Environmental Assessment Document

Initial Environmental Examination: Sikar Waste Water Management Subproject
Project Number: 40031
September 2008

India: Rajasthan Urban Sector Development Investment Program

Prepared by Local Self Government Department

For the Government of Rajasthan
Rajasthan Urban Infrastructure Development Project

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	-	liter per capita per day
lps	-	liter per second
LSGD	-	Local Self-Government Department
MFF	-	Multi-tranche Financing Facility
MLD	-	Million liter 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
STP	-	Sewerage Treatment Plant
ToR	-	Terms of Reference
UA	-	Urban Agglomeration
UIDSSMT	-	Urban Infrastructure Development Scheme for Small and Medium Towns
uPVC	-	Unplastized 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
µg/m^3	–	micrograms per cubic meter
km	–	kilometer
lpd	–	liters per day
m	–	meter
mg/l	–	milligrams per liter
mm	–	millimeter
ppm	–	parts per million

NOTE{S}

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

CONTENTS

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 Multitranche 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 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 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: 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 categorises 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 (facilities that are shared by more than one town)[1]. EC is thus not required for the sewerage and sanitation sub-project that is the subject of this Environmental Examination.

3 Review and Approval Procedure

12. 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 and the national environmental protection agency (MoEF in this case). 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

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

II. DESCRIPTION OF THE PROJECT

A. Type, Category and Need

14. 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 Sikar City at present. Only few households have covered individual septic tanks. 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.

15. From the demand gap analysis it is to be concluding that there is comprehensive need of ULB scheme for proper collection and treatment and disposal of sewage in the town. It is also to be seen from demand gap assessment that significant area of land will be required for installation of sewage treatment facilities.

B. Location, Size and Implementation Schedule

16. The sub-project is located in Sikar, the headquarters town of Sikar 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. A new outfall sewer will be buried alongside the Road. There will be a new Sewage Treatment Plant (STP), to be built on 12 ha of government land **(Figure 2.3).** Proposed

[1] According to the Rajasthan State Pollution Control Board, the MoEF intends to issue a clarification to the EIA Notification in due course, which will add all landfill facilities and Sewage Treatment Plants to the list of projects specified as requiring EC under the Notification. This has not yet been issued, so the text above indicates the correct legal position at the time of writing

new sewer layout and trunk main routing is shown in **Figure 2.2.** Environmental features in and around the STP is shown in Survey of India Toposheet **(Figure 2.4).**

17. The treatment works will be built in around 6 months. Construction of the trunk sewer and networks will take up to 1½ years, so all work should be completed by the middle of 2010. Photographs of the project area are attached as **Appendix 1**

C. Existing sewerage and sanitation situation

18. Discharge of waste water from kitchen and bathrooms from houses reaches the nearby open drains. There are also instances where many of the septic tanks do not have soak pits and septic tank effluent discharged directly in the nearby storm water drains. A large number of households in slum areas, even today, use dry latrines or resort to open defecation. The existing drains thus not only carry sullage, but also include sewage causing unhygienic conditions. During rains situation worsens when sewage mixed rain water overflows on the roads. Thus providing underground sewerage system in the selected areas of the town is considered as priority.

19. The selected area for the Subproject is having a population 99906 as of 2001 in an area of 477.09 hectare comprising of 40 wards (2,3,5,6,7,11,16,20 to 27,32 to 35,37,38 - fully covered and 1,4,8,9,10,12,13,14,15,17,18,19,28,29,31,39,40 & 45 - partially covered). This area is densely populated and adequate onsite treatment facilities are not in existence as also not possible due to space constraints. Area will also have adequate water supply on completion of the water supply improvement scheme now being executed.

D. Description of the Sub-project including detailed scope of work

20. **Description of the Area proposed:** Though the town is densely populated in atleast 30 wards (density being >100 persons per hectare), 40 wards (2,3,5,6,7,11,16,20 to 27,32 to 35,37,38 are fully covered and 1,4,8,9,10, 12,13,14,15,17,18, 19,28,29,31, 39,40 & 45 are partially covered),the area comprising North of Rani Sati Road(South East corner in Bajaj Circle) and South West of NH-11 upto RSEB Power house. Main road being Bajaj Road upto Salasar Bus stand, Station Road upto Gulabi Devig G.H.S school, have been selected for providing sewerage system as the present population density in the area is quite high, more than 200 persons per hectare as per 2001 census as also will have adequate water supply on completion of water supply augmentation scheme now being executed by PHED.

21. **Details of Sub-project:** The sewerage Subproject is proposed to include construction of 10 MLD sewage treatment plant (with UASB) including a terminal pumping station at STP site, laying of trunk/ intercepting sewer line of 700mm to 900mm diameter for a length of 2.17km and laterals of 76.83 km. For the house service connection it has been proposed to use 110&160mm OD uPVC pipes (4 to 6 per manholes). The house service connections are normally to the manholes. However, provisions for required number of road side chambers also made which, if required, shall be used in wide roads for ease in constructions and maintenance where 2 or 3 House service connections (HSC) shall be to Road side Chamber (RSC) and RSCs will be in turn connected with manholes. Also provision is given for dismantling cum refilling the septic tank / soak pit utilities for those who do not find a separate connection.

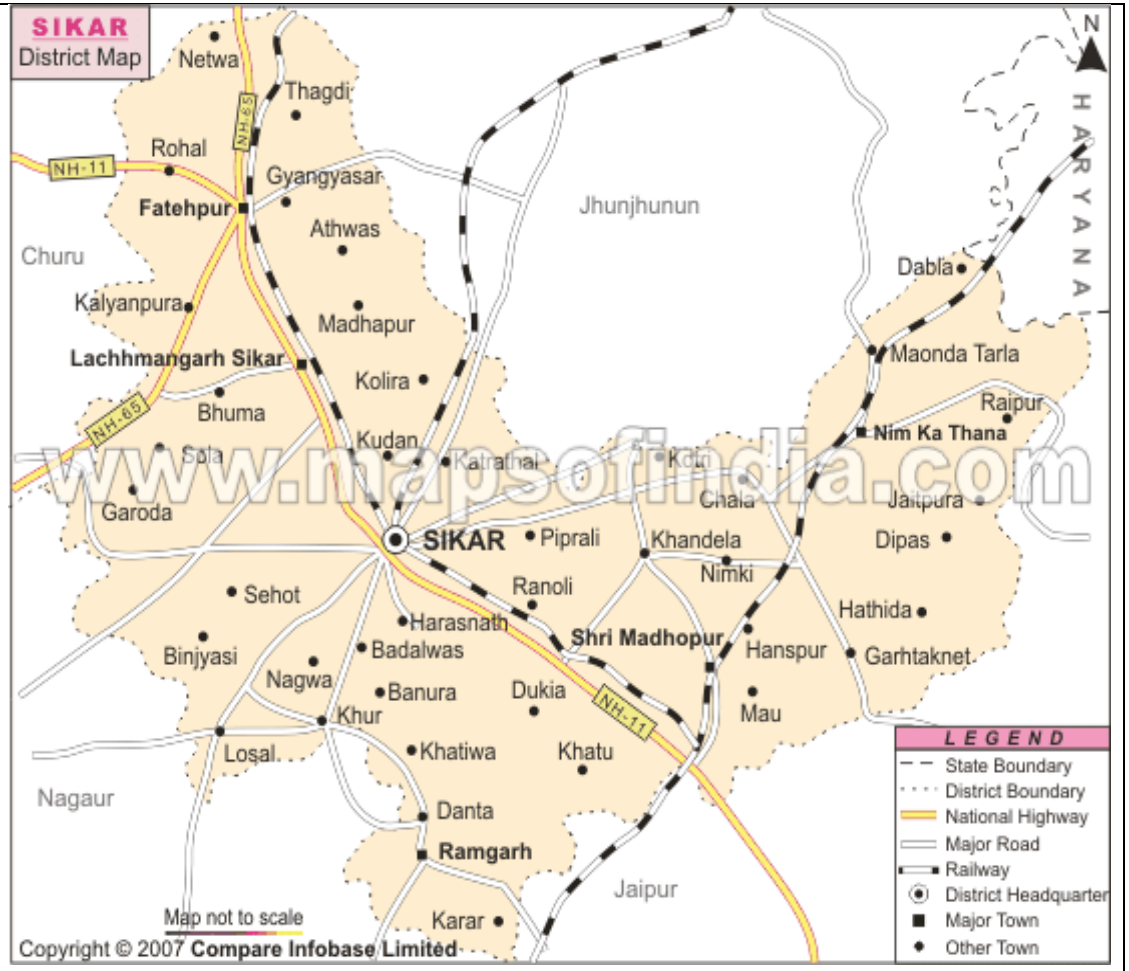
22. **Design Criteria:** The collection system is designed for waste water volume to be generated for the projected population of 2041. Per capita waste water generation is considered as 80% of the net water supply of 135 lpcd. Peak factor has been considered to

design the sewer lines. Minimum velocity of 0.6 m/ sec to achieve self cleansing and maximum velocity of 2.5 m/ sec to avoid possible scouring have been considered for design purposes. For all the component designs standard design criteria and practices have been adopted. Minimum cover is 0.9m. Provision of manholes at suitable intervals is also considered.

23. **Table 2.1** shows the nature and size of the various components of the subproject. As indicated above there are three main elements: provision of a network to collect sewage from different city part; a trunk sewer to transport waste to the STP; and a new STP to treat sewage to Indian urban standards. 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.

24. Under Tranche-II, works of the STP (which will be of approx.10.0 MLD capacity in 1st phase and can be increased in phase manner) will be constructed comprising of secondary treatment by Conventional Activated Sludge process as the land requirement is limited and Sewerage Network of pipe line in the main old town including out fall and Trunk sewer, Laterals and house connection. The work for sewerage network for the city including laying of Laterals and sewer lines in surrounding developed areas of the town and house connections are also considered. Land identified for STP to an extent of 12 ha. and in the process of acquisition by PHED, Sikar

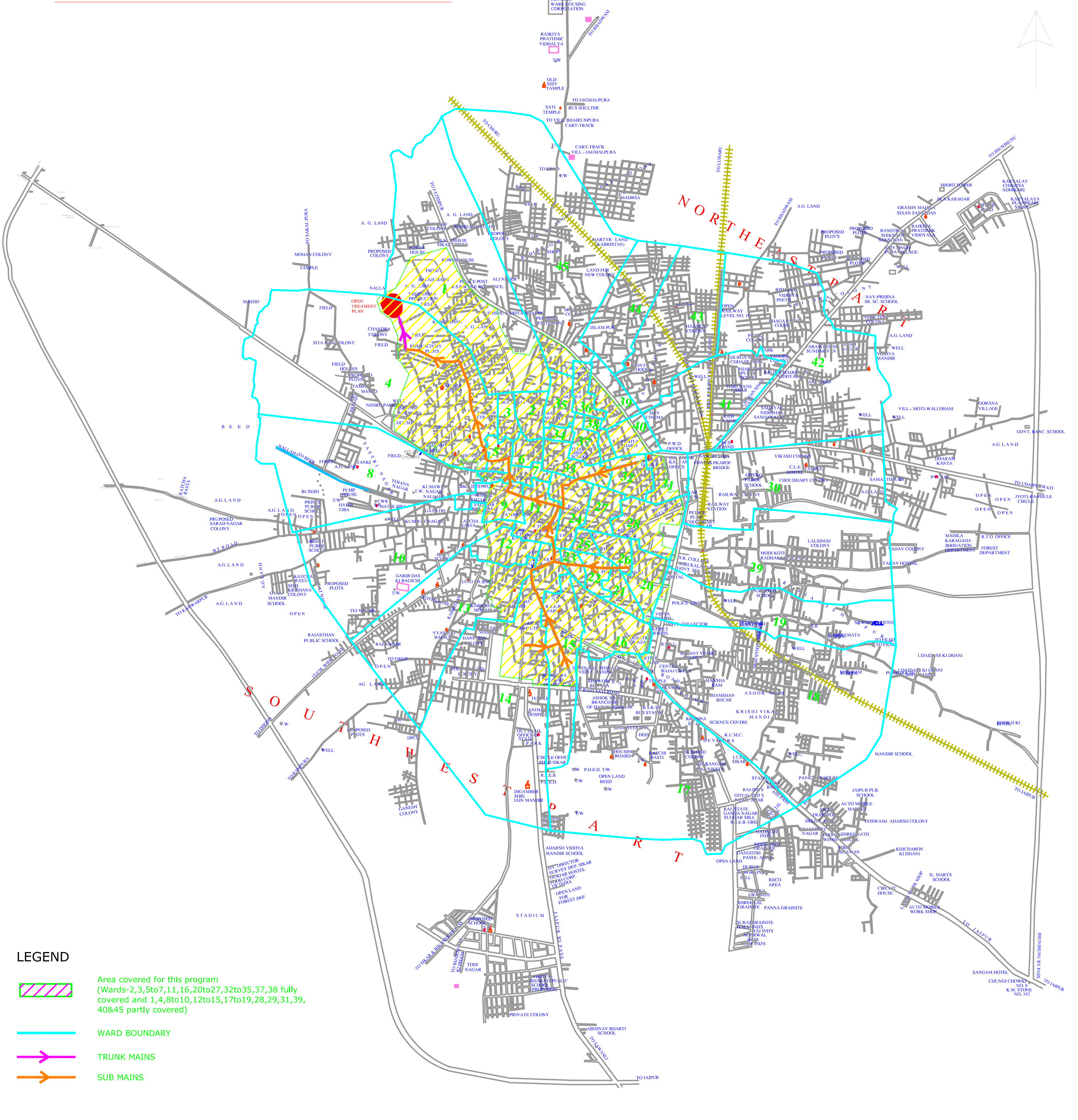
Figure 2.1: Map showing the location of the project



Rajasthan Urban Sector Development Investment Program **ADB TA 4814-IND**	**Govt of Rajasthan** **Asian Development Bank**
Sikar Regional Map	

Figure 2.2: Proposed new sewer layout and trunk main routing

PROPOSED SEWERAGE SYSTEM SIKAR TOWN



LEGEND

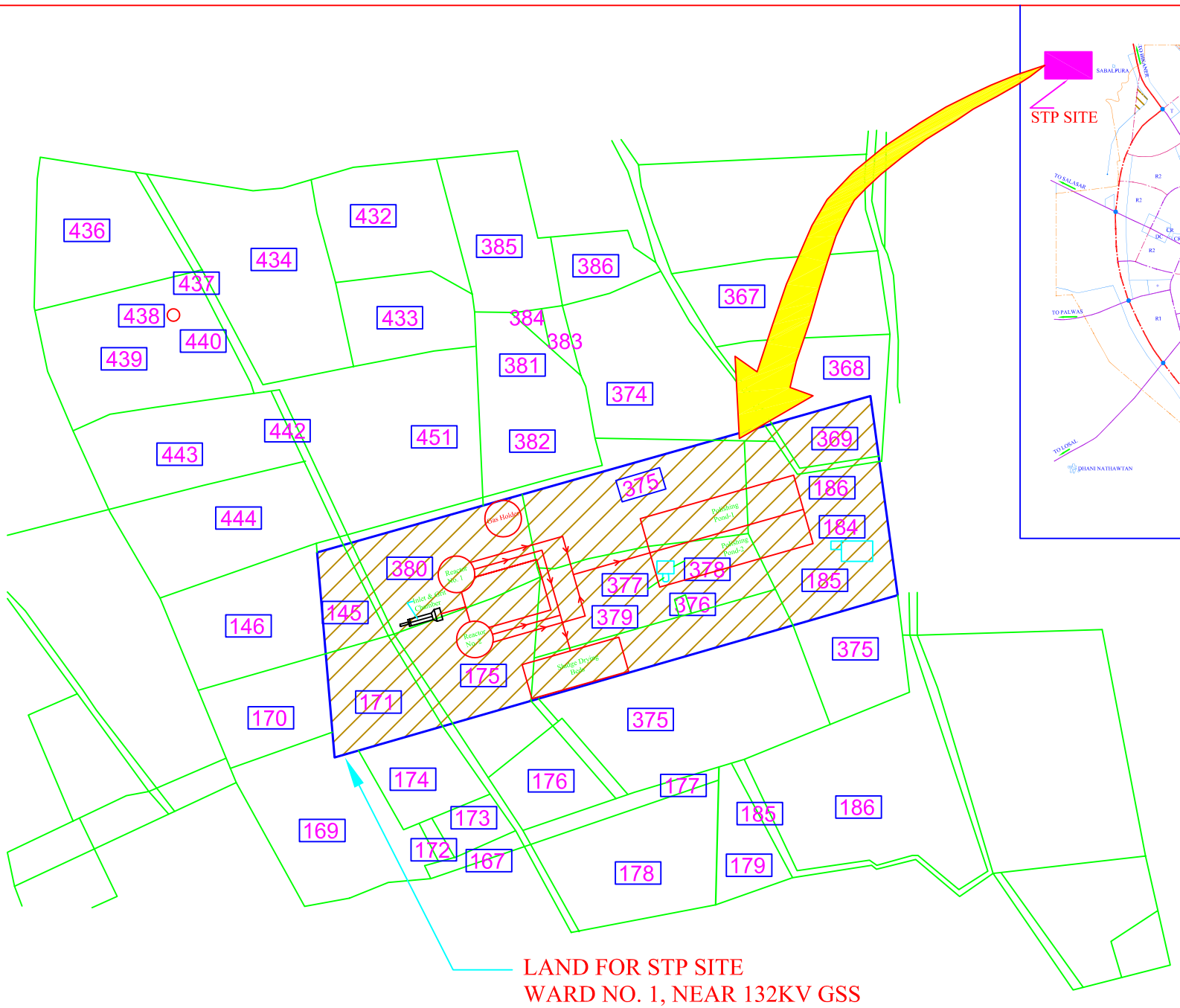
Area covered for this program (Wards-2,3,5to7,11,16,20to27,32to35,37,38 fully covered and 1,4,8to10,12to15,17to19,28,29,31,39, 40&45 partly covered)

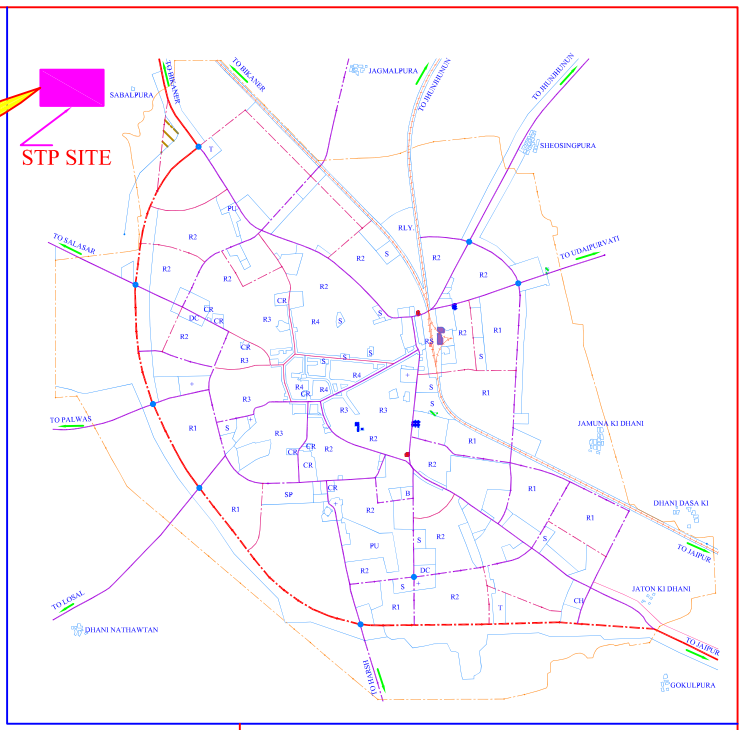
WARD BOUNDARY

TRUNK MAINS

SUB MAINS

Figure 2.3: Location of proposed Sewage Treatment Plant at Sikar





Salient Features:-

1. Area required -12.00 Hac.
2. Detail of Structure /Monuments in
   -500 M vicinity- Nil
   -Sabalpura Power House:-700MT
3. Distance from Main Road-
   -1000M from NH-11 Jaipur-Bikaner Highway
4. Distance of any historical monuments-
   -Shri Gopinath Gaushala half km away
   -Collectorate about 8KM away.

LEGEND:-

- RAILWAY STATION AND YARD
- NATIONAL HIGHWAY/ BYE PASS
- STATE HIGHWAY
- SUB ARTERIAL ROADS
- ROAD JUNCTIONS
- MUNICIPAL LIMIT
- 378 STP SITE

RUSDIP(SIKAR)	RAJASTHAN URBAN SECTOR DEVELOPMENT INVESTMENT PROGRAM
SECTOR:-	TITLE:- PROPOSED STP SITE
CONTENT:- CLIP DRAWING	DRAWING NO. RUSDIP/SIK/01 R0
	DRAWN BY:- R.KRISHNA APPROVED BY:-
	DATE:- MAR-2008 SCALE:-NOT TO SCALE

Figure 2.4: Location of Sewage Treatment Plant in SOI toposheet

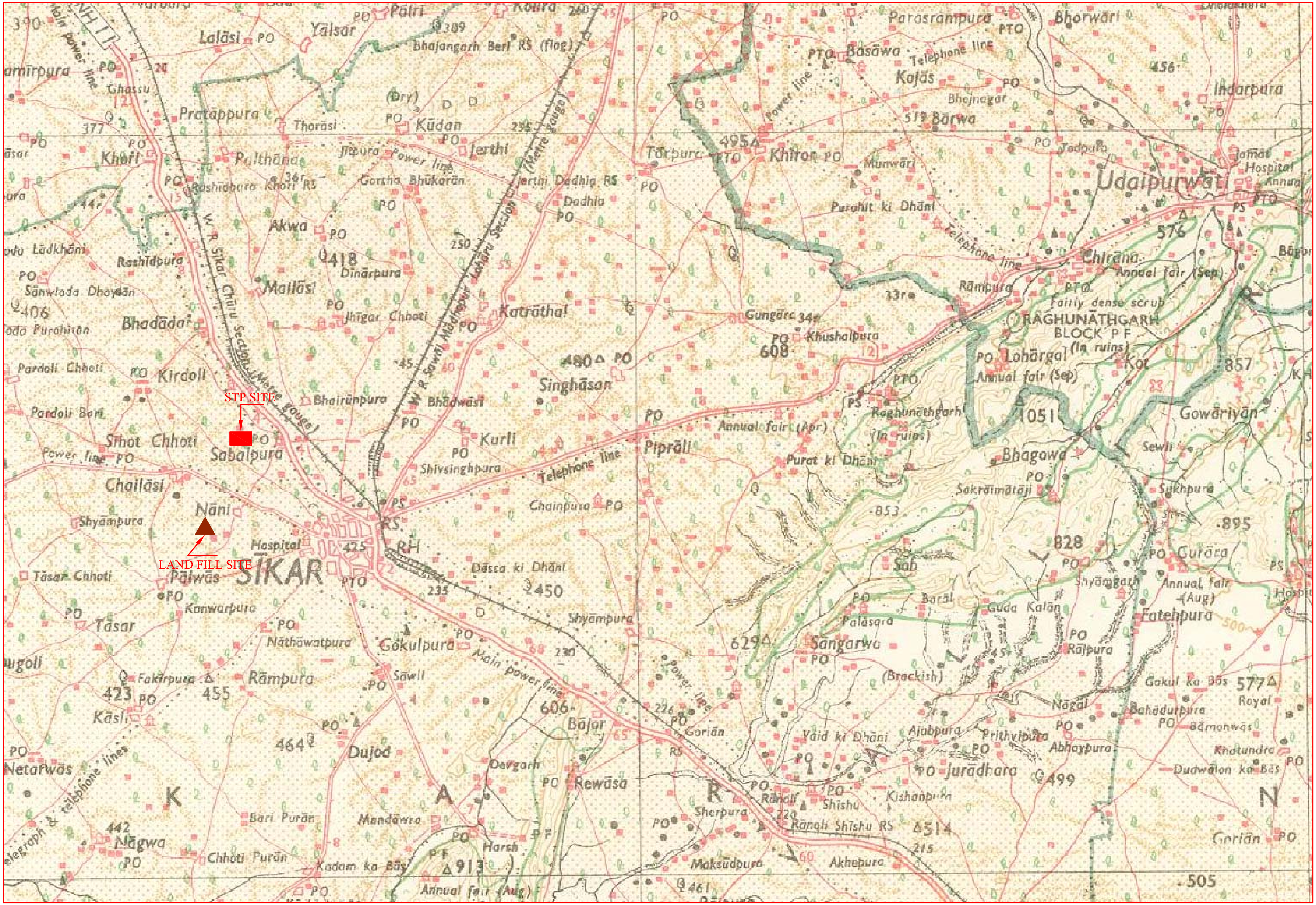

STP SITE
LAND FILL SITE
SIKAR
Hospital
Sabalpura
Nani
Palwas
Chailasi
Kurli
Piprali
Singhasan
Katrathal
Udaipurwati
Chirana
RAGHUNATHGARH BLOCK P F
Gokulpura
Rampura
Dujod
Rewasa
Bajor
Sangarwa
Juradhara
Fatehpura
W R Sikar Churu Section (Metre gauge)
W R Sawai Madhopur Loharu Section (Metre gauge)
Main power line
Telephone line

Table 2.1: Improvements in sewerage infrastructure proposed in Sikar

Infrastructure	Function	Description	Location
Sewage Treatment Plant (STP)	For Treatment of Raw Sewage collected from town	Approximately 10 MLD capacity STP (UASB technology) will be required – 5 ha of land. - 1 inlet chamber, 1 no. cross screen channel, 1 no. fine screen channel, 2 nos. grit channel, 1 distribution chamber, 2 nos. reactor, 2 nos. degassing aeration tanks and 2 nos. polishing tanks	Tentative location at Ward1 near 132 KV GSS- 12 ha of area available
Trunk /Outfall Sewer	To connect collection net works up to STP.	Trunk main dia varying from 700mm to 900mm dia - 2.169 km	After finalising site of STP this will be decided on main source covering different zones
Lateral (Secondary) Sewers and tertiary network and house connection	To collect Sewage from households and from the consumers	Collection network dia varying from 200mm to 600mm dia- approx. 76.835 km	Though the town, densely populated in atleast 30 wards (density being >100 persons per hectare), 40 wards (2,3,5,6,7,11,16,20 to 27,32 to 35,37,38 are fully covered and 1,4,8,9,10, 12,13,14,15,17,18, 19,28,29,31, 39,40 & 45 are partially covered),the area comprising North of Rani Sati Road(South East corner in Bajaj Circle) and South West of NH-11 up to RSEB Power house. Main road being Bajaj Road upto Salasar Bus stand, Station Road upto Gulabi Devig G.H.S school,

III. DESCRIPTION OF THE ENVIRONMENT

A. Physical Resources

1 Location

25. The Urban Agglomeration (UA) of Sikar is situated at the foothills of the Aravalli Mountain series and is strategically located between the State capital of Jaipur and the National Capital of New Delhi. Sikar city is one of the Historical city of the Rajasthan state and it is also a Railway Junction. Historical monuments such as Victoria Diamond jubili hall Tatya Tope Samadhi, Rani Mahal Madhav Niwas are some of the places of Tourist's attractions. This town is Origin of rich Marwaris and is known as Sekhawati Region. Colourful frescoes on the walls of Forts, Palaces Havelis, Baoris depict daily rich life & Culture, religion and Architecture.

26. The district is located in the north-eastern part of the state. It is bound in the north by Jhunjhunun District, in the north-west by Churu district, in the south-west by Nagaur district and in the south-east by Jaipur district. It also touches Mehandergarh district of Haryana on its north-east corner.

27. Sikar is situated at the junction of National Highways (NH-11), State Highways (SH -8), & (SH -20) and, provides connectivity to Delhi via Jhunjhnu. It is also having the connectivity to Jabalpur & Bikaner, state via Jaipur state capital . District map of Sikar shown in **Figure 3.1.**

2 Topography, Natural hazard and Drought

28. **Topography**: Sikar lies between the East longitude $75^{o}16'$and North latitude 27^{o} 30'. It is situated at the center of Sikar District at 437 meters above MSL.

29. **Natural Hazards**- Earthquake**:** Sikar town lies in Low damage risk Zone – II. The area is less prone to earthquakes as it is located on relatively stable geological plains based on evaluation of the available earthquake zone information. **Figure 3.2** depicts the earthquake zones of Rajasthan. **Figure 3.3** shows natural hazard zone.

30. **Drought:** Low rainfall coupled with erratic behaviour of the monsoon in the State makes Rajasthan the most vulnerable to drought. Based upon the discussion with PHED officials the water table in the City continuously decreases by 3-4 meter on an annual basis combined with significant drawdown conditions.

Figure 3.1: District Map of Sikar

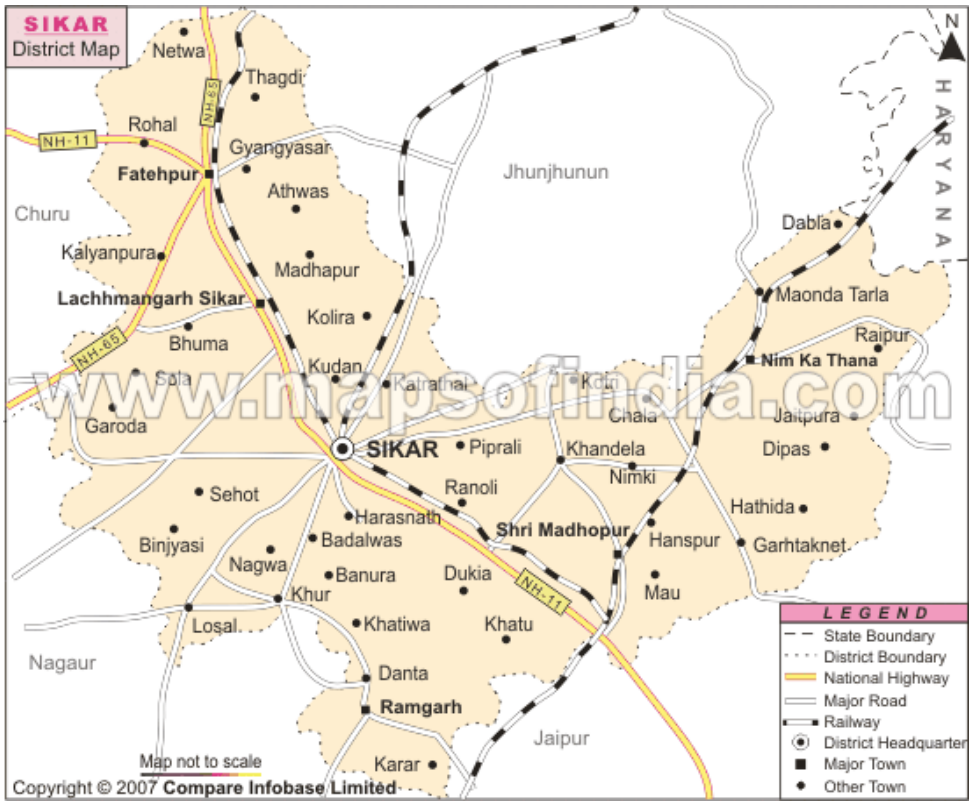


Figure 3.2: Earthquake zones of Rajasthan

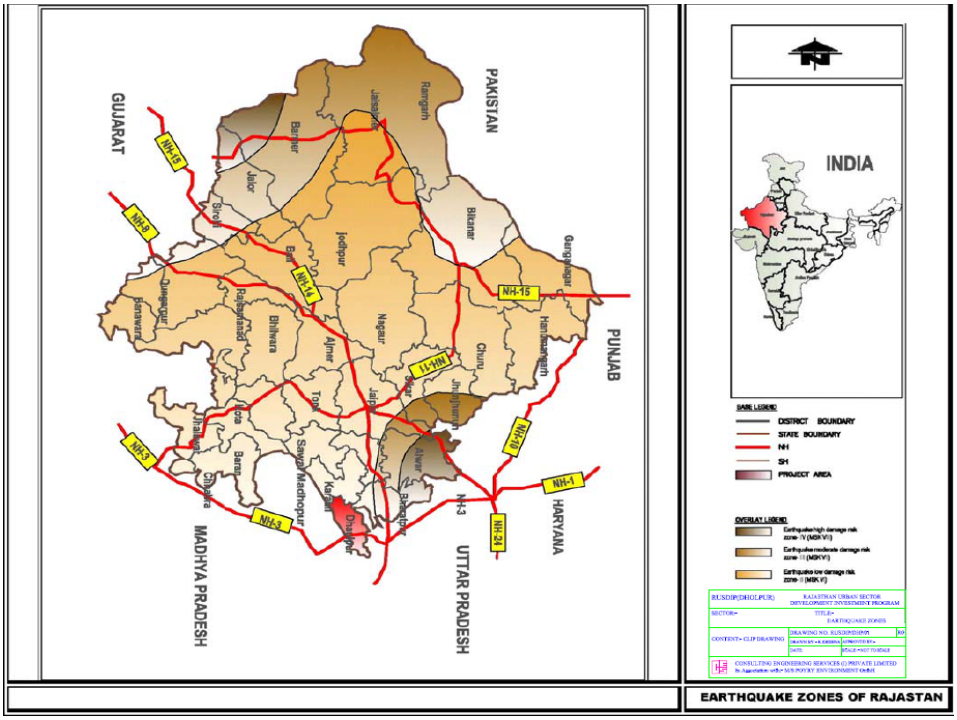
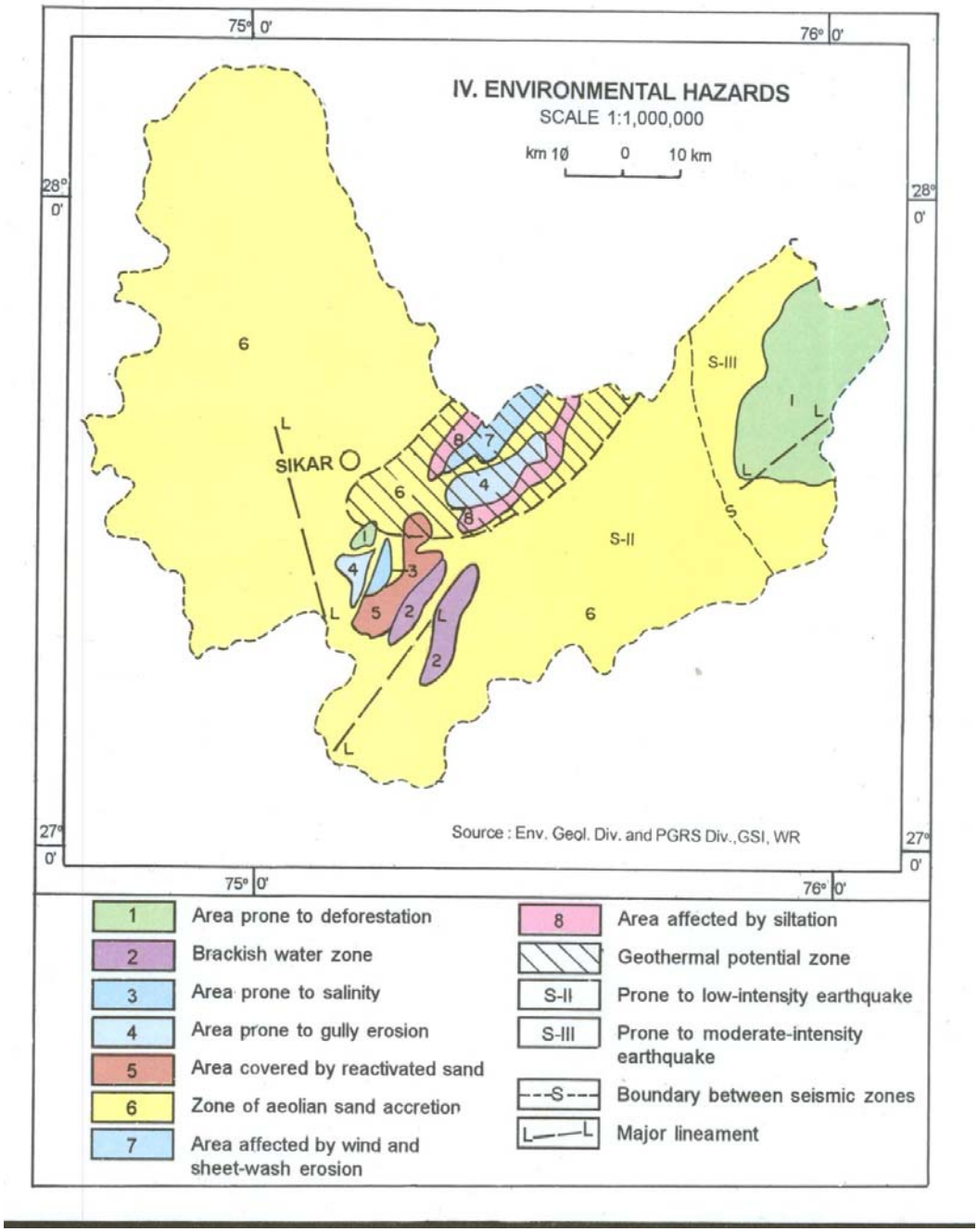


Figure 3.3: Natural Hazard map of Sikar (Source: Resource map GSI)



3 Geology, geomorphology, mineral resources and soil

31. Sikar district in northcentral of Rajasthan, covers an area of 7732 km^2 . The district has six tehsils namely Fatehpur, Lachhmangarh, Sikar, Danta Ramgarh, Shri Madhopur and Nim – ka – Thana. There is network of railways and Roads in the area. Semi arid to arid climate prevails in the district. The average annual rainfall is 460mm. The district can be divided into

two main topographic units the western half characterized by dunal country and waste land, and the eastern half characterized by NE-SW trending hill ranges. These hill ranges act as natural barriers and restrict large scale sand migration from the west.

32. Geologically, the district is not of much significance as the major part of the district is covered by Aeolian sand and sand dunes. Hard rock exposures are mainly confined to the eastern part of the district as isolated outcrop or as thin linear ridges. The Saladipura Group (Archaean) comprisin quartzite, paragneiss dolomatic marble and schist, exposed in the central part of the Khetri Copper belt (Lower Proterozoic age) tappers down in the northcentral part of the district. The lithounits of the Khetri Copper belt mainly include quartize, phyllite, calc – silicate and marble. Quartzite, staurolite – garnet – biotite schist and marble belonging to Shyangarh Group of Delhi Supergroup are juxtaposed with the Saladipura Group in the southern and eastern part of the district, the scanty outcrops of the Ajabgarh Groups of the Delhi Supergroup (Lower to Middle proterozoic). Granite, pegmatites quartz veins gabbro are the acid and basic intrusive. Faults, shears, fold axis are the manifestation of deep- seated tectonic in the area.

33. Geomophologically the district is classified into seven geomorphic units namely longitudinal dune, transverse dune, obstacle dunes, sand sheet, piedmont, ridge and valley and pediment. The shadow zones behind ridge and valley acting as sand barriers, are the only areas used for cultivation of seasonal crops. The area is characterized by two hydrogeological domains unconsolidated porous Quaternary formations and consolidated fissured formations with ground water potential ranging from less than 1 to 100 LPS, The district forms the catchment areas for various river valleys. These are Dohan in the northeast, Sabi, Sota and Banganga in the east and Mendha in the south. Although, these river systems originate from Sikar district, they remain dry for the most part of the year due to scanty rainfall and sand migration. As the district is prone to sand accumulation and migration, the effects of environmental hazards related to desertification is visible at most of the places these includes disorganisation of river valley, salinity of ground water and over-stepping of recent dunes over the cultivated lands.

34. **Mineral Resources:** Huge deposit of pyrite - pyrrhotites is recorded from Saladipura (27°40':75°31') which is mined extensively for sulphur extraction. The estimated reserves of 111.62 million tonne (Mt) of pyrite -pyrrhotite with an average of 21.63% Sulphur. Extensive ancient mining activities for copper in the form of old Working and slag, dump are recorded from a number of places within the South Khetri Belt namely Baleshwar (27°43':75°55') South of Mavanda (27°48':75°50').NW of Ghata (27°35':75°50')etc. Apatite is found In Kerpura (27°39' - 75°34') Salwari (27°39':75°36') area In post Delhi - granite as veins. P_2O_5 contains is nearly 41%. Fluorite occurs as siringers, veins and pockets in quartz veins, amphibole rich rock and granite Limestone deposit near Patan (27°50': 75°58') is estimated to contain 6.98 Mt of limestone with 46.54% CaO. Other occurrences are reported from Raipur Jhingar (27°38' : 76°01') and Saladipura. The Khandela area has revealed the presence of moderately radioactive zones in quartz - biotite schist aplitic rocks and quartz-tourmaline veins. The Uranium zone contains 0.04 to 0.11% O_3U_8. The mineralised zone also contain molybdenum and copper mineralization. Barytes occurrences are reported from Kalakhera of Gaonri (27°42':75°50'). Iron ore occurrene from Kalakhera (27°42':75°59') and NW of Jhalra (27°52':75°52') Clay deposit is located NE- of Churla (27°34':75°56') Calcite occurrences are located at Mavanda, Raipur. West of Kalakhera north of Saladipura and many other places' Calcite occurs as veins, pockets and lenses in the marble and gneisses of Delhi Supergroup.

35. Geology and mineral map of Sikar shown in **Figure 3.4**, while geomorphological map of Sikar depicted in **Figure 3.5.**

Figure 3.4: Geology and mineral map of Sikar district (Source: GSI Resource map)

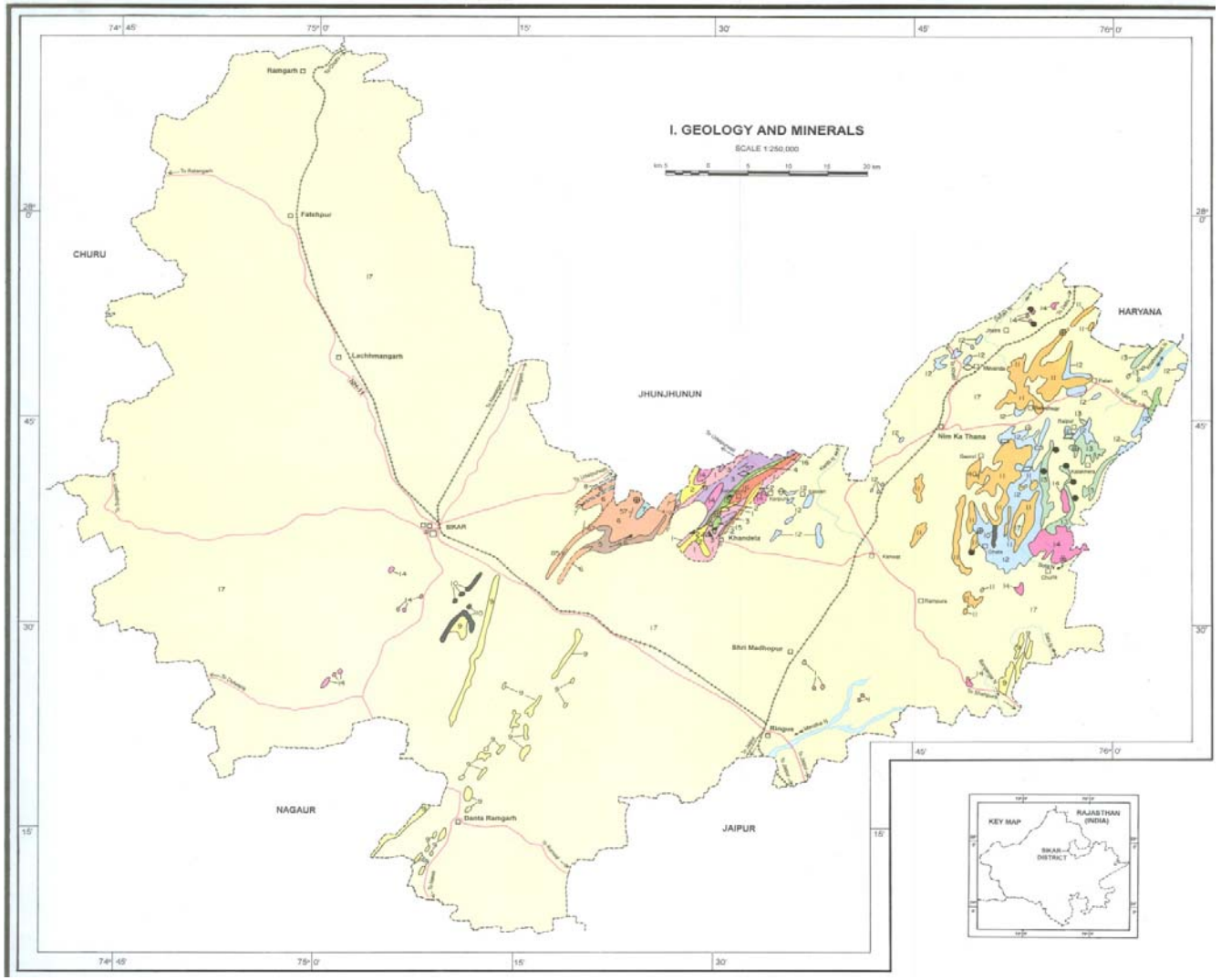
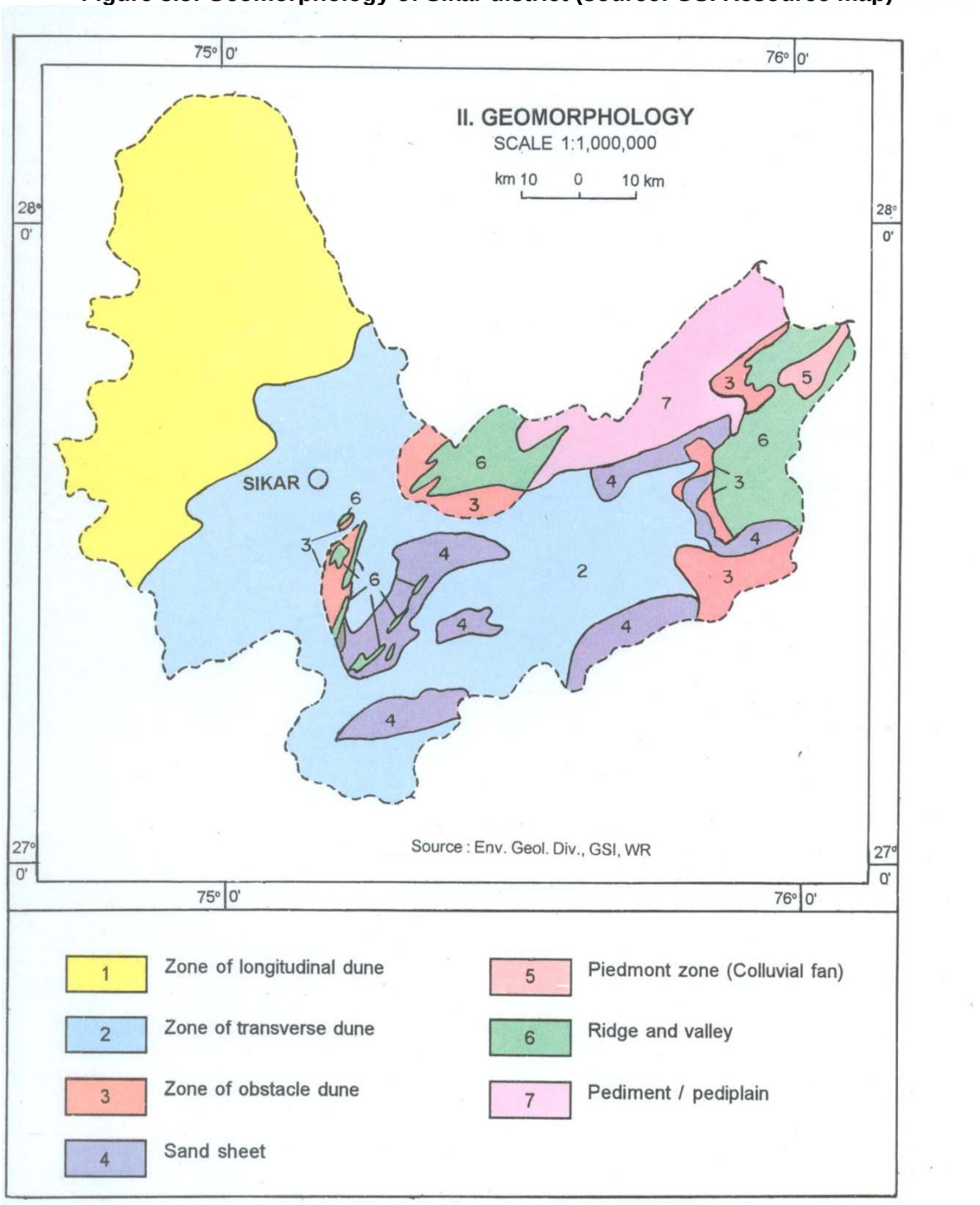


Figure 3.5: Geomorphology of Sikar district (source: GSI Resource map)



36. Soil characteristics: Soil of the region falls within rainfall zone of 300 – 500 mm. The soil is sandy loam, sallow depth red soils in depressions. Table 3.1 shows nutrient level in the Sikar soil including area coverage of saline and sodic soil. The nutrient status of the Sikar soil is graded as low to medium level.

Table 3.1: Fertility status – major nutrients and problematic soils of Sikar district

	Nutrient			Saline Soil(Ha)	Sodic or Alkali(Ha)
	N	P	K		
Status	L	M	M	59936	30036

(Source: Vital Agricultural Statistics 2004-05, Directorate of Agriculture, Rajasthan)

4 Climate

37. The district has a hot summer, scanty rainfall, a chilly winter season and general dryness of the air except in brief monsoon season. The average maximum & minimum temperature are 46 & zero degree celsius respectively. The normal rainfall, mostly received from south-west monsoon is 46.60 cms.

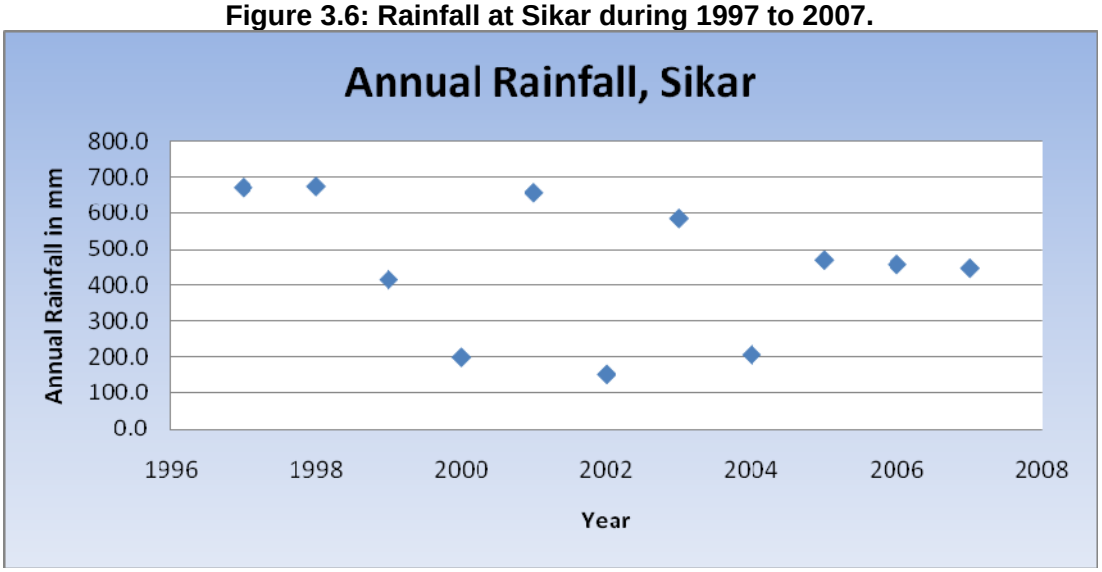
38. The rainfall over Sikar is scanty and is concentrated over four month i.e. from June to September. The rains are erratic and so is the distribution of the rainfall. However agriculture and the animal wealth are dependent on rains to large extent. Seasonal Rainfall data for the recent year (2005-2006) shown in Table 3.2. Figure 3.6 shows yearly variation (1997-2007) of rainfall at Sikar.

Table 3.2: Rainfall at Sikar in recent years (2005-06)

	Months	Rainfall (mm)
1	June	123
2	July	229
3	August	0
4	September	81
5	October	0
6	November	0
7	December	0
8	January	0
9	February	0
10	March	18
11	April	0
12	May	80
13	**Monsoon Rainfall**	433
14	**Non monsoon rainfall**	98
15	**Annual Rainfall**	**531**

(Source: Irrigation Department, Govt. of Rajasthan)

Figure 3.6: Rainfall at Sikar during 1997 to 2007.



Source: Deputy Director hydrology water resources ID and R, Jaipur

5 Air Quality

39. There are no data on ambient air quality of Sikar Town, which is not subject to monitoring by the Rajasthan State Pollution Control Board (RPCB) as there are no major industries. The nearest station is located at Jaipur (115 km from Sikar). Traffic is the only significant pollutant in Sikar, so levels of oxides of sulphur and nitrogen are likely to be well within the National Ambient Air Quality Standards (NAAQS). The ambient air quality data is depicted in **Table 3.3.**

Table 3.3: Ambient Air Quality in Jaipur (Annual Average, 2004; units in µg/m3)

Monitoring Station	Land use	SOx	NOx	RSPM	SPM
Jaipur Residential, Rural and others area	Residential	5.57	29.9	106	302
NAAQ Standard	Residential	60	60	60	140
JaipurIndustrial area	Industrial	22.69	9.32	131	300
NAAQ Standard	Industrial	80	80	120	360

RSPM: Respirable Suspended Particulate Matter; SPM: Suspended Particulate Matter

Source: Annual Report 2005-2006 Rajasthan State Pollution Control Board

6 Surface Water

40. There are no monitoring data on surface water quality in and around Sikar. The nearest station is located at Ghagar nadi (260 km from Sikar). The parameters as measured by Rajasthan Pollution Control Board are pH, Electrical conductivity (EC), BOD and DO. Water quality data of Ghagar River – upstream and downstream location are shown in **Table 3.4** and **Figures 3.7** and **3.8.**

Table 3.4: Water quality of Ghagar River

Location	Date of Sample Collection	Dissolved Oxygen (mg/lt)	P^H	BOD (mg/lt) (3 days at 27o C)	Conductivity at 25° C (m-MHO)
Ghagar Nadi , Hanumangarh, up stream	7/29/2005	4.37	8.23	1.39	0.39
Ghagar Nadi , Hanumangarh, down stream	7/29/2005	4.2	8.52	1.26	0.38

Figure3.7: Variation of water quality parameters Ghagar Nadi , Hanumangarh, Up stream

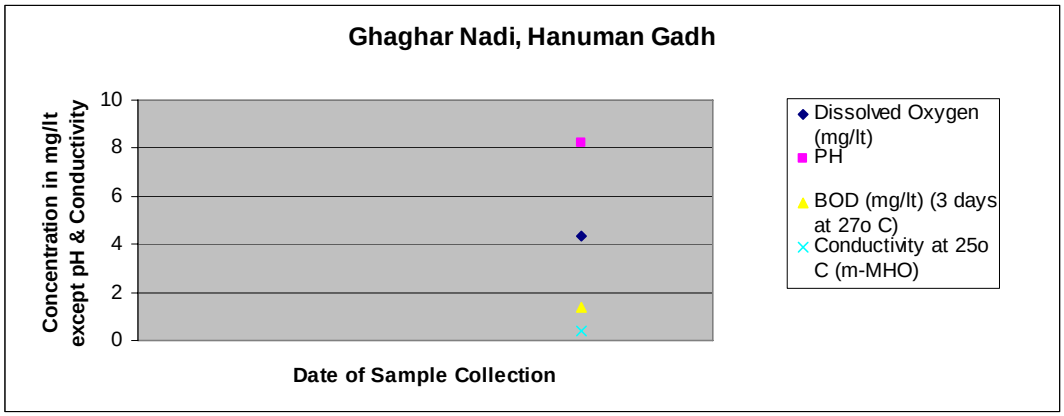
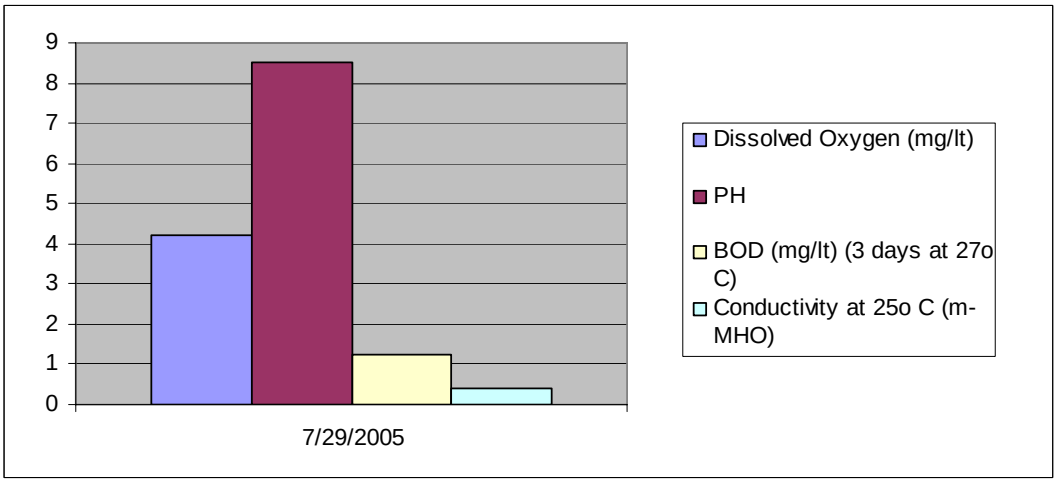


Figure 3.8: Variation of water quality parameters: Ghagar Nadi , Hanumangadh, down stream



7 Geohydrology and Groundwater

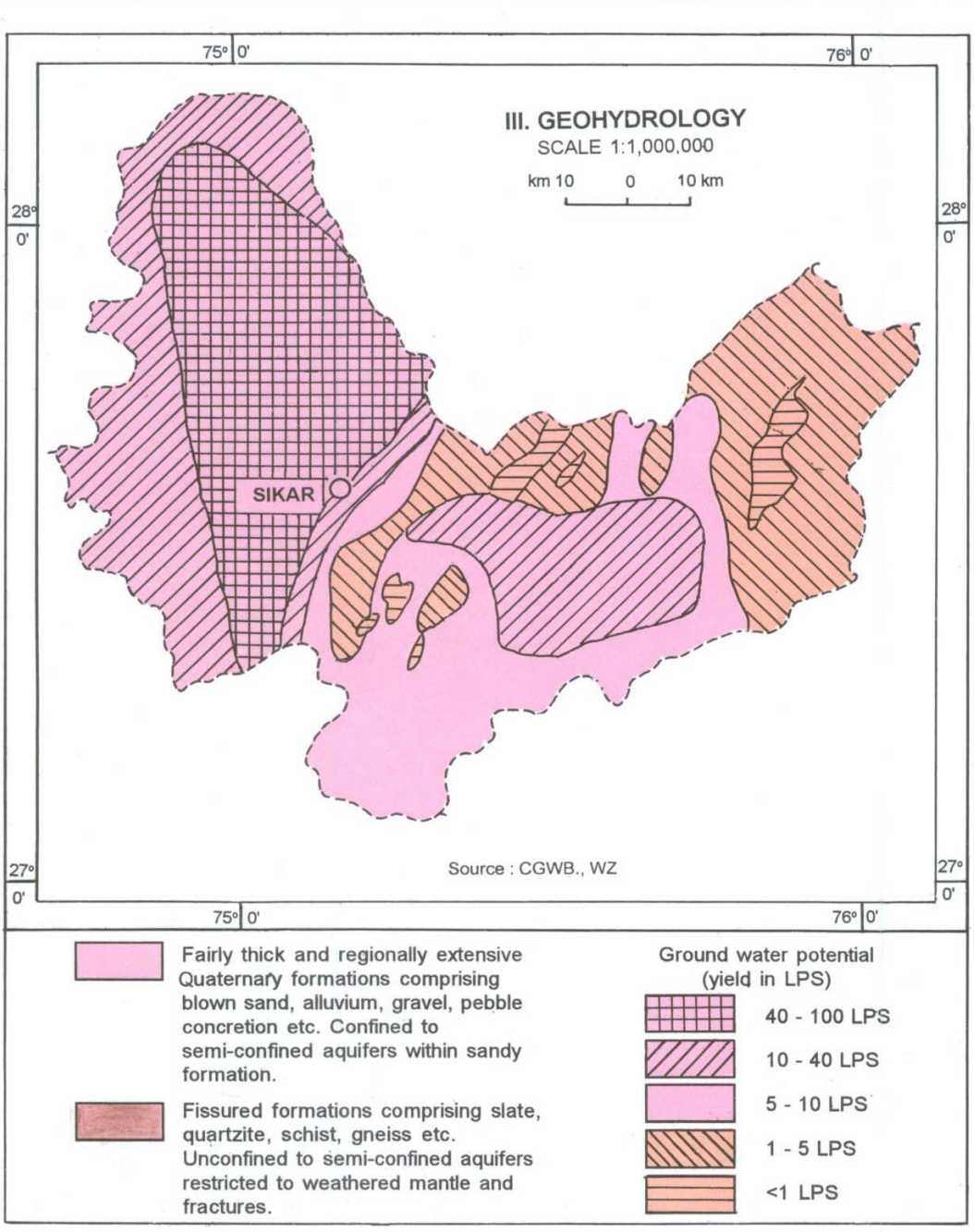
41. Geohydrological map of the Sikar district is shown in **Figure 3.9.** For broadly grouping geological formations from ground water occurrence and movement considerations, the various

lithological units have been classified into two groups on the basis of their degree of consolidation and related parameters. These are,

- Fairly thick regionally extensive quaternary formations
- Fissured formations – consolidated protereozoic formations.

42. On an average 70 % of the district area covered with Fissured formations.

Figure 3.9: Geohydrological map of Sikar (Source- GSI Resource map)



43. Groundwater in Sikar generally occurs under confined to semi confined conditions. The principal aquifers of the district are quartzite, Schist, Phyllites, Limestone and Dolomite Limestone constitute important water bearing formation in the district. The average depth of ground water in the sikar district varies from 4.59 m below land surface to 64.50 m below land surface. Town is located in Piprali Block of District. The depth of water in piprali block varies from 8.30 m to 54.65 m below ground level. The average yield of wells in this zone is 80,000 litres per day with pump and 30,000 litres per day without pump. The average discharge of water from tubewells is $11M^3$ / hr.in general the ground water quality is potable. This whole block is catogorised as "OVEREXPLOITED" therefore it has been recommended for future ground water development.

Table 3.5:. Ground Water Potential of Piprali Block Sikar as on 31.03.2004

(Estimation of Ground Water Recharge in Monsoon period by Water Table Fluctuation Method)

Sl. No	Description	Year				
		1999	2000	2001	2002	2003
1	Zone Area (Sq. km)	51.59	51.59	51.59	51.59	51.59
2	Water Level Fluctuation	-0.96	0.30	-0.59	1.69	1.87
3	Monsoon Recharge from Ground water Irrigation Rgw (mcm)	0.0086	0.0063	0.0093	0.0108	0.0123
4	Rainfall Recharge (mcm)	-	0.5540	-	1.7414	1.9115
5	Gross Agricultural Draft (mcm)	0.6890	0.5048	0.7440	0.8636	0.9833
6	Gross Domestic Draft (mcm)	0.6197	0.6260	0.6675	0.6883	0.7090
7	Normal Monsoon Rainfall (m)	0.4055	0.4034	0.4052	0.4023	0.4036
8	Monsoon Rainfall (m)	0.0000	0.2010	0.0000	0.1090	0.5360
9	Rainfall Monsoon	0.0000	0.0404	0.0000	0.0119	0.2873
10	Rainfall Monsoon Recharge	0.0000	0.1114	0.0000	0.1898	10246

Source – Ground Water Board ,Sikar August 2006

Table 3.6: Ground Water Potential of Piprali Block Sikar as on 31.03.2004

(Water Recharge , Extraction & Stages of Ground Water Department)

Sl No.	Description	Unit
1	Block Area (Sq km)	807.66
2	Water Bearing Formation	Potential Zone Ao
3	Potential Zone Area (Sq km)	674.59
4	Net Ground Water Availability (mcm)	35.12
5	Existing Gross Ground Water Draft for Irrigation (mcm)	44.0
6	Existing Gross Ground Water Draft for Domestic & Industrial (mcm)	6.6
7	Existing Gross Ground Water Draft for all uses (mcm)	50.74
8	Allocation for Domestic & Industrial Requirement for year 2025 (mcm0	17.5
9	Net Ground Water Availability for future Irrigation Development (mcm)	-26.4
10	Stage of Ground Water Development (%)	144.4
11	Whether Significant Decline in Pre-Monsoon Water Level	Yes

Sl No.	Description	Unit
12	Whether Significant Decline in Post-Monsoon Water Level	Yes
13	Category	Over Exploited

Source – Ground Water Board Sikar , August 2006

44. There are number of National Hydrographic monitoring stations of Central Ground Water Board in and around Sikar. Fluctuation of ground water level is shown in Table 3.7. In most of the cases ground water table ranged between 20 -60 m bgl.

Table 3.7: Number and Percentage of National Hydograph Network Stations at Sikar with water fluctuation range

Period	No of wells analysed	Range		0-2 m		2-5 m		5-10m		10-20m		20-60m		>60 m	
		Min	Max	No	%	No	%	No	%	No	%	No	%	No	%
Jan-06	20	3.56	63.5	0	0	1	3.57	0	0	3	10.71	22	78.57	2	7.14
Nov-05	28	2.7	62.24	0	0	1	3.57	0	0	3	10.71	23	82.14	1	3.57
Aug-05	28	2.85	66.46	0	0	1	3.57	0	0	3	10.71	21	75	3	10.71
May-05	31	4.98	61.48	0	0	1	3.23	0	0	4	12.9	25	80.65	1	3.23

Source: Ground water year book 2005-06 Rajasthan, Central Ground Water Board, Jaipur (2007)

45. The Central Ground Water Board carried out chemical testing of tube well water seasonally. The average concentrations of major constituents are shown in Table 3.8.

Table 3.8: Ground Water Quality in and around Sikar

Parameters	Maximum Level	Minimum Level	Standard of Drinking water (IS: 10500: 1991)	
			Desirable limit (mg/l)	Maximum Permissible limit (mg/l)
pH	8.7	7.56		
EC (micro mhos/cm at 25°C)	4900	560		
Cl (mg/l)	1250	7	250	1000
SO_4(mg/l)	300	10	200	400 (if Mg does not exceeds 30 ppm)
NO_3(mg/l)	610	7.7	-	100
PO_4(mg/l)	1.82	0.07		
Total Hardness(mg/l)	620	60	300	600
Ca(mg/l)	72	8	75	200
Mg(mg/l)	114	10	30	100
Na(mg/l)	863	8	-	-
K(mg/l)	55	0.78	-	-
F(mg/l)	2.78	0.17	1.0	1.5
Fe(mg/l)	6.52	0.05	0.3	1.0
SiO_2(mg/l)	30	5		
TDS (mg/l)	3185	364	500	2000

Note: Total – 15 nos. samples

Source: Ground water year book 2005-06 Rajasthan, Central Ground Water Board, Jaipur (2007)

46. Supply water quality as measured by Public Health dept. is shown below. It is noted that ground water contains high level of total dissolved solid and nitrate.

Table 3.9: Present supply water quality at Sikar

Total supply per day (lac liter)	Type of Sources Surface / Ground	Ground	Surface	No. of CWR	No. of SR	F^- Min	F^- Max	TDS Min	TDS Max	NO_3^- Min	NO_3^- Max
214.8	Ground	100	0	10	10	0.1	0.9	460	1390	Trace	185

B. Ecological Resources

47. FLORA : The flora of the district consists of a considerable variety. In 1972, 73, 1.46 per cent of the total area of the district was classified as forests. The forest area in Sikar district may be broadly divided into four botanical divisions, some details of which are as follows.

- Anogeissus pendula Type : In this type *Anogeissus pendula* (Dhok) usually occurs as pure stands. Its common associates are *Acacia senega* (Kumtha) , *Dischrostachys cinerea* (Buiya).

- Anogeissus pendula Degraded Type: The *Anogeissus pendula* degraded type is most commonly found on the hill slopes. Due to continuous biotic interferences, this has been reduced to a spreading and creeping form.

- Throny Type: These forests are found on the marginal lands , foothills and consolidated sandy plains or sand-dunes and ravine lands.

- Tree Savannah Type: This type of botany is found in plains which are sandy or which contain sandy loam soils. The specie is specially managed for grass production. The tree layer is composed of *Acacia leucophloe* (Ronjh) and *Acacia senegal* (Kumtha) etc.

48. FAUNA : The common mongoose and the hedge hog are seen in the entire area of the district due to their adaptability to varied surroundings. Besides, domesticated animals such as cows, oxen , horses , buffaloes and camels are found everywhere in the district. Birds commonly found in the district may be listed as house sparrow, house crow, jungle crow, blue rock common teal and brahminy duck.

49. There is no protected area, forest nearby the sub-project site.

C. Economic Development

50. Economic base of a town reflects its prosperity. Sikar being district headquarter, has been functioning as administrative city with sustained growth in tertiary economic activities. The major economic activities are trade and commerce, thus it offers a number of wholesale and retail markets which act as a distribution center for nearby towns and villages. Tourism income contributes very less towards economic generation of the town on the contrary household industries play a big role in providing employment and income generation. As per the master plan new town centers and community centers have been proposed .This section focuses on

number of workers, their category, and occupational pattern of the town in general. Also .attempt has been made to define the market centers and industrial activities of the town .The town has look of business-hub indicating fast growth.

51. The workforce participation .rate of the city was about 25.2 percent of the total population as per 2001 census. The following table shows that out of this total workforce only about 3.5percent were employed in the primary sector (Agriculture, mining and quarrying etc) followed by 6.7percent in secondary sector (industry and construction).It is observed that tertiary sector including commercial activities , trade and commerce and related activities dominate with about 89.7 percent workers engaged in the sector. The workforce participation ratio in Sikar (UA) and Sikar (MA) is 25.2 as per 2001 census (Table 3.10)

Table 3.10: Number of Workers, Work Force Participation Ratio and percentage of workers in Sikar Town.

Economic Profile	Total Workers	WPR	Primary Workers	Primary Workers %	Secondary Workers	Secondary Workers %	Tertiary Workers	Tertiary Workers %
Sikar (MCL)	46690	25.2	1647	3.5	3149	6.7	41894	89.7
Sikar (MCL+OG)	46845	25.2	1661	3.5	3153	6.7	42031	89.7

Source: Census of India 2001

52. Rajasthan's strong economic performance during the 80's and the early 90's reflected well in Sikar, However although at present Industrial Sector in Sikar is not so strong as compare to other economic sector like services, trade and commerce, construction, etc yet the recent trend have shown fast development in Industrial activities.

53. Sikar falls on the National Highway No.11 connecting Jaipur to Bikaner and has been most important trade center on this route. sikar will therefore continue to grow as principal commercial and Distribution center. A continuous rise is expected in number of workers and this will increase population. It is therefore desirable that Industries are distributed rationally in conformity with the Infrastructure Developments of the Town .In summary to the aforementioned the following issues can be mentioned;

- All commercial nodes are too congested and overcrowded.
- Industrial sector in Sikar is deteriorating day by day.
- Most of the Industries that were established in beginning are declared sick today.
- Effective Planning strategy in locating various Industrial units is needed to decongest the present position.
- Proper internal roads for industries need to be planned.
- As there is no demarcated site for disposal of Industrial waste, all Industrial waste is being dumped on the Forest land without any treatment.
- Continuous disposal of Granite slurry on forest land, in Debipura block near RIICO industrial complex, is destroying vegetation / plantation on one hand and

breathing problem among residents in nearby colonies on the other hand thus has become a major threat to environment in the city.

- Artesian / Household industry is creating noise, water and air pollution in the core residential area of the town.
- Tourism Industry is very much neglected and underdeveloped.
- Lack of Tourism Infrastructure.

54. **Power status of the area:** There is no power generation unit at Sikar. The consumption of electricity by different sectors is shown in Table below.

Table 3.11: Consumption of Electricity in Million Kwh (2003-04)

District	Domestic	Non- Domestic (Commercial)	Industrial	Public Lighting	Public Water Works	District	Domestic
			Small	Medium	Large		
Sikar	91.943	20.978	14.51	7.879	9.821	2.053	29.916

1 Land use

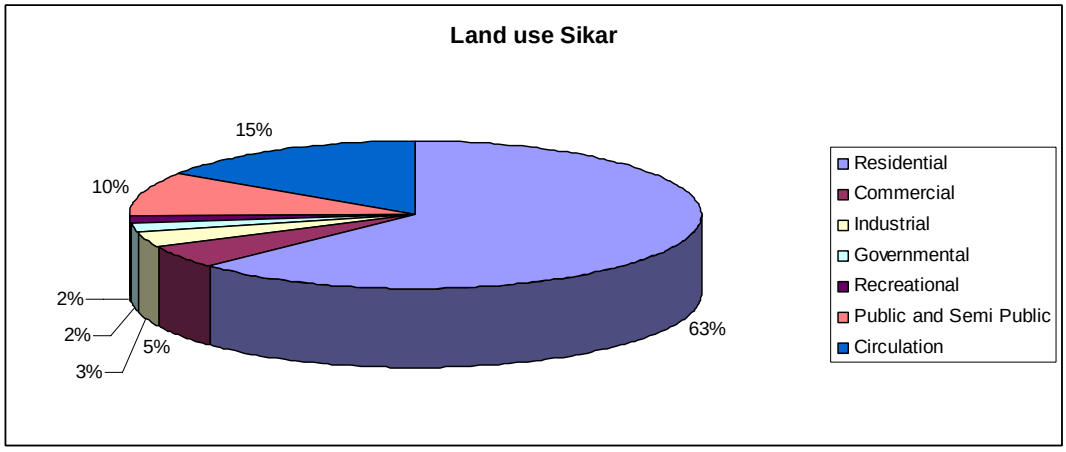
55. The Municipal council of Sikar is implementing a Master Plan which has been notified by the Government of Rajasthan on 07.03.1999. This plan is aimed at integrated and balanced development of entire notified urban area and provides guidelines for future growth of the town. It has been kept in proportion with socioeconomic need of the citizens and financial resources of the state. As per land use survey conducted in 1985 the Municipal limit of Sikar encompassed and area of about 9800 acres out of which 2680 acres was urbanized as per Master Plan 1985 -2011. The remaining land was vacant comprising of sandy area with fair cultivation. About 63% of developed urban area is under residential use, which is high in comparison to other towns in the region. This is due to lack of industrial area, parks and open spaces and other community facilities. The percentage of recreational use is only 1.6% against 3-7 percent normal in other towns. The table below shows land use area based on the survey conducted in 1985 (Table 3.12)

Table 3.12: Existing Land Use Sikar-1985

Sl No.	Landuse	Area in Acres	Percentage of Developed area	Percentage of urban area
1	Residential	1580	62.70	58.98
2	Commercial	130	5.16	4.85
3	Industrial	80	3.17	2.98
4	Governmental	50	1.98	1.86
5	Recreational	40	1.60	1.49
6	Public and Semi Public	250	9.92	9.32
7	Circulation	390	15.47	14.55
Total Developed Area		**2520**	**100**	-
8	Government Reserved	30	-	1.12
9	Agricultural	40	-	1.49
10	Vacant land	90	-	3.36
Urban Area		**2680**	-	**100**

Source – Master Plan of Sikar

Figure 3.10: Land use percentage- Sikar Urban developed area



2 Commerce, Industry and Agriculture

56. The state Government of Rajasthan Industrial Investment Corporation are providing various incentive and facilities for promoting Industrial activities. There is no large scale Industry in Sikar. Only small scale industries such as Granite industry, plywood industry, dal and oil mill industry, cattle feed industry, PVC pipe industry and Electric Transformers industry are functioning with very little workforce.(Table 3.13)

Table3.13: Type and Number of Industrial Units

Sl No.	Type of Industry	No. of Units
1	Granite	40
2	Plywood	8
3	Dal and Oil Mill	8
4	Cattle Feed	10
5	PVC pipe	6
6	Electric Transformers	9

Source: DIC- Sikar August 2006

57. Artesian /Household Industry provides for employment to a large no. of people These Industries are mainly Tie and Dyeing of cloth and leather tanning chemicals. These Industries are causing a lot of Noise Pollution, nuisance, traffic hazards and problem of waste disposal in Residential zones.(Table 3.14)

Table 3.14: Type and Number of Artesian/Household Industries

Sl No.	Type of Household Industry	No. of Units	Location (ward No.)
1	Leather	200	2,6,7
2	Tie and Die	200	2,6,7
3	Bangles	200	Ajmer Bus Stand (near Suraj Pole Gate)

Source: DIC- Sikar August 2006

58. In and around the Sikar city area there are about 50-60% of lands used for agricultural purpose. Crop production statistics as depicted in Table 3.15 indicates that crop production is slightly more in Kharif season in compared to Rabi season.

Table 3.15: Crop production in around Sikar

Type of Crops	Under Rabi Crops 2003-04 (Prod in Tonnes)	Under Kharif Crops 2003-04 (Prod in Tonnes)
Cereals	285673	35,1984
Pulses	49763	40,013
Food Grains	335409	3,91,997
Oilseeds	42157	29,316
Others	44135	39,782
Total	**421701**	**46,1095**

(Source: Vital Agricultural Statistics 2004-05, Directorate of Agriculture, Rajasthan)

3 Infrastructure

59. Water supply: Water supply of Sikar is wholly drawn from local tube wells, which are situated in almost whole city i.e. around the water work compound on Harsh Road and Udaipurwati Road. Ground water is the only source of water supply in Sikar. The water supply in the town is intermittent during morning and evening only. The per capita water supply of the town is about 89 lpcd, which is merely adequate and as per the recently sanction reorganization water supply scheme of Sikar, which is under execution it would be upgraded to 135 lpcd. Tube wells are largest sources of water supply in the town. The average depth of water table in Sikar is about 54.65 mt. The supply timing is one hour i.e. morning 6-7 a.m. All the wards in the town are connected either partially or fully by piped water network. The Sikar town is firstly growing important town and its water supply projects are to be based on reliable sources of water supply. Therefore it is necessary to propose surface water sources which are perennial sources. The present water supply sources are Tube wells (146 Nos.) and open wells (34 Nos.).

60. Sewerage System: Sikar town does not have underground sewerage system. Out of the occupied residential houses only about 55% have some kind of latrines. Most of the houses have adopted the practice of providing onsite disposal by constructing water seal / bore hole latrines or by providing septic tank with effluent discharge into soak pits or open surface drains. Economically weaker section generally defecates into the open field. No sewerage treatment facility is there in the town and the drains having combined drainage and sewage are having outfall discharge in open fields towards west of the town on forest land. In the absence of any sewerage facility, the major mode of disposal is through individual septic tanks and low cost sanitation.

61. The city has around five thousands population as floating population that depends of public or community toilets. In core city area, market areas there are very few public toilet for men, but there is no public toilet for females. PHED division Sikar has recently prepared a Sewerage scheme for Sikar town. Components covered in it are as follows. As per topography of the Sikar town whole area is divided into following two zones based on the ground level and feasibility of laying of sewer at required depth and are denoted as-

A North-East zone

- Area surrounding Nawalgadh Road
- Area surrounding Udaipurwati Road up to railway line
- Area surrounding Fathepur Road
- Area surrounding Bajaj Road, Bakra mandi and Kabristan

B South-West zone

- Area surrounding Jaipur Road
- Area surrounding Fathepur Bye- Pass Road

62. Sanitation: Only 50-60% of the households reportedly have septic tanks and soak well as the system of sewerage disposal. The remaining accounted for cases of open defecation which is an unacceptable and unhygienic practice. The raw settled sewage from septic tank is periodically flushed out by sanitary workers of the Municipal Board and discharge to open spaces, agricultural lands in an indiscriminate manner. Slum areas were also not equipped with requisite sanitation (LCS etc.) resulting in open defecation.

63. Drainage: The existing drainage system in Sikar is piecemeal construction of open *Nallah* as per local and temporary requirements without proper whole to part designs. The town has mainly open drains. The waste water along with sewage is discharged into the fields towards west of the town through open drains. Storm water drainage is expressed in terms of its coverage with respect to the total road length. Ideally length of the storm water drain should be twice that of the total road length. The open drain system in the town is irregular and mismanaged. The improper construction and maintenance of open drains cause spillage of rain water mixed with sewage and gets collected in local depressions at following core places of the town and requires pumping for several days.

64. Industrial Effluents. Small industries exists in under RIICO, which is out side the city area and small amount of effluent disposed scattered in local *nallahs*. As reported by the local MC, the responsibility of effluent disposal is under RIICO's own and could not be connected to the proposed sewer network. The individual industry should treat their effluent to bring it to the required standard before final disposal.

65. Solid Waste: Sikar town spreads over 9800 acres of which 4600 acres is developed. The total waste generation in the town is about 200 T / day. Considering a population of 185,925 persons in year 2001 census, the per capita generation of waste generation is 0.92 kg / day. It is important to note that no initiatives has been taken till now in terms of door to door collection of solid waste in Sikar. Presently most of the city wastes are simply dumped without any treatment in depressions, ditches or by the sides of the road flank in an unscientific manner. This practice may lead to air and water pollution, releases foul smell and this situation may cause major threat to the public health. Primarily, the sweeping is done by municipal staffs and collection and disposal is performed by the contractor. The garbage is collected and stored in a common point in every ward and the transportation is done by the tractor. There are 157 open points within the town demarcated by Sikar municipal council for garbage disposal in the wards. The average number of trips performed by vehicles ranges from 3-5 trips per vehicle per

day and the average collection performance of 70 percent for Sikar Municipal Council, the vacuum emptier is used for gutter cleaning. Municipal Council of Sikar charges about Rs. 600 / household for cleaning the gutter per nos.

4 Transportation

66. Sikar is well connected with all the important towns of the state. It is situated on the National Highway No.11 running from Bikaner to Agra at the junction of State Highway No.20 and State Highway No.8 connecting Sikar to Salasar and Jhunjhnu respectively. It is also connected to Delhi via Jhunjhnu and Neem Ka Thana.

67. As per the Master Plan 13.80% area (755 acres) has been reserved as roads and circulation area. The road in the walled city consists of narrow road on Grid iron pattern. In the absence of ring road, these roads have become overcrowded and outdated. Mahatma Gandhi road and Jamnalal Bajaj road are two main roads, which caters most of the traffic of the town. The width of the Mahatma Gandhi road varies from 80 ft to 100 ft .while the width of Jamnalal Bajaj road is 20ft to 55ft. There are large number of road crossings on these roads, which have not been planned at all and subject to congestion and accidents. Most of the other roads are not been metalled. The type of construction of roads within Sikar Municipality is shown in Table 3.16

Table 3.16: Roads based on type of Surface

Sl No.	Type of Surface	Length of Roads (KM)
1	Concrete Road	60
2	Black Topped / Bituminous	75
3	Water Bound Macadam	5
4	Earthen	0
Total		**140**

Source Sikar Municipality August 2006

D. Social and Cultural Resources

1 Demography

68. According to Census 2001, the population of (Sikar Municipal Council is 185323) Sikar Urban Agglomeration is 185,925 and spreads over Sikar Municipal Council` (organized into 45 wards). The total spread of the Urban Agglomeration is approximately 39.00 sq. km, Municipal Council. The UA supports an average density of 4767 persons per sq. km. Of the total population the males constitute 96,379 and females 88,944 with sex ratio of 923 females per 1000 males. The number of Schedule Castesin Sikar Municipal Area and Sikar Urban Area is 17207 & 17377 respectively. Whereas The number of Schedule Tribes in Sikar Municipal area and Sikar urban area are 1413 and 1418 respectively. Thus the percentage of vulnerable population to the total population is 10%. The UA witnessed a high growth between 1971 and 1981 on account of induced industrial development, the growth rate fell during the last decade i.e. 1991-2001..this remarkable growth can be ascribed to various reasons, which includes increase due to natural growth, concentration of developmental activities like establishments of more government offices ,trade and commerce ,services and other activities , colleges and residential colonies (Table 3.17). Population projection of Sikar town is shown in Table 3.18.

Table 3.17: Population Growth in Sikar town

Year	Population
	Sikar town
1961	50,636
1971	70,987
1981	102,970
1991	143,900
2001	185,925
2011	240,783
2021	311,749
2031	403,811
2041	523,840

Source: Census of India, 2001.

Table 3.18: Population Projection of Sikar

Year / Stage	Census Population	Recommended Projected Population
1961	50,636	
1971	70,987	
1981	102,970	
1991	143,900	
2001	185,925	
2007		217,136
2011		240,783
2021		311,749
2026		354,765
2041		523,840

2 Health and educational facilities

69. There are good educational facilities in Sikar district, which serve both townspeople and inhabitants of surrounding villages and towns in the hinterland. There are 1695 primary schools, 299 higher secondary schools, plus 13 general degree colleges.

Table 3.19: Educational facility of Sikar District

	(Nos.)
Colleges	13
Professional Colleges	2
Higher Secondary Schools	299
Middle Schools	843
Primary School	1695

(Source: Rajdarpan, the official web portal of Rajasthan government)

70. As the district headquarters town, Sikar is the main centre for health facilities in the area and there is a 1 district general hospital, 1 primary health center in the Sikar town. The detail of the health facilities given in Table 3.20.

Table 3.20: Health facility Sikar Urban 2003- 04

S.No.	Facilities	Number
1	Hospital	1
2	Primary Health Center and Maternity Center	1
3	TB Hospital	1
4	Mother and Child Care Center	1
5	Total	4

(Source: District Statistical Hand Book 2005)

3 History, culture and tourism

71. Sikar has rich heritage sites. A detailed inventory of some important religious and tourist spots in Sikar are given below-

- 17^{th} century a Fort
- The Painted Biyani, Murarka
- Bawri (Step Well)
- Digamber Jain Temple
- Somani Havelis
- Sagarmal Sodhani Havelis
- Madho Niwas Kothi
- The Jubilee Hall
- Devi Singh Cenotaph
- Temple of Gopinath
- Laxman Singh Cenotaph
- Raghunath Temple
- Madan Mohan ji Temple
- Shekhawati Museum
- Bara Talab Madhave Sagar

72. Today Sikar is the most important city of Shekhawati region of Rajasthan. Sikar city being the capital of the district, functions as the administrative city and hub of the tertiary economic activities like services, trade and commerce.

IV. ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES: LOCATION AND DESIGN

73. 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 V and VI below and no other impacts are expected.

74. 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.

75. However in the case of this subproject it is not considered that there are any impacts that can clearly be said to result from either the design or location. This is because:

- 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;
- Most of the predicted impacts are associated with the construction process, and are produced because that process is invasive, involving trenching and other excavation. these are more routine in nature, and the impacts that can be most 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.

V. POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES: INFRASTRUCTURE CONSTRUCTION

A. Screening out areas of no significant impact

76. 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. Areas outside the town will also be affected, by construction of the trunk sewer and STP. It is not expected that the construction work will cause major negative impacts, mainly because:

- Most of the network and the trunk sewer will be built on unused ground alongside existing roads and can be constructed without causing major disruption to road users and any adjacent houses, shops and other businesses;

- The STP will be located on government-owned land (At present agricultural land acquisition under process)

- 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.

77. 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.

78. These environmental factors have thus been screened out presently but will be assessed again before starting of the work.

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	Sikar is not located in a coastal area
Population and communities	Construction will not affect population numbers, location or composition.

79. Rapid Environmental Impact Assessment checklist is shown in **Appendix – 2**

B. Sewage Treatment Plant

1 Construction method

80. Work components of STP involve

- o A series of reactor chambers, ponds for tertiary treatment
- o Pump stations and pipes

81. Although the site is fairly large the construction will be straightforward, involving mainly simple excavation and development of reactor chamber. 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.

82. 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.

83. Foundations for the small pump houses will be dug by backhoe, and concrete and aggregate will be tipped in to create the foundations and floor. The brick sides will then be built by hand by masons and pumps will be brought in on trucks and placed inside the pump house by crane. The roof material will then be attached by hand.

2 Physical Resources

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

85. Ponds will be dug on around 80% of the site, and if these are excavated to a depth of 2.5 m, and substantial waste soil will be generated. This is a very large amount of waste, which could not be dumped without causing further physical impacts on air quality (dust), topography, soil quality, etc. It will be important therefore to reduce the amount of dumping by finding beneficial uses for as much waste soil as possible. This will require:

- Contacting the town authorities to arrange for the use of this material where 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;

- Preventing 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.

86. Another physical impact associated with large-scale excavation is the effect on drainage and the local water table if groundwater and/or surface water collect in the voids. Given the difficulties of working in wet conditions the Contractor will almost certainly conduct all excavation in the dry season, so this should avoid any impacts on surface water drainage. If water collects in any quantity it will need to be pumped out, and it should then be donated to neighbouring farmers to provide a beneficial use to the communities most affected by this aspect of the work, and improve public perceptions of the project.

3 Ecological Resources

87. At proposed site no objects exist having ecological interest, so construction will cause moderate to less ecological impacts. There are some trees that will need to be removed, and given global concerns regarding the loss of trees, the project should make a small positive ecological contribution by planting three native trees at a nearby site for every one that is removed.

4 Economic Development

88. The site of the proposed STP 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 farmed (encroached by villagers) and there are no industries or housing in the vicinity so there should be no impact on income-generating activities.

89. 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 near the site and particularly in Sikar 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 Sikar 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

90. Although the STP will be built on an uninhabited, with no residential areas adjacent (within 250 m few houses present), there is a risk that the work could damage social and cultural resources, so careful mitigation and strict adherence by the EA and Contractor will be necessary.

91. 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:
  - Having excavation observed by a person with archaeological field training;
  - Stopping work immediately to allow further investigation if any finds are suspected;

- Calling in the state archaeological authority if a find is suspected, and taking any action they require to ensure its removal or protection in situ.

92. 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.

93. 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 STP labour force from communities within a radius of say 2 km from the site, if sufficient people are available.

C. Sewerage Network and Trunk Sewer

1 Construction method

94. Provision of a sewerage system in part of the town during the second phase will involve construction of:

- o The secondary and tertiary network will collect sewage from individual houses have a sufficient water supply, These pipes will be of small diameter (200 to 600 mm) and will be located in shallow trenches (ca 1.5 m in depth).

- o The trunk sewer will also be of RCC pipes and will convey sewage from the secondary network to the STP These pipes will be 700 and 900 mm in diameter

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

96. 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 the trenches may have to be dug into the edge of the road.

97. 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 compressor.

98. 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 2.3 m deep and 1.2 m wide for the trunk main, and a minimum of 1.5 m deep and 0.4 m wide for the tertiary network.

99. At intervals, small chambers (ca 1-2 m^3) 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.

100. As noted above, some of the narrower roads are constructed of concrete and have no available space at the edge because of the presence of drains, or shop- and house-fronts encroaching into the ROW. In these places it may be necessary to break open the surface of the road using hand-held pneumatic drills, after which the trench and pipeline will be constructed as described above. On completion a concrete layer will be re-applied to the surface to repair the road.

2 Physical Resources

101. Construction of trenches will have similar physical impacts to the excavation work at the STP, although their extent and significance will be different because trenches are linear structures and the network is located in the town. Since length of the trunk main is not much the generation of waste will be less. Although this is <10% of the quantity produced at the STP it is still a significant amount of waste, and in this case there are additional considerations because piles of soil could impede traffic and other activities in the town (see below) and dust could affect inhabitants during dry weather. These impacts should be mitigated by applying the same measures as at the STP 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.

102. The other important physical impact associated with large-scale excavation (effects on surface and groundwater drainage) should not be an issue in this case because of the very low rainfall in this area and the very low water table. In addition the Contractor will almost certainly conduct all excavation in the dry season, to avoid the difficult working conditions during the monsoon.

103. 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 on the physical environment are not expected to be of major significance.

3 Ecological Resources

104. 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

105. As the network and trunk sewer pipelines will all be conducted within the ROW of existing roads (either adjacent to the road, or beneath the road surface in narrower streets) there will be no need to acquire land, so there should be no direct effect on the income or assets of landowners, or the livelihoods of tenants.

106. There could be some economic impacts however, if the presence of trenches, excavated material, workers and machinery discourage customers from visiting shops and businesses adjacent to network construction sites, and the businesses 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:

- 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.

107. ADB policy on Involuntary Resettlement requires that no-one should be worse off as a result of an ADB-funded project, and a separate Resettlement Plan and Resettlement Framework have been prepared to examine these issues and provide appropriate mitigation. This establishes that, in addition to the above practical measures to reduce the economic impact of the construction work, owners and tenants of affected businesses will also be compensated in cash for any income they lose.

108. Excavation could also damage existing infrastructure, in particular storm drains and water supply pipes, both of which are located alongside roads in the town. 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 the public (see below). It will be important therefore to avoid these impacts by:

- Obtaining details from the Municipal Council of the nature and location of all infrastructure, and planning the sewer networks so that all such sites are avoided;
- Integrating the construction of the various Sikar subprojects (in particular water supply and sewerage) so that:
  - Different pipelines are located on opposite sides of the road wherever feasible;
  - Roads and inhabitants are not subject to repeated disturbance by trenching in the same area for different purposes.

109. 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.

110. It is inevitable that there will be an increase in the number of heavy vehicles in the town (particularly trucks removing waste and delivering pipes and other materials to site), 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

111. As was the case with the STP site, there is a risk that sewer construction, which involves extensive disturbance of the ground surface, could damage undiscovered archaeological and/or historical remains, or even unknown sites. The risks are in fact considerably higher in this case, because such artefacts are more likely to occur in areas that have been inhabited for a long period. The preventative measures described in Section V.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 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 trenching, to recognise, protect and conserve any chance finds (see Section V.B.5 for details).

112. Sewer construction will also disturb some modern-day social and cultural resources, such as schools, hospitals, temples, and sites that are of interest to tourists. Impacts will include noise, dust, and interrupted access for pedestrians and vehicles, and in cases where pneumatic drills are used to break the surface of concrete roads, there could be a risk of damage from vibration. Mitigation will therefore 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.

113. 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.

114. 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.

115. 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.

116. Given the dangerous nature of this material for both workers and the public, 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:
  - Removal of all persons to a safe distance;
  - Usage of appropriate breathing apparatus and protective equipment by persons delegated to deal with the AC material;
  - Procedures for the safe removal and long-term disposal of all asbestos-containing material encountered.

117. 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 VB.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. POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES: OPERATION AND MAINTENANCE

A. Screening out areas of no significant impact

118. 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 factors 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	The only local fishery is in local pond, which will not be

[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

	affected
Wildlife, forests, rare species, protected areas	There are none of these features in or outside the town
Coastal resources	Sikar is not located in a coastal area

119. These environmental factors have thus been screened out presently but will be assessed again before starting of construction.

B. Operation and maintenance of the improved sewerage system

120. The new sewerage system will collect and treat all surface water, domestic wastewater and sewage produced by 50% of the town, and the remainder of the inhabited area and future expansion will be served by additional sewers provided via subsequent tranches of funds. Although treatment will not be to the standards of more developed countries, the technology is approved by the Central Public Health and Environmental Engineering Organization (CPHEEO) and Pollution Control Board attached as **Appendix 3**, and the discharge after treatment will comply with Indian wastewater standards (**Table 6.2**).

Table 6.2: Waste Water Quality Discharge Standards

SL.no	Parameter	Standards			
		Inland surface water	**Public sewers**	**Land irrigation**	**Marine/coastal areas**
(a)		(b)	(c)		(d)
1.	Colour and odour	remove as far as practicable			
2.	Suspended solids mg/l. max.	100	600	200	(a) For process waste water100 (b) For cooling water effluent 10% above total suspended matter of influent.
3.	Particle size of suspended solids	shall pass 850 micron IS Sieve			(a)Floatable solids, max. 3mm. (b)Settable solids (max 850 micron)
4.	pH value	5.5. to 9.0	5.5 to 9.0	5.5 to 9.0	5.5 to 9.0
5.	Temperature	shall not exceed 5^0C above the receiving water temperature			shall not exceed 5^0C above the receiving water temperature
6.	Oil and grease, mg./l, max.	10	20	10	20
7.	Total residual chlorine, mg/l. max.	1.0			1.0
8.	Ammonical nitrogen (as N.) mg/l max	50	50		50
9.	Total Kjeldahl Nitrogen (as NH_3) mg/l. max	100			100
10.	Free ammonia (as NH_3), mg/l.max	5.0			5.0
11.	Biochemical oxygen demand (3 days at 27^0C),	30	350	100	100

SL.no	Parameter	Standards			
		Inland surface water	Public sewers	Land irrigation	Marine/coastal areas
	mg/l. max.				
12.	Chemical oxygen demand, mg/l, max.	250			250
13.	Arsenic (as As) mg/l, max.	0.2	0.2	0.2	0.2
14.	Mercury (As Hg), mg/l, max.	0.01	0.01		0.01
15.	Lead (as Pb) mg/l, max	0.1	1.0		2.0
16.	Cadmium (as Cd) mg/l. max	2.0	1.0		2.0
17.	Hexavalent chro-mium (as Cr. +6). mg/l, max	0.1	2.0		1.0
18.	Total Chromium (as Cr) mg/l, max	2.0	2.0		2.0
19.	Copper (as Cu) mg/l, max	3.0	3.0		3.0
20.	Zinc (as Zn) mg/l, max	5.0	15		15
21.	Selenium (as Se) mg/l, max	0.05	0.05		0.05
22.	Nickel (as Ni) mg/l, max	3.0	3.0		5.0
23.	Cyanide (as CN) mg/l, max	0.2	2.0	0.2	0.2
24.	Fluoride (as F) mg/l, max	2.0	15		15
25.	Dissolved phosphates (as P) mg/l, max	5.0			
26.	Sulfide (as S) mg/l, max	2.0			5.0
27.	Phenolic compounds (as C_6H_5OH) mg/l, max	1.0	5.0		5.0

121. 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.

122. 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.

123. 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

124. The provision of an effective sewerage system in 50% of the town should improve the physical appearance and condition of the city area that will no longer be discharged to the nallahs. This measure and the fact that there will be fewer septic tanks and less sewage discharged to drains, should also improve the appearance of the town and the quality of surface water drainage and groundwater. Clearly there will be further significant improvements once the whole town is connected to sewer via the future funding.

125. There could also be small-scale physical benefits from the operating STP if the sewage sludge that is removed periodically from the treatment ponds is provided to farmers and applied to fields, as it will improve soil structure and fertility. There could be a useful cost-recovery element if a system was established to sell this material to farmers, so this should be considered by the EA.

126. 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.

127. Treated effluent from an STP is often discharged to a nearby water body, which may then become contaminated by the high levels of nitrate, phosphate and organic matter in the effluent. As there is a *nallah* (natural or man-made drainage channel) in the vicinity of the proposed STP site, effluent may be discharged into this channel, which may then pollute surface and groundwater and present a risk to the health of humans and animals if it is consumed via well water. This can be avoided by developing a system to sell the treated wastewater to farmers (delivered by tanker) to irrigate their fields. This would provide water and plant nutrients and thus improve agricultural productivity and farm incomes, as well as allowing further cost-recovery by the EA. This should be operated in conjunction with a scheme to sell inert sewage sludge as a farm fertilizer as recommended above, and some of the capacity building and training provided by the project should focus on providing the GA with the skills to operate these measures. This should be preceded by rigorous bacteriological tests to confirm that the treatment methods render all dried sludge and effluent free from enteric bacteria and pathogens, so that it is safe to humans, animals and crops (see Section VII.C below). This water can also be discharged into ponding system developed specifically for aqua-culture if the potential exists

2 Ecological Resources

128. 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 will 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 or the treated water is discharged into water ponding system which can be developed by the project.

3 Economic Development

129. 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.

130. 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

131. 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.

132. Repair work could cause some temporary disruption of activities at sites of social and cultural importance such as schools, hospitals, temples, etc, so at these locations the same 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.

133. 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.

134. 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.

135. 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 these areas, 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.

VII. INSTITUTIONAL REQUIREMENTS AND ENVIRONMENTAL MONITORING PLAN

A. Summary of environmental impacts and mitigation measures

136. Table 7.1 lists the potential adverse impacts of the Sikar sewerage subproject as identified and discussed in Sections IV, V and VI, and the mitigation proposed to reduce these impacts to acceptable levels. The table also shows how the mitigation will be implemented, who will be responsible, and where and when the mitigation activities will take place. The mitigation programme is shown as the quarter of each year in which each activity will occur, which relates to the project programme described in Section II.B. The final column assesses whether the proposed action will successfully mitigate the impact (shown as 0), and indicates that some of the measures will provide an additional benefit (shown as +).

B. Institutional arrangements for project implementation

137. 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.

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

Figure 7.1: Institutional Responsibility- RUSDIP

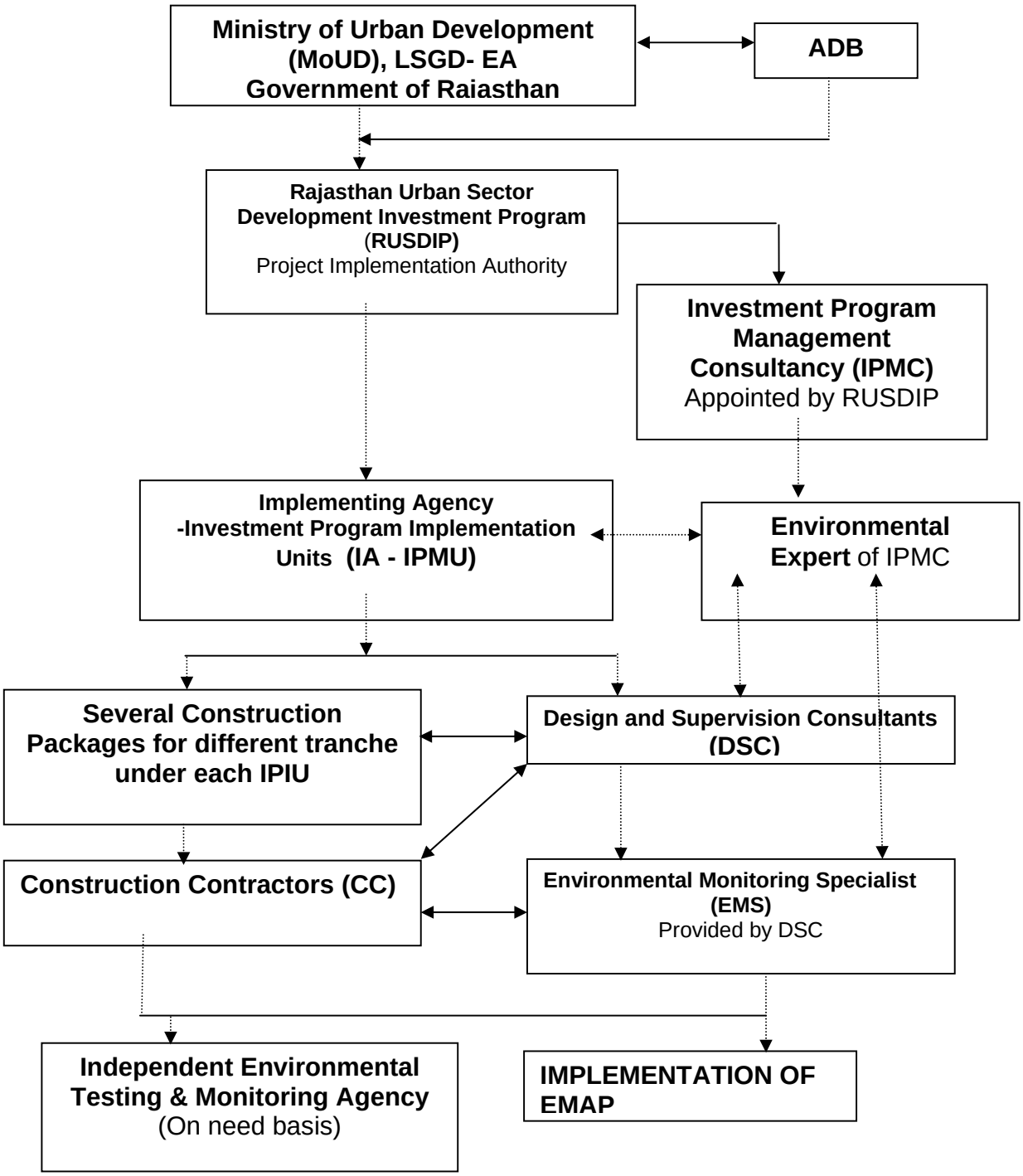


Table 7.1: Environmental impacts and mitigation for the Sikar Sewerage Subproject (Black = continuous activity; Grey = intermittent)

Potential Negative Impacts	Sig	Dur	Mitigation Activities and Method	Responsibility	Location	2008				2009				[3]
Location & Design						**D**	**D**	**3**	**4**	**1**	**2**	**3**	**Op**	
Discharge of treated effluent to *nallah* could pollute surface & groundwater with nitrate, phosphate, etc. •Water ponding systems for aquaculture can be introduced for treated water	M	P	Conduct bacteriological tests to ensure safety of effluent	GA	STP									0
			Sell treated wastewater to farmers for irrigation Aquaculture can be introduced on a small scale											+
Construction: Sewage Treatment Plant														
Excavation will produce large amounts of waste soil	M	P	Find beneficial uses for waste soil in construction, land raising and infilling of excavated areas	Contractor	All sites									+
Stockpiled soil could create dust in windy weather	M	T	Remove soil as soon as it is excavated	Contractor	All sites									0
Dust could also be produced when soil is transported	M	T	Use tarpaulins to cover dry soil when carried on trucks	Contractor										0
Rain and ground water could collect in excavated areas	M	T	Conduct all excavation in the dry season	Contractor	All sites									0
			Pump out groundwater & provide to farmers for irrigation	Contractor	STP site									+
Some trees will need to be removed from the site	M	P	Only remove trees if it cannot be avoided	Contractor	All sites									0
			Plant and maintain two trees for every one removed											0
Traffic may be disrupted by lorries carrying waste soil	M	T	Plan routes to avoid Sikar Town and narrow local roads	Contractor	From STP site									0
			Schedule transportation to avoid peak traffic periods											0
Ground disturbance could damage archaeological and historical remains	S	P	Request state and local archaeological authorities to assess archaeological potential of proposed STP site	DSC	All sites									0
			Select alternative if site has medium-high potential	DSC										0
			Include state and town historical authorities as project stakeholders to benefit from their expertise	LSGD										0
			Develop and apply protocol to protect chance finds (excavation observed by archaeologist; stop work if finds are suspected; state authority to plan appropriate action)	DSC and Contractor										+
Economic benefits if local people are employed in Contractor's workforce	M	T	Contractor should employ at least 50% of workforce from communities in vicinity of STP site	Contractor	All sites									+
						2008				**2009/2010**				
						D	**D**	**3**	**4**	**1**	**2**	**3**	**4**	
Construction: Sewerage Network and Trunk Sewer														
Trenching will produce additional amounts of waste soil	M	P	As above: find beneficial uses in construction or infill	Contractor	All sites									+
Waste soil may create dust when stored or transported	M	T	As above: remove waste soil as soon as it is excavated	Contractor	All sites									0
			As above: cover soil with tarpaulins on trucks											0

Sig = Significance of Impact (NS = Not Significant; M = Moderately Significant; S = Significant). Dur = Duration of Impact (T = Temporary; P = Permanent)
D = Detailed Design Period; Op = Period when infrastructure is operating
[3] This column shows impacts remaining after mitigation: 0 = zero impact (impact successfully mitigated); + = positive impact (mitigation provides a benefit)
* Mitigation of these impacts will be provided through a separate Resettlement Plan, see Section VII.B

Potential Negative Impacts	Sig	Dur	Mitigation Activities and Method	Responsibility	Location	2008				2009				
			Cover or damp down stored soil in dry weather											0
Trees may be removed along pipeline routes	M	P	As above: avoid removing trees, plant 2 for every 1 cut	Contractor	All sites									0
Shops may lose income if customers' access is impeded	M	T	Leave spaces for access between mounds of soil	Contractor	Network sites									0
			Provide bridges to allow people/vehicles to cross trench	Contractor										0
			Increase workforce in these areas to finish work quickly	Contractor										0
			Inform shopkeepers of work in advance	LSGD										0
			*Compensate businesses for lost income	LSGD										0
Trenching could damage other infrastructure	S	P	Confirm location of infrastructure and avoid these sites	DSC	Network sites									0
			Locate water and sewer pipes on opposite sides of roads	DSC										0
Roads/people may be disturbed by repeated trenching	M	T	Integrate subprojects to conduct trenching at same time	DSC/LGD	Network									0
Traffic will be disrupted if lack of space means that dug soil has to be placed on the road, and/or sewers have to be located in the road itself	M	T	Consult authorities – work in light traffic periods	Contractor	Network sites									0
			Ensure police provide diversions when necessary	Contractor										0
			As above: increase workforce to finish this work quickly	Contractor										0
Traffic, people and activities could be disrupted by trucks carrying waste soil or delivering materials to site	M	T	Plan routes to avoid narrow streets, congested roads, important/fragile buildings, key religious and tourism sites	Contractor	Network sites									0
			Plan work to avoid peak traffic and main tourism season											0
Major risk that ground disturbance in town could damage archaeological and historical remains	S	P	As above: ask authorities to assess potential of all sites	DSC	All sites									0
			As above: alternative sites where risk is high/medium	DSC										0
			As above: include state/local authorities as stakeholders	LSGD										0
			As above: apply protocol to protect chance finds	DSC/CC										+
Sites of social/cultural importance (schools, hospitals, temples) may be disturbed by noise, dust, vibration and impeded access	M	T	Identify buildings at risk from vibration damage and avoid using pneumatic drills nearby	Contractor	Network sites									0
			As above: remove waste quickly, cover/spray stockpiles, cover soil when carried on trucks											0
			As above: increase workforce to finish work quickly											0
			As above: use bridges to allow access (people/vehicles)											0
			Use modern vehicles/machinery & maintain as specified	Contractor	All sites									0
			Consult relevant authorities, custodians of buildings, local people to address issues & avoid work at sensitive times	Contractor	Network sites									0
Workers and the public are at risk from accidents on site	M	T	Prepare and implement a site Health and Safety Plan that includes measures to:	Contractor	All sites									0
			- Exclude the public from site;											0
			- Ensure that workers use Personal Protective Equipment											0
			- Provide Health & Safety Training (including process of transmission of HIV/AIDS) for all personnel;											0
			- Follow documented procedures for all site activities;											0
			- Keep accident reports and records.											0
Existing water supply system uses AC pipes, a material	S	T	Design infrastructure to avoid locations of AC pipes	DSC	Network									0

Potential Negative Impacts	Sig	Dur	Mitigation Activities and Method	Responsibility	Location	2008				2009				
that can be carcinogenic if inhaled as dust particles			Train all construction personnel in dangers of AC pipes and how to recognise them in situ	Contractor	All sites									0
			Develop and apply protocol if AC pipes are encountered. This should include:	DSC and Contractor	Network sites									0
			- immediate reporting of any occurrence to management	Contractor	Network sites									0
			- removal of all persons to a safe distance											0
			- use of appropriate breathing apparatus and protective suits by workers delegated to deal with AC material											0
			- safe removal and long-term disposal of AC material											+
Economic benefits for people employed in workforce	M	T	As above: 50% of workforce from affected communities	Contractor	All sites									+
Operation and Maintenance														
Leaking sewers can damage human health and contaminate soil and groundwater	M	T	Detect and repair sewer leaks rapidly and effectively	GA	Network sites									0
Sludge is removed from treatment ponds every 5 years	S	T	Dry sludge and test for absence of bacteria & pathogens	GA	STP									0
			Sell dried sludge to farmers to fertilize land											+
Shops may lose small amounts of income if customers' access is impeded by network repair works	S	T	As before: inform shopkeepers of work in advance	GA	Network sites									0
			As before: provide walkways and bridges for vehicles	OMC										0
			As before: request police to divert traffic if necessary	OMC										0
Sites of social/cultural importance may be disturbed by noise, dust, vibration, impeded access for short time during network repairs	S	T	As before: avoid using drills/trucks near fragile buildings	OMC	Network sites									0
			As before: finish work quickly in sensitive areas	OMC										0
			As before: provide walkways and bridges for vehicles	OMC										0
			As before: consult authorities and communities, inform them of work in advance, avoid sensitive periods	GA										0
Health and safety of workers & the public could be at risk from repair work and AC pipes of old water supply system	M	T	Prepare and operate H&S plan with same measures as used in construction phase	OMC	All sites									0
			Apply previously-developed protocol to protect all persons if AC pipes are encountered											0
Local people will benefit if employed by project	M	P	STP workers should be residents of neighbouring areas	GA	STP									+

139. Resettlement issues will be coordinated centrally by a Resettlement Specialist within the IPMU, who will ensure consistency of approach between towns. A local Resettlement Specialist will also be appointed to IPIUs of zones in which there are resettlement impacts and they will prepare and implement local Resettlement Plans following the framework established in Tranche 1.

140. 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 (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

141. Table 7.1 shows that most mitigation activities are the responsibility of the Construction Contractors[4] (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.

142. 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 specialist 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 operate[5].

143. Table 7.1 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 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.

[4] 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

[5] 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)

144. Table 7.2 shows the proposed Environmental Monitoring Plan (EMP) for this subproject, which specifies the various monitoring activities to be conducted during all phases. Some of the measures shown in Table 7.1 have been consolidated to avoid repetition, and there has been some re-ordering to present together those measures that relate to the same activity or site. 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.

145. Given the scale of the investment in providing the infrastructure, LSGD will also wish to conduct monitoring during the operational period to ensure the correct functioning of the STP and confirm the long-term benefits of the scheme. There will also be bacteriological surveys when the STP is operating, to ensure the safety of dried sludge and treated effluent before sale to farmers to fertilize and irrigate fields. Table 7.2 shows that these long-term surveys will monitor:

- the chemical and bacteriological quality of treated STP effluent;
- the bacteriological content of dried sewage sludge;
- the health of the population and the prevalence of diseases of poor sanitation.

146. An accredited consulting laboratory will be appointed to collect and analyse samples of treated effluent and dried sludge once per month for the first five years of operation of the STP. A domestic social studies consultant will be appointed to monitor public health and the incidence of disease, once per year over the same five year period, after collecting baseline data during the construction period.

D. Environmental management and monitoring costs

147. 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. Costs of compensating shopkeepers for loss of business income during the construction period (Table 7.1) are calculated separately in the budgets for the Resettlement Framework and Resettlement Plans so are also excluded from this analysis.

148. 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.

149. These have not been budgeted elsewhere, and their costs are shown in Table 7.3, 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 2.3 million, ie US$ 53,605.

Table 7.2: Environmental Monitoring Plan

Mitigation Activities and Method	Location	Responsible for Mitigation	Monitoring Method	Monitoring Frequency	Responsible for Monitoring
LOCATION AND DESIGN					
Sell treated wastewater to farmers for irrigation, , development of water ponding system	STP	GA	Site observation; farmer survey	Monthly	
CONSTRUCTION					
Find beneficial uses for waste soil (construction, land raising, infill)	All sites	Contractor	Site observations; CC records	Monthly	EMS
Remove waste soil as soon as it is excavated	All sites	Contractor	Site observations	Weekly	EMS
Use tarpaulins to cover soil when transported on trucks	All sites	Contractor	Site observations	Weekly	EMS
Avoid Sikar Town and narrow local roads when transporting soil	From STP	Contractor	Observations off site; CC record	Weekly	EMS
Avoid transporting soil during peak traffic periods	From STP	Contractor	Observations on and off site	Weekly	EMS
Cover or damp down stockpiled soil in dry weather	Inhabited areas	Contractor	Site observations	Weekly	EMS
Conduct all excavation work in the dry season	All sites	Contractor	Site observations	Monthly	EMS
Pump groundwater from excavated areas and provide to farmers	STP site	Contractor	Site observations; farmer survey	Monthly	EMS
Leave spaces for access between mounds of soil	Network sites	Contractor	Site observations	Weekly	EMS
Provide bridges to allow people & vehicles to cross open trenches	Network sites	Contractor	Site observations	Weekly	EMS
Only remove trees if it cannot be avoided	All sites	Contractor	Site observations	Weekly	EMS
Plant and maintain two trees for every one removed	All sites	Contractor	Observations on/off site; CC records	Monthly	EMS
*Compensate businesses for lost income	Where required	LSGD	Shopkeeper survey; LSGD record	As needed	IMA[6]
Increase workforce in inhabited areas to finish work quickly	Network sites	Contractor	Site observations; CC records	Monthly	EMS
Inform shopkeepers and residents of work in advance	Network sites	LSGD	Resident surveys; CC records	Monthly	EMS
Confirm location of infrastructure and avoid these sites	Network sites	DSC	Site observation; design reports	Monthly	EMS
Locate water and sewer pipes on opposite sides of roads	Network sites	DSC	Site observation; design reports	Monthly	EMS
Integrate subprojects to conduct trenching at same time	Network sites	DSC/LSGD	Site observation; design reports	Monthly	EMS
If work will affect traffic, conduct when traffic is light	Network sites	Contractor	Site observations; CC records	Monthly	EMS
Ensure police provide traffic diversions when required	Network sites	Contractor	Site observations; CC records	Monthly	EMS
Request archaeological authorities to assess potential of all sites	All sites	DSC	DSC records; design reports	As needed	EMS
Select alternatives if sites have medium or high potential	All sites	DSC	DSC records; design reports	As needed	EMS
Include state and town historical authorities as stakeholders	All sites	LSGD	CC records; observations at meetings	As needed	EMS
Develop and apply archaeological protocol to protect chance finds	All sites	DSC and CC	DSC and CC records; site observations	Weekly	EMS
Plan transport routes to avoid narrow streets, important or fragile buildings, religious and tourism sites	Network sites	Contractor	Observations off site: CC record	Weekly	EMS
Plan work to avoid peak traffic and main tourism season	Network sites	Contractor	Site observations; CC records	Monthly	EMS
Avoid using pneumatic drills near buildings at risk from vibration	Network sites	Contractor	Site observations; CC records	Weekly	EMS
Use modern vehicles and machinery and maintain as specified	All sites	Contractor	Site observations; CC records	Monthly	EMS

[6] Resettlement issues (asterisked) will be monitored by an Independent Monitoring Agency (IMA) established under the Resettlement Framework

Mitigation Activities and Method	Location	Responsible for Mitigation	Monitoring Method	Monitoring Frequency	Responsible for Monitoring
Consult authorities, custodians of buildings, communities: address key issues, avoid working at sensitive times	Network sites	Contractor	Site observations; CC records; resident surveys	Monthly	EMS
Prepare and implement a site H&S Plan including personal protection from transmission of HIV/AIDS (safety of workers/public)	All sites	Contractor	Site observations; CC records	Monthly	EMS
Exclude public from the site	All sites	Contractor	Site observations; CC records	Monthly	EMS
Ensure that workers wear Personal Protective Equipment	All sites	Contractor	Site observations; CC records	Monthly	EMS
Provide Health and Safety training including process of transmission of HIV/AIDS for all personnel	All sites	Contractor	CC records; worker interviews	Monthly	EMS
Follow documented procedures for all site activities	All sites	Contractor	Site observations; CC records	Monthly	EMS
Keep accident reports and records	All sites	Contractor	CC records	Monthly	EMS
Design infrastructure to avoid known locations of AC pipes	Network sites	DSC	DSC records; design reports	As needed	EMS
Train all personnel in dangers and recognition of AC pipes	All sites	Contractor	Site observations; CC records	Monthly	EMS
Develop and apply protocol if AC pipes are encountered	All sites	DSC/CC	DSC & CC records; site observations	Weekly	EMS
If AC pipes are encountered, report to management immediately	All sites	Contractor	Site observations; CC records	Weekly	EMS
Remove all persons to safe distance	All sites	Contractor	Site observations; CC records	Weekly	EMS
Workers handling AC: wear breathing apparatus; protective suits	All sites	Contractor	Site observations; CC records	Weekly	EMS
All AC material must be removed and disposed of safely	All sites	Contractor	Observations on and off site; CC records	As needed	EMS
Employ at least 50% of workforce from communities near sites	All sites	Contractor	CC records; worker interviews	Monthly	EMS
OPERATION AND MAINTENANCE					
Detect and repair sewer leaks rapidly and effectively	Network sites	GA	Site observation; resident survey	Monthly	
Sell dried inert sludge to farmers to fertilize land, ponding of water to introduce aquaculture	STP	GA	Site observation; farmer survey	Monthly	
Inform shopkeepers and residents of work in advance	Network sites	GA	Resident surveys	Monthly	
Provide walkways and bridges for vehicles	Network sites	OM Contractor	Site observation; resident survey	Monthly	
Request police to divert traffic if necessary	Network sites	OM Contractor	Site observations	Monthly	
Avoid using drills or heavy vehicles near fragile buildings	Network sites	OM Contractor	Site observations	Monthly	
Finish work quickly in sensitive areas	Network sites	OM Contractor	Site observations; OMC records	Monthly	
Consult communities, avoid working during sensitive periods	Network sites	GA	Site observation; resident survey	Monthly	
Prepare and operate H&S plan to protect workers and citizens	All sites	OM Contractor	Site observations; OMC records	Monthly	
Apply AC protocol to protect all persons if AC pipes encountered	All sites	OM Contractor	Site observations; OMC records	Monthly	
STP workers should be residents of neighbouring areas	STP	GA	Employer record; worker survey	Monthly	
LONG-TERM SURVEYS					
Survey of chemical and bacteriological quality of STP effluent	STP	GA	Water quality sampling/analysis	Monthly for 5 years	Consulting lab
Bacteriological surveys of dried STP sludge	STP	GA	Bacterial sampling/analysis		Consulting lab
Survey of public health and incidence of water borne disease	Sikar Town	GA	Hospital records; resident surveys	Annual for 6 years	Social studies consultant

Table 7.3: Environmental management and monitoring costs (INR)

Item	Quantity	Unit Cost	Total Cost	Sub-total
1. Implementation of EMP (2 years)				
Domestic Environmental Monitoring Specialist	1 x 3 month	130,000[7]	390,000	
Survey Expenses	Lumpsum	100,000	100,000	490,000
2. Survey of STP sludge and effluent (5 years)				
Domestic Consultant	5 x ½ month	130,000	325,000	
Sample Analysis	5 x 20	3,500[8]	350,000	
Other Expenses	Lumpsum	200,000	200,000	875,000
3. Survey of public health (6 years)				
Domestic Consultant	6 x ½ month	130,000	390,000	
Expenses	Lumpsum	200,000	200,000	590,000
4. Environmental mitigation measures including green belt development at STP site	Lumpsum	350,000	350,000	350,000
TOTAL				**2,305,000**

E. Associated Facilities

150. There are no upstream associated facilities in this subproject; however, the downstream users of treated water can be considered associated to the facility.

151. If the Sewage Treatment Plant's (STP's) treated waste water is drained into a *nallah* or discharged into boreholes, care must be taken to properly treat it before it is discharged otherwise the infusion of contaminated waters in the ground aquifers can render the water permanently unfit for human consumption.

152. Inappropriate waste water disposal pollutes the receiving waters such as rivers, *nallahs*, water ponding systems for aquaculture and may render them unfit for abstraction and treatment if toxic in nature. These *nallahs*, rivers or farmers which "take away/use" this waste water are deemed to be end users of the wastewater from the STP. Therefore before disposal, all Indian wastewater discharge standards must be met in full and proper records must be maintained.

VIII. PUBLIC CONSULTATION AND INFORMATION DISCLOSURE

A. Project stakeholders

153. 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:

- 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

[7] Unit costs of domestic consultants include fee, travel, accommodation and subsistence
[8] Cost of a standard bacteriological analysis (total and faecal coliforms, E.coli, enterococci, etc) is $90 (INR 3,500) per sample

- Owners and users of any land that is acquired along the transmission main route;
- Custodians and users of socially and culturally important buildings in affected areas;
- State and local authorities responsible for the protection and conservation of archaeological relics, historical sites and artefacts;
- State and local tourism authorities.

154. Secondary stakeholders are:

- LSGD as the Executing Agency;
- 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);
- NGOs and CBOs working in the affected communities;
- Other community representatives (prominent citizens, religious leaders, elders, women's groups);
- The beneficiary community in general; and
- The ADB.

B. Consultation and disclosure to date

155. 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 animal near the project site

156. Local populations are very much interested on the project and they will help project authorities in all aspects. But mitigation measures will be required at project sites to minimise the impact on environment.

157. The public Consultation and group discussion meeting were conduct by RUIDP on Date 31 May, 2008 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 Sikar, the environmental and social impacts of the proposed subprojects under Tranche 2 in Sikar were discussed.

158. 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 Sikar; and discussed the Government and ADB's Environment policies acts and potential environment impacts of the sub-projects in Sikar. 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. Detail of this Public consultation/ Group Discussion are attached as **Appendix 4**

C. 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.

D. Future consultation and disclosure

159. 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:
  - 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;
  - Structured consultation meetings with the institutional stakeholders (government bodies and NGOs) to discuss and approve key aspects of the project.
- Consultation during construction:
  - Public meetings with affected communities to discuss and plan work programmes and allow issues to be raised and addressed once construction has started;
  - 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:
  - 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;
  - 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;
  - 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.

IX. FINDINGS AND RECOMMENDATIONS

A. Findings

160. 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.

161. 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.

162. The process described in this document has assessed the environmental impacts of all elements of the infrastructure proposed under the Sikar 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:

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

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

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

164. 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 and the excavation of ponds at the STP site; because 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 remains. Because of these factors the most significant impacts are on the physical environment, the human environment, and the cultural heritage.

165. 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:

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

166. 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.

167. 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:

- Assessing the archaeological potential of all proposed construction sites, and selecting alternative locations to avoid any areas of medium or high risk;
- Including 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 ensure that any chance finds are recognised, protected and conserved.

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

- Avoid all known sites of AC pipes when the locations of new infrastructure are planned in the detailed design stage;
- Train all construction personnel to raise awareness of the dangers of AC and enable early recognition of such pipes if encountered;
- 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).

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

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

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

170. These and the other mitigation and enhancement measures are summarised in Table 7.1, which also shows the location of the impact, the body responsible for the mitigation, and the programme for its implementation.

171. 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:

- 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;

- Treated effluent from the STP is sold to farmers to fertilize and irrigate fields instead of being discharged into a nearby *nalla*h. Water ponding system could also be established for development of acquaculture in treated water

172. 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.

173. The regular removal of sludge from the treatment ponds should also have no environmental impacts, and if tests show that the drying procedure removes bacterial contamination the material should be sold to farmers to fertilize soil, as this will provide an environmental gain and some cost recovery.

174. 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.

175. Table 7.1 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).

176. 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. There will also be longer-term surveys to ensure the safety of sewage sludge and treated effluent for use in agriculture, and to monitor the expected improvements in the health of the population.

B. Recommendations

177. 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 environmental status report (**Table 7.1**) are implemented in full, as described in the text above;
- The Environmental Monitoring Plan proposed in Section VII.C of this report is also implemented in full.

X. CONCLUSIONS

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

179. The overall conclusion of both processes is that providing 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.

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

Appendix – II-A

Photographs

APPENDIX – V-A

RAPID ENVIRONMENTAL ASSESSMENT (REA) CHECKLIST

Country/Project Title: India/Rajasthan (Sikar) Urban Sector Development Investment Programme (Tranche-II).

Sub-Project: Construction of sewerage treatment plant in Sikar.

SCREENING QUESTIONS	Yes	No	REMARKS
A. Project Siting Is The Project Area…			
▪ Densely Populated?	Yes		**The location of STP site is near residential area called Hasnain colony and new Roshan Ganj.**
▪ Heavy with Development Activities?		No	
▪ Adjacent to or Within Any Environmentally Sensitive Areas?		No	
• Cultural Heritage Site		No	
• Protected Area		No	
• Wetland		No	There is no protected/environmental sensitive area along the sewerage line.
• Mangrove		No	
• Estuarine		No	
• Buffer Zone of Protected Area		No	
• Special Area for Protecting Biodiversity		No	
• Bay		No	
B. Potential Environmental Impacts Will The Project Cause…		No	
▪ Impairment of historical/cultural monuments/areas and loss/damage to these sites ?		No	No such impact is anticipated as sewerage line will pass under the existing road

SCREENING QUESTIONS	Yes	No	REMARKS
▪ Interferance with other utilities and blocking of access to buildings; nuisance to neighbouring areas due to noise, smell, and influx of insects, rodents, etc.?	Yes		STP site is located near (within 500 m, approx within 300 m) New Roshan Ganj and Hasnain colony which will be impacted due to noise, smell and influx of insects. Strict mitigation measures (buffer zone) necessary
▪ Dislocation or involuntary resettlement of people		No	Not applicable. There is no R&R required for this project.
▪ Impairment of downstream water quality due to inadequate sewage treatment or release of untreated sewage ?		No	There is no surface water resources in this area and all treated water will be used for agriculture purpose only.
▪ Overflows and flooding of neighbouring properties with raw sewage ?		No	This area is water scare area and all water will be used for agriculture purpose only.
▪ Environmenal pollution due to inadequate sludge disposal or industrial waste discharges illegally disposed in sewers?		No	Sludge will be disposed scientifically designed disposal sites. There are few small scale industries in this area.
▪ Noise and vibration due to blasting and other civil works ?	Yes		During construction phase there will be some noise pollution for short periods.
▪ Discharge of hazardous materials into seweres,resulting in damage to sewer system and danger to workers		No	All precautions as per EMP will be taken during construction phase to avoid any risk and danger to workers.
▪ Inadequate buffer zone around pumping and treatment plants to alleviate noise and other possible nuisnces, and protect facilities ?		No	There is no facility nearby to alleviate noise and other nuisances. Adequate buffer zone will be provided
▪ Social conflicts between construction workers from other areas and community workers ?		No	Mostly local labour will be employed during construction. Therefore, no conflict situation is expected.
▪ Road blocking and temporary flooding due to land excavation during the rainy season ?	Yes		As this sewer line is going through heavily congested residential and commercial area there are chances that for short period there may be blockage of road due to land excavation and this problem may further alleviate in rainy season.

SCREENING QUESTIONS	Yes	No	REMARKS
▪ Noise and dust from construction activities?	Yes		Little increase in noise levels and dust emission is anticipated from construction activities and will be minimised by taking proper mitigation measures.
▪ Traffic disturbances due to construction material transport and wastes?	Yes		As said above project area is very congested for construction activities which may lead to traffic disturbance but for short period.
▪ Temporary silt runoff due to construction?		No	Not applicable. No water body exists in this area.
▪ Hazards to public health due to overflow flooding, and groundwater pollution due to failure of sewerage system?		No	There is no groundwater in this area. There will be proper maintenance of sewer line and in case of any blockage and chocking; the material will be immediately removed. In case failure of STP system arrangement have been made to bypass the partially treated effluents.
▪ Deterioration of water quality due to inadequate sludge disposal or direct discharge of untreated water ?		No	Not applicable. There is no surface water and ground water resources in this area. Also sludge will be disposed in scientifically manner at selects locations.
▪ Contamination of surface and ground water due to sludge disposal on land ?		No	Not applicable. There is no surface water and ground water resources in this area. Also sludge will be disposed in scientifically manner at selects locations.
▪ Health and safety hazards to workers from toxic gases and hazards materials which may be contained in sewage flow and exposure to pathogens in sewage and sludge?		No	During construction period all precautions will be taken to avoid any health and safety hazards of workers. All personal protective equipments like mask, helmets will be provided to the workers. Also one health and safety engineer will be employed by contractor who will supervise this work.

Appendix VI-A

Up Flow Anaerobic Sludge Blanket (UASB)

UASB reactors are anaerobic type of reactors. These reactors operate in the absence of oxygen and generally anaerobic bacteria which eat up the bio mass from the incoming sewage. This bio mass accumulates and forms a blanket called Sludge Blanket(for a depth of 2 to 2.5 m) on the lower portion of the reactors. (The upflowing sewage itself forms millions of small 'granules' or particles which are held in suspension and provide a large surface area on which organic matter can attach and undergo biodegradation).The solids are thus supposed to stay there for several days ,30 -50days (and digests).

The sewage after being retained in the reactor for about 8 to 10 hours over flows and shall be either retained in a tank for about 30 minutes or allowed to pass through an Cascade type aeration arrangements to give slight aeration to the effluent to destroy anaerobicity.

The effluent, if required, further may allowed to stay at Polishing Pond one day, after which, can be used for irrigation, horticulture or for washing purposes.

The effluent BOD can be expected to be about 60mg/l assuming influent BOD of 300mg/l with 75-80% efficiency of BOD removal. The irrigation standard (BOD<100 mg/l) are generally conveniently met by UASB

1. Sludge Production and nutrient Requirement:

In UASB system sludge is well stabilized and dries directly on sand. The excess sludge is remove time to time through separate pipe and sent to simple sand bed for drying. The nutrients nitrogen and phosphorus are conserved in the process and make the irrigational use of the effluent more valuable.

2. Gas Recovery:

Gas recovery is optional, though currently favored. Gas produced can be collected and used of desired. The system functions satisfactory when temperatures inside reactor are above 18-20ºC.

Gas production/ recovery in case of municipal waste, is relatively small. If gas is collected but not used, a flare may be installed to burn the biogas, it helps avoid odour nuisance from any H_2S present in gas.

In case gas recovery is to be practiced for municipal waste, it would be beneficial to find bulk consumers of gas and sell them the gas directly rather than try to produce electricity. Gas conversion to electricity requires the use of dual fuel engines and various controls. It is therefore important that economics and desirability of whole gas recovery is carefully reviewed in each individual case.

In terms of operating cost, generally the UASB process is cheaper than usual conventional process for municipal plants even when income from gas recovery is neglected.

THE TREATMENT PLANT SHALL CONSIST OF FOLLOWING UNITS

1) Initial Pumping
2) Screening and Degritting
3) Main UASB Reactor
4) Gas Collection and Holding
5) Sludge Drying Bed
6) Post treatment facility (Optional)

Appendix – VIII-A

Public consultation