any chance finds are recognised and measures are taken to ensure they are protected and conserved. This should involve:
 - o Having excavation observed by a person with archaeological field training;
 - o Stopping work immediately to allow further investigation if any finds are suspected;
 - o Calling in the state archaeological authority if a find is suspected, and taking any action they require ensuring its removal or protection in situ.

81. There are no modern-day social and cultural resources (such as schools and hospitals) near the site, and no areas that are used for religious or other purposes, so there is no risk of other impacts on such community assets.

82. Finally, there could be some short-term socio-economic benefits from the construction work if local people are able to gain employment in the construction workforce. To ensure that such gains are directed towards communities most directly affected by this part of the scheme, the Contractor should be required to employ at least 50% of the labour force from communities within a radius of say 2 km from the site, if sufficient people are available.

C. Sewerage Network

1. Construction method

83. Provision of a sewerage system in the town will involve construction of sub-mains and laterals outside the Fort for about 17 km.

84. These elements of the project involve the same kinds of construction and will produce similar effects on the environment, so their impacts are considered together.

85. Most pipes will be buried in trenches immediately adjacent to roads, in the un-used area within the ROW, alongside the edge of the tarmac. The trunk main and secondary network will be located alongside main roads, where there is generally more than enough free space to accommodate the pipeline. However in parts of the tertiary network where roads are narrow, this area is occupied by drains or the edges of shops and houses etc, so to avoid damage to property some trenches may dug into the edge of the road.

86. Trenches will be dug by backhoe digger, supplemented by manual digging where necessary. Excavated soil will be placed nearby, and the pipes (brought to site on trucks and stored on unused land nearby) will be placed in the trench by crane or using a small rig. After the pipes are joined, loose soil will be shovelled back into the trench, and the surface layer will be compacted by hand-operated vibrating compressor. Where trenches are dug into an existing roadway, the bitumen or concrete surface will be broken by hand-held pneumatic drills, after which the trench will be excavated by backhoe, and the appropriate surface will be reapplied on completion.

87. Pipes are normally covered by 1.2 m of soil, and a clearance of 100 mm is left between the pipe and each side of the trench to allow backfilling. Trenches will therefore be quite large, a

maximum of 2.2 m deep and 1.1 m wide for the trunk main, and a minimum of 1.4 m deep and 0.4 m wide for the tertiary network.

88. At intervals, small chambers (ca 1-2 m³) will be created to allow inspection and clearance of blockages and sediment during operation. These will be excavated by backhoe and hardcore and concrete (mixed on site) will be tipped in to form the base. Brick sides will then be added by masons by hand, and the top will be sealed at ground level by a metal manhole cover.

2. Physical Resources

89. Construction of trenches will have linear structures and the network is located in the town. If average trench dimensions is 1.5 x 0.7 m for the 17 km mains and laterals network, then construction of the trenches will require the excavation of almost 17,850 m³ of material. After construction, approximately 30% of the trench will be occupied by the pipe, so there will be around 12,495 m³ of waste soil left over. The material will still need to be handled responsibly, and there are other considerations because this work will be conducted in the town where piles of soil could impede traffic and other activities (see below) and dust could affect inhabitants. These impacts should therefore be mitigated by applying the same measures as at the PS site to minimise waste and dust, and there will need to be some additional precautions to control dust. The Contractor should:

- Contact the town authorities to find beneficial uses for the waste material, in construction projects, to raise the level of land prior to construction of roads or buildings, or to fill previously excavated areas, such as brickworks;
- Remove waste material as soon as it is excavated (by loading directly into trucks), to reduce the amount stockpiled on site;
- Use tarpaulins to cover loose material when transported from the site by truck;
- Cover or water stockpiled soil to reduce dust during windy weather.

90. The other important physical impact associated with excavation (effects on surface and groundwater drainage) should again be negated by the low rainfall and very low water table in this area, and the fact that the Contractor will almost certainly conduct the excavation work in the dry season.

91. The physical impacts of trenching will also be reduced by the method of working, whereby the network and trunk sewer will probably be constructed by small teams working on short lengths at a time, so that impacts will be mainly localised and short in duration. Physical impacts are also mainly temporary as trenches will be refilled and compacted after pipes are installed, and any disturbed road surfaces will be repaired. Because of these factors and the mitigation measures proposed above, impacts of network construction on the physical environment are not expected to be of major significance.

3. Ecological Resources

92. There are no significant ecological resources in or outside the town (protected areas or rare or important species or habitats), so construction of the network and trunk sewer should have no ecological impacts. Roadside trees should not be removed unnecessarily to build the trenches, and to mitigate any such losses the Contractor should be required to plant and maintain three new trees (of the same species) for each one that is removed.

4. Economic Development

93. Most of the network sub-main sewer pipelines will be constructed within the RoW of existing roads where there is no need to acquire land, so there should be no direct effect on the income or assets of landowners, or the livelihoods of tenants.

94. Some of this land is owned by the government, but some is in private ownership, and is farmed when there is sufficient rainfall. Private land will be obtained through the Land Acquisition Act (1894) by which the government purchases the land compulsorily at a rate established on the basis of recent transactions. ADB policy on Involuntary Resettlement requires that owners and users of acquired land do not suffer economically as a result of the project, and a separate Resettlement Plan and Resettlement Framework have been prepared to examine these and related issues. This establishes that no more than 10% of the land of any owner or occupant should be acquired, and that in addition to the price of the land, farmers should be compensated for any standing crops or trees they lose.

95. Although most of the work will not require land acquisition it could still have economic impacts, if the presence of trenches, excavated material, workers and machinery discourage customers from visiting shops and businesses, which lose income as a result. These losses will be short in duration as work at any one site should be completed in a week or less. However the loss of income could be significant for small traders and other businesses that exist on low profit margins. These impacts should therefore be mitigated by:

- Compensating shopkeepers and other affected businesses for lost income;
- Leaving spaces for access between mounds of excavated soil, and providing footbridges so that pedestrians can cross open trenches;
- Increasing the workforce in these areas to ensure that work is completed quickly;
- Consulting affected businesspeople to inform them in advance when work will occur.

96. Excavation could damage existing infrastructure, in particular water pipes, which are mainly located alongside roads, storm drains where present, and the sewer network inside the fort area. It will be particularly important to avoid damaging existing water pipes as these are mainly manufactured from Asbestos Cement (AC), which can be carcinogenic if inhaled, so there are serious health risks for both workers and citizens (see below). It will be important therefore to avoid these impacts by:

- Obtaining details of the nature and location of all infrastructure from the municipal authorities and planning the sewer network to avoid any conflict;
- Integrating construction of the various Jaisalmer subprojects (in particular water supply, sewerage and drainage) so that:
 - o Different infrastructure is located on opposite sides of the road wherever feasible;
 - o Roads and inhabitants are not subject to repeated disturbance by construction in the same area at different times for different purposes.

97. Transport is another type of infrastructure that will be affected by some of the work, as in the narrower streets there is not enough space for excavated soil to be piled off the road. As noted above the road itself may also be excavated in places where there is no available land alongside. Traffic will therefore be disrupted, and in some very narrow streets the whole road may need to be closed for short periods. The Contractor should therefore plan this work in conjunction with the town authorities and the police force, so that work can be carried out during

periods when traffic is known to be lighter, and alternative routes and diversions can be provided where necessary. The Contractor should also increase the workforce in areas such as this, so that the work is completed in the shortest possible time.

98. It is inevitable that there will be an increase in the number of heavy vehicles in the town (particularly trucks removing waste material for disposal), and this could disrupt traffic and other activities, as well as damage fragile buildings if vibration is excessive. These impacts will therefore need to be mitigated by:

- Careful planning of transportation routes with the municipal authorities to avoid sensitive areas as far as possible, including narrow streets, congested roads, important or fragile buildings and key sites of religious, cultural or tourism importance;
- Scheduling the transportation of waste to avoid peak traffic periods, the main tourism season, and other important times.

5. Social and Cultural Resources

99. As was the case with the Pumping station site, there is a significant risk that sewer construction, which involves further extensive disturbance of the ground surface, could damage undiscovered archaeological and/or historical remains, or even unknown sites. The risks are in fact very much higher in this case, as most of the work will be conducted in Jaisalmer town, which has been inhabited for a long period, and where there is therefore a greater risk of artefacts being discovered. The preventative measures described in Section IV.B.5 will thus need to be employed and strictly enforced. These are:

- Consulting national and state historical and archaeological authorities to assess the archaeological potential of all construction sites;
- Selecting alternative routes or sites to avoid any areas of medium or high risk;
- Including state and local archaeological, cultural and historical authorities and interest groups as project stakeholders to benefit from their expertise;
- Developing a protocol for use in conducting all excavation, to recognise, protect and conserve any chance finds (see Section IV.B.5 for details).

100. Sewer construction will also disturb some more modern-day social and cultural resources, such as schools, hospitals, temples, and also sites that are of tourism importance. Impacts could include noise, dust, and interrupted access for pedestrians and vehicles, and if pneumatic drills are used to break the surface of roads, there could be a risk of damage from vibration. Given the historical importance of Jaisalmer and particularly the fort and walled city, any such damage or disruption could be highly significant, so very careful mitigation will be needed to protect these resources and to enable usage by local people and visitors to continue throughout the construction work. This will be achieved through several of the measures recommended above, including:

- Consulting the town authorities to identify any buildings at risk from vibration damage and avoiding any use of pneumatic drills or heavy vehicles in the vicinity;
- Limiting dust by removing waste soil quickly, covering and watering stockpiles, and covering soil with tarpaulins when carried on trucks;
- Increasing the workforce in sensitive areas to complete the work quickly;
- Providing wooden bridges for pedestrians and metal sheets for vehicles to allow access across open trenches where required (including access to houses);

- Using modern vehicles and machinery with standard adaptations to reduce noise and exhaust emissions, and ensuring they are maintained to manufacturers' specifications.

101. In addition the Executing Agency and Contractor should:

- Consult municipal authorities, custodians of important buildings, cultural and tourism authorities, and affected communities in advance of the work to identify and address key issues, and avoid working at sensitive times, such as religious and cultural festivals.

102. There is invariably a safety risk when substantial construction such as this is conducted in an urban area, and precautions will thus be needed to ensure the safety of both workers and citizens. The Contractor will be required to produce and implement a site Health and Safety Plan, and this should include such measures as:

- Excluding the public from the site;
- Ensuring that all workers are provided with and use appropriate Personal Protective Equipment;
- Health and Safety Training for all site personnel;
- Documented procedures to be followed for all site activities;
- Accident reports and records;
- Etc.

103. An additional, particularly acute health risk presented by this work derives from the fact that, as mentioned above, the existing water supply system comprises mainly AC pipes, so there is a risk of contact with carcinogenic material if these pipes are uncovered in the course of the work. Precautions have already been introduced into the design of the project to avoid this, of which the most important is that:

- The locations of all new infrastructures will be planned to avoid locations of existing AC pipes so AC pipes should not be discovered accidentally.

104. Given the dangerous nature of this material for both workers and citizens, additional precautions should be taken to protect the health of all parties in the event (however unlikely) that AC pipes are encountered. The design consultant should therefore develop a protocol to be applied in any instance that AC pipes are found, to ensure that appropriate action is taken. This should be based on the approach recommended by the United States Environmental Protection Agency (USEPA)², and amongst other things, should involve:

- Training of all personnel (including manual labourers) to enable them to understand the dangers of AC pipes and to be able to recognise them in situ;
- Reporting procedures to inform management immediately if AC pipes are encountered;
- Development and application of a detailed H&S procedure to protect both workers and citizens. This should comply with national and international standards for dealing with asbestos, and should include:
 - o Removal of all persons to a safe distance;
 - o Usage of appropriate breathing apparatus and protective equipment by persons delegated to deal with the AC material;

² In the USA, standards and approaches for handling asbestos are prescribed by the Occupational Health and Safety Administration (OHSA) and the Environmental Protection Agency (EPA) and can be found at <http://www.osha.gov/SLTC/asbestos>

- o Procedures for the safe removal and long-term disposal of all asbestos-containing material encountered.

105. There could again be some short-term socio-economic benefits from the construction work if local people gain employment in the workforce. To ensure that these benefits are directed to communities that are affected by the work, as suggested in Section V.B.5, the Contractor should be required to employ at least 50% of his labour force from communities in the vicinity of construction sites. Creating a workforce from mainly local people will bring additional benefits by avoiding problems that can occur if workers are imported, including social difficulties in the host community and issues of health and sanitation in poorly serviced temporary camps.

VI. ENVIRONMENTAL IMPACTS AND MITIGATION: OPERATION AND MAINTENANCE

A. Screening out areas of no significant impact

106. Although the sewerage system will need regular maintenance when it is operating, with a few simple precautions this can be conducted without major environmental impacts (see below). There are therefore several environmental sectors which should be unaffected once the system begins to function. These are identified in **Table 6.1** below, with an explanation of the reasoning in each case. These factors are thus screened out of the impact assessment and will not be mentioned further.

Table 6.1: Fields in which operation and maintenance of the completed sewerage system is not expected to have significant impacts

Field	Rationale
Climate, topography, geology, seismology	There are no known instances where the operation of a relatively small sewerage system has affected these factors
Fisheries & aquatic biology	No water bodies will be affected by operation of the sewerage system
Wildlife, forests, rare species, protected areas	There are none of these features in or outside the town
Coastal resources	Jaisalmer is not located in a coastal area

B. Operation and maintenance of the improved sewerage system

107. The new sewerage system will collect and treat surface water, domestic wastewater and sewage produced in most of the town. Although treatment will not be to the standards of more developed countries, the technology is approved by the Public Health Engineering Department, and the discharge after treatment will comply with Indian wastewater standards.

108. The sewer pipes will not function without maintenance, as silt inevitably collects in areas of low flow over time. The project will therefore provide equipment for cleaning the sewers, including buckets and winches to remove silt via the inspection manholes, diesel-fuelled pumps to remove blockages, and tankers to transport the waste hygienically to the STP.

109. Piped sewers are not 100% watertight and leaks can occur at joints. Any repairs will be conducted by sealing off the affected sewer and pumping the contents into tankers, after which the faulty section will be exposed and repaired following the same basic procedure as when the sewer was built. Trenches will be dug around the faulty section and the leaking joint will be re-sealed, or the pipe will be removed and replaced.

110. At the STP sewage sludge will need to be removed from the active treatment ponds every four or five years. This is a simple process that does not require a Sludge Management Plan. Ponds are allowed to dry out naturally and the solid sludge is removed by manual digging. The treatment and drying processes kill enteric bacteria and pathogens, and because of its high content of nitrates, phosphates and other plant nutrients the sludge is an excellent organic fertilizer and farmers are normally allowed to remove the dry material for application to their land.

C. Environmental impacts and benefits of the operating system

1. Physical Resources

111. The provision of an effective sewerage system should improve the physical appearance and condition of the town because raw sewage will no longer be discharged onto open ground, and there will be far fewer sewer leaks and blockages than occur at present. This, and the fact that there will also be fewer septic tanks, pit latrines and discharges of sewage to municipal drains, means that the quality of the town environment and its surface and groundwater should improve significantly.

112. There are also certain environmental risks from the operating system, most notably from leaking sewer pipes, as untreated faecal material can damage human health and contaminate both soil and groundwater. It will be imperative therefore that the Government Agency (GA) responsible for operating the sewerage system establishes a procedure to routinely check the operation and integrity of the sewers, and to implement rapid and effective repairs where necessary. If trenches are dug to locate and repair leaks or remove and replace lengths of pipe, the work will follow the same procedure as occurred when the infrastructure was provided. However the impacts should be much less significant as the work will be infrequent, and will affect individual small locations for short periods only. Work will not be conducted during rainfall so there will be no effect on drainage, and the excavated soil will be replaced in the trench so there will be no waste. Physical impacts should thus be negligible.

2. Ecological Resources

113. Although the new sewerage system will improve the environment of the town, there are unlikely to be significant ecological benefits as there are no natural habitats or rare or important species. If effluent from the STP was discharged into the nearby *nallah* there could be some small ecological benefits as marsh plants and animals would colonise the small wetland that is likely to be formed. However the risks of contaminating groundwater are more significant, so it would be more appropriate to forego this ecological gain in favour of the better disposal method suggested above, whereby the effluent is supplied to farmers to irrigate and fertilize their fields.

3. Economic Development

114. Although repairs to the sewer network could result in shops losing some business if access is difficult for customers whilst the work is carried out, any losses will be small and short-lived and will probably be at the level of normal business fluctuations. It should therefore not be necessary to compensate for such losses. Nevertheless simple steps should be taken to reduce the inconvenience of the works, including:

- Informing all residents and businesses about the nature and duration of any repair work well in advance so that they can make preparations if necessary;
- Requiring contractors employed to conduct these works to provide wooden walkways across trenches for pedestrians and metal sheets where vehicle access is required;
- Consulting the local police regarding any such work so that it can be planned to avoid traffic disruption as far as possible, and road diversions can be organised if necessary.

115. As noted above, a by-product of the scheme could be to provide economic improvements in the agricultural sector if sewage sludge and treated wastewater provide farmers with a safe and affordable source of organic fertilizer, and crop yields increase as a result. The completed scheme should also contribute to improvements in environmental and community health in the

town (discussed below), which could provide some knock-on benefits to business from healthier workers and consumers.

4. Social and Cultural Resources

116. Although there is a high risk of excavation in the town discovering material of historical or archaeological importance, there will be no need to take precautions to protect such material when areas are excavated to repair leaks in the sewer network, as all work will be conducted in trenches that have already been disturbed when the infrastructure was installed.

117. Repair work could cause some temporary disruption of activities at sites of social and cultural importance such as schools, hospitals, temples, tourist sites, etc, so at these locations the same type of precautions as employed during the construction period should be adopted. These include:

- Consulting the town authorities to identify any buildings at risk from vibration damage and avoiding any use of pneumatic drills or heavy vehicles in the vicinity;
- Completing work in these areas quickly;
- Providing wooden bridges for pedestrians and metal sheets for vehicles to allow access across open trenches where required;
- Consulting municipal authorities, custodians of important buildings, cultural and tourism authorities, and local communities to inform them of the work in advance, and avoid sensitive times, such as religious and cultural festivals.

118. The responsible authorities will employ local contractors to conduct repairs of the sewer network, and contractors should be required to operate the same kinds of Health and Safety procedures as used in the construction phase (see Section V.C.5) to protect workers and the public. This should include application of the asbestos protocol if any AC pipes are encountered.

119. The use of local contractors will provide economic benefits to the companies and the workers they employ. There is however little prospect of directing these benefits to persons affected by any maintenance or repair works as contractors will utilise their existing workforce. To provide at least some economic benefits to affected communities, unskilled persons employed to maintain and operate the STP should be residents of the neighbouring area.

120. The citizens of the town will be the major beneficiaries of the new sewerage system, as human waste from those areas served by the new network will be removed rapidly and treated to an acceptable standard. This should improve the environment of the town, and in conjunction with the development of other infrastructure (in particular water supply), should deliver major improvements in individual and community health and well-being. Diseases of poor sanitation, such as diarrhoea and dysentery, should be reduced, so people should spend less on healthcare and lose fewer working days due to illness, so their economic status should also improve, as well as their overall health.

121. There should also be significant benefits for the cultural resources of the town, because the improvements in water and sewerage infrastructure will remove the leaks that are proving so damaging to the fabric of the fort and other historical buildings at present.

VII. INSTITUTIONAL REQUIREMENTS AND ENVIRONMENTAL MONITORING PLAN

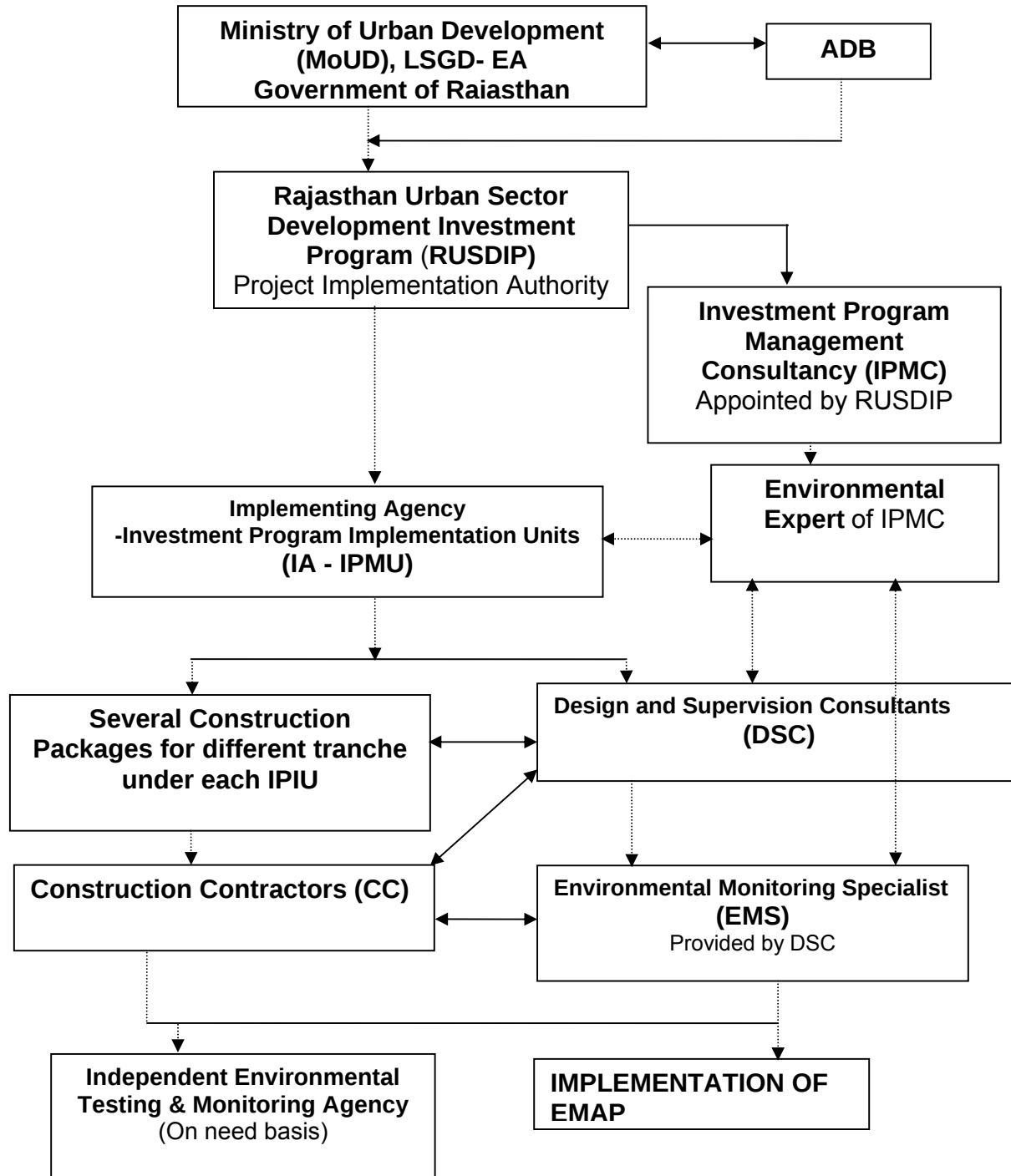
A. Institutional arrangements for project implementation

122. The main agencies involved in managing and implementing the subproject are:

- LSGD is the Executing Agency (EA) responsible for management, coordination and execution of all activities funded under the loan.
- The Implementing Agency (IA) is the Project Management Unit of the ongoing RUIDP, which will be expanded to include a broader range of skills and representation from the Urban Local Bodies (ULB, the local government in each town). Assigned as the RUSDIP Investment Program Management Unit (IPMU), this body will coordinate construction of subprojects across all towns, and ensure consistency of approach and performance.
- The IPMU will be assisted by Investment Program Management Consultants (IPMC) who will manage the program and assure technical quality of design and construction; and Design and Supervision Consultants (DSC), who will design the infrastructure, manage tendering of Contractors and supervise the construction process.
- Investment Program Implementation Units (IPIU) will be established in seven zones across the State to manage implementation of subprojects in their area. IPIUs will be staffed by professionals seconded from government departments (PHED, PWD), ULBs, and other agencies, and will be assisted by consultants from the IPMC and DSC as necessary.
- The IPMU will appoint Construction Contractors (CC) to build elements of the infrastructure in a particular town. The CCs will be managed by the IPIU, and construction will be supervised by the DSC.
- LSGD will be assisted by an inter-ministerial Empowered Committee (EC), to provide policy guidance and coordination across all towns and subprojects. The EC will be chaired by the Minister of Urban Development and LSG, and members will include Ministers, Directors and/or representatives of other relevant Government Ministries and Departments.
- City Level Committees (CLCs) have also been established in each town, chaired by the District Collector, with members including officials of the ULB, local representatives of state government agencies, the IPIU, and local NGOs and CBOs. The CLCs will monitor project implementation in the town and provide recommendations to the IPIU where necessary.

123. **Figure 7.1** shows institutional responsibility for implementation of environmental safeguard at different level.

Figure 7.1: Institutional Responsibility- RUSDIP



B. Environmental Mitigation Plan

124. **Tables 7.1 to 7.3** shows the potential adverse environmental impacts, proposed mitigation measures, responsible parties, and estimated cost of implementation. This EMP will be included in the bid documents and will be further reviewed and updated during implementation.

125. Environmental issues will be coordinated by an Environmental Specialist within the IPMU, who will ensure that all subprojects comply with environmental safeguards. An Environmental Monitoring Specialist (EMS) who is part of the DSC team will implement the Environmental Monitoring Plan from each IEE (see below), to ensure that mitigation measures are provided and protect the environment as intended. Domestic Environmental Consultants (DEC) will be appointed by each IPIU to update the existing IEEs in the detailed design stage, and to prepare IEEs or EIAs for new subprojects, where required to comply with national law and/or ADB procedure.

C. Environmental Monitoring Plan

126. **Tables 7.1 to 7.3** shows that most mitigation activities are the responsibility of the Construction Contractors³ (CC) employed to build the infrastructure during the construction stage, or the O&M Contractors employed to conduct maintenance or repair work when the system is operating. Responsibility for the relevant measures will be assigned to the Contractors via the contracts through which they are appointed (prepared by the DSC during the detailed design stage), so they will be legally required to take the necessary action. There are also some actions that need to be taken by LSGD in their role as project proponent, and some actions related to the design that will be implemented by the DSC.

127. A program of monitoring will be conducted to ensure that all parties take the specified action to provide the required mitigation, to assess whether the action has adequately protected the environment, and to determine whether any additional measures may be necessary. This will be conducted by a qualified Environmental Monitoring Specialist (EMS) from the DSC. The EMS will be responsible for all monitoring activities and reporting the results and conclusions to the IPMU, and will recommend remedial action if measures are not being provided or are not protecting the environment effectively. The EMS may be assisted by environmental specialists in particular technical fields, and junior or medium-level engineers who can make many of the routine observations on site. Post-construction monitoring will be conducted by the relevant Government Agency (GA) to whom responsibility for the infrastructure will pass once it begins to operate⁴.

128. EMP Tables shows that most of the mitigation measures are fairly standard methods of minimising disturbance from building in urban areas (maintaining access, planning work to avoid sensitive times, finding uses for waste material, etc), and experienced Contractors should be familiar with most of the requirements. Monitoring of such measures normally involves making observations in the course of site visits, although some require more formal checking of records

³ During implementation the contractor will submit monthly progress reports, which includes a section on EMP implementation to the IPIU. The IPIU will submit reports to the IPMU for review. The IPMU will review progress reports to ensure that the all mitigation measures are properly implemented. The IPMU will consolidate monthly reports and submit quarterly reports to ADB for review

⁴ In the operational period some infrastructure will be the responsibility of the Municipal Boards/Councils, whilst others will be the responsibility of the appropriate branch of the State government (such as PWD, PHED, etc)

and other aspects. There will also be some surveys of residents, as most of the measures are aimed at preventing impacts on people and the human environment.

129. **Table 7.4** to **Table 7.6** shows the proposed Environmental Monitoring Plan (EMP) for this subproject, which specifies the various monitoring activities to be conducted during all phases. The EMP describes: (i) mitigation measures, (ii) location, (iii) measurement method, (iv) frequency of monitoring and (v) responsibility (for both mitigation and monitoring). It does not show specific parameters to be measured because as indicated above, most measures will be checked by simple observation, by checking of records, or by interviews with residents or workers.

Table 7.1: Anticipated Impacts and Mitigation Measures – Pre-construction Environmental Mitigation Plan

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
Environmental clearances	CFE and CFO are required from the SPCB in order to implement the project. Land allotment letter required. If not pursued on timely basis, this can delay the project.	Pursue all clearances and follow up with relevant authorities	IPMU & IPIU	IPMU to follow up with SPCB on clearances
Utilities	Telephone lines, electric poles and wires, water and sewer lines within the existing bridge right-of-way (ROW) may be damaged.	(i) Identify and include locations and operators of these utilities in the detailed design documents to prevent unnecessary disruption of services during construction phase; and (ii) Require construction contractors to prepare a contingency plan to include actions to be done in case of unintentional interruption of services.	DSC	(i) List of affected utilities and operators; (ii) bid document to include requirement for a contingency plan for service interruptions
Asbestos Cement Pipes	Risk of contact with carcinogenic materials	(i) Require DSC to develop AC Protocol; (ii) Develop reporting procedures to inform management immediately if AC pipes are encountered; and (ii) Require construction consultants to develop and apply an AC Management Plan, as part of the over-all health and safety (H&S) plan, to protect both workers and citizens in case accidental uncovering of AC pipes. This AC Management Plan should also contain national and international standards for safe removal and long-term disposal of all asbestos-containing material encountered.	IPIU and DSC	(i) Asbestos Cement Protocol; (ii) requirement for AC Management included in bid documents
Social and Cultural Resources	Ground disturbance can uncover and damage archaeological and historical remains	(i) Consult Archaeological Survey of India (ASI) to obtain an expert assessment of the archaeological potential of the site; (ii) Consider alternatives if the site is found to be of medium or high risk; (iii) 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; and (iv) Develop a protocol for use by the construction contractors in conducting any excavation work, to ensure that any chance finds are recognised and	IPIU and DSC	Chance Finds Protocol

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
		measures are taken to ensure they are protected and conserved.		
Construction work camps, hot mix plants, stockpile areas, storage areas, and disposal areas.	Disruption to traffic flow and sensitive receptors	(i) Prioritize areas within or nearest possible vacant space in the subproject sites; (ii) If it is deemed necessary to locate elsewhere, consider sites that will not promote instability and result in destruction of property, vegetation, irrigation, and drinking water supply systems; (iii) Do not consider residential areas; (iv) Take extreme care in selecting sites to avoid direct disposal to water body or in areas which will inconvenience the community.	IPIU and DSC to determine locations prior to award of construction contracts.	List of selected sites for construction work camps, hot mix plants, stockpile areas, storage areas, and disposal areas.
Sources of Materials	Extraction of materials can disrupt natural land contours and vegetation resulting in accelerated erosion, disturbance in natural drainage patterns, ponding and water logging, and water pollution.	(i) Prioritize sites already permitted by the Mining Department; (ii) If other sites are necessary, inform construction contractor that it is their responsibility to verify the suitability of all material sources and to obtain the approval of IPIU; and (iii) If additional quarries will be required after construction is started, inform construction contractor to obtain a written approval from IPMU.	IPIU and DSC to prepare list of approved quarry sites and sources of materials	(i) List of approved quarry sites and sources of materials; (ii) bid document to include requirement for verification of suitability of sources and permit for additional quarry sites if necessary.

Table 7.2: Anticipated Impacts and Mitigation Measures – Construction Environmental Mitigation Plan

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
Sources of Materials	Extraction of rocks and material may cause ground instability	(i) Use quarry sites and sources permitted by government; (ii) Verify suitability of all material sources and obtain approval of Investment Program Implementation Unit (IPIU); (iii) If additional quarries will be required after construction has started, obtain written approval from PMU; and (iv) Submit to DSC on a monthly basis documentation of sources of materials.	Construction Contractor	Construction Contractor documentation
Air Quality	Emissions from construction vehicles, equipment, and machinery	(i) Consult with IPIU/DSC on the designated areas for stockpiling of clay, soils, gravel, and	Construction Contractor	(i) Location of stockpiles; (ii) complaints from

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
	used for excavation and construction resulting to dusts and increase in concentration of vehicle-related pollutants such as carbon monoxide, sulfur oxides, particulate matter, nitrous oxides, and hydrocarbons)	other construction materials; (iii) Damp down exposed soil and any stockpiled on site by spraying with water when necessary during dry weather; (iv) Use tarpaulins to cover sand and other loose material when transported by trucks; and (v) Fit all heavy equipment and machinery with air pollution control devices which are operating correctly.		sensitive receptors; (iii) heavy equipment and machinery with air pollution control devices (iii) ambient air for respirable particulate matter (RPM), PM2.5, SOx, NOx and CO; (iv) vehicular emissions such as sulphur dioxide (SO2), nitrous oxides (NOx), carbon monoxide (CO), and hydrocarbons
Surface water quality	Mobilization of settled silt materials, run-off from stockpiled materials, and chemical contamination from fuels and lubricants during construction works can contaminate downstream surface water quality.	(i) Avoid stockpiling of earth fill especially during the monsoon season unless covered by tarpaulins or plastic sheets; (ii) Prioritize re-use of excess spoils and materials in the construction works. If spoils will be disposed, consult with IPIU/DSC on designated disposal areas; (iii) Install temporary silt traps or sedimentation basins along the drainage leading to the water bodies; (iv) Place storage areas for fuels and lubricants away from any drainage leading to water bodies; (v) Dispose any wastes generated by construction activities in designated sites; and	Construction Contractor	(i) Areas for stockpiles, storage of fuels and lubricants and waste materials; (ii) number of silt traps installed along drainages leading to water bodies; (iii) effectiveness of water management measures;
Noise Levels	Increase in noise level due to earth-moving and excavation equipment, and the transportation of equipment, materials, and people	(i) Plan activities in consultation with IPIU/DSC so that activities with the greatest potential to generate noise are conducted during periods of the day which will result in least disturbance; (ii) Require horns not be used unless it is necessary to warn other road users or animals of the vehicle's approach; (iii) Minimize noise from construction equipment by using vehicle silencers, fitting	Construction Contractor	(i) Complaints from sensitive receptors; (ii) use of silencers in noise-producing equipment and sound barriers; (iii) equivalent day and night time levels

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
		jackhammers with noise-reducing mufflers, and portable street barriers the sound impact to surrounding sensitive receptor; and (iv) Maintain maximum sound levels not exceeding 80 decibels (dbA) when measured at a distance of 10 m or more from the vehicle/s.		
Existing Infrastructure and Facilities	Disruption of service and damage to existing infrastructure located alongside roads, in particular water supply pipes and sewer lines.	(i) Obtain from IPIU and/or DSC the list of affected utilities and operators; (ii) Prepare a contingency plan to include actions to be done in case of unintentional interruption of services; and (iii) Develop and implement an AC Pipes Management Plan	Construction Contractor	(i) Existing Utilities Contingency Plan; (ii) Asbestos Cement Pipes Management Plan
Landscape and Aesthetics	Solid wastes as well as excess construction materials	(i) Prepare and implement Waste Management Plan; (ii) Avoid stockpiling of excess excavated soils; (ii) Coordinate with Municipal Board for beneficial uses of excess excavated soils or immediately dispose to designated areas; (iv) Recover used oil and lubricants and reuse or remove from the sites; (v) Manage solid waste according to the following preference hierarchy: reuse, recycling and disposal to designated areas; (vi) Remove all wreckage, rubbish, or temporary structures (such as buildings, shelters, and latrines) which are no longer required; and (vii) Request IPIU/DSC to report in writing that the necessary environmental restoration work has been adequately performed before acceptance of work.	Construction Contractor	(i) Waste Management Plan; (ii) complaints from sensitive receptors; (iii) IPIU/DSC to report in writing that the necessary environmental restoration work has been adequately performed before acceptance of work.
Accessibility	Traffic problems and conflicts in right-of-way (ROW)	(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;	Construction Contractor	(i) Traffic Management Plan; (ii) complaints from sensitive receptors; (iii) number of signages placed at subproject

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
		(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; (vi) Coordinate with Municipal Traffic Office for temporary road diversions and with for provision of traffic aids if transportation activities cannot be avoided during peak hours; and (vii) Notify affected sensitive receptors by providing sign boards informing nature and duration of construction works and contact numbers for concerns/complaints		sites.
Socio-Economic – Income.	Impede the access of residents and customers to nearby shops	(i) Leave spaces for access between mounds of soil; (ii) Provide walkways and metal sheets where required to maintain access across trenches for people and vehicles; (iii) Increase workforce in front of critical areas such as institutions, place of worship, business establishment, hospitals, and schools; (iv) Consult businesses and institutions regarding operating hours and factoring this in work schedules; and (v) Provide sign boards for pedestrians to inform nature and duration of construction works and contact numbers for concerns/complaints. (vi) Execution of work in the night to complete it as early as possible, wherever necessary; (vii) Avoid peak tourist season for execution of work where shops exists	Construction Contractor	(i) Complaints from sensitive receptors; (ii) number of walkways, signages, and metal sheets placed at subproject sites.
Socio-Economic - Employment	Generation of contractual employment and increase in local revenue	(i) Employ at least 50% of the labour force, or to the maximum extent, local persons within the 2-km immediate area if manpower is available; and (ii) Secure construction materials from local	Construction Contractor	(i) Employment records; (ii) records of sources of materials

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
		market.		
Occupational Health and Safety	Occupational hazards which can arise from working in infrastructures like roads and bridges	(i) Develop and implement site-specific Health and Safety (H&S) Plan which will include measures such as: (a) excluding public from the site; (b) ensuring all workers are provided with and use Personal Protective Equipment; (c) Hands Training for all site personnel; (d) documented procedures to be followed for all site activities; and (e) documentation of work-related accidents; (ii) Ensure that qualified first-aid can be provided at all times. Equipped first-aid stations shall be easily accessible throughout the site; (iii) Provide medical insurance coverage for workers; (iv) Secure all installations from unauthorized intrusion and accident risks; (v) Provide supplies of potable drinking water; (vi) Provide clean eating areas where workers are not exposed to hazardous or noxious substances; (vii) Provide H&S orientation training to all new workers to ensure that they are apprised of the basic site rules of work at the site, personal protective protection, and preventing injuring to fellow workers; (viii) 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; (ix) Ensure the visibility of workers through their use of high visibility vests when working in or walking through heavy equipment operating areas; (x) Ensure moving equipment is outfitted with audible back-up alarms; (xi) Mark and provide sign boards for	Construction Contractor	(i) Site-specific Health and Safety (Ha&) Plan; (ii) Equipped first-aid stations; (iii) Medical insurance coverage for workers; (iv) Number of accidents; (v) Supplies of potable drinking water; (vi) Clean eating areas where workers are not exposed to hazardous or noxious substances; (vii) record of H&S orientation trainings (viii) personal protective equipments; (ix) % of moving equipment outfitted with audible back-up alarms; (xi) sign boards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal.

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
		hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, 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; and (xii) Disallow worker exposure to noise level greater than 85 dBA for a duration of more than 8 hours per day without hearing protection. The use of hearing protection shall be enforced actively.		
Asbestos Cement Pipes	Health risk	(i) Train all personnel (including manual laborers) to enable them to understand the dangers of AC pipes and to be able to recognise them in situ; (ii) Report to management immediately if AC pipes are encountered; (iii) Develop and apply AC Management Plan.	Construction Contractor	(i) Records of trainings; (ii) AC Management Plan approved by IPIU/DSC
Community Health and Safety.	Traffic accidents and vehicle collision with pedestrians. Work site safety	(i) Plan routes to avoid times of peak-pedestrian activities. (ii) Liaise with IPIU/DSC in identifying high-risk areas on route cards/maps. (iii) Maintain regularly the vehicles and use of manufacturer-approved parts to minimize potentially serious accidents caused by equipment malfunction or premature failure. (iv) Provide road signs and flag persons to warn of dangerous conditions. (v) Provide fences to keep public out of work areas and ensure no trespassing for community safety	Construction Contractor	(i) Traffic Management Plan; (ii) complaints from sensitive receptors
Work Camps	Temporary air and noise pollution from machine operation, water pollution from storage and use of fuels, oils, solvents, and lubricants	(i) Consult with IPIU/DSC before locating project offices, sheds, and construction plants; (ii) Minimize removal of vegetation and disallow cutting of trees; (iii) Provide water and sanitation facilities for employees;	Construction Contractor	(i) Complaints from sensitive receptors; (ii) water and sanitation facilities for employees; and (iii) IPIU/DSC report in writing that the camp

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
		(iv) Prohibit employees from poaching wildlife and cutting of trees for firewood; (v) Train employees in the storage and handling of materials which can potentially cause soil contamination; (vi) Recover used oil and lubricants and reuse or remove from the site; (vii) Manage solid waste according to the following preference hierarchy: reuse, recycling and disposal to designated areas; (viii) Remove all wreckage, rubbish, or temporary structures (such as buildings, shelters, and latrines) which are no longer required; and (ix) Request IPIU/DSC to report in writing that the camp has been vacated and restored to pre-project conditions before acceptance of work.		has been vacated and restored to pre-project conditions
Social and Cultural Resources	Risk of archaeological chance finds	(i) Strictly follow the protocol for chance finds in any excavation work; (ii) Request IPIU/DSC or any authorized person with archaeological field training to observe excavation; (iii) Stop work immediately to allow further investigation if any finds are suspected; and (iv) Inform IPIU/DSC if a find is suspected, and take any action they require ensuring its removal or protection in situ.	Construction Contractor	(i)Records of chance finds

Table 7.3: Anticipated Impacts and Mitigation Measures – Operation and Maintenance Environmental Mitigation Plan

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
Water Quality	deterioration of surface and groundwater quality	(i) Ensure treated water complies with GOI Standards for Discharges	Municipal Board/Council and O and M	(i) Inland parameters: colour and odour, suspended solids, particle size of suspended solids, pH value, temperature,

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
		to Inland Waters and Land for Irrigation	Contractors	oil and grease, total residual chlorine, ammonical nitrogen, total Kjeldahl nitrogen, free ammonia, biochemical oxygen demand, chemical oxygen demand, heavy metals, cyanide, fluoride, dissolved phosphates, sulfide and phenolic compounds. (ii) Land for Irrigation: colour and odour, suspended solids, pH value, oil and grease, biochemical oxygen demand, arsenic, and cyanide
Occupational Health and Safety	Adverse impacts on the appearance of surrounding environment and exposure of workers to hazardous debris and gases from sewage pipeline	(i) Ensure persons employed will be provided with suitable equipment (such as shovels and wheelbarrows); and (ii) Ensure all removed material will be deposited in the municipal waste storage bins. (iii) Arrangement of oxygen and PPE for laborer during repairing work (iv) Train all personnel (including manual laborers) to enable them to understand the dangers of AC pipes and to be able to recognise them in situ; (v) Report to management immediately if AC pipes are encountered; and (vi) Develop and apply AC Management Plan.	PHED, Municipal Board/Council and O and M Contractors	(i) Records of training; (ii) H and S Plan and AC Management Plan approved by PHED
General maintenance	may cause disturbance to sensitive receptors, dusts, increase in noise level	(i) Refill and re-compact trenches soil and backfilled sand will be	PHED, Municipal Board/Council and O and M	Complaints from sensitive receptors

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
		removed to expose the leaking junction or pipe; (ii) Conduct work during non-monsoon period; and Cover or wet excavated material to prevent dusts.	Contractors	
Economic Development	Impediments to residents and businesses	(i) Inform all residents and businesses about the nature and duration of any work well in advance so that they can make preparations if necessary; (ii) Conduct these works to provide wooden walkways across trenches for pedestrians and metal sheets where vehicle access is required; and (iii) Consult the local police regarding any such work so that it can be planned to avoid traffic disruption as far as possible, and road diversions can be organised if necessary. (iv) Supply of sewage sludge from STP to farmers for use in farming – economic development through utilization of waste material	PHED, Municipal Board/Council and O and M Contractors	Complaints from sensitive receptors
Social and Cultural Resources	Temporary disruption of activities	(i) Consult the town authorities to identify any buildings at risk from vibration damage and avoiding any use of pneumatic drills or heavy vehicles in the vicinity;	PHED, MB/MC and O and M Contractors	Complaints from sensitive receptors

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
		(ii) Complete work in these areas quickly; (iii) Provide wooden bridges for pedestrians and metal sheets for vehicles to allow access across open trenches where required; and (iv) Consult municipal authorities, custodians of important buildings, cultural and tourism authorities and local communities in advance of the work to identify and address key issues, and avoid working at sensitive times, such as religious and cultural festivals.		

Table 7.4: Pre-construction Environmental Monitoring Program

Field	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
Environmental Clearances	not applicable	IPIU/IPMC/IPMU	IPIU to follow up with SPCB on clearances	checking of records	Clearances issued	as needed	IPMU
Utilities	not applicable	DSC	(i) list of affected utilities and operators; (ii) bid document to include requirement for a contingency plan for service interruptions	checking of records	(i) list of affected utilities and operators prepared; (ii) requirement for a contingency plan for service interruptions included in bid documents	once	IPMU
Asbestos Cement Pipes	not applicable	IPIU and DSC	(i) Asbestos Cement Protocol; (ii) requirement for AC Management	checking of records	(i) AC Protocol prepared; (ii) bid documents include requirements for AC Management Plan	once	IPMU

Field	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
			included in bid documents				
Social and Cultural Resources	not applicable	IPIU and DSC	Chance Finds Protocol	checking of records	Chance Finds Protocol provided to construction contractors prior to commencement of activities	once	IPMU
Construction work camps, hot mix plants, stockpile areas, storage areas, and disposal areas.	not applicable	IPIU and DSC to determine locations prior to award of construction contracts.	List of selected sites for construction work camps, hot mix plants, stockpile areas, storage areas, and disposal areas.	checking of records	List of selected sites for construction work camps, hot mix plants, stockpile areas, storage areas, and disposal areas provided to construction contractors prior to commencement of works.	once	IPMU
Sources of Materials	not applicable	IPIU and DSC to prepare list of approved quarry sites and sources of materials	(i) list of approved quarry sites and sources of materials; (ii) bid document to include requirement for verification of suitability of sources and permit for additional quarry sites if necessary.	checking of records	(i) list of approved quarry sites and sources of materials provided to construction contractors (ii) bid document included requirement for verification of suitability of sources and permit for additional quarry sites if necessary.	once	IPMU
Baseline Environmental Condition – Ambient Air Quality	Subproject sites	DSC	Establish baseline values of respirable particulate matter (RPM) and (ii) suspended particulate matter (SPM)	Air sample collection and analyses by in-house laboratory or accredited 3rd party laboratory	GOI Ambient Air Quality Standards	Once prior to start of construction	IPMU
Baseline Environment	Subproject sites	DSC	Establish baseline values of suspended	Air sample collection	GOI Water Quality Standards	Once prior to start of	IPMU

Field	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
tal Condition - Water Quality			solids (TSS), (iii) pH (iv) biological oxygen demand (BOD), (v) fecal coliform	and analyses by in-house laboratory or accredited 3rd party laboratory		construction	

Table 7.5: Construction Environmental Monitoring Program

Mitigation Measures	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
Sources of Materials	quarries and sources of materials	Construction Contractor	Construction Contractor documentation	(i) checking of records; (ii) visual inspection of sites	(i) sites are permitted; (ii) report submitted by construction contractor monthly (until such time there is excavation work)	monthly submission for construction contractor as needed for DSC	DSC
Air Quality	construction sites and areas designated for stockpiling of materials	Construction Contractor	(i) Location of stockpiles; (ii) complaints from sensitive receptors; (iii) heavy equipment and machinery with air pollution control devices (iii) ambient air for respirable particulate matter (RPM) and particulate matter (PM2.5); oxides of sulphur and nitrogen, CO; (iv) vehicular emissions such as sulphur dioxide (SO2),	(i) checking of records; (ii) Records of generated monitoring data	(i) stockpiles on designated areas only; (ii) complaints from sensitive receptors satisfactorily addressed; (iii) air pollution control devices working properly; (iv) GOI Ambient Quality Standards for ambient air quality; (iv) GOI Vehicular Emission Standards for SO2, NOx, CO and HC.	monthly for checking records	DSC

Mitigation Measures	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
			nitrous oxides (NOx), carbon monoxide (CO), and hydrocarbons (HC)				
Water Quality	(i) construction sites; (ii) areas for stockpiles, storage of fuels and lubricants and waste materials;	Construction Contractor	(i) Areas for stockpiles, storage of fuels and lubricants and waste materials; (ii) number of silt traps installed along drainages leading to water bodies; (iii) effectiveness of water management measures;	visual inspection	(i) designated areas only; (ii) silt traps installed and functioning; (iii) no noticeable increase in suspended solids and silt from construction activities (iv) GOI Standards for Water Discharges to Inland Waters and Land for Irrigation	monthly	DSC
Noise Levels	(i) construction sites; (ii) areas for stockpiles, storage of fuels and lubricants and waste materials; (iii) work camps	Construction Contractor	(i) Complaints from sensitive receptors; (ii) use of silencers in noise-producing equipment and sound barriers; (iii) equivalent day and night time levels	(i) checking of records; (ii) visual inspection	(i) complaints from sensitive receptors satisfactorily addressed; and (ii) silencers in noise-producing equipment functioning as design; and (iii) sound barriers installed where necessary	monthly	DSC
Existing Infrastructure and Facilities	(i) construction sites; (ii) alignment of affected utilities	Construction Contractor	(i) Existing Utilities Contingency Plan; (ii) Asbestos Cement Pipes Management Plan	(i) checking of records; (ii) visual inspection	implementation according to Utilities Contingency Plan and Asbestos Cement Plan	as needed	DSC
Landscape and Aesthetics	(i) construction sites;	Construction Contractor	(i) Waste Management Plan; (ii) complaints from	(i) checking of records; (ii) visual	(i) no accumulation of solid wastes on-site; (ii) implementation of	monthly	DSC

Mitigation Measures	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
	(ii) areas for stockpiles, storage of fuels and lubricants and waste materials; (iii) work camps		sensitive receptors; (iii) IPIU/DSC to report in writing that the necessary environmental restoration work has been adequately performed before acceptance of work.	inspection	Waste Management Plan; (iii) complaints from sensitive receptors satisfactorily addressed.		
Accessibility	(i) construction sites; (ii) traffic routes	Construction Contractor	(i) Traffic Management Plan; (ii) complaints from sensitive receptors; (iii) number of signages placed at subproject sites.	visual inspection	(i) implementation of Traffic Management Plan; (ii) complaints from sensitive receptors satisfactorily addressed; (iii) signages visible and located in designated areas	monthly	DSC
Socio-economic - Income	construction sites	Construction Contractor	(i) complaints from sensitive receptors; (ii) number of walkways, signages, and metal sheets placed at subproject sites.	visual inspection	(i) complaints from sensitive receptors satisfactorily addressed; (ii) walkways, ramps, and metal sheets provided (iii) signages visible and located in designated areas	quarterly	DSC
AC Pipes	construction sites	Construction Contractors	(i) records of trainings; (ii) AC Management Plan approved by PIU/DSC	checking of records	no exposure to AC pipes	as needed	PIU and DSC
Socio-Economic - Employment	construction sites	Construction Contractor	(i) employment records; (ii) records of sources of	checking of records	number of employees from project town equal or greater than	quarterly	DSC

Mitigation Measures	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
			materials		50% of total work force		
Occupational Health and Safety	construction sites	Construction Contractor	(i) site-specific Health and Safety (H and S) Plan; (ii) Equipped first-aid stations; (iii) Medical insurance coverage for workers; (iv) Number of accidents; (v) Supplies of potable drinking water; (vi) Clean eating areas where workers are not exposed to hazardous or noxious substances; (vii) record of H and S orientation trainings (viii) personal protective equipments; (ix) % of moving equipment outfitted with audible back-up alarms; (xi) sign boards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment,	(i) checking of records; (ii) visual inspection	(i) implementation of H and S plan; (ii) number of work-related accidents; (iii) % usage of personal protective equipment; (iv) number of first-aid stations, frequency of potable water delivery, provision of clean eating area, and number of sign boards are according to approved plan; (v) % of moving equipment outfitted with audible back-up alarms	quarterly	DSC

Mitigation Measures	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
			and areas for storage and disposal.				
Community Health and Safety	construction sites	Construction Contractor	(i) Traffic Management Plan; (ii) complaints from sensitive receptors	visual inspection	(i) implementation of Traffic Management Plan; (ii) complaints from sensitive receptors satisfactorily addressed (iii) fences set up to keep public out of construction site.	quarterly	DSC
Work Camps	work camps	Construction Contractor	(i) complaints from sensitive receptors; (ii) water and sanitation facilities for employees; and (iii) IPIU/DSC report in writing that the camp has been vacated and restored to pre-project conditions	visual inspection	(i) designated areas only; (ii) complaints from sensitive receptors satisfactorily addressed	quarterly	DSC
Social and Cultural Resources	construction sites	Construction Contractor	records of chance finds	checking of records	Implementation of Chance Finds Protocol	as needed	DSC

Table 7.6: Operation and Maintenance Environmental Monitoring Program

Mitigation Measures	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
Water Quality	(i) STP effluent; (ii) nearby water bodies	MB/MC in coordination with PHED and O and M Contractors	(i) Inland parameters: colour and odour, suspended solids, particle size of suspended solids, pH value, temperature, oil	Sample collection and laboratory analyses	GOI Standards for Discharges to Inland Waters and Land for Irrigation	Quarterly or as prescribed by CPCB	IPMU

Mitigation Measures	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
			and grease, total residual chlorine, ammonical nitrogen, total Kjeldahl nitrogen, free ammonia, biochemical oxygen demand, chemical oxygen demand, heavy metals, cyanide, fluoride, dissolved phosphates, sulfide and phenolic compounds.(ii) Land for Irrigation: colour and odour, suspended solids, pH value, oil and grease, biochemical oxygen demand, arsenic, and cyanide				
Occupational Health and Safety	subproject sites	PHED, MB/MC and O and M Contractors	complaints from sensitive receptors	(i) records of training; (ii) H and S Plan and AC Management Plan approved by PHED	(i) complaints from sensitive receptors satisfactorily addressed; (ii) no exposure to AC pipes	as needed	IPMU
General maintenance	subproject sites	PHED, MB/MC and O and M Contractors	complaints from sensitive receptors	checking of records	complaints from sensitive receptors satisfactorily addressed	as needed	IPMU
Economic Development	subproject sites	PHED, MB/MC and O and M Contractors	complaints from sensitive receptors	checking of records Use of sludge – observation in field	complaints from sensitive receptors satisfactorily addressed	as needed	IPMU
Social and Cultural Resources	subproject sites	PHED, MB/MC and	complaints from sensitive receptors	checking of records	complaints from sensitive	as needed	IPMU

Mitigation Measures	Location	Responsible for Mitigation	Monitoring of Mitigation	Method of Monitoring	Indicators/ Standards	Frequency	Responsible for Monitoring
		O and M Contractors			receptors satisfactorily addressed		

D. Environmental management and monitoring costs

130. Most of the mitigation measures require the contractors to adopt good site practice, which should be part of their normal procedures already, so there are unlikely to be major costs associated with compliance. Regardless of this, any costs of mitigation by the contractors (those employed to construct the infrastructure or the local companies employed to conduct O&M when the system is operating) are included in the budgets for the civil works and do not need to be estimated separately here. Mitigation that is the responsibility of LSGD will be provided as part of their management of the project, so this also does not need to be duplicated here.

131. The remaining actions in the Environmental Management Plan are:

- The environmental monitoring during construction, conducted by the EMS;
- The long-term post-construction surveys that will be commissioned by LSGD.

132. These have not been budgeted elsewhere, and their costs are shown in **Table 7.7**, with details of the calculations shown in footnotes beneath the Table. The figures show that the total cost of environmental management and monitoring for the project as a whole (covering design, 1 ½ years of construction and the first five years of operation) is INR 1.58 million.

Table 7.7: Environmental management and monitoring costs (INR)

Item	Quantity	Unit Cost	Total Cost	Sub-total	Source of Funds
1. Implementation of EMP (2 years)					
Domestic Environmental Monitoring Specialist	1 x 2 month	140,000 ⁵	280,000		DSC
Survey Expenses	Lumpsum	100,000	100,000	380,000	
2. Survey of STP sludge and effluent (5 years)					Contractor
Sample Analysis	5 x 20	4000 ⁶	400,000		
Other Expenses- Air quality, water sample, noise quality	Lumpsum	200,000	200,000	600,000	
3. Survey of public health (5 years)					Contractor
Expenses	Lumpsum	200,000	200,000	200,000	
4. Environmental mitigation measures including buffer zone development- plantation near STP	Lump sum	400,000	400,000	400,000	Contractor
TOTAL				158,0000	

⁵ Unit costs of domestic consultants include fee, travel, accommodation and subsistence

⁶ Cost of a standard bacteriological analysis (total and faecal coliforms, E.coli, enterococci, etc) is \$90 (INR 3,500) per sample

VIII. PUBLIC CONSULTATION AND INFORMATION DISCLOSURE

A. Project stakeholders

133. Most of the main stakeholders have already been identified preliminary. If any other stakeholders that are identified during project implementation will be brought into the process in the future. Primary stakeholders are:

- o Residents, shopkeepers and businesspeople who live and work alongside the roads in which network improvements will be provided and near sites where facilities will be built
- o Owners and users of any land that is acquired along the transmission main route;
- o Custodians and users of socially and culturally important buildings in affected areas;
- o State and local authorities responsible for the protection and conservation of archaeological relics, historical sites and artefacts;
- o State and local tourism authorities.

134. Secondary stakeholders are:

- o LSGD as the Executing Agency;
- o Other government institutions whose remit includes areas or issues affected by the project (state and local planning authorities, Department of Public Health Engineering, Local Government Dept, Ministry of Environment and Forests, Roads and Highways Division, etc);
- o NGOs and CBOs working in the affected communities;
- o Other community representatives (prominent citizens, religious leaders, elders, women's groups);
- o The beneficiary community in general; and
- o The ADB and Government of India, Ministry of Finance.

B. Consultation and disclosure to date

135. Some informal discussion was held with the local people during site visit. Issues discussed are

- Awareness and extent of the project and development components
- Benefits of Project for the economic and social upliftment of community
- Labour availability in the Project area or requirement of outside labour involvement
- Local disturbances due to Project Construction Work
- Necessity of tree felling etc. at project sites

- Water logging and drainage problem if any
- Drinking water problem
- Forest and sensitive area nearby the project site
- Movement of wild animals within the village

136. Local populations are very much interested on the project and they will help project authorities in all aspects. The results of Public consultation conducted on 09 July 2010 specifically on environmental issues are shown in **Annexure-IV**.

137. The public Consultation and group discussion meeting were conduct by RUIDP on Date 26 July, 2009 after advertising in Local NEWS papers. The objective of the meeting was to appraise the stakeholders about the environmental and social impacts of the proposed program and the safeguards provided in the program to mitigate the same. In the specific context of Jaisalmer, the environmental and social impacts of the proposed subprojects in Jaisalmer were discussed.

138. Meetings and individual interviews were held at potentially temporarily affected areas; and local informal interviews were conducted to determine the potential impacts of sub-project construction to prepare the sample Environmental Framework. A town-wise stakeholder consultation workshop was conducted which provided an overview of the Program and sub-projects to be undertaken in Jaisalmer; and discussed the Government and ADB's Environment policies acts and potential environment impacts of the sub-projects in Jaisalmer. During the workshop, Hindi versions of the Environmental Framework were provided to ensure participants understood the objectives, policy principles and procedures related to Environment, English and Hindi versions of the Environmental Framework have been placed in the Urban Local Body (ULB) office and Environmental Framework will be provided later on. The NGO to be engaged to implement the Mitigation Measures will continue consultations, information dissemination, and disclosure. The Environmental Framework will be made available in the ULB office, Investment Program Project Management Unit and Implementation Unit (IPMU and IPIU) offices, and the town library. The finalized IEE containing Mitigation Measures will also be disclosed in ADB's website, the State Government website, the local government website, and the IPMU and IPIU websites. ADB review and approval of the RP is required prior to award of civil works contracts.

139. Major Issues discussed during Public consultation are

- (i) Proposed waste water management project should ensure proper hygienic disposal of sewerage water in all wards of city.
- (ii) Executive agency should give preference to engage internationally reputed contractor like Gammon, HCC, etc as people do not faith about the local contractors in respect of quality of works as well as timely completion of work;
- (iii) Livelihood affected households should be given assistance in the mode of cash compensation;
- (iv) Local people should be employed by the contractor during construction work;
- (v) Adequate safety measures should be taken during construction work;
- (vi) Mobile kiosks/vendors/hawkers have shown willingness to shift in nearby places without taking any compensation and assistance from the Executing Agency;

- (vii) Local people have appreciated the waste water management proposal of the government and they have ensured that they will cooperate with the Executing Agency during project implementation.

C. Future consultation and disclosure

140. LSGD will extend and expand the consultation and disclosure process significantly during implementation of RUSDIP. They will appoint an experienced NGO to handle this key aspect of the programme, who will conduct a wide range of activities in relation to all subprojects in each town, to ensure that the needs and concerns of stakeholders are registered, and are addressed in project design, construction or operation where appropriate. The programme of activities will be developed during the detailed design stage, and is likely to include the following:

➤ Consultation during detailed design:

- o Focus-group discussions with affected persons and other stakeholders (including women's groups, NGOs and CBOs) to hear their views and concerns, so that these can be addressed in subproject design where necessary;
- o Structured consultation meetings with the institutional stakeholders (government bodies and NGOs) to discuss and approve key aspects of the project.

➤ Consultation during construction:

- o Public meetings with affected communities to discuss and plan work programmes and allow issues to be raised and addressed once construction has started;
- o Smaller-scale meetings to discuss and plan construction work with individual communities to reduce disturbance and other impacts, and provide a mechanism through which stakeholders can participate in subproject monitoring and evaluation;

➤ Project disclosure:

- o Public information campaigns (via newspaper, TV and radio) to explain the project to the wider city population and prepare them for disruption they may experience once the construction programme is underway;
- o Public disclosure meetings at key project stages to inform the public of progress and future plans, and to provide copies of summary documents in Hindi;
- o Formal disclosure of completed project reports by making copies available at convenient locations in the study towns, informing the public of their availability, and providing a mechanism through which comments can be made.

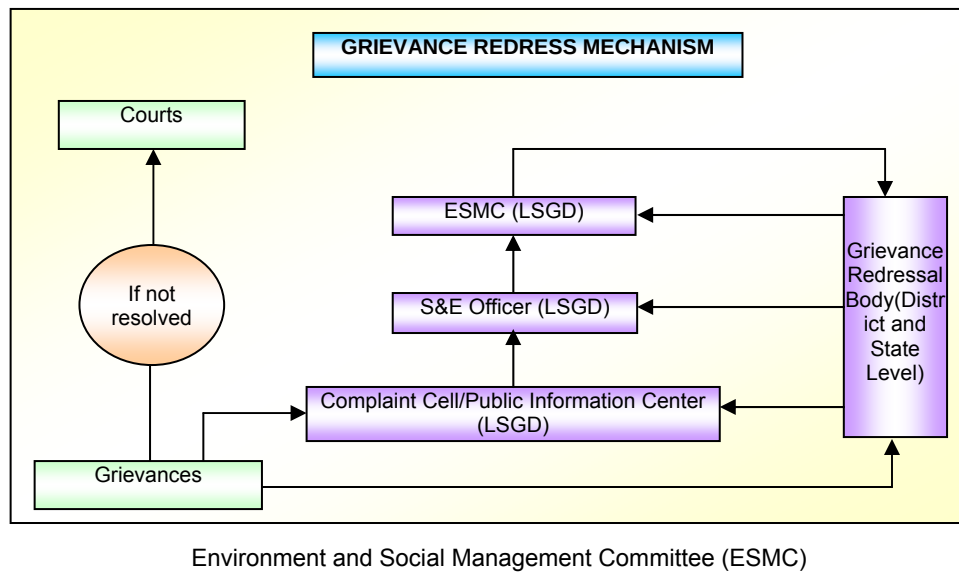
D. Grievance Redress Mechanism

141. The project authority will establish a mechanism to receive and facilitate resolution of affected persons' concerns, complaints and grievances about the project's environmental

performance. The grievances mechanism should be scaled to the risks and adverse impacts of the project. It will be addressed affected peoples' concerns and complaints promptly, using an understandable and transparent process that is gender responsive, culturally appropriate, and readily accessible to all the affected people at no cost and without retribution. The affected people will be informed by appropriate mechanism. The figure given below indicates the grievance redress mechanism for this purpose.

142. During implementation process performance monitoring fact sheet will be prepared against each possible environmental impacts.

Figure 8.1: Grievance redress mechanism - RUSDIP



IX. FINDINGS AND RECOMMENDATIONS

A. Findings

143. The Project is designed to improve the quality of life of small town residents and enhance the small towns' roles as market, services, and manufacturing centers. It has a strong community development focus reinforced by integrated poverty reduction, health and hygiene improvement investment projects. The towns' economies will benefit from enhanced productivity as a result of health improvement, time savings in collecting water, as well as from increased urban efficiency arising from improved roads, bridges, drainage, drinking water and sanitation. Residents in towns will also benefit from savings in health care costs.

144. During project design, community meetings were held with beneficiaries to discuss sanitation, poverty, resettlement, affordability issues, and environmental concerns. Socioeconomic surveys obtained information and individual views on current situations and future preferences. Potential environmental impacts of urban infrastructure improvements are mainly short-term during the construction period and can be minimized by the proposed mitigating measures and environmentally sound engineering and construction practices.

145. The process described in this document has assessed the environmental impacts of all elements of the infrastructure proposed under the Jaisalmer Sewerage and Sanitation Subproject. Potential negative impacts were identified in relation to construction and operation of the improved infrastructure, and the design and location of the subproject. Mitigation measures have been developed to reduce all negative impacts to acceptable levels. These were discussed with specialists responsible for the engineering aspects, and as a result some measures have already been included in the outline designs for the infrastructure. These include:

- o Locating the main and sewerage networks within the ROW of existing roads, to avoid the need to acquire land or relocate people;
- o Locating sewers on unused land adjacent to roads wherever possible, to avoid damaging roads and disrupting traffic and other activities.

146. This means that the number of impacts and their significance has already been reduced by amending the design.

147. Changes have also been made to the location of elements of the project to further reduce impacts. These include:

- o Locating the SPS on government-owned land to avoid the need for land acquisition and relocation of people;
- o Locating main sewer in the ROW alongside the Road, to avoid acquiring agricultural land and affecting the livelihoods of farmers and farm workers.

148. Regardless of these and various other actions taken during the IEE process and in developing the subproject, there will still be impacts on the environment when the infrastructure is built and when it is operating. This is mainly because of the invasive nature of trenching work; the sewer network is located in a town, some parts of which are densely populated; and because Rajasthan is an area with a rich history, in which there is a high risk that ground disturbance may uncover important archaeological remains. Because of these factors the most significant impacts are on the physical environment, the human environment, and the cultural heritage.

149. During the construction phase, impacts mainly arise from the need to dispose of large quantities of waste soil; and from the disturbance of residents, businesses, traffic and important buildings by the construction work. These are common impacts of construction in urban areas, and there are well developed methods for their mitigation. These include:

- o Finding beneficial uses for waste material;
- o Covering soil and sand during transportation and when stored on site;
- o Planning work to minimize disruption of traffic and communities;
- o Providing temporary structures to maintain access across trenches where required.

150. Although there will be no need to acquire land or relocate people, roadside businesses will lose some income as access will be difficult for customers when work is in their vicinity. ADB policy requires that no-one should be worse off as a result of an ADB-funded project, so these losses will be compensated through a Resettlement Plan and Framework prepared to comply with Bank policy on Involuntary Resettlement.

151. One field in which impacts are much less routine is archaeology, and here a series of specific measures have been developed to avoid damaging important remains. These include:

- o Assessing the archaeological potential of all proposed construction sites, and selecting alternative locations to avoid any areas of medium or high risk;
- o Including archaeological, cultural and historical authorities and interest groups as project stakeholders to benefit from their expertise;
- o Developing a protocol for use in conducting all excavation to ensure that any chance finds are recognized, protected and conserved.

152. Special measures were also developed to protect workers and the public from exposure to carcinogenic asbestos fibers in the event that Asbestos Cement pipes used in the existing water supply system are encountered accidentally during excavation work. These are to:

- o Avoid all known sites of AC pipes when the locations of new infrastructure are planned in the detailed design stage;
- o Train all construction personnel to raise awareness of the dangers of AC and enable early recognition of such pipes if encountered;
- o Develop and apply a protocol to protect workers and the public if AC pipes are encountered (including evacuation of the immediate area, use of protective equipment by workers, and safe removal and disposal of AC material).

153. There were limited opportunities to provide environmental enhancements, but certain measures were included. For example it is proposed that the project will:

- o Employ in the workforce people who live in the vicinity of construction sites to provide them with a short-term economic gain;

- o Ensure that people employed in the longer term to maintain and operate the new SPS are residents of nearby communities.

154. These and the other mitigation and enhancement measures are summarised in EMP Tables, which also shows the location of the impact, the body responsible for the mitigation, and the programme for its implementation.

155. On completion the sewerage system should operate with routine maintenance, which should not significantly affect the environment, providing certain pre-conditions are met. These are that:

- o The operation and integrity of sewers are checked regularly and any leaks are repaired rapidly and effectively to avoid public health risks and contamination of land and water;

156. The repair of sewers will have fewer environmental impacts than the original sewer construction as the work will be infrequent and will affect small areas only. It will also be conducted in areas that have already been excavated, so there will be no need to protect archaeological material.

157. The main impacts of the operating sewerage system will be beneficial as human waste from those areas served by the new network will be removed rapidly and treated to an acceptable standard. This will improve the environment and appearance of these areas, and the health and quality of life of the citizens. Diseases of poor sanitation should be reduced, which should lead to economic gains as people will be away from work less and will spend less on healthcare, so their incomes should increase.

158. EMP also assesses the effectiveness of each mitigation measure in reducing each impact to an acceptable level. This is shown as the level of significance of the residual impact (remaining after the mitigation is applied). This shows that all impacts will be rendered at least neutral (successfully mitigated), and that certain measures will produce a benefit (in addition to the major benefits provided by the operating scheme).

159. Mitigation will be assured by a program of environmental monitoring conducted during both construction and operation to ensure that all measures are provided as intended, and to determine whether the environment is protected as envisaged. This will include observations on and off site, document checks, and interviews with workers and beneficiaries, and any requirements for remedial action will be reported to the IPMU.

B. Recommendations

160. There are three straightforward but essential recommendations that need to be followed to ensure that the environmental impacts of the project are successfully mitigated. These are that LSGD should ensure that:

- o All mitigation, compensation and enhancement measures proposed in this environmental status report are implemented in full, as described in the text above;
- o The Environmental Monitoring Plan proposed in this report is also implemented in full.

X. CONCLUSIONS

161. The environmental status of the proposed improvements in sewerage and sanitation in Jaisalmer Town has been assessed. Issues related to Involuntary Resettlement were assessed by a process of resettlement planning and will be compensated by measures set out in detail in the Resettlement Framework for the subproject.

162. The overall conclusion of process is that provided the mitigation, compensation and enhancement measures are implemented in full, there should be no significant negative environmental impacts as a result of location, design, construction or operation of the subproject. There should in fact be some small benefits from recommended mitigation and enhancement measures, and major improvements in quality of life and individual and public health once the scheme is in operation.

163. There are no uncertainties in the analysis, and no further studies are required to comply with ADB procedure or national law.

ANNEXURE - I

PHOTO ILLUSTRATION

ANNEXURE - II

CASE STUDY – RECOVERY OF ENERGY AND CONTROL OF GREEN HOUSE GASES FROM SEWERAGE

Local body seeks carbon credit for green power from sewage

Surat, Nov 2, (PTI):

Buoyed by the success of generating power from sewage, an urban local body here has sought carbon credit for its green gas project.

"We are not only been able to reduce the green house gas emission but also minimising the grid power consumption through our sewage-based power plants. Now we are gearing to earn about 50,000 units of carbon credit per year for the successful generation of the green gas," Surat Municipal Corporation (SMC) Commissioner S Aparna said. Currently, SMC is producing 3.5 MW power from sewage at four places in the city

The project is first of its kind in India to generate green energy from sewage gas by using State-of-the-art Spanish machinery. There are four biogas-based power units operational in the Sewage treatment plants at Anjana, Singanpur, Karanj and Bhattar. "Two more plants are coming up at Dindoli and Kasar under the JNNURM scheme," Aparna said. "The power generated here is being used to operate these plants only and thereby reducing the grid power consumption," she said, adding "we have approached the concerned authorities for the carbon credit scheme". Sewage gas is one of the end products of sewage treatment plants. It contains methane and carbon dioxide which are greenhouse gases and are generally released into the atmosphere. Reduction in emission of green house gases protects the environment.

SMC has harnessed sewage gas for power generation. Currently about 600 MLD (million litre per day) sewage is being treated in the city. We have increased our capacity from 562.5 MLD to 642.5 MLD to meet the needs of growing population in the city under the JNNURM," Aparna said. The city municipal has saved about Rs 7 crores as energy saving cost from these sewage treatment plants. The two plants under construction at Dindoli and Kosad are each of 0.75 MW and 0.6 MW respectively.

When the two projects will be completed, SMC will have installed capacity of generation of 4.65 MW of power from sewage gas. Under JNNURM, SMC has entered into PPP with Hanjer Bio-tec Energies for converting 400 tonnes of municipal solid waste per day into compost and fuel pellets. The daily collection of the solid waste is about 1100 tonnes. While the compost is being used in agriculture and horticulture, the fuel pellets (Green fuel) are being used as supplementary fuel in industrial boilers, mainly in textile units in and around the city.

ANNEXURE -III

Rapid Environmental Assessment (REA) Checklist

Instructions:

- (i) The project team completes this checklist to support the environmental classification of a project. It is to be attached to the environmental categorization form and submitted to the Environment and Safeguards Division (RSES) for endorsement by the Director, RSES and for approval by the Chief Compliance Officer.
- (ii) This checklist focuses on environmental issues and concerns. To ensure that social dimensions are adequately considered, refer also to ADB's (a) checklists on involuntary resettlement and Indigenous Peoples; (b) poverty reduction handbook; (c) staff guide to consultation and participation; and (d) gender checklists.
- (iii) Answer the questions assuming the "without mitigation" case. The purpose is to identify potential impacts. Use the "remarks" section to discuss any anticipated mitigation measures.

Country/Project Title: **INDIA / RUIDP-PHASE-II-RAJASTHAN**

Sector Division: **Waste Water**

Screening Questions	Yes	No	Remarks
B. PROJECT SITING IS THE PROJECT AREA...	√		
▪ DENSELY POPULATED?		√	No
▪ HEAVY WITH DEVELOPMENT ACTIVITIES?		√	No
▪ ADJACENT TO OR WITHIN ANY ENVIRONMENTALLY SENSITIVE AREAS?		√	There is no protected / environmental sensitive area along the proposed project
• CULTURAL HERITAGE SITE		√	No
• PROTECTED AREA		√	No
• WETLAND		√	No
• MANGROVE		√	No
• ESTUARINE		√	No
• BUFFER ZONE OF PROTECTED AREA		√	No
• SPECIAL AREA FOR PROTECTING BIODIVERSITY		√	No
• BAY		√	No

Screening Questions	Yes	No	Remarks
A. POTENTIAL ENVIRONMENTAL IMPACTS WILL THE PROJECT CAUSE...			
▪ Impairment of historical/cultural monuments/areas and loss/damage to these sites?		√	No such impact is anticipated as proposed scope of work is away from these sensitive locations
▪ Interference with other utilities and blocking of access to buildings; nuisance to neighbouring areas due to noise, smell, and influx of insects, rodents, etc.?		√	Not applicable.
▪ Dislocation or involuntary resettlement of people?		√	Not applicable. There is no R&R required for this project.
▪ Disproportionate impacts on the poor, women and children, Indigenous Peoples or other vulnerable groups?		√	Not applicable.
▪ Impairment of downstream water quality due to inadequate sewage treatment or release of untreated sewage?		√	Not applicable.
▪ Overflows and flooding of neighboring properties with raw sewage?		√	Not applicable. This area is totally devoid of industries.
▪ Environmental pollution due to inadequate sludge disposal or industrial waste discharges illegally disposed in sewers?	√		During construction phase there will be some noise pollution but that will be manageable. Contractor will use modern machinery with low noise generation.
▪ Noise and vibration due to blasting and other civil works?		√	Blasting will not be done in the proposed project
▪ Risks and vulnerabilities related to occupational health and safety due to physical, chemical, and biological hazards during project construction and operation?			
▪ Discharge of hazardous materials into sewers, resulting in damage to sewer system and danger to workers?		√	Not applicable. This is a new sewerage system project.
▪ Inadequate buffer zone around pumping and treatment plants to alleviate noise and other possible nuisances, and protect facilities?		√	There is no facility to alleviate noise and other nuisances.
▪ Road blocking and temporary flooding due to land excavation during the rainy season?	√		There will be temporary road blocking due to excavation. But diversion will be provided to avoid vehicle congestion.

Screening Questions	Yes	No	Remarks
▪ Noise and dust from construction activities?	√		Little increase in noise levels and dust emission is anticipated from construction activities and shall be contained by taking proper mitigation measures as and when required.
▪ Traffic disturbances due to construction material transport and wastes?	√		This will be observed to some extent. Alternate routes will be used to avoid such problems. Contractor will provide a separate stockyard for storage of construction material to avoid such problems.
▪ Temporary silt runoff due to construction?		√	Not applicable.
▪ Hazards to public health due to overflow flooding, and groundwater pollution due to failure of sewerage system?		√	Not applicable.
▪ Deterioration of water quality due to inadequate sludge disposal or direct discharge of untreated sewage water?		√	Not applicable.
▪ Contamination of surface and ground waters due to sludge disposal on land?		√	Not applicable. There is no ground and surface water resources in the vicinity of the project area.
▪ Health and safety hazards to workers from toxic gases and hazardous materials which maybe contained in confined areas, sewage flow and exposure to pathogens in untreated sewage and unstabilized sludge?		√	There is no existing sewerage system in this town. All precautionary measures will be taken.
▪ Large population increase during project construction and operation that causes increased burden on social infrastructure (such as sanitation system)?		√	Sufficient labour is available in this town, during construction phase contractor will engage labour from the nearby community.
▪ Social conflicts between construction workers from other areas and community workers?		√	Local labour will be engaged during work this problem is avoided.
▪ Risks to community health and safety due to the transport, storage, and use and/or disposal of materials such as explosives, fuel and other chemicals during construction and operation?		√	Contractor will store explosives, fuel and other chemicals to a separate stockyard to avoid any incident.
▪ Community safety risks due to both accidental and natural hazards, especially where the structural elements or components of the project are accessible to members of the affected community or where their failure could result in injury to the community throughout project construction, operation and decommissioning?		√	Not applicable as per nature of work

Climate Change and Disaster Risk Questions The following questions are not for environmental categorization. They are included in this checklist to help identify potential climate and disaster risks.	Yes	No	Remarks
Is the Project area subject to hazards such as earthquakes, floods, landslides, tropical cyclone winds, storm surges, tsunami or volcanic eruptions and climate changes?		√	The town is covered under medium earthquake risk (Zone III) areas,
Could changes in precipitation, temperature, salinity, or extreme events over the Project lifespan affect its sustainability or cost?		☐	No such possibility
Are there any demographic or socio-economic aspects of the Project area that are already vulnerable (e.g. high incidence of marginalized populations, rural-urban migrants, illegal settlements, ethnic minorities, women or children)?		☐	Proposed project will not impact any marginalized population, rural-urban migrants, illegal settlement etc.
Could the Project potentially increase the climate or disaster vulnerability of the surrounding area (e.g., increasing traffic or housing in areas that will be more prone to flooding, by encouraging settlement in earthquake zones)?		☐	No such possibility of vulnerability Increase of the surrounding area.

ANNEXURE -IV

PUBLIC CONSULTATION- ENVIRONMENT (Sewerage Network and SPS) Conducted for Enhanced Scope

Issues to be discussed

- Awareness and extent of the project and development components
- Benefits of Project for the economic and social Upliftment of Community
- Labour availability in the Project area of requirement of outside labour involvement
- Local disturbances due to Project Construction Work
- Necessity of tree felling etc. at project sites
- Water logging and drainage problem if any Drinking water problem
- Forest and sensitive area nearby the project site
- Movement of wild animal within the village

Date & time of Consultation **09.07.2010.....Time: - 2:00 P.M**

Location: **Gandhi Colony, Proposed Sewer Line & Pumping Station, RIICO**

Table: issues of the Public Consultation- Design Phase

Sr. No.	Key issues/Demands	Perception of community	Action to be Taken
1.	Awareness of the project – including coverage area	People are not aware of the project in this area	Awareness programme and disclosure of Information is a part of sub-project
2.	In what way they may associate with the project	Sufficient numbers of labours are available in and around the Jaisalmer town who can be engaged for different construction works. Tractors or dumpers can also be hired locally. Local residents should also be involved in Sewer Line.	Engagement of Local labours may be encouraged during construction. Possibilities of engaging the local population in laying of pipeline may be explored in the sub-project Selling of treated sewage and solid waste at easy rates to the local farmers should be ensured
3.	Presence of any forest, wild life or any sensitive/ unique environmental components nearby the project	There is no forest, wild life or any sensitive area nearby our proposed project.	Adequate preventive measures required to be incorporated in the project to avoid all sensitive components.
4	Presence of historical/cultural/ religious sites nearby	No religious or cultural site situated near the landfill site	
5	Un favourable climatic condition	The temperature during summer is extremely high and it becomes very difficult to work during this season.	Proper rest sheds water supply and first aid box to be provided at work site. Scheduling of works should be adjusted according to the climatic condition
6	Occurrence of flood	No flood occurs in the Jaisalmer town as there is scanty rainfall in this area. Only 3-4 rain is observed in a year on an average basis.	

Sr. No.	Key issues/Demands	Perception of community	Action to be Taken
7	Drainage and sewerage problem facing	Presently there is severe problem of drainage and sewerage in the town. However people believe that this problem can be solved after implementation of drainage and sewerage projects taken up under RUIDP.	Part of Drainage and Sewerage project
8	Present drinking water problem- quantity and quality	The present water quality is poor, with high concentration of Fluoride.	This is a part of Drinking water supply sub-project
9	Present solid waste collection and disposal problem	At present there is no designated site for solid waste disposal. There is a major problem of collection & disposal of solid waste.	This issue shall be part of Solid Waste Management system and shall be automatically covered.
10	Availability of Labour during construction time	Sufficient labours are available in this town.	
11	Access road to project site	The proposed project is along the road. There will be no congestion over this road.	
12	Perception of villagers on tree felling and afforestation	In general people are not in favour of cutting of bigger trees along the roadside. No big trees are situated in our proposed project. Local people want plantation along the access road.	Greenbelt development will be provided in the sub-project as taken in DPR
13	Dust and noise pollution and disturbances during construction work	Dust and Noise pollution should be controlled during construction activity.	Contractor should provide all preventive measures to control the Dust and Noise during construction work.
14	Setting up of worker's camp site within the village/ project locality	The people of nearby village want that workers should be engaged from nearby villages for different construction activities. However they agreed to cooperate with the project authority for setting up worker camp near the work site.	
15	Safety of residents during construction phase and applying of vehicle for construction activities	As our project area is within the city, so locals feel that all safety measures would be taken for public safety during construction phase.	Contractor should appoint a safety officer to encounter the Public as well as workers safety during construction phase.
16	Conflict among beneficiaries downstream users – water supply project using of river water	Not applicable	Water Supply project is proposed in this town, and proposed water supply will be around 132 lpcd to meet the demand of water supply.
17	Requirement of enhancement of other facilities	Persons feel that three problems are major one i. e water supply, sewerage line, and solid waste disposal. These should be solved as early as possible.	

Sr. No.	Key issues/Demands	Perception of community	Action to be Taken
18	Whether local people agreed to sacrifice their lands (cultivable or not) for beneficial project after getting proper compensation	Local people agreed to give their own land if there is need for the project. However adequate compensation should be paid according to prevailing market rate in advance in consultation with the local people.	No acquisition of private land proposed in the sub-project

Name and Position of Persons Consulted

Sr. No.	Name	Occupation
1	Mr. Rahul Rathore	Service
2	Mr. Kewal Singh	Shopkeeper
3	Mr. Dilip Singh	Shopkeeper
4	Mr. Arjun Das	Shopkeeper
5	Mr. Malam Singh	Shopkeeper
6	Mr. Dharmendra	Driver
7	Mr. Vishal	Labour
8	Mr. Ganpat	Labour
9	Mr. Pawan Kumar	Labour
10	Mr. Bhanwar Singh	Service

Summary of out come

1. Person those are involved are very much positive about this project and they want that this should be completed as early as possible. They will help in every respect as they can.
2. The respondents have no objection with Sewage Network project as for Jaisalmer town.
3. The locals are not satisfied with the existing water supply, drainage system as well as Solid Waste Management facilities provided to them. They feel that sweepers are not doing their job properly. They want early solution for this problem
4. The local population perceives the project as an opportunity for job and willing to join in the system.
5. According to the local people, sufficient Labours, especially unskilled and semi-skilled, are available for construction in the town and nearby areas and they should preferably be engaged for different construction works. The tractor or dumpers can be hired locally.
6. Sewerage is a major problem in this town and locals wants that this project should be completed as early as possible. They wants that light vehicles and machinery is available in this town and that may be used during construction work.