

Initial Environmental Examination

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**IND: Rajasthan Secondary Towns Development
Sector Project – Water Supply and Sewerage Project
in Abu Road Town, District - Sirohi, Rajasthan**

Prepared by Project Management Unit, Rajasthan Urban Drinking Water Sewerage and Infrastructure Corporation Limited, Government of Rajasthan for the Asian Development Bank.

CURRENCY EQUIVALENTS

(as of 10 March 2020)

Currency unit	–	Indian rupee (₹)
₹ 1.00	=	\$0.03434
\$1.00	=	₹74.4370

ABBREVIATIONS

ADB	–	Asian Development Bank
BOCW	–	Building and other Construction Workers
CGWB	–	central ground water board
CLC	–	city level committee
CPCB	–	central pollution control board
CPHEEO	–	Central Public Health and Environmental Engineering Organization
CTE	–	consent to establish
CTO	–	consent to operate
CWR	–	clear water reservoir
DBO	–	design-build-operate
DPR	–	detailed project report
EHS	–	environmental health and safety
EIA	–	environmental impact assessment
EMP	–	environmental management plan
FAO	–	Food and Agricultural Organization
FCO	–	fertilizer control ordinance
FSSM	–	Fecal Sludge and Septage Management
IEE	–	initial environmental examination
IFC	–	International Finance Corporation
LSGD	–	Local Self Government Department
MOEFCC	–	Ministry of Environment, Forest and Climate Change
OHSR	–	overhead service reservoir
PHED	–	Public Health Engineering Department
PIU	–	project implementation unit
PMU	–	project management unit
PWD	–	Public Works Department
REA	–	rapid environmental assessment
ROW	–	right-of-way
RSPCB	–	Rajasthan State Pollution Control Board
RSTDSP	–	Rajasthan Secondary Towns Development Sector Project
RUDSICO-EAP	–	Rajasthan Urban Drinking Water Sewerage and Infrastructure Corporation Limited-Externally Aided Projects
RUDSICO	–	Rajasthan Urban Drinking Water Sewerage and Infrastructure Corporation
SCADA	–	supervisory control and data acquisition
SBR	–	sequential batch reactor
SEIAA	–	State Environmental Impact Assessment Authority
SPS	–	Safeguard Policy Statement, 2009
STP	–	sewage treatment plant
TEER	–	treated effluent elevated reservoir
TESR	–	treated effluent storage reservoir
ULB	–	urban local body

WHO	–	World Health Organization
WTP	–	water treatment plant

WEIGHTS AND MEASURES

m ³	–	cubic meter
dB	–	decibels
°C	–	degree centigrade
dia	–	diameter
kg	–	kilogram
kl	–	kiloliter
km	–	kilometer
kmph	–	kilometer per hour
KLD	–	kiloliters per day
ha	–	hectare
HP	–	horsepower
LPCD	–	liters per capita per day
lps	–	liters per second
m	–	meter
mg	–	milligram
mm	–	millimeter
MCM	–	million cubic meter
MLD	–	million liters per day
km ²	–	square kilometer

NOTE

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

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EXECUTIVE SUMMARY

Rajasthan Secondary Towns Development Sector Project (RSTDSP), the fourth phase of investment projects financed by Asian Development Bank (ADB) and implemented by the Rajasthan Urban Drinking Water Sewerage and Infrastructure Corporation Limited (RUDSICO), previously known as Rajasthan Urban Infrastructure Development Project (RUIDP). RSTDSP will support the ongoing efforts of the Government of Rajasthan towards improving the water and wastewater services in about 14 towns.¹ RSTDSP seeks to improve water supply and sewerage (WSS) services in secondary towns with populations between 20,000-115,000 through a sector loan modality. The project is aligned with the following impact(s): (i) access to potable, affordable, reliable, equitable, and environmentally sustainable drinking water supply in all urban areas of Rajasthan improved;² and (ii) health status of urban population, especially the poor and underprivileged improved.³ The project will have the following outcome: urban service delivery in secondary towns of Rajasthan improved. There are three outputs.

- **Output 1:** Water supply infrastructure in project towns improved with climate-resilient and inclusive features. By 2027: (i) about 1,350 kilometers (km) of water supply pipelines will be commissioned through a district metered area approach for effective non-revenue water (NRW) management, (ii) about 100,000 households will be connected to an improved water supply system (including at least 95% below poverty line [BPL] households) with 100% functional meters allowing for the introduction of volumetric billing, (iii) 3 new water treatment plants (WTP) will be commissioned with total capacity of at least 28 million liters per day (MLD) and (iv) 2 WTP will be rehabilitated.
- **Output 2:** Sanitation systems in project towns improved with climate-resilient, cost-effective and inclusive features.⁴ By 2027: (i) about 1,300 km of sewers will be constructed, (ii) 19 sewerage treatment plants (STP)s with co-treatment of wastewater and fecal sludge and with a total capacity of about 80 MLD will be commissioned and 2 existing STPs will be upgraded to meet current effluent standards, (iii) about 103,000 new household connections (including at least 95% BPL households) to sewer system will be installed, (iv) 1 fecal sludge treatment plant with total 10 kiloliters per day (KLD) capacity will be commissioned, and (v) agreements for reuse of wastewater mainly for industry or agriculture will be signed in at least 5 project ULBs.
- **Output 3:** Institutional and human capacities strengthened for service improvements, gender equality and sustainability. Under the sector project: (i) at least 500 women will gain professional experience through an internship program at RUDSICO, (ii) about 500 staff and 500 elected representatives of project ULBs, including 80% of eligible women, will report increased knowledge on operation and maintenance (O&M) of WSS services, citywide inclusive sanitation (CWIS),

¹ The project towns under consideration for the sector loan are: Abu Road, Banswara, Didwana, Fatehpur, Khetri, Kuchaman, Ladnu, Laxmangarh, Makrana, Mandawa, Pratapgarh, Ratangarh, Sardarshahar and Sirohi. Of these towns, Khetri and Mandawa are heritage towns.

² Government of Rajasthan. 2018. Rajasthan: Urban Water Supply Policy. Jaipur.

³ Government of Rajasthan. 2016. State Sewerage and Wastewater Policy. Jaipur.

⁴ Climate resilient and inclusive features included are: improvements in the distribution system to reduce losses; rainfall water harvesting; energy-efficient pumps; solar panels at project facilities; pressure control mechanisms in the water system to help avoid losses through pipe bursts; and wastewater reuse for productive uses.

financial sustainability and gender equality and social inclusion (GESI) action plan implementation, (iii) about 500 girls will report enhanced knowledge in conducting water audits in schools and households, and (iv) data platforms will be established in all project towns.⁵

Abu Road Town water supply and sewerage subproject is one of the subprojects proposed under the investment component of RSTDSP. Water supply at present in Abu Road is groundwater dependent, the supply is intermittent, unreliable and suffers with huge losses and quality issues. There is no sewerage system in the town. Due to lack of sewerage system, most of the households depends on septic tanks for disposal of sewage. Effluents from septic tanks and sullage are let off into open drains which ultimately accumulates in low lying areas and natural drains in the outskirts of the town.

Screening and assessment of potential impacts. ADB requires consideration of environmental issues in all aspects of the Bank's operations, and the requirements for environmental assessment are described in ADB's Safeguard Policy Statement (SPS), 2009. As per the Government of India environmental impact assessment (EIA) Notification, 2006, this subproject does not require EIA study or environmental clearance. The potential environmental impacts of the subproject have been assessed using ADB rapid environmental assessment (REA) checklist for Sewerage. The potential negative impacts were identified in relation to preconstruction, construction and operation phases. This initial environmental examination (IEE) addresses the infrastructure components proposed under Abu Road Town water supply and sewerage subproject.

Categorization. Environmental assessment has been conducted for the Abu Road water supply and sewerage subprojects based on (i) preliminary detailed design, and (ii) most likely environmentally sensitive components. The environmental assessment used ADB's REA checklists for sewerage works and water supply and "No Mitigation Scenario Checklist". The environmental assessment of the Abu Road water supply and sewerage subprojects are not likely to have any significant adverse environmental impacts that are irreversible, diverse, or unprecedented. Potential impacts are mostly site-specific and few of them are irreversible. In most cases mitigation measures can be designed with uncomplicated measures commonly used at construction sites and known to civil works contractors.

Abu Road Town water supply and sewerage subproject is classified as environmental category B as per the SPS as no significant impacts are envisaged. Accordingly, this IEE assesses the environmental impacts and provides mitigation and monitoring measures to ensure that there are no significant impacts as a result of the project.

It is designed to improve the water supply system in Abu Road Town under RSTDSP. This will benefit the total population of 39,229 (2011 Census) 58,613 by 2051 (projected) with a per capita water supply rate of 135 liters per day (LPD). Proposed components include: (i) 1 intake cum raw water pumping station (3 pumps) at Bhaisa Singh dam; (ii) construct 18 new tube wells; (iii) raw water main 8.5 km length 400 millimeter (mm) diameter (dia); (iv) construction of new WTP of 10 MLD capacity; (v) 5 clear water pump houses; (vi) transmission mains – 32.44 km length 150-400 mm dia of ductile iron (DI) material; (vii) 5 clear water reservoirs (CWRs) of capacity -300 kiloliter (kl), 850 kl, 600 kl, 500 kl and 300 kl; (viii) chlorinator systems at five CWRs; (ix) Distribution

⁵ Includes supervisory control and data acquisition system, hydraulic model, geographic information system, and drinking water and treated wastewater quality monitoring system.

network of 134 km (75-315 mm dia); (viii) 12,800 house service connections with meters; (ix) bulk meters, supervisory control and data acquisition (SCADA); and (x) Offices for customer relation and control centers for water supply operation (2 consumer relation management center [CRMC], 1 master control center [MCC] and 1 central control center [CCC]). It is also proposed to rehabilitate following existing facilities to improve efficiency: (i) 11 open wells and 13 tube wells; (ii) pump houses; and (iii) reservoirs.

It is designed to develop a comprehensive sewerage system in Abu Road Town to collect, treat, and dispose/reuse the domestic wastewater safely. This is being provided in a combination of underground sewerage system including treatment facility, and Fecal Sludge and Septage Management (FSSM) system in areas that are not fully developed at present and not feasible to provide sewer network. About 91% of the total base year population (2021) is proposed to be covered by sewerage system, while the rest 9% will be covered by FSSM. Proposed components include: (i) 105 km of sewer network including mains (200-800 mm dia), manholes; (ii) 2 STP of capacity – 6.90 MLD and 2.30 MLD based on sequential batch reactor (SBR) process; (iii) two treated effluent storage reservoirs (TESR) of capacity 690 kl and 230 kl; (iv) two treated effluent elevated reservoirs (TEER) of capacity 345 kl and 115 kl, (v) outfall sewers from STPs to discharge point, to discharge excess/unused treated effluent; (vi) House sewer connection- 11,600 nos.; and (vii) mobile tankers with suction and discharge arrangements to collect and convey septage from septic tanks in FSSM covered area (provide 3 trucks of 1 nos.-4000 liters [L] and 2 nos.-1000 L).

Description of the Environment. Subproject components are located in Abu Road Town and in its immediate surroundings which were converted into urban use for many years ago, and there is no natural habitat left at the proposed sites. Water intake is proposed in Bhausa Singh Dam, which is outside the town, and about 2 km from the boundary of Balaram Ambaji Wildlife Sanctuary. Critical habitat and biodiversity assessment conducted indicated project area not qualifying as critical habitat, however, presence of five protected species noted. Aquatic life is limited to local common fish species, and fishing activity is conducted periodically by the local fishing community. No involuntary land acquisition of private land is anticipated for this project. The project sites are located in existing road right-of-way (ROW) and government-owned lands. Two proposed STPs and the WTP will be constructed on vacant govt. land. Site are covered with sparse tree cover, shrubs and bushes, and no notable wildlife at these sites. The climatic conditions in Abu Road district is of semi-arid type. As per the seismic zoning map of India, Abu Road falls under the Zone-III, which is the Moderate earthquake risk zone in India. This zone is termed as "Moderate damage risk zone". There are no protected monuments or places of historical or archeological importance at the project locations. A state protected monument is about 5 km outside the town, and nearest component is raw water main, passing at about 1.3 km from the monument boundary.

Potential Environmental Impacts and Mitigation Measures. In this draft IEE, negative impacts were identified in relation to location, design, construction and operation of the improved infrastructure. Environmental impacts as being due to the project design or location were not significant as various measures are already included in site planning and preliminary design. There are no environmentally or archeologically sensitive areas within Abu Road Town. However, there are wildlife sanctuaries nearby to project area. The Nearest protected area is Balaram Ambaji Wildlife Sanctuary, which is about 2.6 km from the proposed intake location in Bhausa Singh Dam. Abu Road Town, the project area, is about 7-8 km from the boundary of the sanctuary. Intake site proposed in Bhausa Singh Dam is about 2.6 km from the boundary of Sanctuary. Given the intake site is mostly surrounded by agricultural areas, and outside the protected areas, no wildlife movement is reported. Nevertheless, various measures are included to avoid any impacts.

During the operation phase, dead storage will always be available if the source is being used by wildlife. Mount Abu Wildlife Sanctuary boundary is about 5 km from the town in the north. A critical habitat screening and biodiversity assessment study has been carried out for potential presence of critical habitat within the proposed projects potential area of influence. There are no known species which would qualify the area as critical habitat under the set criteria, however, within the area of influence there is the potential species of vultures to utilize the wider area for feeding. There are five species which have been identified as potentially qualifying the identified area of analysis as critical habitat. To ensure that no measurable adverse impacts on biodiversity is achieved, study recommended various measures. These include: (i) engaging a local biodiversity expert to verify findings on-site; (ii) conducting field-level site visits for the review and updating of the environmental management plan (EMP). If species of interest are found on-site, ensure that the findings are recorded and reported to the project implementation unit/ project management unit (PIU/PMU), no disturbances or works on the site should start/continue until PIU/PMU issues clearance to proceed. Measures to restrict poaching or hunting shall be put in place, and if species of interest are present, PMU/PIU shall coordinate with the Forest Department for the translocation of the animals and contractor to undertake biodiversity awareness training to be organized by PMU/PIU.

Abu Road Town is presently supplying water to its residents through ground water sources. Since the present water requirements are more than 10 MLD and projected water demand for year 2051 is 15.56 MLD, the project scope is including bringing water from a surface water source. This source, Bhaisa Singh dam, is however able to provide only 10 MLD water in a year. Therefore, the town will still be dependent on ground water sources to meet the future years' requirement. The project scope also includes construction of 18 new tube wells with production around 3.6 MLD. The construction of new tube wells has been proposed keeping in consideration the worst scenario of last 40 years' rainfall and catchment yield data. Bhaisa Singh Dam has a total storage capacity of 5.069 million cubic meter (MCM). Out of this, dead storage of dam is 0.453 MCM and live storage is 4.616 MCM. It is live storage only which can be used for drinking and other similar purposes and the proposal is to depend on 80% of live storage (3.693 MCM) considering 20% in evaporation and other losses. The catchment of the dam is spread over an area of 40.15 square kilometer (km^2) and the inflow to the dam from rainfall over 40 years period indicate that annual inflow is generally more than the dam storage capacity. However, there are instances when the catchment contribution was less than 3.693 MCM. Such scenario would pose a threat on water availability once 10 MLD regular withdrawal (~ 3.65 MCM/year) is made. The town will then be depending on ground water sources (tube wells) to meet out the deficit. The project proposes rehabilitation of existing tube wells as well as developing new tube wells. A feasibility study was conducted by Hydrogeologist, Ground Water Department, Government of Rajasthan. Measures suggested accordingly to harvest groundwater resources. Therefore, no impacts due to source sustainability envisaged. Dam water is fully allocated to Abu Road Town water supply, and accordingly the dam is transferred from Irrigation Department to Public Health Engineering Department (PHED) to use it for drinking water purposes.

In water treatment various measures are included to safely collect, reuse/dispose the wastewater and sludge generated in the process. Two STPs of capacities 6.90 MLD and 2.3 MLD are proposed based on SBR process. Proposed SBR technology is advanced, treats sewage in a compact aerobic process, therefore issue due to bad odor is minimal. It is proposed to design the STPs to stringent discharge standards suggested by CPCB in 2015. Following the Rajasthan Sewerage and Wastewater Policy, 2016 treated effluent from STPs will be reused in various feasible purposes, and a reuse plan will be prepared during the detailed design. Various measures are suggested for safe reuse of wastewater and sludge. Excess/surplus of treated

effluent will be disposed into water channels/drains, which are either dry or carry untreated wastewater at present. No impacts envisaged.

Potential impacts during construction are considered significant but temporary and are common impacts of construction in urban areas, and there are well developed methods to mitigate the same. Except laying of sewer and water pipelines, all other construction activities will be confined to the selected sites and the interference with the general public and community around is minimal. In these works, the temporary negative impacts arise mainly from construction dust and noise, hauling of construction material, waste and equipment on local roads (traffic, dust, safety etc.), mining of construction material, occupational health and safety (OHS) aspects. Pipe and sewer laying works will be conducted along public roads in an urban area congested with people, activities and traffic. Therefore these works may have adverse, but temporary impacts arising mainly from the disturbance of residents, businesses and traffic due to construction work; safety risk to workers, public and nearby buildings due to deep trench excavations in the road; access impediment to houses and business, disposal of large quantities of construction waste etc. These are all general impacts of construction in urban areas and there are well developed methods of mitigation that are suggested in the EMP. Trenchless method will be adopted for sewers deeper than 3.5 m and also at main road crossings in traffic areas.

Subproject includes rehabilitation of existing infrastructure like tube wells, pumping stations and OHSRs. Presence of asbestos containing material (ACM), mainly asbestos cement pipes in the existing infrastructure is the main concern. Asbestos is recognized as a cause of various diseases and is considered health hazard if inhaled. It is suggested to prepare and implement asbestos management plan. Once the new system is operating, the facilities will operate with routine maintenance, which should not affect the environment. Improved system operation will comply with the operation and maintenance manual and standard operating procedures to be developed for all the activities.

Potential impacts during operations are considered that relates to the OHS requirements of operating WTP such as the handling and maintenance of chlorine and for the STPs include the testing and verification of treated effluent to environmental standards per central pollution control board (CPCB). Sludge management should be compliant with the requirements of the Solid Waste Management Rule, 2000 and its amendment. Other solid waste disposal should be at designated sites. Dumping at vacant lot is not allowed per Solid Waste Management Rule, 2000 and its amendment.

Environmental Management. An environmental management plan (EMP) has been developed to provide mitigation measures to reduce all negative impacts to acceptable levels, along with the delegation of responsibility to appropriate agency. Various design related measures are already included in the project design. During construction, the EMP includes mitigation measures such as (i) selection of construction methodology for intake on dams.; (ii) proper planning of sewer and water supply works to minimize the public inconvenience; (iii) barricading, dust suppression and control measures; (iv) traffic management measures for works along the roads and for hauling activities; (v) provision of walkways and planks over trenches to ensure access will not be impeded; and (vi) finding beneficial use of excavated materials to extent possible to reduce the disposal quantity. EMP will guide the environmentally-sound construction of the subproject. EMP includes a monitoring program to measure the effectiveness of EMP implementation and include observations on- and off-site, document checks, and interviews with workers and beneficiaries. A copy of the updated EMP/ site environmental management plan (SEMP) shall be kept on-site during the construction period at all times. The EMP shall be made binding on all contractors operating on the site and will be included in the contractual clauses. Non-compliance with, or any

deviation from, the conditions set out in this document shall constitute a failure in compliance. To monitor the operation stage performance, there will also be longer-term surveys to monitor raw and treated water quality, treatment efficiency of STP (raw and treated sewage quality), sludge at WTP and STPs. Mitigation and monitoring measures, along with the project agency responsible for such actions, form part of the EMP. The estimated implementation cost of the EMP is INR 37,502,782 (USD 503,819). This indicative cost includes INR 7,000,000 for asbestos management (identification, inventory, removal, transport, temporary storage, disposal/treatment, and overall supervision of contractor related to asbestos materials).

This draft IEE and EMP will be included in the bid and contract documents to ensure compliance with the conditions set out in this document. The contractor will be required to submit to PIU, for review and approval, an updated EMP/SEMP including (i) proposed sites/locations for construction work camps, storage areas, hauling roads, lay down areas, disposal areas for solid and hazardous wastes; (ii) specific mitigation measures following the approved EMP; and (iii) monitoring program as per EMP. No works are allowed to commence prior to approval of SEMP. A copy of the EMP/approved SEMP will be kept on site during the construction period at all times.

Implementation Arrangements. Government of Rajasthan's Local Self Government Department (LSGD) acting through the RUDSICO will be the project executing agency. The PMU is housed in RUDSICO's division for externally aided projects (EAP). There will be two zonal offices in Jaipur and Jodhpur, and PIUs in each project town/urban local body (ULB). PMU will be responsible for submitting environmental assessment and monitoring reports to ADB, monitoring of safeguards compliance, addressing safeguards issues, providing support and guidance to PIUs. The PIUs will be responsible for day-to-day monitoring of EMP implementation, information disclosure, consultations and other field-level activities. PMU has appointed a project officer for environment and each PIU will deputize assistant safeguard officers (ASOs). The PMU Environment Project Officer will be assisted by specialists from project management and capacity building consultants (PMCBC) and construction management and supervision consultants (CMSC).

Consultation, Disclosure and Grievance Redress. The stakeholders were involved in developing the IEE through discussions on-site and a public consultation workshop at city level, after which views expressed were incorporated into the IEE and in the planning and development of the project. Apart from on-site public consultations, a stakeholder meeting of City Level Committee (CLC) was held and CLC has appreciated and approved the subproject. The IEE will be made available at public locations and will be disclosed to a wider audience via the ADB and RUDSICO websites. The consultation process will be continued and expanded during project implementation to ensure that stakeholders are fully engaged in the project and have the opportunity to participate in its development and implementation. A grievance redress mechanism (GRM) is described within the IEE to ensure any public grievances are addressed quickly.

Monitoring and Reporting. The PMU, PIU and consultants will be responsible for monitoring and reporting. During construction, results from internal monitoring by the DBO contractor will be reflected in their monthly EMP implementation reports to the PIU. PIU with the assistance of CMSC, will monitor the compliance of contractor, prepare a quarterly environmental monitoring report (QEMR) and submit to PMU. The PMU will oversee the implementation and compliance and will submit semi-annual environmental monitoring reports (SEMR) to ADB. ADB will post the environmental monitoring reports on its website. Monitoring reports will also be posted RUDSICO-EAP/PMU websites.

Conclusions. The citizens of the Abu Road will be the major beneficiaries. The subproject is primarily designed to improve environmental quality and living conditions of Abu Road Town through provision of water supply and sewerage. The benefits arising from this subproject include: (i) increased availability of potable water at appropriate pressure to all households including urban poor; (ii) reduced time and costs in accessing alternative sources of water. (iii) better public health particularly reduction in waterborne and infectious diseases; (iv) reduced risk of groundwater contamination; (v) reduced risk of contamination of treated water supplies; and, (vi) reduced dependence on fresh water resource due to reuse of treated wastewater, and (vi) improvement in quality of water bodies due to disposal of treated effluent meeting disposal standards.

The subproject is therefore unlikely to cause significant adverse impacts. The potential impacts that are associated with design, construction and operation can be mitigated to standard levels without difficulty through proper engineering design and the incorporation or application of recommended mitigation measures and procedures. Based on the findings of the IEE, there are no significant impacts and the classification of the project as category "B" is confirmed. The subproject is not covered by the Government of India EIA Notification (2006).

Recommendations. The following are recommendations applicable to the subproject to ensure no significant impacts:

- Obtain all statutory clearances at the earliest time possible and ensure conditions/provisions are incorporated in the detailed design;
- Include this IEE in bid and contract documents;
- Update and implement the asbestos management plan per site-specific conditions;
- Update and implement the recommendations from the biodiversity assessment report;
- Secure permits for the abstraction of groundwater from additional wells;
- Update/revise this IEE based on detailed design and/or if there are unanticipated impacts, change in scope, alignment, or location;
- Conduct safeguards induction to the contractor upon award of contract;
- Ensure that sludge management protocols are compliant with environmental regulations (Solid Waste Management Rules 2000 and its amendments) and solid waste disposal should have a designated site (dumping on vacant lot is not allowed);
- Strictly supervise EMP implementation;
- Ensure contractor appointed qualified environment, health and safety (EHS) officers prior to start of works;
- Documentation and reporting on a regular basis as indicated in the IEE;
- Continuous consultations with stakeholders;
- Timely disclosure of information and establishment of GRM;
- Involvement of contractors, including subcontractors, in first level GRM;
- Commitment from PMU, PIUs, project consultants, and contractors to protect the environment and the people from any impact during project implementation.

I. INTRODUCTION

A. Project Background

1. Rajasthan Secondary Towns Development Sector Project (RSTDSP), the fourth phase of investment projects financed by Asian Development Bank (ADB) and implemented by the Rajasthan Urban Drinking Water Sewerage and Infrastructure Corporation Limited (RUDSICO), previously known as Rajasthan Urban Infrastructure Development Project (RUIDP). RSTDSP will support the ongoing efforts of the Government of Rajasthan towards improving the water and wastewater services in about 14 towns.⁶ RSTDSP seeks to improve water supply and sanitation (WSS) services in secondary towns with populations between 20,000-115,000 through a sector loan modality. The project is aligned with the following impact(s): access to potable, affordable, reliable, equitable, and environmentally sustainable drinking water supply in all urban areas of Rajasthan improved;⁷ and health status of urban population, especially the poor and underprivileged improved.⁸ The project will have the following outcome: urban service delivery in secondary towns of Rajasthan improved. There are three outputs.

- (i) **Output 1:** Water supply infrastructure in project towns improved with climate-resilient and inclusive features. By 2027: (i) about 1,350 kilometers (km) of water supply pipelines will be commissioned through a district metered area approach for effective non-revenue water (NRW) management; (ii) about 100,000 households will be connected to an improved water supply system (including at least 95% below poverty line [BPL] households) with 100% functional meters allowing for the introduction of volumetric billing; (iii) 3 new water treatment plants (WTP) will be commissioned with total capacity of at least 28 million liters per day (MLD); and (iv) 2 WTPs will be rehabilitated.
- (ii) **Output 2:** Sanitation systems in project towns improved with climate-resilient, cost-effective and inclusive features.⁹ By 2027: (i) about 1,300 kilometers (km) of sewers will be constructed, (ii) 19 sewerage treatment plants (STPs) with co-treatment of wastewater and fecal sludge and with a total capacity of about 80 MLD will be commissioned and 2 existing STPs will be upgraded to meet current effluent standards, (iii) about 103,000 new household connections (including at least 95% BPL households) to sewer system will be installed, (iv) 1 fecal sludge treatment plant with total 10 kiloliters per day (KLD) capacity will be commissioned, and (v) agreements for reuse of wastewater mainly for industry or agriculture will be signed in at least 5 project ULBs.
- (iii) **Output 3:** Institutional and human capacities strengthened for service improvements, gender equality and sustainability. Under the sector project: (i) at least 500 women will gain professional experience through an internship program at RUDSICO, (ii) about 500 staff and 500 elected representatives of project ULBs,

6 The project towns under consideration for the sector loan are: Abu Road, Banswara, Didwana, Fatehpur, Khetri, Kuchaman, Ladnu, Laxmangarh, Makrana, Mandawa, Pratapgarh, Ratangarh, Sardarshahar and Sirohi. Of these towns, Khetri and Mandawa are heritage towns.

7 Government of Rajasthan. 2018. Rajasthan: Urban Water Supply Policy. Jaipur.

8 Government of Rajasthan. 2016. State Sewerage and Wastewater Policy. Jaipur.

9 Climate resilient and inclusive features included are: improvements in the distribution system to reduce losses; rainfall water harvesting; energy-efficient pumps; solar panels at project facilities; pressure control mechanisms in the water system to help avoid losses through pipe bursts; and wastewater reuse for productive uses.

including 80% of eligible women, will report increased knowledge on operation and maintenance (O&M) of WSS services, citywide inclusive sanitation (CWIS), financial sustainability and gender equality and social inclusion (GESI) action plan implementation, (iii) about 500 girls will report enhanced knowledge in conducting water audits in schools and households, and (iv) data platforms will be established in all project towns.¹⁰

2. A series of subprojects will be implemented under the Project, with each subproject providing improvements to water supply or sanitation (on-site and off-site) or both in a project town. Abu Road Town water supply and sewerage subproject is one of the subprojects proposed under RSTDSP. Water supply is currently intermittent and suffers with huge losses and quality issues. At present no proper sewerage system exists in the town. Most of the households depend on septic tanks for disposal of sewage. Effluent from septic tanks and sullage water is let off into open drains which ultimately collect in low lying areas and natural drains in the outskirts of the town. It is therefore proposed to improve water supply and sanitation in the town. For sanitation, sewerage will be limited to the core areas and fecal sludge management will be improved for areas not served by sewers. ADB requires the consideration of environmental issues in all aspects of the Bank's operations, and the requirements for environmental assessment are described in ADB's Safeguards Policy Statement (SPS), 2009. Accordingly, this initial environmental examination (IEE) has been conducted to assess the environmental impacts and provide mitigation and monitoring measures to ensure that there are no significant impacts because of the subproject.

B. Purpose of Initial Environmental Examination Report

3. ADB requires the consideration of environmental issues in all aspects of the Bank's operations, and the requirements for environmental assessment are described in ADB's SPS, 2009. The potential environmental impacts of the subproject have been assessed using ADB rapid environmental assessment (REA) checklist for water supply and sewerage treatment (Appendix 1). Then potential negative impacts were identified in relation to pre-construction, construction and operation of the improved infrastructure, and results of the assessment show that the subproject is unlikely to cause significant adverse impacts. Thus, this IEE has been prepared in accordance with ADB SPS, 2019 requirements for environment category B projects.

4. The Abu Road water supply and sewerage subproject is proposed for implementation under the design-build-operate (DBO) modality, where in which the design is carried out by the selected bidder based on the feasibility/preliminary project report prepared prior to bidding. Thus, this IEE is based on the preliminary project report prepared by RUDSICO-EAP PMU. The IEE was based mainly on field reconnaissance surveys and secondary sources of information. No field monitoring (environmental) survey was conducted, however, the environmental monitoring program developed as part of the environmental management plan (EMP) will require the contractors to establish the baseline environmental conditions prior to commencement of civil works. The results will be reported as part of the environmental monitoring report and will be the basis to ensure no degradation will happen during subproject implementation. Stakeholder consultation was an integral part of the IEE.

5. This IEE will be updated and finalized during detailed design stage to reflect change in scope of works, change in location of component and change in cost due to addition or subtraction

¹⁰ Includes supervisory control and data acquisition system, hydraulic model, geographic information system, and drinking water and treated wastewater quality monitoring system.

of components which can change the environmental impacts. The revised IEE shall supersede the earlier version of IEE and shall be contractually applicable to the contractor after approval from PMU and ADB.

6. The implementation of the subprojects will be governed by Government of India and Rajasthan and other applicable environmental acts, rules, regulations, and standards. Environmental safeguards will be followed in accordance with the ADB SPS, 2009. During the design, construction, and operation of the project the borrower/client will apply pollution prevention and control technologies and practices consistent with international good practice, as reflected in internationally recognized standards.

C. Report Structure

7. This Report contains the following eleven (11) sections including the executive summary at the beginning of the report:

- (i) Executive summary;
- (ii) Introduction;
- (iii) Description of the project;
- (iv) Analysis of alternatives;
- (v) Policy, legal and administrative framework;
- (vi) Description of the environment;
- (vii) Anticipated environmental impacts and mitigation measures;
- (viii) Public consultation and information disclosure;
- (ix) Grievance redress mechanism;
- (x) Environmental management plan; and
- (xi) Conclusions and recommendations.

II. DESCRIPTION OF THE PROJECT

A. Abu Road Town

8. Abu Road is one of the project towns selected for implementation of the ADB funded RSTDSP. Under the investment component of the project, it is proposed to improve the WSS system in Abu Road Town. Abu Road is tehsil headquarter of Sirohi District. It is located at 24°48' N latitude and 72°78' E longitudes on the west banks of river Banas. It has an average elevation of 263 m from the mean sea level. Total area of the Abu Road Town is 1108 hectares comprising of 31 wards.

B. Present Status of Water Supply and Sewerage

9. **Water Supply.** Presently in Abu Road, water supply is being provided through 11 open wells and 13 tube wells. The well field is in the city. The total production from above tube well and open well is 3.75 MLD in summer and 4.7 MLD in winter. Water is supplied on alternate days to consumers. Present water supply system consists of 44 km of transmission mains (80- 250 mm dia) and distribution network of 132 km (80-300 mm). The existing water supply pipes are mainly of asbestos cement (AC) pipes – 37 km of transmission (84%) and 52 km of distribution (40%), and remaining are of galvanized iron (GI), ductile iron (DI) and unplasticized polyvinyl chloride (uPVC). Presently 4 clear water reservoirs (CWRs) and 10 overhead service reservoirs (OHSRs) are available in the town at different locations. There are 31 wards in the town which are organized into 8 zones for distribution. Present population of town is 60,326 (2017) while water production is at the rate of 55 to 70 liters per capita per day (LPCD) and the water is supplied for one and half hour on alternate days. This is less than the Central Public Health and Environmental Engineering Organization (CPHEEO) norms of 135 LPCD. As the raw water source in the town is ground water, no water treatment facility is available in the town. Water is disinfected with bleaching powder (Calcium Hypochlorite) and supplied to consumers.

10. **Sewerage.** Abu Road Municipality does not have any organized sewerage system. Presently wastewater from kitchens and bathrooms is discharged into storm water drains culminating finally to a pond, nallah or on ground, which pollutes the environment and contaminates the ground water. Open defecation is not uncommon. Most of the residential and commercial buildings and educational institutions have on-site septic tanks and soak pits. The sewage is directly let into open drains from the houses with no septic tanks. Septic tanks followed by soak pits are an accepted onsite treatment, however, most of these are not properly designed and/or maintained properly, and have no soak pits, and the effluent is directly let into the open drains.

11. In the absence of safe disposal system of sewage, the people of Abu Road are facing unhealthy and unhygienic environmental conditions therefore public representatives have also demanded facilities of sewerage system on priority basis. Water supply is also not adequate in terms of quantity and quality therefore the town requires sound water supply and sewerage system.

C. Proposed Water Supply and Sewerage Infrastructure in Abu Road under RSTDSP

12. **Water Supply Works.** As described above, the existing water supply system in Abu Road suffers from various issues and resulting inadequate and intermittent supply. It is proposed to improve the water supply system in Abu Road under RSTDSP to meet the following objectives:

- (i) To establish continuous pressurized water supply system to consumers with quality and quantity at required pressure;
- (ii) To establish raw water intake and water treatment to reliably supply the specified quantity and quality of water;
- (iii) To adopt energy efficient water treatment processes and electromechanical machinery;
- (iv) To reduce NRW as per performance indicators using district metering areas (DMA) approach;
- (v) To ensure 100 % house service connections with metering for water supply; and
- (vi) To ensure sustainability of the project by implementing a comprehensive asset management plan focusing on an integrated approach to operation & maintenance to minimize lifecycle costs.

13. **Water Demand and Supply.** Project will provide water supply to the entire population of Abu Road municipality. Besides, it will also provide treated water (bulk supply) to 6 villages (Manpur, Tartoli, Khadar, Umarani, Kui and Santpur) located in the periphery of town. It is proposed that treated water to these villages will be made available at the WTP, and the necessary infrastructure to transmit and distribute water supply in the villages will be developed by Public Health Engineering Department (PHED). Per capital water supply rate of 135 liters per day (LPD) is considered for Abu Road Town, and for villages a per capita rate of 40 LPCD is considered as per the CPHEEO norms. Raw water demand of the town plus 6 villages is estimated as 10.97 MLD (base year 2021), and 15.56 MLD (ultimate design year 2051). As there is no feasible surface water source that can fulfil the entire demand, it is proposed to meet this demand by both surface and groundwater sources. Nearest surface water source – Bhaisa Singh Dam, will provide 10 MLD of water per day and rest of the demand will be met by groundwater sources (tube wells and open wells).

- (i) **Bhaisa Singh Dam.** Located 18 km south of Abu Road, this dam construction was started in 1988 by Water Resource Department for irrigation purpose, and it was completed, and started filling water only recently in 2013-2014. Since then dam water was not utilized for any purpose, and in 2016 dam has been transferred to PHED (Appendix 2) for utilizing it for drinking water purposes. The gross and live storage capacity of the dam respectively are 180 million cubic feet (MCFT) or 5 million cubic meter (MCM) and 163 MCFT (4.6 MCM). PHED has confirmed allocation of dam water storage fully (100% allocation) to Abu Road Town and six villages in periphery of the town (Appendix 3). This subproject also includes demand of six towns besides Abu Road. It is estimated that, at 75 % dependability, the dam will provide 10 MLD of water throughout the year.
- (ii) **Groundwater.** It is proposed that the remaining demand of 0.97 MLD (in base year 2021) and 5.51 MLD (in ultimate design year 2051) will be met by groundwater sources. This water will be provided by both existing wells (11 open wells and 13 tube wells), and 18 new tube wells that will be drilled at various locations in the town to fulfil the ultimate demand. Given less than 100% dependability of dam, in the low rainfall years, the deficit from the dam, if any, will be met by tube wells, and accordingly the water abstraction from groundwater sources will be increased as required.

14. **Water Treatment.** A 10 MLD water treatment plant is proposed to treat the surface water from Bhaisa Singh Dam. Groundwater quality is fit for drinking; therefore, only disinfection is proposed prior to supply. Chlorinator units are proposed at all five headworks in the town. At these

headworks, treated water from WTP, and groundwater from tube wells will be collected in CWRs and combined water is chlorinated prior to distribution from CWRs.

15. **Water Distribution.** The entire town is divided into 8 water supply zones. Except Zone 5, all the zones will be supplied by direct pumping into distribution network. In Zone 5, an existing ground level service reservoir (GLSR) on a hillock will be utilized and water will be supplied via gravity.

16. **Operation and maintenance of water supply system.** The DBO contractor will operate and maintain the system for a period of 10 years after completion of construction and commissioning the new / improved system. This will include the following:

- (i) Drawing raw water from Intake to the WTP including raw water pumping main and maintenance of entire raw water system;
- (ii) Drawing ground water from tube well / open well to the CWR through transmission main including raw water pumping main and maintenance of entire raw water system;
- (iii) Operating and maintenance of all the proposed clear water pumping stations to fill all the CWRs through transmission pipe lines and also direct pumping to distribution system and operation of chlorination system, maintenance of complete system and maintaining the infrastructure and maintaining the specified water levels at each of the reservoirs throughout the operation and maintenance period;
- (iv) Managing the distribution network for distributing water efficiently, equitably and minimizing NRW and maintaining the infrastructure on DMA basis in the distribution network;
- (v) Providing continuous pressurized water supply with improvement in level of service on continuous basis to the connected consumers and maintaining the infrastructure while meeting the performance indicators. 12 meter (m) pressure head shall be maintained at all ferrule points;
- (vi) Meter reading, customer services and maintaining the infrastructure in water supply sector;
- (vii) Meter reading, bimonthly billing, bill distribution, revenue collection and customer services and maintaining the infrastructure in water supply;
- (viii) Sampling treated water received at all the CWRs and from random points within the zones/DMA to ensure that it meets the potable water specification and monitor on monthly basis;
- (ix) Assessing and minimizing non-revenue water and locating the causes for high NRW and bringing down the NRW level within the 7% for DMA, and 15% of raw water;
- (x) Provide consumer service connections on approval or sanction by employer representative;
- (xi) Contractor will provide continuous on-the-job trainings that will start from the day the contractor gets mobilized, and other capacity building programs by the contractor as important regular activities for staff of the employer, PHED and local body; and
- (xii) Maintain environmental and safety norms at entire system components.

17. **Sewerage works.** Under RSTDSP, it is proposed to develop a sewerage system in Abu Road Town to collect, treat, and dispose/reuse the domestic wastewater safely. This is being provided in a combination of underground sewerage system including treatment facility, and Fecal Sludge and Septage Management (FSSM) system in areas that are not fully developed at present

and not feasible to provide sewer network. About 91% of the total base year population (2021) is proposed to be covered by sewerage system, while the rest 9% will be covered by FSSM. The objectives of the proposed sewerage works are:

- (i) Construction of sewerage network, including house sewer connection and collection of wastewaters from point of generation;
- (ii) Construction of energy efficient and mechanized STP and electromechanical machinery;
- (iii) Septage management and decentralized wastewater treatment systems in suitable areas;
- (iv) Provision for reuse of treated effluent etc.;
- (v) To ensure 100 % house service connections for wastewater collection; and
- (vi) To ensure sustainability of the project by implementing a comprehensive asset management plan focusing on an integrated approach to O&M to minimize lifecycle costs.

18. The sewer system will be designed as a separate sewer system that carries only the domestic wastewater. The open drain system that exists in the town will cater to storm runoff. No industrial wastewater will be allowed into the sewers. This subproject complies with the environmental subproject selection criteria agreed between the government and the ADB (Appendix 4).

19. **Sewage treatment.** It is proposed to develop sequential batch reactor (SBR) based sewage treatment facility that will treat the incoming sewage to stringent discharge standards specified in this IEE and included in the bid documents. SBR is a cyclic activated sludge treatment process and provides highest treatment efficiency possible in a single step biological process. Two STPs with capacities of 6.9 MLD and 2.3 MLD are proposed as part of the project in Abu Road to meet the demand.

20. **Reuse of treated effluent.** The Rajasthan State Sewerage and Wastewater Policy, 2016, promotes the reuse of treated sewage for non-potable applications, and also to make sewerage projects environmentally sustainable. This policy:

- (i) aims to ensure improved health status of urban population, specially the poor and under privileged, through the provision of sustainable sanitation services and protection of environment;
- (ii) promotes the reuse and provides guidance on the same;
- (iii) prioritizes reuse in irrigation (agriculture, forestry, and landscaping), followed by fish farming, industry and non-potable domestic reuse;
- (iv) requires monitoring of treated wastewater quality, soil quality etc.;
- (v) prohibits artificial recharge of aquifers using treated wastewater, and promotes construction of storage tanks to store treated wastewater to facilitate reuse;
- (vi) prescribes that the detailed project report (DPR) of a sewerage project should clearly define the best reuse option specific to the town and prepare a reuse action plan part of the DPR duly following the water quality norms and legal implications; and
- (vii) suggests use of sludge produced from the treatment as fertilizer and soil conditioner after processing.

21. To further the implementation of the Policy, to promote the reuse and provide guidance to the stakeholders, the LSGD is currently in the process of publishing "Guidelines for Reuse of

Treated Wastewater in Rajasthan, 2019. These guidelines:

- (i) promote the use the treated wastewater and envisages to maximize the collection and treatment of sewage generated and reuse of treated wastewater on a sustainable basis, thereby reducing dependency on freshwater resources; and
- (ii) promotes the use of treated wastewater as an economic resource.

22. Under the subproject, following the State Policy, treated effluent will be reused in applications such as agriculture, horticulture, development of urban forestry and industry, as appropriate. A Treated Effluent Reuse Plan will be prepared by the DBO Contractor during the detailed design phase as envisage by the State Policy, and reuse modalities will be firmed up. To facilitate reuse and supply of treated effluent, a TESR, effluent pumping station and a TEER are proposed at the STP in the subproject. Total storage capacity of TESR and TEER at each STP is 15% of respective STP treatment capacity. Treated effluent will be chlorinated prior to its entry into TESR/TEER.

23. **Discharge of treated wastewater.** The excess / surplus treated wastewater that is not reused will be discharge into Banas River, and necessary facilities – pipelines and pumping requirements, will be developed.

24. **Sludge treatment and disposal.** A Sludge Sump shall be provided to collect thickened sludge from SBR basins. Supernatant from the sump will be returned to inlet/equalization tank for treatment. Sludge from sump will be pumped to sludge thickener, and the thickened sludge will be pumped to mechanical sludge dewatering system (such as centrifuge). Dewatered sludge cake will further air dried in a sludge storage shed for 15 days and disposed in an identified site.

25. **Operation & maintenance of sewerage system.** The DBO contractor will operate and maintain the system for a period of 10 years after completion of construction and commissioning the new system. This will include the following:

- (i) Sewage pumping system to pump sewage to STP including maintenance of entire system and maintaining the infrastructure (power charges to be paid by the Employer);
- (ii) STP including maintenance of entire system and maintaining the infrastructure (power charges to be paid by the Employer);
- (iii) Managing the sewerage network for collection of sewage including maintenance of entire system from property chambers up to disposal outfall of Sewage to STP;
- (iv) Sampling treated effluent to ensure that it meets the guaranteed treatment parameters;
- (v) Provide house connections for collection of sewage from house properties on approval or sanction by Employer;
- (vi) Contractor will provide continuous on-the-job trainings that will start from the day the contractor gets mobilized, and other capacity building programs by the contractor as important regular activities for staff of the Employer, PHED and Municipal Council / Corporation Abu road; and
- (vii) Maintaining environmental norms at entire system components.

26. **Fecal Sludge and Septage Management.** It is proposed to provide FSSM system in areas where the population density is low (less than 100 persons per hectare) and will not generate sewage in adequate quantity to convey by sewer network. FSSM will provide low cost sanitation in areas where sewer network is not an immediate requirement, will make septage collection, treatment and effluent management environment- friendly. Of the 31 wards in Abu Road, there

D. Proposed Subproject Components

29. Table 1 shows the nature and size of the various civil works components of this water supply and sewerage subproject in Abu Road. Conceptual layout plans and alignments are shown in Figures 2 to 13.

30. Subproject is proposed for implementation under DBO modality, wherein which the successful bidder will design the water supply and sewerage systems and components (based on the feasibility/preliminary design/standards/guidelines provided in the bid document), construct, commission, and operate for 10 years, after which it will be transferred to Abu Road Municipality. Therefore, at this stage, subproject is designed only in outline, and the details of components of the subproject provided in the table below are as finalized at this stage based on the preliminary designs and as included in the bid documents. This IEE is based on the subprojects and components detailed in the below table, and the IEE will be further updated during the detailed design phase.

Table 1: Proposed Abu Road Subproject Components

Infrastructure	Function	Description	Location
Water Supply			
Water intake facilities	Raw water abstraction from Bhaisa Singh Dam and pumping to WTP	<i>New</i> Capacity of intake and pumping house to abstract 10 MLD water - Intake well cum pump house (diameter - 10 m height - 12 m) - Approach bridge / road - Pumping machinery	Intake well cum pump house will be built in Bhaisa Singh Dam / Reservoir. Dam is under the control of PHED. Raw water pipeline will be laid underground from the intake well intake to WTP site along existing road and along river
Tube Wells	Abstract groundwater	<i>New</i> 18 nos. - Drilling new tube wells, fixing pipes, casing, pumping equipment - Depth: 140-160 m - Drilling hole: 445 mm diameter - Submersible pumps <i>Rehabilitation</i> 11 open wells and 13 tube wells - Replacement of pipes, pumps, valves, all electro-mechanical items etc.,	
Raw water main	Convey raw water from intake to WTP	<i>New</i> 8.5 km length 400 mm diameter DI pipe	Along the existing roads from intake to WTP
Water Treatment Plant	Treatment of raw water to meet the drinking water	<i>New</i>	Proposed WTP site is located in within the existing PHED headworks at Santpur. Land

Infrastructure	Function	Description	Location
	standards	10 MLD capacity water treatment plant with arrangements: • Alum coagulation & flocculation • Sedimentation, • Rapid gravity filtration, • Disinfection with chlorination • Wash water recovery • Sludge drying beds • Laboratory, office etc., Clear water reservoir of 2400 KL capacity	owned by PHED (24°27'49.31"N 72°45'10.62"E)
Clear water pump houses	To provide adequate pressure in water supply system to distribute to consumers directly/transmit water to overhead tanks for gravity supply	<i>New: 6 nos.</i> • Pump rooms with all mechanical and electrical equipment • Office areas and wash/toilet facilities <i>Rehabilitation</i> Four existing pump houses at Market area, Housing Board, Gandhi Nagar and Santpur will be rehabilitated as required including: civil repairs, replacement of electro-mechanical items, and provision of SCADA	1. Gandhi Nagar Pump House 2. Luniya Pura Pump House 3. Santpur pump house 4. Market Area Pump House 5. At Housing Board Pump House 6. Pump House Gandhi Nagar
Transmission system	Water transmission from intake to WTP to CWRs to distribution	<i>New</i> • 32.44 km length 100- 400 mm diameter DI pipes	Transmission pipelines will be mostly laid along the main roads. Pipes will be laid underground.
Clear water reservoirs	Store clear water for supply	<i>New: 5 nos. with following capacity</i> • 300 kl • 850 kl • 600 kl • 500 kl • 300 kl <i>Rehabilitation</i> • Existing GLSR at Gandhi Nagar and OHSR at Housing Board will be rehabilitated as required including: civil repairs, replacement of electro-mechanical items, and provision of SCADA	New CWRs at following places: 1. Santpur (Nayakheda) 2. Market area (Andheshwar) 3. Gandhi Nagar 4. Housing Board 5. Luniyapura Land owned by PHED
Chlorinator system	Post chlorination / disinfection of	<i>New</i>	1. Santpur (Nayakheda)

Infrastructure	Function	Description	Location
	water prior to supply	5 nos. chlorinator room and vacuum feed chlorination system of capacity 1 kg per hour (one at each CWRs)	2. Market area (Andheshwar) 3. Gandhi Nagar 4. Housing Board 5. Luniyapura
Distribution network	To distribute water to consumers	New 134 km 133 km HDPE pipes 75-315 mm diameter 1 km DI pipes 100 – 300 mm diameter	Pipes will be laid underground along the public roads/streets covering entire area of the town; Majority of the existing pipes are of AC; new pipes will be laid without distributing the existing pipes, which will be left as it is in the ground untouched
Bulk Water Meters	Monitor water flow in the improved network	New As per the requirement – to be finalized during the detailed design	Fixed at strategic locations in network as per the design., bulk meters will be fixed with the pipe section
Consumer connection with flow meters	Provide water to consumers and measure water usage	New Consumer connection with meters 12,800nos,	Water delivery pipe (PE of dia 20 - 25 mm) will be connected to distribution lines and meters will be attached to the delivery pipe at each house with a meter chamber
Offices for costumer relation and control centers for water supply operation	Consumer relations and SCADA system control for entire water supply system	New - Consumer Relation Management Centers (CRM) – 2nos. - Central Control Center (CCC) – 1 nos. - Master Control Center- 1 nos.	1. CRMs and CCC will be constricted on government owned lands 2. MCC will be constructed at Santpur WTP
Sewerage			
Sewage collection network including house connections	Collect wastewater from houses and convey by a combination of gravity and pressure pumping to pumping station and ultimately to the STPs	New 105 km of diameter 200-800 mm 87 km HDPE DWC pipes 3.5 km RCC pipes 14.5 km HDPE PN6 pipes - Manholes, house sewer connections House Sewer Connections- 11,600.	Sewers will be laid underground in the roads and internal streets in the town. Sewers will be located in the center of the road. The existing/proposed water pipes are/will be located on one or either side of the roads, and therefore sewers will be laid in the center without distributing the water pipes. It is proposed that 16 km length of sewers will be laid by trenchless method; these will include highway /main road crossings, and the sewers to be laid deeper than 3.5 m
Sewage Treatment	Treatment of collected	New – 2 STPs 6.90 MLD	1. Near Moksh Dham at Santpur; land owned by

Infrastructure	Function	Description	Location
Plant (STP)	wastewater to meet stipulated discharge standards	• 2.30 MLD Components • SBR (sequential batch reactor) based STP with primary, secondary, tertiary treatment • Disinfection of treated wastewater for reuse – chlorination tank • sludge management (sludge collection, thickening, dewatering and disposal) • Laboratory, and online testing facilities for BOD, COD, TSS etc.,) • Instrumentation, automation, SCADA etc.,	government (24°28'37.97"N, 72°45'39.95"E) 2. Near Banas River at Manpur, land owned by government (24°29'38.15"N 72°47'14.49"E)
Treated wastewater storage tanks	Store the treated wastewater for reuse, and also provide adequate pressure / elevation for supply	<i>New</i> • Treated Effluent Storage Reservoir (TESR)– 2 nos. (1 each at STPs) – 690 KL & 230 KL • Treated Effluent Elevated Reservoir (TEER) – 2 no.s (1 each at STPs) – 345 KL & 115 KL • Provision for mobile tanker filling points and rising mains/ distribution system, bypass/overflow arrangements at the TEER to facilitate reuse • Instrumentation, automation, SCADA etc.,	At two STPs Santpur and near Banas River
Outflow sewer	Disposal of treated effluent – surplus/excess treated effluent that is not put to reuse will be discharged through outflow sewer	• Outfall sewer / effluent discharge pipe • This will be designed during the detailed design phase	From STP outlet to West Banas River along government owned vacant lands / existing roads
FSSM			
Truck mounted mobile desludging equipment	Desludging of septage from household pits/ septic tanks, transportation & discharge to STP	• mobile tankers with suction and discharge arrangements – number of tankers to be procured will be estimated during the detailed design	Mobile equipment

E. Subproject Benefits

31. The subproject is primarily designed to improve environmental quality and living conditions of Abu Road Town through provision of water supply and sewerage. The benefits arising from this subproject include: (i) increased availability of potable water at appropriate pressure to all households including urban poor; (ii) reduced time and costs in accessing alternative sources of water. (iii) better public health particularly reduction in waterborne and infectious diseases; (iv) reduced risk of groundwater contamination; (v) reduced risk of contamination of treated water supplies; and, (vi) improvement in quality of water bodies due to disposal of treated effluent meeting disposal standards.

F. Implementation Schedule

32. After the completion feasibility study /preliminary designs, bids were invited in March 2019 for the subproject to be implemented under the DBO modality. Bids will be awarded in March 2020. Successful bidder then will carry out detailed designs and construction is likely to take about 48 months. After completion of construction and commissioning, scheme will be operated by DBO contractor for 10 years, and after which the O&M will be carried out by ULB.

Figure 2: Location of Proposed Water Supply Components

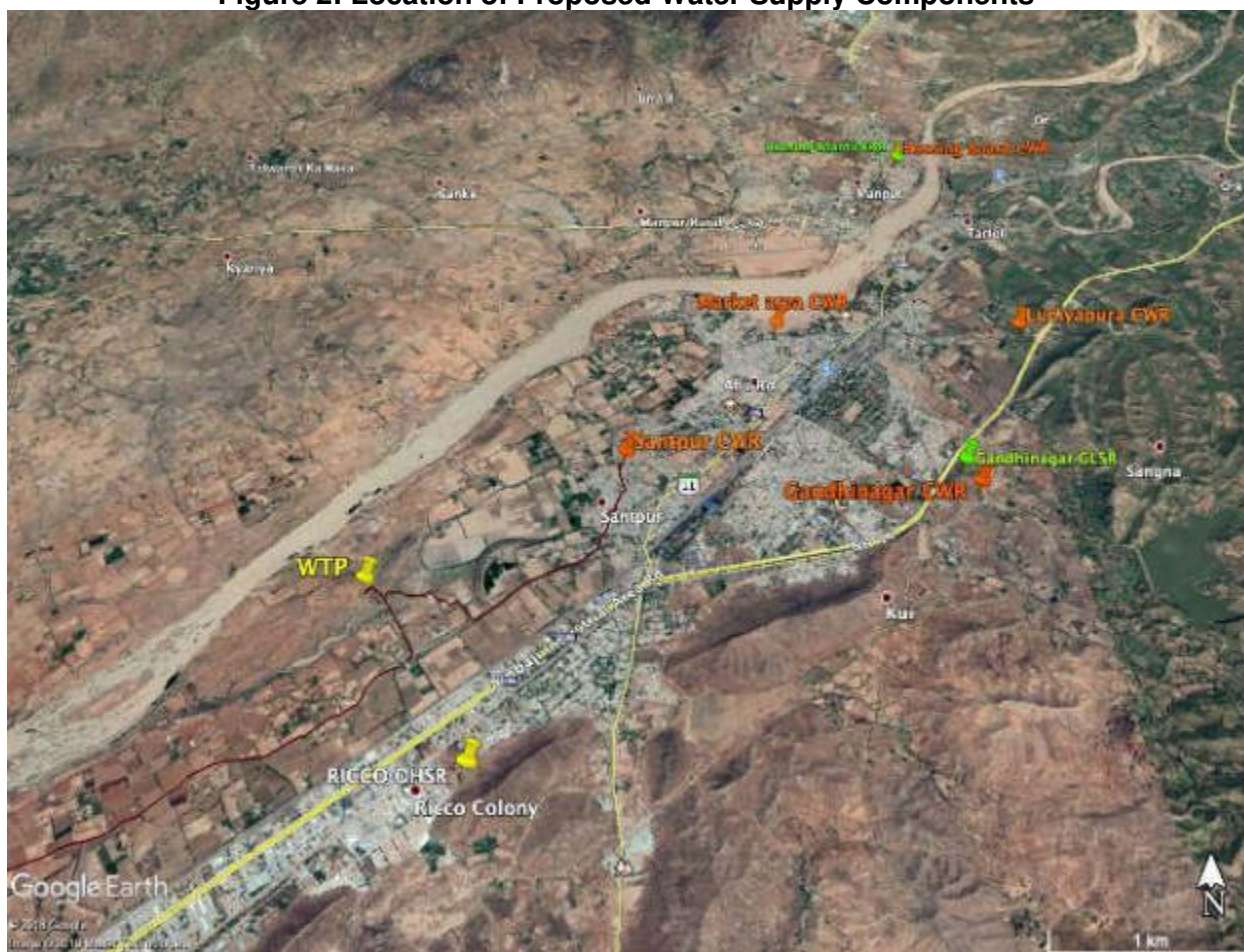


Figure 3: Raw Water Alignment from Dam to WTP

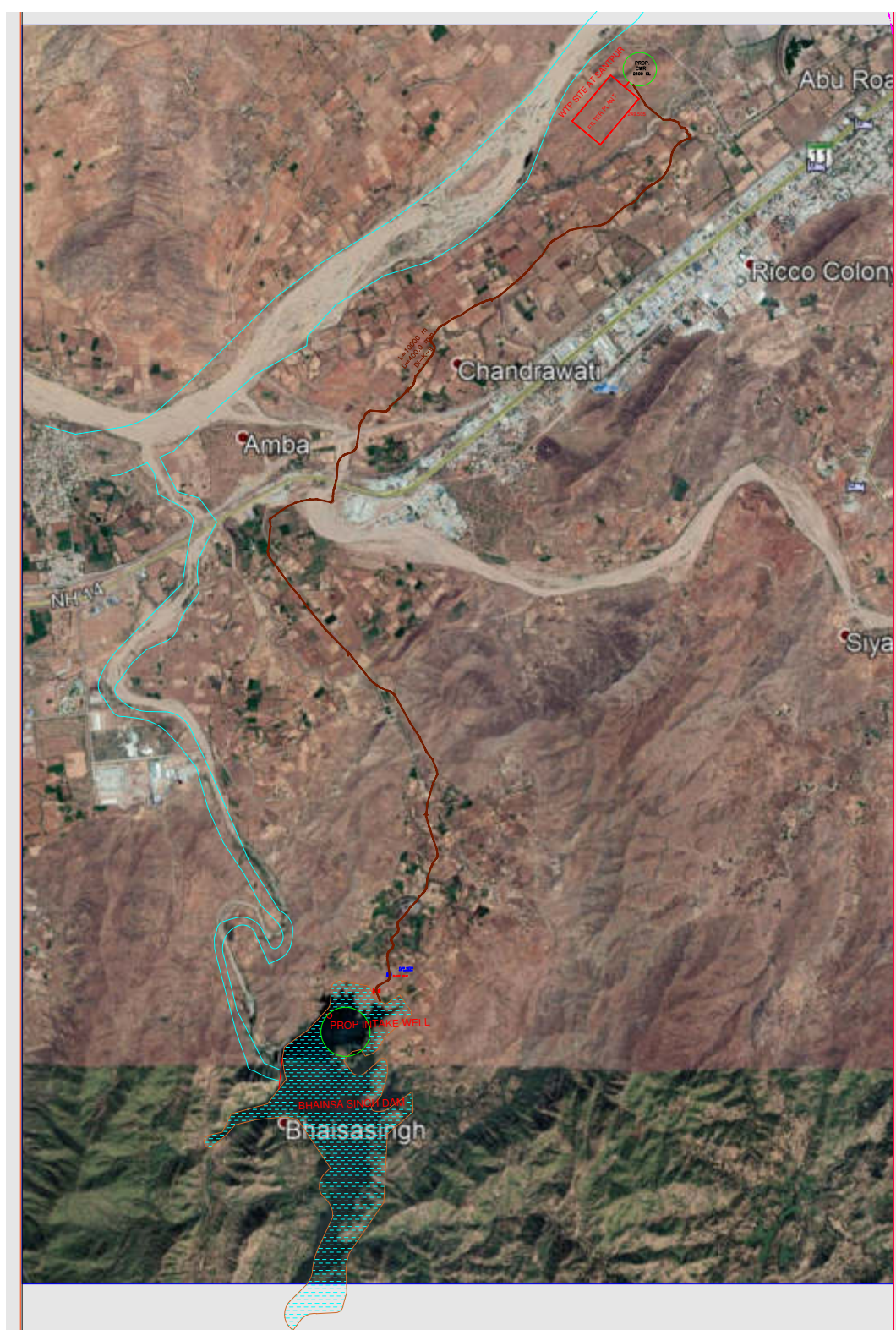


Figure 4: Proposed Water Supply Improvements in Abu Road



Figure 5: Location of Proposed Sewerage Components



Figure 6: Proposed STP1 at Santapur and Discharge Location

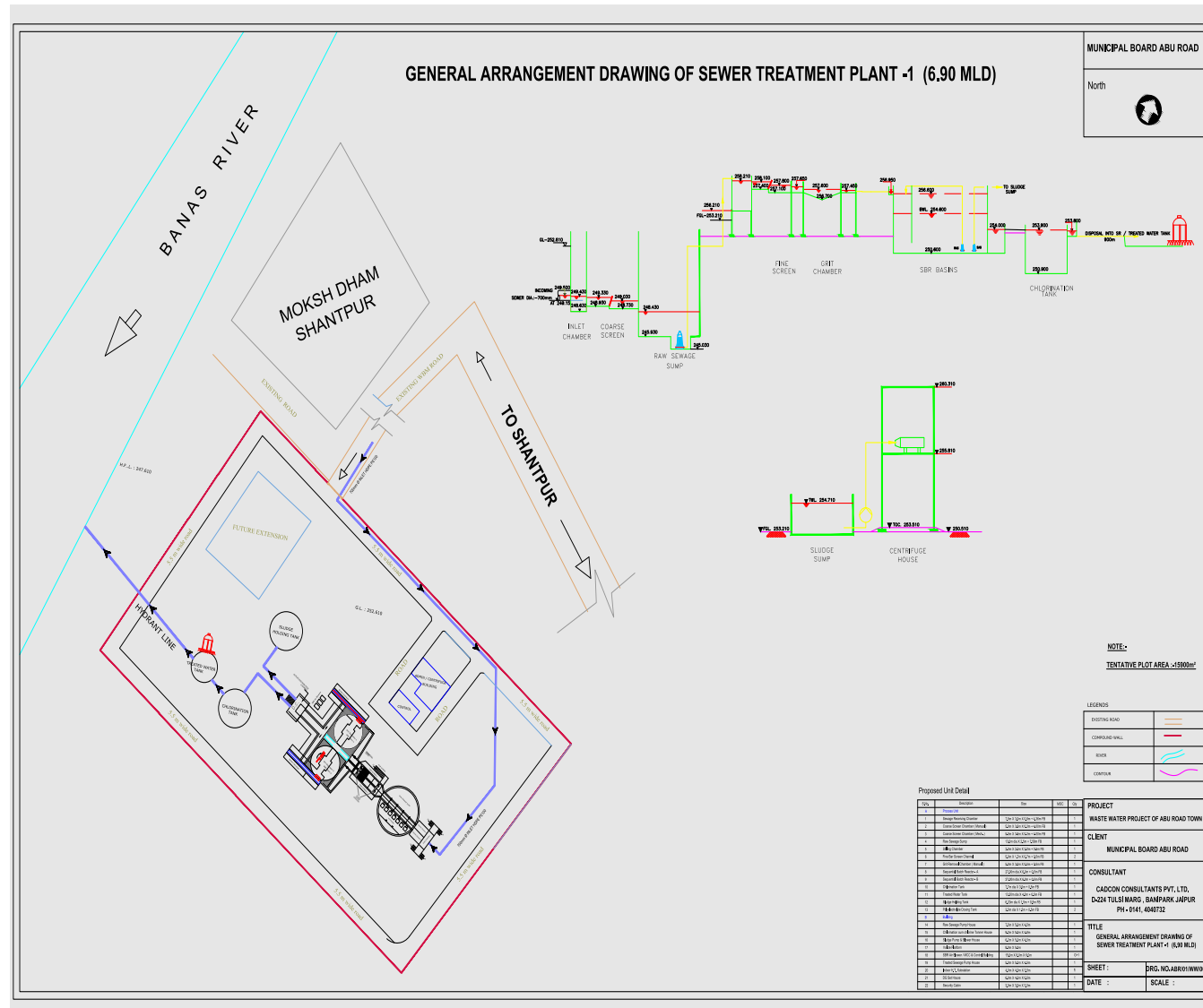


Figure 7: Proposed STP2 at Manpur and Discharge Location

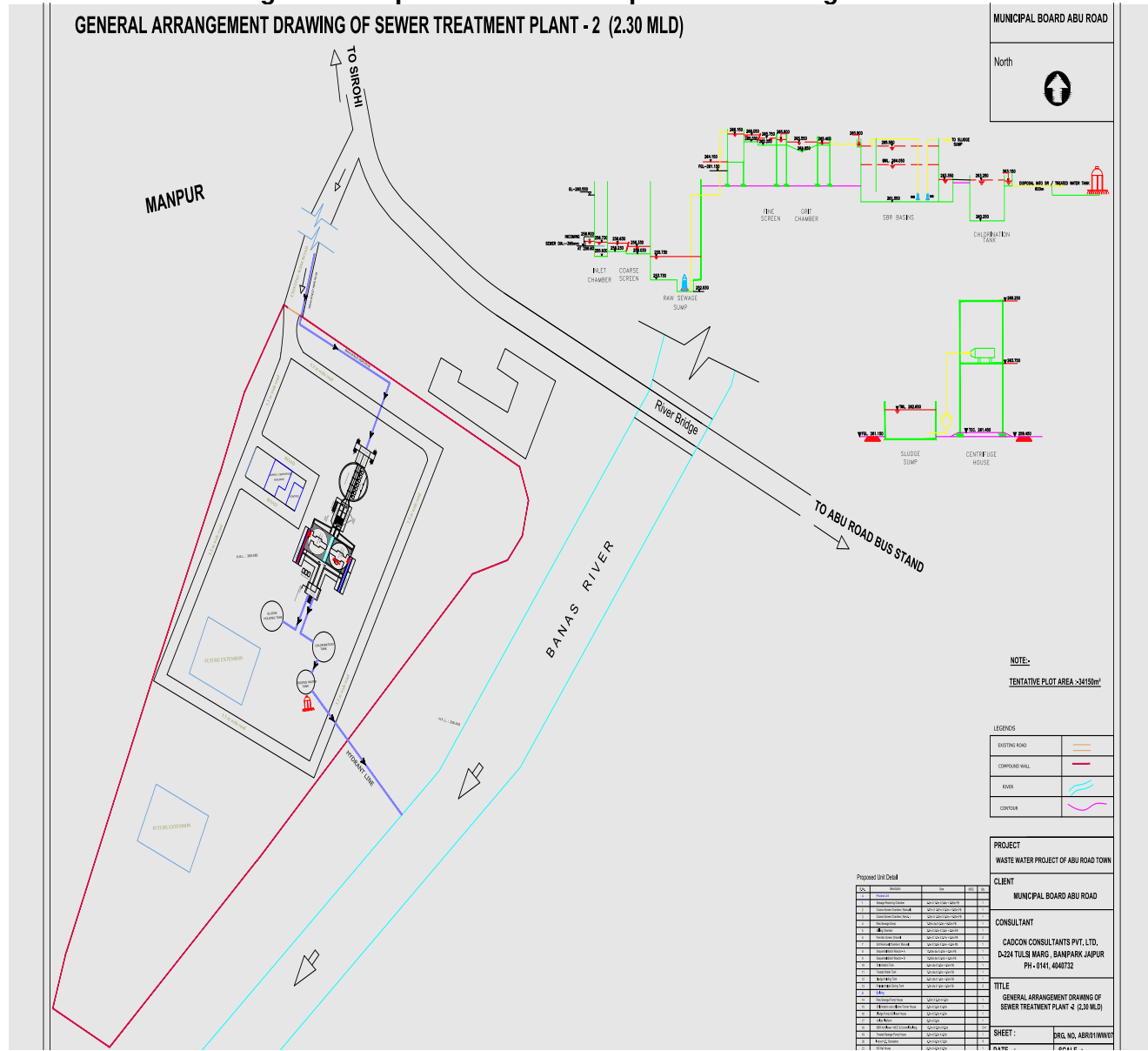


Figure 8: Proposed Sewer Network Coverage – Abu Road Town

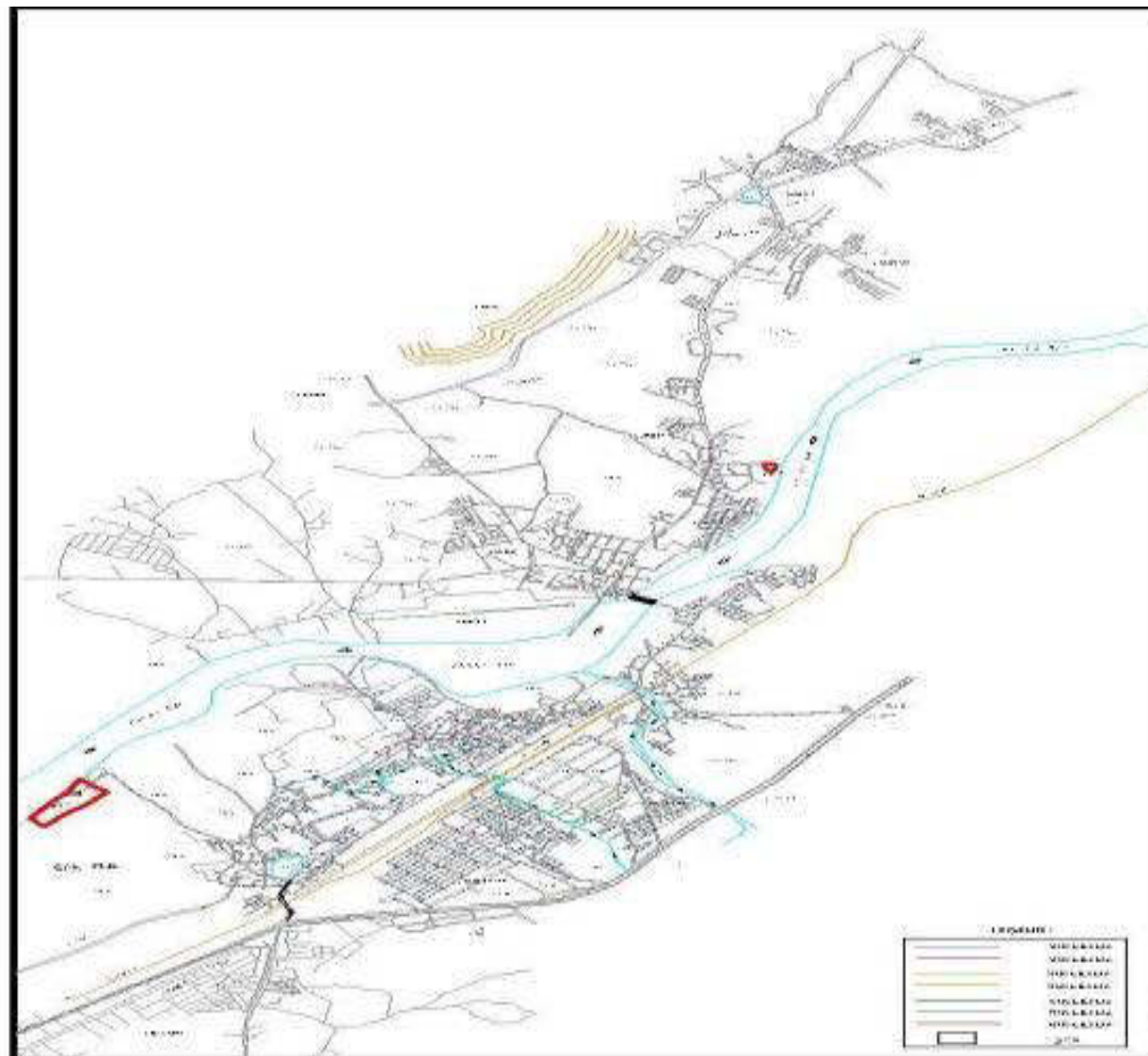


Figure 9: Layout Plan of proposed STP in Abu Road with SBR Technology

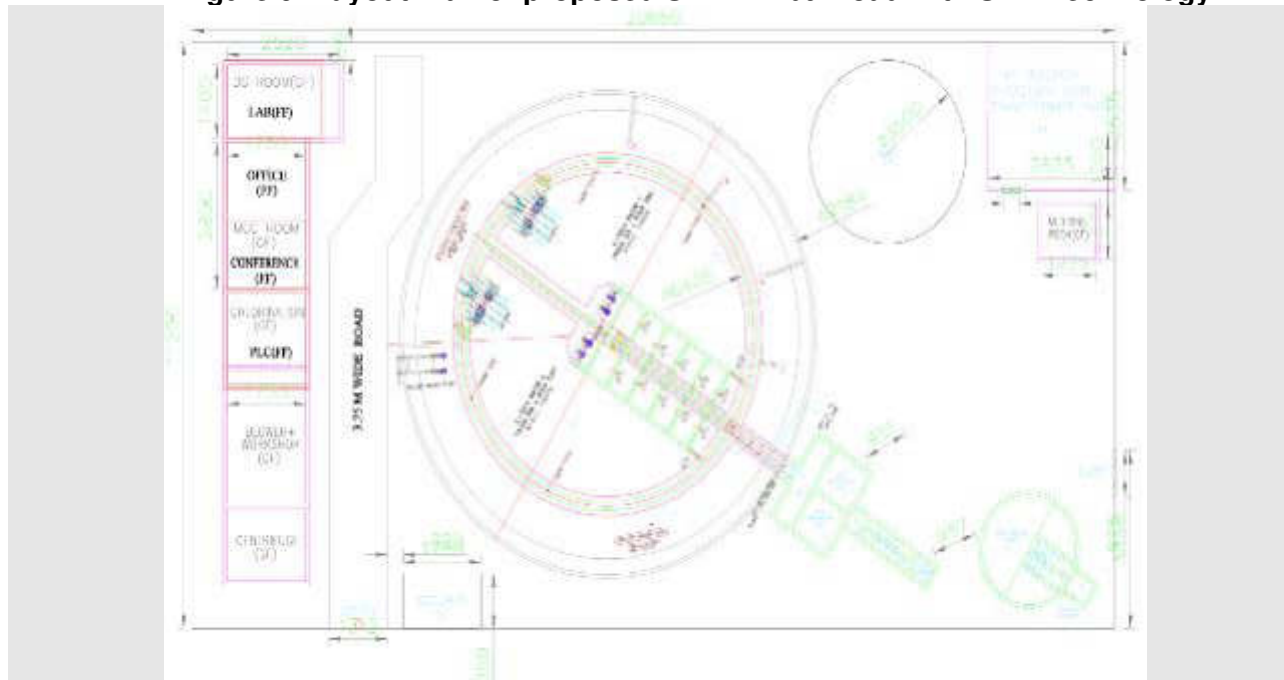


Figure 10: STP 1 Site and Discharge Points

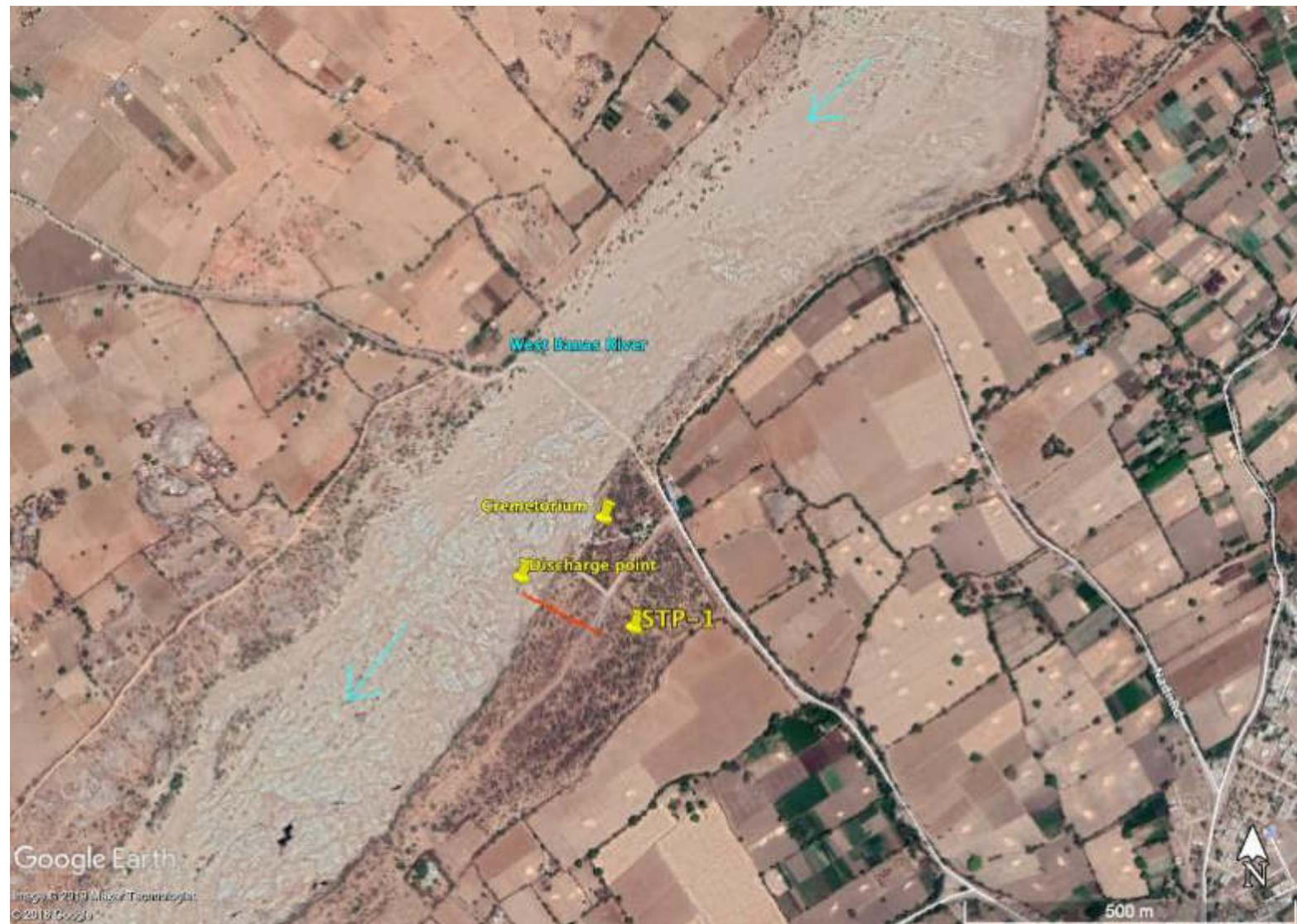


Figure 11: STP 2 Site and Discharge Points



Figure 12: Layout of the Treated Effluent Elevated Reservoir (TEER)

III. ANALYSIS OF ALTERNATIVES

33. The SPS requires an analysis of project alternatives to determine the best method of achieving project objectives (which is providing potable water to people, and safely collecting and disposing the human waste generated, in Abu Road Town, in this case) while minimizing environmental impacts. Alternative analysis provides opportunity to integrate environmental considerations into early stages of project (i.e., pre-feasibility or feasibility study), so that adverse environmental impacts can be avoided or minimized by various alternatives. It also provides opportunity to study various options vis a vis costs, provides a logical base, via transparent process, assist in decision making, gaining public support and ultimately in project approvals and timely implementation.

34. The proposed water supply subproject component in Abu Road include source augmentation to provide adequate water, water conveyance, treatment, storage and distribution. Similarly, the sewerage component includes sewage collection network, transmission, treatment and treated wastewater reuse and disposal. Descriptions of various alternatives considered for critical components such as water source, sewage treatment, treated wastewater disposal etc., are presented in the following Table.

Table 2: Analysis of Alternatives

1.	Project Need – No Project Alternative
Type of alternative	'No project' alternative
Description of alternatives	Abu Road subproject is proposed to improve the service levels of basic infrastructure – water supply and sewerage, which will ultimately improve At present, Abu Road residents suffer from inadequate, intermittent and low-pressure supply at a rate of 55 to 70 liters per capita per day (LPCD), which is considerably less than the norm of 135 LPCD. Water is supplied on alternative days, for a duration of just 1.5 hours. System is old, inefficient, and leakages are frequent in water pipes, and consequently water losses are high. At present there is no sewerage system in the town; households depend on individual septic tanks or direct discharge into open drains that meant for surface drainage. There are no soak pits, and the effluent discharge into open drains. The untreated / partially treated sewage flow in the open drains through habitation areas and discharged into West Banas River. Living conditions due to lack of proper water supply and sewerage, are poor, unhealthy, unhygienic. Lack of infrastructure is also causing environmental pollution, overall poor quality of life. Poor environmental quality affects the urban poor more. The project intends to provide following benefits to the town population, and the "no project" alternative will deprive people of these benefits: (i) increased availability of potable water at appropriate pressure to all households including urban poor; (ii) reduced time and costs in accessing alternative sources of water. (iii) better public health particularly reduction in waterborne and infectious diseases; (iv) reduced risk of groundwater contamination; (v) reduced risk of contamination of treated water supplies; and, (vi) improvement in quality of water bodies due to disposal of treated effluent meeting disposal standards
Selected Alternative	Without subproject would yield the town to be continuously under-serviced that puts the health of the general public at an increasing risk and could potentially worsen the living environment. This 'no project' scenario would impede further social and economic development of the district and the defer commitments to improve the proportion of the population with sustainable access to clean water and basic sanitation.

	Given the large-scale benefits to the population and environment, 'no project' alternative is considered inappropriate																							
2	Alternative source of water																							
Type of alternative	'Water source'																							
Description of alternatives	Groundwater. At present water supply in Abu Road is fully groundwater based; 3.105 - 4.23 MLD of water is abstracted from 24 tube wells and open wells, while the water demand of the town estimated as 10.97 MLD (base year 2021) and 15.56 MLD (design year 2051). Given the semi-critical nature of groundwater development as per Central Groundwater Board, depending entirely on groundwater for water supply is considered unsustainable. Surface water. Bhaisa Singh Dam, 18 km from Abu Road, is considered as a source. Although construction started in 1988, the dam became operational 2013-14. Dam water never utilized for its intended irrigation purpose or for any other purpose till now. In 2016 dam is transferred to PHED for drinking water purposes, and PHED in turn allocated this water to Abu Road Town. With the available capacity, it is assessed that the dam, at 75% dependability, can supply 10 MLD of water throughout the year. Given recent origin, water availability over a long term is unavailable. There are no other feasible surface water sources to Abu Road Town. Combined ground and surface source – adoption of conjunctive use: Either the groundwater or surface water is not able to fulfil the projected town demand, and therefore it is proposed to utilize both the source optimally. That is 10 MLD water is provided from dam, and remaining supply gap will be met by tube wells/open wells. Additional 18 tube wells are proposed. Given less than 100% dependability of dam, in the low rainfall years, the deficit from the dam will be met by tube wells, and accordingly the water abstraction from groundwater sources will be increased as required.																							
Selected Alternative	Selected source: Combined ground and surface source – Existing tube wells and open wells + new tube wells + Bhaisa Singh Dam																							
3	Sewage treatment process																							
Type of alternative	Sewage treatment technology																							
Description of alternatives	Various secondary treatment technologies have been considered in the sewage treatment process after the primary treatment consisting of screening and grit removal. Secondary treatment is the critical process that removes the organic putrescible organic matters and brings down the BOD of the effluent to meet the discharge standards. Following process technologies considered: Waste Stabilization Ponds; Aerated Lagoons; Up Flow Anaerobic Sludge Blanket (UASBR) + FAL; Conventional Activated Sludge Process; and Cyclic Activated Sludge Process/Sequential Batch Reactor (SBR) A comparison of various treatment technologies is presented below in terms of merits of the process over key parameters like quality characteristics and land requirement: <table border="1"> <thead> <tr> <th>Item</th><th>Conventional Activated Sludge</th><th>Extended Aeration</th><th>UASB followed by Facultative Aerobic Lagoon</th><th>Cyclic Activated Sludge Process / SBR</th></tr> </thead> <tbody> <tr> <td>Performance (Typical)</td><td>Mostly stable</td><td>Mostly stable</td><td>Varying with temperature variations</td><td>Complete Stable</td></tr> <tr> <td>BOD</td><td><30 ppm</td><td><30 ppm</td><td><30 ppm</td><td><10 ppm</td></tr> <tr> <td>COD</td><td><250 ppm</td><td><250 ppm</td><td><250 ppm</td><td><100 ppm</td></tr> </tbody> </table>				Item	Conventional Activated Sludge	Extended Aeration	UASB followed by Facultative Aerobic Lagoon	Cyclic Activated Sludge Process / SBR	Performance (Typical)	Mostly stable	Mostly stable	Varying with temperature variations	Complete Stable	BOD	<30 ppm	<30 ppm	<30 ppm	<10 ppm	COD	<250 ppm	<250 ppm	<250 ppm	<100 ppm
Item	Conventional Activated Sludge	Extended Aeration	UASB followed by Facultative Aerobic Lagoon	Cyclic Activated Sludge Process / SBR																				
Performance (Typical)	Mostly stable	Mostly stable	Varying with temperature variations	Complete Stable																				
BOD	<30 ppm	<30 ppm	<30 ppm	<10 ppm																				
COD	<250 ppm	<250 ppm	<250 ppm	<100 ppm																				

	Suspended solids	<50 ppm	<50 ppm	<100 ppm	<10 ppm
	Total Nitrogen	No Treatment	No Treatment	No Treatment	<10 ppm
	Total Phosphorous	No Treatment	No Treatment	No Treatment	<2 ppm
	Coliform removal, %	60-90	60-90	-	99.99%
	Re-use Options	can only be used for low end usages like flushing and gardening tertiary treatment required for high and usages like construction water, industrial usages, cooling water etc.	can only be used for low end usages like flushing and gardening tertiary treatment required for high and usages like construction water, industrial usages, cooling water etc.	can only be used for low end usages like flushing and gardening tertiary treatment required for high and usages like construction water, industrial usages, cooling water etc.	Can be used for low end usages as well as for high end usages without any tertiary treatment.
	Land requirement (m ² /person)	0.1-0.18	0.08-0.15	0.2-0.25	0.035-0.07
	Process Power requirement (kWh/person/year)	12-15	16-19	4-5	6-8
	Sludge handling	Sludge needs digestion prior to drying on beds or use mech. devices	Digested sludge, dry on beds or use mech. devices	Digested sludge, dry on beds or use mech. Devices	Digested sludge, dry on beds or use mech. devices
	Equipment requirement (excluding screening and grit removal)	Aerators, recycle pumps, scrapers, thickeners, digester, dryers, gas equipment	Aerators, recycle pumps, sludge scrapers, (for large settlers)	Nil (gas collection optional)	Diffuse aeration system, recycle sludge and waste sludge pumps, decanters
	Operational characteristics	Skilled Operation required	Simpler than activated sludge	Simpler than activated sludge	Complete automatic operation by computer and PLC. Negligible manpower Intervention required
	Special features	Considerable equipment and skilled operation required especially if gas collection and usage involved. Method considered mainly for large sized plants	BOD removal high, effluent nitrified relatively high power requirement, favoured for small and medium sized plants	Minimal to negligible power requirement of the system makes it an economical alternative if gas revenue is neglected land requirement is also relatively small but depends on	Highest treatment efficiency with crystal quality power requirement is 50% of conventional technologies land requirement is less than 50% of conventional technologies

				type of past treatment adopted															
Selected Alternative	Selected processes: Sequential batch reactor (SBR) The genesis of selecting a suitable treatment process is primarily correlated with degree of treatment aimed to be achieved. In India, the latest court Order of April 2019 (NGT Order dated 30 April 2019) mandates all the civic authorities to adopt the treated sewage characteristics applicable are as shown in table below: <table><tr><td>Parameter</td><td>Standards</td></tr><tr><td>BOD, mg/l</td><td>10</td></tr><tr><td>TSS, mg/l</td><td>20</td></tr><tr><td>COD, mg/l</td><td>50</td></tr><tr><td>Nitrogen-Total, mg/l</td><td>10</td></tr><tr><td>Phosphorus- Total, mg/l</td><td>1</td></tr><tr><td>Fecal Coliform (MPN/ 100 ml)</td><td>100 (permissible 230)</td></tr></table> SBR provides highest treatment efficiency possible in a single step biological process. The system is operated in a batch reactor mode this eliminates all the inefficiencies of the continuous processes. A batch reactor is a perfect reactor, which ensures 100% treatment. Separate modules are provided to ensure continuous treatment. The complete process takes place in a single reactor, within which all biological treatment steps take place sequence. The complete biological operation is divided into cycles. Each cycle is of 3 – 5-hour duration, during which all treatment steps take place.					Parameter	Standards	BOD, mg/l	10	TSS, mg/l	20	COD, mg/l	50	Nitrogen-Total, mg/l	10	Phosphorus- Total, mg/l	1	Fecal Coliform (MPN/ 100 ml)	100 (permissible 230)
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Fecal Coliform (MPN/ 100 ml)	100 (permissible 230)																		
4	Treated wastewater disposal																		
Type of alternative	Treated wastewater disposal – reuse applications																		
Description of alternatives	(i) Discharge of treated wastewater into West Banas River (ii) Reuse the treated wastewater in non-potable uses Rajasthan is a water scarce region and receives low rainfall. Recognizing the importance of treated wastewater in reducing the demand on water, Sewerage and Wastewater Policy, 2016, of Rajasthan promotes the reuse of treated sewage for non-potable applications, and also to make sewerage projects environmentally sustainable. This policy prioritizes reuse in irrigation (agriculture, forestry, and landscaping), followed by fish farming, industry and non-potable domestic reuse. Policy suggests construction of storage tanks to store treated wastewater to facilitate reuse. Policy prescribes that the detailed project report (DPR) should clearly define the best reuse option specific to the town and prepare a Reuse Action Plan part of the DPR following water quality norms and legal implications. Accordingly, it is proposed to utilize the treated wastewater for non-potable uses. A detailed Reuse Action Plan will be prepared during the detailed design phase, and, implemented. It is also proposed that the excess / surplus treated wastewater which is not being utilized in reuse will be discharge into West Banas River, and necessary facilities – pipelines and pumping facilities, will be developed.																		
Selected Alternative	Reuse in non-potable applications and discharge excess/surplus into West Banas River																		
5	Project Locations																		
Description of	Location of water intake: The location of water intake in Bhaisa Singh Dam is selected towards northern side of the dam. Location selection is guided by technical feasibility,																		

alternatives	and easy approach. The location within the dam will be fine-tuned during the detailed design following the detailed site surveys and investigations. One of the main criteria is to locate intake where there is adequate depth of water and as close as possible to the bund. This will optimize the infrastructure requirement (approach bridge, inlet pipes) and ensures year-round availability of water Location of pipelines / sewers: Raw water alignment. The proposed raw water main is aligned along the existing roads from the dam to proposed WTP site in Santpur. Near the dam, the pipeline will be laid along the existing gravel approach road within the right of way. From the main road to WTP, two alternative alignments are selected on along the national highway, and the second along a road parallel to national highway. Considering various pros and cons, the alignment along national highway rejected. Requirement of permissions to lay the pipeline in national highway, likely disturbance to national highway traffic and safety issues, etc., are considered. The national highway alignment is about 500 m from Chandrawati, Rajasthan government protected archeological area, while the new alignment is about 1.3 km from this protected area. WTP Location. Two WTP sites are selected initially, one in the north of the town, and second in the south. Both the sites are government owned vacant and currently unused lands. Considering the technical feasibility of proximity to the town and service area, and easy access, the site in the north is selected for WTP. Location of CWRs, pump houses. All the five proposed clear water sumps, and six pump houses are located within the existing water supply facilities in Abu Road Town. These are located Gandhi Nagar, Luniyapura, Santpur, Market area, Housing Board. STPs location. Based on the technical feasibility of gravity flow system, sewerage system in Abu Road is designed and optimized with two sewage treatment plants (STPs). Site selection is guided by technical suitability, availability of government owned vacant land, adequate land parcel, site away from habitation, and where there is a channel to discharge the treated wastewater. The two selected sites are away from habitations and surrounded by agricultural lands (nearest house is 230 m from STP site at Manpur, and 450 m from STP site at Santpur). Although as far as possible a 500 m distance from habitation is desirable, due to lack of suitable lands, and also considering the selected superior and compact sewage treatment technology (SBR), the two sites are selected. Water distribution and sewer lines. Sewer and water supply pipes are proposed along the roads/streets in the town within the road right-of-way (ROW). In wider roads water pipes will be laid in the road shoulder beside the tarmac, and in narrow roads, where there is no space, pipes will be laid in the road carriage way by break opening the tarmac. Sewers will be mostly laid in the center of the road, away from water pipes. There are existing asbestos cement pipes underground, the alignment will be fine-tuned during the detailed design, to avoid existing AC pipe alignments as far as possible.

IV. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

A. ADB Policy

35. ADB SPS requires that during the design, construction and operation of the project necessary compliance to all applicable laws and international conventions / treaties along with pollution prevention and control technologies and practices consistent with international good practice, are ensured.

36. **Screening and Categorization with that of ADB SPS, 2009.** ADB uses a classification system to reflect the significance of a project's potential environmental impacts. A project's category is determined by the category of its most environmentally sensitive component, including direct, indirect, cumulative, and induced impacts in the project's area of influence. Each proposed project is scrutinized as to its type, location, scale, and sensitivity and the magnitude of its potential environmental impacts. Projects are assigned to one of the following four categories:

- (i) **Category A.** A proposed project is classified as category A if it is likely to have significant adverse environmental impacts that are irreversible, diverse, or unprecedented. These impacts may affect an area larger than the sites or facilities subject to physical works. An environmental impact assessment is required;
- (ii) **Category B.** A proposed project is classified as category B if its potential adverse environmental impacts are less adverse than those of category A projects. These impacts are site-specific, few if any of them are irreversible, and in most cases mitigation measures can be designed more readily than for Category A projects. An initial environmental examination is required;
- (iii) **Category C.** A proposed project is classified as category C if it is likely to have minimal or no adverse environmental impacts. No environmental assessment is required although environmental implications need to be reviewed; and
- (iv) **Category FI.** A proposed project is classified as category FI if it involves investment of ADB funds to or through a FI.

37. The environmental impacts of Abu road water supply and sewerage subproject have been identified and assessed as part of the planning and design process. An environmental assessment using ADB's REA checklist for water supply and sewerage (see Appendix 1) was conducted, and results of the assessment show that the subproject is unlikely to cause significant adverse impacts. Thus, this IEE has been prepared in accordance with ADB SPS's requirements for environment category B projects.

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

39. **Environmental Audit of Existing Facilities.** ADB SPS, 2009 requires an environmental audit, if a subproject involves facilities and/or business activities that already exist or are under construction, including an on-site assessment to identify past or present concerns related to impacts on the environment. The objective of this compliance audit is to determine whether actions were in accordance with ADB's safeguard principles and requirements for borrowers/clients, and to identify and plan appropriate measures to address outstanding compliance issues.

40. **Public Disclosure.** The IEE will be put in an accessible place (e.g., local government offices, libraries, community centers, etc.), and a summary translated into local language for the project affected people and other stakeholders. The following safeguard documents will be put up in ADB's website so that the affected people, other stakeholders, and the public can provide meaningful inputs into the project design and implementation:

- (i) For environmental category A projects, a draft EIA report at least 120 days before Board consideration;
- (ii) Final or updated EIA and/or IEE upon receipt; and

- (iii) Environmental monitoring reports submitted by the PMU during project implementation upon receipt.

41. **Consultation and Participation.** ADB SPS, 2009 require borrower to conduct meaningful consultation¹¹ with affected people and other concerned stakeholders, including civil society, and facilitate their informed participation. The consultation process and its results are to be documented and reflected in the environmental assessment report.

42. **Grievance Redress Mechanism.** ADB SPS, 2009 require borrowers to establish a mechanism to receive and facilitate resolution of affected people's concerns, complaints, and grievances about the subproject's performance. The grievance mechanism shall be scaled to the risks and adverse impacts of the subproject.

43. **Monitoring and Reporting.** Borrower shall monitor, measure and document the implementation progress of the EMP. If necessary, the borrower shall identify the necessary corrective actions, and reflect them in a corrective action plan. Borrower shall prepare and submit to ADB semi-annual environmental monitoring reports that describe progress with implementation of the EMP and compliance issues and corrective actions, if any. For subprojects likely to have significant adverse environmental impacts during operation, reporting will continue at the minimum on an annual basis until ADB issues a project completion report.

44. **Unanticipated Environmental Impacts.** Where unanticipated environmental impacts become apparent during subproject implementation, ADB SPS, 2009 requires the borrower to update the environmental assessment and EMP or prepare a new environmental assessment and EMP to assess the potential impacts, evaluate the alternatives, and outline mitigation measures and resources to address those impacts.

45. **Occupational Health and Safety.** ADB SPS, 2009 requires the borrower¹² to ensure that workers¹³ are provided with a safe and healthy working environment, taking into account risks inherent to the sector and specific classes of hazards in the subproject work areas, including physical, chemical, biological, and radiological hazards. Borrower shall take steps to prevent accidents, injury, and disease arising from, associated with, or occurring during the course of work, including: (i) identifying and minimizing, so far as reasonably practicable, the causes of potential hazards to workers; (ii) providing preventive and protective measures, including modification, substitution, or elimination of hazardous conditions or substances; (iii) providing appropriate equipment to minimize risks and requiring and enforcing its use; (iv) training workers and providing them with appropriate incentives to use and comply with health and safety procedures and protective equipment; (v) documenting and reporting occupational accidents, diseases, and incidents; and (vi) having emergency prevention, preparedness, and response arrangements in place.

11 Per ADB SPS, 2009, meaningful consultation means a process that (i) begins early in the project preparation stage and is carried out on an ongoing basis throughout the project cycle 1; (ii) provides timely disclosure of relevant and adequate information that is understandable and readily accessible to affected people; (iii) is undertaken in an atmosphere free of intimidation or coercion; (iv) is gender inclusive and responsive, and tailored to the needs of disadvantaged and vulnerable groups; and (v) enables the incorporation of all relevant views of affected people and other stakeholders into decision making, such as project design, mitigation measures, the sharing of development benefits and opportunities, and implementation issues.

12 In case where responsibility is delegated to subproject contractors during construction phase, borrower shall ensure that the responsibilities on occupational health and safety are included in the contract documents.

13 Including nonemployee workers engaged by the borrower/client through contractors or other intermediaries to work on project sites or perform work directly related to the project's core functions.

46. **Community Health and Safety.** ADB SPS, 2009 requires the borrower to identify and assess risks to, and potential impacts on, the safety of affected communities during the design, construction, operation, and decommissioning of the subproject, and shall establish preventive measures and plans to address them in a manner commensurate with the identified risks and impacts.

47. **Physical Cultural Resources.** Borrower is responsible for siting and designing the subproject to avoid significant damage to physical cultural resources. ADB SPS, 2009 requires that such resources likely to be affected by the subproject are identified, and qualified and experienced experts assess the subproject's potential impacts on these resources using field-based surveys as an integral part of the environmental assessment process. When the proposed location of a subproject component is in areas where physical cultural resources are expected to be found as determined during the environmental assessment process, chance finds procedures shall be included in the EMP.

48. **ADB SPS International Best Practice Requirements.** ADB SPS, 2009 requires that, during the design, construction, and operation of the project, the executing agency shall apply pollution prevention and control technologies and practices that are consistent with international good practice, as reflected in internationally recognized standards such as the World Bank Group's Environment, Health and Safety (EHS) Guidelines. (IFC's General EHS Guidelines¹⁴ and Sector Specific [Water and Sanitation] Guidelines¹⁵). These standards contain performance levels and measures that are normally acceptable and applicable to projects. These standards contain performance levels and measures that are normally acceptable and applicable to projects. When Government of India regulations differ from these levels and measures, the PMU and PIUs will achieve whichever is more stringent. If less stringent levels or measures are appropriate in view of specific project circumstances, the PMU and PIUs will provide full and detailed justification for any proposed alternatives that are consistent with the requirements presented in ADB SPS, 2009.

49. The IEEs shall also reflect meaningful consultation and disclosure process with a provision for grievance redress mechanism.

B. National Laws

50. The implementation of the subprojects will be governed by Government of India and State of Rajasthan and other applicable environmental acts, rules, regulations, and standards. These regulations impose restrictions on the activities to minimize or mitigate likely impacts on the environment. It is the responsibility of the project executing and implementing agencies to ensure subprojects are consistent with the legal framework, whether applicable international, national, state or municipal or local. Key standards include those related to drinking water quality, air quality, effluent discharge, and protected areas. Compliance is required in all stages of the subprojects including design, construction, and operation and maintenance.

51. Environmental assessment. The Government of India EIA Notification of 2006 (replacing the EIA Notification of 1994), sets out the requirement for environmental assessment in India. This states that environmental clearance is required for specified activities/projects, and this must

¹⁴<https://www.ifc.org/wps/wcm/connect/554e8d80488658e4b76af76a6515bb18/Final%2B%2BGeneral%2BEHS%2BGuidelines.pdf?MOD=AJPERES>

¹⁵<https://www.ifc.org/wps/wcm/connect/e22c050048855ae0875cd76a6515bb18/Final%2B%2BWater%2Band%2BSanitation.pdf?MOD=AJPERES>

be obtained before any construction work or land preparation (except land acquisition) may commence. Projects are categorized as A or B depending on the scale of the project and the nature of its impacts.

52. **Category A** projects require environmental clearance from the central Ministry of Environment, Forests and Climate Change (MOEFCC). The proponent is required to provide preliminary details of the project in the prescribed manner with all requisite details, after which an Expert Appraisal Committee (EAC) of the MOEFCC prepares comprehensive terms of reference (TOR) for the EIA study. On completion of the study and review of the report by the EAC, MOEFCC considers the recommendation of the EAC and provides the environmental clearance if appropriate.

53. **Category B** projects require environmental clearance from the State Environment Impact Assessment Authority (SEIAA). The State level EAC categorizes the project as either B1 (requiring EIA study) or B2 (no EIA study) and prepares TOR for B1 projects within 60 days. On completion of the study and review of the report by the EAC, the SEIAA issues the environmental clearance 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.

54. None of the components of this water supply and sewerage system subproject falls under the ambit of the EIA Notification 2006, and, therefore EIA Study or environmental clearance is not required for the subproject.

55. Applicable environmental regulations. Besides EIA Notification 2006, there are various other acts, rules, policies and regulations currently in force in India that deal with environmental issues that could apply to infrastructure development. The specific regulatory compliance requirements of the subproject are shown in Table 3.

Table 3: Applicable Environmental Regulations

Law	Description	Requirement	Relevance to Project Phase
National Environment Policy (NEP), 2006.	NEP is a comprehensive guiding document in India for all environmental conservation programs and legislations by Central, State and Local Government. The dominant theme of this policy is to promote betterment of livelihoods without compromising or degrading the environmental resources. The policy also advocates collaboration method of different stakeholders to harness potential resources and strengthen environmental management.	RSTDSP should adhere to NEP principle of "enhancing and conservation of environmental resources and abatement of pollution".	All phases of project
Rajasthan State Environment Policy, 2010 including And Rajasthan Environment Mission and Climate Change Agenda for Rajasthan (2010-14)	Follows the National Environment Policy, 2006 and core objectives and policies are: -Conserve and enhance environmental resources; assure environmental sustainability of key economic sectors; and, improve environmental governance and capacity building - it recommends specific strategies and actions to address the key environmental issues: water resources, desertification and land degradation, forest and biodiversity, air quality, climate change: adoption and mitigation, mining, industry, tourism, energy, urban development, etc. - Establishment of Environment Mission under the chairpersonship of the Chief Minister and a Steering Committee under the chairpersonship of Chief Secretary, Government of Rajasthan Tasks force set up for six key areas	Project implementation should adhere to the policy aims of: conservation and enhancement of environmental resources, integration of environmental concerns into projects/plans, and capacity building in environmental management. Under water sector, major concerns, as the policy notes, are huge water losses and wastage, declining water availability, pollution. Relevant recommendations for the project include control of losses, integrated water resources management, control of raw water pollution¹⁸, reuse and recycling. Avoid/minimize use of forest lands. With reference to climate change adoption and mitigation following should be considered in the project: (i) diminishing flows in surface water bodies, and groundwater depletion, and revival traditional water bodies as water sources (lakes/tanks); (ii) equal stress on demand side	All phases of project

Law	Description	Requirement	Relevance to Project Phase
		management in water; and (iii) minimize energy use - design energy efficiency systems.	
EIA Notification, 2006	Projects indicated in the schedule of this notification requires EIA study and environmental clearance.	None of the components of this subproject falls under the ambit of the notification; no EIA study or environmental clearance required	-
<u>Central Ground Water Authority Public Notice 2/100</u>	<u>Public Notice specifies districts and areas where there are restrictions on the construction and installation of any new structure for extraction of groundwater resources without specific approval from the CGWA</u>	<u>Subprojects belonging to the Notified Areas in the Public Notice and will require new structures on extracting groundwater should seek the permission from the Central Groundwater Authority</u>	
<u>Public Health Engineering Department Office Order P5 (1) PHE-2010 dated July 14 2020</u>	<u>PHED Office Order states that the State Government is instructed that permits for any new tube wells, bore wells or any structures extracting ground water shall be secured from the District Collector</u>	<u>Subprojects with components shall secure permits from the District Collector for components that include any new tube wells, bore wells or structures extracting groundwater</u>	
Air (Prevention and Control of Pollution) Act of 1981, Rules of 1982 and amendments.	This Act was enacted to achieve prevention, control and abatement of air pollution activities by assigning regulatory powers to Central and State boards for all such functions. The Act also establishes ambient air quality standards. The projects having potential to emit air pollutants into the atmosphere have to obtain CTE and CTO under Section 21 of the Act from RPCB. The occupier of the project/facility has the responsibility to adopt necessary air pollution control measures for abating air pollution.	The following will require CTE and CTO from RPCB: (i) Diesel generators); (ii) Batching Plant hot mix plants; and (iii) stone crushers, if installed for construction. All relevant forms, prescribed fees and procedures to obtain the CTE and CTO can be found in the RPCB website (http://environment.rajasthan.gov.in). If ready mix concrete and hot mix bitumen is procured from third party, contractor to ensure that the plants, from where material is being purchased is having CTE/CTO and copy should be collected from third party and submitted in PIU	Construction and operation
Biodiversity Act of 2002	This Act primarily addresses access to genetic resources and associated knowledge by foreign	Not Applicable	-

Law	Description	Requirement	Relevance to Project Phase
	individuals, institutions or companies, to ensure equitable sharing of benefits arising out of the use of these resources and knowledge to the country and the people.		
Wildlife Protection Act, 1972 and amendment 1991	This overarching Act provides protection to wild animals, birds, plants and matters connected with habitat protection, processes to declare protected areas, regulation of wildlife trade, constitution of state and national board for wildlife, zoo authority, tiger conservation authority, penalty clauses and other important regulations.	Not applicable – none of the project components are located in protected areas. Nearest protected areas are: Balaram Ambaji Wildlife Sanctuary and Mount Abu Wildlife Sanctuary. The boundary of Balaram Ambaji WLS is about 2.6 km from Bhainsa Singh Dam/ intake. Mount Abu Wildlife Sanctuary is about 5 km from the municipal boundary in the northeast. Proposed Santpur CWR is located about 4.5 km from the sanctuary boundary. None of the components of the subproject are located within the protected Area. Therefore, this act is not applicable.	Construction
Forest (Conservation) Act, 1980	The Forest (Conservation) Act prohibits the use of forest land for non-forest purposes without the approval of Ministry of Environment Forests & Climate Change (MoEFCC), Government of India	Not applicable; none of the components of the subproject are located in forest.	Construction
Environmental (Protection) Act, 1986 amended in 1991 and the following rules/notifications:	This is an "umbrella" legislation that empowers the Central Government to take all necessary measures to protect and improve the quality of the environment and prevent, control and abate environmental pollution. Empowers central government to enact various rules to regulate environmental pollution, including standards for quality of air, water, noise, soil; discharge standards or allowable concentration limits for environmental pollutants, handling of hazardous substances, locating/prohibiting industries, etc.,	There are rules / notifications that have been brought out under this Act, which are relevant to RSTDSP, and are listed below	Construction and operation

Law	Description	Requirement	Relevance to Project Phase
Environmental Standards (ambient and discharge).	Emissions and discharges from the facilities to be created or refurbished or augmented shall comply with the notified standards	Appendix 5 provides ambient air quality standards, emission limits and emission stack height requirements for diesel generators Appendix 6 provides STP discharge standards	Construction and operation
Noise Pollution (Regulation and Control) Rules, 2000 amended up to 2010.	Rule 3 of the Act specifies ambient air quality standards in respect of noise for different areas/zones.	Appendix 7 provides applicable noise standards and noise limits for DG sets	Construction and operation
Indian Drinking Water Standards	Gives details of the permissible and desirable limits of various parameters in drinking water as per the Bureau of Indian Standards	Appendix 8 provides drinking water standards	Construction and operation
Solid Waste Management Rules 2016	Responsibility of Solid Waste Generator segregate and store the waste generated in three separate streams namely bio-degradable, non-biodegradable and domestic hazardous wastes in suitable bins and handover segregated wastes to authorized waste pickers or waste collectors as per the direction or notification by the local authorities from time to time; store separately construction and demolition waste, as and when generated, in his own premises and shall dispose off as per the Construction and Demolition Waste Management Rules, 2016; (iii) No waste generator shall throw, burn or bury the solid waste generated by him, on streets, open public spaces outside his premises or in the drain or water bodies.	Contractor to follow all the rules during construction works	Construction and operation
Construction and Demolition Waste Management Rules 2016	(i) Every waste generator shall segregate construction and demolition waste and deposit at collection centre or handover it to the authorized processing facilities (ii) Shall ensure that there is no littering or deposition so as to prevent obstruction to the traffic or the public or drains (iii) Large generators (who generate more than 20 tons or more in one day or 300 tons per project in a month) shall submit waste management plan and get appropriate approvals from the local authority before	Construction waste shall be collected at stockpile area for 8-10 days and will be sent to disposal site. Disposal site shall be identified and allotted by Municipal Council after mobilization of contractor (during SIP period) and can't be mentioned at this time. Contractor to follow all the rules during construction works. Sludge or any material if classified as hazardous waste / material is to be handled and disposed according to this Rules	Construction

Law	Description	Requirement	Relevance to Project Phase
	starting construction or demolition or remodeling work, (iv) Large generators shall have environment management plan to address the likely environmental issues from construction, demolition, storage, transportation process and disposal / reuse of C & D Waste. (v) Large generators shall segregate the waste into four streams such as concrete, soil, steel, wood and plastics, bricks and mortar, (vi) Large generators shall pay relevant charges for collection, transportation, processing and disposal as notified by the concerned authorities;		
Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016,	Responsibilities of the occupier for management of hazardous and other wastes.- (1) For the management of hazardous and other wastes, an occupier shall follow the following steps, namely:- (a) prevention; (b) minimization; (c) reuse, (d) recycling; (e) recovery, utilization including co-processing; (f) safe disposal. (2) The occupier shall be responsible for safe and environmentally sound management of hazardous and other wastes. (3) The hazardous and other wastes generated in the establishment of an occupier shall be sent or sold to an authorized actual user or shall be disposed of in an authorized disposal facility. (4) The hazardous and other wastes shall be transported from an occupier's establishment to an authorized actual user or to an authorized disposal facility in accordance with the provisions of these rules. (5) The occupier who intends to get its hazardous and other wastes treated and disposed of by the operator of a treatment, storage and disposal facility shall give to the operator of that facility, such specific information as may be needed for safe storage and disposal. (6) The occupier shall take all the steps while managing hazardous and other wastes to- 6 (a) contain contaminants and prevent	Contractor to comply all the requirements of this Act during construction works. There are asbestos cement (AC) in the existing water supply system. As per these Rules, any waste with asbestos concentration limit exceeding 10,000 mg/kg (i.e. 1%), and is in the form of friable, powdered or finely divided state, is classified as hazardous waste. As per Bureau of Indian Standards (BIS), "AC pipes generally contain about 10-15% asbestos fibers in a cement matrix that comprises the rest of the materials and are termed as locked in asbestos products as these products have the asbestos fibers bound in cement. There is very little possibility of generation of airborne asbestos fibers during any reasonable handling, storage, and use of such products. However, during storing and installation, recommended work practices shall be followed to avoid harmful exposure".	Construction and operation

Law	Description	Requirement	Relevance to Project Phase
	accidents and limit their consequences on human beings and the environment; and (b) provide persons working in the site with appropriate training, equipment and the information necessary to ensure their safety.	Except over the ground connections near CWRs, almost all the AC pipes were laid underground. In RSTDSP, no AC pipes are proposed, existing AC pipes will be left as it is. However, some pipes may have to be removed / handled, and if such waste pipes conform to the provisions of this act, waste shall be treated as hazardous waste and disposed as per the rules.	
Wetlands (Conservation and Management) Rules, 2017	The Rules specify activities which are harmful and prohibited in the wetlands such as industrialization, construction, dumping of untreated waste and effluents, and reclamation. The Central Government may permit any of the prohibited activities on the recommendation of Central Wetlands Regulatory Authority.	Not applicable as subprojects components are not located in or near to designated wetland area.	
Ancient Monuments and Archaeological Sites and Remains Act, 1958 and Ancient Monuments and Archaeological Sites and Remains (Amendment and Validation) Act, 2010.	The Act designates areas within 100 meters (m) of the "protected monument/area" as "prohibited area" and beyond that up to 200 m as "regulated area" respectively. No "construction" is permitted in the "prohibited area" and any construction activity in the "regulated area" requires prior permission of the Archaeological Survey of India (ASI).	Not applicable - there are no protected monuments / places of archeological / historical places in or near Abu Road; Nearest protected monuments are Dilwara temple, Achal fort and Toad rock, located at about 30-40 km from Abu Road In case of chance finds, the contractor/ PIU will be required to follow a protocol as defined in the Environmental Management Plan (EMP)	Construction
The Building and Other Construction Workers (BOCW) Act 1996 and Rajasthan Building and Construction Workers Rules 2009	Employer shall- • Provide and maintain, at suitable point, sufficient quantity of wholesome drinking water, such point shall be at least 6 meters away from any washing areas, urinals or toilets • Provide sufficient urinals and latrines at convenient place, easily accessible by workers • Provide free of charge, temporary living accommodations near to work sites with separate cooking place, bathing and lavatory facilities and	Contractors are required to follow all the provisions of BOCW Act and Rajasthan BOCW Rules. Salient features of Rajasthan BOCW Rules are- Chapter III, section 17- Registration of establishments Chapter VIII, section 61- Hours of works, intervals or rest and spread over, overtime Section 62- weekly rest Section 63- night shift	Construction

Law	Description	Requirement	Relevance to Project Phase
	restore the site as preconditions after completing the construction works • Provide crèche with proper accommodation, ventilation, lighting, cleanliness and sanitation if more than fifty female workers are engaged • Provide first aid facilities in all construction sites For safety of workers employer shall provide- • Safe access to site and workplace • Safety in demolition works • Safety in use of explosives • Safety in operation of transporting equipment and appoint competent person to drive or operate such vehicles and equipment • Safety in lifting appliance, hoist and lifting gears • Adequate and suitable lighting to every workplace and approach • Prevention of inhalation of dust, smoke, fumes, gases during construction works and provide adequate ventilation in workplace and confined space • Safety in material handling and stacking/unstacking • Safeguarding the machinery with fly-wheel of moving parts • Safe handling and use of plants operated by compressed air • Fire safety • Limit of weight to be lifted by workers individually • Safety in electric wires, apparatus, tools and equipment • Provide safety net, safety sheet, safety belts while working at height (more than 1.6 mtrs as per OSHA) • Providing scaffolding, ladders and stairs, lifting appliances, chains and accessories where required	Section 67- registers of workers Section 68- Muster roll, wages register Section 70- latrine and urinal facilities Chapter XI- Safety and Health Section 78- fire protection Section 79- emergency action plan Section 80- fencing of motors Section 81- lifting and carrying of weight Section 82- H&S policy Section 83- dangerous and harmful environment Section 84- Overhead protection Section 88- eye protection Section 89- PPEs Section 90- electrical hazards Section 97- use of safety helmets and shoes Chapter XIII-lifting appliances and gears Chapter XV- transport and earth moving equipments Chapter XVI- concrete works Chapter XVII- demolition works Chapter XVIII-Excavation and tunneling Chapter XX- ladders and step ladders Chapter XXII- structural frame and formworks Chapter XXIV- medical facilities and first aid box	

Law	Description	Requirement	Relevance to Project Phase
	• Safety in pile works, concrete works, hot asphalt, tar, insulation, demolition works, excavation, underground construction and handling materials • Provide and maintain medical facilities for workers • Any other matters for the safety and health of workers		
Contract Labor (Regulation and Abolition) Act, 1970; The Inter-State Migrant Workmen (Regulation of Employment and Conditions of Service) Act, 1979	Provides for welfare measures to be provided by the Contractor to contract labor and in case the Contractor fails to provide, the same are required to be provided by the Principal Employer by Law. The principal employer is required to take Certificate of Registration and the Contractor is required to take a License from the designated Officer. The Act is applicable to the establishments or Contractor of principal employer if they employ 20 or more contract labor. The inter-state migrant workmen, in an establishment to which this Act becomes applicable, are required to be provided certain facilities such as housing, medical aid, traveling expenses from home up to the establishment and back, etc.,	• Applicable to all construction works in the project • Principle employer (RUDSICO-EAP) to obtain Certificate of Registration from Department of Labour, as principle employer • Contractor to obtain license from designated labor officer • Contractor shall register with Labor Department, if Inter-state migrant workmen are engaged • Adequate and appropriate amenities and facilities shall be provided to workers including housing, medical aid, traveling expenses from home and back, etc., Appendix9 provides applicable labor laws including amendments issued from time to time applicable to establishments engaged in construction of civil works.	Construction and operation
The Child Labour (Prohibition and Regulation) Act, 1986	Prohibits employment of children below 14 years of age in certain occupations and processes Employment of child labor is prohibited in building and construction Industry.	No child labour shall be employed	Construction and operation
Minimum Wages Act, 1948	Minimum wages fixed by appropriate Government as per provisions of the Act if the employment is a scheduled employment. Construction of buildings, roads and runways are scheduled employment.	Applicable to all construction works in the project All construction workers should be paid not less than the prescribed minimum wage	Construction and operation

Law	Description	Requirement	Relevance to Project Phase
Workmen Compensation Act, 1923	Provides for compensation in case of injury by accident arising out of and during the course of employment.	Compensation for workers in case of injury by accident	Construction and operation
Equal Remuneration Act, 1979	Provides for payment of equal wages for work of equal nature to male and female workers and not for making discrimination against female employees in the matters of transfers, training and promotions etc.	Equal wages for work of equal nature to male and female workers	Construction and operation
The Rajasthan Monuments, Archaeological Sites and Antiquities Act, 1961; the Rajasthan Monuments, Archaeological Sites and Antiquities (amendment) Act 2007	Any construction/excavation work in the 'protected area' (as declared by GoR under the Act) requires priori permission of Department of Archeology & Museums -Application under the Rules shall be submitted to Director, State Archeological Department, at least 3 months prior to the work. Department provides conditional permission, including time for completion, procedures to be followed during the work and for chance finds etc.	Not applicable - there are no state protected monuments in the town Chandrawati protected site is located about 5 km from the town boundary. No components are proposed in the protected area. Nearest component is raw water main, which is proposed along a road, which is at about 1.3 km from the protected area boundary. In case of chance finds, the contractor/ PIU will be required to follow a protocol as defined in the Environmental Management Plan (EMP).	Construction
Rajasthan Forest Act, 1953 and Rajasthan Forest Rules, 1962	This Act makes the basis for declaration of Reserved Forests, constitution of village forest committees, management of reserved forests and penalties and procedures.	Not applicable; none of the components / pipeline alignment are in forest areas.	Construction
IS 11768: 1986/2005: Recommendations for disposal of asbestos waste material	The standard emphasizes that every employer who undertakes work which is liable to generate asbestos containing waste, shall undertake adequate steps to prevent and /or reduce the generation of airborne dust during handling, storing, transportation and final disposal of final disposal of asbestos and asbestos containing products.	The crux is waste avoidance: the practice inculcated should focus on minimal waste generation. Waste Collection: In the project circumstance, the waste is referred to the damaged powered asbestos which will be collected in the Permissible plastic bags to be disposed to the nearest TSDF facilities.	Construction
IS 12081: Pictorial Warning to be implemented on equipment containing Asbestos	The objective of the caution is to make the person handling to take all pre-cautionary measures and make them aware of all the possible risk.	The following signs and personal protective equipment shall be used in handling ACM.	Construction

Law	Description	Requirement	Relevance to Project Phase
Contaminated Products.			
IS 11451: Safety and Health Requirements related to Occupational Exposure to Asbestos contaminated Products.	This standard details the occupational exposure allowable and safety at work place to be enforced.	In the project the norms pertaining to limiting number of hours working with ACM will be 8.0 hrs/48 hrs a week and the medical examination has to be periodic, the environmental monitoring has to be done as per the protocol. The safety at work place shall be enforced.	Construction
IS 11768: Waste Disposal Procedure for Asbestos Containing Products.	The protocol pertaining to disposal of the waste is emphasized.	The collection of ACM powered will be in permissible plastic bags, which will be twisted tight at the neck so that the wear and tear due to abrasion will be minimum and the transportation of the asbestos waste has to be	Construction

Law	Description	Requirement	Relevance to Project Phase
		done by the authorized vendor to the approved landfill site.	
International conventions and treaties			
Ramsar Convention, 1971	The Ramsar Convention is an intergovernmental treaty that provides the framework for national action and international co-operation for the conservation and wise use of wetlands and their resources. India is one of the signatories to the treaty. The Ramsar convention made it mandatory for the signatory countries to include wetland conservation in their national land use plans.	There are no Ramsar sites in or near Abu Road. Not applicable to Abu Road water supply and sewerage subproject.	-
Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), 1973	India is a signatory of this convention which aims to control international commercial trade in endangered species	Not applicable in this project as no endangered species of wild fauna and flora is found in project town.	-
Montreal Protocol 1992	India is a signatory of this convention which aims to reduction in the consumption and production of ozone-depleting substances (ODS), while recognizing differences in a nation's responsibilities. Ozone depleting substances are divided in two groups Chlorofluorocarbons (CFCs) and Hydrochlorofluoro carbons (HCFCs)	Not applicable in this project as no ODS are involved in construction works	-
Basel Convention on Trans-boundary Movement of Hazardous Wastes, 1989	India is a signatory of this convention which aims to reduce trans-boundary movement and creation of hazardous wastes	Contractor to follow the provisions of Hazardous Waste Rules 2016 for storage, handling, transport and disposal of hazardous waste emerged during construction works Under this Convention, asbestos or asbestos waste in the form of dust and fibers is classified as hazardous waste.	-
Convention on Migratory Species of Wild Animals (CMS), 1979 (Bonn convention)	CMS, also known as Bonn convention, was adopted in 1979 and entered into force on 1 November 1983, which recognizes that states must be the protectors of migratory species that live within or pass through their national jurisdictions, and aims to conserve	Not applicable to this project as no migratory species of wild animals are reported in the project areas.	-

Law	Description	Requirement	Relevance to Project Phase
	terrestrial, marine and avian migratory species throughout their ranges. Migratory species threatened with extinction are listed on Appendix I of the Convention. CMS Parties strive towards strictly protecting these species, conserving or restoring the places where they live, mitigating obstacles to migration and controlling other factors that might endanger them. Migratory species that need or would significantly benefit from international cooperation are listed in Appendix II, and CMS encourages the Range States to conclude global or regional agreements.		

56. Clearances/permissions to be obtained prior to start of construction. Table 4 shows the list of clearances/permissions required for project construction. This list is indicative, and the contractor should ascertain the requirements prior to start of the construction and obtain all necessary clearances/permission prior to start of construction.

Table 4: Clearances and permissions required

S. No	Construction Activity	Statute under which Clearance is Required	Implementation	Supervision
1	Land for project activity	Allotment and approval for specific land use	ULB	PMU
2	Use of construction area	Approval for use of city roads and shifting of utilities	ULB, PWD and other utility agencies such as BSNL, electricity department	PIU
3	Establishment of construction camps	Allotment and approval for specific land use	Contractor	PIU
4	Construction of new WTP and STP	Consent to establish and consent to operate under Water Act, 1974 from RSPCB	PIU & Contractor	PIU
5	Construction of new Tube Wells	NOC from State Ground Water Board is required before extraction of water from underground source	PIU and contractor	PMU
6	Tree Cutting	State forest department/Revenue (Tehsildar)	PIU	PIU and PMU
7	Hot mix plants, Crushers, Batching plants and DG Set	Consent to establish and consent to operate under Air Act, 1981 from RSPCB	Contractor	PIU
8	Storage, handling and transport of hazardous materials	Hazardous Wastes (Management and Handling) Rules. 2016 Manufacturing, Storage and Import of Hazardous Chemicals Rules, 1989 from RSPCB	Contractor	PIU
9	Sand mining, quarries and borrow areas	Permission from District Collector/ State Department of Mines & Geology	Contractor	PIU
10	New quarries and borrow areas	Environmental clearance under EIA Notification 2006	Contractor	PIU
11	Use of vehicles and equipment	Pollution under control certificate (PUC) form RTO	Contractor	PIU
12	Temporary traffic diversion measures	Temporary traffic diversion measure including use of alternate road from District traffic police	Contractor	PIU
13	Use of Railways ROW for construction area/ crossing	Indian Railways	PIU	PMU
14	Use of highway ROW for construction area/ crossing	National Highway authority of India	PIU	PMU
15	Pipe laying works	Permission from Nagar Palika and PWD	PIU	PMU

S. No	Construction Activity	Statute under which Clearance is Required	Implementation	Supervision
16	Construction of new tube wells or any new extraction of ground water	Permission from the competent authority per PHED Office Order P5 (1) PHE-2010 dated July 14 2011	PIU	PMU

Table 5: Details of Railways and highway crossing

Table of Details of Railways and Highway Crossing									
Town Name	Railway Crossing								
	S. No.	Track	Sector	From	To	Pipe Dia	Material	Crossing Dia	Detail
	1	Broad gauge	Water	Intake at Bhaisasingh Dam	WTP-Santpur	400	DI K-9	800	Pumping main
	2			WTP-Santpur	RIICO-CWR	150	DI K-9	600	Pumping main
	3			WTP-Santpur	Gandhi Nagar GLSR JN	350	DI K-9	700	Pumping main
	4		Sewer	MH-1392	MH-1855	500	HDPE	1000	Gravity
	5			MH-1566	MH-1730	250	HDPE	600	Gravity
National Highway Crossing									
S. No.	NH No.	From		To	Pipe Dia	Material	Crossing Dia	Detail	
1	27	Intake at Bhaisasingh Dam		WTP-Santpur	400	DI K-9	800	Pumping main	
2		JN from WTP at Santpur		Gandhi Nagar GLSR	200	DK K-9	600	Pumping main	

57. PMU will be overall responsible for supervision in getting all clearances and provide details to ADB through semi-annual report. PMU will ensure all necessary regulatory clearances and approvals are obtained prior to commencement of works. Respective PIUs, with support of project consultants and DBO contractors, are responsible for obtaining the clearances/permits and ensuring conditions/specifications/provisions are incorporated in the subproject design, costs, and implementation. The PIUs shall report to PMU the status of compliance to clearances/permits as part of the regular progress reporting.

V. DESCRIPTION OF THE ENVIRONMENT

A. Physical Resources

1. Location, Area and Connectivity

58. Abu Road is a tehsil headquarter in Sirohi District of Rajasthan. It is located at 24°48' N latitude and 72°78' E longitude on the banks of river west Banas and close to the state boundary between Rajasthan and Gujarat. It has an average elevation of 263 m above mean sea level (MSL). Total area of Abu Road Town is 1,289 hectares comprising of 31 wards. Mount Abu is the only Hill station of Rajasthan which is near to Abu Road and is 27 km away from Abu Road. Prominent religious place, Ambaji Temple, in neighboring Gujarat State is located near the Abu Road.

Figure 14: Location of Project Town



59. Road, Rail and Air Connectivity: national highway 14 (NH14) passes through Abu Road. State Capital Jaipur is located about 465 km, and Jodhpur is 300 km. It is located on main Delhi-Jaipur- Ahmedabad Broad Gauge railway line and connected with all the important cities of India and Rajasthan. Nearest domestic airport is Maharana Pratap Airport, Udaipur, which is 164km away and nearest International airport is the Sardar Vallabh Bhai Patel International Airport, Ahmedabad which is 193 km far. There is an Air Strip in the town. Project location is given in Figure 14.

2. Topography, Soils and Geology

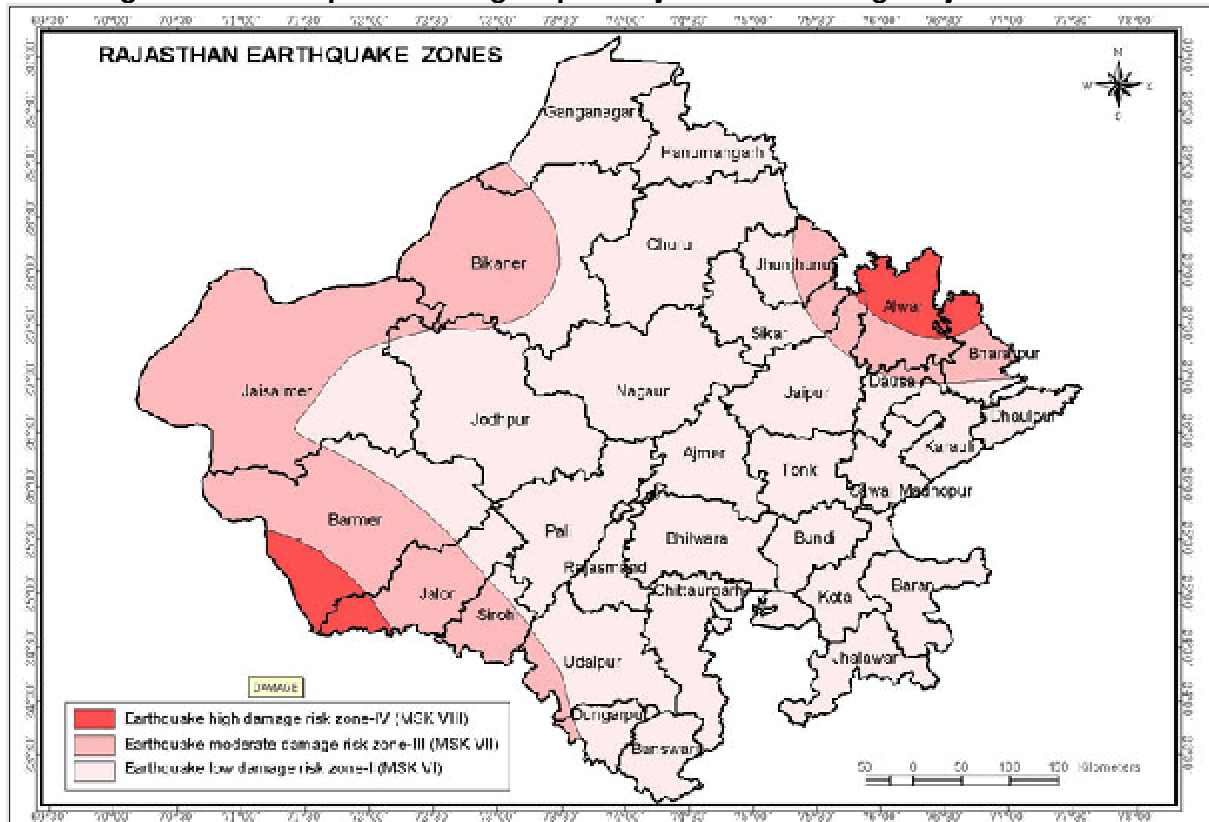
60. Topography of Abu Road had been derived by Aravalli hills, hills on the southwest to North West. The basement below alluvium consists of rocks belonging to series of carbonaceous

phyllite, quartzite, schists & marble.

3. Seismology

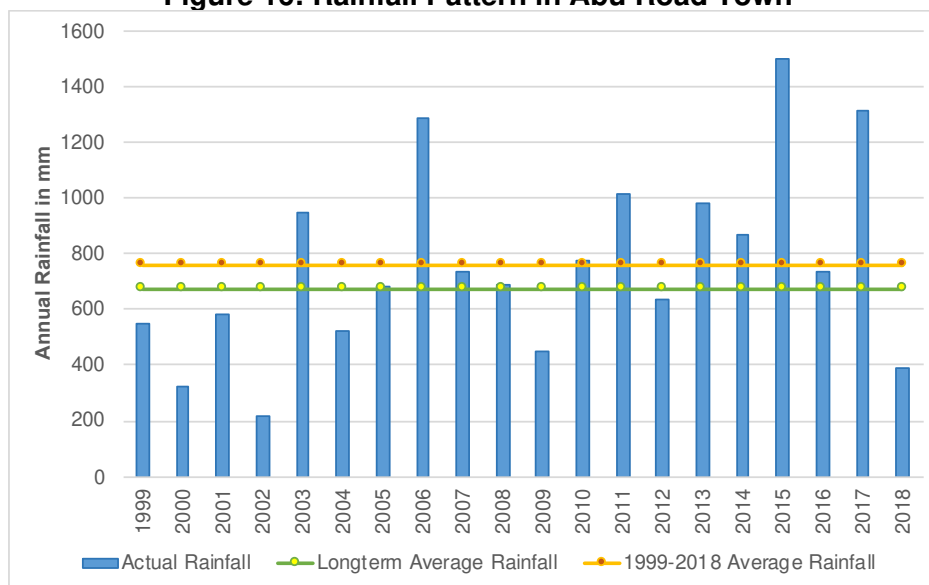
61. As per the seismic zoning map of India, Abu Road falls under the Zone 3, which is the Moderate earthquake risk zone in India. This zone is termed as "Moderate damage risk zone". Accordingly, all designs of project component structures will be based on the latest Bureau of Indian Standard (BIS) specifications for earthquake resistant design (IS: 1893: Criteria for earthquake resistant design of structures). These are duly indicated in the bid document.

Figure 15: Earthquake Zoning Map of Rajasthan Showing Project Area



4. Climatic Conditions

62. The climate of Abu Road varies between dry and partially sub-humid. Maximum average temperature is around 42°C during summer months of March to June and minimum average temperature is 23°C in winters. In Summer, it's hot and humid with hot sandy winds. Just before monsoon, it becomes hot along with humidity. In winter, temperature range between 7 and 14 °C. The long term annual average rainfall is 672 mm. As presented in the following Figure 16, rainfall pattern has been very erratic in the last 20 years, 1999-2018, which witnessed a highest rainfall of 1498 mm (2015) and lowest rainfall of 216 mm (2002). Average rainfall (760 mm) was higher than the long term average (672 mm).

Figure 16: Rainfall Pattern in Abu Road Town

5. Surface Water

63. Abu Road Town is located on the banks of West Banas River, that originates in the Aravalli Ranges in Sirohi District. This river drains the valley between Mount Abu on the west and Aravallis in the east. After Rajasthan, it flows through the plains of Banaskantha and Patan districts of Gujarat and discharges into Little Rann of Kutch, a seasonal wetland. This is a seasonal river only flows during monsoon. It is the most important source of water for districts of Sirohi, Banaskantha and Patan in the states of Rajasthan and Gujarat. Dantiwada dam, about 40 km downstream of Abu Road is an important dam the provides water supply to several villages and also provided irrigation water. Tributaries of river are: Sipu, Khari, Sukli, Balaram, Suket, Sevaran and Batriya.

64. Bhaisa Singh Dam is constructed across a tributary of West Banas River. This tributary originates in Aravalli Ranges, in the southwest of Abu Road, and flows northwards to join West Banas River, in the downstream of Abu Road. Dam is constructed near the foothills of the Aravallis. This dam construction was started in 1988 by Water Resources Department of Rajasthan and completed in 2013-2014. Although it is constructed for irrigation purposes, dam water was not utilized for any purpose since completion of construction in 2013-2014, and in 2016 the dam was transferred to PHED for using as source of drinking water in this water scarce area. This dam is adopted as main source of water supply to Abu Town, and necessary infrastructure is being developed under RSTDSP to provide water supply from the dam.

65. **Water quality.** Test Report of Bhaisa Singh Dam water quality is given as Appendix 10. Result of water quality of Bhaisa Singh Dam is given in Table 6 below. Dam is located in the foothills of Aravalli mountain range. The river originates in the mountain range, and during its course it completely flows through forests, barren lands etc., and area where there are no notable pollution sources like industries. The water quality testing conducted in April 2016 indicated that all the tested parameters are well within the limits except turbidity which is higher than the acceptable limit. The proposed subproject includes treatment facility and therefore no impacts due to water quality envisaged. There are no notable risks of source contamination due to its location.

Table 6: Water Quality Report of Bhaisa Singh Dam

Parameter	Raw Water Quality	Drinking Water Standards (IS: 10500-2012)	
		Desirable	Permissible in absence of alternate source
pH	7.9	6.5-8.5	No relaxation
Turbidity NTU)	12	1	5
Temperature (°C)	27	-	-
Color	None	5	15
Odor	None	Agreeable	Agreeable
Chlorides as Cl, mg/l	60	250	1000
Nitrate as NO ₃ , mg/l	1	45	100
Total Dissolved Solids mg/l	595	500	2000
Iron, mg/l	-	0.3	No relaxation
Fluorides, mg/l	0.8	1.0	1.5
Alkalinity (CaCO ₃), mg/l	150	200	600
Total Hardness, mg/l	100	200	600
Calcium Hardness, mg/l	70	-	-
Magnesium Hardness, mg/l	30	-	-

Source: Office of the junior chemist, PHED Laboratory Aburoad.

6. Groundwater

66. Geological formations exposed in Sirohi district range in age from Proterozoic to recent. Oldest rocks are calc-schist, and calc. Gneiss belonging to Kumbhalgarh group of Delhi Super Group of Proterozoic age, while the youngest formation is alluvium belonging to quaternary age. Rocks of Delhi Supergroup are exposed in the southeastern and central parts of the district. Post Delhi intrusive include Erinpura, Sendra and Ambaji granite/ granitic gneiss, which are exposed in the northeastern, southwestern and southeastern parts of the district. Malani rhyolites are exposed in the southern and northern parts of the district around Abu Road and Sheoganj blocks. Northwestern and southwestern parts of the district are covered by unconsolidated sediments comprising of alluvium and windblown sand.

67. Groundwater occurs under water table conditions both in unconsolidated and consolidated formations. The basement below alluvium consists of rocks belonging to series of carbonaceous phyllite, quartzite, schists, marble. Phylites and schists aquifers occur predominantly in Abu Road, Pindwara and central part of Sirohi Tehsil. Groundwater is retained in weathered zones, fractures, joints etc. Groundwater is retained in weathered zones, fractures, joints etc. Depth of open wells tapping these aquifers ranges from 25 m to 40 m. Yield of wells varies from 30 to 250 m³/day. Alluvial area is restricted to riverbeds. The depth to water level in the area tapping these aquifers ranges from 10 m to 20 m. Depth and diameter of the dug well and bore well depends on formation and geomorphology. However, general depth of dug well and bore well ranges from 9 m to 50 m and 100 m to 120 m respectively.

68. Groundwater is the main source of irrigation and domestic use and is utilized through dug wells, and tube wells. The depth to water level varies widely depending upon topography, drainage, bedrock geology etc., in the district. As per Central Groundwater Board (CGWB) report on Sirohi District Groundwater Scenario, 2013, depth to water in pre monsoon of 2011 varied from 4.13 m to 34.1 m below ground level (BGL), while post monsoon varied from 0.55 m to 20.97 m BGL. In Abu Road, depth to water level ranges between 10 m and 20 m BGL. In terms of pre and

post monsoon fluctuation in groundwater level in 2011, according to CGWB report, decline in water level recorded in some of the wells in parts of Abu Road.

69. **Groundwater utilization.** Annually replenishable groundwater resources of the district have been estimated to be 300.9981 MCM, while the net annual groundwater availability is estimated to be 274.224 MCM. Total annual groundwater withdrawal for all uses has been estimated to be 299.9916 MCM. With the stage of development at 109.40%, district is classified as 'Over Exploited' (OE, >100%). Of the five blocks/tehsils in Sirohi District, 3 are classified as semi critical, and two are classified as over exploited. In Abu Road Block/Tehsil, while the estimated net annual groundwater availability is 26.5459 MCM, the total utilization for all uses is estimated as 25.8975 MCM (97.56% utilization). Abu Road Block is classified as "Semi Critical" (90-100% utilization but with no significant long-term decline in groundwater). CGWB recommend cautious groundwater development in semi critical areas, and conjunctive use of surface and groundwater resources.

70. **Groundwater quality.** Groundwater quality of tube wells and open wells in Abu Road is presented in the following tables. This data pertains to pre-monsoon (March) of 2018 and monitoring was conducted by PHED. Groundwater is alkaline in nature with pH ranging from 7.3 to 8.1, and within the acceptable range of drinking water quality. Most of the tested parameters are well within the desirable limits of drinking water standards (IS: 10500- 2012). Fluoride content in two open wells, and total dissolved solids (TDS) content in an open well is exceeding the acceptable limit. Chloride content in most of the open wells is above desirable limit (250 milligrams per liter [mg/l]), but within the acceptable limit (1000 mg/l). TDS content in all the tube wells and open wells monitored is exceeding the desirable limit (500 mg/l), but within the acceptable limit (2000 mg/l), except one tube well which has a TDS content of 2,320 mg/l, above the acceptable limit. Laboratory test reports of groundwater quality are given in Appendix 11.

Table 7: Ground Water Quality Report in Abu Road

Parameter	OW (Location- Bavasi, Akra bhatta)	OW (Housing Board)	OW (Banas Pump)	OW (Chirafadi Kua)	OW (Hanuman ji Kua)	OW (Back Side Darbar School)	OW (Akbari Road PHED Campus)	OW (Andeshw eri)
Date of Sampling	16.04.2018	16.04.2018	28.03.2018	28.03.2018	28.03.2018	28.03.2018	28.03.2018	28.03.2018
pH	7.9	7.6	8	7.3	7.8	7.7	7.6	7.8
Turbidity (NTU)	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear
Colour	None	None	None	None	None	None	None	None
Odour	None	None	None	None	None	None	None	None
Chlorides (As Cl ⁻)	140	140	280	250	300	350	500	290
Nitrates (As NO ₃ ⁻)	15	14	9	21	31	86	8	10
Nitrite (As NO ₂ ⁻)	0	0	0	0	0	0	0	0
Fluoride (As F ⁻)	2.4	2.3	0.6	0.4	0.4	0.5	0.8	0.6
Total Dissolved Solids	920	940	1435	1160	1280	1540	1920	1480

Source: PHED Lab, Abu Road, District-Sirohi, Rajasthan.

Table 8: Ground Water Quality Report in Abu Road

Parameter	TW (Source No.3 PHED) Awal	CWR (Andeshwarji)	CWR (Vijasani),	CWR (RHB Colony)	OW (Satpur)	TW (ITI Satpur)	OW (Jogiwas Satpur,
Date of Sampling	28.03.2018	28.03.2018	28.03.2018	28.03.2018	28.03.2018	28.03.2018	28.03.2018
pH	7.4	7.5	7.8	7.9	7.6	8.1	7.4
Turbidity (NTU)	Clear	Clear	Clear	Clear	Clear	Clear	Clear
Colour	None	None	None	None	None	None	None
Odour	None	None	None	None	None	None	None
Chlorides (As Cl ⁻)	100	450	200	150	500	130	480
Nitrates (As NO ₃ ⁻)	12	31	26	16	37	4	41
Nitrite (As NO ₂ ⁻)	0	0	0	0	0	0	0
Fluoride (As F ⁻)	0.6	0.7	1	0.9	0.8	0.7	0.6
Total Dissolved Solids	560	1700	1180	950	1980	770	1940

Source: PHED Lab, Abu Road, District-Sirohi, Rajasthan.

Table 9: Groundwater Quality Report in Abu Road

Parameter	TW (Bhanawala/ Man Doweri)	TW (Main Road, Mandower)	GLR (Bus Stand, Siyawa)	OW (Near Talab Satpur),	OW (Siyava),	TW (Siyava),	Drinking water Standards (IS: 10500-2012)		WHO Guideline Values
Date of Sampling	28.03.2018	28.03.2018	28.03.2018	28.03.2018	28.03.2018	28.03.2018	Desirable	Permissible in absence of alternate source	-
pH	7.6	7.9	7.5	7.6	7.7	7.8	6.5-8.5	No relaxation	-
Turbidity (NTU)	Clear	Clear	Clear	Clear	Clear	Clear	1	5	-
Colour	None	None	None	None	None	None	5	15	-
Odour	None	None	None	None	None	None	Agreeable	Agreeable	-
Chlorides (As Cl-)	160	150	160	550	150	180	250	1000	250
Nitrates (As NO ₃ -)	4	3	11	39	14	5	45	100	50
Nitrite (As NO ₂ -)	0	0	0	0	0	0	-	-	
Fluoride (As F-)	0.6	1.4	1.2	0.6	1.1	1.5	1.0	1.5	1.5
Total Dissolved Solids	740	730	760	2320	705	880	500	2000	-

Source: PHED Lab, Abu Road, District-Sirohi, Rajasthan.

7. Ambient Air Quality

71. Ambient air quality in Rajasthan is monitored by Rajasthan State Pollution Control Board. However, at present there is no monitoring station in Abu Road and therefore no data on ambient air quality available. The roads are not in good condition, traffic on these roads and winds are the main source of dust generation. There are also industrial units that generate air emissions. Air quality monitoring shall be conducted in the pre-construction phase (SIP period) by the contractor and shall be updated in IEE. Baseline air quality monitoring will be conducted by contractor as per the Environmental Monitoring Plan.

72. **Noise Quality.** As there are no major industries or other activities, which may create high noise in City, the main source of noise pollution in the city area is traffic only that also in main and busy roads and other inner and connecting roads are quite peaceful. Environmental monitoring for ambient air, noise and water quality has not been conducted during design period. Baseline noise quality monitoring will be conducted by contractor as per the Environmental Monitoring Plan, prior to start of construction.

B. Ecological Resources

73. Project area, Abu Road municipality in Sirohi District. It is situated on the banks of West Banas River, close to Rajasthan state border with Gujarat. State boundary is closet in southwest, about 5 km from the municipal boundary. Town is developed along West Banas River, linearly, in predominantly plain land along flood plain. It is abutted by Mount Abu hills in the north and Aravalli Hill Ranges in the south, extending southwest – northeast direction. Mount Abu hills are also part of Aravalli Range. Situated in the picturesque Aravalli Ranges, Mount Abu is the only hill station in Rajasthan, which is known for its natural and man-made heritage, picturesque area, eco sensitive areas and wildlife. Mount Abu is about 20 km northeast of Abu Road Town.

74. There are no forest areas or ecologically sensitive areas within the municipal boundary of Abu Road. Nearest protected area to Abu Road Town is Mount Abu Wildlife Sanctuary in the north, and the boundary of sanctuary is about 5 km from Abu road municipal boundary. Aravalli ranges in the south of the town existing in southwest-northeast direction are characterized fairly dense mixed jungles, undulating and hilly areas falling in Abu Road Forest range up to Gujarat state border. Aravalli ranges extend into Gujarat. Bhausa Singh Dam, which is the source of water for the subproject, is located at about 4 km southwest of municipal boundary of Abu Road. Dam is about 2.6 km from the state boundary. Balaram Ambaji Wildlife Sanctuary located in the state of Gujarat is another protected area close to the project area. Boundary of sanctuary (which is also the state boundary) is about 2.6 km southwest of Bhausa Singh Dam / proposed intake, and about 6-7 km southwest of municipal boundary. Water spread of Bhausa Singh dam is entirely located in Rajasthan state, and is not part of wildlife sanctuary. Part of the inundated land was originally a forest area, that was transferred to water resources department for construction of dam/reservoir. Therefore, as this forest land is already converted into non-forest use, no permission from Forest Department is required for construction of intake or raw water main falling in the dam area.

75. **Mount Abu Wildlife Sanctuary.** Declared as wildlife sanctuary in 1960, it comprises the the Aravalis, oldest mountain range. Altitude varies from 300 m at the foothill to 1722 m at Gurushikhar, the highest peak of the Aravali Ranges. Mount Abu has a very rich floral biodiversity starting with xenomorphic subtropical thorn forest at the foothills to subtropical evergreen forest along water courses and valleys at higher altitudes. These forests consist of 112 plant families with 449 genera and 820 species. The southwest part of the sanctuary is rich in bamboo forests.

The sanctuary is rich in herbal medicinal plants also. About 81 species of tree, 89 species of shrubs, 28 species of climbers and 17 species of tuberous plants of medicinal importance have been identified. A variety of fauna including rare, threatened and endangered species are found in this sanctuary, including panther, sambhar, Jungle cat, Small Indian civet, wolf, hyaena, jackal, Indian fox, Common langoor, Wild boar, pangolin, ratel, Common mongoose, Indian hare, porcupine, hedgehog, etc. The sanctuary provides an ideal habitat for Sloth bear. As stated above, this sanctuary boundary is about 5 km from Abu Road municipal boundary in the north. Since all the subproject components are located in the municipal area, there is no likely interference with the sanctuary due to project activities.

76. **Balaram Ambaji Wildlife Sanctuary.** Declared as sanctuary in 1989, Balaram Ambaji Wildlife Sanctuary is located at Banaskantha district in Gujarat state bordering Rajasthan. It is spread over an area of 542 square kilometer (km²), sanctuary characterized by undulating hills of Aravali, dry-deciduous forests of North Gujarat that spread in the catchment areas of Banas and Sabarmati Rivers. The protected area is rich in floral diversity, particularly medicinal plants, and is home to variety of flora and fauna species some of which include species of global conservation significance. The predominant trees are: khair, salai, modad, dhavada, khakhara, timru. The rare animals include sloth bear, striped hyena, leopard, bluebull, porcupine, fox, small Indian civet, Indian pangolin and a number of reptiles including venomous and non-venomous snakes, monitor lizards, star tortoise etc. The rare birds of this area are adjutant stork, spoonbill, osprey, white backed vulture and black vultures.

77. A reconnaissance survey was conducted on 11 November 2019 near the dam and intake site to understand the ecological profile, flora and fauna in the area. Three sites were identified representing different ecosystem and land-use types in the area. At each site, floristic diversity was studied through quantitative sampling. A quadrat of approximately 20 m x 20 m was used to record species of tree, 5 m x 5 m for species of shrubs and large climbers, and 1 m x 1 m for species of herbs. Owing to the relatively short duration of the survey, the focus of the floristic observations was limited to the higher flora. At each site, faunal diversity was studied through direct evidence, in the form of visual sightings or calls, and indirect evidence, such as nests, burrows, droppings, scats, moults, tracks, etc. Owing to the survey being conducted during the daytime only, the focus of the faunal observations remained limited to the diurnally active faunal species, mainly birds. Floral species recorded during this survey is given in the below table:

Table 10: Flora Species Recorded near Intake Site

S. No	Species	Habit	% frequency	Abundance	Density per Ha
	Woody trees				
1	Azadirachta indica	Tree	67	1	17
2	Abutilon indicum	Shrub	33	1	133
3	Anona squamosa	Tree	33	1	8
4	Euphorbia antiquorum	Shrub	67	1	267
5	Ziziphus mauritiana	Tree	67	1	17
6	ziziphusnummularia	Shrub	67	2	400
7	Prosopis juliflora	Tree	100	2	58
8	Celosia argentea	Shrub	67	4	1,067
9	Securinegaleucopyrus	Tree	67	1	17
10	Butea monosperma	Tree	67	1	8
11	Phoenix sylvestris	Tree	67	1	17
12	Sidacordifolia	Shrub	33	1	133
13	Vernonia cinerea	Shrub	67	3	800

S. No	Species	Habit	% frequency	Abundance	Density per Ha
14	Typha angustifolia	Shrub	33	6	800
15	Tephrosiapurpurea	Shrub	100	1	533
16	Xanthium indicum	Shrub	67	3	800
17	Calotropis procera	Shrub	67	1	267
18	Calotropis gigantea	Shrub	33	1	133
19	Datura metel	Shrub	33	2	267
20	Saccharum munja	Shrub	67	2	533
	Non-woody flora				
1	Achyranthes aspera	Herb	100	6	56,667
2	Croton bonplandianus	Herb	33	5	16,667
3	Commelinasps.	Herb	33	4	13,333
4	Cynodondactylon	Grass	67	5	30,000
5	Indigoferacordifolia	Herb	67	3	20,000
6	Evolvulusalsinoides	Herb	33	2	6,667
7	Chamaesycehirta	Herb	33	1	3,333
8	Andrographis paniculate	Herb	33	2	6,667
9	Leucas Aspera	Herb	67	2	10,000
10	Rungiarepens	Herb	33	10	33,333
11	Origanumsp	Herb	33	4	13,333
12	Boerhaviadiffusa	Herb	33	2	6,667
13	Cuscutareflexa	Herb	33	1	3,333
14	Tridaxprocumbens	Herb	100	5	50,000
15	Hyptissuaveolens	Herb	100	3	26,667
16	Peristrophepaniculata	Herb	100	5	50,000

Figure 17: Location of Reconnaissance survey Points near Intake



78. **Fauna of the study area.** The avifaunal profile recorded in the quadrat studies is dominated by birds associated with open scrub such as Grey francolin, Laughing dove, Indian robin, Common stonechat, Brahminy starling, Common babbler and Yellow-eyed babbler. Some wetland associated species were also recorded on dam. They include resident species such as little grebe, Asian openbill and Red-wattled lapwing, and no migratory species were seen during the visit. Another significant component comprises birds associated with habitation, cultivation and gardens, including Indian peafowl, Indian roller, Common pigeon, Common myna, Red-vented bulbul and Ashy prinia.

79. **Migratory Avifauna.** The subproject area is part of the massive avian migratory channel called the Central Asian Flyway (CAF), which spans the entire Indian subcontinent. Thus, the subproject area lies in the path of various winter migratory birds entering the Indian subcontinent from the north and headed farther south. With its diversity of habitats, the area in general is likely to be providing seasonal habitats or staging points to many of these visitors. Although dam constructed started in 1988, it was completed only in 2013-2014, after which the dam started impounding water. Given this recent origin, migratory birds are not reported. Local people, public representatives and forest officials were consulted during the visit confirmed that there are no migratory birds that visit dam. There is no notable wildlife presence/movement indicated during the consultations with locals and forest officials. Although dam is located close to the boundary of (2 km) Balaram-Ambaji wildlife sanctuary, it is not used as a source of water, as the core area of the sanctuary is far from the boundary. The dam is also of new origin. villagers informed the presence of Golden jackal and Monitor lizard in the dam area.

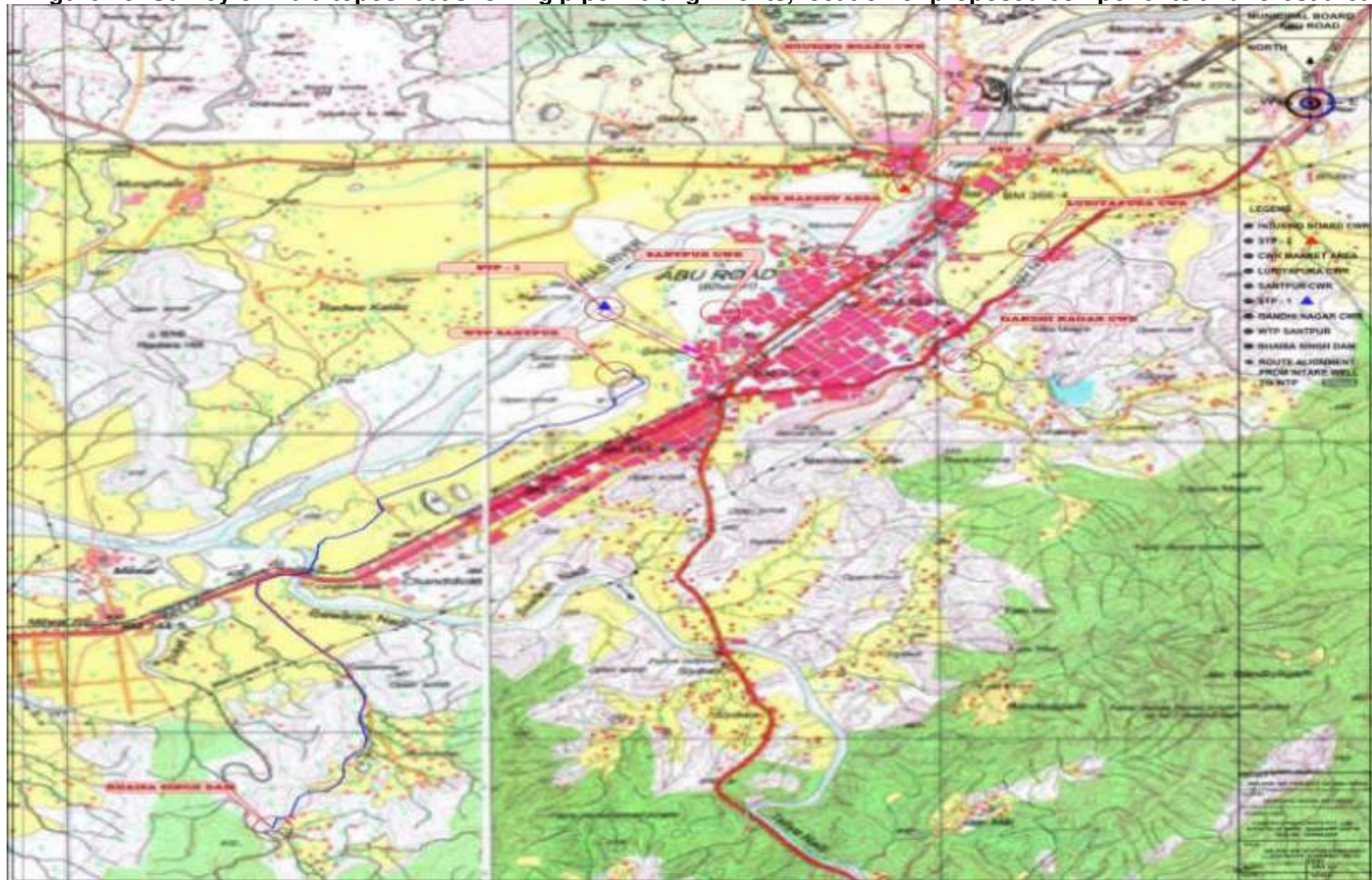
80. A critical habitat screening and biodiversity assessment study (desk-based) has been carried out by a biodiversity expert for potential presence of critical habitat within the proposed projects potential area of influence. In addition, to the potential impacts on identified local biodiversity and ecosystems, ADB's SPS, 2009 requires demonstration that the project will not adversely affect the identified critical habitat. ADB SPS, 2009 states that projects should not be developed within critical habitat areas unless all of the below criterion are met (i) there are no measurable adverse impacts, or likelihood of such, on the critical habitat which could impair its high biodiversity value or the ability to function; (ii) the project is not anticipated to lead to a reduction in the population of any recognized endangered or critically endangered species or a loss in area of the habitat concerned such that the persistence of a viable and representative host ecosystem be compromised; and (iii) any lesser impacts are mitigated.

81. Critical Habitation Screening and Biodiversity Assessment Study Report is appended at Appendix 12. The screening study for critical habitation indicates that within the area of analysis (AOA) there are no known species which would qualify the area as critical habitat under the set criteria (criterion 1–5, as presented in the report). However, within the AOA there is the potential species of vultures to utilize the wider area for feeding.

82. ADB SPS, 2009 however, also includes the statement that internationally recognized designations of sites should be considered as critical habitat. There are five species which have been identified as potentially qualifying the identified AOA as critical habitat. These are:

- (i) Gyps bengalensis;
- (ii) Sarcogyps calvus;
- (iii) Gyps indicus;
- (iv) Manis crassicaudata; and
- (v) Sypheotides indicus.

Figure 18: Survey of India toposheet showing pipeline alignments, location of proposed components and forest areas



C. Economic Development

1. Land use

83. The geographical area under the Abu Road Municipal Board is 3,186 acres as per master plan 2005. Out of which developed area is 2,275 acres and the rest is mainly agriculture land, water bodies, hilly area and an air strip (NOC of Air Strip is obtained and given as Appendix 13).

Table 11: Existing Land Use of Abu Road

S. No	Land use	Area	Developed Area	Total
		acre	%	%
1	Residential	1,005	44.18	31.54
2	Commercial	56	2.46	1.76
3	Industrial	430	18.9	13.50
4	Govt.	10	0.44	0.31
5	Recreational	22	0.97	0.69
6	Public & semi public	224	9.85	7.03
7	Transport & Communication	528	23.2	16.57
	Sub Total (Developed Area)	2,275	100.00	-
8	Agriculture and Open Land	625		19.62
9	Water Bodies, River Nalla	185		5.80
10	Hilly area	11		0.35
11	Air Strip	90		2.83
	Total	3,186.00		100.00

Reference: Master Plan 2005-2025.

2. Industry and Agriculture

84. Abu Road Town has industries, providing employment to about 9.75% of its workforce. In Abu Road industries are mainly based on agriculture, forest, mineral, engineering and dairy. There are 4 industrial areas in Abu road: (i) Arbuda industrial area; (ii) Ambaji; (iii) RIICO growth center phase I and II; and (iv) Railway loco shed. As per the census 2001, about 4.21% of total workers are engaged in primary agricultural related activities in the town.

3. Infrastructure

85. **Water Supply.** The water supply is being made through 11 open wells and 13 tube wells. The well field is in the city. The total production from above tube well and open well is 3,750 KLD in summer and 4,700 KLD in winter. There are 25 water supply zones in town area. Entire town area is provided with distribution system with gravity fed from respective OHSRs. The present service level is 51.40 LPCD in summer and 70.11 LPCD in winter. Water supply system comprises transmission mains of 44 km length and distribution network of 132 km length and 11,672 house service connections. Transmission and distribution pipes consist of AC, GI, DI and uPVC. About 84% of transmission mains and 40% of distribution network is of AC pipes.

86. **Sewerage.** There is no functional sewerage system in Abu Road. Most of the residential and commercial buildings and educational institutions have on-site septic tanks and soak pits. Though septic tanks are an accepted onsite treatment, as the septic tanks are not designed and maintained properly, the effluent does not confirm to the standards. The effluent from the septic tanks is directly let out in the open drains, which pollutes environment.

87. **Solid Waste Management.** There is no proper solid waste management system in Abu

Road. The total solid waste generation in the town is about 7-8 tons per day, with an average per capita waste generation of 110 gram (gm). Presently, 50-60% of total wastes generated from the various sources are collected through door-to-door collection system and the rest through street sweeping. Waste collected from various locations across the city is disposed-off at the identified dumping site near Shamshan Ghat (Santpur). Waste is disposed at the site by crude open dumping method.

88. **Storm Water Drainage.** Storm water from the town is carried out by drains and ultimately disposed off into open fields. The total length of roadside drains in the town is 47.28 km, which is about 60-70% of the length of roads. However, most of the roads have one side drains due to which, during rains, most of the roads get flooded.

89. **Power Supply.** Thermal power is the main source of energy from conventional sources in Rajasthan, contributing nearly 90% of the electricity, compared to hydropower, which produces the remainder. State-level companies (Rajya Vidyut Utpadan Nigam Ltd, RVUN; and Rajya Vidyut Prasaran Nigam Ltd, RVPN) are responsible for power generation and transmission respectively, and distribution is provided by 3 regional companies, (i) the Ajmer Vidyut Vitaran Nigam Limited (AVVNL); (ii) Jaipur Vidyut Vitaran Nigam Limited (JVVNL); and (iii) Jodhpur Vidyut Vitaran Nigam Limited (JDVVNL). Presently, total power availability/installed capacity of RVUN in the State is 17,281 megawatt (MW) as on December 2016, including 5,957.35 MW installed capacity of RVUN power stations as on 31 December 2016. In addition, RVUN is also managing and operating 2 Inter State Hydel Power Stations with installed capacity of 271 MW. Over 26% of total power generation (conventional and non-conventional) comes from non-conventional sources like wind, solar and biomass.

90. Power is supplied from 132 kilovolt (kV) from Sirohi and its distribution is provided by a regional company Jodhpur Vidyut Vitaran Nigam Ltd. Power is supplied from the central grid by overhead cables carried on metal and concrete poles, mainly located in public areas alongside roads. The power supply in the state is continuous and reliable, except in warmer months with periodic outages in warmer months, and large fluctuations in voltage. Average consumption of power per month is 37 lacs unit.

D. D. Socio-Cultural Resources

1. Demography

91. As of the 2011 India census, Abu Road had a population of 55,599. Males constitute 53% of the population and females 47%. Abu Road has an average literacy rate of 80.81%, higher than the state average of 66.11%. 89.63% of the males and 70.97% of females are literate. 11.89% of the population is under 6 years of age. Religious population of Abu Road is 86.85% Hindu, 11.25% Muslim, 0.64% Christian, 0.23% Sikh, 0.91% Jain, 0.03% others and 0.08% not stated.

2. History, Culture and Tourism

92. The old name of Abu Road city was Kharadi. The Rajputana Malwa Railway set up the railway station here on 30 December 1880, and the station was named Abu Road. The road to Mount Abu was built in 1845, during the rule of Maharao Shiv Singh of Sirohi. Abu Road city is also famous for religious place of Jain community. There are a total number of 14 beautiful and well-known Jainteerth or temples which are situated in and around the city where all the seasons pilgrims and tourists keep visiting to have darshan and blessings of Lord Sri Adinath Parshvanathji

Bhagwan. There are however no protected monuments or places of historical, archeological significance in the project area.

93. Abu Road and surrounding have notable history. Chandrawati village located close to Abu Road Town in the southwest is an archeological site where excavations were conducted by archeological agencies. As per the excavations, it is inferred that a large settlement existed on the same place even before Chandrawati was established by Paramaras, rulers of Chandrawati, in early 10th century. Chandrawati was said to be a major city, but lost its glory in the times, and now it's a small village. Archeological excavations conducted in Chandrawati, and a museum established, where the artifacts, remains collected from excavations are preserved. The areas of archeological importance are declared as protected areas by the state government demarcated and are fenced. This site is located outside the project area, and none of the project components are located in or close to the protected sites. Nearest component is raw water main from intake to WTP which is proposed along a road that passes about 1.3 km away from the archeological area.

E. Environmental Settings of Investment Program Component Sites

94. Subproject components are located in Abu Road Town and in its immediate surroundings which were converted into urban use for many years ago, and there is no natural habitat left at the proposed sites. No involuntary land acquisition of private land is anticipated for this project. The project sites are located in existing road ROW and government-owned lands. Proposed STPs (2 nos.), and the WTP will be constructed on vacant municipal land. Site are covered with sparse tree cover, shrubs and bushes, and no notable wildlife at these sites. There are no protected areas, wetlands, mangroves, or estuaries in or near the project locations.

95. Proposed STP sites are away from habitations and surrounded by agricultural lands (nearest house is 230 m from STP site at Manpur, and 450 m from STP site at Santapur). Treated wastewater will be reused for beneficial purposes (such as agriculture, horticulture, urban forestry, industry etc.,) a reuse plan will be prepared by the DBO contractor following the Sewerage and Wastewater Policy, 2016 and draft Guidelines Reuse of Treated Wastewater, 2019, of Government of Rajasthan. Necessary infrastructure like treated wastewater storage tanks, including an elevated reservoir, and pumping station etc., is already included in the subproject at STP.

96. Surplus/excess/unused treated wastewater will be disposed into West Banas River, that flows near the STP sites. West Banas is a seasonal river, flows only during the monsoon. In dry season it is mostly dry and carries the untreated wastewater that flows into it from the towns/habitations. There is no notable aquatic life. Agricultural activities are noticed in the surrounding areas adjoining the river

97. Sewer and water supply pipes will be laid along the roads/streets in the town within the road ROW. In wider roads pipes/sewers will be laid in the road shoulder beside the tarmac, and in narrow roads, where there is no space, sewers will be laid in the road carriage way by break opening the tarmac. Roads in some part of the town are narrow. Roads are lined both sides with open drains. In narrow roads sewers will be laid in the middle of the road, which may affect the traffic. Bigger diameter trunk sewers will be laid along the main roads, which are wide and have adequate space. No tree cutting is anticipated as there is adequate space to lay the sewer in those roads.

98. Site environmental features of all subproject sites and photographs are presented in the

following Table. Geographical position coordinates of all project sites are given in Appendix 14.

Table 12: Site Environmental Features

S. No	Subproject component	Environmental Features of the Site	Photographs
1	Intake well and pumping station in Bhaisa Singh Dam (24°34'10"N 72°73'44"E)	Intake is proposed in the dam; an approach bridge will be constructed from bund to intake well; site is approachable by a kutchra earthen road; this road will be constructed. Dam and approach road are under the control of PHED. Dam started operation in 2013-14, mainly to provide irrigation water. In 2016, dam is transferred to PHED for use as drinking water source. Dam is constructed on a small river / stream, a tributary of West Banas River. This river/stream originates in nearby Aravalli mountain range in the south and flows. Gross storage capacity of dam is 5.07 MCM, live storage is 4.616 MCM while dead storage is 0.453 MCM. Given that dam is of recent origin, there is no notable aquatic life. There are no notable fishes as per the local information. This was originally a forest land – dry deciduous forest, mixed jungle. Forest department approved diversion of 20.1 ha of forest land for Bhaisa Singh Irrigation project in 2009. Therefore, as this is currently not under forest, no forest permission is required for construction of intake, approach bridge or laying raw water main near the intake. Dam is surrounded by agricultural lands, and forest area in south. Gujarat border in the south is about 2-3 km. Balaram Ambaji Wildlife Sanctuary is located in Gujarat, the state border forms the border of sanctuary. As the dam is of recent origin, as per the local information, there are no notable wildlife activities in and around the dam / dependency of dam. Dam and surroundings are mostly converted to human use long ago and there are very few patches natural areas, mostly in the south. Approach will be constructed within the existing kutchra road footprint; no tree cutting envisaged.	

S. No	Subproject component	Environmental Features of the Site	Photographs
2	Raw water pipeline alignment	Raw water pipeline from intake in Bhaisa Singh Dam to WTP in Santpur will be laid along the existing roads. Pipeline will be partially laid along West Banas River Chandravati State protected archeological site is located at a distance of about 1.3 km from the pipeline alignment. No tree cutting is envisaged as pipe will be laid along the existing roads within the right of way. As stated above, Forest Department has already given permission for diversion of 20.1070 ha of forest land for Bhasisa Singh Irrigation project in 2009. Therefore, no involvement of forest land for laying Raw water pipeline from intake to WTP.	  

S. No	Subproject component	Environmental Features of the Site	Photographs
3	WTP site capacity at Santpur (24°27'49.31"N 72°45'10.62"E)	Site is located at Santpur in the northwest of the town, total area of the site is 22,761 sq. m, of which 10,000 sq. m will be utilized for WTP. Site is owned by Municipal Board, Abu Road. Site is predominantly flat. Site is presently vacant, and sparsely covered with few local trees, shrubs and bushes. There are 22 trees in the site. During detail design all efforts should be made to reduce numbers of trees to be cut by appropriate layout design.	
4	STP 1 at Santpur (6.90 MLD) (24°28'37.97"N 72°45'39.95"E)	Site is located near Mokshdam (crematorium) at Santpur. Area of the site is 20,000 sq. m. Site is owned by Municipal Board, Abu Road. Site is predominantly flat, presently vacant, and sparsely covered with few local trees, shrubs and bushes. Site is surrounded by agricultural / barren vacant lands and is away from habitation. Nearest house is located at about 450 m from the site. It is proposed to reuse the treated effluent for beneficial purposes (agriculture, horticulture, urban forestry etc.) and remaining /surplus / excess treated effluent is proposed to be discharged into Banas River.	

S. No	Subproject component	Environmental Features of the Site	Photographs
5	Outfall sewer alignment from STP 1 to discharge point	Treated wastewater will be discharged into West Banas River (surplus after reuse). A pipeline (of 300 mm diameter) will be laid along existing road from STP site to the river. A crematorium is located on the bank of river, and river is used for rituals and bathing. STP is located on the downstream of Treated effluent will be disposed on the downstream side of this, to avoid any interference. River remains mostly dry except during rains, and there are no water intake points in the immediate downstream. River carries the untreated wastewater from the town.	 Outfall alignment  Discharge point in West Banas River  Cremetorium on the bank of the river

S. No	Subproject component	Environmental Features of the Site	Photographs
6	STP 2 at Manpur near Banas River (2.30 MLD) (24°29'38.15"N 72°47'14.49"E)	Site is located in Manpur. Area of the site is 10,000 sq. m. Site is owned by Municipal Board, Abu Road. Site is predominantly flat. Site is presently vacant, and there is no notable tree cover or vegetation. Site is surrounded by agricultural / barren vacant lands and is away from habitation. Nearest house is located at about 230 from the site. Air strip, used for landing of helicopters, is located close to the site in the north. No objection certificate (NOC) already obtained from the concerned authority. It is proposed to reuse the treated effluent for beneficial purposes (agriculture, horticulture, urban forestry etc.) and remaining /surplus / excess treated effluent is proposed to be discharged into Banas River. River remains mostly dry except during rains, and there are no water intake points in the immediate downstream. River carries the untreated wastewater from the town.	
7	Outfall sewer alignment from STP 2 to discharge point	Treated wastewater will be discharged into West Banas River (surplus after reuse). A sewer outfall pipe of 720 m length will be laid through vacant and unused government lands from the STP site to West Banas River. River remains mostly dry except during rains, and there are no water intake points in the immediate downstream. River carries the untreated wastewater from the town.	 Outfall alignment

S. No	Subproject component	Environmental Features of the Site	Photographs
			
			Discharge location in West Banas River
8	Water sewer mains and network	Transmission mains and sewer mains will be mostly laid along the main roads and wider roads in the town, while the water and sewer network pipes will be laid in all the roads and streets in the town. Sewer pipes will not be laid in the area that are being covered under FSSM. Pipes and sewers will be laid underground along the roads/streets in the towns within the road right of way (ROW). In wider roads pipes/sewers will be laid in the road shoulder, and in narrow roads, where there is no space, pipes/sewers will be laid in the road carriage way. Water pipes will be laid mostly in the edge of the road, while sewers will be laid in the centre of the road. Roads in the old part of the town are quite narrow (~3m), and in the rest of the town roads are wider. Roads are lined with open drains. There are no trees along the roads, except in some new colonies in the outer areas. There are no environmentally, archeologically sensitive or protected areas in the town. There are common property resources such as community-owned facilities, hospitals, schools, religious places, public utilities, in the town. Commercial establishments are abutting most of the main roads in the town.	       

VI. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

A. Introduction

99. Potential environmental impacts of the proposed infrastructure components are presented in this section. Mitigation measures to minimize/mitigate negative impacts, if any, are recommended along with the agency responsible for implementation. Monitoring actions to be conducted during the implementation phase is also recommended to reduce the impact.

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

- (i) **Location impacts** include impacts associated with site selection and include loss of on-site biophysical array and encroachment either directly or indirectly on adjacent environments. It also includes impacts on people who will lose their livelihood or any other structures by the development of that site;
- (ii) **Design impacts** include impacts arising from investment program design, including technology used, scale of operation/throughput, waste production, discharge specifications, pollution sources and ancillary services;
- (iii) **Construction impacts** include impacts caused by site clearing, earthworks, machinery, vehicles and workers. Construction site impacts include erosion, dust, noise, traffic congestion and waste production; and
- (iv) **Operations and Maintenance impacts** include impacts arising from the operation and maintenance activities of the infrastructure facility. These include routine management of operational waste streams, and occupational health and safety issues.

101. Screening of environmental impacts has been based on the impact magnitude (negligible/moderate/severe – in the order of increasing degree) and impact duration (temporary/permanent).

102. This section of the IEE reviews possible project-related impacts, in order to identify issues requiring further attention and screen out issues of no relevance. ADB SPS, 2009 require that impacts and risks will be analyzed during pre-construction, construction, and operational stages in the context of the project's area of influence.

103. The ADB REA checklist for water supply and sewerage has been used to screen the project for environmental impacts and to determine the scope of the IEE.

104. In the case of this project (i) most of the individual elements are relatively small and involve straightforward construction and operation, so impacts will be mainly localized and not greatly significant; (ii) negative impacts associated with sewage facilities such as odor, treated wastewater discharge are already considered in design/siting of facilities, (iii) most of the predicted impacts are associated with the construction process, and are produced because that process is invasive, involving excavation and earth movements; and (iv) being located in an urban area, will not cause direct impact on biodiversity values. The project will be in properties held by the local government and access to the project location is through public ROW and existing roads hence, land acquisition and encroachment on private property will not occur.

B. Pre-Construction Impacts– Design and Location

1. Location Impacts

105. **Intake in Bhaisa Singh Dam.** The intake to abstract and pump water from Bhaisa Singh Dam will be constructed in the dam. It is proposed that intake will be constructed close to the northern side bund of the reservoir. There is no notable aquatic life in the dam, and therefore there are no likely impacts. The gross storage capacity of the dam 180 MCFT or 5 MCM, that include live storage of 163 MCFT (4.6 MCM), and dead storage of 17 MCFT (0.4 MCM). This dead storage will not be abstracted, and will remain in the dam, except for the infiltration and evaporation losses. This dead storage therefore will support the propagation of aquatic life even during the lean season. Given no notable aquatic life, impacts due to entrapment and impingement of aquatic organisms during intake operation are negligible. Appropriate measures however will be implemented to avoid entry of aquatic organisms, if any, during intake operation. Construction works in the reservoir may lead degradation of water quality due to increase in turbidity and chemical contamination from fuels and lubricant used in construction work. Increase in silt content and water turbidity, chemical quality can affect the aquatic life, silting/chocking of spill ways/canals etc. Though there are no notable aquatic life, to ensure that any negative impacts are mitigation, appropriate measures such as the following shall be implemented:

- (i) Do not utilize the dead storage for supply; ensure that dead storage is available in the dam all times;
- (ii) Design inlet of intake pipe in the dam with appropriate screen to avoid entry of aquatic organisms into inlet;
- (iii) Select a construction methodology that is least disturbing, and appropriate for the in-situ soil condition, and able to complete the construction work prior to onset of monsoon;
- (iv) Schedule the construction works during low water level period–late winter months to pre monsoon (February–June/July); ensure that works are completed during the same period to prior to onset of monsoon;
- (v) Erect temporary barriers to form enclosed construction area with least disturbance
- (vi) Allow adequate time to settle the distributed solids to prior to pumping out water; only clear/clarified water shall be pumped back into the reservoir; any silt laden water should be pumped to a silt pond;
- (vii) Avoid/minimize use of fuels, chemicals and lubricants; ensure no spillage;
- (viii) Clear the work site after completion at least to pre project conditions, ensure that there are no materials, debris, spills etc., and prior to removal of temporary barriers/coffer dam; and
- (ix) Implement work site safety at works in water body.

106. **Odor Nuisance from STPs.** As presented in the baseline profile, the 2 proposed STP sites are identified away from habitation, and sites are currently vacant, and do not have any notable sensitive environmental features. The Urban Improvement Trust of Abu Road has given its approval for setting up of STPs at the identified site (Approval letter attached at Appendix 15). Tree cover/vegetation is very limited. STP sites are located away from the habitation, and the nearest house from the proposed STP site at Manpur is about 230 m while at Santapur STP site, it is 450 m. The proposed treatment technology, SBR, being an aerobic process and conducted in a compacted and a closed system with automated operation, odor nuisance will be very minimal. Limited bad odors may be generated from wet well, primary treatment units and sludge treatment. Also, to account for future development potential around the sites, and to enhance the environmental benefits following measures should be included in the STP site planning and

design:

- (i) Provide a green buffer zone of 10-20 m wide all around the STP with trees in multi-rows. This will act as a barrier, visual screen around the facility and will improve the aesthetic appearance. Treated wastewater shall be used for plantation.
- (ii) Develop layout plan of STP such that odor generating units (such as sludge/ solids handling facilities) are located away from the surrounding area with future development potential.

107. Interference/Impact on local cultural practices. STP sites are located close to West Banas River, and the treated wastewater will be discharge into the river. Although priority is given to reuse of treated wastewater for beneficial purposes following the Sewerage and Wastewater Policy of Government of Rajasthan, discharge point is necessary to provide for excess/surplus or when it is not reused. River is mostly dry, and carries untreated wastewater from the town, except during the rains. There is a crematorium near the discharge point, and river course at this section is used for bathing and rituals. Following measures are to be included design so that discharge do not interfere with local cultural practice:

- (i) Locate discharge point of STP-1 at Santpur on the downstream of crematorium, and comfortably away from the river section used for rituals/bathing; consult with local community to finalize location.

108. Physical Cultural Resources. Abu Road and surrounding have notable history. Chandrawati village located close to Abu Road Town in the southwest is an archeological site where excavations were conducted by archeological agencies. As per the excavations, it is inferred that a large settlement existed on the same place even before Chandrawati was established by Paramaras, rulers of Chandrawati, in early 10th century. Chandrawati was said to be a major city, but lost its glory in the times, and now it's a small village. Archeological excavations conducted in Chandrawati, and a museum established, where the artifacts, remains collected from excavations are preserved. The areas of archeological importance are declared as protected areas by the State Government demarcated and are fenced. This site is located outside the project area, and none of the project components are located in or close to the protected sites. Nearest component is raw water main from intake to WTP which is proposed along a road that passes about 1.3 km away from the archeological area. Therefore, no impacts envisaged. Although none of the components are located in the areas demarcated by archeological agencies, risk of uncovering archaeological remains during the excavations cannot be ruled out completely. Construction contractors therefore should follow the below measures in conducting any excavation work:

- (i) Ensure that worksites are not located in archeologically sensitive areas; liaise and reconfirm with local Archeological Department during detailed design phase;
- (ii) Create awareness among the workers, supervisors and engineers about the chance finds during excavation work;
- (iii) Stop work immediately to allow further investigation if any finds are suspected; and
- (iv) Inform local Archeological Department/Museum office if a find is suspected and take any action, they require to ensure its removal or protection in situ.

109. Tree cutting at project sites. At the proposed WTP site, there are 22 small trees of local species. These trees may be required to cut for construction of WTP. There are few small trees at STP-1 site. There is no notable tree cover or vegetation in STP-2 site. Water pipelines and sewers will be laid along the road within road ROW. There are no notable trees in the alignment,

therefore no tree cutting is envisaged. Following measures need to be implemented to minimize and/or compensate for the loss of tree cover.

- (i) Minimize removal of trees by adopting to site condition and with appropriate layout design of WTP or any other site with trees;
- (ii) Obtain prior permission for tree cutting at WTP site or at any other site that may require tree cutting finalized during detailed design; and
- (iii) Plant and maintain 3 trees for each tree that is removed.

110. **Critical Habitat and Biodiversity Assessment.** A critical habitat screening and biodiversity assessment study (desk-based) has been carried out by a Biodiversity Expert for potential presence of Critical Habitat within the proposed projects potential Area of Influence. In addition, to the potential impacts on identified local biodiversity and ecosystems, ADB's SPS requires demonstration that the project will not adversely affect the identified Critical Habitat. ADB SPS states that projects should not be developed within Critical Habitat areas unless all of the below criterion are met. (i) there are no measurable adverse impacts, or likelihood of such, on the critical habitat which could impair its high biodiversity value or the ability to function; (ii) the project is not anticipated to lead to a reduction in the population of any recognized endangered or critically endangered species or a loss in area of the habitat concerned such that the persistence of a viable and representative host ecosystem be compromised, and (iii) any lesser impacts are mitigated.

111. Critical Habitation Screening and Biodiversity Assessment Study Report is appended at Appendix 16. The Screening Study for critical habitation indicates that within the area of analysis (AOA) there are no known species which would qualify the area as critical habitat under the set criteria (criterion 1–5, as presented in the report). However, within the AOA there is the potential species of vultures to utilize the wider area for feeding.

112. ADB SPS, 2009 however, also includes the statement that internationally recognized designations of sites should be considered as critical habitat. There are five species which have been identified as potentially qualifying the identified AOA) as critical habitat. These are:

- (i) *Gyps bengalensis*;
- (ii) *Sarcogyps calvus*;
- (iii) *Gyps indicus*;
- (iv) *Manis crassicaudata*; and
- (v) *Sypheotides indicus*.

113. **Recommendations of Critical Habitat and Biodiversity Assessment Study.** Based on the proposed project design and activities an initial assessment of the risk of significant effects on the potentially qualifying species has been conducted. To ensure that no measurable adverse impacts on biodiversity is achieved, the main recommendations are as follows:

- (i) Engage a local biodiversity expert to verify findings on-site;
- (ii) Conduct field-level site visits for the review and updating of the EMP;
- (iii) If species of interest are found on-site, ensure that the findings are recorded and reported to the PIU/PMU. No disturbances or works on the site should start/continue until PIU/PMU issues clearance to proceed. Measures to restrict poaching or hunting shall be put in place; and

- (iv) If species of interest are present, PMU/PIU shall coordinate with the Forest Department for the translocation of the animals and contractor to undertake biodiversity awareness training to be organized by PMU/PIU.

114. For contractors working in areas where species of interest are present, the toolbox talk should include reminders and actions required related to biodiversity conservation as specified in the EMP.

115. The below table provides potential impacts, proposed mitigation and a review of critical habitat assessment criterion 1 and 2. For criterion 3, it is considered that all lesser impacts have been mitigated so that effects or risks are at an acceptable, non-significant level. It is stressed that this is an initial assessment of impacts on potential critical habitat. If any of the five species are present and qualify the AOA as critical habitat then a fully detailed assessment will be required. The below table will be included in the EMP and should be provided to contractors as part of their contracts.

116. The main risk of significant effects for all five species will relate to the construction phase, and in particular the pipeline construction activities. Once operational, assuming a fully buried pipeline is constructed with no permanent access along the route, just a protected wayleave, then operational impacts are not considered to represent a risk to the five species which potentially represent critical habitat qualifying species.

117. From the table it can be seen that provided suitable design mitigation project design and that the construction and operational phases are effectively managed, that no adverse impacts on the potential Critical Habitat or the qualifying species is likely to occur.

Table 5: Critical Habitat Assessment: Impacts and Mitigation Measures

Receptor	Potential Impacts	Mitigation	Criterion 1 - no measurable adverse impacts on CH	Criterion 2 – no reduction in the population of CR and EN	Monitoring/Comment
<i>Gyps bengalensis</i> <i>Sarcogyps calvus</i> <i>Gyps indicus</i>	Loss of habitat and breeding trees Change in food availability – carcasses Induced impacts of improved water supply leading to increased agriculture and cattle rearing in location which in turns increases local use of chemicals harmful to vultures Disturbance of vultures at feeding locations during construction phase	Before starting any construction activities, conduct pre-construction survey for presence of this species. If these species are present, the findings should be recorded and reported. No disturbance or works on the site should start/continue until PIU issues clearance to proceed. PIU should coordinate with the Forestry Department to coordinate the translocation of the affected species. If these vulture species are present, the design shall ensure that breeding areas are not directly affected by the proposed pipeline routes and permanent infrastructure. Changes in route alignment, timing of	Based on full implementation and avoidance of impacts and risks through the proposed mitigation measures it is considered that there will be no measurable effects on this group of Criterion 1 qualifying species	Based on full implementation and avoidance of impacts and risks through the proposed mitigation measures it is considered that there will be no measurable effects on this group of Criterion 1 qualifying species	If such species are present the project shall take the opportunity to monitor vulture activities within the project area and develop a local community awareness program to support conservation of the species

Receptor	Potential Impacts	Mitigation	Criterion 1 - no measurable adverse impacts on CH	Criterion 2 – no reduction in the population of CR and EN	Monitoring/Comment
		works and avoidance of tree felling will reduce risk and impacts Construction work shall be timed to avoid the breeding season if specimens of the these birds are found to be using the AoA during the breeding season			
<i>Manis crassicaudata</i>	Direct loss of habitat due to pipeline work Disturbance of breeding pairs during courtship and rearing of chicks	Before starting any construction activities, conduct pre-construction survey for presence of this species. If these species are present, the findings should be recorded and reported. No disturbance or works on the site should start/continue until PIU issues clearance to proceed. PIU should coordinate with the Forestry Department to coordinate the translocation of the affected species.	Based on full implementation and avoidance of impacts and risks through the proposed mitigation measures it is considered that there will be no measurable effects on this group of Criterion 1 qualifying species	Based on full implementation and avoidance of impacts and risks through the proposed mitigation measures it is considered that there will be no measurable effects on this group of Criterion 1 qualifying species	Monitor potential presence of this species throughout construction period

Receptor	Potential Impacts	Mitigation	Criterion 1 - no measurable adverse impacts on CH	Criterion 2 – no reduction in the population of CR and EN	Monitoring/Comment
		The design shall ensure that breeding areas are not directly affected by the proposed pipeline routes and permanent infrastructure. Changes in route alignment, timing of works and avoidance of tree felling will reduce risk and impacts Construction work shall be time to avoid the breeding season if specimens of the these birds are found to be using the AoA during the breeding season			
<i>Manis crassicaudata</i>	Direct harm or killing of individuals during construction earthworks, tracking of vehicles and equipment across burrows. Indirect disturbance of individuals through noise and vibration during pipeline construction works. Induced impacts through improved access along pipeline wayleave during	Before starting any construction activities, conduct survey of species for the EIA process AND prior to construction works, even if not found in initial surveys. If these species are present, the findings should be recorded and reported. No disturbance or works on the site should	Based on full implementation and avoidance of impacts and risks through the proposed mitigation measures it is considered that there will be no measurable effects on this group of Criterion 1 qualifying species	Based on full implementation and avoidance of impacts and risks through the proposed mitigation measures it is considered that there will be no measurable effects on this group of Criterion 1 qualifying species	This is a uncommon species which is difficult to survey and establish with certainty that they are absent from a site. There habit is mainly fossorial and only indirect evidence of activity may be present. During ground excavation works for the pipelines, permanent footprint, all temporary facilities such as access

Receptor	Potential Impacts	Mitigation	Criterion 1 - no measurable adverse impacts on CH	Criterion 2 – no reduction in the population of CR and EN	Monitoring/Comment
	and after construction period causing increased opportunity for hunting of species for meat trade.	start/continue until PIU issues clearance to proceed. PIU should coordinate with the Forestry Department to coordinate the translocation of the affected species.			roads, a pre-clearance check and ongoing monitoring for the presence of this species must be conducted.

2. Design Impacts

118. **Design of the Proposed Components.** The Central Public Health and Environmental Engineering Organization (CPHEEO) manual suggests a design period of 15/30 years¹⁶ in general while designing the systems for water supply and sewerage components. It is proposed to consider 2051 as the design year for all the components in order to maintain unanimity in the design period and design population. Accordingly, 2021 shall be the base year and 2036 the intermediate year to cross check the designs pertaining to intermediate demand. The rate of water supply has been taken as 135 LPCD for 100% population. Sewage generation is 85% of water supply (including 5% to account for infiltration). Technical design of all the elements of water supply (intake, WTP, reservoirs, pumping, transmission and distribution system etc.), and sewerage (STP, reuse arrangements, sewer mains and network including manholes and house connections, etc.), follows the relevant national planning and design guidelines, include the Sewerage and Wastewater Policy of Rajasthan 2016.

119. Following environmental considerations are already included in the project to avoid and/or minimize adverse impacts and enhance positive benefits:

- (i) Adopting conjunctive use approach in water use; utilizing feasible surface water sources and groundwater source optimally thereby reducing the existing groundwater abstraction to the extent possible;
- (ii) Locating components and facilities appropriately by avoiding sensitive locations like forests and protected areas (environmentally, socially, and archeologically);
- (iii) Recovering wash water from treatment process to optimise the water use;
- (iv) Treatment and reuse of sludge from treatment process; providing a covered shed of adequate space to air dry the processed sludge for at least 15 days at STPs;
- (v) Designing the entire system to maintain optimal flow and terminal pressure, and optimising the overall energy usage;
- (vi) Avoiding usage of asbestos containing materials;
- (vii) Reducing the incidence of water borne diseases by providing 100% population including urban poor with potable water supplies;
- (viii) Reuse of treated wastewater from STP for non-potable uses thereby reducing the load in freshwater resources;
- (ix) Adopting a combined approach of sewerage system and faecal sludge and septage management to cover 100% population of the town with safe collection, conveyance and treatment of sewage generated in the town; and
- (x) Provision of appropriate personal protection equipment to the workers and staff.

120. **Water Source Sustainability.** Abu Road Town is presently supplying water to its residents through ground water sources i.e., 11 open wells and 13 tube wells, which have production of 3.75 MLD water in summer. Based on proposed water supply rate of 135 LPCD for Abu Road Town, and 40 LPCD for 6 villages, the total raw water demand is estimated as 10.97 MLD (base year 2021), and 15.51 MLD (ultimate design year 2051). Nearest surface water source – Bhaisa Singh Dam is considered as a source It is estimated based on the available data that 10 MLD water will be available from Bhaisa Singh Dam throughout out the year at 75% dependability, which will not be sufficient to meet the demand. There is no other feasible and dependable surface water source near Abu Road. Therefore, it is proposed to adopt conjunctive use approach, utilizing both surface and groundwater sources to meet the demand. During the high rainfall years, entire water demand may be fulfilled by Bhaisa Singh Dam, while in low rainfall years the

¹⁶ As per CPHEEO, pumps, motors, STP, storage reservoirs are to be designed for a life of 15 years.

dam water will be supplemented by groundwater.

121. Bhaisa Singh Dam is constructed across a small river originating in the nearby Aravalli Range of mountains. This is a tributary of West Banas River, and joins the river on the downstream side Abu Road Town. Dam is constructed at the foothills of Aravalli Range, about 18 km southwest of Abu Road. This earthen dam of 70 m wide and 14 m high was constructed by Water Resource Department of Government of Rajasthan for irrigation purposes. The construction of dam was completed in 2013, and later on the dam was transferred to PHED in 2016 for utilizing it for drinking water purposes. Therefore, entire water storage of dam is available for water supply, and therefore it is taken as a source for Abu Road Town. The gross and live storage capacity of the dam respectively is 180 MCFT or 5 MCM and 163 MCFT (4.6 MCM). Salient features of the dam are provided in Appendix 17. It is live storage only which can be used for drinking and other similar purposes and the proposal is to depend on 80% of live storage (3.693 MCM) considering 20% in evaporation and other losses. PHED has allocated Bhaisa Singh Dam water fully to water supply of Abu Road Town, therefore no issues related to water sharing and/or competing uses envisaged. Only live storage will be utilized, leaving the minimum water level (that is dead storage) in the dam. This will support flora and fauna.

122. The catchment of the dam is spread over an area of 40.15 km² and the inflow to the dam from rainfall over 40 years period indicate that annual inflow is generally more than the dam storage capacity. However, there are instances when the catchment contribution was less than 3.693 MCM. Such scenario would pose a threat on water availability once 10 MLD regular withdrawal (~3.65 MCM/year) is made. The town will then be depending on ground water sources (tube wells) to meet out the deficit. The project proposes rehabilitation of existing tube wells as well as developing new tube wells.

123. **Groundwater:** The 24 existing open wells and tube wells provide minimum 3.75 MLD to the town. The proposal is to rehabilitate these sources and developing 18 new tube wells which would add another 3.60 MLD water into the system. The construction of new tube wells has been proposed keeping in consideration the worst scenario of last 40 years' rainfall and catchment yield data. In the initial years, these ground water sources shall be used as an alternative source to meet the crisis in case of drought situation since the Bhaisa Singh dam is having limited storage capacity and cannot cope up two consecutive years in case of no- monsoon situation."

124. A feasibility study was conducted by Hydrogeologist, Groundwater Department, Government of Rajasthan. A detailed source sustainability analysis is presented in Appendix 18.

125. To ensure groundwater sustainability, the following measures should therefore be implemented:

- (i) Conduct detailed geophysical study to locate the tube wells appropriately to avoid failing tube wells and unsustainable abstractions;
- (ii) Prepare a groundwater harvesting and artificial recharge plan;
- (iii) Creation of artificial recharge pits in public places/public buildings. Local body can issue a notification to this effect;
- (iv) Household level artificial recharge (like roof top rainwater harvesting) should be encouraged; and
- (v) Groundwater regulation–tube wells in houses will be put to minimum used for domestic purposes in Abu Road as the continues water supply will be available once the project is implemented.

126. **Dam water quality.** Dam is located in the foothills of Aravalli mountain range. The river originates in the mountain range, and during its course it completely flows through forests, barren lands etc., and area where there are no notable pollution sources like industries. The water quality testing conducted in April 2016 (Table 14) indicates that all the tested parameters are well within the limits except turbidity which is higher than the acceptable limit. The proposed subproject includes treatment facility and therefore no impacts due to water quality envisaged. There are no notable risks of source contamination due to its location in the foothills. Dam water quality testing will be conducted during the design of WTP to reconfirm the raw water quality. Water quality of dam will be monitored during construction, and throughout operation phase at regular intervals as per the environmental monitoring plan. Water quality monitoring will be conducted at various places such as at dam, (raw water), at WTP (raw and treated water), CWRs (treated) and consumer end at sample households (supplied treated water) to ensure that water supplied to consumers meet the drinking water standards.

Table 14: Water Quality Report of Bhaisa Singh Dam

Parameter	Raw Water Quality	Drinking Water Standards (IS: 10500-2012)	
		Desirable	Permissible in absence of alternate source
pH	7.9	6.5-8.5	No relaxation
Turbidity NTU)	12	1	5
Temperature (°C)	27	-	-
Color	None	5	15
Odor	None	Agreeable	Agreeable
Chlorides as Cl, mg/l	60	250	1000
Nitrate as NO ₃ , mg/l	1	45	100
Total Dissolved Solids mg/l	595	500	2000
Iron, mg/l	-	0.3	No relaxation
Fluorides, mg/l	0.8	1.0	1.5
Alkalinity (CaCO ₃), mg/l	150	200	600
Total Hardness, mg/l	100	200	600
Calcium Hardness, mg/l	70	-	-
Magnesium Hardness, mg/l	30	-	-

Source: Office of the junior chemist, PHED Laboratory Abu Road.

127. **Groundwater Quality.** As presented in the baseline profile, groundwater is alkaline in nature with pH ranging from 7.3 to 8.1, and within the acceptable range of drinking water quality. Most of the tested parameters are well within the desirable limits of drinking water standards (IS 10500-2012). Fluoride content in couple of open wells, and TDS in an open well is exceeding the acceptable limit. Chloride content in most of the open wells is above desirable limit (250 mg/l), but within the acceptable limit (1,000 mg/l). TDS content in all the tube wells and open wells monitored is exceeding the desirable limit (500 mg/l), but within the acceptable limit (2,000 mg/l), except one tube well which has a TDS content of 2,320 mg/l, above the acceptable limit. Has the high Fluoride and TDS is only in isolated cases, and the water is mixed with other tube wells and groundwater, the blending effect thus will reduce the concentration to a great extent. In any case, the DBO contractor must ensure that supplied water to the household meets the drinking water standards, and if any additional / specific treatment (such as defluorination or softening) required, it must be included in the treatment process. As there is no sewerage system at present, groundwater is at risk of contamination due to discharge of untreated wastewater. Open defecation is not uncommon, and indiscriminate solid waste disposal is prevalent. The sewerage system being developed under the project will prevent the untreated sewage flow in open drains. A source protection plan shall be prepared to avoid source contamination at tube wells.

- (i) Prepare a source protection plan for tube wells and open wells (existing and new);
- (ii) Prevent flow of untreated wastewater in the drains;
- (iii) Ensure proper construction of tube wells including casing pipes to prevent water contamination from well spaces, and due to flooding;
- (iv) Measures should be taken to control the open defecation, and to close all unsafe latrines (for example pit latrines); and
- (v) Awareness programs shall be conducted regarding the sanitation practices and its effect on groundwater quality.

128. **Design of Water Treatment Plant.** A 10 MLD WTP is proposed to be constructed at the identified site at Santpur in Abu Road Town to treat the raw water abstracted from Bhaisa Singh Dam to meet the drinking water standards for potable water supply in the Town. Since the package is proposed under DBO contract, the DBO contract will design the WTP during the detailed design phase following the guidelines/requirements/standards prescribed in the bid documents. Water treatment process will generate wastewater from filter backwash activity and sludge from sedimentation of particulate matter in raw water, flocculated and precipitated material resulting from chemical coagulation, residuals of excess chemical dosage, plankton etc., and waste from rinsing and back washing of filter media containing debris, chemical precipitates, straining of organic debris and plankton. Bid includes various provisions in design of WTP to collect and dispose the wastewater and sludge generated in the treatment process, and the DBO contract will design the WTP accordingly. As it is a DBO contract, the process of wastewater recovery and sludge system given is indicative only at this stage, the actual system will be designed by the DBO contractor during the detailed design with the following bid provisions:

- (i) Backwash water reuse system and sludge recovery and disposal system;
- (ii) Backwash recycling components: Filter backwash holding tank, recovered water storage tank and pumping for recycling;
- (iii) Sludge management system components: Gravity thickeners for sludge from clarifiers, mechanical sludge dewatering system, storage facility for dewatered sludge; and
- (iv) Disposal of sludge at a landfill or the disposal site provided by the ULB.

129. Thus, the WTP will not generate any wastewater as recycling system will recirculate the water from holding tank to inlet to put back into the process, thus saving the water and avoiding the need to discharge into environment, therefore there are no impacts. Similarly, sludge will be collected, and dried safely, any coagulants such as alum that can be recovered from the sludge will be recovered, sludge thickened, and dried and stored in a temporary storage in WTP. Solid waste residuals which may be generated by the WTP include process residuals, used filtration membranes, spent media and miscellaneous wastes. Process residuals primarily consist of settled suspended solids from source water and chemicals added in the treatment process, such as lime and coagulants/polyelectrolyte. Pre-sedimentation, coagulation (e.g., with aluminum hydroxide [alum] or ferric hydroxide), and iron will produce sludge. Composition of the sludge depends on the treatment process and the characteristics of the source water. Bid requires the disposal to a landfill or disposal site. Disposal site not yet identified at this stage, following measures are suggested:

- (i) DBO Contractor should prepare sludge management plan for safe handling and disposal of sludge from WTP;
- (ii) Estimate the quantity of sludge/solids generated from the WTP during the detailed design phase, and likely composition based on the raw water quality and process

- chemicals;
- (iii) Minimize the quantity of solids generated by the water treatment process through optimizing coagulation processes;
- (iv) Recover process chemicals to the extent possible to minimize/prevent the disposal;
- (v) Carryout pretreatment prior to disposal;
- (vi) Dispose dried sludge / solids from WTP at approved solid waste landfill / disposal site identified by ULB;¹⁷ this should be identified during the detailed design phase;
- (vii) Evaluate the option of land application during the operation stage; conduct quality tests on the first batch of sludge generated from the WTP, check for physico chemical characteristics including heavy metals;
- (viii) Manage hazardous/harmful waste if any, as per the Hazardous Waste Management Rules; and
- (ix) Employ safe and beneficial methods for disposal of dried sludge: in building and construction industry, brick/tile manufacturing etc.

130. Use of Hazardous/Harmful Substances in Water and Wastewater Treatment. Water and/or wastewater treatment may involve application hazardous/harmful chemicals such as in coagulation, disinfection etc. As the treatment process will be designed by DBO contractor, the use of chemicals in treatment is not available at this stage. Measures are required to reduce the usage as well the handle if any hazardous substances safely following prevailing rules and regulations. For disinfection, the bid specifies, however, the use of Chlorine as disinfectant. In addition to water chlorination at WTP, post chlorination will be conducted at CWRs. It is proposed to establish chlorination system at WTP and at five CWRs. Groundwater from the tube wells/open wells will be directly pumped to CWRs where it will be mixed with the treated surface water from the WTP, and the mixed water will be chlorinated prior to distribution. Disinfection with chlorine is proposed at STP. There is invariably a safety risk when chlorine is handled. Safety precautions are necessary to ensure the safety of workers and citizens. Following measures are suggested:

- (i) Reduce the use of chemicals in the treatment process to the extent possible (water treatment); provide non-chemical alternatives or easily recoverable and/or reusable chemicals or biocompatible alternatives;
- (ii) Establish proper handling/storage/application system according to the relevant standards, safety precautions and prevent accidental release/spill;
- (iii) Provide leak/spill detection, collection/capture and safe disposal facilities such as chlorine absorption and neutralization facility;
- (iv) Provide ventilation, lighting, entry and exit facilities; visible & audible alarm facilities to alert chemical/chlorine leak;
- (v) Facility for isolation in the event of major leakages;
- (vi) Eye wash & shower facility;
- (vii) Personal protection and safety equipment for the operators (masks, oxygen cylinders, gloves, etc.);
- (viii) Provide training to the staff in safe handling and application of chemicals, material safety, and standard operating procedures and emergency responses; and
- (ix) Develop emergency response procedures.

¹⁷ At present there is no landfill in Abu Road; solid waste collected from the town is disposed by open dumping method at a disposal site identified by ULB; as per the information, a proper solid waste disposal facility including landfill will be developed in the near future. Quantity of sludge/solids of WTP shall be considered in landfill design.

131. **Design of Sewage Treatment Plant.** Two STPs of capacities 6.90 MLD and 2.3 MLD is proposed to be constructed at the identified sites to treat the sewage generated from Abu Road Town. It is proposed to establish STP based on SBR (sequential batch reactor) process, followed by disinfection by chlorine. As the bid is DBO type, detailed design of the STP will be carried out by the contractor to the following specific discharge standards. Currently for STPs in India, the standards notified by Ministry of Environment, Forests and Climate Change (MOEFCC) in 2017 (see column 4 in table below) are applicable. However, under RSTDSP, PMU has decided to base the STP design on discharge standards for STPs suggested by CPCB in 2015, which are more stringent. The strident standards also facilitate maximum utilization of treated wastewater for reuse in various purposes following the Sewerage and Wastewater Policy, 2016 of Rajasthan.¹⁸ It is also to be noted that in April 2019, the National Green Tribunal (NGT) in one of its orders directed MOEFCC to reconsider stringent standards for STPs.

Table 15: Proposed Raw and Treated Wastewater Characteristics for STP Design

S. No	Parameter	Proposed Discharge Standards for Abu Road STPs	MOEFCC STP Discharge Standards, 2017	CPCB discharge standards, 2015	IFC Guideline value for sewage discharge	WHO Guideline Value for safe use in agriculture
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1	pH	6.5 – 9.0	6 – 9	6.0-9.0	6 – 9	6 – 9
2	BOD5, mg/l	≤10	<30	≤10	30	-
3	COD, mg/l	≤50		≤50	125	-
4	TSS, mg/l	≤20	<100	≤10	50	-
5	NH4-N, mg/l	<25	-	≤5	-	
6	Total nitrogen, mg/l	<10	-	≤10	10	-
7	Oil & grease, mg/l	-	-	-	10	-
8	Total phosphorus, mg/l	-	-	-	2	-
9	Fecal Coliform, MPN/100 ml	<1000	<1000	≤100	-	<1,000
10	Nematodes, number of eggs per litre	-	-	-	-	1

BOD = Biochemical Oxygen Demand; COD = Chemical Oxygen Demand; CPCB = Central Pollution Control Board; IFC = International Finance Corporation, the World Bank Group; TSS = Total Suspended Solids.

132. **Treated wastewater Reuse/disposal.** Rajasthan is a water scarce region and receives

¹⁸ "The use of treated wastewater in irrigation and industrial application shall be given the highest priority and shall be pursued with care. Effluent quality standards shall be defined based on the best attainable treatment technologies, and calibrated to support or improve ambient receiving conditions, and to meet public health standards for end users".

low rainfall. Recognizing the importance of treated wastewater in reducing the demand on water, Sewerage and Wastewater Policy, 2016, of Rajasthan promotes the reuse of treated sewage for non-potable applications, and also to make sewerage projects environmentally sustainable. Government of Rajasthan adopted this policy to ensure "improved health status of urban population, specially the poor and under privileged, through the provision of sustainable sanitation services and protection of environment". To further promote the reuse and provide guidance, Policy prioritized reuse in irrigation (agriculture, forestry, and landscaping), followed by fish farming, industry and non-potable domestic reuse. Policy requires monitoring of treated wastewater quality, soil quality etc. Policy prohibits artificial recharge of aquifers using treated wastewater and promotes construction of storage tanks to store treated wastewater to facilitate reuse. Policy prescribes that the detailed project report (DPR) should clearly define the best reuse option specific to the town and prepare a Reuse Action Plan part of the DPR following water quality norms and legal implications. LSGD is currently in the process of publishing Guidelines for Reuse of Treated Wastewater in Rajasthan 2019 to promote the reuse and provide guidance to the stakeholders. Guidelines promotes the use the treated wastewater and envisages to maximize the collection and treatment of sewage generated and reuse of treated wastewater on a sustainable basis, thereby reducing dependency on freshwater resources.

133. Policy provided priority to reuse in agricultural for unrestricted irrigation. It suggests blending of treated wastewater with fresh water to improve quality where possible, and crops to be irrigated shall be selected to suit the irrigation water, soil type and chemistry. Policy requires monitoring of accumulation of heavy metals and salinity. It encourages farmers to use modern and efficient irrigation technologies, and to ensure protection of on-farm workers and crops. As a contingency measure, policy requires regular monitoring of treated water quality, and emergency alerts to users in any event of deterioration of quality. Policy prohibits use of treated wastewater for artificial recharge (excerpts from Policy on Reuse is provided in Appendix 19).

134. **Reuse Options.** Following the Sewerage and Wastewater Policy, 2016, the draft Guidelines on Reuse provides the following reuse applications:

- (i) Agriculture, horticulture, irrigation;
- (ii) Gardening in park;
- (iii) Road washing and water sprinkling to reduce fugitive dust;
- (iv) Industries including mining;
- (v) Recreational ponds and lakes;
- (vi) Social forestry;
- (vii) Construction activities;
- (viii) Firefighting and other municipal uses;
- (ix) Railway;
- (x) Thermal power plants;
- (xi) Cantonments; and
- (xii) Individual users.

135. **Allocation of treated wastewater for reuse.** City Level Committee (CLC) headed by the district collector will allocate the water for most appropriate uses. According to the proposed procedure, agencies/individuals that require treated wastewater shall apply to the district collector. CLC will allocate water to users. In case of supply is more than the demand of the town, the treated wastewater can be allocated to users with 25 km of STP by the CLC. It may also be made mandatory to industries to use treated wastewater under certain conditions. Memorandum of understanding between ULB and the users of the treated water (Appendix 32).

136. **Reuse Plan.** The State Policy require the sewerage detailed project report provide reuse options and strategy to implement reuse, and detailed reuse action plan. As the Abu Road subproject is proposed under DBO, the reuse plan will be prepared by the DBO contractor during the detailed design phase in consultation with the stakeholders in Abu Road, and reuse modalities will be firmed up. Subproject includes following components as part of the STP to facilitate reuse: disinfection of treated wastewater, treated effluent storage reservoir (TESR), effluent pumping station and a treated effluent elevated reservoir (TEER). At STP-1 (6.9 MLD), the capacities of TESR and TEER respectively are 690 kl (10% of STP capacity) and 345 kl (5%), and at STP 2 (2.3 MLD), the capacities are 230 kl (10%) and 115 kl (5%). Thus, total storage capacity that will be available at each STP for treated wastewater will be 15% of respective STP capacity, which will mainly facilitate supply to reuse applications from the TESR. Treated effluent will be chlorinated prior to its entry into TESR/TEER. Following needs to be considered in the preparation of reuse plan:

- (i) As part of the plan, identify potential reuse application in Abu Road, and establish quality criteria for each of the use;
- (ii) For applications that use treated wastewater directly (e.g. agriculture), the quality required for such application in safe manner considering health, environment and crop yield concerns shall be ensured;
- (iii) Prepare a reuse plan for agriculture, if that is the priority use or one of the applications as per the CLC in Abu Road, clearly indicating the limits (geographical/crops/type of application/type of soils etc.); adopt international good practice suggested by agencies like World Health Organization (WHO), Food and Agricultural Organization (FAO) of the United Nations;
- (iv) Plan should include awareness and training provisions and responsibilities; these can be conducted by concerned department (e.g., Agricultural Department, District Collectorate); and
- (v) Carryout regular/online monitoring of critical quality parameters of treated wastewater to ensure that they meet the preset standards established for reuse

137. **Use of treated wastewater for irrigation.** Use of wastewater for irrigation is associated with some health risks – from germs in wastewater, which may contaminate food and spread disease, health risk to farm workers from worms (helminths) and nematodes and chemical risk is associated if industrial wastewater enter the sewers. If the wastewater with bacteriological contaminants are used for food crops like lettuce, tomato, which are eaten without peeling or cooking, it will present a greater health risk if precaution such as such washing with chlorinated water or storing for adequate time in normal temperature before use (at least 10 days). According to the WHO, effluent which is used to irrigate trees, industrial/commercial (not food, like cotton) and fodder crops, fruit trees, and pasture should have less than one viable nematode egg per liter. Effluent used for the irrigation of food crops, sports fields, public parks, should have and less than one viable nematode egg per liter and less than 1,000 fecal coliforms per 100 milliliters (ml). These shall be considered in the reuse plan that will be prepared during the detailed design and complied accordingly.

138. **Disposal of treated wastewater.** Proposed STP sites are located close West Banas River, and the excess/surplus/unused treated wastewater will be discharge into this river. As the wastewater is treated to stringent disposal standards, no notable impacts envisaged. West Banas River runs mostly dry except during monsoon. River carries untreated wastewater from the surrounding areas town and surrounding areas. The disposal of treated wastewater meeting the set quality standards, in fact, will improve the quality of water by dilution. There are no water intakes or abstraction points in the downstream proximity. River course is surrounded

mostly by agricultural and barren lands. Dantiwada Dam across West Banas River is about 30 km-40 km downstream. Considering the existing status of river, and the degree of treatment, no significant impacts envisaged. Proper systems should be put in place at the proposed STP to ensure that treated wastewater at all times meet the stipulated standards prior to its disposal into river. Baseline water quality monitoring of West Banas River will be conducted during the detailed design phase (monsoon flow). Any change/lowering of treatment efficiency during operation may lead to poor quality of wastewater and may further pollute West Banas River. It is therefore critical that STP treats the sewage as designed. O&M of STP and change in incoming sewage quality will have impact on the treatment efficiency. This therefore requires monitoring:

- (i) Obtain of consent of RPCB for discharge of treated wastewater into West Banas River;
- (ii) Conduct a baseline water quality assessment of receiving water body – West Banas River at the discharge location;
- (iii) Regularly monitor the treated wastewater quality at STP and ensure that it meets the discharge standards; and
- (iv) Monitor water quality periodically during operation phase as per the EMP.

139. **Sludge treatment and disposal.** Sewage sludge generally consists of organic matter, pathogens, metals and micro pollutants. The concentration of parameters such as metals can be influenced by input to the sewers system from industry. Since no industrial wastewater is allowed into sewers, it is unlikely that sludge contains heavy metals. Heavy metal concentration may not be ruled out completely as the chemicals used in treatment may potentially contains heavy metals, which will then leach into the sludge.

140. Subproject includes sludge management infrastructure in STP, including system for sludge collection, thickening, solar drying, and disposal at landfill/identified site. This includes a sludge sump to collect sludge from SBR basins; returning arrangement for supernatant from the sump to inlet/equalization tank for treatment; pumping sludge to sludge thickener and pumping thickened to mechanical sludge dewatering system (such as centrifuge). It also requires contractor to establish a shed where the dewatered sludge cake can be further air dried for 15 days. This is indicative sludge management system, and DBO contractor will design the system meeting these requirements. Bid indicates that "the sludge produced from the treatment process would be processed so it may be used as fertilizer and soil conditioner" and it requires DBO contractor "to conform to the regulations of public health and environment protection norms". This follows the Sewerage and Wastewater Policy, 2016, which suggests "use of sludge produced from the treatment as fertilizer and soil conditioner after processing". Other solid waste materials from sludge treatment should be covered by an environmentally compliant disposal management plan. Disposal to vacant lot (even if government land) should not be allowed.

141. 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 for application to the land. Adequate drying is however necessary to ensure maximum kill of enteric bacteria. To achieve adequate drying minimum drying period (15 days) shall be ensured. The drying period, which will be varying depending on the season will be determined during operation and be followed. A sludge management plan will be developed by the DBO contractor during the detailed design phase. Proper sludge handling methods should be employed. Personal protection equipment should be provided to the workers.

142. Contractor will propose the sludge management plan with best methods for reuse of sludge as per guidelines of CPHEEO (guidelines are attached as Appendix 20) and best

international practices in consultation with PMU and Municipal Council. Properly dried sludge can be used as soil conditioner. Periodic testing of dried sludge will be conducted to ensure that it does not contain heavy metals that make it unsuitable for food crops. Tests shall be conducted to confirm the concentrations below the following standards. As there are no specific standards notified for sludge reuse, the compost quality standards notified under the Solid Waste Management Rules, 2016 have been adopted here. Rules stipulate that "In order to ensure safe application of compost, the following specifications for compost quality shall be met".

Table 16: Standards for Sludge Reuse as Manure

Standards for Composting. As there are no specific standards notified for sludge reuse, the compost quality standards notified under the Solid Waste Management Rules, 2016 (Schedule II A, Standards for Composting) have been adopted here. According to the standards "In order to ensure safe application of compost, the following specifications for compost quality shall be met, namely:			
Parameters	Units	Organic Compost (FCO 2009)	Phosphate Rich Organic Manure (FCO 2013)
Arsenic	mg/kg	10	10
Cadmium	mg/kg	5	5
Chromium	mg/kg	50	50
Copper	mg/kg	300	300
Lead	mg/kg	100	100
Mercury	mg/kg	0.15	0.15
Nickel	mg/kg	50	50
Zinc	mg/kg	1000	1000
C/N ratio	-	<20	<20:1
pH	-	6.5 – 7.5	(1:5 solution) maximum 6.7
Moisture, percent by weight, maximum		15.0 – 25.0	25.0
Bulk density	g/cm ³	<1	Less than 1.6
Total Organic Carbon, per cent by weight, minimum	percent by weight	12	7.9
Total Nitrogen (as N), per cent by weight, minimum	percent by weight	0.8	0.4
Total Phosphate (as P ₂ O ₅) percent by weight, minimum	percent by weight	0.4	10.4
Total Potassium (as K ₂ O), percent by weight, minimum	percent by weight	0.4	-
Colour			
Odour		Absence of foul Odor	
Particle size		minimum 90% material should pass through 4.0 mm is sieve	minimum 90% material should pass through 4.0 mm is sieve
Conductivity, not more than	dsm-1	4	8.2
* compost (final product) exceeding the above stated concentration limits shall not be used for food crops. however, it may be utilized for purposes other than growing food crops. FCO = Fertilizer Control Order, Department of Agriculture, Government of India			

143. In order to ensure the safe use of dried sludge, following should be followed:

- (i) Prepare a dried Sludge utilization plan for Abu Road within the help of Agriculture Department/CLC; plan should also include if any additional processing is required for sludge to use as soil conditioner;
- (ii) Plan should clearly various potential uses and demand in Abu Road and surroundings;
- (iii) Establish usage limits, where required, (geographical/crops/type of application /type of soils etc.); adopt international good practice suggested by agencies like World Health Organization (WHO), Food and Agricultural Organization (FAO) of the United Nations;
- (iv) Identify a landfill/suitable site for disposal of surplus dried sludge;
- (v) Monitor sludge quality during operation phase as per the EMP, ensure that it meets the quality parameters established by FCO; and
- (vi) In case of sludge not meeting the quality parameters, it shall not be used as soil condition, and shall be disposed at appropriate disposal site (if it falls under hazardous category, it shall be disposed as per the Hazardous Waste Management Rules, 2016).

144. Mixing of industrial effluent in wastewater. One of the critical aspects in sewerage system operation is, change in raw sewage characteristics at inlet of sewage treatment plant may affect the process and output quality. STPs are designed for municipal wastewater, which does not include industrial effluent. Characteristics of industrial effluent widely vary depending on the type of industry, and therefore disposal of effluent into sewers may greatly vary the inlet quality at STP and will upset process and affect the efficiency. Abu Road is one of the industrial areas in Rajasthan. Rajasthan Industrial Infrastructure Corporation (RIICO) has established an industrial area in town. There are also industrial units outside RIICO area. Various type of industries, including marble, granite, cement plant, leather, textile, plastic, synthetic yarns, resins industries. Most of these industries generate wastewater from the process, which is generally treated at effluent treatment plants specifically established for the purposes and are not allowed into municipal sewers. While the project does not provide sewerage system in established industrial areas, there is a risk of industrial effluent joining municipal sewers from the small/household units established in town areas where sewers are being provided. Mixing of industrial effluent will severely deteriorate the quality of treated wastewater, and therefore the proposed reuse. Reuse of such water may have significant impact on public health, and on land and water. Following measures should be incorporated to safeguard the sewerage system and the intended reuse:

- (i) No industrial wastewater shall be allowed to dispose into municipal sewers;
- (ii) As there is a risk of potential mixing of industrial waste, no domestic wastewater from industrial units shall be allowed into municipal sewers;
- (iii) Ensure that there is no illegal discharge through manholes or inspection chambers;
- (iv) Conduct public awareness programs in coordination with RPCB and CLC; and
- (v) Conduct regular wastewater quality monitoring (at inlet and at outlet of STP) to ensure that the treated wastewater quality complies with the effluent standards.

145. Sewer system – collection & conveyance. The sewerage system is designed as a separate system of sewage collection (i.e. caters only to domestic wastewater). There is considerable length of existing surface drains in the project area that can be used for disposal of storm runoff. The underground gravity sewers will carry sewage from households to trunk sewers and further to STPs. To maximize the benefits as intended, Abu Road Municipality should ensure that all existing septic tanks in areas that are being provided by sewers are phased out by bypassing the inlet and connecting the toilet discharge from each house directly to sewerage system.

Accumulation of silt in sewers in areas of low over time, overflows, blockages, power outages, harmful working conditions for the workers cleaning sewers etc., are some of the issues that needs to be critically looked into during the sewer system design. A properly designed system is a must for system sustainability. Measures such as the following shall be included in sewer system design to ensure that the system provides the benefits as intended:

- (i) Limit the sewer depth where possible;
- (ii) Sewers shall be laid away from water supply lines and drains (at least 1 m, wherever possible);
- (iii) In all cases, the sewer line should be laid deeper than the water pipeline (the difference between top of the sewer and bottom of water pipeline should be at least 300 mm);
- (iv) In unavoidable, where sewers are to be laid close to storm water drains, appropriate pipe material shall be selected (stoneware pipes shall be avoided);
- (v) For shallower sewers and especially in narrow roads, use small inspection chambers in lieu of manholes;
- (vi) Design manhole covers to withstand anticipated loads & ensure that the covers can be readily replaced if broken to minimize silt/garbage entry;
- (vii) Ensure sufficient hydraulic capacity to accommodate peak flows and adequate slope and gas vents in gravity mains to prevent buildup of solids and hydrogen sulfide generation; and
- (viii) Take necessary precautionary measures to protect sewer network, and to avoid disposal of solid wastes, debris, wastewater into newly laid sewers from the time it is constructed to the start of operation phase.

146. Fecal Sludge and Septage Management. The proposed FSSM will help the ULB to cover entire population with safe disposal of human excreta by serving areas which are not feasible to be provided with a sewerage system. About 9% of households will be served by this method. Under the FSSM, fecal sludge/septage will be collected from the household level septic tanks using truck mounted mobile desludging equipment and transported to STP for treatment. At this stage, the quantity of septage generated from this area is not available. This will be estimated during the detailed design phase, and number of mobile tankers required to collect the transport the septage to STP, frequency of collection depending on the size of septic tanks etc., will be worked out accordingly. IEE needs to be updated during the detailed design phase to reflect the final project design. Although handling, transportation and disposal into STP is completely mechanized, the system will however be operated by the workers, therefore proper precautions as workers will be dealing with highly harmful septage. Accessibility of septic tanks to mobile suction tankers to collect septage is critical for success of the septage management system. At STP, the septage will be mixed with the sewage and will be treated combinedly in the STP. Septage will be in concentrated and partially degraded form, and disposal of the same into STP inlet stream may upset the sewage treatment process, may generate bad odors, and may ultimately affect the quality of treated wastewater. Treatment process needs to be properly designed. Following measures are suggested for implementation:

- (i) Conduct detailed survey of the households to be covered with FSSM to design the system to suit the local conditions, such as type of septic tanks and their location in the houses;
- (ii) Create awareness program on the FSSM from collection to treatment system that will be adopted;
- (iii) Design the sewage treatment process duly considering mixing of septage;
- (iv) Ensure that the FSSM system is completely mechanized no human touch, even

- accidentally, from collection at household to discharge into STP, and in periodic cleaning of tankers;
- (v) Demarcate a proper area for cleaning of mobile tankers in STP premises, and ensure that the wastewater shall be discharged into STP;
 - (vi) Provide proper training to the workers, and staff in safe handling of FSSM tasks, provide all necessary personal protection equipment, eliminate any risks to the workers and the communities by providing proper training and necessary PPEs to workers. Safeguards induction prior to start of works will include detailed instructions handling, managing and protection from diseases and other biological hazards;
 - (vii) Ensure proper facilities for workers including showers, wash areas, toilets, drinking water, eating and resting places;
 - (viii) Conduct regular health checks; and
 - (ix) Prepare health and safety plan for FSSM.

C. Environmental Audit of Existing Water Supply Infrastructure

147. It is proposed to utilize existing water supply infrastructure like tube wells, clear water reservoirs, pump houses etc., with necessary improvements. As per the ADB SPS 2009, these are associated facilities and therefore the component operation shall comply with the ADB and applicable environmental laws of India. Besides, ADB SPS lays emphasis on impacts and risks on biodiversity and natural resources, pollution prevention abatement including hazardous waste, occupational health and safety, community health and safety, and physical cultural resources. A random environmental audit is conducted to (i) assess the compliance of the existing infrastructure with environmental legislations and (ii) improve environmental performance to minimize future potential liabilities. The preliminary audit note is given in Appendix 21. A more detailed environmental audit and risk assessment shall be carried out during detailed design stage and incorporated into the final IEE.

148. All the existing infrastructure facilities are located in Abu Road Town, which is an urban area and where there are no protected or sensitive environmental areas such as forests, wildlife sanctuaries or archeologically protected areas. Therefore, there are no risks or impacts on biodiversity and natural resources. The proposed project will optimally utilize the surface and groundwater sources. Due to nature of components, the existing infrastructure components do not fall under the ambit of any environmental related regulations, and therefore there is no requirement of permissions or clearances. Presence of ACM in the form of asbestos cement pipes in the existing water supply infrastructure is a cause of concern due to its potentially hazardous nature. Project, however, do not include rehabilitation or repair of asbestos cement pipes, and the project, in fact, proposes to discontinue the use of asbestos cement pipes. Presence of asbestos cement pipes in the existing facilities may create hazardous conditions for the workers and surrounding community. Besides, the generation and disposal of debris and discarded materials, and construction phase health and safety need to be considered and mitigated to comply with the SPS provisions. Following table provides component wise compliances and concerns. Corrective actions for the identified environmental concerns are discussed in the following section.

Table 17: Environmental Audit of Existing Facilities

Infrastructure	Details	Proposed Rehabilitation	Compliance with environmental regulatory framework	Environmental Concerns
Tube wells & open wells	11 open wells 13 tube wells. <i>Location:</i> Aabkari, Sabji Mandi, Luniyapura, Keserganj and Santpur (nayakhera).	- Replacement of pipes, submersible pumps, cables, panels, valves, flow meters and synchronization with SCADA enabled devices - Depth of the tube well will not be increased	No requirements under existing laws New tube wells require permission from State Groundwater Department; however, these are existing, and permission not required	Occupational health and safety, public safety during the construction works Disposal of discarded material, debris There are no asbestos containing material / AC pipes noticed
Clear water reservoirs (CWRs)	4 CWRs (Housing Board, Market Area, Santpur and Gandhi Nagar)	- Civil repairs and rehabilitation, replacement of pipes, connections, electrical and mechanicals parts as required - Cleaning	No requirements under existing laws	Presence of AC pipes in existing connections Occupational health and safety, public safety during the construction works Disposal of discarded material, debris including AC pipes
Plumbing stations	4 pumping stations (Housing Board, Market Area, Santpur and Gandhi Nagar)	- Replacement of pumps, motors - Civil repairs and rehabilitation, - replacement of pipes, connections, electrical and mechanicals parts as required	No requirements under existing laws	Presence of AC pipes in existing connections Spillage of oils, lubricants etc., Occupational health and safety, public safety during the construction works Disposal of discarded material, waste oils, mechanical and electrical parts, debris including AC pipes
Transmission and distribution	Transmission mains: 44 km, 80-250 mm diameter distribution: 132 km, 50-300 mm diameter pipes	- Replacement; new pipes will be laid in the place of existing pipes - Pipes will be left as it is in the ground, no	No requirements under existing laws	Presence of underground AC pipes (35 km transmission mains and 52 km distribution lines of 80-250 mm dia); exact location and condition not known; no maps

Infrastructure	Details	Proposed Rehabilitation	Compliance with environmental regulatory framework	Environmental Concerns
		rehabilitation / removal proposed		available. Accidental disturbance / need to remove in narrow roads Occupational health and safety, public safety during trenching Disposal of AC pipes / debris

149. **Corrective Measures.** As presented in the above table, there are no regulatory non-compliance issues in the existing infrastructure. The environmental concerns are mainly related to occupational health and safety, public safety, disposal of debris, discarded materials etc. A work specific environmental management plan needs to be prepared for these aspects. The exact nature of rehabilitation and repair works will be known only during the detailed design phase as the detailed technical audit will be conducted by the DBO contractor and the required rehabilitation and repair measures will be proposed accordingly. Therefore, a separate EMP will be prepared for rehabilitation works during the detailed design phase by the DBO contractor, and reviewed and approved by PMU/consultants, and the same will be implemented by the DBO contractor. These are included in the EMP.

150. Presence of ACM, mainly asbestos cement pipes, in the existing infrastructure is the main concern. Asbestos is recognized as a cause of various diseases and is considered health hazard if inhaled.

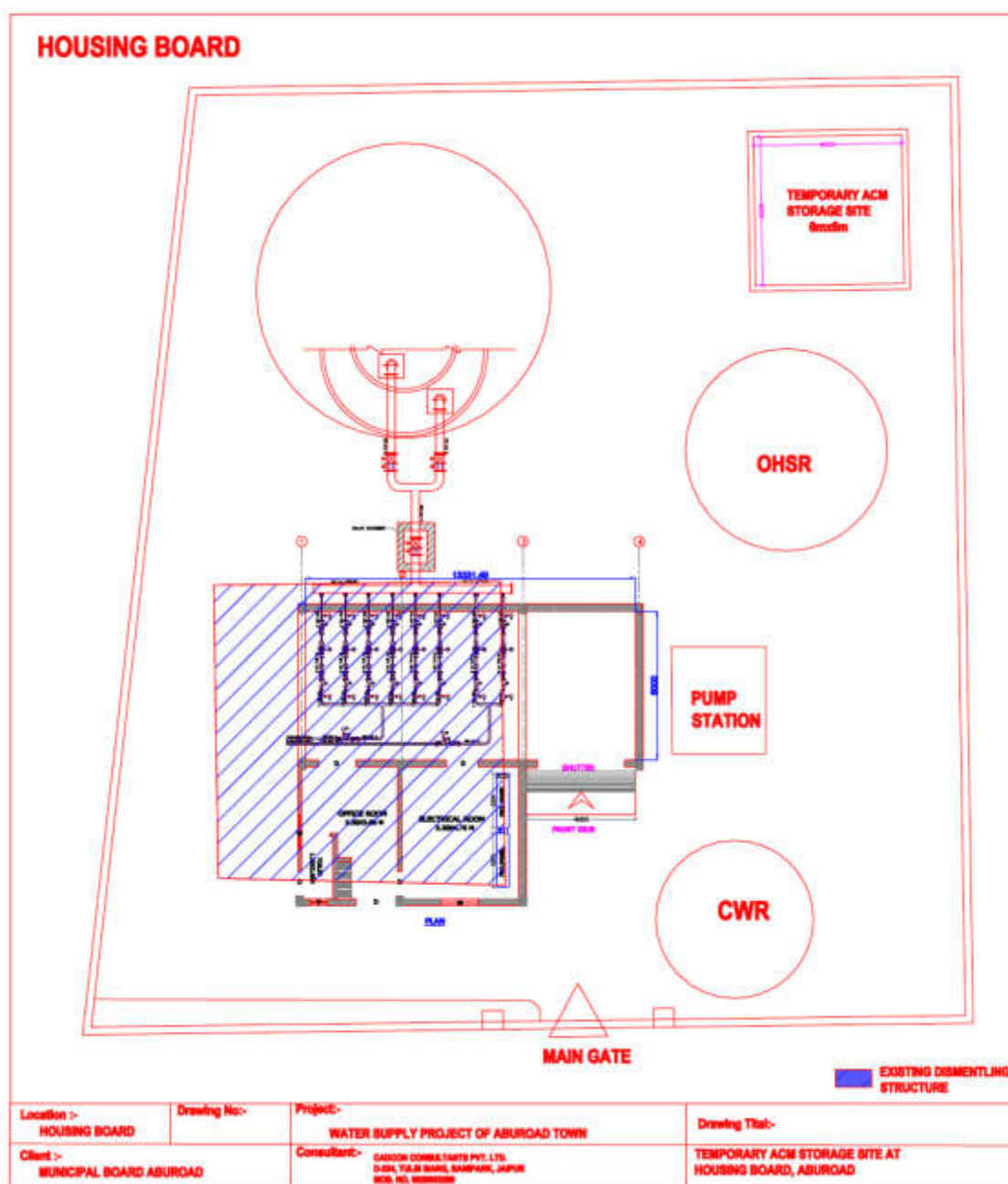
151. Nearly half of the existing 52 km of underground water transmission and distribution system consists asbestos cement pipes of 80-250 mm diameter. Most of the asbestos cement are old. There is no use of new asbestos cement pipes but for repairing work in the existing network, and for replace the damaged sections, asbestos cement pipes are being used. There will be no use of any asbestos cement pipe in the future as under the present project, water supply network is being provided in the entire town with non-asbestos cement pipes. It is normal practice in Rajasthan that existing asbestos cement pipes are left as it is in the ground and new pipes will be laid in a new alignment. As per the discussion with the local water supply staff in Abu Road, existing asbestos cement pipes are laid long back, they are deep in ground, more than 2 m at many places, as the road level has raised considerably. In wider roads, there will be adequate space to lay the new pipelines, and therefore there is no need to remove the existing pipelines.

152. However, complete avoidance of handling and disposal of asbestos cement pipes may not be possible. There are narrow lanes, where asbestos cement pipes may be encountered during the laying of new pipes. Some connections/inlet/outlet pipes at the existing CWRs are also of asbestos cement pipes. These will be removed and replaced with new non-asbestos cement pipes. At present no maps available on the exact location/position of asbestos cement pipes. The

local long serving O&M staff of PHED seem to be well aware of the location of asbestos cement pipes in the roads. Consultation with the staff indicates that of the total 87 km of underground asbestos cement pipes, about 10% may be required to be removed, especially in the narrow lanes to lay the new lines. This will be about 9 km length of water pipes.

153. A temporary storage area shall be provided in the project site by the PMU. Asbestos materials present and removed from the construction activities will be temporarily maintained at the identified area. The temporary storage area shall be constructed by the DBO contractor based on the specifications of the asbestos management service contractor.

Figure 19: Indicative location of the temporary ACM storage



154. Bureau of Indian Standards (BIS) Guidelines for Safe Use of Products containing asbestos states that "asbestos cement products (such as asbestos cement pipes) generally contain about 10-15% asbestos fibers in a cement matrix that comprises the rest of the materials and are termed as locked in asbestos products as these products have the asbestos fibers bound in cement. There is very little possibility of generation of airborne asbestos fibers during any reasonable handling, storage, and use of such products. However, during storing and installation, recommended work practices shall be followed to avoid harmful exposure". According to Hazardous and other Wastes (Management and Transboundary Movement) Rules, 2016, any waste having asbestos concentration limit of 10,000 mg/kg (i.e. 1%), however this will apply only if the asbestos containing substances are in a friable, powdered or finely divided state. Under the Basel Convention,¹⁹ asbestos or asbestos waste in the form of dust and fibers is classified as hazardous waste.

155. Working with or handling asbestos cement pipes in manner that produces dust, fibers, air borne particles etc., is very harmful and hazardous to the workers and general public around the work sites. The condition of existing underground asbestos cement pipes is not known, however, as these are old, pipes may be in deteriorated conditions. Condition needs to be assessed to check whether it is in friable form or in a condition in which it can release fibers before it is subjected any disturbance or removal.

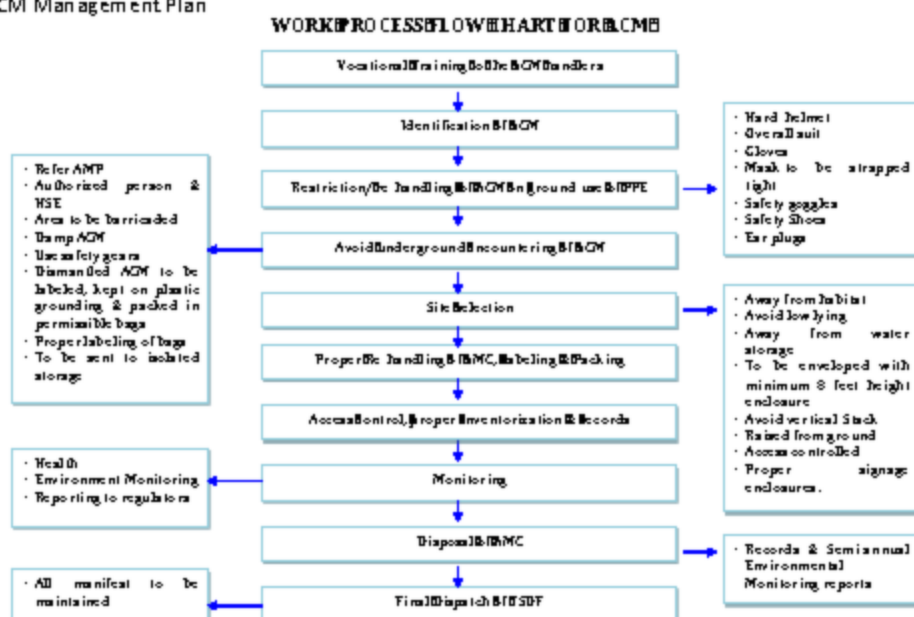
156. During the project preparation, an expert on Asbestos and ACMs was mobilized to assist PMU to conduct an assessment and field validation of the extent of asbestos cement materials covered under the sample RSTDSP subprojects. The assessment has indicated that specific measures are necessary to safeguard the health and safety of the nearby communities and the potential contractors consistent with the requirements of the ADB SPS, 2009. Activities such as clearing, transfer and disposal of asbestos cement pipes, work in narrow streets, and interventions in existing asbestos cement pipes may have adverse impacts on workers and surrounding population. Air borne asbestos if handled unsafely, cut, drilled or broken into pieces that may cause health issues such as Inflammation of the lungs, mesothelioma, peritoneal mesothelioma, pleural plaques, asbestosis and bronchogenic carcinoma. Following measures are to be implemented to avoid any impacts:

- (i) Develop and implement the ACM Management Plan (AMP) that includes identification of hazards, the use of proper safety gear and disposal methods. Sample AMP is provided in Appendix 22. Adhere to the workflow process suggested in Figure 20;
- (ii) Conduct awareness program on safety during the construction work;
- (iii) Undertake the construction work stretch-wise; excavation, pipe laying and trench refilling should be completed on the same day;
- (iv) Provide barricades, and deploy security personnel to ensure safe movement of people and also to prevent unnecessary entry and to avoid accidental fall into open trenches;
- (v) Identify risk of intervention with existing asbestos cement pipes. If there is significant risk, implement the AMP strictly that includes identification of hazards, the use of proper safety gear and disposal methods;
- (vi) Appropriate actions as defined in the AMP will have to be adhered to; and
- (vii) Maintain records of asbestos cement pipes as per the AMP.

¹⁹ Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, adopted in 1989.

Figure 20: ACM Management Plan – Work Process Flow Chart

ANNEX 1 – ACM Management Plan



157. Requirement for the contractor and the subcontractor. The following are operational requirements related to works involving asbestos:

- (i) engaging certified and competent asbestos service provider to identify, handle and remove the asbestos materials present and encountered in the project sites;
- (ii) adopting good practices per EHS Guidelines²⁰ to minimize the health risks associated with asbestos materials by avoiding their use in new construction and renovation, and, if installed asbestos-containing materials are encountered, by using internationally recognized standards and best practices to mitigate their impact;²¹
- (iii) training of workers and supervisors, possession of (or means of access to)

²⁰ ADB SPS specifies application of pollution prevention and control technologies and practices consistent with international good practice, as reflected in internationally recognized standards such as the World Bank Group's *Environment, Health and Safety (EHS) Guidelines*. These standards contain performance levels and measures that are normally acceptable and applicable to projects. When host country regulations differ from these levels and measures, the borrower/client will achieve whichever is more stringent. If less stringent levels or measures are appropriate in view of specific project circumstances, the borrower/client will provide full and detailed justification for any proposed alternatives that are consistent with the requirements presented in this document.

²¹ The EHS Guidelines specify that the use of ACM should be avoided in new buildings and construction or as a new material in remodeling or renovation activities. Existing facilities with ACM should develop an asbestos management plan that clearly identifies the locations where the ACM is present, its condition (e.g., whether it is in friable form or has the potential to release fibers), procedures for monitoring its condition, procedures to access the locations where ACM is present to avoid damage, and training of staff who can potentially come into contact with the material to avoid damage and prevent exposure. The plan should be made available to all persons involved in operations and maintenance activities. Repair or removal and disposal of existing ACM in buildings should be performed only by specially trained personnel following host country requirements or, if the country does not have its own requirements, internationally recognized procedures. Decommissioning sites may also pose a risk of exposure to asbestos that should be prevented by using specially trained personnel to identify and carefully remove asbestos insulation and structural building elements before dismantling or demolition.

- adequate equipment and supplies for the scope of envisioned works, and a record of compliance with regulations on previous work;
- (iv) removal, repair, and disposal of ACM shall be carried out in a way that minimizes worker and community asbestos exposure, and require the selected contractor to develop and submit a plan, subject to the PMU and PIU's acceptance, before doing so;
- (v) providing adequate protection to its personnel handling asbestos, including respirators and disposable clothing; and
- (vi) notifying the Rajasthan State Pollution Control Board (RSPCB) of the removal and disposal according to applicable regulations as indicated in the technical requirements and cooperating fully with representatives of RSPCB during all inspections and inquiries.

158. PMU will engage an asbestos management specialist to provide training and awareness, and to coordinate with various stakeholders on the risks, management, and mitigation measures required for the identification, safe handling, transport and disposal of the asbestos materials.

D. Pre-construction Impacts

159. **Utilities.** Telephone lines, electric poles and wires, water lines within the proposed project locations may require to be shifted in few cases. To mitigate the adverse impacts due to relocation of the utilities, the contractor, in collaboration with ULB will:

- (i) identify the locations and operators of these utilities to prevent unnecessary disruption of services during construction phase; and
- (ii) instruct construction contractors to prepare a contingency plan to include actions to be done in case of unintentional interruption of services.

160. **Site selection of construction work camps, stockpile areas, storage areas, and disposal areas.** Priority is to locate these near the project location. However, if it is deemed necessary to locate elsewhere, sites to be considered will not promote instability and result in destruction of property, vegetation, irrigation, and drinking water supply systems. Residential areas will not be considered for setting up construction camps to protect the human environment (i.e., to curb accident risks, health risks due to air and water pollution and dust and noise and to prevent social conflicts, shortages of amenities and crime). Extreme care will be taken to avoid disposals near forest areas, water bodies, swamps or in areas which will inconvenience the community. Construction sites will be selected by DBO contractor in compliance with these conditions and the same will be reflected in Site Environmental Management Plan (SEMP) which is to be prepared by DBO contractor prior to start of construction and approved by PIU.

161. **Site selection of sources of materials.** Extraction of materials can disrupt natural land contours and vegetation resulting in accelerated erosion, disturbance in natural drainage patterns, ponding and water logging, and water pollution. To mitigate the potential environmental impacts, locations of quarry site/s and borrow pit/s (for loose material other than stones) would be assessed by PIU. Priority would be sites already permitted by Mines and Geology Department. If new sites are necessary, these would be located away from population centers, drinking water intakes and streams, cultivable lands, and natural drainage systems; and in structurally stable areas. It will be the construction contractor's responsibility to verify the suitability of all material sources and to obtain the approval of Department of Mines & Geology and local revenue administration. If additional quarries will be required after construction is started, then the construction contractor shall use the mentioned criteria to select new quarry sites, with written approval of PIU. DBO

contractor will identify sources of water for construction purposes and obtain necessary permissions as required, and approval of PIU before the use. Details of material sources and water sources will be provided in SEMP.

E. Construction Impacts

162. The civil works for the subproject includes construction of intake, WTP, STPs and CWRs. These works will be confined to sites, and construction will include general activities like site clearance, excavation for foundations, and creation of concrete structures will be one of the major construction activities for this project. Most such structures will be constructed from reinforced concrete, where steel reinforcing rods and bars are placed and attached by hand to create an interior skeleton for the foundations, walls, columns, plinths, etc., and heavy-duty metal and timber/plywood formwork is bolted around the outside to build a mould into which pre-mixed concrete is poured. Once the concrete has set, the formwork is removed, and the concrete surface is finished by masons by hand if necessary. Some buildings, such as the pump station, facilities, etc., may be constructed from brick work, in which case this work will be done using standard house-building techniques. Some components of the WTP and STP may comprise a variety of prefabricated elements which will be installed on site as ready-made individual units. These will be directly brought from the manufacturers place to the sites lifted into position by crane, affixed to plinths or other installation points, and connected up to pipework and the electricity supply. Since these works are confined to the boundary of identified sites, there is no direct or significant interference of construction work with the surrounding land use. However, construction dust, noise, use of local roads for transportation of construction material, waste, labour camps etc., will have negative impacts, which needs to be avoided or mitigated properly.

163. Intake will be constructed in Bainsa Singh Dam. An enclosed area will be created using a temporary coffer dam at the selected site using barriers/sheet piles and the water will be pumped out to make the area dry for construction. Once this is created, the rest of the construction will follow the general construction procedures to create an intake of required size. Once the work is over and site is cleared, the coffer dam will be removed.

164. Subproject also include linear works (laying of 134 km of water pipes, and 105 km of sewers along the roads). This covers almost entire project area of Abu Road Town. Distribution lines/small sewers (tertiary sewers) will be laid in all streets and roads, the larger sewers and water mains will be laid mostly on wider main roads. Pipes/sewers will be laid by open cut method. Water pipes will be laid in the ground without a maximum cover of 1 m, so that depth of excavation will be up to 1.5 m-1.8 m. The maximum depth for sewers depends on the design, and in Abu Road most of the sewers will be laid 1.2 m to 2 m below the ground, and some sewers will be laid deeper (>2 m) and maximum depth will be 8 m. As per the bid conditions, sewers of more than 3.5 m deep should not be laid by open cutting method. As per the bid conditions, "the maximum depth of sewer is 3.5 m for open excavation after 3.5 m sewer shall be laid by the trenchless method only. Trenchless method may also be used even where depth is less than 3.5 m for important roads in the city where traffic density is more, and in the streets where traffic diversion is not feasible etc. Sufficient care will be taken while laying so that existing utilities and cables are not damaged and pipes are not thrown into the trenches or dragged, but carefully laid in the trenches. Trenches deeper than 1.5 m will be protected by shoring/bracings to avoid collapse of trenches, and also to avoid any risk to surrounding buildings. Once they are laid, pipes will be joined as per specification and then tested for any cracks or leakages. The minimum working hours will be 8 hours daily, the total duration of each stage depends on the soil condition and other local features. Extraneous soil after backfilling of trenches shall be used for filling low lying area or stored/ dumped in approved debris disposal sites.

165. Although construction of these project components involves quite simple techniques of civil work, the invasive nature of excavation and the project locations in the built-up areas of the town where there are a variety of human activities, will result in impacts to the environment and sensitive receptors such as schools, religious places, hospitals and the community in general. Although these anticipated impacts are temporary and for short duration, require proper mitigation measures to limit the impacts to acceptable levels. Physical impacts will be reduced by the method of working and scheduling of work. Likely impacts of construction phase, and appropriate mitigation measures are discussed below:

166. **Sources of Materials.** Significant amount of gravel, sand, coarse aggregate, and cement will be required for this project. The construction contractor will be required to:

- (i) Use material sources permitted by government only;
- (ii) Verify suitability of all material sources and obtain approval of PIU; and
- (iii) Submit to PIU monthly documentation of sources of materials. If contractor is purchasing ready mix concrete, asphalt/macadam and aggregates from third party, contractor will assure that all the parties/ suppliers are having CTE/CTO from RPCB and will collect the copy of these certificates and submit to PIU/consultants.

167. **Work near Forest Areas/Protected Areas.** Bhaisa Singh Dam, the water source, is surrounded by forests mostly on south, and southwest, while towards north and northeast, it is mostly surrounded by agricultural areas. The proposed intake is located in the north, which is away from forest. The boundary of protected area, Balaram Ambaji Wildlife Sanctuary, is about 2.6 km from the dam/intake. Towards north/northeast of the Abu Road Town, 5 km from its boundary is the Mount Abu Wildlife Sanctuary. Although none of the components are in forests or protected areas, given their proximity, following measures are to be implemented to avoid any impacts due to trespassing or accidental entry or in the unlikely event of wildlife movement near the work sites:

- (i) Intake work site and associated work facilities shall be properly demarcated and barricaded;
- (ii) All works, construction material storage/ancillary works shall be confined to the demarcated areas, no movement of workers, vehicles, equipment allowed outside this area;
- (iii) Ensure proper barricading so that no wildlife, even if it is unlikely, accidentally enters work area;
- (iv) No labor camps shall be located near intake or near forests (maintain minimum 2 km buffer);
- (v) Limit the work to daylight hours only; no work after sunset
- (vi) No workers /personnel shall enter forest areas; it is the DBOC responsibility to take necessary precautions & prevent workers removing/damaging trees/vegetation, hunting / harming animals;
- (vii) Create awareness among workers on environment & safety; and
- (viii) No high noisy works shall be conducted.

168. **Air Quality.** Emissions from construction vehicles, equipment, and machinery used for excavation and construction will induce impacts on the air quality in the construction sites. Anticipated impacts include dusts and increase in concentration of vehicle-related pollutants such as carbon monoxide, sulfur oxides, particulate matter, nitrous oxides, and hydrocarbons. These however will be temporary limiting to construction activities only. To mitigate the impacts,

construction contractors will be required to:

- (i) Plan the work sites properly, and demarcate the sites for stockpiling of, soils, gravel, and other construction materials away from the traffic, vehicle, general worker movement to avoid disturbance of loose materials;
- (ii) Damp down exposed soil and any stockpiled material on site by water sprinkling;
- (iii) Use tarpaulins to cover sand and other loose material when transported by trucks;
- (iv) Clean wheels and undercarriage of haul trucks prior to leaving construction site;
- (v) Don't allow access in the work area except workers to limit soil disturbance and prevent access by barricading and security personnel;
- (vi) Fit all heavy equipment and machinery with air pollution control devices which are operating correctly; contractor's vehicles and equipment should compulsorily have PUC and submit to PIU before deployment at site;
- (vii) Obtain, CTE and CTO for batching plant, hot mix plant, crushers and DG set etc. if specifically established for this project;
- (viii) If contractor procures any material (such as ready mix concrete, asphalt/macadam, aggregates etc.), from third party agencies, contractor shall ensure that such agencies have all necessary clearances/permissions as required under the law; these include CTE/CTO from RPCB, environmental clearance, etc.; contractor shall collect the copy of these certificates and submit to PIU; PIU will approve the source only after all the certificates are submitted; and
- (ix) Conduct air quality monitoring according to the EMP.

169. Surface Water Quality – Works during rains. Run-off from stockpiled materials and chemical contamination from fuels and lubricants during construction works can contaminate downstream surface water quality of the streams. These potential impacts are temporary and short-term duration only. However, to ensure that these are mitigated, construction contractor will be required to:

- (i) Prepare and implement a spoils management plan (Appendix 23);
- (ii) Avoid stockpiling of earth fill especially during the monsoon season unless covered by tarpaulins or plastic sheets;
- (iii) Prioritize re-use of excess spoils and materials in the construction works. If spoils will be disposed, consult with PIU on designated disposal areas;
- (iv) Inspect all the drainage at construction site/construction camp/labor camp etc. and clear all the drainage lines so that no water stagnation/flooding may occur during heavy rainfall;
- (v) As far as possible avoid trench works and excavation works (pipe laying) during monsoon season to avoid any water logging and accident due to it;
- (vi) If open trenches are not avoidable during monsoon, keep ready all the mitigations measures to avoid water logging such as dewatering pumps and sufficient pipes, traffic assistance, barricades etc.;
- (vii) Inspect and verify all the emergency measures and emergency control system before start of monsoon, keep the emergency response committee on high alert during monsoon/heavy rain fall
- (viii) Install temporary silt traps or sedimentation basins along the drainage leading to the water bodies;
- (ix) Place storage areas for fuels and lubricants away from any drainage leading to water bodies;
- (x) Dispose any wastes generated by construction activities in designated sites; and
- (xi) Conduct surface quality inspection according to the EMP.

170. **Surface Water Quality - Intake Works in Bhaisa Singh Dam.** Construction works in the reservoir may lead degradation of water quality due to increase in turbidity and chemical contamination from fuels and lubricant used in construction work. Increase in silt content and water turbidity, chemical quality can affect the aquatic life, silting/chocking of spill ways/canals etc. Though there are no notable aquatic life, to ensure that any negative impacts are mitigation, the following measures shall be implemented:

- (i) Select a construction methodology that is least disturbing, and appropriate for the in-situ soil condition, and able to complete the construction work prior to onset of monsoon;
- (ii) Schedule the construction works during low water level period – late winter months to pre monsoon (February–June/July); ensure that works are completed during the same period to prior to onset of monsoon;
- (iii) Erect temporary barriers to form enclosed construction area with least disturbance;
- (iv) Allow adequate time to settle the distributed solids to prior to pumping out water; only clear/clarified water shall be pumped back into the reservoir; any silt laden water should be pumped to a silt pond;
- (v) Avoid/minimize use of fuels, chemicals and lubricants; ensure no spillage;
- (vi) Clear the work site after completion at least to pre project conditions, ensure that there are no materials, debris, spills etc., and prior to removal of temporary barriers/coffer dam; and
- (vii) Implement work site safety at works in water bodies.

171. **Noise and Vibration Levels.** Construction works will be conducted along the roads in Abu Road urban area, where there are houses, schools and hospitals, religious places and small-scale businesses. Increase in noise level may be caused by excavation, particularly breaking of cement concrete or bitumen roads, operation of construction equipment like concrete mixers, and the transportation of equipment, materials, and people. Vibration generated from construction activity, for instance from the use of pneumatic drills, will have impact on nearby buildings. This impact is negative but short-term, and reversible by mitigation measures. The construction contractor will be required to:

- (i) Plan activities in consultation with PIU so that activities with the greatest potential to generate noise are conducted during periods of the day which will result in least disturbance;
- (ii) Horns should not be used unless it is necessary to warn other road users or animals of the vehicle's approach;
- (iii) As far as possible use new construction machineries and keep all the old machineries in good and maintained state;
- (iv) Minimize noise from construction equipment by using vehicle silencers, fitting jackhammers with noise-reducing mufflers, and use portable street barriers to minimize sound impact to surrounding sensitive receptor; and
- (v) Maintain maximum sound levels not exceeding 80 decibels (dBA) when measured at a distance of 10 m or more from the vehicle/s;
- (vi) Identify any buildings at risk from vibration damage and avoiding any use of pneumatic drills or heavy vehicles in the vicinity;
- (vii) Consult the custodians of important buildings, cultural and tourism authorities and local communities in advance of the work to identify and address key issues, and avoid working at sensitive times, such as religious and cultural festivals; and
- (viii) Conduct Noise monitoring according to the EMP.

172. **Landscape and Aesthetics.** Many trees will be required to cut due to which landscape and aesthetics of those sites will be reduced. The construction works will produce excess excavated earth, excess construction materials, and solid waste such as removed concrete, wood, packaging materials, empty containers, spoils, oils, lubricants, and other similar items. Haphazard disposal of these will have negative impacts on landscape and overall aesthetics. These impacts are negative but are of short-term and reversible by mitigation measures. The construction contractor will be required to:

- (i) Take all the efforts to reduce number of tree cutting by amending design;
- (ii) Compensatory plantation in the ratio of 1:3 is required to increase landscape and aesthetics of the sites where tree cutting has been done;
- (iii) Prepare and implement spoils management plan;
- (iv) Avoid stockpiling of excess excavated soils;
- (v) Coordinate with ULB for beneficial uses of excess excavated soils or immediately dispose to designated areas;
- (vi) Recover used oil and lubricants and reuse or remove from the sites;
- (vii) Manage solid waste according to the following preference hierarchy: reuse, recycling and disposal to designated areas;
- (viii) Remove all wreckage, rubbish, or temporary structures which are no longer required; and
- (ix) Request PIU to report in writing that the necessary environmental restoration work has been adequately performed before acceptance of work.

173. **Accessibility.** Excavation along the roads, hauling of construction materials and operation of equipment on-site can cause traffic problems. Potential impact is negative but short term and reversible by mitigation measures. The construction contractor will be required to:

- (i) Prepare and implement a traffic management plan (TMP) - Appendix 24;
- (ii) Plan transportation routes so that heavy vehicles do not use narrow local roads, except in the immediate vicinity of delivery sites;
- (iii) Schedule transport and hauling activities during non-peak hours;
- (iv) Locate entry and exit points in areas where there is low potential for traffic congestion;
- (v) Keep the site free from all unnecessary obstructions;
- (vi) Drive vehicles in a considerate manner;
- (vii) Coordinate with traffic police for temporary road diversions and for provision of traffic aids if transportation activities cannot be avoided during peak hours; and
- (viii) Notify affected sensitive receptors by providing sign boards informing nature and duration of construction works and contact numbers for concerns/complaints.

174. Wherever road width is minimal, there will be temporary loss of access to pedestrians and vehicular traffic (including 2-wheelers) during the laying of pipes. Under those circumstances, contractor shall adopt following measures:

- (i) Inform the affected local population 1-week in advance about the work schedule;
- (ii) Plan and execute the work in such a way that the period of disturbance/loss of access is minimum; and
- (iii) Provide pedestrian access in all the locations until normalcy is restored. Provide wooden/metal planks over the open trenches at each house to maintain the access.

175. **Traffic diversion and/or road closure.** Laying of water and sewer lines simultaneously may significantly impact the traffic movement. This should be avoided as far as possible by proper planning of construction works. If traffic diversion and/or road closure is required for the proposed works, prior consent from traffic department will be required and prior information to affected areas and public should be disseminated through consultations by CAPP. Proper road signage and traffic aids should be provided at site. Excavation along the roads, hauling of construction materials and operation of equipment on-site can cause traffic problems. As the trenchless method adopted for sewers of more than 3.5 m deep avoiding open cut excavation, this will avoid large scale disturbances in the busy roads. Potential impact is negative but short term and reversible by mitigation measures. The construction contractor will be required to:

- (i) Plan water and sewer line works to minimize traffic disturbance/blockades; as the both water and sewer lines are to be laid in all the roads and streets in the town, work planning is crucial to minimize the inconvenience to public due to repeated excavations;
- (ii) Prepare and implement a TMP (Appendix 24);
- (iii) Duly consider and select sections for trenchless method of pipelaying based on traffic conditions;
- (iv) Locate entry and exit points in areas where there is low potential for traffic congestion;
- (v) Keep the site free from all unnecessary obstructions;
- (vi) Coordinate with traffic police for temporary road diversions and for provision of traffic aids if transportation activities cannot be avoided during peak hours;
- (vii) Notify affected sensitive receptors by providing sign boards informing nature and duration of construction works and contact numbers for concerns/complaints; and
- (viii) Maintain sufficient access to houses and shopkeepers (commercial establishments) during pipe/sewer laying work through metal sheets and temporary bridges.

176. **Socio-Economic–Income.** The project components will be located in government land and there is no requirement for land acquisition or any resettlement. Construction works will impede the access of residents to specific site in limited cases. The potential impacts are negative and moderate but short-term and temporary. The construction contractor will be required to:

- (i) Prepare and implement spoils management plan (SMP) - Appendix 23; ensure that there is no unnecessary obstruction due to soil, debris on the site;
- (ii) Leave spaces for access between mounds of soil;
- (iii) Provide walkways and metal sheets where required to maintain access across for people and vehicles;
- (iv) Increase workforce in the areas with predominantly institutions, place of worship, business establishment, hospitals, and schools;
- (v) Consult businesses and institutions regarding operating hours and factoring this in work schedules;
- (vi) Provide sign boards for pedestrians to inform nature and duration of construction works and contact numbers for concerns/complaints;
- (vii) Notify community/ water users in advance about likely interruptions in water supply; and
- (viii) Provide alternate sources of clean water until water supply is restored.

177. **Socio-Economic – Employment.** Manpower will be required during the 36-months

construction stage. This can result in generation of temporary employment and increase in local revenue. Thus, potential impact is positive and long-term. The construction contractor will be required to employ local labor force or to the maximum extent possible.

178. Occupational Health and Safety. Workers need to be mindful of the occupational hazards which can arise from working in height and excavation works. Potential impacts are negative and long-term but reversible by mitigation measures. The construction contractor will be required to:

- (i) Comply with all national, state and local labor laws (see Appendix 9);
- (ii) Following best practice health and safety guidelines: IFC's General EHS Guidelines²², WHO Interim Guidance (and its updates) on Water, Sanitation, Hygiene and Waste management for the COVID19 virus (Appendix 33), and Sector Specific (Water and Sanitation) Guidelines;²³
- (iii) Develop and implement site-specific occupational health and safety (OHS) plan which will include measures such as: (a) excluding public from the site; (b) ensuring all workers are provided with and use personal protective equipment; (c) OHS Training²⁴ for all site personnel; (d) documented procedures to be followed for all site activities; and (e) documentation of work-related accidents;
- (iv) Conduct work in confined spaces, trenches, and at height with suitable precautions and using standards and safe construction methods; do not adopt adhoc methods; all trenches deeper than 1.5 m shall be provided with safety shoring/braces; and avoid open cutting method for trenches deeper than 3.5 m by adopting trenchless technology;
- (v) Ensure that qualified first aid is provided at all times. Equipped first-aid stations shall be easily accessible throughout the site;
- (vi) Provide medical insurance coverage for workers;
- (vii) Secure all installations from unauthorized intrusion and accident risks; and
- (viii) The project area experiences extreme temperature during summer months of April and May, which may affect the health of workers engaged in construction work. Contractor should take necessary measures during summers including the following:
 - Work schedule should be adjusted to avoid peak temperature hours (12 -3 PM);
 - Provide appropriate shade near the workplace; allow periodic resting and provide adequate water; and
 - Provide necessary medicine and facilities to take care of dehydration related health issues.
- (ix) Provide supplies of potable drinking water;

²²<https://www.ifc.org/wps/wcm/connect/554e8d80488658e4b76af76a6515bb18/Final%2B-%2BGeneral%2BEHS%2BGuidelines.pdf?MOD=AJPERES>

²³<https://www.ifc.org/wps/wcm/connect/e22c050048855ae0875cd76a6515bb18/Final%2B-%2BWater%2Band%2BSanitation.pdf?MOD=AJPERES>

²⁴ Some of the key areas that may be covered during training as they relate to the primary causes of accidents include (i) slips, trips and falls; (ii) personal protective equipment; (iii) ergonomics, repetitive motion, and manual handling; (iv) workplace transport; and (v) legislation and responsibilities. Training can provide the foundations of competence, but it does not necessarily result in a competent worker. Therefore, it is essential to assess staff competence to ensure that the training provided is relevant and effective. Supervision and monitoring arrangements shall be in place to ensure that training has been effective, and the worker is competent at their job. The level of supervision and monitoring required is a management decision that shall be based on the risks associated with the job, the level of competence required, the experience of the individual and whether the worker works as part of a team or is a lone worker.

- (x) Provide clean eating areas where workers are not exposed to hazardous or noxious substances;
- (xi) Provide H&S orientation training to all new workers to ensure that they are apprised of the basic site rules of work at the site, personal protective protection, and preventing injuring to fellow workers;
- (xii) Provide visitor orientation if visitors to the site can gain access to areas where hazardous conditions or substances may be present. Ensure also that visitor/s do not enter hazard areas unescorted;
- (xiii) Ensure the visibility of workers through their use of high visibility vests when working in or walking through heavy equipment operating areas;
- (xiv) Ensure moving equipment is outfitted with audible back-up alarms;
- (xv) Mark and provide sign boards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal. Signage shall be in accordance with international standards and be well known to, and easily understood by workers, visitors, and the general public as appropriate;
- (xvi) Disallow worker exposure to noise level greater than 85 dBA for a duration of more than 8 hours per day without hearing protection. The use of hearing protection shall be enforced actively;
- (xvii) Conduct regular health check-ups for workers;
- (xviii) Provide periodical awareness camps and special trainings for workers for health issues and risks in construction sites; and
- (xix) During working in Dam area, workers should be made aware of risks of water depth and dangerous areas of water should be properly marked by fix or floating barricades and signage of danger. Workers should also be made aware for protection of biodiversity of the water and fishing should be strictly prohibited. A boat should be made available at site for transport of labour and materials and should be well maintained for any emergency condition. Workers should not be allowed to dip or bath in water of dam. Suitable working platform should be provided during construction works in water.

179. **Asbestos Containing Materials.** No ACM is proposed to be used in the subproject construction. There are however ACM in the existing water supply infrastructure, which may be disturbed or come in contact with the workers and general public and may have serious health implications. This is already discussed in under the existing facilities audit, and necessary measures are suggested.

180. **Community Health and Safety.** Hazards posed to the public, specifically in high-pedestrian areas may include traffic accidents and vehicle collision with pedestrians. Potential impact is negative but short-term and reversible by mitigation measures. The construction contractor will be required to:

- (i) Plan routes to avoid times of peak-pedestrian activities;
- (ii) Liaise with PIU in identifying risk areas on route cards/maps;
- (iii) Maintain regularly the vehicles and use of manufacturer-approved parts to minimize potentially serious accidents caused by equipment malfunction or premature failure; and
- (iv) Provide road signs and flag persons to warn of on-going trenching activities.

181. Central part of the town is characterized by narrow roads. Particularly, the areas located on slopes have very narrow roads with sharp turns and are accessible only to pedestrians.

Besides impeding the access, the trench excavation and pipe laying will pose safety risks to pedestrians, and the people living in these areas. The construction contractor will be required to:

- (i) Trench excavation and pipeline works shall be conducted in a safe manner; if the allowing public movement along the work sites (pedestrians or vehicles as the case may be) is likely to cause safety risks, movement should be blocked temporarily and work shall be conducted; in such areas, conducting night work or working in small stretches to avoid blockage of traffic/movement no more than few hours in due consultation with the local community and ULB shall be planned;
- (ii) All trenches deeper than 1.5 m shall be provided with safety shoring/braces; and avoid open cutting method for trenches deeper than 3.5 m by adopting trenchless technology;
- (iii) Survey the surrounding vulnerable buildings for likely issues in structural stability/differential settlement during the excavation works;
- (iv) Provide prior information to the local people about the nature and duration of work;
- (v) Conduct awareness program on safety during the construction work;
- (vi) Undertake the construction work stretch-wise; excavation, pipe laying and trench refilling should be completed on the same day; and
- (vii) Provide hard barricades and deploy security personnel to ensure safe movement of people and also to prevent unnecessary entry and to avoid accidental fall into open trenches.

182. Establishment and Operation of Construction Camps and Workers Facilities. It is likely that the contract may employ workers from outside project area, and therefore may provide temporary workers accommodation during the construction phase. Proper provision and maintenance of facilities is necessary for proper living conditions and avoid health, environment and safety issues. Workers camps may also adverse impacts on surrounding communities. Operation of construction camps can cause temporary air and noise pollution from machine operation, water pollution from storage and use of fuels, oils, solvents, and lubricants. Potential impacts are negative but short-term and reversible by mitigation measures. The construction contractor will be required to:

- (i) Consult PIU before locating project offices, sheds, and construction plants;
- (ii) Minimize removal of vegetation and disallow cutting of trees;
- (iii) Provide drinking water, water for other uses, and sanitation facilities for employees;
- (iv) Provided temporary rest and eating area at all work sites;
- (v) Ensure conditions of liveability at work camps are maintained at the highest standards possible at all times; living quarters and construction camps shall be provided with standard materials (as far as possible to use portable ready to fit-in reusable cabins with proper ventilation); thatched huts, and facilities constructed with materials like GI sheets, tarpaulins, etc., shall not be used as accommodation for workers; accommodation shall meet the IFC standards for workers accommodation²⁵ which include: provision of safe housing, availability of electricity, plumbing, water and sanitation, adequate fire protection and dormitory/room facilities; accommodation shall be in the range from 10 to 12.5 cubic meter (m³) (volume) or 4 to 5.5 square meters (m²) (surface) per worker, a minimum ceiling height of 2.10 m; a reasonable number of workers are allowed to share the same room—(standards range from 2 to 8 workers); workers with

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https://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/sustainability-at-ifc/publications/publications_gpn_workersaccommodation

accompanying families shall be provided with a proper and safe accommodation (IFC benchmark standards for workers accommodation is provided in Appendix 25);

- (vi) Prohibit employees from poaching wildlife and cutting of trees for firewood;
- (vii) Train employees in the storage and handling of materials which can potentially cause soil contamination;
- (viii) Recover used oil and lubricants and reuse or remove from the site;
- (ix) Manage solid waste according to the following preference hierarchy: reuse, recycling and disposal to designated areas;
- (x) Remove all wreckage, rubbish, or temporary structures which are no longer required; and
- (xi) Report in writing that the camp has been vacated and restored to pre-project conditions before acceptance of work.

183. **Social and Cultural Resources.** Abu Road and surrounding have notable history. Chandrawati village located close to Abu Road Town in the southwest is an archeological site where excavations were conducted by archeological agencies. As per the excavations, it is inferred that a large settlement existed on the same place even before Chandravati was established by Paramaras, rulers of Chandrawati, in early 10th century. Chandrawati was said to be a major city, but lost its glory in the times, and now it's a small village. Archeological excavations conducted in Chandrawati, and a museum established, where the artifacts, remains collected from excavations are preserved. The areas of archeological importance are declared as protected areas by the State Government demarcated and are fenced. This site is located outside the project area, and none of the project components are located in or close to the protected sites. Nearest component is raw water main from intake to WTP which is proposed along a road that passes about 1.3 km away from the archeological area. Therefore, no impacts envisaged. Although none of the components are located in the areas demarcated by archeological agencies, risk of uncovering archeological remains during the excavations cannot be ruled out completely. Construction contractors therefore should follow the below measures in conducting any excavation work:

- (i) Strictly follow the protocol for chance finds in any excavation work;
- (ii) Create awareness among the workers, supervisors and engineers about the chance finds during excavation work;
- (iii) Stop work immediately to allow further investigation if any finds are suspected;
- (iv) Inform local Archeological Department/Museum office if a find is suspected and take any action, they require to ensure its removal or protection in situ.

184. **Debris disposal.** Prior to the commencement of works, contractor shall identify a debris disposal site in consultation with the PIU and consultant contractor will follow all the prescribed rules²⁶ during construction and adhering to following criteria (including but not limited to):

- (i) The site shall be selected preferably from barren, infertile lands. In case agricultural land needs to be selected, top-soil stripping, stacking and preservation should be undertaken prior to initiation of any activities;
- (ii) Debris disposal site shall be at least 200 m away from surface water bodies;²⁷
- (iii) No residential areas shall be located within 100 m downwind side of the site;

²⁶ Construction and Demolition Waste Management Rules 2016 (refer Appendix 8).

²⁷ In the absence of site meeting the stipulated criteria, an alternate site can be selected specifying the reasons. In such a case, the construction camp management plan should incorporate additional measures specific to the site as suggested by the Construction Manager.

- (iv) The site is minimum 250 m away from sensitive locations like hospitals, religious places, ponds/lakes or other water bodies; and
- (v) The local governing body and community shall be consulted while selecting the site.

185. Night works. Most of the construction works shall be undertaken only during day hours. Night works are required only in the extreme conditions such as road having heavy traffic in day time and/or no alternate access can be provided for the road users, extreme climatic conditions (extreme hot during summers), religious fairs/celebrations in daytime etc. Contractors are required to take prior approval from PIU and concerned town authorities for night works. Contractors are required to adhere following conditions for night works including those prescribed by concerned authorities:

- (i) Prepare a night work protocol and obtain prior approval from PIU, and strictly implement and report on implementation of protocol during the workers;
- (ii) Contractors should have handheld noise level meter for measurement of noise during night hours;
- (iii) Contractors should have handheld lux meter for the measurement of illumination during night hours;
- (iv) Preferably electrical connection is available for running equipment otherwise soundproof/super silent Diesel Generator set should be available;
- (v) Sound level should not increase as prescribe by CPCB; and
- (vi) Illumination should be as follows:

Minimum illumination (lx)	Areas to be illuminated	Type of work activity
54	Illumination throughout the work area	General work area lighting, and performance of visual tasks of large size, or medium contrast, or low require accuracy
108	Illumination of work area and areas adjacent to equipment	Performance of visual tasks of medium size, or low to medium contrast, or medium required accuracy
216	Illumination of task	Performance of visual tasks of small size, or low contrast or high required accuracy or fine finish

- (vii) As far as possible ready-mix concrete from batching plant to be used, otherwise the concrete should be prepared away from residential areas and brought to the site;
- (viii) All the noisy activities like hammering, cutting, crushing, running of heavy equipment should be done in daytime and avoided in nighttime;
- (ix) Workers engaged in night works should have adequate rest/sleep in daytime before start of night works;
- (x) Worker engaged for night works should have previous experience of night works and should be physically fit for such works including clear vision in night;
- (xi) All the necessary provisions of traffic aids such as traffic signals, road signage, barricades, cautions boards, traffic diversion boards etc., should be available with fluorescent/retro-reflective arrangements;
- (xii) Workers should be trained before start of night works about risks and hazards of night works and their mitigation measures and should be provided all the protective aids (PPEs) including fluorescent/retro-reflective vests;
- (xiii) Horns should not be permitted by equipment and vehicles;
- (xiv) Workers should not shout and create noise;
- (xv) First aid and emergency vehicles should be available at site;
- (xvi) Emergency preparedness plan should be operative during night works;

- (xvii) Old persons and pregnant women and women having small kids should not work in nighttime;
- (xviii) All the vehicles and equipment being used at night works should have adequate type of silencers/enclosures/mufflers to reduce noise;
- (xix) All the vehicles should be checked for working head lamps, tail lamps, inner lights etc. before start of night works;
- (xx) PIU/CMSC site engineers and contractor's safety personnel should closely monitor the safety of works continuously and noise and illumination levels on hourly basis and maintain photographic and video graphic records as well as register the observations;
- (xxi) Night works should be stopped early in the morning at least one hour before start of pedestrian/traffic movement;
- (xxii) After completion of night works all the site should be cleaned and maintained obstruction free for daytime movement of vehicles and pedestrians;
- (xxiii) Drivers and workers should be alert and responsive during night works;
- (xxiv) All the wages to workers working in night hours should be as per the applicable labor acts;
- (xxv) Avoid any nuisance which may create problems to nearby habitants and work peacefully during night hours; and
- (xxvi) Night works should not be conducted near hospitals and during peak seasons such as peak tourist season, students' exam times etc.

F. Operation and Maintenance Impacts

186. **Water Supply System.** O&M of the water supply system will be carried out by DBO contractor for 10 years and then by Abu Road Municipality directly or through an external operator. The water supply system is intended to deliver potable water meeting drinking water standards (Appendix 8) to the consumers at their homes. This must be ensured.

187. The system has a design life of 30 years, during which shall not require major repairs or refurbishments and should operate with little maintenance beyond routine actions required to keep the equipment in working order. The stability and integrity of the system will be monitored periodically to detect any problems and allow remedial action if required. Any repairs will be small-scale involving manual, temporary, and short-term works involving regular checking and recording of performance for signs of deterioration, servicing and replacement of parts.

188. Recurrence of pipe bursting and leakage problems in water supply system will be managed by the leak detection and water auditing surveys. The operating agency will be required to ensure that the leak detection and rectification time is minimized.

189. Water treatment and disinfection in the WTP and CWRs is one of the main operation activities of the water supply system. This activity produces wastewater, solid waste, and poses safety risk due to handling of chlorine.

190. Since backwash water/wastewater from the process is recovered and recirculated in the WTP, no wastewater will be generated from water treatment process. Water treatment process will generate sludge from sedimentation of particulate matter in raw water, flocculated and precipitated material resulting from chemical coagulation, residuals of excess chemical dosage, plankton etc.; and waste from rinsing and back washing of filter media containing debris, chemical precipitates, straining of organic debris and plankton. The management and safe disposal of wastewater and sludge have already been considered in the design phase, and if these activities

are implemented as intended will have no negative impacts.

191. It is proposed to use chlorine for disinfection of water, therefore there is a safety risk due to handling of large quantities of chlorine at the WTP. Likely impacts will be negligible if the various measures are suggested safety features and equipment to meet with any accidental eventuality are included in the design and development of the facility. During the operation phase, it is necessary that the facility is operated by trained staff as per the standard operating procedures.

192. Following measures are suggested for implementation/compliance during the operation phase:

- (i) Judiciously utilize the available water in Bhaisa Singh Dam water and groundwater resources by adapting conjunctive use; prepare a water utilization plan every year post monsoon season depending on the water storage in Bhaisa Singh Dam;
- (ii) Ensure that dead storage is always maintained in Bhaisa Singh Dam; utilize only available live storage for water supply;
- (iii) Prepare and implement contingency plan for low rainfall years that will result in low water levels in Bhaisa Singh Dam; in such cases revise the water supply rate appropriately to ensure uninterrupted water supply throughout the year; provide prior information to stakeholders;
- (iv) Ensure that water supplied to the consumers at all times meet the drinking water standards; carry out regular sampling and testing, and disseminative information;
- (v) Ensure zero wastewater discharge from the water treatment process via collection and recirculation of process wastewater/backwash water;
- (vi) Implement sludge management plan; ensure collection, processing, drying, and safe disposal/reuse accordingly;
- (vii) Assess composition and characteristics of sludge from the first batch operation at the initial phases, and confirm the handling, management and disposal/reuse actions suggested in the management plan;
- (viii) Conduct periodic testing of sludge as per the EMP;
- (ix) Ensure valid consent to operate (CTO) from RPCB for operation of WTP;
- (x) Ensure that all conditions/standards prescribed by RPCB are complied duly;
- (xi) Ensure that chlorinator facility is operated only by trained staff and as per the standard operating procedures; in case of any accident and/or maintenance activity, ensure that the staff follows documented procedures only; and
- (xii) Implement emergency response system (ERS) for the chlorine leakage; Guidelines and Emergency plan for handling and storing chlorine is attached as Appendix 26.

193. **Sewerage System.** O&M of the sewerage system will be carried out by DBO contractor for 10 years and then by Abu Road Municipality directly or through an external operator. The sewerage system is intended to collect, convey, treat and dispose the sewage from the town areas safely. Operation will involve collection and conveyance of wastewater from houses to STP; treatment of sewage at STP to meet the disposal standards; and final disposal of treated wastewater, and treatment and disposal of sludge.

194. Treated wastewater is proposed to be utilized in reuse applications following the Sewerage and Wastewater Policy 2016 of Rajasthan, and accordingly reuse plan will be prepared by the DBO contractor during the detailed design phase. As stated previously, subproject will be implemented under DBO, and the successful bidder/DBO contractor will carry out detailed designs, therefore at present the subproject is designed in outline only. The treated wastewater if utilized

for reuse purposes as per the reuse plan there will be no negative impacts, and in fact it will enhance environmental benefits in the form of water savings. Various measures to safeguard environment and health environment in utilizing the treated wastewater, including required quality for various process will be established in the reuse plan and will be implemented accordingly. All necessary safety, mitigation and monitoring measures as suggested in the reuse plan shall be implemented. The excess/surplus/unused wastewater, if any, will be discharged into West Banas River. River mostly runs dry except during monsoon. It carries untreated wastewater from habitations and towns located along its course. There are no water intake points in the downstream proximity. Considering the existing status of river, and the degree of treatment proposed, no significant impacts envisaged. However, any change/ lowering of treatment efficiency during operation may lead to poor quality of wastewater and affect the reuse. Mixing of industrial effluents in sewers may affect the inlet quality of sewage. It is therefore critical that STP receives the sewage with intended quality and treats the same to design discharge standards.

195. STP operational procedures will be firmed up during the detailed design phase, including the amount of automated or manual operation. It must be ensured that the facility is operated with standard operating procedures and only by trained staff. Ensuring uninterrupted power supply with back-up facility is a must. Standard operating procedures and operation manual will be prepared by the DBO contractor. Besides routine operation, this should cover all necessary items such as preventive maintenance, periodic maintenance and emergency maintenance, replacement of pumps, motors, and other electro-mechanical parts as per the design life to optimize energy use and system efficiency etc. Adequate resources – technical and financial, has been taken into consideration in the project design. Manual will also include safety awareness and mock drills for worker safety.

196. Subproject includes sludge management infrastructure in STP, including system for sludge collection, thickening, solar drying, and disposal at landfill/identified site. This includes a sludge sump to collect sludge from SBR basins; returning arrangement for supernatant from the sump to inlet/equalization tank for treatment; pumping sludge to sludge thickener and pumping thickened to mechanical sludge dewatering system (such as centrifuge). It also requires contractor to establish a shed where the dewatered sludge cake can be further air dried for 15 days. This is indicative sludge management system, and DBO contractor will design the system meeting these requirements and prepare sludge management plan. Bid indicates that "the sludge produced from the treatment process would be processed so it may be used as fertilizer and soil conditioner" and it requires DBO contractor "to conform to the regulations of public health and environment protection norms". The norms for safe use of processed sludge as fertilizer and soil conditioner are discussed in Para 139 of this IEE. This follows the Sewerage and Wastewater Policy, 2016, which suggests "use of sludge produced from the treatment as fertilizer and soil conditioner after processing". A sludge disposal site will be identified during the detailed design phase to dispose unutilized dried sludge in reuse applications. The updated IEE will include the details of disposal site. If the sludge is managed accordingly, there will no impacts.

197. During the operation phase, it is necessary that the facility is operated by trained staff as per the standard operating procedures. Following measures are suggested for implementation/ compliance during the operation phase:

- (i) Ensure that treated wastewater meets the established discharge standards all times; conduct regular wastewater quality monitoring (at inlet and at outlet of STP) to ensure that the treated effluent quality complies with design standards;
- (ii) Conduct baseline water quality assessment of West Banas River prior to start of operation;

- (iii) Ensure implementation of reuse plan, and ensure intended quality for each direct reuse;
- (iv) Assess composition and characteristics of sludge from the first batch operation at the initial phases, and confirm the handling, management and disposal/reuse actions suggested in the management plan;
- (v) Conduct periodic testing of dried sludge/compost to check presence of heavy metals and confirming the concentrations to use as compost as specified in the Standards for Composting, Schedule II A, Solid Waste Management Rules, 2016, Fertilizer Control Order (FCO), 1985, amendments in 2009 and 2013. It shall not be used for food crops;
- (vi) Ensure valid consent to operate (CTO) from RPCB for operation of STP;
- (vii) Ensure that all conditions/standards prescribed by RPCB are complied duly;
- (viii) Ensure that chlorinator facility is operated only by trained staff and as per the standard operating procedures; in case of any accident and/or maintenance activity, ensure that the staff follows documented procedures only;
- (ix) Implement emergency response system (ERS) for the chlorine leakage; Guidelines and Emergency plan for handling and storing chlorine is attached as Appendix 26;
- (x) Ensure proper knowledge transfer, hands-on training to municipal staff engaged in STP operation has been provided by contractor prior to handover of facility;
- (xi) Operate and maintain the facility following standard operating procedures of operational manual;
- (xii) Undertake preventive and periodic maintenance activities as required;
- (xiii) Conduct periodic training to workers; ensure that all safety apparatus at STP including personal protection equipment are in good condition all times; and are at easily accessible and identifiable place; periodically check the equipment, and conduct mock drills to deal with emergency situations;
- (xiv) No wastewater from industrial premises (including domestic wastewater) shall be allowed to dispose into municipal sewers; monitor regularly and ensure that there is no illegal discharge through manholes or inspection chambers; conduct public awareness programs; in coordination with RPCB.

198. There are also certain environmental risks from the operation of the sewer system, most notably from leaking sewer pipes as untreated fecal material can damage human health and contaminate both soil and groundwater. It will be imperative therefore that the operating agency establishes a procedure to routinely check the operation and integrity of the sewers, and to implement rapid and effective repairs where necessary. There is an occupation health risk to workers engaged in sewer maintenance activities. Following measures should inter alia be followed:

- (i) Establish regular maintenance program, including:
 - (a) Regular cleaning of grit chambers and sewer lines to remove grease, grit, and other debris that may lead to sewer backups. Cleaning should be conducted more frequently for problem areas;
 - (b) Inspection of the condition of sanitary sewer structures and identifying areas that need repair or maintenance. Items to note may include cracked/deteriorating pipes; leaking joints or seals at manhole; frequent line blockages; lines that generally flow at or near capacity; and suspected infiltration or exfiltration;
 - (c) Monitoring of sewer flow to identify potential inflows and outflows; and
 - (d) Conduct repairs on priority based on the nature and severity of the problem;

- (e) Immediate clearing of blockage or repair is warranted where an overflow is currently occurring or for urgent problems that may cause an imminent overflow (e.g., pump station failures, sewer line ruptures, or sewer line blockages).
- (ii) Review previous sewer maintenance records to help identify "hot spots" or areas with frequent maintenance problems and locations of potential system failure, and conduct preventative maintenance, rehabilitation, or replacement of lines as needed;
- (iii) When a spill, leak, and/or overflow occurs, keep sewage from entering the storm drain system by covering or blocking storm drain inlets or by containing and diverting the sewage away from open channels and other storm drain facilities (using sandbags, inflatable dams, etc.). Remove the sewage using vacuum equipment or use other measures to divert it back to the sanitary sewer system;
- (iv) Prohibit/prevent disposal of wastewater/effluent from industrial units in the sewers; ensure regular checking to ensure no illegal entry of industrial wastewater into sewers;
- (v) Develop an ERS for the sewerage system leaks, burst and overflows, etc.;
- (vi) Provide necessary health & safety training to the staff;
- (vii) Provide all necessary personnel protection equipment;
- (viii) During cleaning/clearing of manholes and sewer lines great precautions should be taken for the safety of workers conducting such works:
 - (a) As far as possible use remote/CCTV mechanism to identify/detect the problems in sewers and do not engage persons for this purpose;
 - (b) As far as possible use mechanized cleaning of manholes and sewers by using modern techniques and machines and do not engage persons for this purpose;
 - (c) Ensure that maintenance staff and supervisors understand the risks; provide proper instructions, training and supervision;
 - (d) Use gas detector to detect any hazardous or inflammable gas in confined areas like sewers/manholes prior to maintenance process;
 - (e) Provide suitable personal protective equipment that may include waterproof/abrasion-resistant gloves, footwear, eye and respiratory protection. Face visors are particularly effective against splashes. Equipment selection and a proper system for inspection and maintenance are important;
 - (f) Provide adequate welfare facilities, including clean water, soap, nail brushes, disposable paper towels, and where heavy contamination is foreseeable, showers;
 - (g) For remote locations portable welfare facilities should be provided;
 - (h) Areas for storage of clean and contaminated equipment should be segregated and separate from eating facilities;
 - (i) Provide adequate first-aid equipment, including clean water or sterile wipes for cleansing wounds, and a supply of sterile, waterproof, adhesive dressings;
 - (j) Make effective arrangements for monitoring the health of staff; and
 - (k) Keep emergency preparedness plan ready before starting the work of sewage system cleaning.

199. Biological hazards are among the environmental risks that may adversely impact the health and wellness of the workers and the community. Breakouts of diseases such as diarrhea, flu or pandemics such as the COVID19 shall be avoided. Designs and

implementation of treatment systems shall ensure that disease-causing pathogens or viruses are disinfected and will not cause any health issues. The World Health Organization has released an interim guidance on Water, Sanitation, Hygiene and Waste Management for the COVID19 virus (see Appendix 33). Measures on managing wastewater and fecal waste and keeping water supplies safe is critical to avoid the start or spread of any disease.

200. **Operation of FSSM.** About 9% of total households will be covered with FSSM system wherein which septage from individual septic tanks at houses will be collected via mobile/vehicle mount tankers with suction equipment, transport and discharged into STP for safe treatment and disposal. Although system will be completely mechanized, given the very harmful nature of septage, following precautionary measures shall be implemented:

- (i) Create awareness program on the FSSM in general public;
- (ii) Implement health and safety plan for FSSM;
- (iii) Provide proper training to the workers, and staff in safe handling of FSSM tasks, provide all necessary personal protection equipment and ensure their usage;
- (iv) Ensure that the system is operated completely mechanically, with least involvement of workers; there shall be no direct contact of septage to any worker or staff;
- (v) Ensure proper facilities for workers including showers, wash areas, toilets, drinking water, eating and resting places;
- (vi) Conduct regular health checks; and
- (vii) Ensure that tankers cleaning is done mechanically, and in the demarcate area at STP, and the wastewater generated in the process shall be discharged into STP.

201. In Abu Road, at present people depend on septic tanks for discharge of sewage. Once the sewerage system is operational, these septic tanks will be decommissioned, and the wastewater outlets from the houses will be connected to sewers. Contractor should prepare a decommissioning plan for all septic tanks

G. Cumulative Impacts

202. Cumulative impacts are those that result from the successive, incremental, and/or combined effects of a project or activity when added to other existing, planned, and/or reasonably anticipated future ones. The subproject aims to improve urban water supply and sewerage in Abu Road Town, by rehabilitating, augmenting, and creating required new infrastructure.

203. Currently, Abu Road Town water supply is fully groundwater based. The improved water supply system will utilize nearby surface water source (Bhaisa Singh Dam), and as this dam is unlikely to fulfill the entire town demand, it is also proposed to utilize groundwater source to supplement the demand-supply gap. Bhaisa Singh Dam is of recent origin, and the dam filling started in the year 2014, and dam water has not been utilized for any purpose till date, although the original purpose of dam construction was irrigation. This dam is allocated to drinking water usage 2016 and is under control of PHED, which in turn allocated the dam water to Abu Road Town and 6 surrounding villages. Dam water availability is estimated as 10 MLD, while the ultimate demand of the town is 15.9 MLD. Dam water will be fully utilized for the town, and as there are no existing or proposed uses of dam, no cumulative impacts envisaged.

204. As stated above the unfulfilled demand from the surface water will be supplemented by the groundwater. Presently, 3.7 - 4.7 MLD of water is abstracted from the existing tube wells and open wells. With the improved system, the groundwater abstraction will be decreased substantially from existing condition (4.7 MLD to 0.97 MLD) in base year, however, it will ultimately

increase to 5.5 MLD in the year 2051. As per the Central Groundwater Board (CGWB) data, in Abu Road Block/Tehsil, the estimated net annual groundwater availability is 26.5459 MCM, the total utilization for all uses is estimated as 25.8975 MCM (97.56% utilization). With the project, the overall utilization will reduce initially, and increase ultimately in the year by 2051. It may also be noted that, during low rainfall/low dam storage years, the groundwater abstraction may increase. CGWB classified Abu Road Tehsil as "Semi Critical" (90-100% utilization but with no significant long-term decline in groundwater), and recommend cautious groundwater development in semi critical areas, and conjunctive use of surface and groundwater resources. Besides the increase in abstraction due to subproject, there is also likelihood of increase in abstraction for other uses, as the groundwater is also the main source of water for irrigation and industrial uses. Strict monitoring of groundwater abstraction, and various measures already suggested to enhance groundwater recharge, will minimize any cumulative impacts.

205. Both water supply and sewerage works are proposed to be taken up simultaneously in Abu Road Town, which is a small town congested with people, traffic and activities. There are sensitive places like hospitals, schools, and religious places. Works will be spread over entire town, covering all the roads and streets. Although no other notable public works are anticipated during the project implementation on public roads, there will be usual construction activities, such as building construction, as Abu Road is a developing town. Given dry and windy weather conditions, dust generation from cumulative construction activities may be significant, and this may increase the particulate matter concentration in ambient air. Dust control measures suggested in the EMP aim to minimize the dust generation from the subproject construction activities. Suggested trenchless method, by avoiding excavation, will also help in reducing the overall dust generation from the subproject activities. If there are any road improvement works proposed to be implemented in Abu Road, scheduling of works needs to be coordinated with the respective road agency (ULB or Public Works Department [PWD]) so that improved roads are not subjected for excavation. There is also a need to streamline water and sewer line works to avoid repeated excavations in the same road/street. The increase in road traffic, disturbance to traffic, public safety and worker safety issues, damage to existing utilities, influx of outstation workers, etc., due to various simultaneous construction works will be notable. However, the measures suggested in the EMP will minimize these impacts greatly, and therefore effective implementation of EMP must be ensured. Thus, the net impacts are unlikely to be significant.

206. **Project Benefits.** The citizens of the Abu Road will be the major beneficiaries of the improved water supply and sewerage systems, as (i) they will be provided with a constant supply of better quality water, piped into their homes at an appropriate pressure; and (ii) the human waste from the homes will be removed rapidly, which otherwise would flow in open drains. This should improve the environment, should deliver major improvements in individual and community health and well-being. The project will improve the over-all health condition of the town as water borne diseases will be reduced. Diseases of poor sanitation, such as diarrhea 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. PUBLIC CONSULTATION AND INFORMATION DISCLOSURE

A. Overview

207. The active participation of stakeholders including local community, NGOs/CBOs, and the media in all stages of project preparation and implementation is essential for successful implementation as well as operation of the project. It will ensure that the subprojects are designed, constructed, and operated with utmost consideration to local needs, ensures community acceptance, and will bring maximum benefits to the people. Public consultation and information disclosure are a must as per the ADB SPS, 2009.

208. A three-tier consultation process has been adopted: focus group discussions, primary household sample surveys and a town-level public consultation workshop. Most of the main stakeholders have already been identified and consulted during preparation of this IEE, and any others that are identified during project implementation will be brought into the process in the future. Primary stakeholders of the subproject are residents, shopkeepers and businesspeople who live and work alongside the roads in which network improvements will be provided, and government and utility agencies responsible for provision of services, Abu Road Nagar Palika, PHED and Rajasthan State Pollution Control Board. Secondary stakeholders are NGOs and CBOs working in the area, community representatives, beneficiary community in general, government agencies, the executing and implementing agencies (LSGD and RUDSICO-EAP), Government of India and the ADB.

B. Public Consultation

209. The public consultation and disclosure is a continuous process throughout the project implementation, including project planning, design and construction. During IEE preparation stage, public consultations were conducted near two proposed STP sites, Intake and WTP locations and other locations of proposed sewerage and water supply network to access the awareness of general public, present water supply situations, environmental and health conditions in town, their opinion about the proposed project and suggestions. Local residents, businesspersons (vendors, hawkers, shopkeepers etc.), Government officials, women residents were consulted during public consultations in April 2018 and October 2018. The proposed facilities will cover the entire Abu Road Town and the people consulted were all residents of Abu road and are direct beneficiaries. Details of public consultations done are given in Appendix 27.

1. Consultation during Project Preparation

210. Institutional consultations were conducted with the Governmental Departments such as LSGD, PWD, PCB, PHED, Abu Road Nagar Palika, etc. The project proposals are formulated in consultation with PHED and Abu Road Nagar Palika and the proposals will be finalized only after certification of Commissioner Abu Road NP that the proposals suit the requirements of the ULB.

211. Focus-group discussions with affected persons and other stakeholders were conducted to learn their views and concerns. Public consultation had been conducted to assess the impact of proposed civil work on the livelihood of the people, local environmental set up and also to EE. The site verification reveals that, all the components of the sewerage works are either located on vacant government land or along the existing ROW of the city as well as enroute villages. The subproject details have been explained in detail to the people who are involved in public consultation and also asked their suggestions and willingness to complete the proposed civil work. It is observed that people shown their willingness in favor of the sewerage and water supply

project at Abu road. They are agreed to take house service (water and sewer) connections. Report of public consultations are attached in Appendix 27 with this report. Main points/issues raises/feedback received are listed below:

- (i) Awareness and extent of the project and development components;
- (ii) Benefits of Project for the economic and social Upliftment of Community;
- (iii) Labor availability in the Project area or requirement of outside labor involvement;
- (iv) Local disturbances due to Project Construction Work;
- (v) Necessity of tree felling etc., at project sites;
- (vi) Water logging and drainage problem if any;
- (vii) Climatic conditions;
- (viii) Drinking water problem;
- (ix) Sewerage system;
- (x) Forest and sensitive area nearby the project site;
- (xi) Movement of wild animal etc.;
- (xii) Pollution level during construction period specially dust and noise pollution;
- (xiii) Health and hygiene;
- (xiv) Safety of residents during construction phase;
- (xv) Solid waste disposal system;
- (xvi) Reuse of treated effluent;
- (xvii) Disposal of treated effluent in natural waterbody; and
- (xviii) Requirement of enhancement of other facilities.

212. It was observed that people are willing to extend their cooperation as the proposed activities are supposed to enhance the infrastructure service levels and the living standard of the public. The proposed project is a need of the town. Locals are very much in favor of the project and they want that this should be completed as early as possible. People are ready to extend all types of support to during execution of the project. Few people expressed their concern regarding the nuisance and disturbance (dust, road closure and traffic management activities) during the construction stage which can have impact on their day to day activities. Public demanded for advance notice before construction and proper warning signs along the construction area to avoid accidents and inconvenience. Public opined that an appropriate operation and maintenance system should be in place, especially for sewerage system, for its best functioning and to have the maximum health and aesthetic benefits.

213. City level committee (CLC) meeting was organized in Udaipur on 25 August 2017 to discuss proposed sewerage works and water supply in Abu Road under the chairmanship of district collector, Sirohi in presence of consultants, RUDSICO-EAP officials, PHED officials and other invitee members. Proposed scope of works and technology was discussed in the meeting and it was decided that treated effluent shall be reused by Municipal Council in beneficial uses. Minutes of CLC meeting and photographs are attached in Appendix 28.

2. Consultation during construction

214. Prior to start of construction, Nagar Palika Abu Road and PIU with the assistance of PMCBC and CSMC/CAPPC will conduct information dissemination sessions at major intersections and solicit the help of the local community leaders/prominent citizens to encourage the participation of the people to discuss various environmental issues. At each ward/neighborhood level, focus group meetings will be conducted to discuss and plan construction work with local communities to reduce disturbance and other impacts, and provide a mechanism through which stakeholders can participate in project monitoring and evaluation.

215. A constant communication will be established with the affected communities to redress the environmental issues likely to surface during construction and operational phases and also regarding the GRM. Nagar Palika Abu Road/PIU with the help of community awareness and public participation consultant (CAPPC) will organize public meetings and will appraise the communities about the progress on the implementation of EMP. Meeting will also be organized at the potential hotspots/sensitive locations before and during the construction.

C. Information Disclosure

216. Executive summary of the IEE will be translated in the local language and made available at the offices of RUDSICO-EAP, PMU and PIU. Copies of summary will be provided to participants of city level workshop to be organized in Abu Road. Hard copies of the IEE will be accessible to citizens as a means to disclose the document and at the same time creating wider public awareness. Electronic version of the IEE in English and executive summary in Hindi will be placed in the official website of the ULB/RUDSICO-EAP/PMU after approval of the IEE by Government and ADB. Stakeholders will also be made aware of grievance register and redress mechanism.

217. Public information campaigns via newspaper/radio/TV, to explain the project details to a wider population will be conducted. Public disclosure meetings will be conducted at key project stages to inform the public of progress and future plans. Prior to start of construction, the PIU will issue notification on the start date of implementation in local newspapers. A board showing the details of the project will be displayed at the construction site for the information of general public.

218. Local communities will be continuously consulted regarding location of construction camps, access and hauling routes and other likely disturbances during construction. The road closure together with the proposed detours will be communicated via advertising, pamphlets, radio broadcasts, road signage, etc.

219. Project related information shall be disclosed through public consultation and making relevant documents available in public locations. PMU and PIUs shall provide relevant safeguards information in a timely manner, in an accessible place and in a form and languages understandable to affected person and other stakeholders. For illiterate people, other suitable communication methods will be used.

220. The following documents shall be made available at the offices of project agencies - PMU, PIU and ULB offices for public reference and shall also be uploaded on respective websites.

- (i) Summary of project and draft IEE (in Hindi and English);
- (ii) Draft IEE report (in English);
- (iii) Final IEE report (in English);
- (iv) Updated/amended IEE (in English);
- (v) Corrective action plan prepared during project implementation (English); and
- (vi) SEMRs (English).

221. A concise summary of project and draft IEE report (in Hindi), providing all necessary details of proposals, implementation arrangements, subproject locations, likely issues and mitigation and monitoring measures and GRM, shall be made available to the stakeholders at consultation meetings. This should also provide contact information of project agency. This summary shall also be displayed at the notice boards of PMU, PIU and other public places. During project implementation, relevant information about any major changes to project scope will be

shared with beneficiaries, affected persons, vulnerable groups, and other stakeholders. The following documents will be submitted to ADB for disclosure on ADB website. PMU will send written endorsement to ADB for disclosing these documents:

- (i) final IEE;
- (ii) a new or updated IEE and corrective action plan prepared during project implementation, if any; and
- (iii) environmental monitoring reports.

VIII. GRIEVANCE REDRESS MECHANISM

A. Project Specific Grievance Redress Mechanism

219. A project-specific, three-tier grievance redress mechanism (GRM) covers both environment and social issues. The GRM will be established to receive, evaluate, and facilitate the resolution of affected persons' concerns, complaints, and grievances about the social and environmental performance at project level. The GRM will aim to provide a time-bound and transparent mechanism to voice and resolve social and environmental concerns related to the project. Assessment of the GRM designed and implemented for Rajasthan Urban Sector Development Program (RUSDP)²⁸ the system was effective in timely resolution of grievances in a transparent manner.²⁹ The multichannel, project-specific, three-tier GRM is functional at RUSDP, hence the design of GRM for RSTDSP takes into account the proposed institutional structure for RSTDSP and the positive features and learnings from the previous GRM.³⁰

220. **Common Grievance Redress Mechanism.** A common GRM will be in place for social, environmental, or any other grievances related to the project. Implementation of the resettlement plans/RIPPs/DDR/IEEs will follow the GRM described below. The GRM will provide an accessible and trusted platform for receiving and facilitating resolution of affected persons' grievances related to the project.

221. Public awareness campaigns within entire ULB/Municipal area will ensure that awareness on grievance redress procedures is generated. The nodal officer- social/environment at field level through community awareness and public participation consultant (CAPPC) will conduct ULB/Municipal area-based awareness campaigns to ensure that poor and vulnerable households are made aware of grievance redress procedures and entitlements. Contractors will provide pamphlets to communities prior to start of works and billboards during construction. The pamphlets and billboards will include relevant environmental and social safeguards, GRM information, and contact details of key personnel from PIU and contractors.

222. Affected persons will have the flexibility of conveying grievances/suggestions by dropping grievance redress/suggestion forms in complaint/suggestion boxes that will be installed by project PIUs or by e-mail, by post, or by writing in a complaints register in ULB offices/complaints register

²⁸ The procedures followed for grievance redress during implementation of RUSDP Phase III included the project GRM and the pilot GRM software application (smart check) in Pali, the Sampark portal of Government of Rajasthan, and the Chief Minister's helpline. Complaints received through various channels were mostly minor and pertained to damage to existing water supply pipelines and disruption of water supply during construction, delays in road restoration, and pending new connections. Complaints related to damage to private property (compound walls/steps, etc.) were less in number. The grievances were mostly possible to resolve in coordination with the contractors. Complaints received were immediately referred by the CAPC/PMDSC supervision staff to the PIU Nodal officer (safeguards) and concerned engineer at PIU, who advised them on further action. Follow up with the contractor on complaint resolution was undertaken by PIU Nodal officer CAPC and PMDSC and final feedback sought from complainant upon resolution. Complaints requiring inter-departmental coordination were referred to the PMU for resolution, and feedback provided to complainant. The PMU kept regular track of grievances through WhatsApp and email alerts, ensuring registration and follow-up until resolution.

²⁹ Town-level grievance registration data indicates that a large number of grievances were registered, pointing to the effectiveness of the multi-channel GRM. No major grievance was received for RUSDP Phase III. The GRM helped smoothen the process of project implementation, hence the proposed architecture for the RSTDSP GRM remains similar, with some refinement, taking into account the changes in institutional setup proposed for project implementation.

³⁰ Continued logistics support at field level will be key to successful management of grievance redress under RSTDSP. The target date for establishment of the first level (PIU level) and second level (Zonal level) of GRM is before loan negotiation.

at contractor's work site³¹ or by sending a WhatsApp message to the PIU³² or by dialling the phone number of town level PIU/CAPPC or by dialling a toll-free number.³³ Any aggrieved person can also avail the facilities of online grievance monitoring system 'Rajasthan Sampark' portal to register their grievances which is a parallel mechanism of grievance registration, in addition to the project GRM.³⁴ Careful documentation of the name of the complainant, date of receipt of the complaint, address/contact details of the person, location of the problem area, and how the problem was resolved will be undertaken and feedback provided to the complainant on action/decision taken. The Safeguard and safety officer of town/city level PIU will have the overall responsibility for timely grievance redressal on environmental and social safeguards issues and for registration of grievances, related disclosure, with the assistance of project consultants. In case of grievances that are immediate and urgent in the perception of the complainant, the contractor, and officials of PIU with assistance from CMSC and CAPPC on-site will provide the most easily accessible or first level of contact for quick resolution of grievances. Contact numbers and names of the concerned PIU safeguard and safety officer, contractors, CAPPC and CMSC personal will be posted at all construction sites at visible locations.

- (i) **1st level grievance.** The contractors, PIU executive engineer/assistant engineer designated as safeguard and safety officer (social and environment), CMSC (safeguard staff) and CAPPC can immediately resolve issues on-site, in consultation with each other and will be required to do so within 7 days of receipt of a complaint/grievance. If required, city level monitoring committee (CLMC)³⁵ will be involved in resolution of grievances at the 1st level;
- (ii) **2nd level grievance.** All grievances that cannot be redressed within 7 days at field/PIU level will be brought to the notice of Zonal PIU headed by Additional Chief Engineer (ACE). The ACE at zonal PIU will resolve the grievance within 7 days of receipt of complaint/grievance in discussion with the ASO, field level PIU, CMSC, CAPPC and the contractor; and
- (iii) **3rd level grievance.** All the grievances that are not addressed by Zonal PIU within 7 days of receipt will be brought to the notice of the PMU. Depending on the nature of grievance, the project officer (social/environment) at PMU will resolve the grievance within 15 days of receipt of grievance with necessary coordination of Zonal PIU and CMSC and guidance/instruction of additional project director (APD-PMU).
- (iv) Grievances not redressed through this process within/at the project level within stipulated time period will be referred to the CLC/GRC, which has been set up.³⁶

³¹ RUSDP piloted an online application based live GRM counter for resolution of public grievances over and above the usual process of grievance registration and redressal. This app based GRM - "RUIDP Smart Check" is available at Google play store (free of cost) and is operational. The RUIDP Smart Check "app" was launched in Pali town in July 2017 and is proposed to be scaled up in RSTDSP project towns. For persons without access to the application, the traditional channels will continue to be available.

³² It is suggested for each PIU to have a dedicated WhatsApp group for registration of grievances and receipt of quick feedback, to be followed by more formal communication.

³³ Project contractors in all project towns will have a toll-free number with specific working hours for registration of grievances related to RSTDSP.

³⁴ <http://www.sampark.rajasthan.gov.in/RajSamWelcome.aspx>

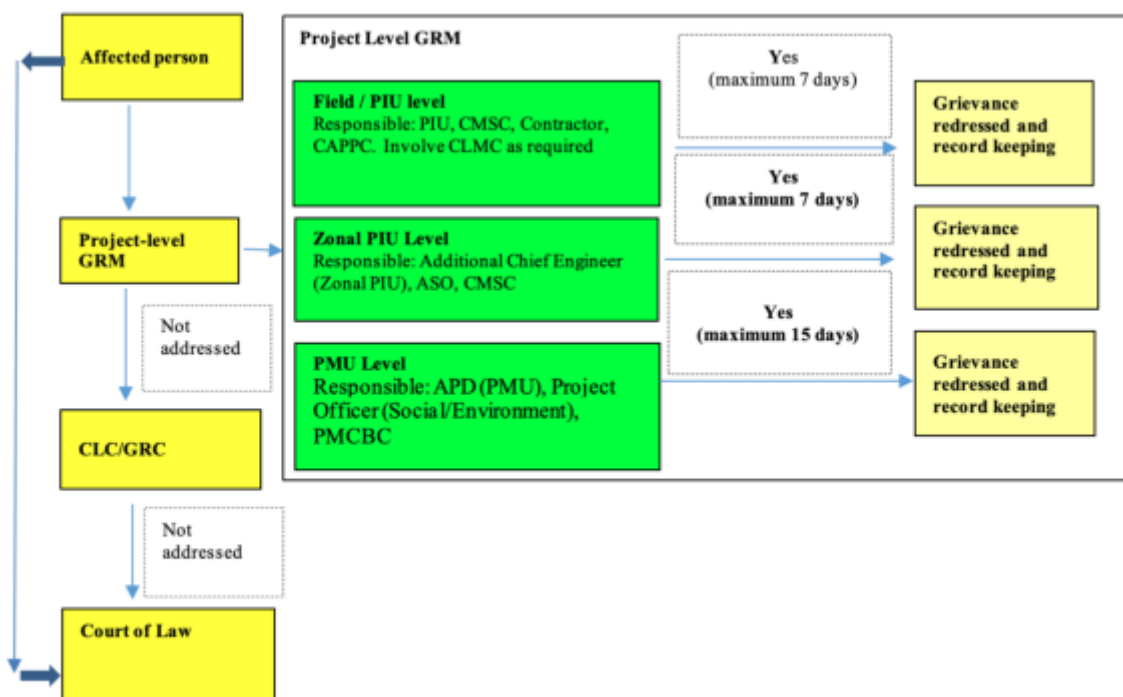
³⁵ The CLMC has been formed at the town/city level for planning and monitoring of work, resolve issues related to departmental coordination etc. It is headed by Commissioner/Executive Officer ULB (Chairman) and city engineer of public health engineering department (PHED), public works department (PWD) and head of PIU acting as Member Secretary.

³⁶ City Level Committee (CLC)/grievance redress committees (GRCs) has been constituted for each town/city under the Chairmanship of District Collector to provide overall subproject guidance and "to sort out issues and remove

In its role as a GRC, the CLC will meet whenever there is an urgent, pending grievance. Other grievances can be discussed during its regular meetings. Zonal PIU will inform the CLC regarding any grievances required to be resolved urgently. The GRC will resolve the grievance within 15 days of receiving the complaint. In case of any indigenous peoples impacts in subprojects, the CLC/GRC must have representation of the affected indigenous people community, the chief of the tribe or a member of the tribal council as traditional arbitrator (to ensure that traditional grievance redress systems are integrated) and an NGO working with indigenous people groups.

- (v) The multi-tier GRM for the project is outlined below (Figure 21), each tier having time-bound schedules and with responsible persons identified to address grievances and seek appropriate persons' advice at each stage, as required. The GRC will continue to function throughout the project duration.

Figure 21: Grievance Redress Mechanism-RSTDSP



APD = Additional Project Director, ASO = Assistant Safeguards Officer, CAPPC = community awareness and public participation consultant, CMSC = construction management and supervision consultants, CLC = city level committee, CLMC = city level monitoring committee, GRC = grievance redress committee, PIU = project implementation unit, PMU = program management unit, PMCBC = project management and capacity building consultant.

hindrances, if any". CLC formed at city-level/district level with members composed of: District Collector as Chairperson, and following as members: ULB Commissioner/Mayor/Chairman; Deputy Mayor/Vice Chairman ULB; Chairman/Secretary Urban Improvement Trust (UIT); Head of Zonal/field level PIU as Member Secretary; one representative each from relevant government departments as appropriate (PWD/PHED/Town Planning Department etc.). All CLCs in their role as GRCs will have at least one-woman member/chairperson. In addition, for project-related grievances, representatives of affected persons, community-based organizations (CBOs), and eminent citizens will be invited as observers in GRC meetings. The concerned Member of Parliament (MP) and Member of Legislative Assembly are also part of the CLC.

222. The project GRM notwithstanding, an aggrieved person shall have access to the country's legal system at any stage and accessing the country's legal system can run parallel to accessing the GRM and is not dependent on the negative outcome of the GRM. In case of grievance related to land acquisition, resettlement and rehabilitation, the affected persons will have to approach a legal body/court specially proposed under the Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act (RFCTLARRA), 2013.³⁷

223. People who are, or may in the future be, adversely affected by the project may submit complaints to ADB's Accountability Mechanism. The Accountability Mechanism provides an independent forum and process whereby people adversely affected by ADB-assisted projects can voice, and seek a resolution of their problems, as well as report alleged violations of ADB's operational policies and procedures. Before submitting a complaint to the Accountability Mechanism, affected people should make an effort in good faith to solve their problems by working with the concerned ADB operations department. Only after doing that, and if they are still dissatisfied, should they approach the Accountability Mechanism.³⁸

224. **Record-keeping.** The PIU of each town/city will keep records of grievances received, including contact details of complainant, date the complaint was received, nature of grievance, agreed corrective actions and the date these were affected and final outcome. The number of grievances recorded and resolved, and the outcomes will be displayed/disclosed in the PMU office, PIU offices, and on the web, as well as reported in monitoring reports submitted to ADB on a semi-annual basis. The sample grievance registration format is attached as [Appendix 29](#).

225. **Periodic review and documentation of lessons learned.** The PMU Project Officers (Social and Environment) will periodically review the functioning of the GRM in each town and record information on the effectiveness of the mechanism, especially on the project's ability to prevent and address grievances.

226. **Costs.** Contractors are required to allocated budget for pamphlets and billboards as part of the EMP. Costs involved in resolving the complaints (meetings, consultations, communication and reporting/information dissemination) will be borne by the concerned PIU at town level while costs related to escalated grievances will be met by the PMU. Cost estimates for grievance redress are included in resettlement cost estimates.

³⁷The Authority admits grievance only with reference to the Land Acquisition and R&R issues under the RFCTLARRA, 2013.

³⁸ Accountability Mechanism. <http://www.adb.org/Accountability-Mechanism/default.asp>.

IX. ENVIRONMENTAL MANAGEMENT PLAN

A. Environmental Management Plan

227. An environmental management plan (EMP) has been developed to provide mitigation measures to reduce all negative impacts to acceptable level and monitoring the same. This is presented in the following tables, which show the potential environmental impacts, proposed mitigation measures and responsible agencies for implementation and monitoring.

228. The purpose of the EMP is to ensure that the activities are undertaken in a responsible, non-detrimental manner with the objectives of: (i) providing a proactive, feasible, and practical working tool to enable the measurement and monitoring of environmental performance on-site; (ii) guiding and controlling the implementation of findings and recommendations of the environmental assessment conducted for the project; (iii) detailing specific actions deemed necessary to assist in mitigating the environmental impact of the project; and (iv) ensuring that safety recommendations are complied with.

229. A copy of the EMP must be kept at work sites at all times. This EMP will be included in the bid documents and will be further reviewed and updated during implementation. The EMP will be made binding on all contractors operating on the site and will be included in the contractual clauses. Non-compliance with, or any deviation from, the conditions set out in this document constitutes a failure in compliance.

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

231. The contractor will be required to submit to PIU, for review and approval, a site environmental plan (SEP) including (i) proposed sites/locations for construction work camps, storage areas, hauling roads, lay down areas, disposal areas for solid and hazardous wastes; (ii) specific mitigation measures following the approved EMP; (iii) monitoring program as per SEP; and (iv) budget for SEP implementation. No works can commence prior to approval of SEP.

232. The following tables show the potential environmental impacts, proposed mitigation measures and responsible agencies for implementation and monitoring.

Table 18: Design Stage Environmental Management Plan

Field	Anticipated Impact	Mitigation Measures	Responsible for Implementation/ Monitoring	Cost and Source of Funds
Intake in Bhaisa Singh Dam	Water quality and ecological impacts	(i) Do not utilize the dead storage for supply; ensure that dead storage is available in the dam all times (ii) Design inlet of intake pipe in the dam with appropriate screen to avoid entry of aquatic organisms into inlet (iii) Select a construction methodology that is least disturbing, and appropriate for the in-situ soil condition, and able to complete the construction work prior to onset of monsoon (iv) Schedule the construction works during low water level period – late winter months to pre monsoon (February – June/July); ensure that works are completed during the same period to prior to onset of monsoon; (v) Erect temporary barriers to form enclosed construction area with least disturbance (vi) Allow adequate time to settle the distributed solids to prior to pumping out water; only clear/clarified water shall be pumped back into the reservoir; any silt laden water should be pumped to a silt pond (vii) Avoid/minimize use of fuels, chemicals and lubricants; ensure no spillage (viii) Clear the work site after completion at least to pre project conditions, ensure that there are no materials, debris, spills etc., and prior to removal of temporary barriers / coffer dam (ix) Implement work site safety at works in water body	DBO Contractor / PIU	Project costs
Sewage Treatment Plant (STP)	Odour nuisance and aesthetics	(i) Provide a green buffer zone of 10-20 m wide all around the STP with trees in multi-rows. This will act as a visual screen around the facility and will improve the aesthetic appearance. Treated wastewater shall be used for plantation. (ii) Develop layout plan of STP such that odour generating units (such as sludge / solids handling facilities) are located away from the surrounding area with future development potential.	DBO Contractor / PIU	Project costs
STP	Interference with cultural activities (crematorium near discharge point)	(i) Locate discharge point of STP-1 at Santpur on the downstream of crematorium, and comfortably away from the river section used for rituals / bathing; consult with local community to finalize location	DBO Contractor / PIU	Project costs

Field	Anticipated Impact	Mitigation Measures	Responsible for Implementation/ Monitoring	Cost and Source of Funds
All work sites	Physical cultural resources and chance finds	(i) Ensure that worksites are not located in archeologically sensitive areas; liaise and reconfirm with local Archeological Department during detailed design phase; (ii) Create awareness among the workers, supervisors and engineers about the chance finds during excavation work; (iii) Stop work immediately to allow further investigation if any finds are suspected; (iv) Inform local Archeological Department / Museum office if a find is suspected and take any action, they require to ensure its removal or protection in situ.	DBO Contractor / PIU	Project costs
All work sites	Tree cutting	(i) Minimize removal of trees by adopting to site condition and with appropriate layout design of WTP or any other site with trees (ii) Obtain prior permission for tree cutting at WTP site or at any other site that may require tree cutting finalized during detailed design (iii) Plant and maintain 3 trees for each tree that is removed	DBO Contractor / PIU	Project costs
Design of water supply and sewerage system	Non-compliance or non-adherence with the environmental considerations proposed in preliminary designs during detailed design:	Ensure compliance with the following during the detailed design: (i) Adopting conjunctive use approach water source; utilizing feasible surface water sources and groundwater source optimally thereby reducing the existing groundwater abstraction to the extent possible (ii) Locating components and facilities appropriately by avoiding sensitive locations like forests and protected areas (environmentally, socially, and archeologically). (iii) Recovering wash water from treatment process to optimise the water use (iv) Treatment and reuse of sludge from treatment process; providing a covered shed of adequate space to air dry the processed sludge for at least 15 days at STPs (v) Designing the entire system to maintain optimal flow and terminal pressure, and optimising the overall energy usage (vi) Avoiding usage of asbestos containing materials (vii) Reducing the incidence of water borne diseases by providing 100% population including urban poor with potable water supplies	DBO Contractor / PMU	Project costs

Field	Anticipated Impact	Mitigation Measures	Responsible for Implementation/ Monitoring	Cost and Source of Funds
		(viii) Reuse of treated wastewater from STP for non-potable uses thereby reducing the load in freshwater resources (ix) Adopting a combined approach of sewerage system and fecal sludge and septage management to cover 100% population of the town with safe collection, conveyance and treatment of sewage generated in the town (x) Provision of appropriate personal protection equipment to the workers and staff		
Seismic sensitivity	Damage to infrastructure and potential risks: project area in moderate earthquake risk zone (Zone III)	(i) Designs of project component structures shall comply with relevant codes of design such as Bureau of Indian Standard (BIS) specifications for earthquake resistant design (IS: 1893: Criteria for earthquake resistant design of structures).	DBO Contractor/PIU	Project costs
Groundwater source	Source sustainability and over exploitation of groundwater	(i) Conduct detailed geophysical study to locate the tube wells appropriately to avoid failing tube wells and unsustainable abstractions (ii) Prepare a groundwater harvesting and artificial recharge plan; (iii) Creation of artificial recharge pits in public places / public buildings. Local body can issue a notification to this effect. (iv) Household level artificial recharge (like roof top rainwater harvesting) should be encouraged. (v) Groundwater regulation – options to close / discontinue all the tube wells in houses used for domestic purposes in Abu Road in a phased manner once the project is implemented.	DBO Contractor/PIU	Project costs
	Groundwater contamination	(i) Prepare a source protection plan for tube wells and open wells (existing and new) (ii) Prevent flow of untreated wastewater in the drains (iii) Ensure proper construction of tube wells including casing pipes to prevent water contamination from well spaces, and due to flooding (iv) Measures should be taken to control the open defecation, and to close all unsafe latrines (for example pit latrines). (v) Awareness programs shall be conducted regarding the sanitation practices and its effect on groundwater quality	DBO Contractor & ULB/PIU	Project costs & ULB costs

Field	Anticipated Impact	Mitigation Measures	Responsible for Implementation/ Monitoring	Cost and Source of Funds
Water Treatment Plant (WTP)	Inefficient treatment, treated water characteristics not satisfying the standards	i) Design treatment process that is suitable for raw water source characteristics duly considering the seasonal variation in quality if any (ii) Duly consider quality of groundwater that will be supplemented for surface water supply variations (iii) Treated water and supplied water at consumer end should meet the drinking water standards all times	DBO Contractor/PIU	Design consultants' cost
Water Treatment Plant (WTP)	Design to prevent pollution due to wastewater and sludge	Ensure that the following are included in the WTP design: (i) Backwash water reuse system and sludge recovery and disposal system (ii) Backwash recycling components: Filter backwash holding tank, recovered water storage tank and pumping for recycling (iii) Sludge management system components: Gravity thickeners for sludge from clarifiers, mechanical sludge dewatering system, storage facility for dewatered sludge (iv) Disposal of sludge at a landfill or the disposal site provided by the ULB	DBO Contractor/PIU	Project costs
WTP	Sludge management	(i) Prepare sludge management plan for safe handling and disposal of sludge from WTP (ii) Estimate the quantity of sludge / solids generated from the WTP during the detailed design phase, and likely composition based on the raw water quality and process chemicals (iii) Minimize the quantity of solids generated by the water treatment process through optimizing coagulation processes; (iv) Recover process chemicals to the extent possible to minimize / prevent the disposal (v) Carryout pretreatment prior to disposal (vi) Dispose dried sludge / solids from WTP at approved solid waste landfill / disposal site identified by ULB ; this should be identified during the detailed design phase (vii) Evaluate the option of land application during the operation stage; conduct quality tests on the first batch of sludge generated from the WTP, check for physico chemical characteristics including heavy metals	DBO Contractor/PIU	

Field	Anticipated Impact	Mitigation Measures	Responsible for Implementation/ Monitoring	Cost and Source of Funds
		(viii) Manage hazardous/harmful waste if any, as per the Hazardous Waste Management Rules (ix) Employ safe and beneficial methods for disposal of dried sludge: in building and construction industry, brick / tile manufacturing etc.,		
WTP, CWRs and STP	Hazardous / harmful chemicals	(i) Reduce the use of chemicals in the treatment process to the extent possible (water treatment); provide non-chemical alternatives or easily recoverable and/or reusable chemicals or biocompatible alternatives. (ii) Establish proper handling / storage / application system according to the relevant standards, safety precautions and prevent accidental release / spill (iii) Provide leak/spill detection, collection / capture and safe disposal facilities such as chlorine absorption and neutralization facility (iv) Provide ventilation, lighting, entry and exit facilities; visible & audible alarm facilities to alert chemical/chlorine leak (v) Facility for isolation in the event of major leakages (vi) Eye wash & shower facility (vii) Personal protection and safety equipment for the operators (masks, oxygen cylinders, gloves, etc.,) (viii) Provide training to the staff in safe handling and application of chemicals, material safety, and standard operating procedures and emergency responses (ix) Develop emergency response procedures	DBO Contractor/PIU	Project costs
Sewage Treatment Plant (STP)	Inefficient sewage treatment, treated effluent characteristics not satisfying the CPCB/ RPCB standards	(i) Ensure that the selected process is appropriate for the town and meets discharge standards and facilitate reuse (ii) Treated effluent should meet the criteria set by RPCB/CPCB or the following bid specified parameters, whichever are stringent:	DBO Contractor / PIU	Project costs

Field	Anticipated Impact	Mitigation Measures		Responsible for Implementation/ Monitoring	Cost and Source of Funds														
		<table><tr><td>pH</td><td>6.5 – 9.0</td></tr><tr><td>BOD5, mg/l</td><td>≤10</td></tr><tr><td>COD, mg/l</td><td>≤50</td></tr><tr><td>TSS, mg/l</td><td>≤20</td></tr><tr><td>NH4-N, mg/l</td><td><25</td></tr><tr><td>Total nitrogen, mg/l</td><td><10</td></tr><tr><td>Fecal Coliform, MPN/100 ml</td><td><1000</td></tr></table>	pH	6.5 – 9.0	BOD5, mg/l	≤10	COD, mg/l	≤50	TSS, mg/l	≤20	NH4-N, mg/l	<25	Total nitrogen, mg/l	<10	Fecal Coliform, MPN/100 ml	<1000			
pH	6.5 – 9.0																		
BOD5, mg/l	≤10																		
COD, mg/l	≤50																		
TSS, mg/l	≤20																		
NH4-N, mg/l	<25																		
Total nitrogen, mg/l	<10																		
Fecal Coliform, MPN/100 ml	<1000																		
Change in raw sewage quality	Mixing of industrial effluent with sewage	(i) No industrial wastewater shall be allowed to dispose into municipal sewers (ii) (ii) As there is a risk of potential mixing of industrial waste, no domestic wastewater from industrial units shall be allowed into municipal sewers (iii) Ensure that there is no illegal discharge through manholes or inspection chambers (iv) Conduct public awareness programs; in coordination with RPCB and CLC, (v)Conduct regular wastewater quality monitoring (at inlet and at outlet of STP) to ensure that the treated wastewater quality complies with the effluent standards		DBO Contractor & PIU / PMU	Project Costs														
STP	Use of treated wastewater for reuse applications	Develop wastewater reuse plan for Abu Road Town in consultation with CLC as per the Sewerage and Wastewater Policy, 2016. The Reuse Plan shall inter alia include the following: (i) Identify potential reuse application in Abu Road, and establish quality criteria for each of the use (ii) For applications that use treated wastewater directly (eg, agriculture), the quality required for such application in safe manner considering health, environment and crop yield concerns shall be ensured; (iii) Prepare a reuse plan for agriculture, if that is the priority use or one of the applications as per the CLC in Abu Road, clearly indicating the limits (geographical / crops / type of application / type of soils etc.); adopt international good practice		DBO Contractor / PIU	Project costs														

Field	Anticipated Impact	Mitigation Measures	Responsible for Implementation/ Monitoring	Cost and Source of Funds
		suggested by agencies like World Health Organization (WHO), Food and Agricultural Organization (FAO) of the United Nations. (iv) Plan should include awareness and training provisions and responsibilities; these can be conducted by concerned department (eg, Agricultural Department, District Collectorate) (v) Carryout regular / online monitoring of critical quality parameters of treated wastewater to ensure that they meet the preset standards established for reuse		
STP	Treated effluent discharge into West Banas River, and associated impacts on river water and downstream users	(i) Obtain of consent of RPCB for discharge of treated wastewater into West Banas River (ii) Conduct a baseline water quality assessment of receiving water body – West Banas River at the discharge location (iii) Regularly monitor the treated wastewater quality at STP and ensure that it meets the discharge standards (iv) Monitor water quality periodically during operation phase as per the Environmental Monitoring Plan	DBO Contractor/ PIU	Project Costs
STP	Sludge management and reuse	(i) Prepare a sludge management plan (ii) Prepare a dried Sludge utilization plan for Abu Road within the help of Agriculture Department / CLC; plan should also include if any additional processing is required for sludge to use as soil conditioner (iii) Plan should clearly various potential uses and demand in Abu Road and surroundings (iv) Establish usage limits, where required, (geographical / crops / type of application / type of soils etc.); adopt international good practice suggested by agencies like World Health Organization (WHO), Food and Agricultural Organization (FAO) of the United Nations. (v) Identify a landfill / suitable site for disposal of surplus dried sludge (vi) Monitor sludge quality during operation phase as per the Environmental Monitoring Plan, ensure that it meets the quality parameters established by FCO (vii) In case of sludge not meeting the quality parameters, it shall not be used as soil condition, and shall be disposed at appropriate disposal site (if it falls under hazardous category, it	DBO Contractor/ PIU	Project costs

Field	Anticipated Impact	Mitigation Measures	Responsible for Implementation/ Monitoring	Cost and Source of Funds
		shall be disposed as per the Hazardous Waste Management Rules, 2016)		
Sewer network – collection & conveyance	Poor design leading to overflows, blockages, and creating nuisance, pollution	(i) Limit the sewer depth where possible (ii) Sewers shall be laid away from water supply lines and drains (at least 1 m, wherever possible); (iii) In all cases, the sewer line should be laid deeper than the water pipeline (the difference between top of the sewer and bottom of water pipeline should be at least 300 mm) (iv) In unavoidable, where sewers are to be laid close to storm water drains, appropriate pipe material shall be selected (stoneware pipes shall be avoided) (v) For shallower sewers and especially in narrow roads, use small inspection chambers in lieu of manholes; (vi) Design manhole covers to withstand anticipated loads & ensure that the covers can be readily replaced if broken to minimize silt/garbage entry (vii) Ensure sufficient hydraulic capacity to accommodate peak flows and adequate slope and gas vents in gravity mains to prevent buildup of solids and hydrogen sulfide generation (viii) Take necessary precautionary measures to protect sewer network, and to avoid disposal of solid wastes, debris, wastewater into newly laid sewers from the time it is constructed to the start of operation phase	DBO Contractor / PIU	Project costs
FSSM	Occupational health and safety issues, and impact on STP process	(i) Conduct detailed survey of the households to be covered with FSSM to design the system to suit the local conditions, such as type of septic tanks and their location in the houses (ii) Create awareness program on the FSSM from collection to treatment system that will be adopted (iii) Design the sewage treatment process duly considering mixing of septage (iv) Ensure that the FSSM system is completely mechanized no human touch, even accidentally, from collection at household to discharge into STP, and in periodic cleaning of tankers (v) Demarcate a proper area for cleaning of mobile tankers in STP premises, and ensure that the wastewater shall be discharged into STP	DBO Contractor / PIU	Project costs

Field	Anticipated Impact	Mitigation Measures	Responsible for Implementation/ Monitoring	Cost and Source of Funds
		(vi) Provide proper training to the workers, and staff in safe handling of FSSM tasks, provide all necessary personal protection equipment (vii) Ensure proper facilities for workers including showers, wash areas, toilets, drinking water, eating and resting places (viii) Conduct regular health checks (ix) Prepare Health and Safety Plan for FSSM		
Critical habitat and protected species <i>Gyps bengalensis</i> <i>Sarcogyps calvus</i> <i>Gyps indicus</i>	Loss of habitat and breeding trees Change in food availability – carcasses Induced impacts of improved water supply leading to increased agriculture and cattle rearing in location which in turns increases local use of chemicals harmful to vultures Disturbance of vultures at feeding locations during construction phase	Before starting any construction activities, conduct pre-construction survey for presence of this species. If these species are present, the findings should be recorded and reported. No disturbance or works on the site should start/continue until PIU issues clearance to proceed. PIU should coordinate with the Forestry Department to coordinate the translocation of the affected species. If these vulture species are present, the design shall ensure that breeding areas are not directly affected by the proposed pipeline routes and permanent infrastructure. Changes in route alignment, timing of works and avoidance of tree felling will reduce risk and impacts Construction work shall be timed to avoid the breeding season if specimens of the these birds are found to be using the AoA during the breeding season <i>Monitoring.</i> If such species are present the project shall take the opportunity to monitor vulture activities within the project area and develop a local community awareness program to support conservation of the species	PIU / CMSC with the assistance of PMCBC and DBO contractor	PMU costs

Field	Anticipated Impact	Mitigation Measures	Responsible for Implementation/ Monitoring	Cost and Source of Funds
<i>Manis crassicaudata</i>	Direct loss of habitat due to pipeline work Disturbance of breeding pairs during courtship and rearing of chicks	Before starting any construction activities, conduct pre-construction survey for presence of this species. If these species are present, the findings should be recorded and reported. No disturbance or works on the site should start/continue until PIU issues clearance to proceed. PIU should coordinate with the Forestry Department to coordinate the translocation of the affected species. The design shall ensure that breeding areas are not directly affected by the proposed pipeline routes and permanent infrastructure. Changes in route alignment, timing of works and avoidance of tree felling will reduce risk and impacts Construction work shall be time to avoid the breeding season if specimens of the these birds are found to be using the AoA during the breeding season <i>Monitoring.</i> Monitor potential presence of this species throughout construction period	PIU / CMSC with the assistance of PMCBC and DBOC	PMU costs
<i>Manis crassicaudata</i>	Direct harm or killing of individuals during construction earthworks, tracking of vehicles and equipment across burrows. Indirect disturbance of individuals through noise and	Before starting any construction activities, conduct survey of species for the EIA process AND prior to construction works, even if not found in initial surveys. If these species are present, the findings should be recorded and reported. No disturbance or works on the site should start/continue until PIU issues clearance to proceed. PIU should coordinate with the Forestry Department to coordinate the translocation of the affected species.		

Field	Anticipated Impact	Mitigation Measures	Responsible for Implementation/ Monitoring	Cost and Source of Funds
	vibration during pipeline construction works. Induced impacts through improved access along pipeline wayleave during and after construction period causing increased opportunity for hunting of species for meat trade.	If such species are present the project shall take the opportunity to monitor vulture activities within the project area and develop a local community awareness program to support conservation of the species		
Asbestos cement (AC) pipes in existing water supply system: clearing, transfer and disposal; work in narrow streets, and interventions in existing AC pipelines	Health impacts due to air borne asbestos if handled unsafely, cut, drilled or broken into pieces	(i) Develop ACM Management Plan (AMP) that includes identification of hazards, the use of proper safety gear and disposal methods. Sample AMP is provided in Appendix 20. Adhere to the workflow process suggested in Figure 19. (ii) Conduct awareness program on safety during the construction work (iii) Undertake the construction work stretch-wise; excavation, pipe laying and trench refilling should be completed on the same day (iv) Provide barricades, and deploy security personnel to ensure safe movement of people and also to prevent unnecessary entry and to avoid accidental fall into open trenches (v) Identify risk of intervention with existing AC pipes. If there is significant risk, implement the AMP strictly that includes identification of hazards, the use of proper safety gear and disposal methods. (vii) Maintain records of AC pipes as per the AMP (viii) Refer to the instructions of the Asbestos Expert	DBO Contractor/PMU	Project costs
Asbestos materials in	Health impacts due to air borne asbestos if handled unsafely, cut,	(i) Conduct survey and inventory of existing asbestos materials on site (ii) Conduct risk assessment to determine extent of asbestos	DBO Contractor/PMU	Project costs

Field	Anticipated Impact	Mitigation Measures	Responsible for Implementation/ Monitoring	Cost and Source of Funds
existing PHED campus	drilled or broken into pieces	materials currently on-site (ii) Coordinate and provide support to the asbestos management service provider on the requirement of sampling, testing and disposing existing asbestos materials (iii) Ensure the selected area for temporary storage is suitable for safe storage of asbestos materials (iv) Incorporate international and national standards considered in designing the temporary storage (v) Ensure that handling and disposal of asbestos materials are carried out by specially trained service provider/s following Government of India requirements, or in their absence, internationally recognized procedures Refer to the requirements of the Asbestos Management Plan (Appendix 20) and instructions of the Asbestos Expert		
Preparation of plans and protocols	Various impacts	(i) Preparation of ACM Management Plan (ii) Prepare traffic management plan (iii) Prepare occupational health and safety plan (iv) Prepare spoils management plan	DBO Contractor and CMSC with the assistance of PMCBC (for ACM plan)	Project costs

Table 19: Environmental Management Plan of Anticipated Impacts during Pre-construction

Field	Anticipated Impact	Mitigation Measures	Responsible for Implementation	Monitoring of Mitigation	Cost and Source of Funds
Compliance with environmental subproject selection criteria	Environmental impacts due to subproject	Compliance with environmental subproject selection criteria	DBO Contractor, PIU and Abu Road Nagar Palika	(i) Compliance checklist in the final IEE	No costs required
Environmental monitoring of baseline conditions of air, noise, water and soil	To establish base line environmental conditions	Environmental monitoring through NABL approved laboratory	Construction contractor	(ii) Baseline data in the final IEE	Contractor
Legal compliance	Environmental legal noncompliance may attract legal actions Failure to obtain necessary consents Permits, NOCs etc. can result to design revisions and/or stoppage of works	(i)Obtain all consents, clearances (CTE/CTO from RPCB), permits NOCs etc. before start of construction works Ensure that all necessary approvals for construction to be obtained by contractor are in place before start of construction (ii)Following consents are required- Tree cutting-local authority Storage, handling and transport of hazardous materials- RPCB Sand mining, quarries, borrow areas- Department of mines and Geology Traffic diversion/road cutting- local authority, traffic police (iii)Acknowledge in writing and provide report on compliance all obtained consents, permits, clearance, NOCsetc.(intake works) (iv)Include in detailed design drawings and documents all	PIU/Consultants in coordination of Nagar Palika	(iii) Compliance check and copies of compliance in final IEE	Cost of obtaining all consents, permits, clearance, NOCs etc. prior to start of civil works responsibility of PIU.

Field	Anticipated Impact	Mitigation Measures	Responsible for Implementation	Monitoring of Mitigation	Cost and Source of Funds
		conditions and provisions; if necessary			
Utilities	Telephone lines, electric poles and wires, water lines within proposed project area	(i) Identify and include locations and operators of these utilities in the detailed design documents to prevent unnecessary disruption of services during construction phase; and (ii) Require construction contractors to prepare a contingency plan to include actions to be taken in case of unintentional interruption of services. (iii) Require contractors to prepare spoils management plan and traffic management plan	Contractor in collaboration with PIU and with approval of PMU	(i) List of affected utilities and operators; (ii) Bid document to include requirement for a contingency plan for service interruptions (example provision of water if disruption is more than 24 hours), spoil management plan and traffic management plan	No cost required. Mitigation measures are part of TOR of PMU, PIU and Consultant
Works close to forest areas	Disturbance / damage to flora, fauna	(i) Intake work site and associated work facilities shall be properly demarcated and barricaded; (ii) All works, construction material storage/ancillary works shall be confined to the demarcated areas, no movement of workers, vehicles, equipment allowed outside this area (iii) Ensure proper barricading so that no wildlife, even if it is unlikely, accidentally enters work area (iv) No labour camps shall be located near intake or near forests (maintain minimum 2 km buffer) (v) Limit the work to daylight hours only; no work after sunset	Contractor in collaboration with PIU and with approval of PMU	Work site plan of Intake works Training / awareness program records	No cost required. Mitigation measures are part of TOR of PMU, PIU and Consultant

Field	Anticipated Impact	Mitigation Measures	Responsible for Implementation	Monitoring of Mitigation	Cost and Source of Funds
		(vi) No workers /personnel shall enter forest areas; it is the DBOC responsibility to take necessary precautions & prevent workers removing/damaging trees/vegetation, hunting / harming animals (vii) Create awareness among workers on environment & safety; (viii) No high noisy works shall be conducted			
Social and Cultural Resources	Ground disturbance can uncover and damage archaeological and historical remains	Develop a chance find protocol for use by the construction contractors in conducting any excavation work, to ensure that any chance finds are recognized, and measures are taken to ensure they are protected and conserved.	DBO Contractor and PIU	Chance Finds Protocol	No cost required. Mitigation measures are part of TOR of PIU and Consultant
Construction work camps, hot mix plants, stockpile areas, storage areas, and disposal areas.	Disruption to traffic flow and sensitive receptors	(i) Prioritize areas within or nearest possible vacant space in the project location; (ii) If it is deemed necessary to locate elsewhere, consider sites that will not promote instability and result in destruction of property, vegetation, irrigation, and drinking water supply systems; (iii) Do not consider residential areas; (iv) Take extreme care in selecting sites to avoid direct disposal to water body which will inconvenience the community. (v) For excess spoil disposal, ensure (a) site shall be selected preferably from barren, infertile	Contractor to finalize locations in consultation and approval of PIU	(i) List of selected sites for construction work camps, hot mix plants, stockpile areas, storage areas, and disposal areas. (ii) Written consent of landowner/s (not lessee/s) for reuse of excess spoils to agricultural land	No cost required. Mitigation measures are part of TOR of PIU and Consultant and also part of contractual terms

Field	Anticipated Impact	Mitigation Measures	Responsible for Implementation	Monitoring of Mitigation	Cost and Source of Funds
		lands. In case agricultural land needs to be selected, written consent from landowners (not lessees) will be obtained; (b) debris disposal site shall be at least 200 m away from surface water bodies; (c) no residential areas shall be located within 50 m downwind side of the site; and (d) site is minimum 250 m away from sensitive locations like settlements, ponds/lakes or other water bodies.			
Sources of Materials	Extraction of materials can disrupt natural land contours and vegetation resulting in accelerated erosion, disturbance in natural drainage patterns, ponding and water logging, and water pollution.	(i) Prioritize sites already permitted by the Department of Mines and Geology (ii) If other sites are necessary, inform construction contractor that it is their responsibility to verify the suitability of all material sources and to obtain the approval of PMU and (iii) If additional quarries will be required after construction is started, inform construction contractor to obtain a written approval from PIU.	DBO Contractor to prepare list of approved quarry sites and sources of materials with the approval of PIU	(i) List of approved quarry sites and sources of materials; (ii) Bid document to include requirement for verification of suitability of sources and permit for additional quarry sites if necessary.	No cost required. Mitigation measures are part of TOR of PIU and Consultant and part of contractual terms
Consents, permits, clearances, NOCs, etc.	Failure to obtain necessary consents, permits, NOC sets. can result to design revisions and/or stoppage of works	(i) Obtain all necessary consents, permits, clearance, NOCs, etc. prior to award of civil works. (ii) Ensure that all necessary approvals for construction to be obtained by contractor are in place before start of construction (iii) Acknowledge in writing and provide report on compliance all	DBO Contractor and PIU	Incorporated in final design and communicated to contractors.	No cost required. Cost of obtaining all consents, permits, clearance, NOCs, etc. prior to start of civil works responsibility of PIU.

Field	Anticipated Impact	Mitigation Measures	Responsible for Implementation	Monitoring of Mitigation	Cost and Source of Funds
		obtained consents, permits, clearance, NOCs, etc. (iv) Include in detailed design drawings and documents all conditions and provisions if necessary			Mitigation measures are part of TOR of PIU and Consultant
Asbestos materials in existing PHED campus	Health impacts due to air borne asbestos if handled unsafely, cut, drilled or broken into pieces	(i) Coordinate and provide support to the asbestos management service provider on the requirement of sampling, testing and disposing existing asbestos materials (ii) Coordinate and implement the the construction of the temporary storage per specification of the asbestos management service provider (iii) Provide support to the asbestos management service provider supervising the removal, transport, disposal and documentation of the asbestos materials (iv) Conduct awareness workshops and trainings to stakeholders on the risks of the asbestos materials Maintain records of asbestos materials inventory (vi) Ensure that handling and disposal of asbestos materials are carried out by specially trained service provider/s following Government of India requirements, or in their absence, internationally recognized procedures	DBO Contractor / PIU	PMU	Project costs

Field	Anticipated Impact	Mitigation Measures	Responsible for Implementation	Monitoring of Mitigation	Cost and Source of Funds
		Refer to the requirements of the Asbestos Management Plan (Appendix 20) and instructions of the Asbestos Expert			
Preparation of plans and protocols	Various impacts	(i) Prepare traffic management plan (ii) Prepare occupational health and safety plan (iii) Prepare spoils management plan	DBO Contractor	Approval of plans by PIU	-

Table 20: Environmental Management Plan of Anticipated Impacts during Construction

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation	Cost and Source of Funds
EMP Implementation Training	Irreversible impact to the environment, workers, and community	(i) Project manager and all key workers will be required to undergo EMP implementation including spoils management, Standard operating procedures (SOP) for construction works; occupational health and safety (OH&S), core labor laws, applicable environmental laws, etc.	DBO Contractor	(i) Certificate of Completion (Safeguards Compliance Orientation) (ii) Posting of Certification of Completion at worksites (iii) Posting of EMP at worksites	Cost of EMP Implementation Orientation Training to contractor is responsibility of PMU. Other costs responsibility of contractor.
Air Quality	Emissions from construction vehicles, equipment, and machinery used for installation of pipelines resulting to dusts and increase in concentration of vehicle-related pollutants such as carbon monoxide, sulfur oxides, particulate matter, nitrous oxides, and hydrocarbons.	(i) Plan the work sites properly, and demarcate the sites for stockpiling of, soils, gravel, and other construction materials away from the traffic, vehicle, general worker movement to avoid disturbance of loose materials (ii) Damp down exposed soil and any stockpiled material on site by water sprinkling; (iii) Use tarpaulins to cover sand and other loose material when transported by trucks; (iv) Clean wheels and undercarriage of haul trucks prior to leaving construction site (v) Don't allow access in the work area except workers to limit soil disturbance and prevent access by barricading and security personnel (vi) Fit all heavy equipment and machinery with air pollution control devices which are operating correctly contractor's vehicles and equipment should compulsorily have PUC and submit to PIU before deployment at site	DBO Contractor	(i) Location of stockpiles; (ii) Complaints from sensitive receptors; (iii) Heavy equipment and machinery with air pollution control devices; (iv) Certification that vehicles are compliant with Air Act (v) Reports of air quality monitoring	Cost for implementation of mitigation measures responsibility of contractor.

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation	Cost and Source of Funds
		(vii) Obtain, CTE and CTO for batching plant, hot mix plant, crushers etc. if specifically established for this project. (viii) If contractor procures any material (such as ready mix concrete, asphalt/macadam, aggregates etc.) from third party agencies, contractor shall ensure that such agencies have all necessary clearances / permissions as required under the law; these include CTE/CTO from RPCB, environmental clearance, etc.; contractor shall collect the copy of these certificates and submit to PIU; PIU will approve the source only after all the certificates are submitted (ix) Conduct air quality monitoring according to the Environmental Management Plan (EMP).			
Surface water quality	Works in rains/ Mobilization of settled silt materials, and chemical contamination from fuels and lubricants during installation of pipelines can contaminate nearby surface water quality.	(i) Prepare and implement a spoils management plan (ii) Avoid stockpiling of earth fill especially during the monsoon season unless covered by tarpaulins or plastic sheets; (iii) Prioritize re-use of excess spoils and materials in the construction works. If spoils will be disposed, consult with PIU on designated disposal areas; (iv) Inspect all the drainage at construction site/construction camp/labor camp etc. and clear all the drainage lines so that no water stagnation/flooding may occur during heavy rainfall	DBO Contractor	(i) Areas for stockpiles, storage of fuels and lubricants and waste materials; (ii) Number of silt traps installed along trenches leading to water bodies; (iii) Records of surface water quality inspection; (iv) Effectiveness of water management measures; (v) No visible degradation to nearby drainages, nallahs or	Cost for implementation of mitigation measures responsibility of contractor.

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation	Cost and Source of Funds
		(v) As for a possible avoid trench works and excavation works (pipe laying) during monsoon season to avoid any water logging and accident due to it (vi) If open trenches are not avoidable during monsoon, keep ready all the mitigations measures to avoid water logging such as dewatering pumps and sufficient pipes, traffic assistance, barricades etc. (vii) Inspect and verify all the emergency measures and emergency control system before start of monsoon, keep the emergency response committee on high alert during monsoon/heavy rain fall (ix) Install temporary silt traps or sedimentation basins along the drainage leading to the water bodies; (x) Place storage areas for fuels and lubricants away from any drainage leading to water bodies; (xi) Dispose any wastes generated by construction activities in designated sites; and (xii) Conduct surface quality inspection according to the Environmental Management Plan (EMP).		water bodies due to civil works	
Surface water quality	Degradation of water quality of Bhainsa singh dam due to intake works	(i) Select a construction methodology that is least disturbing, and appropriate for the in-situ soil condition, and able to complete the construction work prior to onset of monsoon (ii) Schedule the construction works during low water level period – late winter months to pre monsoon (February	DBO Contractor	(i) Construction methodology for intake construction (iii) Records of water quality inspection; (iv) Effectiveness of water management measures;	Cost for implementation of mitigation measures responsibility of contractor.

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation	Cost and Source of Funds
		– June/July); ensure that works are completed during the same period to prior to onset of monsoon; (iii) Erect temporary barriers to form enclosed construction area with least disturbance (iv) Allow adequate time to settle the distributed solids to prior to pumping out water; only clear/clarified water shall be pumped back into the reservoir; any silt laden water should be pumped to a silt pond (v) Avoid/minimize use of fuels, chemicals and lubricants; ensure no spillage (vi) Clear the work site after completion at least to pre project conditions, ensure that there are no materials, debris, spills etc., and prior to removal of temporary barriers / coffer dam (vii) Implement work site safety at works in water bodies		(v) No visible degradation of water quality	
Noise Levels	Increase in noise level due to earth-moving and excavation equipment, and the transportation of equipment, materials, and people	(i) Plan activities in consultation with PIU/Consultant so that activities with the greatest potential to generate noise are conducted during periods of the day which will result in least disturbance; (ii) Horns should not be used unless it is necessary to warn other road users or animals of the vehicle's approach; (iii) Minimize noise from construction equipment by using vehicle silencers, fitting jackhammers with noise-reducing mufflers, and portable street barriers the sound impact to surrounding sensitive receptor; and	DBO Contractor	(i) Complaints from sensitive receptors; (ii) Use of silencers in noise-producing equipment and sound barriers; (iii) Equivalent day and night time noise levels	Cost for implementation of mitigation measures responsibility of contractor.

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation	Cost and Source of Funds
		(iv) Maintain maximum sound levels not exceeding 80 decibels (dbA) when measured at 10 m or more from the vehicle/s. (v) Periodical monitoring of noise quality as per EMP			
Landscape and aesthetics	Impacts due to excess excavated earth, excess construction materials, and solid waste such as removed concrete, wood, packaging materials, empty containers, spoils, oils, lubricants, and other similar items.	(i) Prepare and implement spoils management plan (ii) Avoid stockpiling of excess excavated soils; (iii) Coordinate with ULB/PIU for beneficial uses of excess excavated soils or immediately dispose to designated areas; (iv) Recover used oil and lubricants and reuse or remove from the sites; (v) Manage solid waste according to the following preference hierarchy: reuse, recycling and disposal to designated areas; (vi) Remove all wreckage, rubbish, or temporary structures which are no longer required; and (vii) Request PIU to report in writing that the necessary environmental restoration work has been adequately performed before acceptance of work.	DBO Contractor	(i) Complaints from sensitive receptors; (ii) Worksite clear of hazardous wastes such as oil/fuel (iii) Worksite clear of any excess excavated earth, excess construction materials, and solid waste such as removed concrete, wood, packaging materials, empty containers	Cost for implementation of mitigation measures responsibility of contractor.
Existing Infrastructure and Facilities	Disruption of service and damage to existing infrastructure at specified project location	(i) Obtain from PIU the list of affected utilities and operators if any; (ii) Prepare a contingency plan to include actions to be done in case of unintentional interruption of service	DBO Contractor	Existing Utilities Contingency Plan	Cost for implementation of mitigation measures responsibility of contractor.
Ecological Resources – Terrestrial	Loss of vegetation and tree cover	(i) Minimize removal of vegetation and disallow cutting of trees; (ii) If tree-removal will be required, obtain tree-cutting permit from the concerned	DBO Contractor	PIU to report in writing the no of trees cut and planted.	Cost for implementation of mitigation measures

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation	Cost and Source of Funds
		Department; and (iii) Plant three native trees for every one that is removed.			responsibility of contractor.
Accessibility	Traffic problems and conflicts near project locations and haul road	(i) Plan water and sewer line works to minimize traffic disturbance / blockades; as the both water and sewer lines are to be laid in all the roads and streets in the town, work planning is crucial to minimize the inconvenience to public due to repeated excavations (ii) Prepare and implement a Traffic Management Plan (Appendix 24) (ii)Duly consider and select sections for trenchless method of pipelaying based on traffic conditions (iii) Plan transportation routes so that heavy vehicles do not use narrow local roads, except in the immediate vicinity of delivery sites; duly consider and select sections for trenchless method of pipelaying based on traffic conditions (iv) Schedule transport and hauling activities during non-peak hours; (v) Locate entry and exit points in areas where there is low potential for traffic congestion; (vi) Keep the site free from all unnecessary obstructions; (vii) Drive vehicles in a considerate manner; (viii) Coordinate with Traffic Police for temporary road diversions and with for provision of traffic aids if transportation activities cannot be avoided during peak hours; (ix) Notify affected sensitive receptors 1-week in advance by providing sign boards informing nature and duration of	DBO Contractor	(i) Traffic route during construction works including number of permanent signages, barricades and flagmen on worksite; (ii) Complaints from sensitive receptors; (iii) Number of signages placed at project location.	Cost for implementation of mitigation measures responsibility of contractor.

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation	Cost and Source of Funds
		construction works and contact numbers for concerns/complaints. (x) Plan and execute the work in such a way that the period of disturbance/ loss of access is minimum. (xi) Provide pedestrian access in all the locations until normalcy is restored. Provide wooden/metal planks over the open trenches at each house to maintain the access.			
Socio-Economic – Income.	Impede the access of residents and customers to nearby shops	(i) Prepare and implement spoils management plan; ensure that there is no unnecessary obstruction due to soil, debris on the site (ii) Leave spaces for access between mounds of soil; (ii) Provide walkways and metal sheets where required for people; (iii) Increase workforce in front of critical areas such as institutions, place of worship, business establishment, hospitals, and schools; (iv) Consult businesses and institutions regarding operating hours and factoring this in work schedules; and (v) Provide sign boards for pedestrians to inform nature and duration of construction works and contact numbers for concerns/complaints. (vi) Notify community/ water users in advance about likely interruptions in water supply. (vii) Provide alternate sources of clean water until water supply is restored.	DBO Contractor	(i) Complaints from sensitive receptors; (ii) Spoils management plan (iii) Number of walkways, signages, and metal sheets placed at project location.	Cost for implementation of mitigation measures responsibility of contractor.
Socio-Economic - Employment	Generation of temporary	(i) Employ local labour force, or to the maximum extent possible	DBO Contractor	(i) Employment records;	Cost for implementation

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation	Cost and Source of Funds
	employment and increase in local revenue	(ii) Comply with labor laws		(ii) Records of sources of materials (iii) Compliance to labor laws (see Appendix 9 of this IEE)	of mitigation measures responsibility of contractor.
Occupational Health and Safety	Occupational hazards which can arise during work	(i) Comply with all national, state and local core labor laws (see Appendix 9 of this IEE); Following best practice health and safety guidelines: IFC's General EHS Guidelines ³⁹ and Sector Specific (Water and Sanitation) Guidelines ⁴⁰ (ii) Develop and implement site-specific occupational health and safety (OH&S) Plan which will include measures such as: (a) excluding public from the site; (b) ensuring all workers are provided with and use personal protective equipment like helmet, gumboot, safety belt, gloves, nose mask and ear plugs; (c) OH&S Training for all site personnel; (d) documented procedures to be followed for all site activities; and (e) documentation of work-related accidents; (i) Conduct work in confined spaces, trenches, and at height with suitable precautions and using standards and safe construction methods; do not adopt adhoc methods; all trenches deeper than 1.5 m shall be provided with safety shoring/braces; and avoid open cutting method for trenches deeper than 3.5 m by adopting trenchless technology	Construction Contractor	(i) Site-specific OH&S Plan; (ii) Equipped first-aid stations; (iii) Medical insurance coverage for workers; (iv) Number of accidents; (v) Supplies of potable drinking water; (vi) Clean eating areas where workers are not exposed to hazardous or noxious substances; (vii) record of H&S orientation trainings (viii) personal protective equipment; (ix) % of moving equipment outfitted with audible back-up alarms; (xi) permanent sign boards for hazardous areas such as energized electrical devices and lines, service rooms housing	Cost for implementation of mitigation measures responsibility of contractor.

³⁹<https://www.ifc.org/wps/wcm/connect/554e8d80488658e4b76af76a6515bb18/Final%2B-%2BGeneral%2BEHS%2BGuidelines.pdf?MOD=AJPERES>

⁴⁰ <https://www.ifc.org/wps/wcm/connect/e22c050048855ae0875cd76a6515bb18/Final%2B-%2BWater%2BAnd%2BSanitation.pdf?MOD=AJPERES>

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation	Cost and Source of Funds
		(ii) Ensure that qualified first-aid can be provided at all times. Equipped first-aid stations shall be easily accessible throughout the site; (iii) Provide medical insurance coverage for workers; (iv) Secure all installations from unauthorized intrusion and accident risks; (v) The project area experiences extreme temperature during summer months of April and May, which may affect the health of workers engaged in construction work. Contractor should take necessary measures during summers including the following: (a) work schedule should be adjusted to avoid peak temperature hours (12 – 3 PM); (b) provide appropriate shade near the work place; allow periodic resting and provide adequate water, and (c) provide necessary medicine and facilities to take care of dehydration related health issues (v) Provide supplies of potable drinking water; (vi) Provide clean eating areas where workers are not exposed to hazardous or noxious substances; (vii) Provide H&S orientation training to all new workers to ensure that they are apprised of the basic site rules of work at the site, personal protective protection, and preventing injuring to fellow workers; (viii) Provide visitor orientation if visitors to the site can gain access to areas		high voltage equipment, and areas for storage and disposal. (xii) Compliance to core labor laws (see Appendix 9 of this IEE)	

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation	Cost and Source of Funds
		where hazardous conditions or substances may be present. Ensure also that visitor/s do not enter hazard areas unescorted; (ix) Ensure the visibility of workers through their use of high visibility vests when working in or walking through heavy equipment operating areas; (x) Ensure moving equipment is outfitted with audible back-up alarms; (xi) Mark and provide sign boards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal. Signage shall be in accordance with international standards and be well known to, and easily understood by workers, visitors, and the general public as appropriate; and (xii) Disallow worker exposure to noise level greater than 85 dBA for a duration of more than 8 hours per day without hearing protection. The use of hearing protection shall be enforced actively. (xiii) Conduct regular health check-ups for workers (xiv) Provide periodical awareness camps and special trainings for workers for health issues and risks in construction sites (xv) During working in Dam area, workers should be made aware of risks of water depth and dangerous areas of water should be properly marked by fix or floating barricades and signage of danger. Workers should also be made			

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation	Cost and Source of Funds
		aware for protection of biodiversity of the water and fishing should be strictly prohibited. An boat should be made available at site for transport of labour and materials and should be well maintained for any emergency condition. Workers should not be allowed to dip or bath in water of dam. Suitable working platform should be provided during construction works in water. (xi) Provide proper solid and liquid waste management program in workers' campsite, separate from spoils and debris disposal, as their presence can add to existing waste volume at the project sites.			
Occupational and community health & safety – asbestos containing material handling (AC pipes)	Hazardous working conditions due to presence of asbestos containing material / AC Pipes in work sites	(i) Develop and implement Comprehensive Asbestos Management Plan (CAMP); CAMP should be prepared during detailed design and should form part of the IEE; Engage experts on asbestos management to develop the plan following international best practice such as the approach recommended by the United States Environmental Protection Agency (USEPA) (ii) CAMP inter alia, should include: - Regulatory framework - Identify location of AC pipes or Asbestos Containing Materials (ACM) in the existing facilities that are to be rehabilitated and / or dismantled under the subproject, - assess the condition of such AC pipes and ACM, if any, - procedures for monitoring its condition	Construction Contractor	(i) Asbestos management plan preparation and implementation (iii) quantity and characteristics of asbestos containing material removed/handled and disposed safely	Cost for implementation of mitigation measures responsibility of contractor.

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation	Cost and Source of Funds
		e. procedures to assess the locations where AC pipes / ACM present to avoid damage f. Awareness and training of staff/workers to avoid damage and prevent exposure g. Most appropriate, safe and least cost approach suitable for local conditions in managing existing AC pipes and ACM; h. AC pipes protocol to be applied in any instance that AC pipes are encountered, to ensure that appropriate action is taken. i. CAMP implementation arrangements and costs (iii) the plan should, inter alia assess, whether it is possible to lay new pipes without disturbing the underground AC pipes, accidentally or otherwise, whether it is appropriate to leave them in-situ in the ground without disturbing or more appropriate to remove the AC pipes and dispose in hazardous waste disposal sites, (iv) 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: (a) removal of all persons to a safe distance; (b) usage of appropriate breathing apparatus and protective equipment by persons delegated to deal with the AC material; and (c) Procedures for the safe removal and long-term disposal of all			

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation	Cost and Source of Funds
		asbestos-containing material encountered. (v) The project shall allocate specific budget in developing and implementing the CAMP (vi) Implement CAMP, and report compliance to ADB via Environmental Monitoring Reports			
Community Health and Safety.	Traffic accidents and vehicle collision with pedestrians during material and waste transportation	(i) Trench excavation and pipeline works shall be conducted in a safe manner; if the allowing public movement along the work sites (pedestrians or vehicles as the case may be) is likely to cause safety risks, movement should be blocked temporarily and work shall be conducted; in such areas, conducting night work or working in small stretches to avoid blockage of traffic/movement no more than few hours in due consultation with the local community and ULB shall be planned (ii) All trenches deeper than 1.5 m shall be provided with safety shoring/braces; and avoid open cutting method for trenches deeper than 3.5 m by adopting trenchless technology (iii) Survey the surrounding vulnerable buildings for likely issues in structural stability / differential settlement during the excavation works (iv) Provide prior information to the local people about the (v) Plan routes to avoid times of peak-pedestrian activities. (vi) Liaise with PIU/ULB in identifying high-risk areas on route cards/maps.	Construction Contractor	(i) Traffic Management Plan; (ii) Complaints from sensitive receptors	Cost for implementation of mitigation measures responsibility of contractor.

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation	Cost and Source of Funds
		(vii) Maintain regularly the vehicles and use of manufacturer-approved parts to minimize potentially serious accidents caused by equipment malfunction or premature failure. (viii) Provide road signs and flag persons to warn of on-going trenching activities.			
Safety of sensitive groups (children, elders etc.) and others pedestrians in narrow streets	Trench excavation in narrow streets will pose high risk to children and elders in the locality	(i) Provide prior information to the local people about the nature and duration of work (ii) Conduct awareness program on safety during the construction work (iii) Undertake the construction work stretch-wise; excavation, pipe laying and trench refilling should be completed on the same day (iv) Provide barricades, and deploy security personnel to ensure safe movement of people and also to prevent unnecessary entry and to avoid accidental fall into open trenches	Construction Contractor	Complaints from neighborhood and monitoring of accidents	Cost for implementation of mitigation measures responsibility of contractor.
Night Works	Public inconvenience due to traffic diversion, disturbance due to excessive noise and access loss, occupational health and safety issues etc	Prepare a night work protocol and obtain prior approval from PIU, and strictly implement and report on implementation of protocol during the workers; - Contractors should have handheld noise level meter for measurement of noise during night hours - Contractors should have handheld lux meter for the measurement of illumination during night hours - Preferably electrical connection is available for running equipment	Contractor	Night work plan / protocol submitted by contractor and approved by PIU/Consultant	Contractor

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation	Cost and Source of Funds
		otherwise soundproof/super silent Diesel Generator set should be available • Sound level should not increase as prescribe by CPCB • Illumination should be as prescribed in protocol • As far as possible ready-mix concrete from batching plant to be used, otherwise the concrete should be prepared away from residential areas and brought to the site • All the noisy activities like hammering, cutting, crushing, running of heavy equipment should be done in day-time and avoided in nighttime • Workers engaged in night works should have adequate rest/sleep in daytime before start of night works • Worker engaged for night works should have previous experience of night works and should be physically fit for such works including clear vision in night • All the necessary provisions of traffic aids such as traffic signals, road signage, barricades, cautions boards, traffic diversion boards etc. should be available with fluorescent/retro-reflective arrangements • Workers should be trained before start of night works about risks and hazards of night works and their mitigation measures and should be provided all the protective aids			

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation	Cost and Source of Funds
		(PPEs) including fluorescent/retro-reflective vests • Horns should not be permitted by equipment and vehicles • Workers should not shout and create noise • First aid and emergency vehicles should be available at site • Emergency preparedness plan should be operative during night works • Old persons and pregnant women and women having small kids should not work in nighttime • All the vehicles and equipment being used at night works should have adequate type of silencers/enclosures/mufflers to reduce noise • All the vehicles should be checked for working head lamps, tail lamps, inner lights etc. before start of night works • PIU/CMSC site engineers and contractor's safety personnel should closely monitor the safety of works continuously and noise and illumination levels on hourly basis and maintain photographic and video graphic records as well as register the observations. • Night works should be stopped early in the morning at least one hour before start of pedestrian/traffic movement			

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation	Cost and Source of Funds
		• After completion of night works all the site should be cleaned and maintained obstruction free for daytime movement of vehicles and pedestrians • Drivers and workers should be alert and responsive during night works • All the wages to workers working in night hours should be as per the applicable labour acts • Avoid any nuisance which may create problems to nearby habitants and work peacefully during night hours Night works should not be conducted near hospitals and during peak seasons such as peak tourist season, students' exam times etc.			
Work in narrow streets	will pose high risk to children and elders in the locality	○ Conduct awareness program on safety during the construction work ○ Undertake the construction work stretch-wise; excavation, pipe laying and trench refilling should be completed on the same day • Provide barricades, and deploy security personnel to ensure safe movement of people and also to prevent unnecessary entry and to avoid accidental fall into open trenches • Trench excavation and pipeline works shall be conducted in a safe manner; if the allowing public movement along the work sites (pedestrians or vehicles as the case may be) is likely to cause safety risks, movement should be			responsibility of contractor.

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation	Cost and Source of Funds
		blocked temporarily and work shall be conducted; in such areas, conducting night work or working in small stretches to avoid blockage of traffic/movement no more than few hours in due consultation with the local community and ULB shall be planned			
Construction camps and worker facilities	Temporary air and noise pollution from machine operation, water pollution from storage and use of fuels, oils, solvents, and lubricants Unsanitary and poor living conditions for workers	(i) Consult with PIU before locating project offices, sheds, and construction plants; (ii) Minimize removal of vegetation and disallow cutting of trees; (iii) Provide drinking water, water for other uses, and sanitation facilities for employees; (iv) Provided temporary rest and eating area at all work sites (v) Ensure conditions of livability at work camps are always maintained at the highest standards possible; living quarters and construction camps shall be provided with standard materials (as far as possible to use portable ready to fit-in reusable cabins with proper ventilation); thatched huts, and facilities constructed with materials like GI sheets, tarpaulins, etc., shall not be used as accommodation for workers; accommodation shall meet the IFC standards for workers accommodation which include: provision of safe housing, availability of electricity, plumbing, water and sanitation, adequate fire protection and dormitory/room facilities; accommodation shall be in the range from 10 to 12.5 cubic meters (volume) or 4 to 5.5 square meters (surface) per	Construction Contractor	(i) Complaints from sensitive receptors; (ii) Drinking water and sanitation facilities for employees	Cost for implementation of mitigation measures responsibility of contractor.

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation	Cost and Source of Funds
		worker, a minimum ceiling height of 2.10 meters; a reasonable number of workers are allowed to share the same room – (standards range from 2 to 8 workers); workers with accompanying families shall be provided with a proper and safe accommodation (IFC benchmark standards for workers accommodation is provided in Appendix 25) (vi) Train employees in the storage and handling of materials which can potentially cause soil contamination; (vii) Recover used oil and lubricants and reuse or remove from the site; (viii) Manage solid waste according to the preference hierarchy: reuse, recycling and disposal to designated areas; (ix) Ensure unauthorized persons specially children are not allowed in any worksite at any given time.			
Social and Cultural Resources	Risk of archaeological chance finds	(i) Strictly follow the protocol for chance finds in any excavation work; (ii) Create awareness among the workers, supervisors and engineers about the chance finds during excavation work (iii) Stop work immediately to allow further investigation if any finds are suspected; (iv) Inform local Archeological Department / Museum office if a find is suspected and take any action, they require to ensure its removal or protection in situ	Construction Contractor	Records of chance finds	Cost for implementation of mitigation measures responsibility of contractor.

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation	Cost and Source of Funds
Submission of EMP implementation report	Unsatisfactory compliance to EMP	(i) Appointment of supervisor to ensure EMP implementation (ii) Timely submission of monitoring reports including pictures	Construction contractor	Availability and competency of appointed supervisor Monthly report	Cost for implementation of mitigation measures responsibility of contractor.
Post-construction clean-up	Damage due to debris, spoils, excess construction materials	(i) Remove all spoils wreckage, rubbish, or temporary structures (such as buildings, shelters, and latrines) which are no longer required; and (ii) All excavated roads shall be reinstated to original condition. (iii) All disrupted utilities restored (iv) All affected structures rehabilitated/compensated (v) The area that previously housed the construction camp is to be checked for spills of substances such as oil, paint, etc. and these shall be cleaned up. (vi) All hardened surfaces within the construction camp area shall be ripped, all imported materials removed, and the area shall be top soiled and re-grassed using the guidelines set out in the re-vegetation specification that forms part of this document. (vii) The contractor must arrange the cancellation of all temporary services. (viii) Report in writing that worksites and camps have been vacated and restored to pre-project conditions before acceptance of work.	Construction Contractor	PIU/Consultant report in writing that (i) worksite is restored to original conditions; (ii) camp has been vacated and restored to pre-project conditions; (iii) all construction related structures not relevant to O&M are removed; and (iv) worksite clean-up is satisfactory.	Cost for implementation of mitigation measures responsibility of contractor.

Table 21: Environmental Management Plan of Anticipated Impacts during Operation

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation	Cost and Source of Funds
Water supply system operation: water treatment	Supply of water not meeting drinking water standards, health and environment issues due to operation of WTP	(i)Judiciously utilize the available water in Bhaisa Singh Dam water and groundwater resources by adapting conjunctive use; prepare a water utilization plan every year post monsoon season depending on the water storage in Bhaisa Singh Dam (ii)Ensure that dead storage is always maintained in Bhaisa Singh Dam; utilize only available live storage for water supply (iii)Prepare and implement Contingency Plan for low rainfall years that will result in low water levels in Bhaisa Singh Dam; in such cases revise the water supply rate appropriately to ensure uninterrupted water supply throughout the year; provide prior information to stakeholders (iv)Ensure that water supplied to the consumers at all times meet the drinking water standards; carry out regular sampling and testing, and disseminative information (v) Ensure zero wastewater discharge from the water treatment process via collection and recirculation of process wastewater / backwash water; (vi) Implement sludge management plan; ensure collection, processing, drying, and safe disposal / reuse accordingly (vii) Assess composition and characteristics of sludge from the first batch operation at the initial phases, and confirm the handling, management and disposal/reuse actions suggested in the management plan (viii) Conduct periodic testing of sludge as per the environmental monitoring plan (ix) Ensure valid consent to operate (CTO) from RPCB for operation of WTP	O&M contractor for 10 years and then Nagar Palika	Nagar Palika, Abu Road	O & M cost of contractor

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation	Cost and Source of Funds
		(x) Ensure that all conditions/standards prescribed by RPCB are complied duly (xi) Ensure that chlorinator facility is operated only by trained staff and as per the standard operating procedures; in case of any accident and/or maintenance activity, ensure that the staff follows documented procedures only (xii) Implement Emergency Response System (ERS) for the chlorine leakage; (ixii) Guidelines and Emergency plan for handling and storing chlorine is attached as Appendix 26			
Sewerage system operation: treatment discharge of treated wastewater, sludge	Environmental and health issues due to operation	(i) Ensure that treated wastewater meets the established discharge standards all times; Conduct regular wastewater quality monitoring (at inlet and at outlet of STP) to ensure that the treated effluent quality complies with design standards; (ii) Conduct baseline water quality assessment of West Banas River prior to start of operation (iii) Ensure implementation of Reuse Plan, and ensure intended quality for each direct reuse (iv) Assess composition and characteristics of sludge from the first batch operation at the initial phases, and confirm the handling, management and disposal/reuse actions suggested in the management plan (v) Conduct periodic testing of dried sludge/compost to check presence of heavy metals and confirming the concentrations to use as compost as specified in the Standards for Composting, Schedule II A, Solid Waste Management Rules, 2016, FCO = Fertilizer Control Order, 1985, amendments in 2009 and 2013. It shall not be used for food crops.	O&M contractor for 10 years and then Nagar Palika	Nagar Palika, Abu Road	O & M cost of contractor

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation	Cost and Source of Funds
		(vi) Ensure valid consent to operate (CTO) from RPCB for operation of STP (vii) Ensure that all conditions/standards prescribed by RPCB are complied duly (viii) Ensure that chlorinator facility is operated only by trained staff and as per the standard operating procedures; in case of any accident and/or maintenance activity, ensure that the staff follows documented procedures only (ix) Implement Emergency Response System (ERS) for the chlorine leakage; Guidelines and Emergency plan for handling and storing chlorine is attached as Appendix 26 (x) Ensure proper knowledge transfer, hands-on training to municipal staff engaged in STP operation has been provided by contractor prior to handover of facility; (xi) Operate and maintain the facility following standard operating procedures of operational manual; (xii) Undertake preventive and periodic maintenance activities as required; (xiii) Conduct periodic training to workers; ensure that all safety apparatus at STP including personal protection equipment are in good condition all times; and are at easily accessible and identifiable place; periodically check the equipment, and conduct mock drills to deal with emergency situations; (xiv) No wastewater from industrial premises (including domestic wastewater) shall be allowed to dispose into municipal sewers; monitor regularly and ensure that there is no illegal discharge through manholes or inspection chambers; conduct public awareness programs; in coordination with RPCB:			

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation	Cost and Source of Funds
		(xv) Conventional and centralized water treatment that use filtration and disinfection that inactivates disease-causing vectors (xvi) Final disinfection step considered if treatment plant technologies are not able to destroy pathogens and remove viruses (xvii) Workers should wear appropriate PPE which includes protective outerwear, gloves, boots, goggles or a face shield and a mask (xviii) Perform hand hygiene frequently, avoid touching eyes, nose, mouth with unwashed hands			
Sewerage system operation: collection and conveyance	Environmental and health issues due to operation of sewer network	(i) Establish regular maintenance program, including: ▪ Regular cleaning of grit chambers and sewer lines to remove grease, grit, and other debris that may lead to sewer backups. Cleaning should be conducted more frequently for problem areas. ▪ Inspection of the condition of sanitary sewer structures and identifying areas that need repair or maintenance. Items to note may include cracked/deteriorating pipes; leaking joints or seals at manhole; frequent line blockages; lines that generally flow at or near capacity; and suspected infiltration or exfiltration; and ▪ Monitoring of sewer flow to identify potential inflows and outflows ▪ Conduct repairs on priority based on the nature and severity of the problem. Immediate clearing of blockage or repair is warranted where an overflow is currently occurring or for urgent problems that may cause an imminent overflow (e.g. pump station failures, sewer line ruptures, or sewer line blockages); (ii) Review previous sewer maintenance records to help identify "hot spots" or areas with	O & M contractor for 10 years and then Nagar Palika	Nagar Palika, Abu Road	O & M cost of contractor

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation	Cost and Source of Funds
		frequent maintenance problems and locations of potential system failure, and conduct preventative maintenance, rehabilitation, or replacement of lines as needed; (iii) When a spill, leak, and/or overflow occurs, keep sewage from entering the storm drain system by covering or blocking storm drain inlets or by containing and diverting the sewage away from open channels and other storm drain facilities (using sandbags, inflatable dams, etc.). Remove the sewage using vacuum equipment or use other measures to divert it back to the sanitary sewer system. (iv) Prohibit/prevent disposal of wastewater/effluent from industrial units in the sewers; ensure regular checking to ensure no illegal entry of industrial wastewater into sewers (v) Develop an Emergency Response System for the sewerage system leaks, burst and overflows, etc. (vi) Provide necessary health & safety training to the staff (vii) Provide all necessary personnel protection equipment (viii) During cleaning/clearing of manholes and sewer lines great precautions should be taken for the safety of workers conducting such works. ▪ As far as possible use remote / CCTV mechanism to identify/detect the problems in sewers and do not engage persons for this purpose ▪ As far as possible use mechanized cleaning of manholes and sewers by using modern techniques and machines and do not engage persons for this purpose			

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation	Cost and Source of Funds
		▪ Ensure that maintenance staff and supervisors understand the risks; provide proper instructions, training and supervision. ▪ Use gas detector to detect any hazardous or inflammable gas in confined areas like sewers /manholes prior to maintenance process ▪ Provide suitable personal protective equipment that may include waterproof / abrasion-resistant gloves, footwear, eye and respiratory protection. Face visors are particularly effective against splashes. Equipment selection and a proper system for inspection and maintenance are important. ▪ Provide adequate welfare facilities, including clean water, soap, nail brushes, disposable paper towels, and where heavy contamination is foreseeable, showers. ▪ For remote locations portable welfare facilities should be provided. ▪ Areas for storage of clean and contaminated equipment should be segregated and separate from eating facilities. ▪ Provide adequate first-aid equipment, including clean water or sterile wipes for cleansing wounds, and a supply of sterile, waterproof, adhesive dressings. ▪ Make effective arrangements for monitoring the health of staff. ▪ Keep emergency preparedness plan ready before starting the work of sewage system cleaning			
Repair and maintenance activities of water supply & sewerage:	All work sites	Implementation of dust control, noise control, traffic management, & safety measures. Site inspection checklist to review implementation is appended at Appendix 30	O&M contractor for 10 years and then Nagar Palika, Abu road	Nagar Palika, Abu Road	O & M cost of contractor

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation	Cost and Source of Funds
Construction disturbances, nuisances, public & worker safety,					
Asset management	Reduction in NRW Increased efficiency of the system	Preparation and implementation of O&M Manual	O&M contractor for 10 years and then Nagar Palika	Nagar Palika, Abu Road	O&M cost of contractor

Table 22: Environmental Monitoring Plan of Anticipated Impacts during Construction

Monitoring field	Monitoring location	Monitoring parameters	Frequency	Responsibility	Cost & Source of Funds
Construction disturbances, nuisances, public & worker safety,	All work sites	Implementation of dust control, noise control, traffic management, safety measures, chance find protocol, asbestos pipes management Site inspection checklist to review implementation is appended at Appendix 30	Weekly during construction	Supervising staff and safeguards specialists	No costs required
Ambient air quality	4locations (STP, WTP, pipe laying, construction camps and workers camp)	PM10, PM2.5, NO2, SO2, CO	Once before start of construction and quarterly (yearly 4-times) during construction	Contractor	Cost for implementation of monitoring measures responsibility of contractor
Ambient noise	4locations (STP, WTP, pipe laying, construction camps and workers camp)	Day time and night time noise levels	Once before start of construction and quarterly (yearly 4-times) during construction	Contractor	Cost for implementation of monitoring measures responsibility of contractor
Surface water quality	2 Location (intake site)	pH, Oil & grease, Cl, F, NO3, TC, FC, Hardness, Turbidity BOD, COD, DO, Total Alkalinity	Once before start of construction and quarterly (yearly 4-times) during construction	Contractor	Cost for implementation of monitoring measures responsibility of contractor

Monitoring field	Monitoring location	Monitoring parameters	Frequency	Responsibility	Cost & Source of Funds
Monitoring of raw wastewater quality	Inlet of the STP	Suspended solids, pH, Temperature Oil and grease, Total residual chlorine, Ammonical nitrogen (as N), BOD, COD, Nitrate Nitrogen The values should be within the limit specified by CPCB to discharge into municipal sewers (see Appendix 6)	Monthly once	O&M contractor for 10 years and then Nagar Palika	Nagar Palika, Abu Road
Sludge quality and suitability as manure	Dried sludge	Test dried sludge/compost for presence of heavy metals and confirming the concentrations to use as compost as specified in the Standards for Composting, Schedule II A, Solid Waste Management Rules, 2016, FCO = Fertilizer Control Order, 1985, amendments in 2009 and 2013. Analysis for concentration of heavy metals and confirm that value are within the following limits (all units are in mg/kg dry basis except pH) Arsenic - 10.00 Cadmium - 5.00 Chromium - 50.00 Copper - 300.00 Lead - 100.00 Mercury - 0.15 Nickel - 50.00 Zinc - 1000.00 pH - 5.5-8.5	Yearly twice	O&M contractor for 10 years and then Nagar Palika	Nagar Palika, Abu Road
Raw water quality	Bhaisa Singh Dam, WTP and tube wells	Parameters as per drinking water standards (IS 10500-2012)	Monthly once	O& M contractor for 10 years and then Nagar Palika	Nagar Palika, Abu Road
Treated water quality	WTP CWRs	Parameters as per drinking water standards (IS 10500-2012)	Monthly once	O& M contractor for 10 years and then Nagar Palika	Nagar Palika, Abu Road

Monitoring field	Monitoring location	Monitoring parameters	Frequency	Responsibility	Cost & Source of Funds
	Bulk water outlets of six villages				
Monitoring of quality of water supplied to consumers	Consumer end-random sampling in all zones	Parameters as per drinking water standards (IS 10500-2012)	Monthly once	O& M contractor for 10 years and then Nagar Palika	Nagar Palika, Abu Road
Consent to operate (CTO) from RPCB	WTP	CTO should be renewed before expired	As per RPCB	Aburoad Nagar Palika	Abu road Nagar Palika

B. Institutional Requirements

223. The Local Self Government Department (LGSD) is the executing agency which will be responsible for the overall strategic guidance and ensure the compliance with ADB loan covenants. RUDSICO is the implementing agency responsible for the technical supervision and project implementation. The RUDSICO Board (under the chairmanship of the Honorable Minister), the LGSD and the City Level Monitoring Committees (CLMCs, under the chairmanship of their respective commissioner/executive officer) is proposed to monitor the project implementation. The PMU is at state-level and headed by a dedicated Project Director. The PIUs have two zonal offices (1 in Jaipur and 1 in Jodhpur). Each zonal office will be headed by an additional chief engineer. Urban Local Bodies (ULBs) will be the final custodian and user of the created infrastructure. As primary stakeholders, the ULBs will be involved and engaged in the day-to-day monitoring and implementation.

224. At the PMU level, the Project Director shall be supported by Additional Project Director (Chief Engineer-level) and a Chief Engineer, who shall then be supported by Dy Project Director and a financial advisor. There shall be one project officer for Social and another project officer for Environmental aspects of the project.

225. The PMU shall be supported by the Project Management and Capacity Building Consultants (PMCBC). The PMCBC shall manage preparation/vetting design documents, tendering of contracts, implementation of resettlement, environmental management and gender action plans; setting and managing project performance monitoring systems, planning and managing implementation of training and capacity building as well as institutional strengthening activities besides preparing reports as per ADB requirements. PMCBC shall engage a social safeguard specialist and environmental safeguard specialist at the PMU level for managing all social and environmental safeguard related support services as envisaged in its scope of work. They will be assisted by concerned field level safeguard support staffs of CMSCs and PIU.

226. PMCBC shall be joined by the following specialists to address site-specific environmental requirements as below:

- (i) **Environment Specialist Consultant.** Responsibilities include the review and refinement of the IEEs and the EMPs and ensure inclusion in the bid documents and during construction, monitor the implementation of the EMPs and support in the reporting and documentation requirements;
- (ii) **Asbestos Management Specialist.** Provides training and awareness on the risks and safe handling and management of asbestos-containing materials (ACMs) and to coordinate with the Asbestos Management Service Provider in the implementation of the Asbestos Management;
- (iii) **Heritage Management Specialist.** Provides guidance on the ADB SPS, 2009 requirement on Physical Cultural Resources in the RSTDSP towns including the conduct of Heritage Impact Assessment, provides support on the statutory clearances to be obtained and the documentation and reporting on the implementation of mitigation measures;
- (iv) **Biodiversity Expert.** Provides guidance on the ADB SPS, 2009 requirement on Biodiversity Conservation and Critical Habitat Assessment including the conduct preliminary screening (e.g. IBAT assessment reports), on-site verifications and consultations, recommend specific measures and provide supervisor support during the planning and construction periods; and

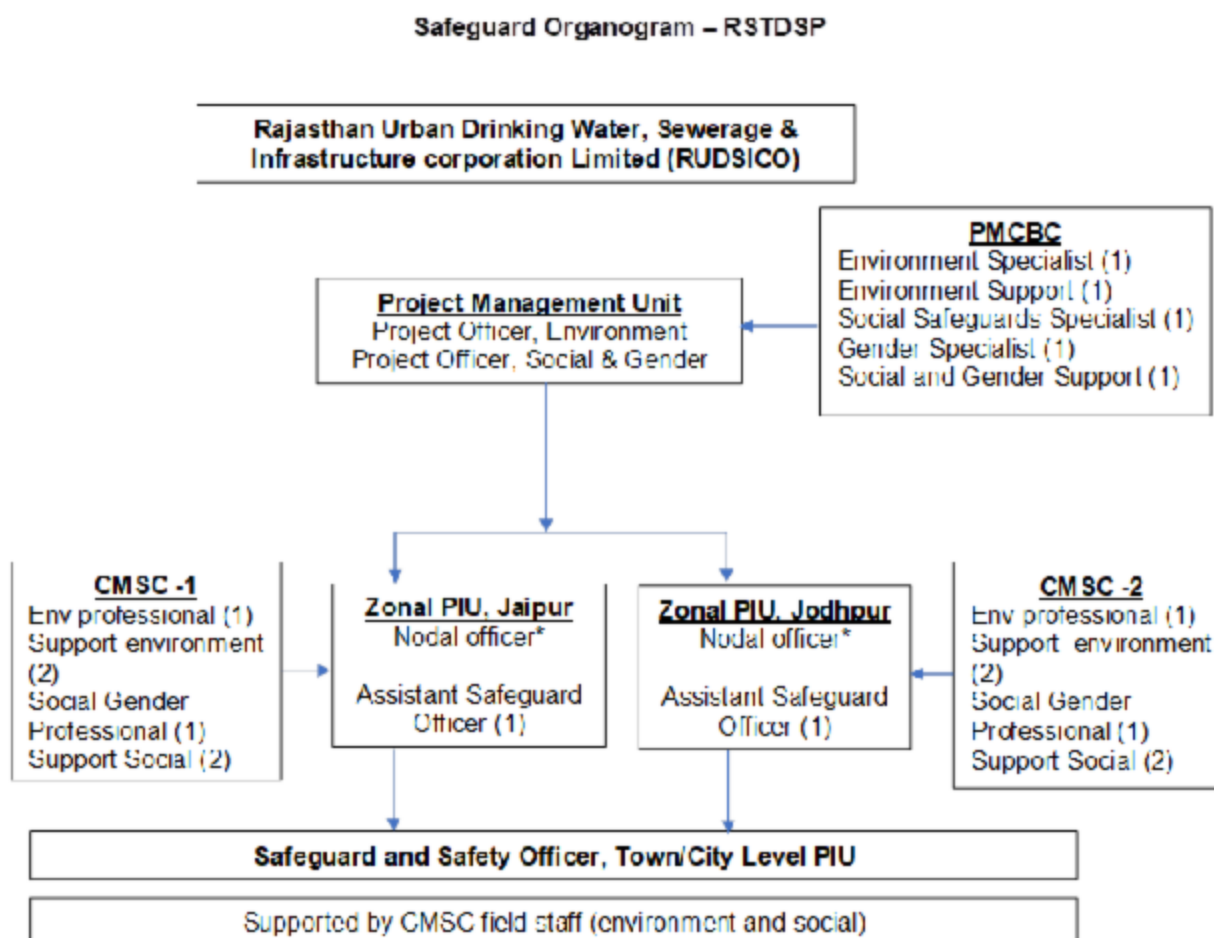
- (v) **Architect.** Assists the team leader and structural expert for review and approval of all drawings from architectural and heritage perspective; review and approve the detailed architectural drawings prepared by the contractor and promptly address ant site-specific issues regarding architectural and heritage aspects.

227. There will be two zonal PIUs and a PIU at every town. PIUs at the town-level shall be headed by a Superintending Engineer / Executive Engineer, who shall work as Project Manager and shall sign the contract documents, manage the contract and disburse payments as Drawing and Disbursing Officer.

228. Construction management and supervision consultants - 2 nos. catering to Jaipur and Jodhpur units. They shall directly support PIUs in day to day contract management, construction supervision including quality management of ongoing works etc. This shall include work measurement, quantities, verification of bills of contractors etc. In compliance with the EMP, the CMSC shall develop a strategy to overcome the difficulties of construction/traffic management in narrow streets and also prepare detailed plans for detour of traffic during excavation for pipe laying. The CMSC will propose and implement mechanism for coordination among all stakeholders such as traffic police, roads department, user committees, etc., for smooth construction execution. Adequate measures shall be taken for working near physical cultural resources involving close coordination with the Department of Archaeology. The CMSC will lead design of surveys and investigations required for the protection of archaeological sites/heritage areas and prepare Archaeological Impact Assessments, or other agreed upon document to be approved by the Department of Archaeology for the archaeologically sensitive locations;

229. Community awareness and public participation consultants (CAPPC) will closely work in the field (with PIUs) to facilitate creation of project awareness and ensuring public participation for all project works at the community level. This shall mainly involve house connections for water supply, sewerage and metering. CAPPC shall also undertake various IEC activities to promote and pursue health and hygiene among the communities.

230. Table 23 to 24 summarize the institutional responsibility of environmental safeguards implementation at all stages of the project.

Figure 22: Safeguards Implementation - RSTDSP

Zonal PIU will be led by a nodal officer of the rank of assistant chief engineer who will also be the nodal person for safeguards and gender compliances in project implementation by town level PIUs. She will be supported by ASO in execution of these responsibilities.

231. Project Management Unit. RUDSICO will establish a state-level PMU, headed by dedicated project director, and housed in EAP division of RUDSICO. For the purpose of project implementation, 2 Zonal project implementation units (Zonal PIUs), at Jaipur and Jodhpur, headed by additional chief engineers (ACE) will be established. At PMU, there will be two dedicated project officers (i) project officer (Environment) and (ii) project officer (Social and Gender), who will be responsible for compliance with the environmental, social safeguards and gender in program implementation. Key responsibilities of the project officer (Environment) are as follows:

- (i) Review REA checklists and assign categorization based on ADB SPS, 2009 and EARF;
- (ii) Submit IEE to ADB for approval and disclosure in ADB website;
- (iii) Ensure approved IEEs are disclosed in RSTDSP/PMU websites and summary posted in public areas accessible and understandable by local people;
- (iv) Ensure EMPs are included in the bid documents and contracts;

- (v) Organize an orientation workshop for PMU, PIU, ULB and all staff involved in the project implementation on (a) ADB SPS, 2009; (b) Government of India national, state and local environmental laws and regulations; (c) core labor standards; (d) OHS; and (e) EMP implementation especially spoil management, working in congested areas, public relations and ongoing consultations, grievance redress, etc.;
- (vi) Assist in addressing any grievances brought about through the GRM;
- (vii) Organize an induction course for the training of contractors preparing them on EMP implementation, environmental monitoring requirements related to mitigation measures; and taking immediate actions to remedy unexpected adverse impacts or ineffective mitigation measures found during the course of implementation;
- (viii) Ensure compliance with all government rules and regulations regarding site and environmental clearances as well as any other environmental requirements;
- (ix) Assist PMU, PIUs, and project consultants to document and develop good practice construction guidelines to assist the contractors in implementing the provisions of IEE and EMP;
- (x) Assist in the review of the contractors' implementation plans to ensure compliance with the IEE;
- (xi) Review monthly monitoring reports submitted by PIUs, and prepare and submit to ADB semi-annual monitoring reports;
- (xii) If necessary, prepare corrective action plan and ensure implementation of corrective actions to ensure no environmental impacts;
- (xiii) Review and submit corrective action plans to ADB;
- (xiv) Coordinate with national and state level government agencies; and
- (xv) Coordinate PIUs, consultants and contractors on mitigation measures involving the community and affected persons and ensure that environmental concerns and suggestions are incorporated and implemented.

232. The PMU will be supported by 3 institutional consultants under the supervision and control of PD, PMU: (i) the project management and capacity building consultants (PMCBC) will support the PMU; (ii) 2 CMSC will support the 2 zonal PIUs and town-level PIUs; and (iii) CAPPC, will support the zonal PIUs and town-level PIUs.

233. **Zonal Project implementation units (Zonal PIUs).** There will be 2 zonal level PIUs at Jaipur and Jodhpur. Under each zonal PIU, there will be city/town level PIUs, for ease of day-to-day monitoring and management at local level. The additional chief engineer at each Zonal PIU will serve as the Nodal Officer, Safeguards and Gender. Each Zonal PIU will be staffed with an assistant safeguards officer (ASO Environmental and Social Safeguards) who will assist PMU project officer (environment/social) in implementation of the environmental/social safeguards and GESI action plan in PIUs under its jurisdiction. Zonal PIUs will undertake internal monitoring and supervision and record observations throughout the project period to ensure that the safeguards and mitigation measures are provided as intended.

234. The zonal level ASO will oversee safeguards implementation by the city/town level PIUs, coordinate public consultations, information disclosure, regulatory clearances and approvals, implementation of resettlement plans, EMP implementation, and grievance redressal. Key safeguard tasks and responsibilities of the zonal PIU ASO (Environment) are as follows:

- (i) Coordinate updating/revision of IEEs updated based on detailed design and technical studies (asbestos management, heritage impact assessment, and/or biodiversity assessment);

- (ii) Review and submit approved updated/revised IEE to PMU;
- (iii) Ensure relevant information in the IEE is disclosed to stakeholders;
- (iv) Obtain all necessary clearances, permits, consents, no objection certificates (NOCs), etc. Ensure compliance to the provisions and conditions;
- (v) Ensure EMP requirements for pre-construction regarding sites for disposal of wastes, camps, storage areas, quarry sites, etc., are complied and communicated by town-level PIUs to contractors in a timely manner;
- (vi) Support town-level PIUs in supervising contractor EMP implementation. If necessary, organize an induction course upon mobilization of contractors, preparing them on EMP implementation, environmental monitoring requirements related to mitigation measures, and on taking immediate action to remedy unexpected adverse impacts or ineffective mitigation measures found during the course of implementation;
- (vii) Coordinate actions required for obtaining ROW in timely manner;
- (viii) Take corrective actions when necessary to ensure no environmental impacts;
- (ix) Consolidate monthly environmental monitoring reports by town-level PIUs and submit to PMU;
- (x) Formulate timebound corrective actions for non-compliances;
- (xi) Conduct continuous public consultation and awareness;
- (xii) Address any grievances in a timely manner as per the GRM; and
- (xiii) Issue clearance for contractor's post-construction activities as specified in the EMP.

235. Town/City Level Project Implementation Unit. The town-level PIUs shall be responsible for the quality of works executed under the project and will be guided by the zonal PIUs. The city/town PIUs will be responsible for implementation of the IEE. The town-level PIUs will be headed by a project manager (executive engineer or assistant engineer) and supported by CMSC field staff. Environment specialist of CMSC will assist PIU in implementation of environmental safeguard. At each PIU, the Assistant Project Manager will be given additional responsibilities of safeguard tasks and will be designated as safeguard and safety officer (SSO). The SSO will be assisted by the social and gender specialist and environment specialist of CMSC in reviewing updated/revised IEEs, etc. They will also be responsible for coordination of field level activities related to safeguards conducted by the DBO contractor and CMSC. Key responsibilities of the town-level environment specialist are as follows:

- (i) Prepare REA Checklists, No Mitigation Checklists, baseline environmental surveys to support screening and categorization per EARF;
- (ii) Submit proposed subproject categorization to Zonal PIU and coordinate with PMCBC the preparation of IEE and technical studies;
- (iii) Coordinate the conduct of technical studies such as but not limited to inventory of asbestos materials in subproject sites, heritage impact assessment and/or biodiversity assessment;
- (iv) Ensure IEEs are updated/revised based on detailed design and recommendations of technical studies;
- (v) Oversee day-to-day implementation of EMPs by contractors, including compliance with all government rules and regulations;
- (vi) Take necessary action for obtaining ROW;
- (vii) Take corrective actions when necessary to ensure no environmental impacts;
- (viii) Submit monthly environmental monitoring reports to Zonal PIUs;
- (ix) Conduct continuous public consultation and awareness;
- (x) Address any grievances in a timely manner as per the GRM; and

- (xi) Issue clearance for contractor's post-construction activities as specified in the EMP.

236. Contractors. The contractor will be required to update the IEE and will be responsible for providing final design (including pipe alignments) to the supervision consultant for finalization/updating of resettlement plan. The contractor shall appoint an environment, health and safety (EHS) engineer who will be responsible on a day-to-day basis for (i) ensuring implementation of EMP, (ii) coordinating with the town-level PIUs and environment specialists of project consultant teams; (iii) community liaison,⁴¹ consultations with interested/affected people, (iv) field-level grievance redress; and (iv) reporting.

237. The Contractor will be required to submit to RUDSICO, for review and approval, a SEMP including (i) proposed sites or locations for construction work camps, storage areas, hauling roads, lay down areas, disposal areas for solid and hazardous wastes; (ii) specific mitigation measures following the approved EMP; (iii) monitoring program per SEMP; (iv) budget for SEMP implementation. No works can commence prior to approval of SEMP.

238. A copy of the EMP or approved SEMP will be kept on-site during the construction period at all times. Non-compliance with, or any deviation from, the conditions set out in the EMP or SEMP constitutes a failure in compliance and will require corrective actions. The EARF and the IEEs specify responsibilities in EMP implementation during design, construction and O&M phases.

239. RUDSICO will ensure that bidding and contract documents include specific provision requiring Contractors to comply with: (i) all applicable labor laws and core labor standards on (a) prohibition of child labor as defined in national legislation for construction and maintenance activities; (b) equal pay for equal work of equal value regardless of gender, ethnicity, or caste and (c) elimination of forced labor; and (ii) the requirement to disseminate information on sexually transmitted diseases including HIV/AIDS, to employees and local communities surrounding the project sites.

Table 23: Safeguards Management Roles and Responsibilities

Implementation Arrangements	Roles and Responsibilities
Executing Agency: LSGD through RUDSICO	▪ Negotiate, sign, and execute the program. ▪ Allocate and release government counterpart funds on time. ▪ Facilitate obtaining timely Government-level approvals for smooth implementation of the program. ▪ Monitor program implementation progress and ensure timely actions for completion of the project. • Plan, implement, and monitor public relations activities; gender mainstreaming initiatives and community participation activities, with the support of PIUs.

⁴¹ Reasonable size social outreach team (SOT) to be appointed by contractor to facilitate community liaison, consultations and R&R implementation (including resolution of grievances). Requirement of SOT will be included in bid document.

Implementation Arrangements	Roles and Responsibilities
RUDSICO Board (like SLEC) Chairman: Minister of Urban Development Department, GOR Members: ▪ Hon'ble Minister, LSGD ▪ Secretary, LSGD – Vice Chairman ▪ Principal Secretary, PHED -Director ▪ Principal Secretary, PWD -Director ▪ Secretary, Finance (Budget) Department - Director ▪ Director, Department of Local Bodies ▪ Executive Director, RUDSICO ▪ Project Director, RUDSICO ▪ Independent Director ▪ Independent Director	▪ Provide strategic guidance. ▪ Provide policy decisions to support smooth program implementation. ▪ Facilitate inter-departmental coordination and cooperation. ▪ Support RUDSICO with government/ministerial level approvals. ▪ Overall project review (physical, financial, safeguards) ▪ Approvals/Decisions as per approved SOP (Standard Operating Procedures – laying delegation of powers, Administrative and Financial Approval of works and services).
RUDSICO (with approval of RUDSICO board, as needed)	▪ Required support to review and monitor the physical and financial progress of the subprojects. ▪ Provide additional technical support from RUDSICO Office (along with PMCBC) to PIUs for speedy resolution of implementation related issues such as variations, deviations, time and cost control, among others. ▪ Provide backup technical support for review and finalization of DPRs, bid documents, bidding and award of contracts. ▪ Review, appraise and put up matters to RUDSICO Board for approval, as described under "Delegation of Powers" ▪ Overall Liaison, Monitoring and Reporting to DEA and ADB as per agreed requirements ▪ Pursue GOR, through LSGD for approval of Policy, Rules, Guidelines, Government Orders for use in the state
Program Management Unit • Program Director: Project Director, RUDSICO • Additional Project Director, RUDSICO • PMU Staff • 2 Zonal Additional Chief Engineers (Jaipur and Jodhpur). The Office of ACE to have Two EE, Two AE, Computer Operator, Support staff • Dy. PD(T) (Procurement, Tendering, Contracts,	• Program and Financial Management • Overall responsibility of the investment program and financial management and administering program procedures and guidelines. • Oversee design of all projects (in individual tranches as needed). • Finalize the DPRs for ULBs/implementing agencies and obtain approval from ADB and government. • Establish project management and monitoring systems (Command and Control Center) • Undertake project appraisals based on technical, financial, economic and safeguards compliance as agreed by GOR/RUDSICO and ADB. • Provide overall technical and implementation guidance to the PIUs as required. • Facilitate approval of various implementation related requests from the Project Implementation management and Field Units

Implementation Arrangements	Roles and Responsibilities
Consultancies) at RUDSICO HQ • Dy. PD(A) (Administration, Institutional) at RUDSICO HQ • SE's (Asset Management, NRW, Safeguards, Resettlement) at RUDSICO HQ • Financial Advisor at RUDSICO, Jaipur HQ • Senior Accounts Officer at RUDSICO, Jaipur HQ PMU at HO supported by: • Project Officers (7 Nos. EE level with POs for Procurement and contracts; NRW Reduction; Contract Management and O&M, Social Safeguards, Environmental Safeguards, Capacity Building etc.) • Accounts officers • Assistant Project Officers – on each with PO – AE level, Assistant Account Officer • IT Cell (project Management and Monitoring, GIS, MIS etc.) with MIS Expert • Statistical Unit • Legal Unit • Administration and Establishment	• Sign key documents including withdrawal applications and audit reports. • Timely submission of any withdrawal applications. • Act as focal point for communication with the ADB. • Ensure compliance with loan covenants, ADB's guidelines, procedures and policies. • Facilitate ADB program review missions. • Represent the program at Tripartite Review Meetings. • Safeguards compliance • Review and monitor safeguards compliance by PIUs and support corrective actions as necessary. • Submit semi-annual safeguard monitoring reports to ADB • Guide PIUs as and when necessary on safeguards compliance, and arrange capacity building for PIUs Capacity Building and Institutional • Allocate funds for capacity building and arrange required disbursements • Approve and Monitor Capacity Building Plan • Pursue reforms with GOR • Supervise and Monitor PMCB Consultants and approve their invoices.
Project Implementation Units • 2 zonal PIUs (1 in Jaipur, 1 in Jodhpur) • PIU Staff • Project Manager (SE level) • Executive Engineer / Assistant Engineer (2 or 3) at each town for monitoring and supervision support • Assistant Accounts Officer • Computer Operator • Support Staff Supported by • Contract Management Officer (SE/EE of cluster shall invariably function as	Project Management • Responsible for implementation management of sub-projects. • Responsible for day-to-day implementation, monitoring and reporting. • Safeguards Compliance (with CAPPC) • Ensure compliance with safeguard frameworks and plans • Facilitate consultation with stakeholders and disclose program information in consultation with PMU. • Address grievances (may be through Grievance Redressal Mechanism) Coordinate land acquisition actions, if required. • Submit quarterly safeguard monitoring reports to PMU. • Advance Project Preparation • Prepare/supervise and monitor preparation of DPRs and bidding documents for future tranches.

Implementation Arrangements	Roles and Responsibilities
contract management officer) - No new position – • CMSC and CAPP Consultants (2 support engineers of CMSC at each town as per CMSC consultancy, 2 community mobilizers for each town – as per CAPP consultancy) besides required consultancy professionals reporting to EE)	
ULBs	• Nodal Officers to be a part of PIU and discharge the assigned functions and part of project planning and implementation • Establish liaison with local communities, resolve local grievances for smooth implementation of the project • Support CAPP in awareness creation, connection modalities to household consumers etc.
Asian Development Bank	• Approve and monitor safeguards documents and implementation compliance. • Field review missions. • Facilitate knowledge sharing. • Provide training in program management and ADB procurement procedures to PMU/PIU staff. • Support LSGD, RUDSICO, PIUs etc. through various capacity building activities.

Table 24: Institutional Roles and Responsibilities for Environmental Safeguards Implementation

Responsible Agency	Responsibility		
	Pre-Construction Stage	Construction Stage	Post-Construction
PMU (Project Officer; Environment),	(i) Review REA checklists and assign categorization based on ADB SPS 2009 (ii) Review and approve EIA/IEE (iii) Submit EIA/IEE to ADB for approval and disclosure in ADB website (iv) Ensure approved IEEs are disclosed in RSTDSP/PMU websites and summary posted in public areas accessible and understandable by local people. (v) Ensure environmental management plans (EMPs) are included in the bid documents and contracts (vi) Organize an orientation workshop for PMU, PIU, ULB and all staff involved in the	(i) Over-all environmental safeguards compliance of the project (iii) Monitor and ensure compliance of EMPs as well as any other environmental provisions and conditions. (i) Review monthly monitoring report (ii) Prepare and submit to ADB semi-annual monitoring reports (iv) If necessary, prepare Corrective Action Plan and ensure implementation of corrective actions to ensure no environmental impacts; (iii) Review and submit Corrective Action Plans to ADB	Compliance monitoring to review the environmental performance of project component, if required and as specified in EMP

Responsible Agency	Responsibility		
	Pre-Construction Stage	Construction Stage	Post-Construction
	project implementation on (a) ADB SPS, (b) Government of India national, state, and local environmental laws and regulations, (c) core labor standards, (d) OH&S, (e) EMP implementation especially spoil management, working in congested areas, public relations and ongoing consultations, grievance redress, etc. (vii) Assist in addressing any grievances brought about through the Grievance Redress Mechanism in a timely manner as per the IEEs (viii) Organize an induction course for the training of contractors preparing them on EMP implementation, environmental monitoring requirements related to mitigation measures; and taking immediate actions to remedy unexpected adverse impacts or ineffective mitigation measures found during the course of implementation. (ix) Ensure compliance with all government rules and regulations regarding site and environmental clearances as well as any other environmental requirements (x) Assist PMU, PIUs, and project NGOs to document and develop good practice construction guidelines to assist the contractors in implementing the provisions of IEE. (xi) Assist in the review of the contractors' implementation plans to ensure compliance with the IEE.	(iv) Organize capacity building programs on environmental safeguards (iv) Coordinate with national and state level government agencies (vi) Assist in addressing any grievances brought about through the Grievance Redress Mechanism in a timely manner as per the IEEs (ix) Coordinate PIUs, consultants and contractors on mitigation measures involving the community and affected persons and ensure that environmental concerns and suggestions are incorporated and implemented	
PIU, Assistant Safeguard Officer	(i) Ensure IEE is included in bid documents and contract agreements. Ensure cost of	(i) oversee day-to-day implementation of EMPs by contractors, including compliance with all	(i) Conducting environmental monitoring, as specified in the EMP.

Responsible Agency	Responsibility		
	Pre-Construction Stage	Construction Stage	Post-Construction
	EMP implementation is provided. (iv) Disclose of approved EIAs/IEEs. (v) Obtain all necessary clearances, permits, consents, NOCs, etc. Ensure compliance to the provisions and conditions. (vi) EMP implementation regarding sites for disposal of wastes, camps, storage areas, quarry sites, etc. (vii) Organize an induction course for the training of contractors, preparing them on EMP implementation, environmental monitoring requirements related to mitigation measures, and on taking immediate action to remedy unexpected adverse impacts or ineffective mitigation measures found during the course of implementation.	government rules and regulations. (ii) take necessary action for obtaining rights of way; (iii) oversee implementation of EMPs, including environmental monitoring by contractors; (iv) take corrective actions when necessary to ensure no environmental impacts; (v) submit monthly environmental monitoring reports to PMU, (vi) conduct continuous public consultation and awareness; (vii) address any grievances brought about through the grievance redress mechanism in a timely manner as per the IEEs; and	(ii) Issuance of clearance for contractor's post-construction activities as specified in the EMP.
Consultant – 1.PMCBC-Environmental Safeguard Specialist – 1 no. Asbestos Expert – 1no. Heritage Expert – 1no. Biodiversity Expert – 1no.	(i) Review IEE/EMP submitted by CMSC and revise report to submit to PMU (ii) Assist PMU and PIU in obtaining all necessary clearances, permits, consents, NOCs, etc. Ensure provisions and conditions are incorporated in the IEE and detailed design documents. (iii) Assist in ensuring IEE is included in bid documents and contract agreements. (iv) Assist in determining adequacy of cost for EMP implementation. (v) Assist in addressing any concern related to IEE and EMP. (vi). Conduct specific assessment requirements	(i) Monitor EMP implementation (ii) Assist in addressing any grievances brought about through the Grievance Redress Mechanism in a timely manner as per the IEEs.	
Consultant- 2. CMSC- 2 nos. Environmental safeguards professional	(i) Update initial environmental assessment for proposed project using REA checklists and submit to PIU/PMCBC	Monitoring of Implementation of EMP at site by contractor Recommend corrective action measures for non-compliance by contractors	(i) Assist in the inspection and verification of contractor's post-construction activities.

Responsible Agency	Responsibility		
	Pre-Construction Stage	Construction Stage	Post-Construction
	(ii) Assist in summarizing IEE and translating to language understood by local people.	Assist in the review of monitoring reports submitted by contractors (iv) Assist in the preparation of monthly monitoring reports conduct continuous public consultation and awareness;	
Contractors (EHS Engineer)	(i) Review the IEE and provide information about changes needed as per revised design and scope of works to ESS of PMCBC for final revision of IEE (ii) Prepare EHS plan and take approval from CMSC/PIU and Ensure EMP implementation cost is included in the methodology. (iii) Undergo EMP implementation orientation by ESS of supervision consultant prior to start of works (iv) Provide EMP implementation orientation to all workers prior to deployment to worksites (v) Seek approval for camp sites and sources of materials. (vi) Ensure copy of IEE is available at worksites. Summary of IEE is translated to language understood by workers and posted at visible places at all times.	(i) Implement EMP. (ii) Implement corrective actions if necessary. (iii) Prepare and submit monitoring reports including pictures to PIU (iv) Comply with all applicable legislation, is conversant with the requirements of the EMP; (v) Brief his staff, employees, and laborer about the requirements of the EMP and provide environmental awareness training to staff, employees, and laborers; (vi) Ensure any sub-contractors/ suppliers who are utilized within the context of the contract comply with all requirements of the EMP. The Contractor will be held responsible for non-compliance on their behalf; (vii) Bear the costs of any damages/compensation resulting from non-adherence to the EMP or written site instructions; (viii) Ensure that PIU and ACM/SO are timely informed of any foreseeable activities related to EMP implementation.	(i) Ensure EMP post-construction requirements are satisfactorily complied (ii) Request certification from PIU

C. Capacity Building and Development

240. Executing and implementing agencies need to have a sustained capacity to manage and monitor environmental safeguards. Although specialist consultants support will be available to PMU and PIUs, it is necessary to mainstream safeguards in day-to-day working. Therefore, PMU and PIUs require capacity building measures for (i) a better understanding of the project-related environmental issues; and (ii) to strengthen their role in preparation of IEE, implementation of

mitigation measures, and subsequent monitoring. Trainings and awareness workshops are included in the project with the primary focus of enabling the PMU and PIU staff to understand impact assessments and carry out environmental monitoring and implement EMPs. After participating in such activities, the participants will be able to review environmental assessments, conduct monitoring of EMPs, understand government and ADB requirements for environmental assessment, management, and monitoring (short- and long-term), and incorporate environmental features into future project designs, specifications, and tender documents and carry out necessary checks and balances during project implementation.

241. PMCBC's ESS shall assess the capabilities of the target participants, customize the training modules accordingly and provide the detailed cost.

242. Typical modules would be as follows: (i) sensitization; (ii) introduction to environment and environmental considerations in water supply and wastewater projects; (iii) review of IEEs and integration into the project detailed design; (iv) improved coordination within nodal departments; and (v) monitoring and reporting system. Specific modules customized for the available skill set will be devised after assessing the capabilities of the target participants and the requirements of the project. The contractors will be required to conduct environmental awareness and orientation of workers prior to deployment to work sites. The proposed training project, along with the frequency of sessions, is presented in Table 25.

Table 25: Capacity Building Program on EMP Implementation

Sl. No.	Description	Target Participants and Venue	Cost and Source of Funds
1	Introduction and Sensitization to Environmental Issues (1 day) - ADB Safeguards Policy Statement -EARF of RSTDSP -Government of India and Rajasthan applicable safeguard laws, regulations and policies including but not limited to core labor standards, OH&S, etc. -Incorporation of EMP into the project design and contracts -Monitoring, reporting and corrective action planning	All staff, ULBs and consultants involved in the project At PMU, Jaipur	PMU cost
2	Treated Effluent Reuse Concepts, Design and Management	All staff at PMU and ULBs	PMU cost
3	Sludge Reuse Concept, Design and Management	All staff at PMU and ULBs	PMU cost
4	EMP implementation (2 days) -Roles and responsibilities -OH&S planning and implementation -Wastes management (water, hazardous, solid, excess construction materials, spoils, etc.) -Working in congested areas, - Public relations - Consultations - Grievance redress -Monitoring and corrective action planning -Reporting and disclosure -Post-construction planning	All staff and consultants involved in the subproject All contractors before start of construction works At PIU	PMU cost

5	Plans and Protocols (1 day) -Construction site standard operating procedures (SOP) - Asbestos Management Plan -Heritage Impact Assessment -Biodiversity and Critical Habitat Assessment - Site-specific EMP -Traffic management plan -Spoils management plan -Waste management plan - Chance find protocol - O&M plans - Post-construction plan	All staff and consultants involved in the project All contractors before start of construction worksor during mobilization stage. At PIU	PMU cost Contractors cost as compliance to contract provisions on EMP implementation
6	Experiences and best practices sharing - Experiences on EMP implementation - Issues and challenges - Best practices followed	All staff and consultants involved in the project All contractors All NGOs At PMU Jaipur	PMU Cost
7	Contractors Orientation to Workers on EMP implementation (OH&S, core labor laws, spoils management, etc.)	All workers (including manual laborers) of the contractor prior to dispatch to worksite	Contractors cost as compliance to contract provisions on EMP implementation

D. Monitoring and Reporting

233. Prior to commencement of the work, the DBO contractor will submit a compliance report to PIU ensuring that all identified pre-construction environmental impact mitigation measures as detailed in the EMP will be undertaken. PIU with the assistance of the SO and ESS of PMCBC, consultant will review the report and thereafter PMU will allow commencement of works.

234. During construction, results from internal monitoring by the DBO contractor will be reflected in their monthly EMP implementation reports to the PIU and ACM, CMSC. Project officer (Environment) and ACM will review and advise contractors for corrective actions if necessary. Monthly report summarizing compliance and corrective measures taken will be prepared by safeguard officer with the assistance of ACM and submitted to PMU.

235. Quarterly report shall be prepared by CMSC and PIU and submitted to PMU for review and further actions.

236. Based on monthly and quarterly reports and measurements, PMCBC will draft semi-annual report and submit PMU for their review and further submission to ADB (Appendix 31). Once concurrence from the ADB is received the report will be disclosed in the Project website.

237. The PMU will include safeguards implementation status in the quarterly progress report (QPR) using the suggested checklists in Appendix 31 and separate semi-annual environmental and social safeguards monitoring reports to ADB, which will be reviewed and disclosed on ADB's website. The monitoring reports will be prepared by PMU with assistance from the PMU-consultant and inputs from the PIU's safeguard officers, contractors and NGOs, where relevant. The status of safeguard implementation, issues, and corrective actions including associated cost and schedule are to be clearly reported to ADB. The status of safeguards implementation will also be discussed at each ADB review mission and with necessary issues and agreed actions recorded in Aide Memoires. ADB will also carry out annual environmental and/or social (including gender) reviews of the Project. The outline of the semi-annual environmental monitoring report is

in Appendix 31. ADB's monitoring and supervision activities are carried out on an ongoing basis until a project completion report (PCR) is issued. Thus, semi-annual report, which may cover O&M of completed packages, will be submitted to ADB until PCR is issued.

238. ADB will review project performance against the project commitments as agreed in the legal documents. The extent of ADB's monitoring and supervision activities will be commensurate with the project's risks and impacts. Monitoring and supervising of social and environmental safeguards will be integrated into the project performance management system.

E. EMP Implementation Cost

239. Most of the mitigation measures require the contractors to adopt good site practice, which are part of their normal procedures. Mitigation that is the responsibility of PIU/ULB will be provided as part of their management of the project. Cost for the capacity building program is included as part of the project. Cost of environmental management are given in Table 26.

Table 26: Cost Estimates to Implement the EMP

	Particulars	Stages	Unit	Total Number	Rate (INR)	Cost (INR)	Costs Covered By
A.	Mitigation Measures						
1	Compensatory plantation measures	Construction	Ha.	0.22	137200	30184	Civil works contract under DBO Contractor
	Subtotal (A)					30184	
B.	Monitoring Measures**						
1	Air quality monitoring	Construction (quarterly monthly)	per sample	12	4920	59040	Civil works contract under DBO Contractor
2	Noise levels monitoring	Construction (quarterly)	Per sample	12	1980	23760	Civil works contract under DBO Contractor
3	Groundwater quality	Construction (quarterly)	per sample	10	6720	67200	Civil works contract under DBO Contractor
4.	Soil quality	Construction (quarterly)	per sample	12	5880	70560	Civil works contract under DBO Contractor
	Subtotal (B)					220560	
C.	Capacity Building						
1.	Introduction and sensitization to environment issues	Pre-construction	lump sum			100,000	PMU
2.	EMP implementation	Construction	lump sum			50,000	PMU
3.	Plans and Protocols	Construction	lump sum			25,000	PMU
			lump sum			25,000	Civil works contract

	Particulars	Stages	Unit	Total Number	Rate (INR)	Cost (INR)	Costs Covered By
							under DBO Contractor
4.	Experiences and best practices sharing	Construction/ Post-Construction	lump sum			100,000	PMU
5.	Contractors Orientation to Workers on EMP implementation	Prior to dispatch to worksite	Lump sum			25,000	Civil works contract under DBO Contractor
	Subtotal (C)					325,000	
D	Civil Works						
1	Water Sprinkling for dust suppression	Construction	KL	3000	111	333,000	Civil works contract under DBO Contractor
2	Rainwater Harvesting for water conservation	Construction	Nos.	3	1000000	3,000,000	Civil works contract under DBO Contractor
3	Implementation of Asbestos Management Plan	Construction	Lumpsum		-	3,000,000	Civil works contract under DBO Contractor
4	Barricading						
	Barricading with MS pipe and PVC Tape	Construction	m	379075	38.50	14594388	Civil works contract under DBO Contractor
	Barricading with MS pipe and Nuts and bolts	Construction	m	37350	50	1867500	Civil works contract under DBO Contractor
	MS Pipe with nut and bolt GI corrugated sheets	Construction	m	67150	101	6782150	Civil works contract under DBO Contractor
	Sub Total (D)					29577038	
E	Asbestos Management	Inventory Testing Overall Supervision for Asbestos Removal Storage Transportation Disposal / Treatment Documentation and Reporting			Lump sum	7,000,000	Civil works contract under DBO Contractor
	Sub Total (E)					7,000,000	

	Particulars	Stages	Unit	Total Number	Rate (INR)	Cost (INR)	Costs Covered By
F	Grievance Redressal Mechanism				Lump sum	350,000	Civil works contract under DBO Contractor
	Sub Total (F)					350,000	
	Total (A+B+C+D+E+F)				INR	37,502,782	

* STPs/SPSSs, Proposed Pipelines location, labor camp/construction camp/storage yard

** STPs/SPSSs, Pipelines/working locations, Labour Camp, Construction Camps on quarterly basis

*** In preliminary design 22 trees are required to be cut, being DBO contract, contractor will be required to revise it. Compensatory plantation measures to be followed by contractor

X. CONCLUSION AND RECOMMENDATION

240. The process described in this document has assessed the environmental impacts of all elements of the Abu Road water supply and sewerage subproject. All potential impacts were identified in relation to pre-construction, construction, and operation phases. Planning principles and design considerations have been reviewed and incorporated into the site planning and design process wherever possible; thus, environmental impacts as being due to the project design or location were not significant. During the construction phase, impacts mainly arise from the construction dust and noise, the need to dispose of large quantities of waste soil and import a similar amount of sand to support the sewer in the trenches; and from the disturbance of residents, businesses, traffic and important buildings by the construction work.

241. There are no environmentally or archeologically sensitive areas within Abu Road Town. However, there are wildlife sanctuaries nearby to project area. The Nearest protected area is Balaram Ambaji Wildlife Sanctuary, which is about 2.6 km from the proposed intake location in Bhaisa Singh Dam. Abu Road Town, the project area, is about 7-8 km from the boundary of the sanctuary. Intake site proposed in Bhaisa Singh Dam is about 2.6 km from the boundary of Sanctuary. Given the intake site is mostly surrounded by agricultural areas, and outside the protected areas, no wildlife movement is reported. Nevertheless, various measures are included to avoid any impacts. During the operation phase, dead storage will always be available if the source is being used by wildlife. Mount Abu Wildlife Sanctuary boundary is about 5 km from the town in the north.

242. A critical habitat screening and biodiversity assessment study has been carried out for potential presence of critical habitat within the proposed projects potential Area of Influence. There are no known species which would qualify the area as critical habitat under the set criteria, however, within the area of influence there is the potential species of vultures to utilize the wider area for feeding. There are five species which have been identified as potentially qualifying the identified AOA as critical habitat. To ensure that no measurable adverse impacts on biodiversity is achieved, study recommended various measures. These include: engaging a local biodiversity expert to verify findings on-site; conducting field-level site visits for the review and updating of the Environmental Management Plan; If species of interest are found on-site, ensure that the findings are recorded and reported to the PIU/PMU; no disturbances or works on the site should start/continue until PIU/PMU issues clearance to proceed. Measures to restrict poaching or hunting shall be put in place; and, If species of interest are present, PMU/PIU shall coordinate with the Forest Department for the translocation of the animals and contractor to undertake biodiversity awareness training to be organized by PMU/PIU.

243. Chandrawati village, about 5 km from the boundary of Abu Road Town, is a historical town with some state government protected areas. None of the components are located within the protected areas. The raw water main from the intake to WTP is proposed along a road, approximately 1.3 km from the protected area. No impacts are envisaged however a chance find procedure will be prepared to ensure during construction any items of heritage value found are treated appropriately.

244. Abu Road Town is presently supplying water to its residents through ground water sources. Since the present water requirements are more than 10 MLD and projected water demand for year 2051 is 15.56 MLD, the project scope is including bringing water from a surface water source. This source, Bhaisa Singh Dam, is however able to provide only 10 MLD water in a year. Therefore, the town will still be dependent on ground water sources to meet the future years'

requirement. The project scope also includes construction of 18 new tube wells with production around 3.6 MLD. The construction of new tube wells has been proposed keeping in consideration the worst scenario of last 40 years' rainfall and catchment yield data. Bhaisa Singh Dam has a total storage capacity of 5.069 MCM. Out of this, dead storage of dam is 0.453 MCM and live storage is 4.616 MCM. It is live storage only which can be used for drinking and other similar purposes and the proposal is to depend on 80% of live storage (3.693 MCM) considering 20% in evaporation and other losses. The catchment of the dam is spread over an area of 40.15 km² and the inflow to the dam from rainfall over 40 years period indicate that annual inflow is generally more than the dam storage capacity. However, there are instances when the catchment contribution was less than 3.693 MCM. Such scenario would pose a threat on water availability once 10 MLD regular withdrawal (~3.65 MCM/year) is made. The town will then be depending on ground water sources (tube wells) to meet out the deficit. The project proposes rehabilitation of existing tube wells as well as developing new tube wells. A feasibility study was conducted by hydrogeologist, Ground Water Department, Government of Rajasthan. Measures suggested accordingly to harvest groundwater resources. Therefore, no impacts due to source sustainability envisaged.

245. During the operation phase, to utilize the surface and groundwater resources optimally, and also to prepare for low rainfall years, it is proposed to prepare and implement an annual water source utilization plan, which needs to be prepared post monsoon considering the corresponding dam water level, and quantum of groundwater to be extracted to fulfil the overall demand. Contingency measures will also be included in this plan, especially when dam water level is low, to ensure water supply throughout the year. Prior information will be provided to and stakeholders consulted on the contingency measures to be adopted in that particular year.

246. In water treatment various measures are included to safely collect, reuse/dispose the wastewater and sludge generated in the process. There are 22 trees in proposed WTP site, which need to be cut for construction of proposed facility. During detail design all efforts should be done to reduce numbers of trees to be cut for construction works. Tree plantation will be carried out as per replacement ratio of 1:3.

247. Two STPs of capacities 6.90 MLD and 2.3 MLD are proposed based on sequential batch reactor (SBR) process, followed by disinfection. As the bid is DBO type, detailed design of the STP will be carried out by the contractor to the following specific discharge standards. Currently for STPs in India, the standards notified by MOEFCC in 2017 (see column 4 in table below) are applicable. However, under RSTDSP, PMU has decided to base the STP design on discharge standards for STPs suggested by CPCB in 2015, which are more stringent. The stringent standards also facilitate maximum utilization of treated wastewater for reuse in various purposes following the Sewerage and Wastewater Policy, 2016, of Rajasthan. The treated wastewater will be reused, and a Reuse plan will be prepared during the detailed design. Various measures are suggested for safe reuse of wastewater and sludge.

248. Proposed STP sites are away from habitations and surrounded by agricultural lands. Some trees and shrubs are present at these sites. No habitation exists close by. Nearest house from STP site at Santapur is 450 m, while at STP site Manpur it is 230 m. Treated wastewater which is excess/surplus of reuse will be disposed into West Banas River. No impacts envisaged as the river is mostly dry and carries untreated wastewater except during monsoon.

249. Except water lines and sewer works, all other construction activities will be confined to the selected sites, and the interference with the general public and community around is minimal. There will be temporary negative impacts, arising mainly from construction dust and noise, hauling

of construction material, waste and equipment on local roads (traffic, dust, safety etc.), mining of construction material, occupation health and safety aspects. Water pipes and sewer line works will be conducted along public roads in an urban area congested with people, activities and traffic, subproject is likely to significant impacts during construction. Impacts mainly arise from the construction dust and noise; from the disturbance of residents, businesses, traffic by the construction work, safety risk to workers, public and nearby buildings due to deep trench excavations, especially in narrow roads, dust, access impediment to houses and business, disposal of large quantities of construction waste, etc. These are all general impacts of construction in urban areas, and there are well developed methods of mitigation that are suggested in the EMP. Trenchless method will be adopted for sewers deeper than 3.5 m and also at main road crossings in traffic areas. A SEMP will be prepared prior to the start of construction, and the measures provided in EMP will be updated to suit the specific site conditions and will be implemented accordingly.

250. Subproject includes rehabilitation of existing infrastructure like tube wells, CWRs, pumping stations and OHSRs. Upon finalization of rehabilitation works during the detailed design phase for implementation, an environmental management plan specific to rehabilitation works will be prepared for implementation. The environmental audit conducted as part of this IEE concluded that there may be health, safety and environment related impacts arising from the rehabilitation works and the need to dispose construction debris, and waste generated. Presence of ACM, mainly asbestos cement pipes in the existing infrastructure is the main concern. Asbestos is recognized as a cause of various diseases and is considered health hazard if inhaled. Nearly half of the existing 176 km of underground water transmission and distribution system consists asbestos cement pipes of 80-250 mm diameter (87 km of total 176 km length of pipes). It is normal practice in Rajasthan that existing asbestos cement pipes are left as it is in the ground and new pipes will be laid in a new alignment. However, complete avoidance of handling and disposal of asbestos cement pipes may not be possible. There are narrow lanes, where asbestos cement pipes may be encountered during the laying of new pipes. Some connections/inlet/outlet pipes at the existing CWRs are also of asbestos cement pipes. These will be removed and replaced with new non-asbestos cement pipes.

251. Asbestos cement pipe as such is not hazardous as it is in the cement bonded form, however, working with or handling asbestos cement pipes in manner that produces dust, fibers, air borne particles etc., is very harmful and hazardous to the workers and general public around the work sites. The condition of existing underground asbestos cement pipes is not known, however, as these are old, pipes may be in deteriorated conditions. Preparation and implementation of asbestos management plan (AMP) suggested to avoid any health hazards.

252. Once the new system is operating, the facilities will operate with routine maintenance, which should not affect the environment. Improved system operation will comply with the operation and maintenance manual and standard operating procedures to be developed for all the activities.

253. Potential impacts during operations are considered that relates to the OHS requirements of operating WTP such as the handling and maintenance of chlorine and for the STPs include the testing and verification of treated effluent to environmental standards per CPCB. Sludge management should be compliant with the requirements of the Solid Waste Management Rule, 2000 and its amendment. Other solid waste disposal should be at designated sites. Dumping at vacant lot is not allowed per Solid Waste Management Rule, 2000 and its amendment.

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operating WTP such as the handling and maintenance of chlorine and for the STPs include the testing and verification of treated effluent to environmental standards per CPCB. Sludge management should be compliant with the requirements of the Solid Waste Management Rule, 2000 and its amendment. Other solid waste disposal should be at designated sites. Dumping at vacant lot is not allowed per Solid Waste Management Rule 2000, and its amendment.

255. Mitigation will be assured by a program of environmental monitoring conducted during construction and operation to ensure that all measures are implemented, and to determine whether the environment is protected as intended. 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 PMU. There will also be longer-term surveys to monitor raw and treated water quality, treatment efficiency of STP (raw and treated sewage quality), sludge at WTP and STPs. Mitigation and monitoring measures, along with the project agency responsible for such actions, form part of the EMP.

256. Stakeholders were involved in developing the IEE through face-to-face discussions, on site meetings, and a city level consultation workshop, which was conducted for larger public participation in the project. Views expressed by the stakeholders were incorporated into the IEE and the planning and development of the project. The IEE will be made available at public locations and will be disclosed to a wider audience via the PMU and ADB websites. The consultation process will be continued during project implementation to ensure that stakeholders are engaged in the project and have the opportunity to participate in its development and implementation. The project's grievance redress mechanism will provide the citizens with a platform for redress their grievances, and describes the informal and formal channels, time frame, and mechanisms for resolving complaints about environmental performance.

257. The EMP will assist the project agencies and contractor in mitigating the environmental impacts and guide them in the environmentally sound execution of the proposed project. A copy of the updated EMP/SEP shall be kept on-site during the construction period at all times. The EMP shall be made binding on all contractors operating on the site and will be included in the contractual clauses. Non-compliance with, or any deviation from, the conditions set out in this document shall constitute a failure in compliance.

258. The citizens of the Abu Road will be the major beneficiaries of the improved water supply and sewerage systems, as (i) they will be provided with a constant supply of better quality water, piped into their homes at an appropriate pressure; and (ii) the human waste from the homes will be removed rapidly, which otherwise would flow in open drains. This should improve the environment, should deliver major improvements in individual and community health and well-being. The project will improve the over-all health condition of the town as water borne diseases will be reduced. Diseases of poor sanitation, such as diarrhea 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.

259. Therefore, as per ADB SPS, 2009 the project is classified as environmental category B and does not require further environmental impact assessment. However, to conform to government guidelines WTP and STPs requires consent to establishment (CTE) and consent to operate (CTO) from Rajasthan Pollution Control Board (RPCB). CTE will be obtained prior to construction, as the detailed designs will be undertaken by contractor. However, ULB shall contact RPCB, and obtained in principle approval for disposal into West Banas River.

260. Recommendations. The following are recommendations applicable to the subproject to

ensure no significant impacts:

- (i) Obtain all statutory clearances at the earliest time possible and ensure conditions/provisions are incorporated in the detailed design;
- (ii) Include this IEE in bid and contract documents;
- (iii) Update and implement the asbestos management plan per site-specific conditions;
- (iv) Update and implement the recommendations from the biodiversity assessment report;
- (v) Secure permits for the abstraction of groundwater from additional wells;
- (vi) Update/revise this IEE based on detailed design and/or if there are unanticipated impacts, change in scope, alignment, or location;
- (vii) Conduct safeguards induction to the contractor upon award of contract;
- (viii) Ensure that sludge management protocols are compliant with environmental regulations (Solid Waste Management Rules, 2000 and amendment) and solid waste disposal should have a designated site (dumping on vacant lot is not allowed);
- (ix) Strictly supervise EMP implementation;
- (x) Ensure contractor appointed qualified EHS officers prior to start of works;
- (xi) Documentation and reporting on a regular basis as indicated in the IEE;
- (xii) Continuous consultations with stakeholders;
- (xiii) Timely disclosure of information and establishment of grievance redressal mechanism (GRM);
- (xiv) Involvement of contractors, including subcontractors, in first level GRM; and
- (xv) Commitment from PMU, PIUs, project consultants, and contractors to protect the environment and the people from any impact during project implementation.

261. This IEE shall be updated by PMU during the implementation phase to reflect any changes, amendments and will be reviewed and approved by ADB.

Appendix 1: Rapid Environmental Assessment (REA) Checklist

Water Supply

Instructions:

(i) The project team completes this checklist to support the environmental classification of a project. It is to be attached to the environmental categorization form and submitted to the Environment and Safeguards Division (RSES) for endorsement by the Director, RSES and for approval by the Chief Compliance Officer.

(ii) This checklist focuses on environmental issues and concerns. To ensure that social dimensions are adequately considered, refer also to ADB's (a) checklists on involuntary resettlement and Indigenous Peoples; (b) poverty reduction handbook; (c) staff guide to consultation and participation; and (d) gender checklists.

(iii) Answer the questions assuming the "without mitigation" case. The purpose is to identify potential impacts. Use the "remarks" section to discuss any anticipated mitigation measures.

Country/Project Title: India/Water supply and Sewerage Project in Abu Road Town, Rajasthan

Sector Division: Urban Development

Screening Questions	Yes	No	Remarks
A. Project siting Is the project area...			
Densely populated?	√		Subproject activities extend to the entire town including the densely populated areas. There are no major negative impacts envisaged, because pipeline will be located within ROW alongside the existing roads and can be constructed without causing any permanent impact to houses, and commercial establishments. WTP site is sufficient away from habitations.
Heavy with development activities?	√		Abu road is a developing town; urban expansion is considerable
Adjacent to or within any environmentally sensitive areas?		√	Subproject sites are within 50 km of identified "likely critical areas" per results of the IBAT screening. Biodiversity and critical habitat assessments were conducted for the sample subprojects. This is: (i) water intake point of the Abu Road subproject is in the Bhaisa Singh Dam which is within 10 km of the Balaram Ambaji Wildlife Sanctuary.. The biodiversity studies indicated that subproject sites are not qualified as critical habitat assessment per the IFC guidelines.

Screening Questions	Yes	No	Remarks
			The EARF includes IBAT results of towns being considered in the project and requires field level verification during detailed design phase. The project will not consider works that are located in critical habitats, such as, but not limited to, wildlife/bird sanctuaries, national parks, tiger reserves, elephant reserves, conservation reserves or core zone of biosphere reserves.
Cultural heritage site		√	
Protected area	√		See response to adjacent to or within any environmentally sensitive areas
Wetland		√	
Mangrove		√	
Estuarine		√	
Buffer Zone of Protected Area		√	
Special area for Protecting Biodiversity	√		See response to adjacent to or within any environmentally sensitive areas
Bay		√	
Potential Environmental Impacts Will the Project cause...			
Pollution of raw water supply from upstream wastewater discharge from communities, industries, agriculture, and soil erosion runoff ?		√	Not anticipated. There is no wastewater or effluent discharge into the upstream sources and are thus not expected to induce pollution of raw water supply.
Impairment of historical/cultural monuments/areas and loss/damage to these sites?		√	Not anticipated. No above-ground infrastructures will be built within or adjacent to PCRs. Only pipe laying will be done outside and around PCRs. The HIA specify the requirements before and during construction to ensure that no loss or damage will be done on these PCRs. Project will have no any effect on historical/cultural monuments as there are no such monuments within influence of proposed works. Chandrawati, a state government protected archeological protected area is outside Abu Road town, and nearest component is raw water main proposed along a road, about 1.3 km from the boundary
Hazard of land subsidence caused by excessive ground water pumping?		√	Not anticipated. Any groundwater source (e.g. tube wells), will require permission from Rajasthan Ground Water Board and conduct of feasibility/source sustainability studies prior to consideration as a source.
Social conflicts arising from displacement of communities?		√	Not anticipated. Project does not involve any land acquisition. A Resettlement Plan will be prepared if there are any involuntary resettlement.

Screening Questions	Yes	No	Remarks
Conflicts in abstraction of raw water for water supply with other beneficial water uses for surface and ground waters?		√	Not anticipated. Water allocation letters from the Public Health Engineering Department (PHED) and Rajasthan Groundwater Department are required, and only allocated water shall be used for the water supply subprojects.
Unsatisfactory raw water supply (e.g. excessive pathogens or mineral constituents)?	√		Not anticipated. Efficient treatment technology and water quality laboratories are included in scope of water supply subprojects.
Delivery of unsafe water to distribution system?	√		Not anticipated.
Inadequate protection of intake works or wells, leading to pollution of water supply?	√		Not anticipated. Design specifications include protection of intake works.
Over pumping of ground water, leading to salinization and ground subsidence?		√	Not anticipated. Groundwater extraction shall be limited to the sustainable levels as indicated in the permits provided by the Groundwater Department.
Excessive algal growth in storage reservoir?	√		Not anticipated. Design specifications confirm maintenance requirements to ensure no algal growth in tanks and reservoir.
Increase in production of sewage beyond capabilities of community facilities?	√		Not anticipated. Sewerage systems and demand requirements are accounted for. The project will include improvement of sewerage and sanitation systems.
Inadequate disposal of sludge from water treatment plants?	√		Not anticipated. Facilities to manage sludge and solid wastes (grit) are included in the design. The IEEs and Operations and Maintenance (O&M) manuals will include handling and disposal procedures.
Inadequate buffer zone around pumping and treatment plants to alleviate noise and other possible nuisances and protect facilities?	√		Not anticipated. Low noise pumps and machineries will be used in pumping stations to alleviate noise to nearby areas.
Impairments associated with transmission lines and access roads?	√		Anticipated during construction only. Complete road closures are not expected, and traffic may be diverted with access ensured for pedestrians. Contractors are required to incorporate in the Traffic Management Plan as part of the site-specific EMP (SEMP).
Health hazards arising from inadequate design of facilities for receiving, storing, and handling of chlorine and other hazardous chemicals.	√		Anticipated but can be mitigated. Potential hazards during O&M phase are identified and mitigation measures in place. Chlorine will be handled by qualified personnel with the proper handling techniques and proper PPE. No other hazardous chemical will be maintained.
health and safety hazards to workers from handling and management of	√		Anticipated but can be mitigated. Potential hazards during O&M phase are identified and mitigation measures in place.

Screening Questions	Yes	No	Remarks
chlorine used for disinfection, other contaminants, and biological and physical hazards during project construction and operation?			Chlorine will be handled by qualified personnel with the proper handling techniques and proper PPE. No other hazardous chemical will be maintained.
Dislocation or involuntary resettlement of people		√	Anticipated but can be mitigated. Any involuntary resettlement is addressed by the resettlement framework.
disproportionate impacts on the poor, women and children, Indigenous Peoples or other vulnerable groups?		√	Not anticipated. Contractor is encouraged to hire workers from the local labor force.
Noise and dust from construction activities?	√		Anticipated but temporary, site-specific and can be mitigated. No blasting activities envisaged. Nuisance or disturbance due to elevated noise may be experienced during construction. All the machineries employed will comply with the noise emission standards of the Central Pollution Control Board. Dust suppression measures such as water sprinkling will be employed. These requirements and monitoring of effectivity should be included in the site-specific EMP.
Increased road traffic due to interference of construction activities?	√		Anticipated but temporary, site-specific and can be mitigated. Complete road closures are not expected, and traffic may be diverted with access ensured for pedestrians. Contractors are required to incorporate in the Traffic Management Plan as part of the site-specific EMP (SEMP).
Continuing soil erosion/silt runoff from construction operations?	√		Anticipated but temporary, site-specific and can be mitigated. Construction work during monsoon shall be carried out such that silt run off is prevented. SEMP's include requirement for contractors to provide silt control measures.
Delivery of unsafe water due to poor O&M treatment processes (especially mud accumulations in filters) and inadequate chlorination due to lack of adequate monitoring of chlorine residuals in distribution systems?	√		Not anticipated. Water treatment plans are designed with on-site and timely monitoring to ensure the quality of treated water prior delivery to the households. The drinking water quality parameters and acceptable levels are included in the contract.
Delivery of water to distribution system, which is corrosive due to inadequate attention to feeding of corrective chemicals?		√	Not anticipated. Treated water will be tested prior distribution.
Accidental leakage of chlorine gas?	√		Not anticipated. Proper Occupational Health and Safety (OHS) handling and storage of chlorine is included in the requirements

Screening Questions	Yes	No	Remarks
Excessive abstraction of water affecting downstream water users?		✓	Not anticipated. Only water allocated by the Government will be used for the water supply services.
Competing uses of water?		✓	Not anticipated. Water used for the project are specifically allocated by the Government for the project's purpose. Only the water allocated will be used.
Increased sewage flow due to increased water supply		✓	Not anticipated. Sewerage systems and demand requirements are accounted for in the analysis. The project will include improvement of sewerage and sanitation systems.
Increased volume of sullage (wastewater from cooking and washing) and sludge from wastewater treatment plant		✓	Not anticipated. Sewerage systems and demand requirements are accounted for in the analysis. Some subprojects also include new sewerage systems.
large population influx during project construction and operation that causes increased burden on social infrastructure and services (such as water supply and sanitation systems)?		✓	Not anticipated. Contractors shall prioritize hiring local labor force. Some of the skilled workers may be brought from outside but numbers should not be so large to have impacts on social services.
social conflicts if workers from other regions or countries are hired?		✓	Not anticipated. Contractors shall prioritize hiring local labor force. Some of the skilled workers may be brought from outside but numbers should not be so large to have impacts on social services.
risks to community health and safety due to the transport, storage, and use and/or disposal of materials such as explosives, fuel and other chemicals during operation and construction?		✓	Anticipated but temporary, site-specific and can be mitigated. Construction does not involve use of explosives. EMPs include measures and monitoring requirements on occupational health and safety for chemical hazards.
community safety risks due to both accidental and natural hazards, especially where the structural elements or components of the project are accessible to members of the affected community or where their failure could result in injury to the community throughout project construction, operation and decommissioning?	✓		Anticipated but temporary, site-specific and can be mitigated. Work area will be clearly demarcated with security access for the workers and project-concerned members only. Community health and safety risks are present during construction such as risks from excavations for pipe laying, equipment and vehicle operations which should be identified and implemented in the site-specific EMPs. Asbestos-containing materials are observed in project sites and are known to be in-situ underground. Such asbestos materials will be handled in accordance to the Asbestos Management Plan including reporting and documentations.

A Checklist for Preliminary Climate Risk Screening

Country/Project Title: India/Rajasthan Secondary Towns Development Sector Project (RSTDSP), Abu road, Rajasthan
Sector : Urban Development
Subsector: Water Supply
Division/Department: SARD/SAUW

Screening Questions		Score	Remarks ⁴²
Location and Design of project	Is siting and/or routing of the project (or its components) likely to be affected by climate conditions including extreme weather related events such as floods, droughts, storms, landslides?	2	The subproject sites in Rajasthan are highly sensitive to fluctuations in rainfall and increases in temperatures. Some project locations may experience drought during dry season. Adequate measures such as installation of rainwater harvesting, minimization of non-revenue water and pressure control mechanisms (for improved asset management) will be included in the designs to safeguard facilities from extreme events. Abu road received huge rains during rainy season, which may impact project execution during construction.
	Would the project design (e.g. the clearance for bridges) need to consider any hydro-meteorological parameters (e.g., sea-level, peak river flow, reliable water level, peak wind speed etc)?	0	
Materials and Maintenance	Would weather, current and likely future climate conditions (e.g. prevailing humidity level, temperature contrast between hot summer days and cold winter days, exposure to wind and humidity hydro-meteorological parameters likely affect the selection of project inputs over the life of project outputs (e.g. construction material)?	0	

⁴²If possible, provide details on the sensitivity of project components to climate conditions, such as how climate parameters are considered in design standards for infrastructure components, how changes in key climate parameters and sea level might affect the siting/routing of project, the selection of construction material and/or scheduling, performances and/or the maintenance cost/scheduling of project outputs.

	Would weather, current and likely future climate conditions, and related extreme events likely affect the maintenance (scheduling and cost) of project output(s) ?	0	
Performance of project outputs	Would weather/climate conditions, and related extreme events likely affect the performance (e.g. annual power production) of project output(s) (e.g. hydro-power generation facilities) throughout their design life time?	1	Extreme weather conditions may disrupt regular operations of water treatment and sewage treatment plants. Moreover, components require continuous power to operate that may be affected by low precipitation conditions. Back-up powers (such as solar panels) may be provided in cases of such extreme events.

Options for answers and corresponding score are provided below:

Response	Score
Not Likely	0
Likely	1
Very Likely	2

Responses when added that provide a score of 0 will be considered low risk project. If adding all responses will result to a score of 1-4 and that no score of 2 was given to any single response, the project will be assigned a medium risk category. A total score of 5 or more (which include providing a score of 1 in all responses) or a 2 in any single response will be categorized as high risk project.

Result of Initial Screening (Low, Medium, High): Medium risk

Other Comments: None

REA Check list – Abu Road Sewerage

Instructions:

The project team completes this checklist to support the environmental classification of a project. It is to be attached to the environmental categorization form and submitted to the Environment and Safeguards Division (RSES) for endorsement by the Director, RSES and for approval by the Chief Compliance Officer.

This checklist focuses on environmental issues and concerns. To ensure that social dimensions are adequately considered, refer also to ADB checklists and handbooks on (i) involuntary resettlement, (ii) indigenous peoples planning, (iii) poverty reduction, (iv) participation, and (v) gender and development.

Answer the questions assuming the "without mitigation" case. The purpose is to identify potential impacts. Use the "remarks" section to discuss any anticipated mitigation measures.

India/Water supply and Sewerage Project in Abu road Town, Rajasthan

Country/Project Title:

Urban Development

Sector Division:

SCREENING QUESTIONS	Yes	No	REMARKS
A. Project Siting Is the project area...			
Densely populated?	√		Subproject activities extend to the entire town including the densely populated areas. There are no major negative impacts envisaged, because pipeline will be located within ROW alongside the existing roads and can be constructed without causing any permanent impact to houses, and commercial establishments. WTP site is sufficient away from habitations.
Heavy with development activities?	√		Abu road is a developing town; urban expansion is considerable
Adjacent to or within any environmentally sensitive areas?		√	Subproject sites are within 50 km of identified "likely critical areas" per results of the IBAT screening. Biodiversity and critical habitat assessments were conducted for the sample subprojects. The biodiversity studies indicated that subproject sites are not qualified as critical habitat assessment per the IFC guidelines. The EARF includes IBAT results of towns being considered in the project and requires field level verification during detailed design phase. The project will not consider works that are located in critical habitats, such as, but not limited to, wildlife/bird sanctuaries, national parks, tiger reserves, elephant reserves, conservation reserves or core zone of biosphere reserves.
Cultural heritage site		√	
Protected Area	√		See response to adjacent to or within any environmentally sensitive areas
Wetland		√	
Mangrove		√	
Estuarine		√	
Buffer zone of protected area		√	

Special area for protecting biodiversity	√		See response to adjacent to or within any environmentally sensitive areas
Bay		√	
Potential Environmental Impacts Will the Project cause...			
Impairment of historical/cultural monuments/areas and loss/damage to these sites?		√	Not applicable.
interference with other utilities and blocking of access to buildings; nuisance to neighboring areas due to noise, smell, and influx of insects, rodents, etc.?	√		Anticipated during construction and operations but can be avoided and mitigated. Sewage treatment plants' design include considerations to minimize, if not reduce, the nuisance to the nearby communities and comply with noise and odor standards. During construction, sewers will be laid underground and may interfere temporarily with access and other utilities. Coordination with the concerned agencies will be conducted in finalizing alignment and shifting of utilities, if necessary.
dislocation or involuntary resettlement of people?	√		Not anticipated. Project does not involve any land acquisition. A Resettlement Plan will be prepared if there are any involuntary resettlement.
disproportionate impacts on the poor, women and children, Indigenous Peoples or other vulnerable groups?		√	Not anticipated. Contractors shall prioritize hiring local labor force. Some of the skilled workers may be brought from outside but numbers should not be so large to have impacts on social services.
impairment of downstream water quality due to inadequate sewage treatment or release of untreated sewage?		√	Not anticipated. Treated effluents from the STP will be utilized in agriculture or similar uses and comply with the State's Reuse policy.
overflows and flooding of neighboring properties with raw sewage?		√	Not anticipated. Risks, climate change factors and forecasted demands are considered in the design and capacity of the sewerage systems.
▪ environmental pollution due to inadequate sludge disposal or industrial waste discharges illegally disposed in sewers?	√		Not anticipated. Designs include sludge collection, handling, treatment and disposal. Standards are provided for the use of sludge as manure. Sewerage system design ensure no industrial effluent will be allowed into the network.
noise and vibration due to blasting and other civil works?		√	Anticipated but temporary, site-specific and can be mitigated.

			Blasting for underground works is prohibited in RUDSICO. Nuisance or disturbance due to noise may be experienced but minimized with mitigation measures specified in the EMPs. Scheduling of works and prior information with the affected people will be conducted.
risks and vulnerabilities related to occupational health and safety due to physical, chemical, and biological hazards during project construction and operation?	√		Anticipated but temporary, site-specific and can be mitigated. EMPs and contract provisions include requirements for an Occupational Health and Safety (OHS) plan. The contractor's OHS plan shall be reviewed and cleared by the PIUs prior to commencement of works.
discharge of hazardous materials into sewers, resulting in damage to sewer system and danger to workers?		√	Not anticipated. Sewerage system only caters to domestic waters, no industrial wastewater is allowed into the system.
inadequate buffer zone around pumping and treatment plants to alleviate noise and other possible nuisances, and protect facilities?	√		Not anticipated. STPs will be isolated through boundary walls and dense plantations to avoid/minimize nuisance.
road blocking and temporary flooding due to land excavation during the rainy season?	√		Anticipated during construction but temporary, site-specific and can be mitigated. Road blocking for pipe laying works may be required and mitigation measures are required as per IEE/EMP. Underground construction works (sewer laying, foundations) should be carried out in non-monsoon period to avoid flooding.
noise and dust from construction activities?	√		Anticipated during construction but temporary, site-specific and can be mitigated. No major noise-generating activities like rock blasting is anticipated. As the sewers will be laid on the road surface, cutting open of road surface using pneumatic drills will produce noise and dust. Temporary nuisance/disturbance due to noise and dust may be experienced by sensitive receptors. These impacts will be minimized with mitigation measures specified in the EMPs. During operations, noise may be experienced by sensitive receptors due to STP operations. This impact will be avoided by including noise barriers and enclosure of noise-producing components.

traffic disturbances due to construction material transport and wastes?	✓		Anticipated during construction but temporary, site-specific and can be mitigated. Linear activities like sewer laying along the roads is likely to disrupt traffic. Vehicle movement for construction purpose will increase the traffic. Identification of alternate routes, allowing limited - at least one-way traffic, prior information about the works and alternative arrangements, providing information/sign boards etc. will reduce the impact.
temporary silt runoff due to construction?	✓		Anticipated during construction but temporary, site-specific and can be mitigated. EMPs and contract provisions include requirement for contractors to provide silt control measures.
hazards to public health due to overflow flooding, and groundwater pollution due to failure of sewerage system?	✓		Not anticipated. Adequately trained staff and necessary equipment will be in place for regular operation and maintenance of the system. Proposed treatment system will be efficient and appropriate repair and maintenance procedure will be developed. Sufficient funds for operation will be ensured. Backup power supply system is part of project.
deterioration of water quality due to inadequate sludge disposal or direct discharge of untreated sewage water?	✓		Not anticipated. STP designs include sludge handling and treatment facilities to state policy standards.
contamination of surface and ground waters due to sludge disposal on land?	✓		Not anticipated. STP designs include sludge handling and treatment facilities to state policy standards. O&M manual includes testing procedures and acceptable parameters for disposal on land.
Health and safety hazards to workers from toxic gases and hazardous materials which may be contained in confined areas, sewage flow and exposure to pathogens in untreated sewage and unstabilized sludge?	✓		Anticipated during operation but temporary, site-specific and can be mitigated. Workers may be exposed during cleaning of blockages in sewerage network. However, O&M Manuals will include standard operating procedures. All necessary health and safety training and personal protection equipment will be given to workers and staff during operation of sewerage system. Implementation of contractors' H&S will be strictly enforced by the PIUs.

Large population increase during project construction and operation that causes increased burden on social infrastructure (such as sanitation system)?		√	Not anticipated. Most of the unskilled workers will be hired from local labor force. Some skilled workers may be brought from outside, but numbers will not be so large to have impacts on social infrastructure.
Social conflicts between construction workers from other areas and community workers?		√	Not anticipated. Most of the unskilled workers will be hired from local labor force. Some skilled workers may be brought from outside, but numbers will not be so large to have impacts on social infrastructure. No conflicts envisaged.
Risks to community health and safety due to the transport, storage, and use and/or disposal of materials such as explosives, fuel and other chemicals during construction and operation?		√	Anticipated but temporary, site-specific and can be mitigated. Construction will not involve use of explosives and chemicals. During operations, chemicals such as pH adjusters, flocculants, or coagulants may be used. The complete list of chemicals, quantities, and requirements for safe use and storage will be included in the final IEE for the STPs (these are design-build-operate packages). The EMPs in the current IEEs already include measures and monitoring requirements conforming with IFC EHS Guidelines. O&M Manuals will include health and safety requirements for managing chemicals.
Community safety risks due to both accidental and natural hazards, especially where the structural elements or components of the project are accessible to members of the affected community or where their failure could result in injury to the community throughout project construction, operation and decommissioning?	√		Anticipated but temporary, site-specific and can be mitigated. Work area will be clearly demarcated with security access for the workers and project-concerned members only. Community health and safety risks are present during construction such as risks from excavations for pipe laying, equipment and vehicle operations which should be identified and implemented in the site-specific EMPs.

A Checklist for Preliminary Climate Risk Screening

Country/Project Title: India/Rajasthan Secondary Towns Development Investment Program (RSTDP), Abu road, Rajasthan

Sector : Urban Development

Subsector: Waste Water
Division/Department: SARD/SAUW

Screening Questions		Score	Remarks ^[1]
Location and Design of project	Is siting and/or routing of the project (or its components) likely to be affected by climate conditions including extreme weather related events such as floods, droughts, storms, landslides?	2	The subproject sites in Rajasthan are highly sensitive to fluctuations in rainfall and increases in temperatures. Some project locations may experience drought during dry season. Adequate measures such as installation of rainwater harvesting, minimization of non-revenue water and pressure control mechanisms (for improved asset management) will be included in the designs to safeguard facilities from extreme events. Abu road received huge rains during rainy season, which may impact project execution during construction.
	Would the project design (e.g. the clearance for bridges) need to consider any hydro-meteorological parameters (e.g., sea-level, peak river flow, reliable water level, peak wind speed etc)?	0	
Materials and Maintenance	Would weather, current and likely future climate conditions (e.g. prevailing humidity level, temperature contrast between hot summer days and cold winter days, exposure to wind and humidity hydro-meteorological	0	

	parameters likely affect the selection of project inputs over the life of project outputs (e.g. construction material)?		
	Would weather, current and likely future climate conditions, and related extreme events likely affect the maintenance (scheduling and cost) of project output(s) ?	0	
Performance of project outputs	Would weather/climate conditions, and related extreme events likely affect the performance (e.g. annual power production) of project output(s) (e.g. hydro-power generation facilities) throughout their design life time?	1	Extreme weather conditions may disrupt regular operations of water treatment and sewage treatment plants. Moreover, components require continuous power to operate that may be affected by low precipitation conditions. Back-up powers (such as solar panels) may be provided in cases of such extreme events.

Options for answers and corresponding score are provided below:

Response	Score
Not Likely	0
Likely	1
Very Likely	2

Responses when added that provide a score of 0 will be considered low risk project. If adding all responses will result to a score of 1-4 and that no score of 2 was given to any single response, the project will be assigned a medium risk category. A total score of 5 or more (which include providing a score of 1 in all responses) or a 2 in any single response will be categorized as high risk project.

Result of Initial Screening (Low, Medium, High): High

Other Comments: None

^[1] If possible, provide details on the sensitivity of project components to climate conditions, such as how climate parameters are considered in design standards for infrastructure components, how changes in key

climate parameters and sea level might affect the siting/routing of project, the selection of construction material and/or scheduling, performances and/or the maintenance cost/scheduling of project outputs.

Appendix 2: Letter of Transfer of Bhaisa Singh Dam to PHED

OFFICE OF THE CHIEF ENGINEER, WATER RESOURCES DEPARTMENT RAJASTHAN JAIPUR
 No.:CEWR/SE(W)/Re.Tech.Estimate/Bhaisasingsh/ 2171 Date: 29-07-2016

Principal Secretary,
 PHED & GWD
 Rajasthan, Jaipur

Sub.: Transfer of Bhaisasingsh Irrigation Project Teh. Abu Road District Sirohi to Public Health Engineering Department, Rajasthan, Jaipur

Sir,

In reference to subject cited above, I am directed to convey that Bhaisasingsh Irrigation Project Teh. Abu Road District Sirohi is hereby transferred to Public Health Engineering Department with immediate effect.

All future works, maintenance and O&M of the project will be done by PHED henceforth.

The share / capital cost of the project will be intimated separately.

This bears concurrence of the Administrative Department at the appropriate level.

Yours faithfully,

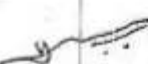

 (P.R. Kholwal)
 Superintending Engineer
 to Addl. Secretary Cum Chief Engineer
 Water Resources Department,
 Rajasthan, Jaipur

No.:CEWR/SE(W)/Re.Tech.Estimate/Bhaisasingsh/ 2172-73

Date: 29-7-2016

Copy to:

- 1- SA to Hon'ble Minister Water Resources Department, Rajasthan, Jaipur
- 2- PS to Additional Chief Secretary, Water Resources Department
- 3- PS to Chief Engineer, Water Resources Department, Rajasthan, Jaipur
- 4- Chief Engineer (SP), PHED, Rajasthan, Jaipur
- 5- District Collector, Sirohi
- 6- Additional Chief Engineer, WR Zone, Jodhpur
- 7- Executive Engineer, Water Resources Division, Sirohi to handover the project and report compliance.


 Superintending Engineer
 to Addl. Secretary Cum Chief Engineer
 Water Resources Department,
 Rajasthan, Jaipur

Appendix 3: Confirmation from PHED on allocation of Bhaisa Singh Dam water to Abu Road



NO./EE/PHED/AbuRoad/2019-20 / 1640

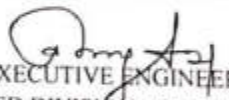
Date: 13.12.19

Executive Engineer
RUSDP, PIU, Pali

Sub :- Regarding reply of observation raised by ADB mission Related to water supply and sewerage project under RUDDP Phase-IV for Abu Road Town
Ref :- Yours letter no 1198 date 09.12.2019.

In reference to above cited subject, The reply of observation were raised by ADB mission related to water supply and sewerage project under RUDDP Phase -IV for AbuRoad Town. This as Below :

S.no	Observation	Reply
1	Provide water level data Bhaisa Singh Dam for 2018.and if possible 2019 also.	Bhaisa Singh Dam was overflow in both the year 2018 & 2019 respectively.and has maximum water level gauge is 11.00 m . Gross capacity of dam is 179 MCFT.
2	Bhaisa Singh Dam transferred from WRD to PHED as per the letter. It is not clear it PHED in turn allocated this fully to Aburoad town.Please clarify.	The Bhaisa Singh Dam water is reserved for AbuRoad Town and Six periphery villeges as per project report submitted by EE Project Dn Sirohi.


EXECUTIVE ENGINEER
PHED DIVISION ABUROAD

Appendix 4: Compliance with environmental criteria for subproject selection**Table 1. Exclusion Criteria**

S. No	Projects / Components to be Excluded from RSTDSP	Compliance check – Abu Road Subproject
I	Type of water supply projects excluded from RSTDSP	
A	New water source development - Dams or reservoirs	Complied
II	Projects that are located in the following environmentally sensitive areas excluded from RSTDSP	
A	All new projects/components located within: • Wildlife sanctuaries • National parks • Tiger reserves • Elephant reserves • Core Zone of Biosphere reserves	Complied
B	Rehabilitation works of existing projects/facilities located in the environmentally sensitive areas (wildlife sanctuaries, national parks, tiger reserves, elephant reserves etc.), shall be excluded if the following criteria is not met: • Proposed rehabilitation works will be confined to the existing footprint, and within the right of way of existing infrastructure • Proposed rehabilitation works will not require any new clearance/permissions. A written confirmation to that effect from the local office of the respective protected area regulatory agency shall be obtained.	Complied – no rehabilitation works in wildlife sanctuaries, national parks, tiger reserves, elephant reserves etc.
III	Projects with significant adverse impacts	
A	Projects likely to have significant adverse environmental impacts that are irreversible, diverse, or unprecedented, and may affect an area larger than the sites or facilities subject to physical works (i.e. category A projects as per ADB SPS 2009) will be excluded from RSTDSP	Complied

Table 3. Environmental Guidelines for Sub-project Selection

Components	Criteria	Design Considerations (if criterion is not met)	Compliance check – Abu Road Subproject
All subprojects			
	Subproject will avoid potentially significant adverse impacts that are diverse, irreversible or unprecedented (ADB SPS Category A for environment).		Complied
	Comply with all requirements of ADB SPS 2009 and follow procedures set in this environmental assessment and review framework (EARF)		Being complied
	Comply with relevant national, and local laws, rules and regulations regarding EIA, environmental protection, pollution prevention (water, air, noise, solid waste, etc.) wildlife protection, core labor standards, physical cultural resources, health and safety, and other laws in specific sectors as indicated below		Being / will be complied
	Does not include and/or involve any activities listed in ADB's Prohibited Investment Activities List ⁴³		Complied
	Reflect inputs from public consultations	Refer to ADB SPS requirements on meaning consultations ⁴⁴	Being complied
Location	Avoid involuntary resettlement by prioritizing rehabilitation over new construction using vacant government land where possible, and taking all possible measures in design and selection of site or alignment to avoid resettlement impacts	If cannot be avoided, prepare Resettlement Plan.	Being complied

⁴³ADB SPS Appendix 5

⁴⁴Per ADB SPS, meaningful consultation is defined as "a process that (i) begins early in the project preparation stage and is carried out on an ongoing basis throughout the project cycle; (ii) provides timely disclosure of relevant and adequate information that is understandable and readily accessible to affected people; (iii) is undertaken in an atmosphere free of intimidation or coercion; (iv) is gender inclusive and responsive, and tailored to the needs of disadvantaged and vulnerable groups; and (v) enables the incorporation of all relevant views of affected people and other stakeholders into decision making, such as project design, mitigation measures, the sharing of development benefits and opportunities, and implementation issues"

	Avoid or minimize the cutting of trees	If tree is to be cut, consider 1:10 replacement	Being complied
Biodiversity	Avoid locating subprojects in critical habitats, such as, but not limited to, wildlife/bird sanctuaries, national parks, tiger reserves, elephant reserves, conservation reserves or core zone of biosphere reserves. Appendix 1 provides preliminary analysis using the International Biodiversity Assessment Tool (IBAT) key biodiversity areas, protected areas, IUCN red list species and likelihood of critical habitats per town. Should not directly affect environmentally protected areas, core zones of biosphere reserves and highly valued habitat	If criteria is not met, this is potential for Category A therefore alternate location should be considered. A Biodiversity Expert shall assess and confirm critical habitat qualification. Appendix 2 provides a Biodiversity Assessment Report prepared for a sample subproject (Abu Road water and sewerage subproject).	Being complied
	If work is proposed with the aim of improving the conservation or management of designated subproject sites (e.g. improved drainage), this must only be undertaken: (i) after a comprehensive study and development of management plans and criteria; and (ii) with the direct involvement and approval of national and local bodies responsible for the subproject site.		Not relevant to this subproject
Physical Cultural Resources	Should not result in the destruction/damage of or encroachment onto physical cultural resources (PCR) ⁴⁵ such as archaeological monuments; heritage sites and movable or immovable objects, sites, structures, group of structures, and natural features and landscapes that have archaeological, paleontological, historical, architectural, religious, aesthetic or other cultural significance.	If location is within 300 m of notified protected monuments/ sites and there is no alternative, permissions from the ASI or State Department of Archaeology to be obtained prior to finalization of detailed engineering design. If potential physical cultural resources are found within or adjacent to project sites, a Heritage Impact Assessment is required to	Complied

⁴⁵ Physical cultural resources as defined as "movable or immovable objects, sites, structures, groups of structures, and natural features and landscapes that have archaeological, paleontological, historical, architectural, religious, aesthetic, or other cultural significance. Physical cultural resources may be located in urban or rural settings and may be above or below ground or under water. Their cultural interest may be at the local, provincial, national, or international level."

		be conducted by a competent expert. Appendix 3 provides a sample Heritage Impact Assessment prepared for a sample subproject (Khetri water and sewerage subproject).	
Existing Facilities to be rehabilitated or expanded	Conduct environmental audit of existing facilities ⁴⁶ per ADB SPS	For non-compliances, provide corrective action for each area of concern including cost and schedule to be included in the subproject EMP.	Complied
Associated Facilities ⁴⁷	Analyse environmental impacts and risks to be included in the IEE		Complied
Asbestos-containing materials (ACM) including, but not limited to, pipes, roofing, ceilings, insulation materials, excess pipes stored in PHED campuses, walls, etc.	Avoid handling or removing any ACM. Ensure asbestos concrete (AC) pipes facilities containing asbestos will not be disturbed and left in-situ. Appendix 4 provides asbestos management plan.	If ACM is suspected, asbestos verification by a competent expert is required and an asbestos management plan (AMP) prepared. Appendix 4 provides a sample AMP prepared for a sample subproject (Sardarshahar water and sewerage subproject). RUIDP shall include AMP in all contracts. Contractor should be certified to handle ACM.	Being complied
	When designing subproject infrastructure that involves excavation in urban areas the relevant authorities must be consulted to ascertain the location of any ACM prior to any subproject activity. Locations of new infrastructure must then be designed to avoid excavating or disturbing any ACM.		Will be complied
Right-of-way	Locate water supply pipelines within the right of way (ROW) of other linear structures (roads, irrigation canals) as far as		Being complied

⁴⁶ ADB SPS Appendix 4 para 12 on Existing Facilities

⁴⁷ ADB SPS Appendix 1 para 6 defines associated facilities as "not funded as part of the project (funding may be provided separately by the borrower/client or by third parties), and whose viability and existence depend exclusively on the project and whose goods or services are essential for successful operation of the project"

	possible, to reduce new land acquisition.		
	Ensure that pipelines ROW do not require land acquisition from individual farmers that is a significant proportion of their total land holding (>10%).		Being complied
Water Supply			
Sustainability	Utilize water sources at sustainable levels of abstraction only (i.e. without significant reductions in the quantity or quality of the source overall)	Water source sustainability or the relevant clearance from PHED should be provided in the subproject's IEE.	Being complied
Quality (raw water, treated water)	Ensure that water supply to consumers comply with the national drinking water standards at all times and confirm this by regular monitoring at WTPs and in domestic premises.		Will be complied
	Avoid using water sources that may be polluted by upstream users	Baseline raw water quality to be included in the IEE.	Being complied
	Avoid water-use conflicts by not abstracting water that is used for other purposes (e.g. irrigation)	If there are other users, permits or clearance for the allocation should be provided in the IEE.	Being complied
Location	Locate all new facilities – Water Treatment Plants (WTP), Tube Wells (TW), etc. within 100m from houses, shops or any other premises used by people, thus establishing a buffer to reduce the effects of noise, dust and the visual appearance of the site.		Being complied for WTP; exact tube well locations will be finalized during the detailed design
	Locate WTP at sites where there is no risk of flooding or other hazards that might impair functioning of the WTP or present a risk if damage to the WTP or the surrounding area		Being complied
Design	Ensure that the water supply system improvements are combined with improvements in sewerage to deal with the increased discharge of domestic wastewater.		Being complied
Sewage System			
Location	As far as possible locate new Sewage Treatment Plants (STP) should be at least 500m from any inhabited areas, in locations where no urban expansion is expected in the	In case of non-availability of suitable sites due to land and technical design constraints in already developed areas, where 500 m buffer is not available,	Being complied

	next 20 years, thus establishing a buffer to reduce effects of odor, visual appearance or other nuisance of the site (this may be reviewed depending on the technology adopted for the treatment of effluent).	following procedures shall be adopted and documented in order to finalize sites for implementation of project: (i) conduct alternate site analysis, justify the selected site; (ii) develop odor mitigation measures to prevent and control odor/air emissions – design measures, and operational practices that are feasible and practical in local conditions and include in IEE; (iii) develop layout plan with maximum buffer to nearby houses; (iv) provide a peripheral green buffer (at least three rows of trees within the STP compound); and (v) public information – consult local community, inform about the need, process adopted to select sites, its suitability, and measures adopted for odor prevention and control	
	As far as possible Sewage Pumping Stations (SPS) and wet wells should be located at least 100m from any inhabited areas and from sites such as hospitals, schools, temples, etc. to minimize nuisance impacts from odor, rodents, etc.	In case of non-availability of suitable sites due to land and technical design constraints in already developed areas, where 100 m buffer is not available, following procedures shall be adopted and documented in order to finalize sites for implementation of project: (i) conduct alternate site analysis, justify the selected site; (ii) develop odor mitigation measures to prevent and control odor/air emissions – design measures, and operational practices that are feasible and practical in local conditions and include in IEE; (iii) develop layout plan with maximum buffer to nearby houses; (iv) provide a peripheral green buffer (at least three rows of trees within the pumping station compound); and (v) public information – consult local community, inform about the	Not relevant – no SPS proposed

		need, process adopted to select sites, its suitability, and measures adopted for odor prevention and control	
	Locate STP at sites where there is no risk of flooding or other hazards that might impair function of the STP or present a risk of damage to the STP or the surrounding area		Being complied
Quality	Ensure that sewage is treated at all times to national wastewater discharge standards and confirm this by regular monitoring of effluent from the STP.		Being / will be complied
Design	Ensure that no wastewater is discharged into a water course in which it could be a hazard to downstream users (e.g. a waterway that is used as a source of water for domestic or municipal supply)		Being complied
	Include measures to ensure the safe disposal of sewage sludge and if possible, to promote its safe and beneficial use as an agricultural fertilizer ⁵		Being complied
Right-of-way	Locate sewage pipelines within the right of way (ROW) of other linear structures (e.g. roads) wherever feasible, to reduce new land acquisition.		Being complied
	Ensure that routes of sewage mains do not require land acquisition from individual farmers that is a significant proportion of their total land holding (10%)		Being complied

Appendix 5: Ambient Air Quality, and Vehicle Emissions Standards

Table 1: Ambient Air Quality Standards

Parameter	Location ^a	India Ambient Air Quality Standard ($\mu\text{g}/\text{m}^3$) ^b	WHO Air Quality Guidelines ($\mu\text{g}/\text{m}^3$)		Applicable Per ADB SPS ^e ($\mu\text{g}/\text{m}^3$)
			Global Update ^c 2005	Second Edition 2000	
PM ₁₀	Industrial Residential, Rural and Other Areas	60 (Annual) 100 (24-hr)	20 (Annual) 50 (24-hr)	-	20 (Annual) 50 (24-hr)
	Sensitive Area	60 (Annual) 100 (24-hr)	20 (Annual) 50 (24-hr)	-	20 (Annual) 50 (24-hr)
PM ₂₅	Industrial Residential, Rural and Other Areas	40 (Annual) 60 (24-hr)	10 (Annual) 25 (24-hr)	-	10 (Annual) 25 (24-hr)
	Sensitive Area	40 (Annual) 60 (24-hr)	10 (Annual) 25 (24-hr)	-	10 (Annual) 25 (24-hr)
SO ₂	Industrial Residential, Rural and Other Areas	50 (Annual) 80 (24-hr)	20 (24-hr) 500 (10-min)	-	50 (Annual) 20 (24-hr) 500 (10-min)
	Sensitive Area	20 (Annual) 80 (24-hr)	20 (24-hr) 500 (10-min)	-	20 (Annual) 20 (24-hr) 500 (10-min)
NO ₂	Industrial Residential, Rural and Other Areas	40 (Annual) 80 (24-hr)	40 (Annual) 200 (1-hr)	-	40 (Annual) 80 (24-hr) 200 (1-hr)
	Sensitive Area	30 (Annual) 80 (24-hr)	40 (Annual) 200 (1-hr)	-	30 (Annual) 80 (24-hr) 200 (1-hr)
CO	Industrial Residential, Rural and Other Areas	2,000 (8-hr) 4,000 (1-hr)	-	10,000 (8-hr) 100,000 (15-min)	2,000 (8-hr) 4,000 (1-hr) 100,000 (15-min)
	Sensitive Area	2,000 (8-hr) 4,000 (1-hr)	-	10,000 (8-hr) 100,000 (15-min)	2,000 (8-hr) 4,000 (1-hr) 100,000 (15-min)
Ozone (O ₃)	Industrial Residential, Rural and Other Areas	100 (8-hr) 180 (1-hr)	100 (8-hr)	-	100 (8-hr) 180 (1-hr)

Parameter	Location ^a	India Ambient Air Quality Standard ($\mu\text{g}/\text{m}^3$) ^b	WHO Air Quality Guidelines ($\mu\text{g}/\text{m}^3$)		Applicable Per ADB SPS ^e ($\mu\text{g}/\text{m}^3$)
			Global Update ^c 2005	Second Edition 2000	
	Sensitive Area	100 (8-hr) 180 (1-hr)	100 (8-hr)		100 (8-hr) 180 (1-hr)
Lead (Pb)	Industrial, Residential, Rural and Other Areas	0.5 (Annual) 1.0 (24-hr)		0.5 (Annual)	0.5 (Annual) 1.0 (24-hr)
	Sensitive Area	0.5 (Annual) 1.0 (24-hr)		0.5 (Annual)	0.5 (Annual) 1.0 (24-hr)
Ammonia (NH_3)	Industrial Residential, Rural and Other Areas	100 (Annual) 400 (24-hr)			100 (Annual) 400 (24-hr)
	Sensitive Area	100 (Annual) 400 (24-hr)			100 (Annual) 400 (24-hr)
Benzene (C_6H_6)	Industrial Residential, Rural and Other Areas	5 (Annual)			5 (Annual)
	Sensitive Area	5 (Annual)			5 (Annual)
Benzo(o)p yrene (BaP) and particulate phase only	Industrial Residential, Rural and Other Areas	0.001 (Annual)			0.001 (Annual)
	Sensitive Area	0.001 (Annual)			0.001 (Annual)
Arsenic (As)	Industrial Residential, Rural and Other Areas	0.006 (Annual)			0.006 (Annual)
	Sensitive Area	0.006 (Annual)			0.006 (Annual)
Nickel (Ni)	Industrial Residential, Rural and Other Areas	0.02 (Annual)			0.02 (Annual)
	Sensitive Area	0.02 (Annual)			0.02 (Annual)

^a Sensitive area refers to such areas notified by the India Central Government.

^b Notification by Ministry of Environment and Forests, Government of India Environment (Protection) Seventh Amendment Rules, 2009

^c WHO Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulfur dioxide. *Global update 2005*. WHO. 2006

^d Air Quality Guidelines for Europe Second Edition. WHO 2000.

^e Per ADB SPS, the government shall achieve whichever of the ambient air quality standards is more stringent. If less stringent levels or measures are appropriate in view of specific project circumstances, the executing agency of the government will provide full and detailed

justification for any proposed alternatives that are consistent with the requirements presented in ADB SPS

Table 2: Vehicle Exhaust Emission Norms

1. Passenger Cars

Norms	CO (g/km)	HC+ NOx (g/km)
1991 Norms	14.3-27.1	2.0 (Only HC)
1996 Norms	8.68-12.40	3.00-4.36
1998 Norms	4.34-6.20	1.50-2.18
India stage 2000 norms	2.72	0.97
Bharat stage-II	2.2	0.5
Bharat Stage-III	2.3	0.35 (combined)
Bharat Stage-IV	1.0	0.18 (combined)
Bharat Stage-VI (Petrol)	1.0	0.16 (Combined)

2. Heavy Diesel Vehicles

Norms	CO(g/kmhr)	HC (g/kmhr)	NOx (g/kmhr)	PM(g/kmhr)
1991 Norms	14	3.5	18	-
1996 Norms	11.2	2.4	14.4	-
India stage 2000 norms	4.5	1.1	8.0	0.36
Bharat stage-II	4.0	1.1	7.0	0.15
Bharat Stage-III	2.1	1.6	5.0	0.10
Bharat Stage-IV	1.5	0.96	3.5	0.02
Bharat Stage-VI (Diesel)	0.5	0.17 (HC+NOx)		0.0045

Source: Central Pollution Control Board

CO = Carbon Monoxide; g/kmhr = grams per kilometer-hour; HC = Hydrocarbons; NOx = oxides of nitrogen; PM = Particulates Matter

Appendix 6: Effluent Discharge Standards for STPs order by NGT 30.04.2019

Sl. No.	Parameters	Parameters Limit
1	pH	5.5-9.0
2	BOD (mg/l)	Not more than 10 mg/l
3	COD (mg/l)	Not more than 50 mg/l
4	TSS (mg/l)	Not more than 20 mg/l
5	P-Total (mg/l)- for discharge into ponds/lakes	Not more than 1.0 mg/l
6	N-Total (mg/l)	Not more than 10 mg/l
7	Fecal Coliform (MPN/100ml)	Desirable- 100 MPN/100ml Permissible- 230 MPN/100ml

Appendix 7: Ambient Air Quality Standards in Respect of Noise

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

^a Noise Pollution (Regulation and Control) Rules, 2002 as amended up to 2010.

^b Guidelines for Community Noise. WHO. 1999

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

Appendix 8: Drinking Water Standards

Group	National Standards for Drinking Water ^a			WHO Guidelines for Drinking-Water Quality, 4 th Edition, 2011 ^b	Applicable Per ADB SPS ^{c, d}
	Parameter	Unit	Max. Concentration Limits ^d		
Physical	Turbidity	NTU	1 (5)	-	1 (5)
	pH		6.5 – 8.5	none	6.5 – 8.5
	Color	Hazen units	5 (15)	none	5 (15)
	Taste and Odor		Agreeable	-	Agreeable
	TDS	mg/l	500 (2,000)	-	500 (2,000)
	Iron	mg/l	0.3	-	0.3
	Manganese	mg/l	0.1 (0.3)	-	0.1 (0.3)
	Arsenic	mg/l	0.01 (0.05)	0.01	0.01
	Cadmium	mg/l	0.003	0.003	0.003
	Chromium	mg/l	0.05	0.05	0.05
	Cyanide	mg/l	0.05	none	0.05
	Fluoride	mg/l	1 (1.5)	1.5	1 (1.5)
	Lead	mg/l	0.01	0.01	0.01
	Ammonia	mg/l	0.5	none established	0.5
Chemical	Chloride	mg/l	250 (1,000)	none established	250 (1,000)
	Sulphate	mg/l	200 (400)	none	200 (400)
	Nitrate	mg/l	45	50	45
	Copper	mg/l	0.05 (1.5)	2	0.05 (1.5)
	Total Hardness	mg/l	200 (600)	-	200 (600)
	Calcium	mg/l	75 (200)	-	75 (200)
	Zinc	mg/l	5 (15)	none established	5 (15)
	Mercury	mg/l	0.001	0.006	0.001
	Aluminum	mg/l	0.1 (0.3)	none established	0.1 (0.3)
	Residual Chlorine	mg/l	0.2	5	0.2
Micro Germs	E-coli	MPN/100ml	Must not be detectable in any 100 ml sample	Must not be detectable in any 100 ml sample	Must not be detectable in any 100 ml sample
	Total Coliform	MPN/100ml			

^a Bureau of India Standard 10500: 2012.

^b Health-based guideline values.

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

^d Figures in parenthesis are maximum limits allowed in the absence of alternate source.

Appendix 9: Salient Features of Major Laws Applicable to Establishments Engaged in Construction of Civil Works

- (i) Workmen Compensation Act, 1923 - The Act provides for compensation in case of injury by accident arising out of and during the course of employment.
- (ii) Payment of Gratuity Act, 1972 - Gratuity is payable to an employee under the Act on satisfaction of certain conditions on separation if an employee has completed 5 years' service or more or on death at the rate of 15 days wages for every completed year of service. The Act is applicable to all establishments employing 10 or more employees.
- (iii) Employees' PF and Miscellaneous Provisions Act, 1952 - The Act provides for monthly contributions by the employer plus workers @10 % or 8.33 %. The benefits payable under the Act are: (a) Pension or family pension on retirement or death as the case may be; (b) deposit linked insurance on the death in harness of the worker; (c) payment of PF accumulation on retirement/death etc.
- (iv) Maternity Benefit Act, 1951 - The Act provides for leave and some other benefits to women employees in case of confinement or miscarriage etc.
- (v) Contract Labour (Regulation and Abolition) Act, 1970 - The Act provides for certain welfare measures to be provided by the Contractor to contract labor and in case the Contractor fails to provide, the same are required to be provided by the Principal Employer by Law. The principal employer is required to take Certificate of Registration and the Contractor is required to take a License from the designated Officer. The Act is applicable to the establishments or Contractor of principal employer if they employ 20 or more contract labor.
- (vi) Minimum Wages Act, 1948 - The employer is supposed to pay not less than the Minimum Wages fixed by appropriate Government as per provisions of the Act if the employment is a scheduled employment. Construction of Buildings, Roads and Runways are scheduled employment.
- (vii) Payment of Wages Act, 1936 - It lays down as to by what date the wages are to be paid, when it will be paid and what deductions can be made from the wages of the workers.
- (viii) Equal Remuneration Act, 1979 - The Act provides for payment of equal wages for work of equal nature to Male and Female workers and not for making discrimination against Female employees in the matters of transfers, training and promotions etc.
- (ix) Payment of Bonus Act, 1965 - The Act is applicable to all establishments employing 20 or more workmen. The Act provides for payments of annual bonus subject to a minimum of 8.33 % of wages and maximum of 20 % of wages to employees drawing Rs. 3,500/- per month or less. The bonus to be paid to employees getting Rs. 2,500/- per month or above up to Rs.3,500/- per month shall be worked out by taking wages as Rs.2,500/- per month only. The Act does not apply to certain establishments. The newly set up establishments are exempted for five years in certain circumstances. Some of the State Governments have reduced the employment size from 20 to 10 for the purpose of applicability of the Act.
- (x) Industrial Disputes Act, 1947 - The Act lays down the machinery and procedure for resolution of industrial disputes, in what situations a strike or lock-out becomes illegal and what

are the requirements for laying off or retrenching the employees or closing down the establishment.

(xi) Industrial Employment (Standing Orders) Act, 1946-It is applicable to all establishments employing 100 or more workmen (employment size reduced by some of the States and Central Government to 50). The Act provides for laying down rules governing the conditions of employment by the employer on matters provided in the Act and get the same certified by the designated Authority.

(xii) Trade Unions Act, 1926 - The Act lays down the procedure for registration of trade unions of workmen and employees. The trade unions registered under the Act have been given certain immunities from civil and criminal liabilities.

(xiii) Child Labor (Prohibition and Regulation) Act, 1986 - The Act prohibits employment of children below 14 years of age in certain occupations and processes and provides for regulation of employment of children in all other occupations and processes. Employment of child labor is prohibited in Building and Construction Industry.

(xiv) Inter-State Migrant Workmen's (Regulation of Employment and Conditions of Service) Act, 1979 - The Act is applicable to an establishment which employs 5 or more inter-state migrant workmen through an intermediary (who has recruited workmen in one state for employment in the establishment situated in another state). The inter-state migrant workmen, in an establishment to which this Act becomes applicable, are required to be provided certain facilities such as housing, medical aid, traveling expenses from home up to the establishment and back, etc.

(xv) Construction and Demolition Waste Management Rules 2016- This Rule stipulate that-

- (xii) Every waste generator shall segregate construction and demolition waste and deposit at collection centre or handover it to the authorized processing facilities
- (xiii) Shall ensure that there is no littering or deposition so as to prevent obstruction to the traffic or the public or drains.
- (xiv) Large generators (who generate more than 20 tons or more in one day or 300 tons per project in a month) shall submit waste management plan and get appropriate approvals from the local authority before starting construction or demolition or remodeling work,
- (xv) Large generators shall have environment management plan to address the likely environmental issues from construction, demolition, storage, transportation process and disposal / reuse of C & D Waste.
- (xvi) Large generators shall segregate the waste into four streams such as concrete, soil, steel, wood and plastics, bricks and mortar,
- (xvii) Large generators shall pay relevant charges for collection, transportation, processing and disposal as notified by the concerned authorities;

(xvi) Solid Waste Management Rules 2016- As per this Rule responsibility of Solid Waste Generator is as below.

- segregate and store the waste generated in three separate streams namely bio-degradable, non biodegradable and domestic hazardous wastes in suitable bins and handover segregated wastes to authorized waste pickers or waste collectors as per the direction or notification by the local authorities from time to time;
- store separately construction and demolition waste, as and when generated, in his own premises and shall dispose off as per the Construction and Demolition Waste Management Rules, 2016; and

- No waste generator shall throw, burn or burry the solid waste generated by him, on streets, open public spaces outside his premises or in the drain or water bodies.
- (xvii) The Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 and the Cess Act of 1996 - All the establishments who carry on any building or other construction work and employ 10 or more workers are covered under this Act. All such establishments are required to pay Cess at rate not exceeding 2% of the cost of construction as may be notified by the Government. The employer of the establishment is required to provide safety measures at the building or construction work and other welfare measures, such as canteens, first-aid facilities, ambulance, housing accommodation for workers near the workplace etc. The employer to whom the Act applies has to obtain a registration certificate from the Registering Officer appointed by the Government. Salient features of this Act are given below.

Employer shall-

- Provide and maintain, at suitable point, sufficient quantity of wholesome drinking water, such point shall be at least 6 meters away from any washing areas, urinals or toilets
- Provide sufficient urinals and latrines at convenient place, easily accessible by workers
- Provide free of charge, temporary living accommodations near to work sites with separate cooking place, bathing and lavatory facilities and restore the site as pre conditions after completing the construction works
- Provide crèche with proper accommodation, ventilation, lighting, cleanliness and sanitation if more than fifty female workers are engaged
- Provide first aid facilities in all construction sites

For safety of workers employer shall provide-

- Safe access to site and work place
- Safety in demolition works
- Safety in use of explosives
- Safety in operation of transporting equipments and appoint competent person to drive or operate such vehicles and equipments
- Safety in lifting appliance, hoist and lifting gears
- Adequate and suitable lighting to every work place and approach
- Prevention of inhalation of dust, smoke, fumes, gases during construction works and provide adequate ventilation in work place and confined space
- Safety in material handling and stacking/un stacking
- Safeguarding the machinery with fly-wheel of moving parts
- Safe handling and use of plants operated by compressed air
- Fire safety
- Limit of weight to be lifted by workers individually
- Safety in electric wires, apparatus, tools and equipments
- Provide safety net, safety sheet, safety belts while working at height (more than 1.6 mtrs as per OSHA)
- Providing scaffolding, ladders and stairs, lifting appliances, chains and accessories where required
- Safety in pile works, concrete works, hot asphalt, tar, insulation, demolition works, excavation, underground construction and handling materials
- Provide and maintain medical facilities for workers
- Any other matters for the safety and health of workers

Appendix 10: Water quality test report of Bhainsa Singh Dam

OFFICE OF THE JUNIOR CHEMIST
PUBLIC HEALTH ENGINEERING DEPARTMENT DISTRICT LABORATORY
Aburoad (Sirohi)
REPORT OF THE CHEMICAL EXAMINATION OF WATER

No. Lab/Tech./2016-17/41 Date: 20.04.2016

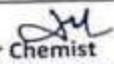
To, Assistant Engineer
P.H.E.D.Lab
Aburoad District: Sirohi
Tehsil: Aburoad
Sample Collector: J.En.staff

Reference: Your Letter 07 Date 18.4.2016

Date of Collection: 18.04.2016 Date of Receipt: 18.04.2016 Date of Examination: 20.4.2016

Lab Sample No.	Source & Location:	Acceptable Limit as per IS 10500 :2012	Permissible limit in the absence of alternate source	Raw Water Bhaisasingh Dame Aburoad
1 pH		6.5 - 8.5	No relaxation	7.9
2 Turbidity (NTU)		1	5	12
3 Colour		5	15	None
4 Odour		Agreeable	Agreeable	None
5 Temp. °C		-	-	27
6 Alkalinity Phenolphthlein (CaCO ₃)		-	-	-
7 Alkalinity Methyl Orange (CaCO ₃)		200	600	150
8 Total Hardness		200	600	100
9 Calcium Hardness		-	-	70
10 Magnesium Hardness		-	-	30
11 Chlorides as Cl		250	1000	60
12 Nitrate as NO ₃		45	No relaxation	1
13 Total Dissolved Solids		500	2000	595
14 Fluorides		1	1.5	0.8
15 Iron		0.3	1	-
16 Alum Dose		-	-	-
17 Lime Dose		-	-	-
18 Dissolved Oxygen		-	-	-
19 BOD		-	-	-
20 Langlier Saturation Index		-	-	-

Note: All results except at Sr No. 1 to 5 are in mg/l


 Junior Chemist
 P. H. E. D. Lab
 ABU-ROAD

Appendix 11: Groundwater Quality Test Reports

OFFICE OF THE JUNIOR CHEMIST
PUBLIC HEALTH ENGINEERING DEPARTMENT, LABORATORY ABU ROAD
REPORT OF THE CHEMICAL EXAMINATION OF WATER

No. Lab/Tech(Chem)/2016-2017/ _____ Dated : _____
 To, _____
Assistant Engineer
P.H.E.D.Sub Division
Abu Road District: **Sirohi**
 Block: **Abu Road**

Reference : Your Letter No. **Sp.1** Dated: **16/04/2018** Name of Sample Taker: **A.En staff**
 Date of Receipt: **16/04/2018** Ref. ID: **14**

Source	OW	OW			
Source Location	Veer Bavasi Akrabha ta	Housing Board			
Village/Town	Abu Road (Urban)	Abu Road (Urban)			
Habitation	Abu Road (Urban)	Abu Road (Urban)			
Village Code No.	0	0			
Date of Collection	16/04/2018	16/04/2018			
Date of Examination	17/04/2018	17/04/2018			
Lab. Sample No.	62	63			

Note :- All results Except pH are in mg/L

1 pH	7.9	7.6			
2 Turbidity(NTU)	Clear	Clear			
3 Colour	None	None			
4 Odour	None	None			
5 Temperature (°C)	25	25			
6 Total Alkalinity (as CaCO ₃)	-	-			
7 Total Hardness (as CaCO ₃)	-	-			
8 Calcium Hardness (as CaCO ₃)	-	-			
9 Magnesium Hardness (as CaCO ₃)	-	-			
10 Chloride (as Cl ⁻)	140	140			
11 Sulphate (as SO ₄ ²⁻)	-	-			
12 Nitrite (as NO ₂ ⁻)	0	0			
13 Nitrates (as NO ₃ ⁻)	15	14			
14 Fluoride (as F ⁻)	2.4	2.3			
15 Total Dissolved Solids	920	940			
16 Iron	-	-			
17 Residual Chlorine					

Junior Chemist
PHED Lab Abu Road
 Dated: _____

No. Lab/Tech(Chem)/2016-2017/ _____
 Copy to:
 1 The Chief Chemist, Public Health Engineering Department, Rajasthan, Jaipur.
 2 The Executive Engineer, PHED Division Sirohi/Abu Road
 3

Junior Chemist

P.T.O.



OFFICE OF THE JUNIOR CHEMIST
PUBLIC HEALTH ENGINEERING DEPARTMENT, LABORATORY ABU ROAD
REPORT OF THE CHEMICAL EXAMINATION OF WATER

No. Lab/Tech(Chem)/2016-2017/

Dated :

To,

Assistant Engineer
P.H.E.D. Sub Division
Aburoad

District: Sirohi
Block: Abu Road

Reference : Your Letter No.
 Date of Receipt: 28/03/2018

Sp.1

Dated: 28/03/2018
 Ref ID: 4

Name of Sample Taker: A.En staff

Source	OW				
Source Location	Banas Pump				
Village/Town	Abu Road (Urban)				
Habitation	Abu Road - (Urban)				
Village Code No.	0				
Date of Collection	28/03/2018				
Date of Examination	05/04/2018				
Lab. Sample No.	26				
Note :- All results Except pH are in mg/L					
1 pH	8				
2 Turbidity (NTU)	Clear				
3 Colour	None				
4 Odour	None				
5 Temperature (°C)	25				
6 Total Alkalinity (as CaCO ₃)	-				
7 Total Hardness (as CaCO ₃)	-				
8 Calcium Hardness (as CaCO ₃)	-				
9 Magnesium Hardness (as CaCO ₃)	-				
10 Chloride (as Cl ⁻)	280				
11 Sulphate (as SO ₄ ²⁻)	-				
12 Nitrite (as NO ₂ ⁻)	0				
13 Nitrates (as NO ₃ ⁻)	9				
14 Fluoride (as F ⁻)	0.6				
15 Total Dissolved Solids	1435				
16 Iron	-				
17 Residual Chlorine					

Junior Chemist
PHED Lab Abu Road

Dated:

No. Lab/Tech(Chem)/2016-2017/

Copy to:

- 1 The Chief Chemist, Public Health Engineering Department, Rajasthan, Jaipur.
- 2 The Executive Engineer, PHED Division Sirohi/Abu Road
- 3

Junior Chemist

P. T. D.

OFFICE OF THE JUNIOR CHEMIST
PUBLIC HEALTH ENGINEERING DEPARTMENT, LABORATORY ABU ROAD
REPORT OF THE CHEMICAL EXAMINATION OF WATER

No. Lab/Tech(Chem)/2016-2017/ To, Assistant Engineer P.H.E.D.Sub Division Aburoad District: Sirohi Block: Abu Road

Reference : Your Letter No. Sp.1 Dated: 28/03/2018 Name of Sample Taker: A.En staff
 Date of Receipt : 28/03/2018 Ref ID: 4

Source	OW	OW	OW	OW	OW
Source Location	Chirafadi Kua	Hanumanji Kua	Back side Darbar School	Abkari road, Phed campus	Andeshwerji
Village/Town	Abu Road (Urban)	Abu Road (Urban)	Abu Road (Urban)	Abu Road (Urban)	Abu Road (Urban)
Habitation	Abu Road (Urban)	Abu Road (Urban)	Abu Road (Urban)	Abu Road (Urban)	Abu Road (Urban)
Village Code No.	0	0	0	0	0
Date of Collection	28/03/2018	28/03/2018	28/03/2018	28/03/2018	28/03/2018
Date of Examination	05/04/2018	05/04/2018	05/04/2018	05/04/2018	05/04/2018
Lab. Sample No.	21	22	23	24	25

Note :- All results Except pH are in mg/L.

1 pH	7.3	7.8	7.7	7.6	7.8
2 Turbidity(NTU)	Clear	Clear	Clear	Clear	Clear
3 Colour	None	None	None	None	None
4 Odour	None	None	None	None	None
5 Temperature (°C)	25	25	25	25	25
6 Total Alkalinity (as CaCO ₃)	-	-	-	-	-
7 Total Hardness (as CaCO ₃)	-	-	-	-	-
8 Calcium Hardness (as CaCO ₃)	-	-	-	-	-
9 Magnesium Hardness (as CaCO ₃)	-	-	-	-	-
10 Chloride (as Cl ⁻)	250	300	350	500	290
11 Sulphate (as SO ₄ ²⁻)	-	-	-	-	-
12 Nitrite (as NO ₂ ⁻)	0-	0-	0-	0-	0-
13 Nitrates (as NO ₃ ⁻)	21	31	86	8	10
14 Fluoride (as F ⁻)	0.4	0.4	0.5	0.8	0.6
15 Total Dissolved Solids	1160	1280	1540	1920	1480
16 Iron	-	-	-	-	-
17 Residual Chlorine					

Junior Chemist
 PHED Lab Abu Road
 Dated:

No. Lab/Tech(Chem)/2016-2017/
 Copy to:
 1 The Chief Chemist, Public Health Engineering Department, Rajasthan, Jaipur.
 2 The Executive Engineer, PHED Division Sirohi/Abu Road
 3

Junior Chemist

P.T.O.



OFFICE OF THE JUNIOR CHEMIST
PUBLIC HEALTH ENGINEERING DEPARTMENT, LABORATORY ABU ROAD
REPORT OF THE CHEMICAL EXAMINATION OF WATER

No. Lab/Tech(Chem)/2016-2017/

Dated :

To,

Assistant Engineer
P.H.E.D. Sub Division
Aburoad

District: Sirohi
Block: Abu Road

Reference : Your Letter No.
Date of Receipt : 28/03/2018

Sp.1

Dated: 28/03/2018
Ref ID: 4

Name of Sample Taker: A.En staff

Source	OW	OW	OW	OW	OW
Source Location	Chirafadi Kua	Hanumanji Kua	Back side Darbar School	Abkari road, Phed campus	Andeshwerji
Village/Town	Abu Road (Urban)	Abu Road (Urban)	Abu Road (Urban)	Abu Road (Urban)	Abu Road (Urban)
Habitation	Abu Road (Urban)	Abu Road (Urban)	Abu Road (Urban)	Abu Road (Urban)	Abu Road (Urban)
Village Code No.	0	0	0	0	0
Date of Collection	28/03/2018	28/03/2018	28/03/2018	28/03/2018	28/03/2018
Date of Examination	05/04/2018	05/04/2018	05/04/2018	05/04/2018	05/04/2018
Lab. Sample No.	21	22	23	24	25
Note :- All results Except pH are in mg/L.					
1 pH	7.3	7.8	7.7	7.6	7.8
2 Turbidity (NTU)	Clear	Clear	Clear	Clear	Clear
3 Colour	None	None	None	None	None
4 Odour	None	None	None	None	None
5 Temperature (°C)	25	25	25	25	25
6 Total Alkalinity (as CaCO ₃)	-	-	-	-	-
7 Total Hardness (as CaCO ₃)	-	-	-	-	-
8 Calcium Hardness (as CaCO ₃)	-	-	-	-	-
9 Magnesium Hardness (as CaCO ₃)	-	-	-	-	-
10 Chloride (as Cl ⁻)	250	300	350	500	290
11 Sulphate (as SO ₄ ²⁻)	-	-	-	-	-
12 Nitrite (as NO ₂ ⁻)	0-	0-	0-	0-	0-
13 Nitrates (as NO ₃ ⁻)	21	31	86	8	10
14 Fluoride (as F ⁻)	0.4	0.4	0.5	0.8	0.6
15 Total Dissolved Solids	1160	1280	1540	1920	1480
16 Iron	-	-	-	-	-
17 Residual Chlorine					

Junior Chemist
PHED Lab Abu Road

Dated:

No. Lab/Tech(Chem)/2016-2017/

Copy to:

- 1 The Chief Chemist, Public Health Engineering Department, Rajasthan, Jaipur.
- 2 The Executive Engineer, PHED Division Sirohi/Abu Road
- 3

Junior Chemist

P.T.O.



OFFICE OF THE JUNIOR CHEMIST
PUBLIC HEALTH ENGINEERING DEPARTMENT, LABORATORY ABU ROAD
REPORT OF THE CHEMICAL EXAMINATION OF WATER

No. Lab/Tech(Chem)/2016-2017/

Dated :

To,

Assistant Engineer
P.H.E.D. Sub Division
Aburoad

District: **Sirohi**
 Block: **Abu Road**

Reference: Your Letter No.
 Date of Receipt: 28/03/2018

Sp.1

Dated: 28/03/2018
 Ref ID: 3

Name of Sample Taker: A. En staff

Source	TW	TW	GLR	TW
Source Location	Bhanswala Man dowari	Main road, Mandowari	Bus stand	no. 3 Phed
Village/Town	Abu Road (Urban)	Abu Road (Urban)	Siyawa	Awai
Habitation	Abu Road (Urban)	Abu Road (Urban)	Siyawa	Awai
Village Code No.	0	0	0	0
Date of Collection	28/03/2018	28/03/2018	28/03/2018	28/03/2018
Date of Examination	05/04/2018	05/04/2018	05/04/2018	05/04/2018
Lab. Sample No.	17	18	19	20
Note :- All results Except pH are in mg/L				
1 pH	7.6	7.9	7.5	7.4
2 Turbidity(NTU)	Clear	Clear	Clear	Clear
3 Colour	None	None	None	None
4 Odour	None	None	None	None
5 Temperature (°C)	25	25	25	25
6 Total Alkalinity (as CaCO ₃)	-	-	-	-
7 Total Hardness (as CaCO ₃)	-	-	-	-
8 Calcium Hardness (as CaCO ₃)	-	-	-	-
9 Magnesium Hardness (as CaCO ₃)	-	-	-	-
10 Chloride (as Cl)	160	150	160	100
11 Sulphate (as SO ₄ ²⁻)	-	-	-	-
12 Nitrite (as NO ₂ ⁻)	0-	0-	0-	0-
13 Nitrates (as NO ₃ ⁻)	4	3	11	12
14 Fluoride (as F)	0.6	1.4	1.2	0.6
15 Total Dissolved Solids	740	730	780	560
16 Iron	-	-	-	-
17 Residual Chlorine				

Junior Chemist
PHED Lab Abu Road
 Dated:

No. Lab/Tech(Chem)/2016-2017/

Copy to:

- 1 The Chief Chemist, Public Health Engineering Department, Rajasthan, Jaipur.
- 2 The Executive Engineer, PHED Division Sirohi/Abu Road
- 3

Junior Chemist

P.T.O.



OFFICE OF THE JUNIOR CHEMIST
PUBLIC HEALTH ENGINEERING DEPARTMENT, LABORATORY ABU ROAD
REPORT OF THE CHEMICAL EXAMINATION OF WATER

No. Lab. Tech (Chem)/2016-2017/ *Sp 2*

Dated *16-4-18*

To,

Assistant Engineer
 P.H.E.D. Sub Division
Abu Road

District: *Sirohi*
 Block: *Abu Road*

Reference Your Letter No. *Lab # sampling* Dated *13/04/2018* Name of Sample Taker _____
 Date of Receipt: *12/04/2018* Ref ID: *13* Lab staff _____

Source	CWR	CWR	CWR	CWR	
Source location	Andkhedi	Vijayn	R.H.B Colony	Sagur	
Village/Town	Abu Road (Urban)	Abu Road (Urban)	Abu Road (Urban)	Abu Road (Urban)	
Habitat	Abu Road (Urban)	Abu Road (Urban)	Abu Road (Urban)	Abu Road (Urban)	
Sample Code No.	0	0	0	0	
Date of Collection	13/04/2018	13/04/2018	13/04/2018	13/04/2018	
Date of Examination	14/04/2018	14/04/2018	14/04/2018	14/04/2018	
Lab Sample No.	56	57	58	59	
Note: All results Except pH are in mg/L					
1. pH	7.5	7.3	7.9	7.6	
2. Colour (NTU)	Clear	Clear	Clear	Clear	
3. Cloud	None	None	None	None	
4. Odour	None	None	None	None	
5. Temperature (°C)	25	25	25	25	
6. Total Alkalinity (as CaCO ₃)	-	-	-	-	
7. Total Hardness (as CaCO ₃)	-	-	-	-	
8. Calcium Hardness (as CaCO ₃)	-	-	-	-	
9. Magnesium Hardness (as CaCO ₃)	-	-	-	-	
10. Chloride (as Cl)	450	200	150	300	
11. Sulphate (as SO ₄)	-	-	-	-	
12. Nitrate (as NO ₃)	9	9	0	0	
13. Nitrite (as NO ₂)	31	20	15	37	
14. Fluoride (as F)	0.7	1	0.8	0.8	
15. Total Dissolved Solids	1700	1180	950	1980	
16. Total Solids	-	-	-	-	
17. Total Chlorine					

Junior Chemist
 PHED Lab Abu Road
 Dated: _____

For Lab Tech (Chem)/2016-2017/
 Page 147

1. To: Chief Chemist, Public Health Engineering Department, Rajasthan, Jaipur.
 2. To: Executive Engineer, PHED Division Sirohi/Abu Road

Junior Chemist



OFFICE OF THE JUNIOR CHEMIST
PUBLIC HEALTH ENGINEERING DEPARTMENT, LABORATORY ABU ROAD
REPORT OF THE CHEMICAL EXAMINATION OF WATER

No. Lab/Tech(Chem)/2016-2017/ *Sp.1*Dated: *19.4.2018*

To,

Assistant Engineer
P.H.E.D. Sub Division
Aburoad

District: **Sirohi**
 Block: **Abu Road**

Reference: Your Letter No.
 Date of Receipt: 28/03/2018

Sp.1

Dated: 28/03/2018

Name of Sample Taker:

A.En staff

Ref ID: **3**

Source	TW	OW	OW	OW	TW
Source Location	ITI Satpur	Jogi vas. Satpur	Nr. Talab, Satpur	Siyava	Siyava
Village/Town	Abu Road (Urban)	Abu Road (Urban)	Abu Road (Urban)	Abu Road (Urban)	Abu Road (Urban)
Habitation	Abu Road (Urban)	Abu Road (Urban)	Abu Road (Urban)	Abu Road (Urban)	Abu Road (Urban)
Village Code No.	0	0	0	0	0
Date of Collection	28/03/2018	28/03/2018	28/03/2018	28/03/2018	28/03/2018
Date of Examination	05/04/2018	05/04/2018	05/04/2018	05/04/2018	05/04/2018
Lab. Sample No.	12	13	14	15	16

Note :- All results Except pH are in mg/L

1 pH	8.1	7.4	7.6	7.7	7.8
2 Turbidity (NTU)	Clear	Clear	Clear	Clear	Clear
3 Colour	None	None	None	None	None
4 Odour	None	None	None	None	None
5 Temperature (°C)	25	25	25	25	25
6 Total Alkalinity (as CaCO ₃)	-	-	-	-	-
7 Total Hardness (as CaCO ₃)	-	-	-	-	-
8 Calcium Hardness (as CaCO ₃)	-	-	-	-	-
9 Magnesium Hardness (as CaCO ₃)	-	-	-	-	-
10 Chloride (as Cl ⁻)	130	480	550	150	180
11 Sulphate (as SO ₄ ²⁻)	-	-	-	-	-
12 Nitrite (as NO ₂ ⁻)	0-	0-	0-	0-	0-
13 Nitrates (as NO ₃ ⁻)	4	41	39	14	5
14 Fluoride (as F ⁻)	0.7	0.6	0.6	1.1	1.5
15 Total Dissolved Solids	770	1940	2320	705	880
16 Iron	-	-	-	-	-
17 Residual Chlorine					

cm
Junior Chemist
PHED Lab Abu Road
 Dated:

No. Lab/Tech(Chem)/2016-2017/

Copy to:

- 1 The Chief Chemist, Public Health Engineering Department, Rajasthan, Jaipur.
- 2 The Executive Engineer, PHED Division Sirohi/Abu Road
- 3

cm
Junior Chemist

P.T.O.

Appendix 12: Critical Habitation Screening and Biodiversity Assessment Study Report

SC ENVIRONMENT LTD



[SUBJECT]

RUIDP

DATE: 19 JANUARY 2020

**FOR ASIAN DEVELOPMENT
BANK**

REF: SCE – ADB TL09-11-19 01

REV: 01

**PRODUCED BY:
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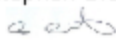
Author Stephen Crute
Signed 
Date 07 December 2019

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Acronyms

ADB	Asian Development Bank
AoA	Area of Analysis
CH	Critical Habitat
CR	Critically Endangered
EN	Endangered
I BA	Important Bird Area
IBAT	Integrated Biodiversity Assessment Tool
IFC	International Finance Corporation
IUCN	International Union for Conservation of Nature
KBA	Key Biodiversity Area
SPS	Safeguard Policy Statement
VU	Vulnerable
WPDA	World Database on Protected Areas

1 INTRODUCTION

1.1 Preamble

The Asian Development Bank (ADB) is considering a loan/grant for a series of water and sewerage infrastructure improvements within the Indian State of Rajasthan. As part of the due diligence process for the loan/grant, ADB wishes to have information on the potential presence of Critical Habitat within the proposed projects potential Area of Influence. In addition, general information on the biodiversity value of the areas where the projects will take place is required for the project development phases if the loan/grant is processed.

Assessment of Risk of Impacts on Critical Habitat

In addition, to the potential impacts on identified local biodiversity and ecosystems, ADB's SPS requires demonstration that the project will not adversely affect the identified Critical Habitat.

ADB SPS states that projects should not be developed within Critical Habitat areas unless all of the below criterion are met.

- (i) There are no measurable adverse impacts, or likelihood of such, on the critical habitat which could impair its high biodiversity value or the ability to function.
- (ii) The project is not anticipated to lead to a reduction in the population of any recognized endangered or critically endangered species or a loss in area of the habitat concerned such that the persistence of a viable and representative host ecosystem be compromised.
- (iii) Any lesser impacts are mitigated.

The text presented here represents an assessment of potential impacts of the project on the habitats present which may or may not be classed as Critical Habitat depending upon the outcome of furthermore detailed survey and assessment.

Asian Development Bank (ADB) has requested an initial screening study for ecological constraints and in particular for Critical Habitat within the AoA of the project areas. This report sets out the outcomes of the conducted screening for one of the projects in an area referred to as Abu Road. The determination of the presence of Critical Habitat is a fundamental part of ADB Safeguard Policy Statement (Asian Development Bank, 2009).

2 PROJECT DESCRIPTION

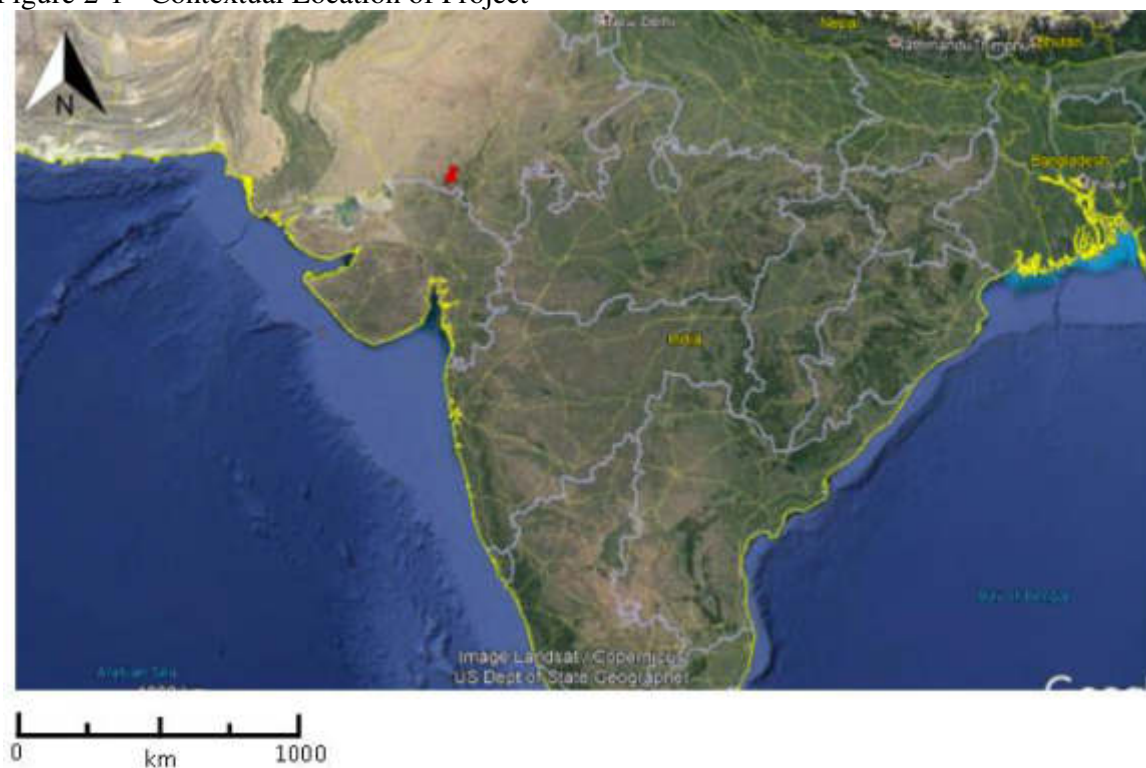
2.1 Preamble

The following text provides an overview of the proposed project relating to the development of infrastructure at Abu Road. This description is provided only for contextual information as the determination of the presence of or potential presence of Critical Habitat is independent of the proposed project, construction activities and operational/maintenance features.

2.2 Project Location

Abu Road is located in the State of Rajasthan, and is situated southern part of the State some 15 km from the border with Gujarat. The context of the location is presented in Figure 2-1.

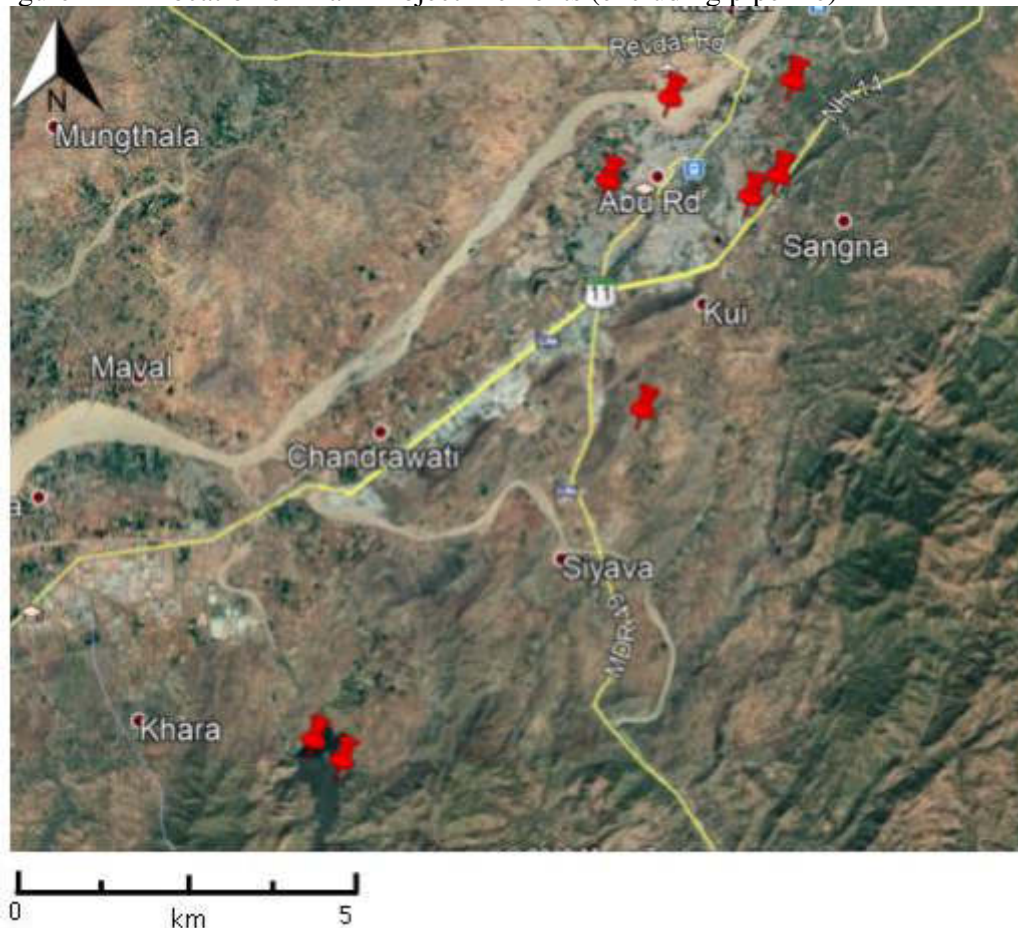
Figure 2-1 - Contextual Location of Project



Source: Base Map – Google Earth

The project site is shown in Figure 2-2. This shows the main project elements including an intake well and pumping station in Bhaisa Singh Dam, a Water Treatment Plant and two Sewage Treatment Plants. Additionally a water supply pipe will run from the dam to the Water Treatment Plant. This is planned to run in the utility corridor of an existing highway.

Figure 2-2 – Location of Main Project Elements (excluding pipeline)



Source: Base Map – Google Earth

2.3 Project Description

The Abu Road project elements, as noted above, include a water intake well at Bhaisa Singh Dam which lies some 9 km south of the urban area of Abu Road. A pumping station at the dam will provide water supply to a new Water Treatment Plant for the town of Abu Road. The connecting pipes and distribution lines form part of the overall project.

In addition, two Sewage Treatment Plants will be developed to serve the needs of Abu Road.

3 SCREENING PROCESS FOR CRITICAL HABITAT

3.1 Process

Two related aspects have been screened. The first is the presence of protected or designated areas which may affect the loan/grant decision making process and the second the potential presence of Critical Habitat⁴⁸ based on an initial risk assessment of the presence of Threatened species (Critically Endangered (CR) and Endangered (EN) species as defined by the IUCN, and to a lesser extent Vulnerable (VU) species).

The process has utilised the International Finance Corporation's (IFC) recommended approach to identification of Critical Habitat but at a more preliminary screening level. The method is presented as part of the IFC's Performance Standard No 6 of 2012, within the Guidance Note for the Performance Standard which was last updated in June 2019 (IFC, 2019).

3.2 Data Sources

The screening process has involved review of publicly available sources of data relating to protected sites and species conservation status.

The following primary sources of data were utilised:

- Integrated Biodiversity Assessment Tool (IBAT);
- The World Database of Key Biodiversity Areas website (WPDa);
- Important Bird Areas (Birdlife International);
- Ramsar website;
- IUCN Redlist;
- UNEP-WCMC (2017) Global Critical Habitat screening layer.

These were supported by general searches for information and data on the project area. Such sources are quoted within the Bibliography section of the report.

⁴⁸ Note the use of the term Critical Habitat refers to the definition utilised by ADB in the Safeguard Policy Statement of 2009 and the International Finance Corporation Performance Standard No 6 – Biodiversity.

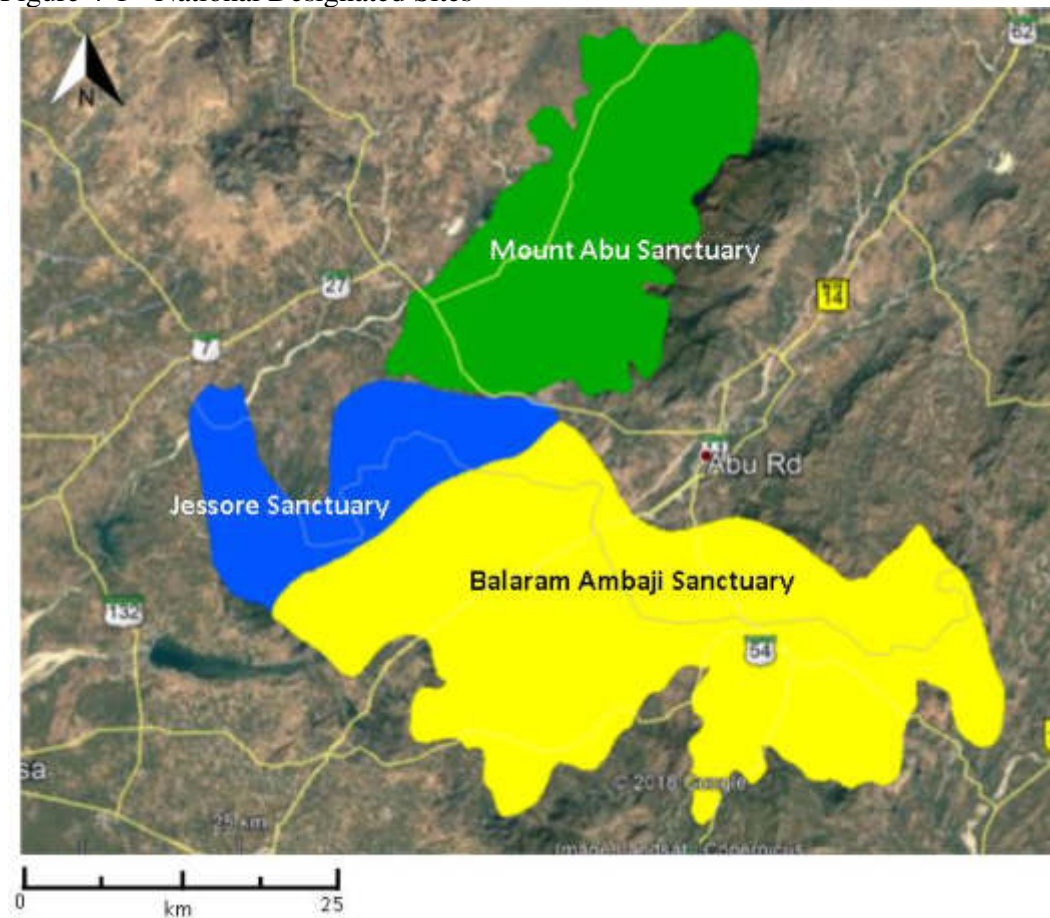
4 RESULTS

4.1 Protected Areas

4.1.1 National Sites

A review of national sites based on IBAT and WPDA data indicates that there are three formally designated areas. These are shown in Figure 4-1.

Figure 4-1 - National Designated Sites



Mount Abu Sanctuary

This site is located in the State of Rajasthan and is a mountain sanctuary. It was designated in 1960 and has an area of 326 km². It has a rich flora with sub-tropical thorn scrub and forest present.

The site is reported to be under the management responsibility of Chief Wildlife Warden, State Forest Department of Rajasthan.

Jessore Sanctuary

This sanctuary is located within the State of Gujarat and is some 181 km² in area, consisting mainly of forest habitat and was notified in 1978. The sanctuary's main interest is the Sloth Bear, but there are a range other mammal and bird species of note within the area.

The site is reported to be under the management responsibility of Chief Wildlife Warden, State Forest Department of Gujarat.

Balaram Ambaji Sanctuary

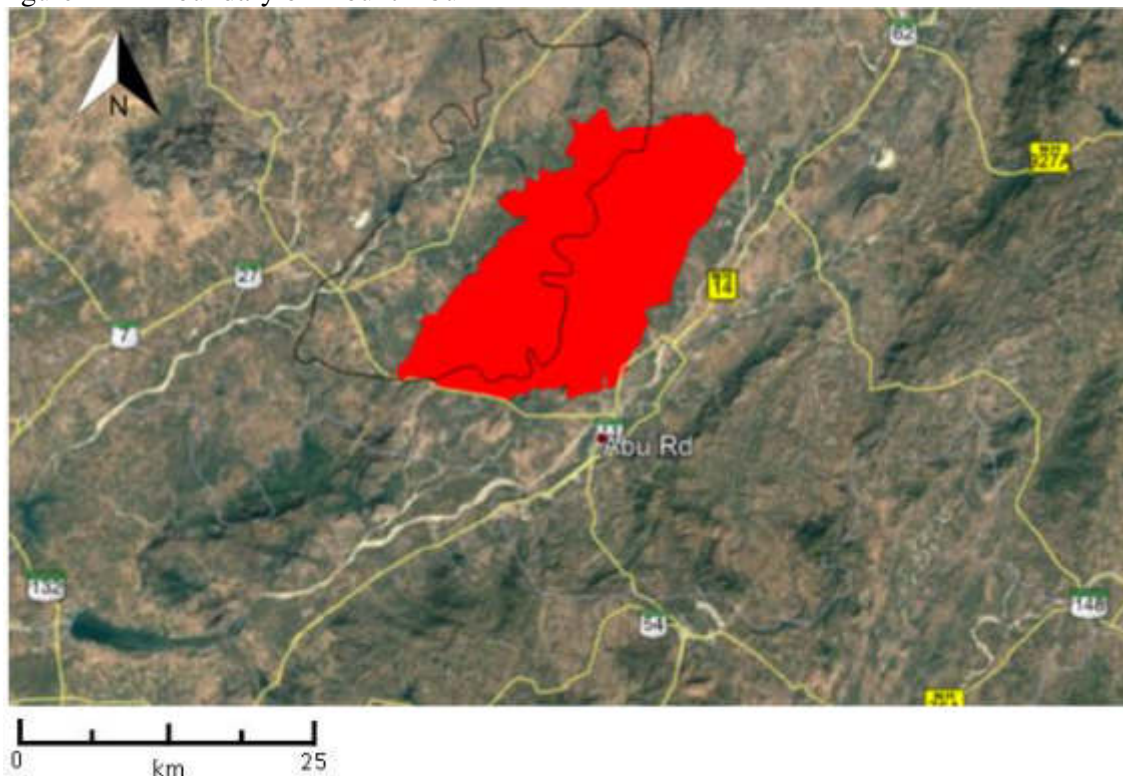
This sanctuary is located mainly within the State of Gujarat and is some 542 km² in area, consisting mainly of forest habitat. The site was initially notified as a sanctuary in 1989. Parts of the site are degraded and in 2013 the National Board for Wildlife undertook surveys to determine exclusion of areas from the sanctuary as they had been degraded. The site boundary provided on the WPDA shows some areas extending into Rajasthan.

The site is reported to be under the management responsibility of Chief Wildlife Warden, State Forest Department of Gujarat.

4.1.2 Key Biodiversity Areas

There is one Key Biodiversity Area in addition to the National Designations discussed above. This is an Important Bird Area (IBA) as declared by Birdlife International. This site is referred to as Mount Abu IBA. This is shown in Figure 4-2. A substantial part of the site coincides with Mount Abu Sanctuary but the IBA does not extend as far west and extends further east than the National Site boundary. The outline of the National Boundary is also presented in Figure 4-2 for comparison purposes.

Figure 4-2 – Boundary of Mount Abu IBA



Source – Base Map Google Earth

4.2 Potential Critical Habitat Qualifying Species

4.2.1 IFC Process for Critical Habitat Assessment

The screening for Critical Habitat has been conducted based on species which may qualify the habitat as Critical. This has been based on the approach as set out in the 2019 IFC updates to Performance Standard No 6 Guidance note (IFC, 2019). This utilises five criterion to determine if the area under consideration would qualify as Critical Habitat. Three of the criterion (1-3) relate to species and have thresholds which are based on the risk of extinction of species as designated by the IUCN Red List status for each species. Criteria 4 and 5 relate to ecosystems and evolutionary processes and do not utilise thresholds. A summary of the criteria are set out below.

Criterion 1: Critically Endangered and Endangered Species

Species threatened with global extinction and listed as CR and EN on the IUCN Red List of Threatened Species shall be considered as part of Criterion 1. Critically Endangered

species face an extremely high risk of extinction in the wild. Endangered species face a very high risk of extinction in the wild.

As described in footnote 11 of Performance Standard 6, the inclusion in Criterion 1 of species that are listed nationally/regionally as CR or EN in countries that adhere to IUCN guidance shall be determined on a project-by-project basis in consultation with competent professionals.

Thresholds for Criterion 1 are the following:

- (a) Areas that support globally important concentrations of an IUCN Red-listed EN or CR species ($\geq 0.5\%$ of the global population AND ≥ 5 reproductive units of a CR or EN species).
- (b) Areas that support globally important concentrations of an IUCN Red-listed Vulnerable (VU) species, the loss of which would result in the change of the IUCN Red List status to EN or CR and meet the thresholds.
- (c) As appropriate, areas containing important concentrations of a nationally or regionally listed EN or CR species.

Criterion 2: Endemic and Restricted range Species

For purposes of this Guidance Note, the term endemic is defined as restricted range.

Restricted range refers to a limited extent of occurrence (EOO).

- For terrestrial vertebrates and plants, restricted range species are defined as those species that have an EOO less than 50,000 km².
- For marine systems, restricted range species are provisionally being considered those with an EOO of less than 100,000 km².
- For coastal, riverine, and other aquatic species in habitats that do not exceed 200 km width at any point (for example, rivers), restricted range is defined as having a global range of less than or equal to 500 km linear geographic span (i.e., the distance between occupied locations furthest apart).

The threshold for Criterion 2 is the following:

- a) Areas that regularly hold $\geq 10\%$ of the global population size AND ≥ 10 reproductive units of a species.

Criterion 3: Migratory and Congregatory Species

Migratory species are defined as any species of which a significant proportion of its members cyclically and predictably move from one geographical area to another (including within the same ecosystem).

Congregatory species are defined as species whose individuals gather in large groups on a cyclical or otherwise regular and/or predictable basis. Examples include the following:

- Species that form colonies.
- Species that form colonies for breeding purposes and/or where large numbers of individuals of a species gather at the same time for non-breeding purposes (for example, foraging and roosting).
- Species that utilise a bottleneck site where significant numbers of individuals of a species occur in a concentrated period of time (for example, for migration).
- Species with large but clumped distributions where a large number of individuals may be concentrated in a single or a few sites while the rest of the species is largely dispersed (for example, wildebeest distributions).
- Source populations where certain sites hold populations of species that make an inordinate contribution to recruitment of the species elsewhere (especially important for marine species).

Thresholds for Criterion 3 are the following:

- (a) Areas known to sustain, on a cyclical or otherwise regular basis, ≥ 1 percent of the global population of a migratory or congregatory species at any point of the species' lifecycle.
- (b) Areas that predictably support ≥ 10 percent of the global population of a species during periods of environmental stress.

Criterion 4: Highly Threatened or Unique Ecosystems

The IUCN is developing a Red List of Ecosystems, following an approach similar to the Red List for Threatened Species. The client should use the Red List of Ecosystems where formal IUCN assessments have been performed. Where formal IUCN assessments have not been performed, the client may use assessments using systematic methods at the national/regional level, carried out by governmental bodies, recognised academic institutions and/or other relevant qualified organizations (including internationally recognised Non-Government Organisations (NGOs)).

The thresholds for Criterion 4 are the following:

- a) Areas representing $\geq 5\%$ of the global extent of an ecosystem type meeting the criteria for IUCN status of CR or EN.
- b) Other areas not yet assessed by IUCN but determined to be of high priority for conservation by regional or national systematic conservation planning.

Criterion 5: Key Evolutionary Processes

The structural attributes of a region, such as its topography, geology, soil, temperature, and vegetation, and combinations of these variables, can influence the evolutionary processes that give rise to regional configurations of species and ecological properties. In some cases, spatial features that are unique or idiosyncratic of the landscape have been associated with genetically unique populations or subpopulations of plant and animal species. Physical or spatial features have been described as surrogates or spatial catalysts for evolutionary and ecological processes, and such features are often associated with species diversification. Maintaining these key evolutionary processes inherent in a landscape as well as the resulting species (or subpopulations of species) has become a major focus of biodiversity conservation in recent decades, particularly the conservation of genetic diversity. By conserving species diversity within a landscape, the processes that drive speciation, as well as the genetic diversity within species, ensures the evolutionary flexibility in a system, which is especially important in a rapidly changing climate.

For illustrative purposes, some potential examples of spatial features associated with evolutionary processes are as follows:

- Landscapes with high spatial heterogeneity are a driving force in speciation, as species are naturally selected based on their ability to adapt and diversify.
- Environmental gradients, also known as ecotones, produce transitional habitat, which has been associated with the process of speciation and high species and genetic diversity.
- Edaphic interfaces are specific juxtapositions of soil types (for example, serpentine outcrops, limestone, and gypsum deposits), which have led to the formation of unique plant communities characterized by both rarity and endemism.
- Connectivity between habitats (for example, biological corridors) ensures species migration and gene flow, which is especially important in fragmented habitats and for the conservation of metapopulations. This also includes biological corridors across altitudinal and climatic gradients and from “crest to coast.”

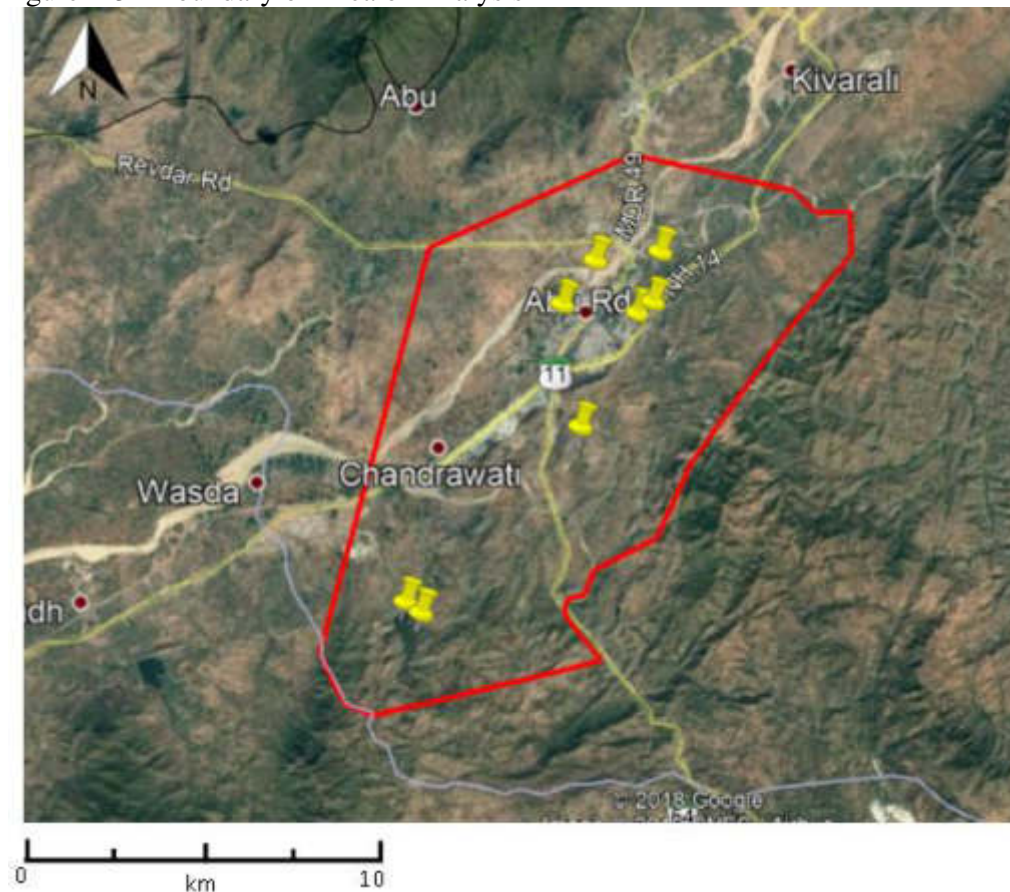
- Sites of demonstrated importance to climate change adaptation for either species or ecosystems are also included within this criterion.

4.2.2 Area of Analysis

The IFC Approach to Critical Habitat Assessment requires the establishment of an Area of Analysis (AoA) to be determined for the assessment. For this initial screening, based on the proposed project layout with its discontinuous elements and pipelines, a single AoA which encompasses all of the project elements has been selected.

As set out in the IFC Guidance on Critical Habitat Assessment (CHA), the AoA will be based on the general location of the project but the selected AoA should not reflect the projects potential impacts or risks. The AoA is not synonymous with the projects Area of Influence. The guidance suggests selecting boundaries which represent ecological units and/or are physical features within the landscape such as roads or rivers. The selected AoA for the Abu Road project elements is shown in Figure 4-3. This has been based on a number physical/topographical features. To the east the boundary generally follows a ridge line, before turning westwards, partially following a small road and then crossing to the west of the project elements. A natural alignment to the west would have been along the wadi which runs through Abu Road area. However, some project elements lie close to the east side of the wadi and it was considered that allowing a buffer of 2 km from the western edge of the wadi was more appropriate. The boundary then turns south and allows a buffer of 2 km around Bhaisa Singh Dam.

Figure 4-3 - Boundary of Area of Analysis



4.2.3 Results Criteria 1 - 3 – IBAT Species Output

Based on an IBAT search for species, a long list of Threatened Species (Critically Endangered (CE), Endangered (EN) and Vulnerable (VU) have been identified as potentially present in the AoA. The screening has used an initial buffer of 50 km from the Abu Road project area.

The long list of CR, EN and VU species which may be present is shown in Table 4-1. This shows that there are four CR species, eight EN species and 23 VU species.

Table 4-1 - Long List of Species based on 50 km Buffer

Scientific Name	Common Name	IUCN Status
<i>Vanellus gregarius</i>	Sociable Lapwing	CR
<i>Gyps bengalensis</i>	White-rumped Vulture	CR
<i>Sarcogyps calvus</i>	Red-headed Vulture	CR

Scientific Name	Common Name	IUCN Status
<i>Gyps indicus</i>	Indian Vulture	CR
<i>Manis crassicaudata</i>	Indian Pangolin	EN
<i>Sypheotides indicus</i>	Lesser Florican	EN
<i>Sterna acuticauda</i>	Black-bellied Tern	EN
<i>Haliaeetus leucoryphus</i>	Pallas's Fish-eagle	EN
<i>Neophron percnopterus</i>	Egyptian Vulture	EN
<i>Aquila nipalensis</i>	Steppe Eagle	EN
<i>Falco cherrug</i>	Saker Falcon	EN
<i>Leptoptilos dubius</i>	Greater Adjutant	EN
<i>Crocodylus palustris</i>	Mugger	VU
<i>Lutrogale perspicillata</i>	Smooth-coated Otter	VU
<i>Melursus ursinus</i>	Sloth Bear	VU
<i>Panthera pardus</i>	Leopard	VU
<i>Tetracerus quadricornis</i>	Four-horned Antelope	VU
<i>Geochelone elegans</i>	Indian Star Tortoise	VU
<i>Rusa unicolor</i>	Sambar	VU
<i>Anacyclus pyrethrum</i>	Atlas Daisy	VU
<i>Marmaronetta angustirostris</i>	Marbled Teal	VU
<i>Aythya ferina</i>	Common Pochard	VU
<i>Columba eversmanni</i>	Yellow-eyed Pigeon	VU
<i>Antigone antigone</i>	Sarus Crane	VU
<i>Clanga clanga</i>	Greater Spotted Eagle	VU
<i>Aquila rapax</i>	Tawny Eagle	VU
<i>Aquila heliaca</i>	Eastern Imperial Eagle	VU
<i>Saxicola macrorhynchus</i>	White-browed Bushchat	VU
<i>Machlolophus nuchalis</i>	White-naped Tit	VU
<i>Chaetornis striata</i>	Bristled Grassbird	VU
<i>Amandava formosa</i>	Green Avadavat	VU
<i>Ciconia episcopus</i>	Asian Woollyneck	VU
<i>Clanga hastata</i>	Indian Spotted Eagle	VU
<i>Chlamydotis macqueenii</i>	Asian Houbara	VU
<i>Oryza malampuzhaensis</i>		VU

IFC PS No 6 approach focuses initially on CR and EN for Criterion No 1 and these have been reviewed using IUCN distribution maps, other literature and likely habitat requirements.

A summary of the screening of the CR and EN species is presented in Table 4-2. This provides a note on each species and then an initial assessment of that species likelihood of qualifying the AoA as Critical Habitat based on Criteria 1-3.

Table 4-2 - Summary of IBAT CR and EN Species and Potential as Critical Habitat Qualifying Species (Criteria 1 – 3)

Scientific Name	Common name	IUCN Status	Notes	1	2	3	Qualifying Species?
<i>Vanellus gregarius</i>	Sociable Lapwing	CR	The IUCN Redlist mapping of this species suggests that it may be extinct within the project area. The IBA listing for Mount Abu (BirdLife International, 2019) does not include this species. This would be a non-breeding species within this area if present	X	X	X	Not considered to be a qualifying species
<i>Gyps bengalensis</i>	White-rumped Vulture	CR	A rare species with wide distribution which has, at least historically included the project area. These are birds with a large home range – Stated to be present in Mount Abu IBA in 2004 account. Chhangani showed this species to be widespread across Rajasthan in surveys conducted between 2005 and 2007 (Chhangani, 2009). Unlikely to be meet IUCN breeding criteria	X	X	?	Possible qualifying species based on congregatory basis as this species will form aggregations in suitable locations
<i>Sarcogyps calvus</i>	Red-headed Vulture	CR	The IUCN species mapping shows that Abu Road lies close to the line of extant and possibly extinct. Chhangani conducted survey for this species within Rajasthan and found it to be present within the state in low numbers, although not specifically within Abu Road location (Chhangani, 2007). The World Bird Database presents a checklist of species at Mount Abu and Surrounding area and <i>Sarcogyps calvus</i> is on the checklist (Lepage, 2019)	X	X	?	Possible as a congregatory species
<i>Gyps indicus</i>	Indian Vulture	CR	Abu Road is located at the boundary of the IUCN mapping of this species as Extant and Likely Extinct. It is not listed as a qualifying species for the Mount Abu IBA but is listed within the Mount Abu and Environs species checklist (Ibid)	X	X	?	Possible as a congregatory species

Scientific Name	Common name	IUCN Status	Notes	1	2	3	Qualifying Species?
<i>Manis crassicaudata</i>	Indian Pangolin	EN	Present across India and reported to be present in the Mount Abu IBA (BirdLife International, 2019). Utilises a range of habitats including degraded sites and agricultural areas	?	X	X	Low potential to fulfil Criterion 1 but further survey would be required to confirm presence/absence of this species with the AoA
<i>Sypheotides indicus</i>	Lesser Florican	EN	A grassland bird species which has been recorded in the Abu Road area previously but is not mentioned in the IBA (ibid) qualifying species description. This species is congregatory on breeding grounds – no specific records for the Abu Road area but potentially present	?	X	?	Low potential to fulfil Criterion 1/3 but further survey would be required to confirm presence/absence of this species with the AoA
<i>Sterna acuticauda</i>	Black-bellied Tern	EN	The AoA is located at the northern edge of the IUCN distribution mapping for this species – it is not listed on the Avi Base checklist for Mount Abu and its environs (Lepage, 2019). Main habitats are large rivers and sometimes smaller lakes	X	X	X	Considered unlikely to be a qualifying species
<i>Haliaeetus leucoryphus</i>	Pallas's Fish-eagle	EN	IUCN mapping shows that the AoA is within a possible extinct, not listed in IBA qualifying species or the Avi Base checklist (Lepage, 2019)	X	X	X	Not considered to be a qualifying species
<i>Neophron percnopterus</i>	Egyptian Vulture	EN	Reported to be present within the Mount Abu area (Lepage, 2019), this is a species which nests on cliffs and high areas, but will forage over a wide area including in villages. Usually solitary but will form congregations at feeding areas	X	X	?	Considered low risk of being a qualifying species but will need further survey to confirm assumption
<i>Aquila nipalensis</i>	Steppe Eagle	EN	A widespread species which prefers high ground and open plains. This species is not mentioned in the IBA citation (BirdLife International, 2019) but is listed as present within area (Lepage, 2019). Considered unlikely to meet the thresholds for Criterion 1 – 3	X	X	X	Not considered to be a qualifying species
<i>Falco cherrug</i>	Saker Falcon	EN	This species is a migrant, non-breeding bird within the areas around Abu Road. It	X	X	X	Not considered to be a qualifying species

Scientific Name	Common name	IUCN Status	Notes	1	2	3	Qualifying Species?
			is not recorded on the avi database (Lepage, 2019). This species would not fulfil the breeding thresholds of Criterion 1 or 2 and is considered unlikely to meet Criterion 3 thresholds				
<i>Leptoptilos dubius</i>	Greater Adjutant	EN	The IUCN distribution mapping for this species indicates that it is considered extinct in the north of India	X	X	X	Not considered to be a qualifying species

4.2.4 Vulnerable Species

For the 24 Vulnerable species identified through the IBAT search, a review of these indicates that none would reach the threshold for Criterion 1, namely loss of a population which would push the IUCN status from VU to either CR or EN.

4.2.5 Results – Criteria 1 – 3 - Other Data Sources

Preamble

In addition, to the above records from IBAT, a review of other potential CR, EN or relevant VU species was conducted, mainly directly through IUCN Red List but also a literature search. This also allowed account of regionally CR and EN species. The IUCN Redlist was filtered for the States of Gujrat and Rajasthan. This listing including some marine based species which were excluded from the screening process.

Table 4-3 shows the list of other CR and EN species identified outside of the IBAT searches. Each of these has been considered for their potential to qualify the AoA as CH. None is considered to qualify the AoA as CH for Criteria 1 – 3.

Table 4-3 - Non IBAT Species (CR and EN) Considered in Screening

Scientific Name	Status	Notes
<i>Commiphora wightii</i>	Critically Endangered	A rare desert species found in the west of Rajasthan, not considered to be a CH qualifying species for the AoA
<i>Chlorophytum borivillianum</i>	Critically Endangered	Annual plant species favouring forest systems – not considered likely to be present in AoA
<i>Tribulus rajasthanensis</i>	Critically Endangered	A plant species of desert and arid rocky areas – not considered likely to be present in AoA
<i>Dalbergia congesta</i>	Endangered	A climbing shrub found at elevations higher than 800 m normally. The AoA sits at about 250 – 300 m above sea level – not considered likely to be present in AoA

Scientific Name	Status	Notes
<i>Tephrosia jamnagarensis</i>	Endangered	Distribution is restricted to the Jamnagar and Junagadh districts of Gujarat state. Not a qualifying species for CH in the AoA
<i>Tor putitora</i>	Endangered	A fresh water fish species recorded only in the northern parts of Rajasthan in the Himalaya foothills and streams Not a qualifying species for CH in the AoA

4.3 Criterion 4 - Highly Threatened or Unique Ecosystems

In addition to the assessment of the extinction threat to species, the IUCN has commenced a program of assessing ecosystems in a similar manner.

The ecosystem within the project area has not been assessed to date.

The ecosystem within the AoA is not considered to be highly threatened, with much of it in urban or agricultural land use. Therefore, the Area of Influence does not meet the thresholds set out in Criterion 4, namely:

- Areas representing $\geq 5\%$ of the global extent of an ecosystem type meeting the criteria for IUCN status of CR or EN.
- Other areas not yet assessed by IUCN but determined to be of high priority for conservation by regional or national systematic conservation planning.

4.4 Criterion 5: Key Evolutionary Processes

There are no known key evolutionary processes within the AoA. Such processes often occur where habitats and ecosystems have become isolated, for example on islands. Indicative of key evolutionary process areas would be the presence of a high number of endemic or range restricted species. This area of India does not match this profile. The AoA is therefore not considered to meet this criterion.

4.5 Protected Areas

ADB SPS states that designated or proposed designation at an international level should be considered as Critical Habitat. Within the AoA there are no internationally designated sites such as Ramsar Sites.

However, the AoA includes part of one Nationally Designated site, the Balaram Ambaji Sanctuary. In addition there are two other Nationally designated sites within the general area.

SPS (2009) states that sites which are of international designation, such as Ramsar and UNESCO sites should be considered as Critical Habitat. However, SPS does not extend this to nationally designated sites.

Based on the SPS definition, the nationally designated sites do not qualify the AoA as Critical Habitat.

5 CONCLUSIONS

5.1 Summary

The Screening Study for CH indicates that within the AoA there are no known species which would qualify the area as CH for Criterion 1 - 3. However, within the AoA there is the potential species of vultures to utilise the wider area for feeding.

The AoA does not qualify as CH under Criteria 4 and 5.

The above determinations are based on IFC requirements and definitions. As noted, ADB includes the statement that internationally recognised designations of sites should be considered as CH.

5.2 ADB SPS Requirements

There are five species which have been identified as potentially qualifying the identified Area of Analysis (AoA) as Critical Habitat. These are:

- *Gyps bengalensis*
- *Sarcogyps calvus*
- *Gyps indicus*
- *Manis crassicaudata*
- *Sypheotides indicus*.

6 RECOMMENDATIONS

Based on the proposed project design and activities an initial assessment of the risk of significant effects on the potentially qualifying species has been conducted.

To ensure that no measurable adverse impacts on biodiversity is achieved, the main recommendations are as follows:

1. Engage a local biodiversity expert to verify findings on-site; and
2. Conduct field-level site visits for the review and updating of the Environmental Management Plan
3. If species of interest are found on-site, ensure that the findings are recorded and reported to the PIU. No disturbances or works on the site should start/continue until PIU issues clearance to proceed. Measures to restrict poaching or hunting shall be put in place.
4. If species of interest are present, PIU shall coordinate with the Forest Department for the translocation of the animals and contractor to undertake biodiversity awareness training to be organized by PIU.

For contractors working in areas where species of interest are present, the tool box talk should include reminders and actions required related to biodiversity conservation as specified in the environmental management plan (EMP). The below table provides potential impacts, proposed mitigation and a review of Criterion 1 and 2 from above. For Criterion 3, it is considered that all lesser impacts have been mitigated so that effects or risks are at an acceptable, non-significant level. It is stressed that this is an initial assessment of impacts on potential Critical Habitat. If any of the five species are present and qualify the AoA as Critical Habitat then a fully detailed assessment will be required. The below table will be included in the EMP and should be provided to contractors as part of their contracts.

The main risk of significant effects for all five species will relate to the construction phase, and in particular the pipeline construction activities. Once operational, assuming a fully buried pipeline is constructed with no permanent access along the route, just a protected wayleave, then operational impacts are not considered to represent a risk to the five species which potentially represent Critical Habitat qualifying species.

From the table it can be seen that provided suitable design mitigation project design and that the construction and operational phases are effectively managed, that no adverse impacts on the potential Critical Habitat or the qualifying species is likely to occur.

Receptor	Potential Impacts	Mitigation	Criterion 1 - no measurable adverse impacts on CH	Criterion 2 – no reduction in the population of CR and EN	Monitoring/Comment
<i>Gyps bengalensis</i> <i>Sarcogyps calvus</i> <i>Gyps indicus</i>	Loss of habitat and breeding trees Change in food availability – carcasses Induced impacts of improved water supply leading to increased agriculture and cattle rearing in location which in turns increases local use of chemicals harmful to vultures Disturbance of vultures at feeding locations during construction phase	Before starting any construction activities, conduct pre-construction survey for presence of this species. If these species are present, the findings should be recorded and reported. No disturbance or works on the site should start/continue until PIU issues clearance to proceed. PIU should coordinate with the Forestry Department to coordinate the translocation of the affected species. If these vulture species are present, the design shall ensure that breeding areas are not directly affected by the	Based on full implementation and avoidance of impacts and risks through the proposed mitigation measures it is considered that there will be no measurable effects on this group of Criterion 1 qualifying species	Based on full implementation and avoidance of impacts and risks through the proposed mitigation measures it is considered that there will be no measurable effects on this group of Criterion 1 qualifying species	If such species are present the project shall take the opportunity to monitor vulture activities within the project area and develop a local community awareness program to support conservation of the species

Receptor	Potential Impacts	Mitigation	Criterion 1 - no measurable adverse impacts on CH	Criterion 2 – no reduction in the population of CR and EN	Monitoring/Comment
		proposed pipeline routes and permanent infrastructure. Changes in route alignment, timing of works and avoidance of tree felling will reduce risk and impacts Construction work shall be timed to avoid the breeding season if specimens of the these birds are found to be using the AoA during the breeding season			
<i>Manis crassicaudata</i>	Direct loss of habitat due to pipeline work Disturbance of breeding pairs during courtship and rearing of chicks	Before starting any construction activities, conduct pre-construction survey for presence of this species. If these species are present, the findings should be recorded and reported. No disturbance or works on the site should	Based on full implementation and avoidance of impacts and risks through the proposed mitigation measures it is considered that there will be no measurable effects on this group of	Based on full implementation and avoidance of impacts and risks through the proposed mitigation measures it is considered that there will be no measurable effects on this group of	Monitor potential presence of this species throughout construction period

Receptor	Potential Impacts	Mitigation	Criterion 1 - no measurable adverse impacts on CH	Criterion 2 – no reduction in the population of CR and EN	Monitoring/Comment
		start/continue until PIU issues clearance to proceed. PIU should coordinate with the Forestry Department to coordinate the translocation of the affected species. The design shall ensure that breeding areas are not directly affected by the proposed pipeline routes and permanent infrastructure. Changes in route alignment, timing of works and avoidance of tree felling will reduce risk and impacts Construction work shall be time to avoid the breeding season if specimens of the these birds	Criterion 1 qualifying species	Criterion 1 qualifying species	

Receptor	Potential Impacts	Mitigation	Criterion 1 - no measurable adverse impacts on CH	Criterion 2 – no reduction in the population of CR and EN	Monitoring/Comment
		are found to be using the AoA during the breeding season			
<i>Manis crassicaudata</i>	Direct harm or killing of individuals during construction earthworks, tracking of vehicles and equipment across burrows. Indirect disturbance of individuals through noise and vibration during pipeline construction works. Induced impacts through improved access along pipeline wayleave during and after construction period causing increased opportunity for hunting of species for meat trade.	Before starting any construction activities, conduct survey of species for the EIA process AND prior to construction works, even if not found in initial surveys. If these species are present, the findings should be recorded and reported. No disturbance or works on the site should start/continue until PIU issues clearance to proceed. PIU should coordinate with the Forestry Department to coordinate the translocation of the affected species.	Based on full implementation and avoidance of impacts and risks through the proposed mitigation measures it is considered that there will be no measurable effects on this group of Criterion 1 qualifying species	Based on full implementation and avoidance of impacts and risks through the proposed mitigation measures it is considered that there will be no measurable effects on this group of Criterion 1 qualifying species	This is a uncommon species which is difficult to survey and establish with certainty that they are absent from a site. Their habit is mainly fossorial and only indirect evidence of activity may be present. During ground excavation works for the pipelines, permanent footprint, all temporary facilities such as access roads, a pre-clearance check and ongoing monitoring for the presence of this species must be conducted.

6.1 Further work

6.1.1 Preamble

The Screening Assessment has been conducted based on available data. The assessment points to the need for targeted survey work on a small number of bird species. These are the vulture species which may potentially be present and form congregations at feeding locations and are:

- *Gyps bengalensis*
- *Sarcogyps calvus*
- *Gyps indicus*

In addition, survey is recommended for *Sypheotides indicus* and *Manis crassicaudata*.

The following sections of text provide proposed survey requirements for the above species. The three vulture species are covered in a single survey methodology.

6.1.2 Vultures

Objective

The objective of the survey work for the three identified CR vulture species is to determine their presence or absence in the Area of Analysis, either as breeding species or utilising regular feeding spots at any point within a year.

Outline Methodology

Establishment of Presence or likely Absence – A field survey shall be undertaken by qualified avi-fauna specialists to:

1. Identify potential vulture feeding areas (locations of regular carcass dumping, slaughterhouses, etc.);
2. Engage with local people, land managers etc to determine historical use of the site and surrounding areas by vultures in general and if possible the three target species; and
3. Conduct site survey for vultures using Vantage Point counts for a minimum of 24 hours per vantage point, spread across a calendar year.

For the community engagement it is recommended that good quality images of the three target species and other vultures which may be present, are used to facilitate discussions. In addition, sample images should be left with local people along with the survey team contact details so that records of vulture sightings by the local community can be passed to the survey team.

Vantage point counts are surveys, conducted by two observers, from a Vantage Point from which the AoA (or parts of it) can be viewed. Records of bird species observed

(and their behaviours, activity etc), focused on the three target species, shall be conducted. The number of vantage points shall be decided on the ground, based on site topography, visibility etc. The intent will be to ensure that the whole of the area of analysis can be directly observed. It is likely that a minimum of six vantage points will be required to cover the entire AoA. VP observed areas shall not overlap nor be more than 2.5 km apart.

Observations shall be made with suitable binoculars and telescopes and recorded in standard format.

Based on the need for 24 hour recording at each vantage point it is recommended that 2 hourly recording is conducted at each VP per month across 12 months. This will give a total survey effort for VP of 144 hours.

Breeding Vulture Surveys – In addition to the presence/absence survey work, monthly site visits shall be conducted during the first three months of the breeding season (October- December) to record presence of target species which are breeding. If breeding is recorded in the early months of the season, then survey shall continue through to final fledging of young.

All records of activity shall be reported and georeferenced and supported where possible with images. The breeding birds shall not be disturbed by any of the survey activities.

6.1.3 Survey for *Sypheotides indicus*

The AoA shall be surveyed for suitable habitats for this grassland bird species. This includes grassland and some agricultural cropland, including cotton. The species has an association with the Rattail Grass (*Sehima nervosum*) and the field work shall include survey for stands of this species.

Field work to establish the presence of this species shall be conducted in July-September when displaying males are conspicuous. A minimum of 8 visits shall be undertaken in suitable weather conditions during this period.

6.1.4 Survey for *Manis crassicaudata* Indian Pangolin

Relatively little is known about the ecology and behaviour of this species which is predominantly fossorial in its habits. Survey techniques should start with discussions

with local people regarding sightings of this species and a habitat survey to identify suitable habits for this species.

Previous work in Sri Lanka for this species, suggests that it can be found in a range of habitats, including plantations and semi cultivated areas.

Identified suitable habitat shall be visited and indirect signs of the species searched for. These include feeding areas, faeces and importantly burrows. Research suggests that two forms of burrows are excavated, resting burrows which are more permanent and deeper, and feeding burrows which tend to be shallower.

Field work shall be supported by a camera trapping campaign within suitable habitat areas. A minimum of ten infra-red cameras shall be deployed within the area for a period of 14 days at each suitable habitat location. Experiments with baiting of camera traps for other species of Pangolin have not shown any particular suitable baits to attract the species to the camera traps. Ideally, if ant nests are located within the suitable habitat areas, camera traps should be established in these locations.

Camera traps should be infra-red only and not have flash photography. Still and video images shall be produced through automatic triggering of the camera. Cameras shall be located about 30 cm above ground level.

7 REFERENCES

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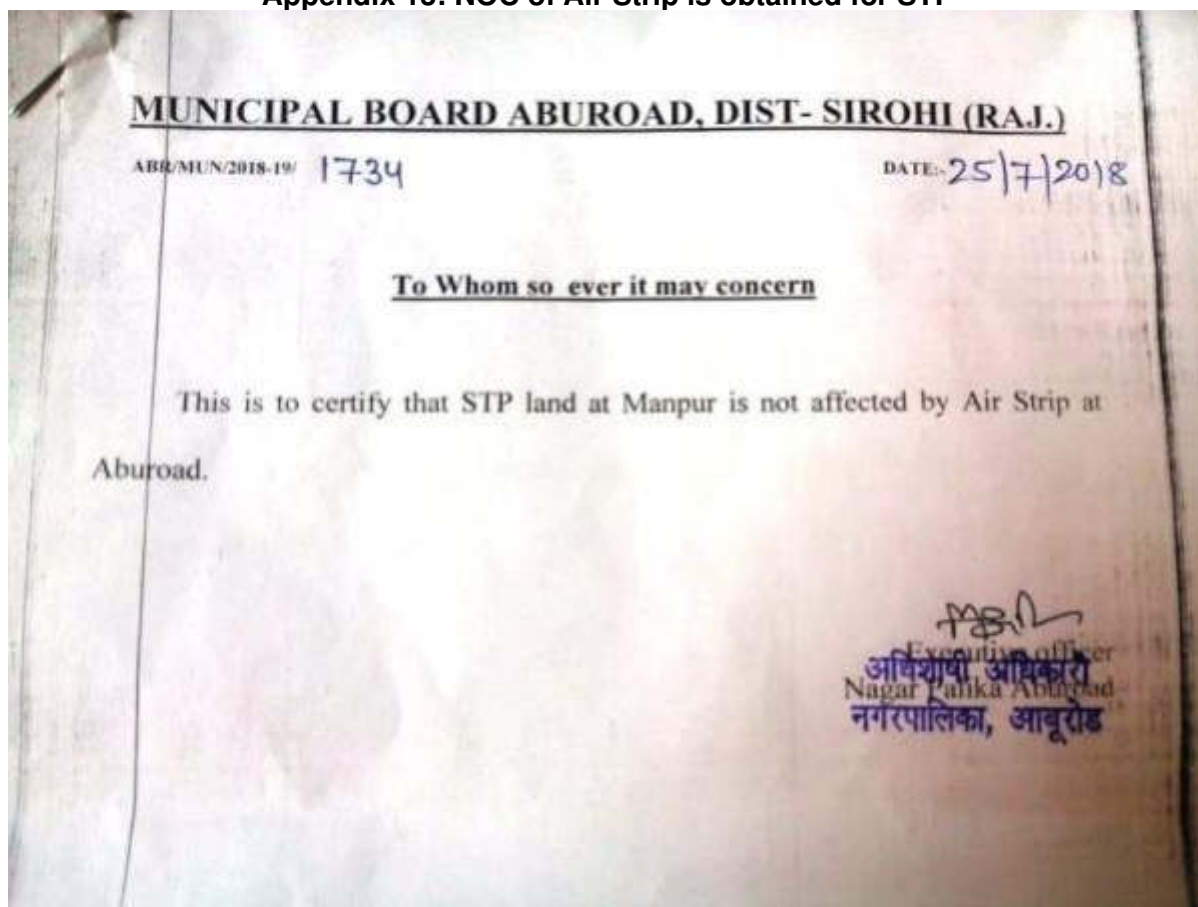
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Appendix 13: NOC of Air Strip is obtained for STP

Appendix 14: Geographical position coordinates of all project sites

S.No.	DESCRIPTION	LOCATION	COORDINATES	
	WATER SUPPLY			
1	Bhainsa Singh Dam	Near Bhainsa Singh village	24°24'1.49"N	72°43'48.85"E
2	WTP	Santhpur	24°27'49.31" N	72°45'10.62"E
3	Santhpur CWR	Santhpur	24°28'24.43" N	72°46'13.35"E
4	Market area CWR (Andeshwar)	Market area	24°29'09.37" N	72°46'50.34"E
5	Gandhi Nagar CWR	Gandhi nagar near Vijasani Temple	24°28'15.08" N	72°47'38.55"E
6	Housing Board CWR	Housing Board	24°30'19.30" N	72°47'41.07"E
7	Luniyapura CWR	Luniyapura	24°29'6.79"N	72°48'0.73"E
	WASTE WATER			
8	STP -1 (6.55 MLD)	Near Moksh Dham at Santhpur	24°28'37.97" N	72°45'39.95"E
9	STP -2 (1.80 MLD)	Manpur Near Bridge	24°29'38.15" N	72°47'14.49"E

Appendix 15: UIT approval letter for STP site

राजस्थान सरकार
कार्यालय नगर सुधार न्यास, आबू जिला-सिरोही (राज.)

क्रमांक / यूआईटी. आबू/भूमि आवंटन/2018/ दिनांक

अधिसापी अधिकारी,
नगरपालिका आबूरोड।

विषय :- नैसासिंह बांध से शहरी जल योजना आबूरोड एवं 8 गाँव में पेयजल हेतु प्रस्तावित पाईप लाईन एवं जल शोधन संयंत्र निर्माण एवं नगरपालिका सीवरेज ट्रीटमेंट प्लांट (STP) बाबत भूमि आवंटन हेतु।

प्रसंग :- आपका पत्रांक : एबीआर/एमयूएन/2018/180 दिनांक 16.04.2018

उपरोक्त विषयान्तर्गत एवं प्रासंगिक पत्रांक के क्रम में लेख है कि मौजा सांतपुर के ख.नं. 323 कुल रकबा 182-05 बीघा किस्म गें.मु. गौघर में से आबूरोड एवं 8 गाँव में पेयजल हेतु प्रस्तावित पाईप लाईन एवं जल शोधन संयंत्र हेतु रकबा 9-05 बीघा भूमि एवं नगरपालिका सीवरेज ट्रीटमेंट प्लांट (STP) निर्माण हेतु रकबा 9-05 बीघा कुल 18-05 बीघा भूमि नगरपालिका आबूरोड को सैद्धान्तिक रूप से आवंटित करने को सहमत है।

इस संबंध में भूमि आवंटन नीति 2015 के तहत निर्धारित प्रपत्र-स (प्रति संलग्न) में आवेदन करते हुए संबंधित दस्तावेज एवं चाही जाने वाली भूमि की जमाबंदी, खसरा गिरदावरी एवं नक्शा ट्रेस तथा साईट प्लान जिसमें बिछाई जाने वाली पाईप लाईन का सीमांकन दर्शाते हुए प्रस्तुत करें, ताकि नियमानुसार आवंटन कार्यवाही की जा सके।


 कुशल कुमार कोठारी (आर.ए.एस.)
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Appendix 16: IBAT screening report of Abu Road subproject**Proximity report generated by the
Integrated Biodiversity Assessment Tool**

Site name	Aburoad, Rajasthan
Latitude/Longitude	24° 24' 9" North, 72° 43' 36" East
Date generated	24th April 2018
Generated by	aslandb
Company	ADB

About this report

This report presents the results of a proximity analysis to identify the biodiversity features and species which are located within 1 km, 5 km and 10 km.

Data used to generate this report

IUCN and UNEP-WCMC, 2017. *The World Database on Protected Areas (WDPA)* [On-line], March 2018.

BirdLife International (on behalf of the KBA Partnership), 2016. *Key Biodiversity Areas: December 2016 version*.

IUCN, 2017. *The IUCN Red List of Threatened Species grid analysis of range maps. Version 2017-3 (December)*.

Limitations

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

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

For ultimate accuracy, distance calculations are performed by reprojecting the spatial data (as shown through the map viewer) to an equal distance projection, and so may not match precisely the results shown on the map.

Protected Areas and Key Biodiversity Areas

The following sites are found within the selected buffer distances:

Features within 1 km

National-level protected areas		
IUCN Category III-IV	Balaram Ambaji	98,377 ha

Features within 5 km

There are no additional features within 5 km.

Features within 10 km

There are no additional features within 10 km.

IUCN RED LIST OF THREATENED SPECIES

Given suitable habitat, the following species are potentially found close to the area of interest:

Taxonomic group	Scientific Name	Common Name	IUCN Red List category
Amphibians	<i>Duttaphrynus melanostictus</i>	Black-spectacled Toad	LC
Amphibians	<i>Duttaphrynus stomaticus</i>		LC
Amphibians	<i>Euphlyctis cyanophlyctis</i>		LC
Amphibians	<i>Fejervarya syhadrensis</i>	Bombay Wart Frog	LC
Amphibians	<i>Hoplobatrachus tigerinus</i>	Indian Bullfrog	LC
Amphibians	<i>Microhyla ornata</i>	Ant Frog	LC
Amphibians	<i>Polypedates maculatus</i>	Himalayan Tree Frog	LC
Amphibians	<i>Sphaerotheca breviceps</i>		LC
Amphibians	<i>Uperodon systoma</i>	Marbled Balloon Frog	LC
Birds	<i>Accipiter badius</i>	Shikra	LC
Birds	<i>Accipiter nisus</i>	Eurasian Sparrowhawk	LC
Birds	<i>Acridotheres fuscus</i>	Jungle Myna	LC
Birds	<i>Acridotheres ginginianus</i>	Bank Myna	LC
Birds	<i>Acridotheres tristis</i>	Common Myna	LC
Birds	<i>Acrocephalus agricola</i>	Paddyfield Warbler	LC
Birds	<i>Acrocephalus dumetorum</i>	Blyth's Reed-warbler	LC
Birds	<i>Acrocephalus stentoreus</i>	Clamorous Reed-warbler	LC
Birds	<i>Actitis hypoleucos</i>	Common Sandpiper	LC
Birds	<i>Aegithina nigrolutea</i>	Marshall's Iora	LC
Birds	<i>Aegithina tiphia</i>	Common Iora	LC
Birds	<i>Alaemon alaudipes</i>	Greater Hoopoe-lark	LC
Birds	<i>Alauda gulgula</i>	Oriental Skylark	LC
Birds	<i>Alcedo atthis</i>	Common Kingfisher	LC
Birds	<i>Amandava amandava</i>	Red Avadavat	LC
Birds	<i>Amandava formosa</i>	Green Avadavat	VU
Birds	<i>Amaurornis phoenicurus</i>	White-breasted Waterhen	LC
Birds	<i>Ammomanes phoenicurus</i>	Rufous-tailed Lark	LC
Birds	<i>Anas acuta</i>	Northern Pintail	LC
Birds	<i>Anas crecca</i>	Common Teal	LC
Birds	<i>Anas platyrhynchos</i>	Mallard	LC
Birds	<i>Anas poecilorhynchos</i>	Indian Spot-billed Duck	LC
Birds	<i>Anastomus oscitans</i>	Asian Openbill	LC
Birds	<i>Anhinga melanogaster</i>	Oriental Darter	NT
Birds	<i>Anser anser</i>	Greylag Goose	LC
Birds	<i>Anthropoides virgo</i>	Demoiselle Crane	LC
Birds	<i>Anthus campestris</i>	Tawny Pipit	LC
Birds	<i>Anthus richardi</i>	Richard's Pipit	LC

Birds	<i>Anthus rufulus</i>	Paddyfield Pipit	LC
Birds	<i>Anthus similis</i>	Long-billed Pipit	LC
Birds	<i>Anthus trivialis</i>	Tree Pipit	LC
Birds	<i>Antigone antigone</i>	Sarus Crane	VU
Birds	<i>Apus affinis</i>	Little Swift	LC
Birds	<i>Apus pacificus</i>	Pacific Swift	LC
Birds	<i>Aquila fasciata</i>	Bonelli's Eagle	LC
Birds	<i>Aquila heliaca</i>	Eastern Imperial Eagle	VU
Birds	<i>Aquila nipalensis</i>	Steppe Eagle	EN
Birds	<i>Aquila rapax</i>	Tawny Eagle	LC
Birds	<i>Ardea alba</i>	Great White Egret	LC
Birds	<i>Ardea cinerea</i>	Grey Heron	LC
Birds	<i>Ardea intermedia</i>	Intermediate Egret	LC
Birds	<i>Ardea purpurea</i>	Purple Heron	LC
Birds	<i>Ardeola grayii</i>	Indian Pond-heron	LC
Birds	<i>Argya malcoimi</i>	Large Grey Babbler	LC
Birds	<i>Asio flammeus</i>	Short-eared Owl	LC
Birds	<i>Athene brama</i>	Spotted Owlet	LC
Birds	<i>Aythya ferina</i>	Common Pochard	VU
Birds	<i>Aythya fuligula</i>	Tufted Duck	LC
Birds	<i>Aythya nyroca</i>	Ferruginous Duck	NT
Birds	<i>Botaurus stellaris</i>	Eurasian Bittern	LC
Birds	<i>Bubo bengalensis</i>	Rock Eagle-owl	LC
Birds	<i>Bubo coromandus</i>	Dusky Eagle-owl	LC
Birds	<i>Bubulcus ibis</i>	Cattle Egret	LC
Birds	<i>Burhinus indicus</i>	Indian Thick-knee	LC
Birds	<i>Butastur teesa</i>	White-eyed Buzzard	LC
Birds	<i>Buteo rufinus</i>	Long-legged Buzzard	LC
Birds	<i>Calandrella brachydactyla</i>	Greater Short-toed Lark	LC
Birds	<i>Caprimulgus affinis</i>	Savanna Nightjar	LC
Birds	<i>Caprimulgus asiaticus</i>	Indian Nightjar	LC
Birds	<i>Caprimulgus indicus</i>	Jungle Nightjar	LC
Birds	<i>Caprimulgus mahrattensis</i>	Sykes's Nightjar	LC
Birds	<i>Cecropis daurica</i>	Red-rumped Swallow	LC
Birds	<i>Centropus sinensis</i>	Greater Coucal	LC
Birds	<i>Ceryle rudis</i>	Pied Kingfisher	LC
Birds	<i>Chaetornis striata</i>	Bristled Grassbird	VU
Birds	<i>Charadrius alexandrinus</i>	Kentish Plover	LC
Birds	<i>Charadrius dubius</i>	Little Ringed Plover	LC
Birds	<i>Chlamydotis macqueenii</i>	Asian Houbara	VU

Birds	<i>Chlidonias hybrida</i>	Whiskered Tern	LC
Birds	<i>Chrysomma sinense</i>	Yellow-eyed Babbler	LC
Birds	<i>Ciconia episcopus</i>	Asian Woollyneck	VU
Birds	<i>Ciconia nigra</i>	Black Stork	LC
Birds	<i>Cinnyris asiaticus</i>	Purple Sunbird	LC
Birds	<i>Circaetus gallicus</i>	Short-toed Snake-eagle	LC
Birds	<i>Circus aeruginosus</i>	Western Marsh-harrier	LC
Birds	<i>Circus macrourus</i>	Pallid Harrier	NT
Birds	<i>Cisticola juncidis</i>	Zitting Cisticola	LC
Birds	<i>Clamator jacobinus</i>	Jacobin Cuckoo	LC
Birds	<i>Clanga clanga</i>	Greater Spotted Eagle	VU
Birds	<i>Columba eversmanni</i>	Yellow-eyed Pigeon	VU
Birds	<i>Columba livia</i>	Rock Dove	LC
Birds	<i>Copsychus saularis</i>	Oriental Magpie-robin	LC
Birds	<i>Coracias benghalensis</i>	Indian Roller	LC
Birds	<i>Coracina macul</i>	Indian Cuckooshrike	LC
Birds	<i>Corvus corax</i>	Common Raven	LC
Birds	<i>Corvus splendens</i>	House Crow	LC
Birds	<i>Coturnix coromandelica</i>	Rain Quail	LC
Birds	<i>Coturnix coturnix</i>	Common Quail	LC
Birds	<i>Cuculus canorus</i>	Common Cuckoo	LC
Birds	<i>Cursorius coromandelicus</i>	Indian Courser	LC
Birds	<i>Cursorius cursor</i>	Cream-coloured Courser	LC
Birds	<i>Cyanecula svecica</i>	Bluethroat	LC
Birds	<i>Cyornis tickelliae</i>	Tickell's Blue-flycatcher	LC
Birds	<i>Dendrocitta vagabunda</i>	Rufous Treepie	LC
Birds	<i>Dicrurus macrocercus</i>	Black Drongo	LC
Birds	<i>Dinopium benghalense</i>	Black-rumped Flameback	LC
Birds	<i>Dumetia hypertyra</i>	Tawny-bellied Babbler	LC
Birds	<i>Egretta garzetta</i>	Little Egret	LC
Birds	<i>Elanus caeruleus</i>	Black-winged Kite	LC
Birds	<i>Emberiza bruniceps</i>	Red-headed Bunting	LC
Birds	<i>Emberiza lathami</i>	Crested Bunting	LC
Birds	<i>Ephippiorhynchus asiaticus</i>	Black-necked Stork	NT
Birds	<i>Eremopterix griseus</i>	Ashy-crowned Sparrow-lark	LC
Birds	<i>Eremopterix nigriceps</i>	Black-crowned Sparrow-lark	LC
Birds	<i>Esacus recurvirostris</i>	Great Thick-knee	NT
Birds	<i>Eudynamis scolopaceus</i>	Western Koel	LC
Birds	<i>Eumyias thalassinus</i>	Verditer Flycatcher	LC
Birds	<i>Euodice malabarica</i>	Indian Silverbill	LC

Birds	<i>Falco amurensis</i>	Amur Falcon	LC
Birds	<i>Falco cherrug</i>	Saker Falcon	EN
Birds	<i>Falco chicquera</i>	Red-headed Falcon	NT
Birds	<i>Falco columbarius</i>	Merlin	LC
Birds	<i>Falco jugger</i>	Laggar Falcon	NT
Birds	<i>Falco naumanni</i>	Lesser Kestrel	LC
Birds	<i>Falco peregrinus</i>	Peregrine Falcon	LC
Birds	<i>Falco tinnunculus</i>	Common Kestrel	LC
Birds	<i>Ficedula parva</i>	Red-breasted Flycatcher	LC
Birds	<i>Fringilla monticola</i>	Black Francolin	LC
Birds	<i>Fringilla pictus</i>	Painted Francolin	LC
Birds	<i>Fringilla pondicerianus</i>	Grey Francolin	LC
Birds	<i>Fulica atra</i>	Common Coot	LC
Birds	<i>Galerida cristata</i>	Crested Lark	LC
Birds	<i>Gallicrex cinerea</i>	Watercock	LC
Birds	<i>Gallinago gallinago</i>	Common Snipe	LC
Birds	<i>Gallinula chloropus</i>	Common Moorhen	LC
Birds	<i>Glaucidium radiatum</i>	Jungle Owlet	LC
Birds	<i>Grus grus</i>	Common Crane	LC
Birds	<i>Gymnoris xanthocollis</i>	Chestnut-shouldered Bush-sparrow	LC
Birds	<i>Gyps bengalensis</i>	White-rumped Vulture	CR
Birds	<i>Gyps fulvus</i>	Griffon Vulture	LC
Birds	<i>Gyps indicus</i>	Indian Vulture	CR
Birds	<i>Halcyon smyrnensis</i>	White-breasted Kingfisher	LC
Birds	<i>Haliaeetus leucoryphus</i>	Pallas's Fish-eagle	EN
Birds	<i>Haliastur indus</i>	Brahminy Kite	LC
Birds	<i>Hieraaetus pennatus</i>	Booted Eagle	LC
Birds	<i>Hierococcyx varius</i>	Common Hawk-cuckoo	LC
Birds	<i>Himantopus himantopus</i>	Black-winged Stilt	LC
Birds	<i>Hirundo rustica</i>	Barn Swallow	LC
Birds	<i>Hirundo smithii</i>	Wire-tailed Swallow	LC
Birds	<i>Hydrophasianus chirurgus</i>	Pheasant-tailed Jacana	LC
Birds	<i>Hypothymis azurea</i>	Black-naped Monarch	LC
Birds	<i>Iduna caligata</i>	Booted Warbler	LC
Birds	<i>Iduna rama</i>	Sykes's Warbler	LC
Birds	<i>Jynx torquilla</i>	Eurasian Wryneck	LC
Birds	<i>Ketupa zeylonensis</i>	Brown Fish-owl	LC
Birds	<i>Lanius cristatus</i>	Brown Shrike	LC
Birds	<i>Lanius excubitor</i>	Great Grey Shrike	LC
Birds	<i>Lanius isabellinus</i>	Isabelline Shrike	LC

Birds	<i>Lanius schach</i>	Long-tailed Shrike	LC
Birds	<i>Lanius vittatus</i>	Bay-backed Shrike	LC
Birds	<i>Larus ridibundus</i>	Black-headed Gull	LC
Birds	<i>Leiopicus mahrattensis</i>	Yellow-crowned Woodpecker	LC
Birds	<i>Limosa limosa</i>	Black-tailed Godwit	NT
Birds	<i>Lonchura punctulata</i>	Scaly-breasted Munia	LC
Birds	<i>Limnocolaptes minimus</i>	Jack Snipe	LC
Birds	<i>Macholophus nuchalis</i>	White-naped Tit	VU
Birds	<i>Mareca penelope</i>	Eurasian Wigeon	LC
Birds	<i>Mareca strepera</i>	Gadwall	LC
Birds	<i>Marmaronetta angustirostris</i>	Marbled Teal	VU
Birds	<i>Melanocorypha bimaculata</i>	Bimaculated Lark	LC
Birds	<i>Merops orientalis</i>	Asian Green Bee-eater	LC
Birds	<i>Merops persicus</i>	Blue-cheeked Bee-eater	LC
Birds	<i>Metopidius indicus</i>	Bronze-winged Jacana	LC
Birds	<i>Microcarbo niger</i>	Little Cormorant	LC
Birds	<i>Milvus migrans</i>	Black Kite	LC
Birds	<i>Mirafra erythroptera</i>	Indian Bushlark	LC
Birds	<i>Mirafra javanica</i>	Horsfield's Bushlark	LC
Birds	<i>Monticola solitarius</i>	Blue Rock-thrush	LC
Birds	<i>Motacilla alba</i>	White Wagtail	LC
Birds	<i>Motacilla cinerea</i>	Grey Wagtail	LC
Birds	<i>Motacilla citreola</i>	Citrine Wagtail	LC
Birds	<i>Motacilla flava</i>	Western Yellow Wagtail	LC
Birds	<i>Motacilla maderaspatensis</i>	White-browed Wagtail	LC
Birds	<i>Muscicapa dauurica</i>	Asian Brown Flycatcher	LC
Birds	<i>Mycteria leucocephala</i>	Painted Stork	NT
Birds	<i>Myophonus horsfieldii</i>	Malabar Whistling-thrush	LC
Birds	<i>Neophron percnopterus</i>	Egyptian Vulture	EN
Birds	<i>Nettapus coromandelianus</i>	Cotton Pygmy-goose	LC
Birds	<i>Nycticorax nycticorax</i>	Black-crowned Night-heron	LC
Birds	<i>Oenanthe chrysopygia</i>	Red-tailed Wheatear	LC
Birds	<i>Oenanthe deserti</i>	Desert Wheatear	LC
Birds	<i>Oenanthe fusca</i>	Brown Rockchat	LC
Birds	<i>Oenanthe isabellina</i>	Isabelline Wheatear	LC
Birds	<i>Oenanthe picata</i>	Variable Wheatear	LC
Birds	<i>Oriolus kundoo</i>	Indian Golden Oriole	LC
Birds	<i>Oriolus xanthornus</i>	Black-hooded Oriole	LC
Birds	<i>Orthotomus sutorius</i>	Common Tailorbird	LC
Birds	<i>Otus bakkamoena</i>	Indian Scops-owl	LC

Birds	<i>Otus brucei</i>	Pallid Scops-owl	LC
Birds	<i>Pandion haliaetus</i>	Osprey	LC
Birds	<i>Parus major</i>	Great Tit	LC
Birds	<i>Passer domesticus</i>	House Sparrow	LC
Birds	<i>Pavo cristatus</i>	Indian Peafowl	LC
Birds	<i>Pelecanus crispus</i>	Dalmatian Pelican	NT
Birds	<i>Pelecanus onocrotalus</i>	Great White Pelican	LC
Birds	<i>Pelecanus philippensis</i>	Spot-billed Pelican	NT
Birds	<i>Perdica argoondah</i>	Rock Bush-quail	LC
Birds	<i>Perdica asiatica</i>	Jungle Bush-quail	LC
Birds	<i>Pericrocotus cinnamomeus</i>	Small Minivet	LC
Birds	<i>Pericrocotus erythropygius</i>	White-bellied Minivet	LC
Birds	<i>Pericrocotus ethologus</i>	Long-tailed Minivet	LC
Birds	<i>Pernis ptilorhynchus</i>	Oriental Honey-buzzard	LC
Birds	<i>Phalacrocorax carbo</i>	Great Cormorant	LC
Birds	<i>Phoenicopterus roseus</i>	Greater Flamingo	LC
Birds	<i>Phoenicurus ochrurus</i>	Black Redstart	LC
Birds	<i>Phylloscopus affinis</i>	Tickell's Leaf-warbler	LC
Birds	<i>Phylloscopus humei</i>	Hume's Leaf-warbler	LC
Birds	<i>Phylloscopus neglectus</i>	Plain Leaf-warbler	LC
Birds	<i>Phylloscopus tristis</i>	Siberian Chiffchaff	LC
Birds	<i>Phylloscopus trochiloides</i>	Greenish Warbler	LC
Birds	<i>Pitta brachyura</i>	Indian Pitta	LC
Birds	<i>Platalea leucorodia</i>	Eurasian Spoonbill	LC
Birds	<i>Plegadis falcinellus</i>	Glossy Ibis	LC
Birds	<i>Ploceus manyar</i>	Streaked Weaver	LC
Birds	<i>Ploceus philippinus</i>	Baya Weaver	LC
Birds	<i>Podiceps cristatus</i>	Great Crested Grebe	LC
Birds	<i>Podiceps nigricollis</i>	Black-necked Grebe	LC
Birds	<i>Pomatorhinus horsfieldii</i>	Indian Scimitar-babbler	LC
Birds	<i>Porphyrio porphyrio</i>	Purple Swampphen	LC
Birds	<i>Porzana porzana</i>	Spotted Crane	LC
Birds	<i>Prinia buchanani</i>	Rufous-fronted Prinia	LC
Birds	<i>Prinia gracilis</i>	Graceful Prinia	LC
Birds	<i>Prinia hodgsonii</i>	Grey-breasted Prinia	LC
Birds	<i>Prinia inornata</i>	Plain Prinia	LC
Birds	<i>Prinia socialis</i>	Ashy Prinia	LC
Birds	<i>Prinia sylvatica</i>	Jungle Prinia	LC
Birds	<i>Psilopogon haemacephalus</i>	Coppersmith Barbet	LC
Birds	<i>Psilopogon zeylanicus</i>	Brown-headed Barbet	LC

Birds	<i>Psittacula cyanocephala</i>	Plum-headed Parakeet	LC
Birds	<i>Psittacula krameri</i>	Rose-ringed Parakeet	LC
Birds	<i>Pterocles exustus</i>	Chestnut-bellied Sandgrouse	LC
Birds	<i>Pterocles indicus</i>	Painted Sandgrouse	LC
Birds	<i>Ptyonoprogne concolor</i>	Dusky Crag Martin	LC
Birds	<i>Pycnonotus cafer</i>	Red-vented Bulbul	LC
Birds	<i>Recurvirostra avosetta</i>	Pied Avocet	LC
Birds	<i>Rhipidura albogularis</i>	White-spotted Fantail	LC
Birds	<i>Rhipidura aureola</i>	White-browed Fantail	LC
Birds	<i>Riparia chinensis</i>	Asian Plain Martin	LC
Birds	<i>Riparia diluta</i>	Pale Sand Martin	LC
Birds	<i>Rostratula benghalensis</i>	Greater Painted-snipe	LC
Birds	<i>Salpornis spilonota</i>	Indian Spotted Creeper	LC
Birds	<i>Sarcogyps calvus</i>	Red-headed Vulture	CR
Birds	<i>Sarkidiornis melanotos</i>	African Comb Duck	LC
Birds	<i>Saxicola caprata</i>	Pied Bushchat	LC
Birds	<i>Saxicola macrorhynchus</i>	White-browed Bushchat	VU
Birds	<i>Saxicola torquatus</i>	Common Stonechat	LC
Birds	<i>Saxicoloides fulicatus</i>	Indian Robin	LC
Birds	<i>Spatula clypeata</i>	Northern Shoveler	LC
Birds	<i>Spatula querquedula</i>	Garganey	LC
Birds	<i>Spilopelia senegalensis</i>	Laughing Dove	LC
Birds	<i>Spilopelia suratensis</i>	Western Spotted Dove	LC
Birds	<i>Sterna acuticauda</i>	Black-bellied Tern	EN
Birds	<i>Sterna aurantia</i>	River Tern	NT
Birds	<i>Streptopelia decaocto</i>	Eurasian Collared-dove	LC
Birds	<i>Streptopelia tranquebarica</i>	Red Turtle-dove	LC
Birds	<i>Strix ocellata</i>	Mottled Wood-owl	LC
Birds	<i>Sturnia malabarica</i>	Chestnut-tailed Starling	LC
Birds	<i>Sturnia pagodarum</i>	Brahminy Starling	LC
Birds	<i>Sturnus vulgaris</i>	Common Starling	LC
Birds	<i>Sylvia curruca</i>	Lesser Whitethroat	LC
Birds	<i>Sylvia nana</i>	Asian Desert Warbler	LC
Birds	<i>Sypheotides indicus</i>	Lesser Florican	EN
Birds	<i>Taccocua leschenaultii</i>	Sirkeer Malkoha	LC
Birds	<i>Tachybaptus ruficollis</i>	Little Grebe	LC
Birds	<i>Tadorna ferruginea</i>	Ruddy Shelduck	LC
Birds	<i>Tephrodornis pondicerianus</i>	Common Woodshrike	LC
Birds	<i>Terpsiphone paradisi</i>	Indian Paradise-flycatcher	LC
Birds	<i>Threskiornis melanocephalus</i>	Black-headed ibis	NT

Birds	<i>Treron phoenicopterus</i>	Yellow-footed Green-pigeon	LC
Birds	<i>Tringa erythropus</i>	Spotted Redshank	LC
Birds	<i>Tringa glareola</i>	Wood Sandpiper	LC
Birds	<i>Tringa nebularia</i>	Common Greenshank	LC
Birds	<i>Tringa ochropus</i>	Green Sandpiper	LC
Birds	<i>Tringa stagnatilis</i>	Marsh Sandpiper	LC
Birds	<i>Tringa totanus</i>	Common Redshank	LC
Birds	<i>Turdoides striata</i>	Jungle Babbler	LC
Birds	<i>Turnix suscitator</i>	Barred Buttonquail	LC
Birds	<i>Turnix sylvaticus</i>	Common Buttonquail	LC
Birds	<i>Turnix tanki</i>	Yellow-legged Buttonquail	LC
Birds	<i>Tyto alba</i>	Common Barn-owl	LC
Birds	<i>Upupa epops</i>	Common Hoopoe	LC
Birds	<i>Vanellus gregarius</i>	Sociable Lapwing	CR
Birds	<i>Vanellus indicus</i>	Red-wattled Lapwing	LC
Birds	<i>Vanellus malabaricus</i>	Yellow-wattled Lapwing	LC
Birds	<i>Vanellus vanellus</i>	Northern Lapwing	NT
Birds	<i>Zapornia akool</i>	Brown Crake	LC
Birds	<i>Zosterops palpebrosus</i>	Oriental White-eye	LC
Fishes	<i>Bagarius yarrelli</i>		NT
Fishes	<i>Bangana ariza</i>	Ariza Labeo	LC
Fishes	<i>Channa gachua</i>	Dwarf Snakehead	LC
Fishes	<i>Channa marulius</i>		LC
Fishes	<i>Cirrhinus mrigala</i>	Mrigal	LC
Fishes	<i>Cirrhinus reba</i>	Reba Carp	LC
Fishes	<i>Esomus danrica</i>	Flying barb	LC
Fishes	<i>Gibellon catla</i>	Catla	LC
Fishes	<i>Labeo bata</i>	Minor Carp	LC
Fishes	<i>Labeo boggut</i>	Boggut labeo	LC
Fishes	<i>Lepidocephalus guntea</i>	Peppered Loach	LC
Fishes	<i>Mastacembelus armatus</i>	Spiny eel	LC
Fishes	<i>Monopterus albus</i>	Rice swampee	LC
Fishes	<i>Nandus nandus</i>		LC
Fishes	<i>Nangra nangra</i>	Kosi Nangra	LC
Fishes	<i>Nemacheilus denisoni</i>		LC
Fishes	<i>Neotropius atherinoides</i>		LC
Fishes	<i>Notopterus notopterus</i>		LC
Fishes	<i>Ompok bimaculatus</i>		NT
Fishes	<i>Parachanna hodgarti</i>	Torrent Catfish	LC
Fishes	<i>Parambassis ranga</i>	Indian Glassy Fish	LC

Fishes	<i>Platycephalus indicus</i>	Bartail Flathead	DD
Fishes	<i>Pseudapocryptes elongatus</i>		LC
Fishes	<i>Puntius vittatus</i>		LC
Fishes	<i>Rasbora daniconius</i>	Slender Barb	LC
Fishes	<i>Silonia silondia</i>	Silong Catfish	LC
Fishes	<i>Sperata aor</i>	Long-whiskered Catfish	LC
Fishes	<i>Wallago attu</i>		NT
Invertebrates	<i>Acisoma panorpoides</i>	Grizzled Pintail	LC
Invertebrates	<i>Agriocnemis pygmaea</i>	Wandering Midget	LC
Invertebrates	<i>Anax ephippiger</i>	Vagrant Emperor	LC
Invertebrates	<i>Archibasis oscillans</i>		LC
Invertebrates	<i>Bellamia bengalensis</i>		LC
Invertebrates	<i>Bithynia cerameopoma</i>		LC
Invertebrates	<i>Bithynia pulchella</i>		LC
Invertebrates	<i>Brachythemis contaminata</i>		LC
Invertebrates	<i>Bradinopyga geminata</i>		LC
Invertebrates	<i>Cercion malayanum</i>		LC
Invertebrates	<i>Ceriatrion cerinorubellum</i>		LC
Invertebrates	<i>Ceriatrion coromandelianum</i>		LC
Invertebrates	<i>Cerithium corallium</i>	Coral Cerith	LC
Invertebrates	<i>Clenchiella microscopica</i>		LC
Invertebrates	<i>Coelicia didyma</i>		LC
Invertebrates	<i>Cratilla metallica</i>		LC
Invertebrates	<i>Diplacodes trivialis</i>		LC
Invertebrates	<i>Ferrissia verruca</i>		LC
Invertebrates	<i>Gabbia orcula</i>		LC
Invertebrates	<i>Gyraulus convexiusculus</i>		LC
Invertebrates	<i>Gyraulus rotula</i>		LC
Invertebrates	<i>Indopianorbis exustus</i>		LC
Invertebrates	<i>Intha umbilicalis</i>		LC
Invertebrates	<i>Ischnura senegalensis</i>	Tropical Bluetail	LC
Invertebrates	<i>Lamellidens corrianus</i>		LC
Invertebrates	<i>Lamellidens marginalis</i>		LC
Invertebrates	<i>Lestes concinnus</i>	Dusky Spreadwing	LC
Invertebrates	<i>Lestes thoracicus</i>		LC
Invertebrates	<i>Lestes umbrinus</i>		DD
Invertebrates	<i>Libellago lineata</i>		LC
Invertebrates	<i>Lymnaea acuminata</i>		LC
Invertebrates	<i>Lymnaea luteola</i>		LC
Invertebrates	<i>Mekongia crassa</i>		LC

Invertebrates	<i>Melanoides tuberculata</i>		LC
Invertebrates	<i>Neritina violacea</i>	Red-mouth Nerite Snail	LC
Invertebrates	<i>Neurobasis chinensis</i>		LC
Invertebrates	<i>Onychargia atrocyana</i>		LC
Invertebrates	<i>Orthetrum luzonicum</i>		LC
Invertebrates	<i>Pantala flavescens</i>	Wandering Glider	LC
Invertebrates	<i>Parreysia corrugata</i>		LC
Invertebrates	<i>Parreysia occata</i>		LC
Invertebrates	<i>Parreysia rajahensis</i>		LC
Invertebrates	<i>Pila globosa</i>		LC
Invertebrates	<i>Pisidium prasongi</i>		LC
Invertebrates	<i>Polymesoda expansa</i>	Marsh Clam	LC
Invertebrates	<i>Pomacea lineata</i>		LC
Invertebrates	<i>Pseudagrion rubriceps</i>		LC
Invertebrates	<i>Rhinocypha biforata</i>		LC
Invertebrates	<i>Rhyothemis variegata</i>		LC
Invertebrates	<i>Tarebia granifera</i>		LC
Invertebrates	<i>Thiara rudis</i>		LC
Invertebrates	<i>Tholymis tillarga</i>	Old World Twister	LC
Invertebrates	<i>Tremea basilaris</i>	Keyhole Glider	LC
Invertebrates	<i>Tremea limbata</i>	Ferruginous Glider	LC
Invertebrates	<i>Trithemis aurora</i>		LC
Invertebrates	<i>Trithemis kirbyi</i>	Orange-winged Dropwing	LC
Invertebrates	<i>Trithemis pallidinervis</i>	Dancing Dropwing	LC
Invertebrates	<i>Urothemis signata</i>		LC
Invertebrates	<i>Zygonyx torridus</i>	Ringed Cascader	LC
Mammals	<i>Antelope cervicapra</i>	Blackbuck	LC
Mammals	<i>Axis axis</i>	Chital	LC
Mammals	<i>Bandicota bengalensis</i>	Lesser Bandicoot Rat	LC
Mammals	<i>Bandicota indica</i>	Greater Bandicoot Rat	LC
Mammals	<i>Boselaphus tragocamelus</i>	Nilgai	LC
Mammals	<i>Canis aureus</i>	Golden Jackal	LC
Mammals	<i>Caracal caracal</i>	Caracal	LC
Mammals	<i>Chaerephon plicatus</i>	Wrinkle-lipped Free-tailed Bat	LC
Mammals	<i>Cremnomys cutchicus</i>	Cutch Rock-rat	LC
Mammals	<i>Cynopterus sphinx</i>	Greater Shortnosed Fruit Bat	LC
Mammals	<i>Felis chaus</i>	Jungle Cat	LC
Mammals	<i>Funambulus pennantii</i>	Five-striped Palm Squirrel	LC
Mammals	<i>Gazella bennettii</i>	Chinkara	LC
Mammals	<i>Gerbillus gleadowi</i>	Little Hairy-footed Gerbil	LC

Mammals	<i>Gerbillus nanus</i>	Dwarf Gerbil	LC
Mammals	<i>Golunda ellioti</i>	Indian Bush-rat	LC
Mammals	<i>Hemiechinus collaris</i>	Indian Long-eared Hedgehog	LC
Mammals	<i>Herpestes auropunctatus</i>	Small Indian Mongoose	LC
Mammals	<i>Herpestes edwardsii</i>	Indian Grey Mongoose	LC
Mammals	<i>Herpestes smithii</i>	Ruddy Mongoose	LC
Mammals	<i>Hipposideros fulvus</i>	Fulvus Leaf-nosed Bat	LC
Mammals	<i>Hipposideros galeritus</i>	Cantor's Leaf-nosed Bat	LC
Mammals	<i>Hyaena hyaena</i>	Striped Hyaena	NT
Mammals	<i>Hystrix indica</i>	Indian Crested Porcupine	LC
Mammals	<i>Lepus nigricollis</i>	Indian Hare	LC
Mammals	<i>Macaca mulatta</i>	Rhesus Monkey	LC
Mammals	<i>Manis crassicaudata</i>	Indian Pangolin	EN
Mammals	<i>Megaderma lyra</i>	Greater False Vampire	LC
Mammals	<i>Mellivora capensis</i>	Honey Badger	LC
Mammals	<i>Melursus ursinus</i>	Sloth Bear	VU
Mammals	<i>Meriones hurrianae</i>	Indian Desert Gerbil	LC
Mammals	<i>Millardia gleadowi</i>	Sand-coloured Metad	LC
Mammals	<i>Millardia meltada</i>	Soft-furred Metad	LC
Mammals	<i>Mus booduga</i>	Little Indian Field Mouse	LC
Mammals	<i>Mus musculus</i>	House Mouse	LC
Mammals	<i>Mus phillipsi</i>	Wroughton's Small Spiny Mouse	LC
Mammals	<i>Mus saxicola</i>	Brown Spiny Mouse	LC
Mammals	<i>Mus terricolor</i>	Earth-colored Mouse	LC
Mammals	<i>Panthera pardus</i>	Leopard	VU
Mammals	<i>Paradoxurus hermaphroditus</i>	Common Palm Civet	LC
Mammals	<i>Paraechinus micropus</i>	Indian Hedgehog	LC
Mammals	<i>Pipistrellus ceylonicus</i>	Kelaart's Pipistrelle	LC
Mammals	<i>Pipistrellus tenuis</i>	Least Pipistrelle	LC
Mammals	<i>Prionailurus rubiginosus</i>	Rusty-spotted Cat	NT
Mammals	<i>Pteropus giganteus</i>	Indian Flying Fox	LC
Mammals	<i>Rattus rattus</i>	House Rat	LC
Mammals	<i>Rhinopoma microphyllum</i>	Greater Mouse-tailed Bat	LC
Mammals	<i>Rousettus leschenaultii</i>	Leschenault's Rousette	LC
Mammals	<i>Scotophilus heathii</i>	Greater Asiatic Yellow House Bat	LC
Mammals	<i>Scotophilus kuhlii</i>	Lesser Asiatic Yellow House Bat	LC
Mammals	<i>Scotozous dormeri</i>	Dormer's Pipistrelle	LC
Mammals	<i>Semnopithecus dussumieri</i>	Southern Plains Gray Langur	LC
Mammals	<i>Suncus murinus</i>	House Shrew	LC
Mammals	<i>Suncus stoliczkanus</i>	Anderson's Shrew	LC

Mammals	<i>Sus scrofa</i>	Wild Boar	LC
Mammals	<i>Tadarida aegyptiaca</i>	Egyptian Free-tailed Bat	LC
Mammals	<i>Taphozous longimanus</i>	Long-winged Tomb Bat	LC
Mammals	<i>Taphozous melanopogon</i>	Black-bearded Tomb Bat	LC
Mammals	<i>Taphozous nudiventris</i>	Naked-rumped Tomb Bat	LC
Mammals	<i>Taphozous perforatus</i>	Egyptian Tomb Bat	LC
Mammals	<i>Tatera indica</i>	Indian Gerbil	LC
Mammals	<i>Tetracerus quadricornis</i>	Four-horned Antelope	VU
Mammals	<i>Vandeleuria oleracea</i>	Asiatic Long-tailed Climbing Mouse	LC
Mammals	<i>Viverricula indica</i>	Small Indian Civet	LC
Mammals	<i>Vulpes bengalensis</i>	Bengal Fox	LC
Mammals	<i>Vulpes vulpes</i>	Red Fox	LC
Plants	<i>Anacyclus pyrethrum</i>	Atlas Daisy	VU
Plants	<i>Isachne globosa</i>	Swamp Millet	LC
Plants	<i>Medicago sativa</i>	Alfalfa	LC
Plants	<i>Prunus bifrons</i>		DD
Reptiles	<i>Boiga forsteni</i>	Reddish Peninsular Cat Snake	LC
Reptiles	<i>Calotes minor</i>	Hardwicke's Bloodsucker	DD
Reptiles	<i>Chamaeleo zeylanicus</i>	Asian Chameleon	LC
Reptiles	<i>Crocodylus palustris</i>	Mugger	VU
Reptiles	<i>Eutropis carinata</i>	Keeled Indian Mabuya	LC
Reptiles	<i>Geoclemys hamiltonii</i>	Spotted Pond Turtle	VU
Reptiles	<i>Lissemys punctata</i>	Indian Flapshell Turtle	LR/lc
Reptiles	<i>Nilssonina gangetica</i>	Indian Softshell Turtle	VU
Reptiles	<i>Ophisops jerdonii</i>	Punjab-snake-eyed Lacerta	LC
Reptiles	<i>Ophisops microlepis</i>		LC
Reptiles	<i>Pangshura tecta</i>	Indian Roofed Turtle	LR/lc
Reptiles	<i>Psammophis condanarus</i>	Indo-chinese Sand Snake	LC
Reptiles	<i>Pseudocerastes persicus</i>	Perisan Horned Viper	LC
Reptiles	<i>Sitana ponticeriana</i>	Fan Throated Lizard	LC
Reptiles	<i>Varanus bengalensis</i>	Common Indian Monitor	LC



About IBAT

The Integrated Biodiversity Assessment Tool (IBAT) provides key decision-makers with access to critical information on biodiversity priority sites to inform risk management and decision-making processes that address potential biodiversity impacts. Developed through a partnership of BirdLife International, Conservation International, International Union for Conservation of Nature (IUCN) and United Nations Environment Programme World Conservation Monitoring Centre (UNEP-WCMC), the vision of IBAT is that decisions affecting critical natural habitats are informed by the best scientific information and in turn decision makers will support the quest to collect and enhance the underlying datasets and maintain that scientific information.

Appendix 17: Salient features of the Bhaisa Singh Dam

S.No.	Particulars	Values	
		F.P.S.	M.K.S.
1	Total Catchment Area	15.50 Sq.mile	40.145 Sq.Km.
2	Type Catchment Area	Good	Good
3	Average Rainfall	24.4 inch	620 inch
4	Expected Yeild as per strange able	174.738 mcft.	4.948 mcum
5	Gross Storage Capacity	179.00 mcft.	5.07 mcum
6	Live Storage Capacity	163.00 mcft.	4.616 mcum
7	Dead Storage	16 mcft.	0.453 mcum
8	Length of dam	617 ft.	188.00 mt.
9	Top Width of Dam	9.84 ft.	3 mt.
10	Length of earthen Dam	230 ft.	70 mt.
12	T.B.L. Level	498.70 ft.	152.04 mt.
13	M.W.L. Level	494.84 ft.	150.83 mt.
14	F.T.L. Level	488.84 ft.	149.00 mt.
15	Sill R.L.	452.87 ft.	138.07 mt.
16	Maximum Flood Discharge	12820 Cuses	362.81 Cuses
17	Free Board	4 Ft	1.21 Mt.
18	Flood Lift	6 Ft.	1.83 Mt.
19	G.C.A.	1112.49 Acre	450.40 Ha.
20	C.C.A.	1035.70 Acre	419.315 Ha.
21	I.C.A.	863.34 Acre	349.53 Ha.
22	Life of Dam	308 years	308 Year
23	Canal Discharge at Head RMC/Khara Minor	7.07 / 10.70 Cusecs	0.20/0.3029 Cumecs

Water Received in Bhainsa Singh dam in last 4 years

S.No.	Year	Bhainsa Singh Dam		REMARK
		Gauge in Feet	Capacity in MCFT	
1	2014	10.93	5.069	Over flowing every year in Monsoon since its construction in 2014
2	2015	10.93	5.069	
3	2016	10.93	5.069	
4	2017	10.93	5.069	

Source: Data received from irrigation department Abu Road

Appendix 18: Source sustainability analysis

ABUROAD WATER SUPPLY AND SEWERAGE PROJECT

WATER SUPPLY SOURCE SUSTAINABILITY

WATER RESOURCES ASSESSMENT
Surface Water + Ground Water

UNDER

RAJASTHAN SECONDARY TOWN DEVELOPMENT SECTOR PROJECT

(RSTDSP- RUIDP, Ph-IV)

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<u>Annexure-2: Gauge Level and Water Storage data from WRD</u>

Abbreviations:

DPR	-Detail Project Report
TW	- Tube well
OW	- Open well
KLD	- Kilolitre per Day
MLD	- Million Litre per Day
lpcd	- Litres per capita per day
GPH	- Gallon per Hectare
KLH	-Kilolitre per Hectare
MCM	-Million Cubic Meter
Mcf	-Million Cubic Feet.
Cusecs	-Cubic feet per second.
m/mtr.	-meter
mm	-Millimetre
Yr.	- Year
Ha.	-Hectare
O&M	-Operation and Maintenance
AMSL	-Above Mean Sea Level
GoI	-Government of India
GoR	-Government of Rajasthan
UN	-United Nations
PHED	-Public Health Engineering Department
WRD	-Water Resource Department
GWD	- Ground Water Department
CGWB	- Centre Ground Water Board
CWC	-Centre Wate Commission
LPD	-Litres per Day
RUIDP	-Rajasthan Urban Infrastructure Development Project

1. Existing water supply source

1.1 Quantity

At present water supply of Aburoad town is totally dependent on ground water source. The water supply is being made through 11 open wells and 13 tube wells. The well field is in the city. The details of tube well and open well are as under: -

Table 1- Detail of Existing Tube wells and Open wells

Zones	Name of Zone	Source	OW	TW
1	Aabkari Area	Aabkari O.W.	1	-
2	Sabji Mandi Area	Hanuman O.W.	1	-
		Banas O.W.	1	-
		Morchary O.W.	1	-
		O.W.	1	-
		O.W.	1	-
3	Luniyapura Area		-	1
4	Keserganj Area		-	
5	Santpur (naya khera)	Santpur	-	1
		Chandrawati T.W. No.1	-	1
		Chandrawati T.W. No.2	-	1
		Chandrawati T.W. No. 3	-	1
		Moongthalia T/W 1,2	-	2
		Amrapuri	-	1
6	Gandhi Nagar Area	Kui Sangna O.W. 1	1	-
		Kui Sangna O.W. 2	1	-
		Kui Sangna O.W. 3	1	-
		Kui Sangna TW No. 1	-	1
		Kui Sangna TW No. 2	-	1
		Kui Sangna TW No. 3	-	1
7	Manpur,Akara Bhatta & Housing Board Area	Akara Bhatta O.W. No. 1	1	1
		Akara Bhatta O.W. No. 2	1	-
		Moongthalia	-	-
		Umari	-	1
	TOTAL	Total	11	13

OW- Open well, TW- Tube well

The total production from above tube well and open well is 3750 KLD in summer and 4700 KLD in winter. The total per day supply is 3105 KLD in summer and 4230 KLD in winter. Supply interval is 48 hours. The present service level in town is only 50-55 lpcd and the water is supplied for one and half hour in duration of 48 Hrs.

1.2 Quality

Water is potable without odour, colour and hardness. Fluoride ranges between 0.4 to 1.4 which is within permissible limit as per IS:10500. Public Health Engineering

RSTDSP

Aburoad Water Supply

Department has its own testing facility where regular sampling of water is being done. Detail of sample tested by PHED collected and attached as Annexure-1. One of the sample is shown below:-

OFFICE OF THE JUNIOR CHEMIST
PUBLIC HEALTH ENGINEERING DEPARTMENT, LABORATORY ABU ROAD
REPORT OF THE CHEMICAL EXAMINATION OF WATER

No. Lab/Tech/Chem/2018-2019/_____ Date: _____

To: **Assistant Engineer**
P.H.E.D. Sub Division
Aburoad District: **Sirohi**
Block: **Abu Road**

Reference: Your Letter No. _____ Sp.1 Date: 28/03/2018 Name of Sample Taker: A.E. staff
Date of Receipt: 28/03/2018 Ref. ID: 3

Source	TS	TW	SD	TW
Source Location	Man- had-Mandawa	Man- had-Mandawa	Man- had-Mandawa	Man- had-Mandawa
Village/Town	Abu Road (Sirohi)	Abu Road (Sirohi)	Sirohi	Abu Road
Hydrant	Abu Road (Sirohi)	Abu Road (Sirohi)	Sirohi	Abu Road
Village Code No.	0	0	0	0
Date of Collection	28/03/2018	28/03/2018	28/03/2018	28/03/2018
Date of Examination	05/04/2018	05/04/2018	05/04/2018	05/04/2018
Lab. Sample No.	17	18	19	20

Note: - All results Except pH are in mg/L

1. pH	7.5	7.5	7.5	7.4
2. Turbidity (NTU)	Clear	Clear	Clear	Clear
3. Colour	None	None	None	None
4. Odour	None	None	None	None
5. Temperature (°C)	25	25	25	25
6. Total Alkalinity (as CaCO ₃)	-	-	-	-
7. Total Hardness (as CaCO ₃)	-	-	-	-
8. Calcium Hardness (as CaCO ₃)	-	-	-	-
9. Magnesium Hardness (as CaCO ₃)	-	-	-	-
10. Chloride (as Cl ⁻)	160	150	160	160
11. Sulphate (as SO ₄ ²⁻)	-	-	-	-
12. Nitrite (as NO ₂ ⁻)	0	0	0	0
13. Nitrate (as NO ₃ ⁻)	4	2	11	12
14. Fluoride (as F ⁻)	0.6	1.4	1.2	0.6
15. Total Dissolved Solids	340	730	790	500
16. Iron	-	-	-	-
17. Residual Chlorine	-	-	-	-

Junior Chemist
PHED Lab Abu Road
Date: _____

No. Lab/Tech/Chem/2018-2019/_____ Copy to:
1 The Chief Chemist, Public Health Engineering Department, Rajasthan, Jaipur.
2 The Executive Engineer, PHED Division Sirohi/Abu Road
3 _____

Junior Chemist

P.T.O.

Figure 1:- Water sample test report under ground water

2. Proposed water supply demand and source

2.1 Water Supply Demand

Water demand for the town @ 135 LPCD at consumer end based on the present as well as projected population for base year (2021) & ultimate design year (2051) considering 30-year design period based on census 2011 and water demand for Aburoad town is as below: -

Table 2- Project Population and Water Demand of Aburoad Town

Year	Stage	Population	Consumer End Water Demand (MLD)
2021	Base Year	63,554	8.60
2036	Intermediate year	76,212	10.30
2051	Ultimate Year	89,742	12.20

During Project formulation and on decision of the proposed source for Aburoad town, Chief Engineer, Project PHED, Jodhpur, also requested to RUIDP to consider the villages 6 peripheral villages of the Aburoad town while considering the demand from the proposed surface water source Bhaisa Singh Dam vide letter no. 5371-74, dt. 18.07.2017.

Table 3- Project Population and Water Demand of Aburoad Town

S. No.	Name of Village	Population Projection			Demand @ 40 LPD (KLD) at consumer end		
		2021	2036	2051	2021	2036	2051
1	2	4	5	6	7	8	9
1	Manpur	1237	1483	1746	49.50	59.32	69.84
2	Tartoli	1521	1824	2148	60.80	72.96	85.92
3	Khadat	1885	2260	2662	75.40	90.40	106.48
4	Umarani	1232	1478	1740	49.30	59.12	69.60
5	Kui	2483	2977	3506	99.30	119.08	140.24
6	Santpur	10500	12592	14827	420.00	503.68	593.08
	Total	18858	22614	26629	754.30	904.56	1065.16

Total Raw water requirement (MLD) for town considering 135 lpcd at consumer end and 15% losses is as below:-

Table 4- Raw Water Demand of Aburoad Town & Six Peripheral Villages

Year	Stage	Consumer End Water Demand		Raw Water Demand
		Urban	Rural	
2021	Base Year	8.60	0.75	10.97
2036	Intermediate year	10.30	0.91	13.15
2051	Ultimate Year	12.20	1.07	15.56

RSTDSP

Aburoad Water Supply

Ar. Pali /215

OFFICE OF THE CHIEF ENGINEER PROJECT, PHED, JODHPUR
 Tel No. 0291-2651700 Fax No. 0291-2651734 E-Mail:- rj_cejod@nic.in
 No:-CEP/PHE/Ju./ Ar. Pali/ 2017-18 / 5371-5374 Date:- 18/7/17

Chief Engineer
 RUIDP
 Jaipur

Subject :- Solution of Drinking water problem in Abu Raod town and nearby villages
 Distt Sirhi

Ref :- Meeting held on dt 16.06.2017 with PHED and RUIDP officials to discuss
 source for water availability for preparation of DPR for the Phase IV towns

In view of above subjected matter and as per decision taken in the above meeting
 referred above vide item no. A (i) " Abu Road :- Present source is tube well and open wells .
 Bhainsa Singh Dam may be considered as proposed source for DPR preparation upto design
 year 2036 and 2051. It was decided to get DPR prepared considering Bhainsa Singh Dam as
 " surface source. "

Therefore, pl. clarify whether complete Project from Bhainsa Singh Dam to Abu Road
 will be taken up by you under RUIDP or shall be restricted to water supply with urban town
 Abu Road only, and development of source at Bhainsa Singh Dam, treatment plant and carrier
 to Abu Road six + village are to be taken with state fund by PHED.

(P.S. Chauhan)
 Chief Engineer Project
 PHED, Jodhpur

No:-CEP/PHE/Ju./ Ar. Jawai/ /2017-18 / 5371-5374 Date:- 18/7/17
 Copy following for information and necessary action :-

1. Chief Engineer (S.P.) PHED Jaipur.
2. Superintending Engineer PHED Project Circle Pali.
3. Executive Engineer PHED Project Div. Sirhi.

(P.S. Chauhan)
 Chief Engineer Project
 PHED, Jodhpur

10/5-2
 22
 11/8/17

APD (PH-III)
 22
 11/8/17

Figure 2:- Letter from CE, Project, PHED, Jodhpur

RUIDP

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2.2 Proposed Water Supply Source

Since the available ground water quantity is not enough to supply water to the town @ 135 LPCD at consumer end for demand as give above, additional tube wells proposed for the town along with surface water source i.e. Bhaisa Singh Dam.

2.3 Surface Water Source

For surface water source PHED, proposed Bhaisa Singh Dam vide letter as given in Fig.-2. This Dam was constructed by the Water Resource Department of Government of Rajasthan in year 2014. After maintaining it for two years, the dam was transferred to PHED vide letter no. 2171, dt. 29.07.2016 (Fig.-3) and handed over on 13.10.2016. (Fig.-4). This dam is for the drinking water supply of Aburoad town and peripheral villages as confirmed by EE, PHED Aburoad vide letter no. 1640, dt. 13.12.2019 (Fig.-5). *Salient features of the Dam are as follows: -*

Table 5- Salient features of Bhaisa Singh Dam

S.NO.	PARTICULAR	RE-REVISED	
		F.P.S.	M.K.S.
1	Basin	West Banas River	
2	Total Catchment Area	15.50 Sq.mile	40.145 Sq.Km.
3	Type Catchment Area	Good	Good
4	Average Rainfall	24.4 inch	620 inch
5	Expected Yeild as per strange able	174.738 mcft.	4.948 MCM
6	Gross Storage Capacity	179.00 mcft.	5.07 MCM
7	Live Storage Capacity	163.00 mcft.	4.616 MCM
8	Dead Storage	16 mcft.	0.453 MCM
9	Total Length of Dam	617 ft.	188.00 mt.
10	Top Width of Dam	9.84 ft.	3 mt.
11	Length of earthen Dam	230 ft.	70 mt.
12	Length of earthen Dam	-	-
13	T.B.L. Level	498.70 ft.	152.04 mt.
14	M.W.L. Level	494.84 ft.	150.83 mt.
15	F.T.L. Level	488.84 ft.	149.00 mt.
16	Sill R.L.	452.87 ft.	138.07 mt.
17	Maximum Flood Discharge	12820 Cuses	362.81 Cuses
18	Free Board	4 Ft	1.21 Mt.
19	Flood Lift	6 Ft.	1.83 Mt.
20	G.C.A.	1112.49 Acre	450.40 Ha.
21	C.C.A.	1035.70 Acre	419.315 Ha.
22	I.C.A.	863.34 Acre	349.53 Ha.
23	Life of Dam	308 years	308 Years

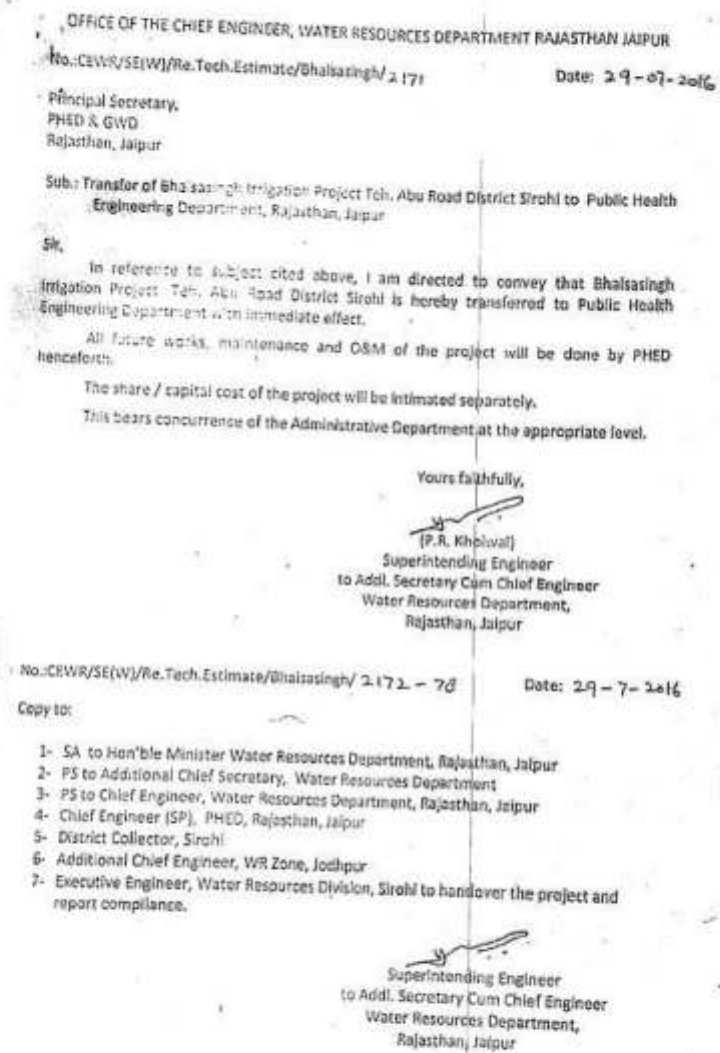


Figure 3:- Transfer of Bhaisa Singh Dam to PHED by WRD.

हस्तानान्तरण चार्ज रिपोर्ट

आज दिनांक 13/10/2016 को अधीक्षण अभियन्ता दस्तऐवज अतिरिक्त सचिव एवं मुख्य अभियन्ता, जल संसाधन विभाग, राजस्थान, जयपुर के पत्रांक/CEWR/SE(W)/Re-tech. Estimate/Bhaisa Singh 2171 दिनांक 29.07.2016 (प्रति संलग्न) को अनुपालना में नैसासिह बांध तहसील आबूरोड जिला सिरौही को जन स्वास्थ्य अभियांत्रिकी विभाग को हस्तानांतरित कर चार्ज सुपुर्द किया। आज दिनांक 13/10/2016 को बांध की कुल भराव क्षमता 179.00 मि.घ.पु. गेज 11.00 मीटर के विरुद्ध 172.00 मि.घ.पु. क्षमता व 11.80 मीटर गेज पानी उपलब्ध है।

नोट:- बांध के संरक्ष में सुरक्षा एवं संभराल में तनवीरी बांध जन संसाधन विभाग द्वारा आवश्यकता होने पर उपलब्ध करवायी जायेगी।

चार्ज देने वाले के हस्ताक्षर

चार्ज लेने वाले के हस्ताक्षर

(प्रमोद चतुर्गुप्त)
सहायक अभियन्ता
जल संसाधन उपखण्ड,
सूरूपगंज

13/10/2016
सहायक अभियन्ता
जन स्वास्थ्य अभियांत्रिकी
उपखण्ड, आबूरोड

प्रतिहस्ताक्षर

(जे.पी.शर्मा)
अधिसाधी अभियन्ता
जल संसाधन खण्ड
सिरौही

13/10/16
अधिसाधी अभियन्ता
जन स्वास्थ्य अभियांत्रिकी
खण्ड, आबूरोड

Figure 4:- Handover of Bhaisa Singh Dam to PHED by WRD.

3. Sustainability of Surface Water Source

3.1 Brief Description of West Banas River Basin

Bhaisa Singh Dam is part of West Banas River Aburoad region is in the West Banas river basin which is a major river basin of Rajasthan. The basin is bounded both in the east and west by prominent hills of Aravali range. The hills on the western side are higher and are part of Mt. Abu range. The streams originating from hills flow in E-W directions as well as in south- south western to contribute to the drainage to West Banas River's main course flowing towards southwest. Being part of the Mt. Abu range, the maximum elevation seen within the basin is about 1695m AMSL. While the general elevation within hilly part is in the 250-750m range, the same in the non-hilly part is generally under 500m AMSL. The hills in the eastern part are not as high as those in the west. The overall slope of the terrain is from a broad north to south – southwest. The lowest point is also in Sirohi district itself and is located near the exit point southwest of Abu road stands at just less than 220m amsl which leaves a relief difference presence in the valley to 217.5m AMSL.

The basin has a well-developed drainage system and the main tributaries of West Banas River are Kukli Nadi, Danot Nadi, Sangbaria Nala, Gangari Nala, Gabir Nala, Batriya Nadi, Kaleri Nadi, Gomati Nadi etc.

3.2 Gauge Level data of Bhaisa Singh Dam pre and post monsoon

Since the construction of dam Water Resource department is continuously maintained the daily water level and storage capacity of the Bhaisa Singh Dam. Data is maintained yearly from June to September. Daily data is given in Annexure-2. Year wise maximum and minimum data is given as below: -

Table 6- Pre and Post Monsoon Gauge Level and Storage Data of Bhaisa Singh Dam

S. No,	Date	Gauge Level (m)	Storage MCM	Date	Gauge Level (m)	Storage MCM
		Pre-Monsoon			Post-Monsoon	
1	25.07.2014*	3.50	1.16	30.09.2014	11.00	5.07
2	15.06.2015	9.80	4.38	29.09.2015	10.95	5.07
3	15.06.2016	10.50	4.79	30.07.2016	11.00	5.07
4	2017#	-	-	-	11.00	5.07
5	2018#	-	-	-	11.00	5.07
6	2019#	-	-	-	11.00	5.07

*Dam commissioned.

Handed over to PHED and no date wise data available with PHED only EE, PHED informed vide letter no. 1640, dt. 13.12.2019 (Fig.-5) that maximum level and storage data.



NO./EE/PHED/AbuRoad/2019-20 / 1640

Date: 13.12.19

Executive Engineer
RUSD, PIU, Pali

Sub :- Regarding reply of observation raised by ADB mission. Related to water supply and sewerage project under RUIDP Phase-IV for Abu Road Town

Ref. :- Yours letter no 1198 date 09.12.2019.

In reference to above cited subject, The reply of observation were raised by ADB mission related to water supply and sewerage project under RUIDP Phase -IV for AbuRoad Town, This as Below :

S.no	Observation	Reply
1	Provide water level data Bhausa Singh Dam for 2018, and if possible 2019 also.	Bhausa Singh Dam was overflow in both the year 2018 & 2019 respectively, and has maximum water level gauge is 11.00 m. Gross capacity of dam is 179 MCFT.
2	Bhausa Singh Dam transferred from WRD to PHED as per the letter. It is not clear if PHED in turn allocated this fully to Aburoad town. Please clarify.	The Bhausa Singh Dam water is reserved for AbuRoad Town and Six periphery villages as per project report submitted by EE Project Dn Sirohi.

EXECUTIVE ENGINEER
PHED DIVISION ABUROAD

Figure 5:- Gauge level Data 2018-19 by PHED

3.3 Surface water Potential of Bhausa Singh Dam's Catchment Area: -

Monthly rainfall for Aburoad station is enclosed in Annexure-3. A summary of mean monthly, seasonal and annual rainfall is given in Table below. Average mean annual rainfall for Aburoad town for last 40 years amounts to 744.43 mm/yr.

On an average monsoon rainfall (months June to September) amounts to 95 % of total annual rainfall for the same period. The presence of hills near Aburoad is reflected by higher rainfall in this area.

Table 7- Monthly Rainfall Data of Aburoad for last 40 years

Year	Total Rainfall mm	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct.	Nov	Dec
1979	665.90	1.00	13.00	-	-	-	47.30	250.40	222.40	-	39.40	92.40	-
1980	605.10	-	9.00	-	-	-	219.60	223.20	113.40	-	-	-	39.90
1981	545.80	-	-	6.00	-	12.00	26.40	159.20	194.00	109.60	-	38.60	-
1982	466.00	-	-	-	25.00	64.60	32.40	107.00	142.80	12.40	7.20	74.60	-
1983	911.60	-	-	-	19.00	-	73.00	384.20	321.40	48.20	65.80	-	-
1984	1742.60	-	-	-	-	-	48.70	434.80	1068.20	170.90	-	-	-
1985	1064.50	-	-	-	-	3.60	45.00	517.20	508.20	5.70	-	-	4.80
1986	257.00	-	-	-	-	-	28.60	149.40	78.80	-	-	-	-
1987	186.20	-	-	-	-	-	14.50	37.60	90.80	17.40	-	-	25.90
1988	735.00	-	-	-	10.00	-	56.70	285.30	280.00	101.00	2.00	-	-
1989	464.10	-	-	-	-	-	64.00	152.00	204.00	44.10	-	-	-
1990	1180.70	-	13.80	-	-	25.50	20.20	443.20	583.60	94.40	-	-	-
1991	374.10	-	-	-	-	-	-	293.10	52.60	28.40	-	-	-
1992	1030.00	-	-	-	-	-	70.50	243.50	216.00	498.00	-	2.00	-
1993	488.00	-	14.00	-	-	-	36.50	365.50	-	72.00	-	-	-
1994	1389.60	15.00	-	-	18.60	43.00	98.00	635.00	420.00	160.00	-	-	-
1995	683.00	-	-	-	-	-	46.00	402.00	175.00	43.00	13.00	-	4.00
1996	517.00	11.00	-	-	-	-	141.00	208.00	77.00	38.00	42.00	-	-
1997	754.00	-	-	-	19.00	18.00	91.00	193.00	292.00	121.00	20.00	-	-
1998	501.40	-	1.40	-	-	-	60.00	84.00	52.00	179.00	125.00	-	-
1999	546.30	-	4.00	-	-	16.00	143.00	147.00	51.00	49.60	135.50	-	-
2000	325.60	-	-	-	13.00	2.00	12.00	211.00	80.50	7.10	-	-	-
2001	584.00	-	-	-	-	-	137.00	301.00	91.00	-	55.00	-	-
2002	216.00	-	-	-	-	-	124.00	8.00	81.00	3.00	-	-	-
2003	950.00	-	22.00	-	-	-	99.00	403.00	350.00	76.00	-	-	-
2004	522.00	-	-	-	-	12.00	116.00	83.00	201.00	82.00	28.00	-	-

RSTDSP

Abroad Water Supply

Year	Total Rainfall mm	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct.	Nov	Dec
2005	582.60	-	-	-	-	-	58.00	211.60	120.00	293.00	-	-	-
2006	1286.00	-	-	2.00	-	-	36.00	292.00	776.00	180.00	-	-	-
2007	735.00	-	-	-	-	4.00	28.00	482.00	143.00	78.00	-	-	-
2008	686.00	-	-	-	-	4.00	28.00	482.00	143.00	78.00	-	-	-
2009	451.00	-	-	4.00	-	-	100.00	227.00	102.00	18.00	-	-	-
2010	775.00	9.00	-	-	-	-	20.00	294.00	248.00	116.00	2.00	83.00	3.00
2011	1016.00	-	-	-	-	-	-	272.00	455.00	289.00	-	-	-
2012	637.00	-	-	-	-	-	17.00	300.00	148.00	172.00	-	-	-
2013	961.00	-	10.00	-	12.00	-	137.00	239.00	259.00	196.00	128.00	-	-
2014	869.00	-	-	-	-	35.00	14.00	295.00	177.00	348.00	-	-	-
2015	1498.00	10.00	-	32.00	19.00	-	260.00	1037.00	115.00	25.00	-	-	-
2016	733.00	-	-	-	-	-	83.00	217.00	303.00	50.00	80.00	-	-
2017	1312.00	-	-	-	-	-	73.00	1116.00	74.00	49.00	-	-	-
2018	390.00	-	-	0.00	0.00	0.00	0.00	195.00	63.00	124.00	8.00	0.00	0.00

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RSTDSPAburoad Water Supply

Using runoff calculated on $Q = IA$, where I is rainfall in mm and A is catchment area in Sq. Km expressed in MCM. Total Catchment of Bhaisa Singh Dam is 40.145 Sq. Km. and assuming 20% flow contributing to the Dam. Yearly in flow to the dam is calculated as below: -

Table 8- Inflow from Bhaisa Singh Dam Catchment

Year	Total Rainfall (mm)	Order	Dependability	Catchment (Sq. Km.)	In Flow (MCM)	Water (MLD)
1979	665.9	22	53.66	40.15	5.347	14.648
1980	605.1	24	58.54	40.15	4.858	13.311
1981	545.8	27	65.85	40.15	4.382	12.006
1982	466	32	78.05	40.15	3.742	10.251
1983	911.6	12	29.27	40.15	7.319	20.053
1984	1742.6	1	2.44	40.15	13.991	38.332
1985	1084.5	7	17.07	40.15	8.707	23.856
1986	257	38	92.68	40.15	2.063	5.653
1987	186.2	40	97.56	40.15	1.495	4.096
1988	735	16	39.02	40.15	5.901	16.168
1989	464.1	33	80.49	40.15	3.726	10.209
1990	1180.7	6	14.63	40.15	9.480	25.972
1991	374.1	36	87.80	40.15	3.004	8.229
1992	1030	8	19.51	40.15	8.270	22.657
1993	488	31	75.61	40.15	3.918	10.735
1994	1389.6	3	7.32	40.15	11.157	30.567
1995	683	20	48.78	40.15	5.484	15.024
1996	517	29	70.73	40.15	4.151	11.373
1997	754	15	36.59	40.15	6.054	16.586
1998	501.4	30	73.17	40.15	4.026	11.029
1999	546.3	26	63.41	40.15	4.386	12.017
2000	325.6	37	90.24	40.15	2.614	7.162
2001	584	25	60.98	40.15	4.689	12.846
2002	216	39	95.12	40.15	1.734	4.751
2003	950	11	26.83	40.15	7.628	20.897
2004	522	28	68.29	40.15	4.191	11.483
2005	682.6	21	51.22	40.15	5.481	15.015
2006	1286	5	12.20	40.15	10.325	28.288
2007	735	16	39.02	40.15	5.901	16.168
2008	686	19	46.34	40.15	5.508	15.090
2009	451	34	82.93	40.15	3.621	9.921
2010	775	14	34.15	40.15	6.222	17.048
2011	1016	9	21.95	40.15	8.157	22.349
2012	637	23	56.10	40.15	5.114	14.012
2013	981	10	24.39	40.15	7.876	21.579
2014	869	13	31.71	40.15	6.977	19.116
2015	1498	2	4.88	40.15	12.027	32.952
2016	733	18	43.90	40.15	5.885	16.124
2017	1312	4	9.76	40.15	10.534	28.860
2018	390	35	85.37	40.15	3.131	8.579

The 75 percent dependable runoff for Bhaisa Singh Dam sub-basins would respectively be 3.918 MCM/yr. There is no other irrigation projects exist in this sub-basins. Bhaisa Singh Dam have a gross storage capacity of 5.07 MCM. Therefore, surface water source is sustainable.

However, this approach assumes that the catchment characteristics of the entire basins are correct. The rainfall - runoff relationship indicates that surface water required for the town is much less than the available potential. Bhaisa Singh Dam sites having free inflow in and around.

3.4 Surface Water Quality

Sample of the water in Bhaisa Singh dam collected and tested in PHED laboratory and found quality show a fair reflection of the quality of the natural runoff at Bhaisa Singh Dam. Test report is as below (Fig.-6). For further treatment of this raw water treatment plant proposed under RUIDP, PH-IV.

OFFICE OF THE JUNIOR CHEMIST
PUBLIC HEALTH ENGINEERING DEPARTMENT DISTRICT LABORATORY
Aburoad (Sirohi)
REPORT OF THE CHEMICAL EXAMINATION OF WATER

No. Lab/Tech./2016/17/41 Date: 20.04.2016

To: Assistant Engineer District: Sirohi
P.H.E.D. Lab Tehsil: Aburoad
Aburoad Sample Collector: J.En.staff

Reference: Your Letter Of Date: 16.4.2016

Date of Collection: 18.04.2016 Date of Receipt: 18.04.2016 Date of Examination: 20.4.2016

Lab Sample No.	Source & Location	Acceptable Limit as per IS:10500:2012	Permissible limit in the absence of alternate source	Raw Water: Bhaisa Singh Dam Aburoad
1 pH		6.5 - 8.5	No relaxation	7.9
2 Turbidity (NTU)		1	5	12
3 Colour		5	15	None
4 Odour		Agreeable	Agreeable	None
5 Temp. °C		-	-	27
6 Alkalinity Phenolphthalein (CaCO ₃)		-	-	-
7 Alkalinity Methyl Orange (CaCO ₃)		200	600	150
8 Total Hardness		200	600	100
9 Calcium Hardness		-	-	70
10 Magnesium Hardness		-	-	30
11 Chlorides as Cl		250	1000	60
12 Nitrate as NO ₃		45	No Relaxation	1
13 Total Dissolved Solids		500	2000	595
14 Fluorides		1	1.5	0.8
15 Iron		0.3	1	-
16 Alum Dose		-	-	-
17 Lime Dose		-	-	-
18 Dissolved Oxygen		-	-	-
19 BOD		-	-	-
20 Langlier Saturation Index		-	-	-

Note: All results except at 50 °C. 1 to 5 are in mg/l

Junior Chemist
P. H. E. D. Lab
ABUROAD

Figure 6:- Surface Water Test Report-Bhais Singh Dam

4. Losses in Dam

Evaporation losses: - As per Maps available by Centre water commission of Gol maximum evaporation rate in June month near Aburoad is 12 mm per day and minimum evaporation rate is in January it is 5 mm per day therefore average evaporation rate is 8.5 mm per day. However, as per AQUASTAT report of UN "Evaporation from artificial lakes and reservoirs" actual rate of evaporation throughout the year is generally 40% of maximum evaporation i.e. $12\text{mm} \times 0.40 = 6\text{ mm}$ per day. Therefore, total evaporation will be $6\text{mm} \times 365\text{ days} = 2.190\text{ m}$.

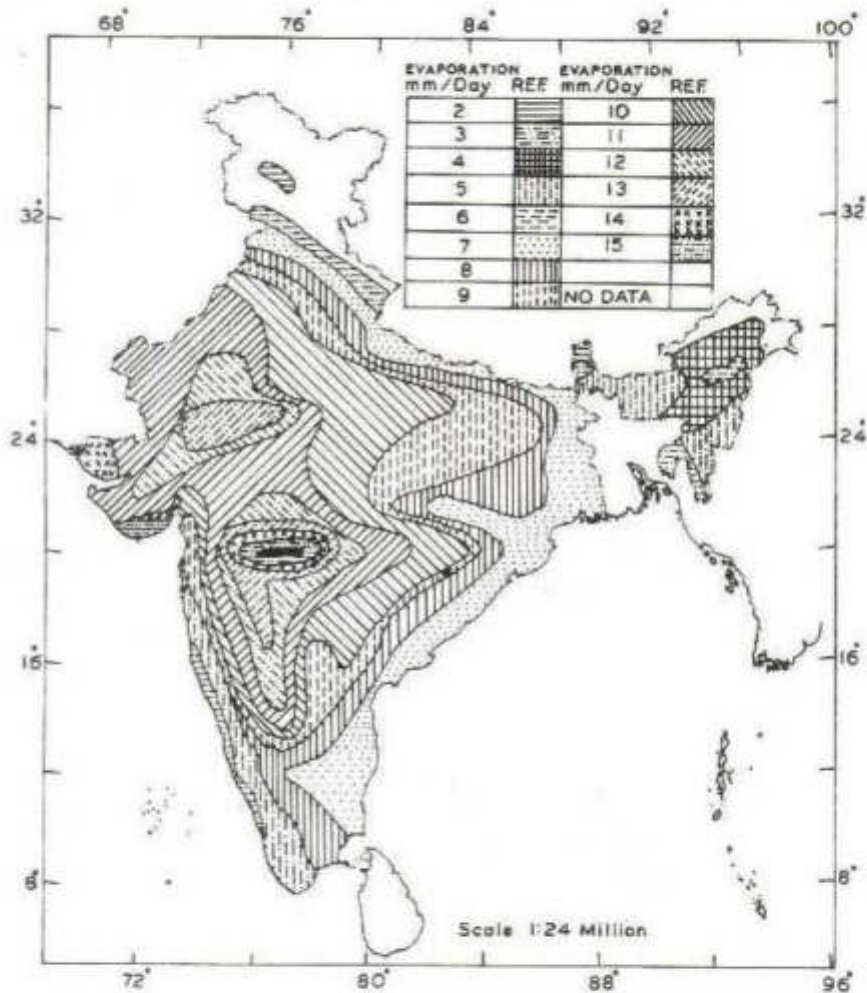


Figure 7:- Maximum Evaporation In Month of June

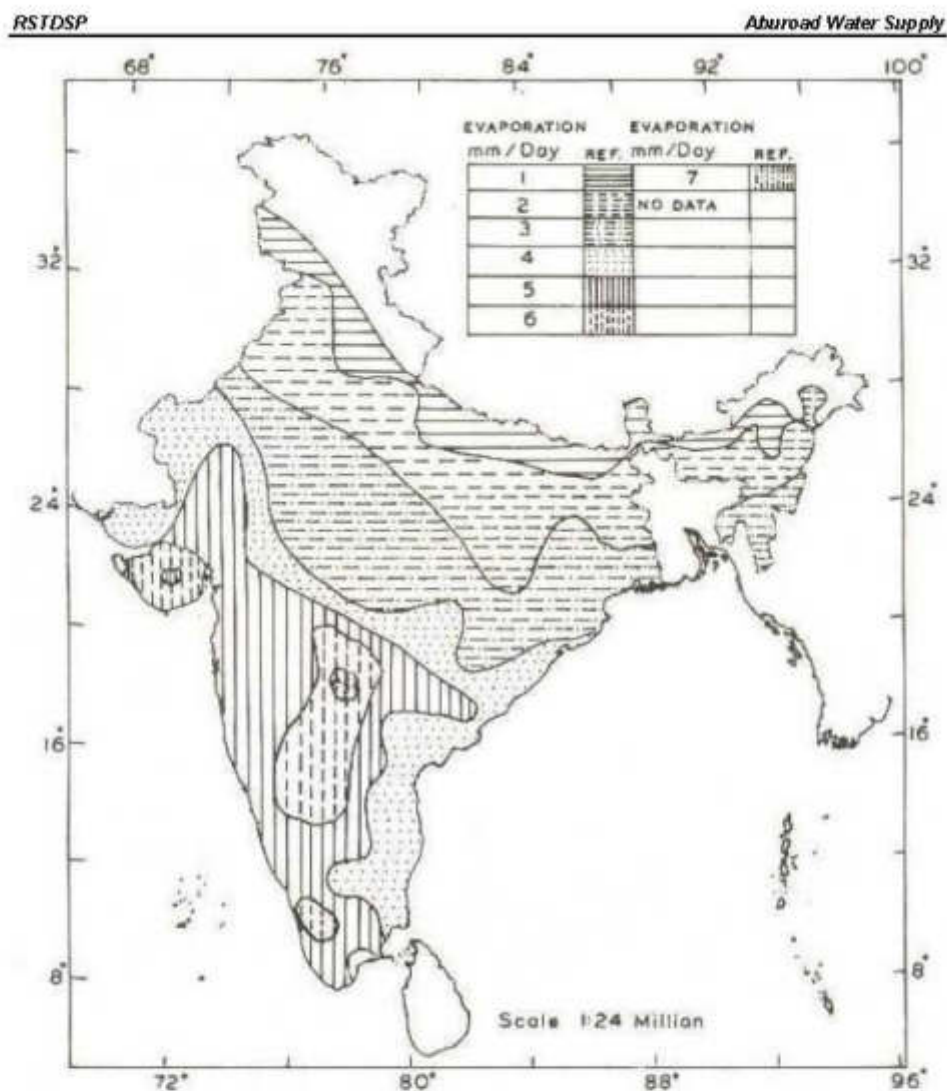


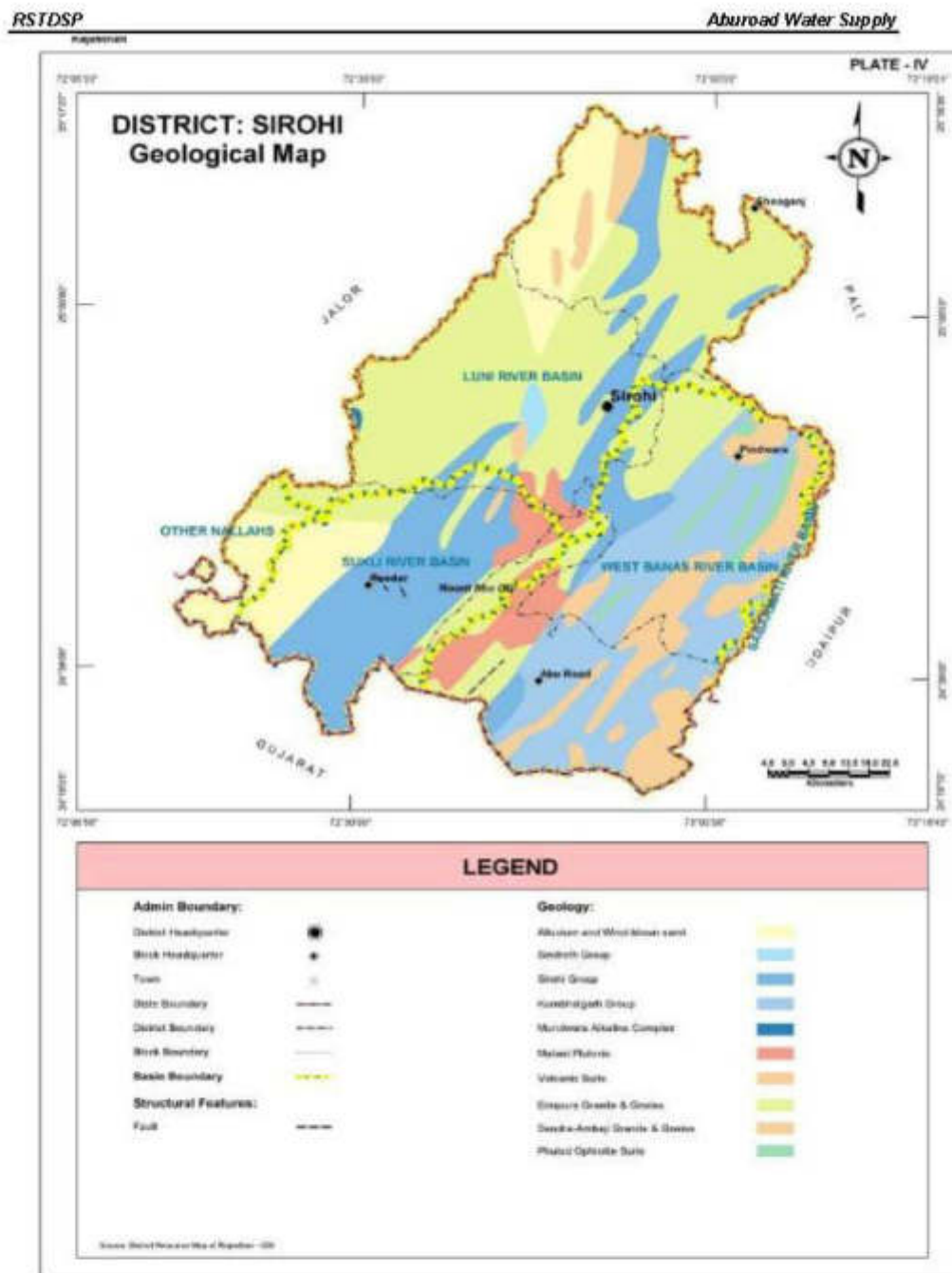
Figure 8:- Minimum Evaporation in Month of January

Maximum gauge height is 11.0 m with storage capacity of 5.07 MCM. Capacity of Dam at 8.81m (11.0m-2.190 m= 8.81m) is 3.75 MCM (refer sr. no. 42 Annexure-2 Gauge Level and Water Storage data from WRD, 25-07-2014 to 30-09-2014).

Seepage Losses- As per geology given in "Hydrogeological Atlas of Rajasthan for Sirohi District" prepared by GWD (Fig.-9), strata of Aburoad come under Sirohi group which consist Quartzite, schist and marble. Since the strata is hard therefore, seepage losses are negligible. Upper layer is with hard soil and boulder but as per geotechnical bore hole log details conducted in town at 15 locations soft to hard rock start from 1.50 m / 5.5 m as shown below. -

*RSTDSP**Aburoad Water Supply***Table 9- Bore Hole Log Details**

Bore Log No	Hard Soil/Boulder (m)	Soft Rock (m)	Hard Rock (m)
B1	3.00	4.50	> 4.50
B2	3.00	4.50	> 4.50
B3	3.00	5.00	> 5.00
B4	5.50	7.00	> 7.00
B5	5.50	7.00	> 7.00
B6	3.00	4.50	> 4.50
B7	2.50	4.00	> 4.00
B8	3.00	4.00	> 4.00
B9	2.50	4.00	> 4.00
B10	3.00	4.50	> 4.50
B11	1.50	2.50	> 2.50
B12	3.00	5.00	> 5.00
B13	3.00	5.00	> 5.00
B14	2.50	3.50	> 3.50
B15	2.50	3.5	> 3.50



Source-Hydro-geological atlas-2013, GWD, Rajasthan

Figure 9:- Geology of Aburoad town

*RSTDSP**Aburoad Water Supply*

However, if the actual gauge level data of Bhaisa Singh Dam is analysed for pre and post monsoon total losses including evaporation and other losses are is shown as below: -

Table 10- Actual losses in Dam

S. No,	Date	Gauge Level (m)	Date	Gauge Level (m)	Total Loss in m
	Pre-Monsoon		Post-Monsoon		
1	15.06.2015	9.80	29.09.2015	10.95	10.95-9.80=1.15m

**Photo 1 Valve to operate Gate of Bhaisa Singh Dam**

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Aburoad Water Supply



Photo 2 Bhaisa Singh Dam view Surrounded by Hills



Photo 3 Bhaisa Singh Dam Wall

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Photo 4 Gauge of Bhaisa Singh Dam



Photo 5 Google Image of Top view of Bhaisa Singh Dam Wall



Photo 6 Google Image of Bhausa Singh Dam

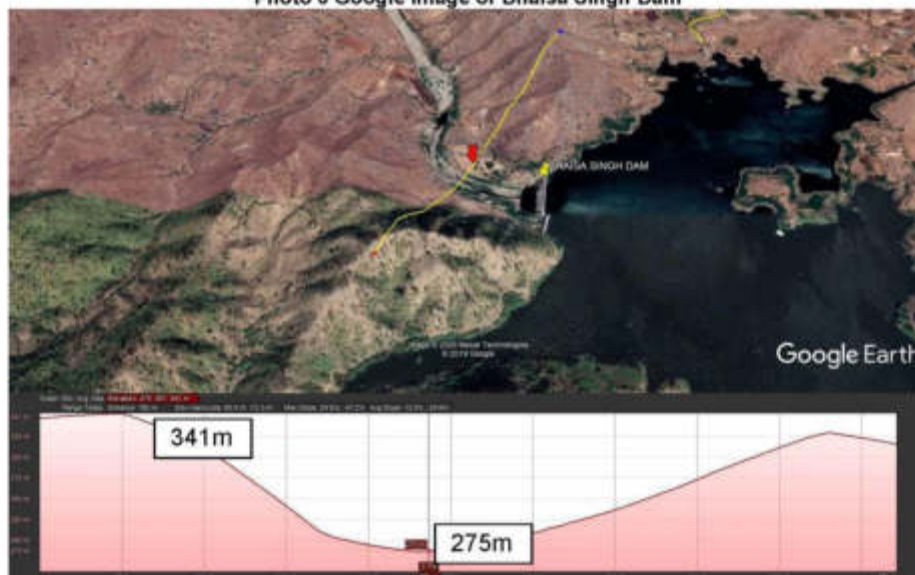


Photo 7 Google Image Elevation Profile of Bhausa Singh Downstream of Dam

5. Conclusion on Surface water availability for Aburoad

The Bhausa Singh Dam has total catchment of 40.145 Sq. Km. Gross storage of Dam is 5.07 MCM and live storage is 4.616 MCM excluding dead storage of 0.454 MCM. Expected life of Dam is 308 years. For water supply demand surface water potential of 3.918 MCM with 75% dependability will be available in Bhausa Singh basin. After considering other losses available water is 3.75 MCM. Total water withdrawal from Dam is proposed 10 MLD i.e. 3.43 MCM, Therefore, source is sustainable and total requirement for the town is less than the live storage of dam 4.616 MCM and yield from catchment.

6. Sustainability of Ground Water Source at Aburoad:-

The water supply is being made through 11 open wells and 13 tube wells of Banas river, Mandawri, Chandrawati, Mungthala & Kui well-fields. The Chandrawati and Mandawari are more potential well fields due to better alluvium thickness and weathered rock. The total production from above tube well and open well is 3750 KLD in summer and 4700 KLD in winter. The total per day supply is 3105 KLD in summer and 4230 KLD in winter.

The main water bearing formations in the town are Alluvium and Granitic gneiss. Ground water occurs under water table (unconfined) conditions in the weathered and fractured zone. The fractured and weathered zone generally limited up to the depth of 15-20m depth. At a few places fractured zone is also available at 40 to 50 meters depth. The water level varies from 15 to 20 meters below ground level. The alluvium thickness is 2 to 10 meters only.

Water supply to the town is being made through following well fields:

Banas river well field:- Water is being supplied through 11 open wells constructed near bank of Banas river flowing near western and northern boundaries of the town.

Mandawari well field:- This well field is located 1.5 kms. south-east of the town. Four tube wells are under operation in the downstream of Mandawari dam.

Chandrawati well field:- This well field is 8 kms. south west of the town near village Chandrawati. Three tube wells are being operated here.

Mungthala well field:- This well field is in the downstream of Bageri dam about 6 kms. west of the town. Three tube wells are under operation in this well field.

Kui well field:- This well field is in the downstream of Sagna dam about 2 kms. east of the town. Three tube wells are being operated in this well field.



Source: - Service Level Benchmarking Report-PHED, Rajasthan

Figure 10:- Well Field of Aburoad Town

The Chandrawati and Mandawari are more potential well fields due to better alluvium thickness and weathered rock. In Banas river well field open wells are existing due to hard rock at shallow depth. Existing well fields of Chandrawati and Banas are suitable for ground water recharge with both topographical as well as hydrogeological point of view as highly porous and permeable alluvium followed by fractured hard rock are existing in the area, and there is sufficient flow. Chandrawati well field is near Suket and Sewaran rivers. The impact of ground water recharge is likely to make the yield of existing open wells and tube wells sustainable with scope of construction of new open wells/ tube wells. Exact location of tube-wells will be as per approved SIP during execution submitted by the contractor.

To meet out the balance demand of the town and cope-up with depletion and loss in % yield 18 new TWs also proposed in town. Ground water is also required for long term sustainability of water supply for the town other than surface water. However, surface water is main source of supply and ground water will be secondary source that will reduce the ground water abstraction and increase in water table. For water supply operation it is always advisable to keep all sources alive to deal with unpredicted rainfall.

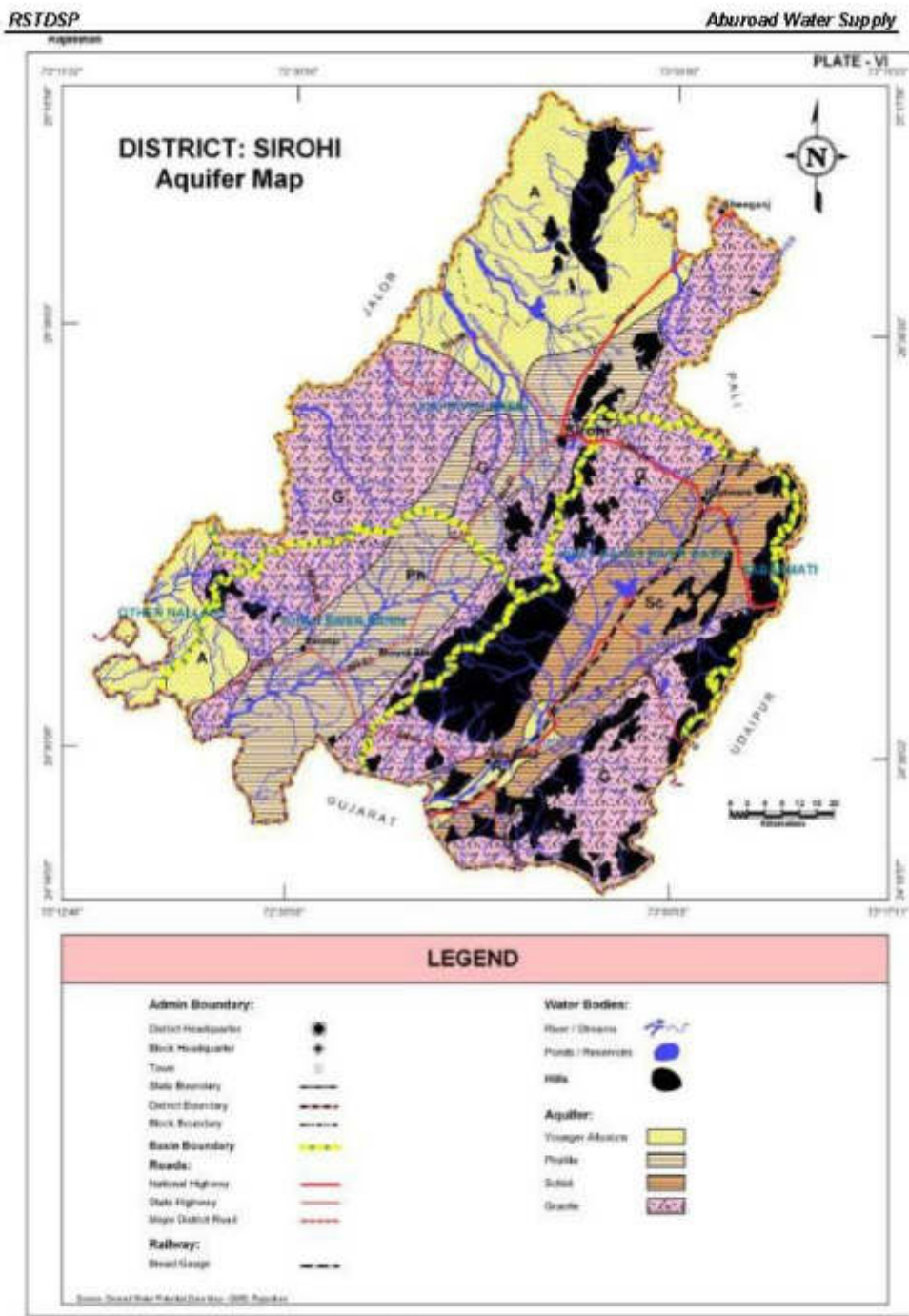
Table 11- Ground water requirement

Year	Stage	Raw Water Demand	Surface Water Bhausa Sing Dam	Ground Water Ex. (OW+TWs) + Pr. TWs
2021	Base Year	10.97	10.00	0.97
2036	Intermediate year	13.15	10.00	3.15
2051	Ultimate Year	15.56	10.00	5.56

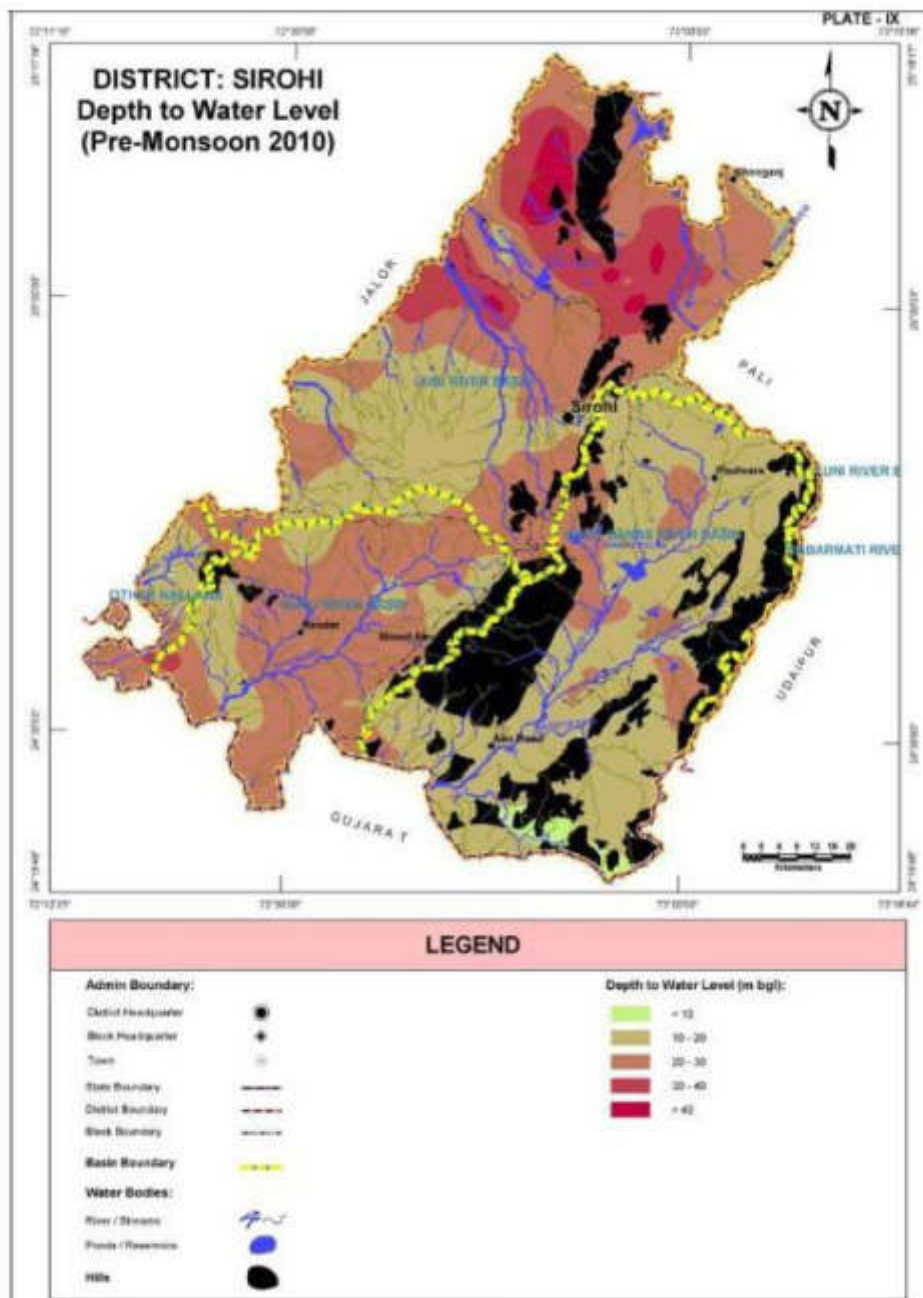
Feasibility of the new TWs assessed by ground water department (GWD), Sirohi and submitted report to Municipal Board, Aburoad vide letter no. 819, dt. 08.04.2018 (Fig.-17) Following are the result of the report: -

- Location – within the town
- Block – Aburoad
- Hydrogeological Formation – Younger Alluvium/Granite/Phyllite/Schist
- Static Water level – 15 to 20 m.
- Proposed depth of Tube-Wells – 140 to 160 m
- Quality – Potable
- Expected discharge- 1500-2500 GPH (5.70 KLH to 9.5 KLH)

The topography, hydro-geological conditions and physical features of the formations mainly control the occurrence of ground water. The major water bearing formations in district are alluvium, granite, granite gneiss and schist & younger alluvium (Fig.-11). As per Hydrogeological report of GWD, for Sirohi District, water level in Abu Road Town is in the range of 10-20 m below ground level as shown in Figure-12. Also, the pre and post monsoon water table fluctuation is 0 to maximum 6 m as shown in Figure-13, which reflects that recharge of the aquifer is good and less loss in the ground water abstraction. Also, as per contour map of average Rainfall of Rajasthan (Figure-14) for 10 year 2007-2016 prepared by Centre Ground Water Board (CGWB), rainfall in Sirohi district is in the range of 800-900 mm per year. As per study conducted by Centre Ground Water Board (CGWB) for Decadal pre (may-2006-2015) and post monsoon (November, 2006-15) water table rise of Rajasthan, aquifer have recharge potential as shown in Figure-15 & 16 respectively. Therefore, ground water source in Aburoad is sustainable.

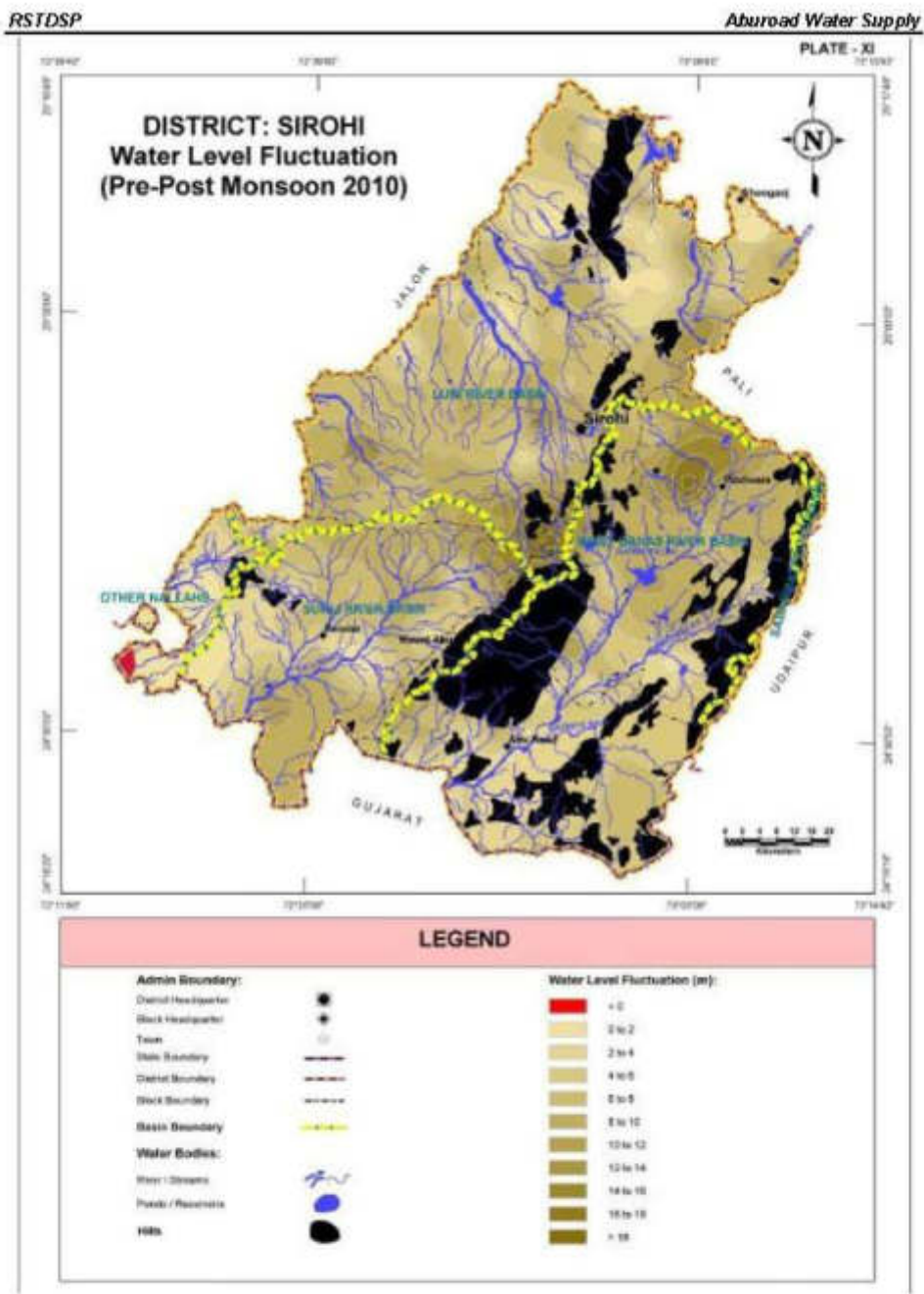


Source-Hydro-geological atlas-2013, GWD, Rajasthan
Figure 11:- Aquifer Map of Sirohi District

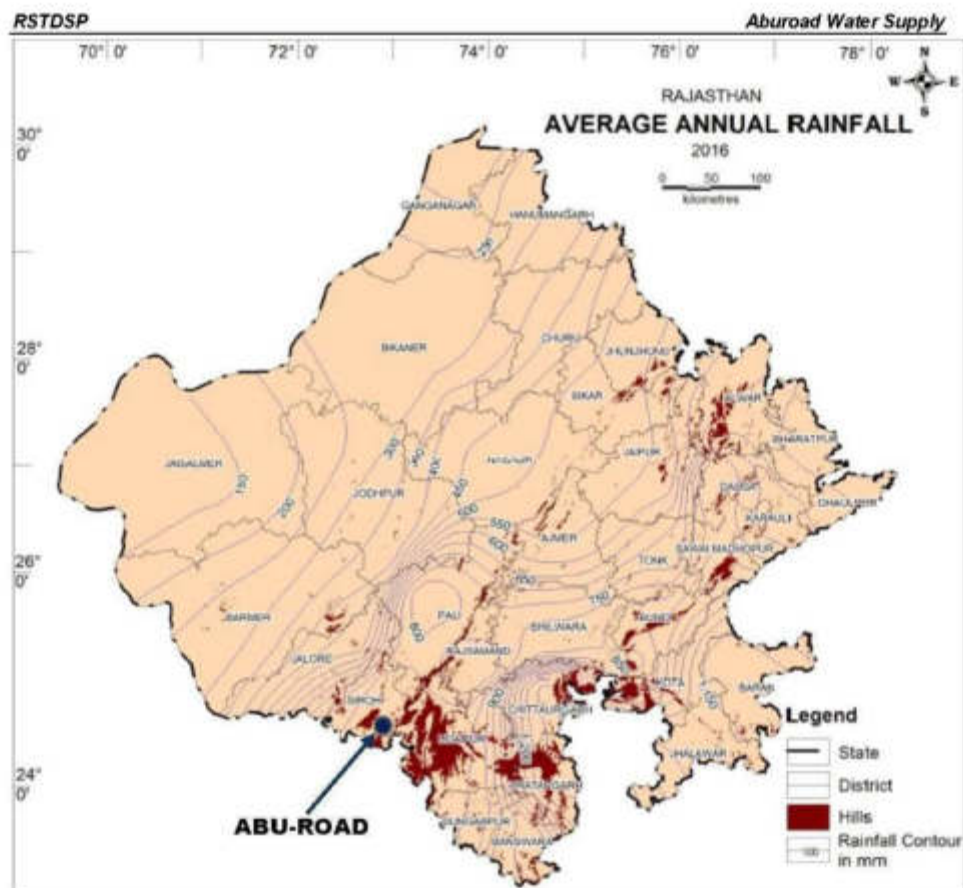


Source-Hydro-geological atlas-2013, GWD, Rajasthan

Figure 12:- Depth of Water Level Pre-monsoon

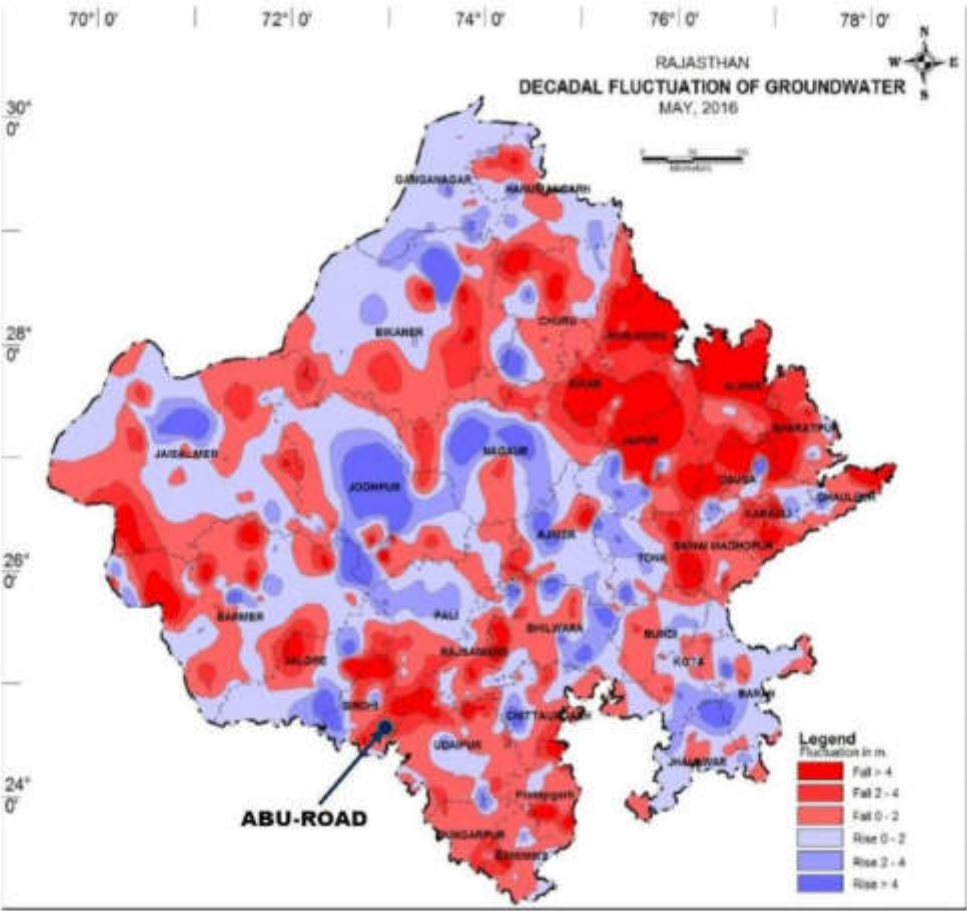


Source-Hydro-geological atlas-2013, GWD, Rajasthan
Figure 13:- Water Level Fluctuation (Pre and Post Monsoon)

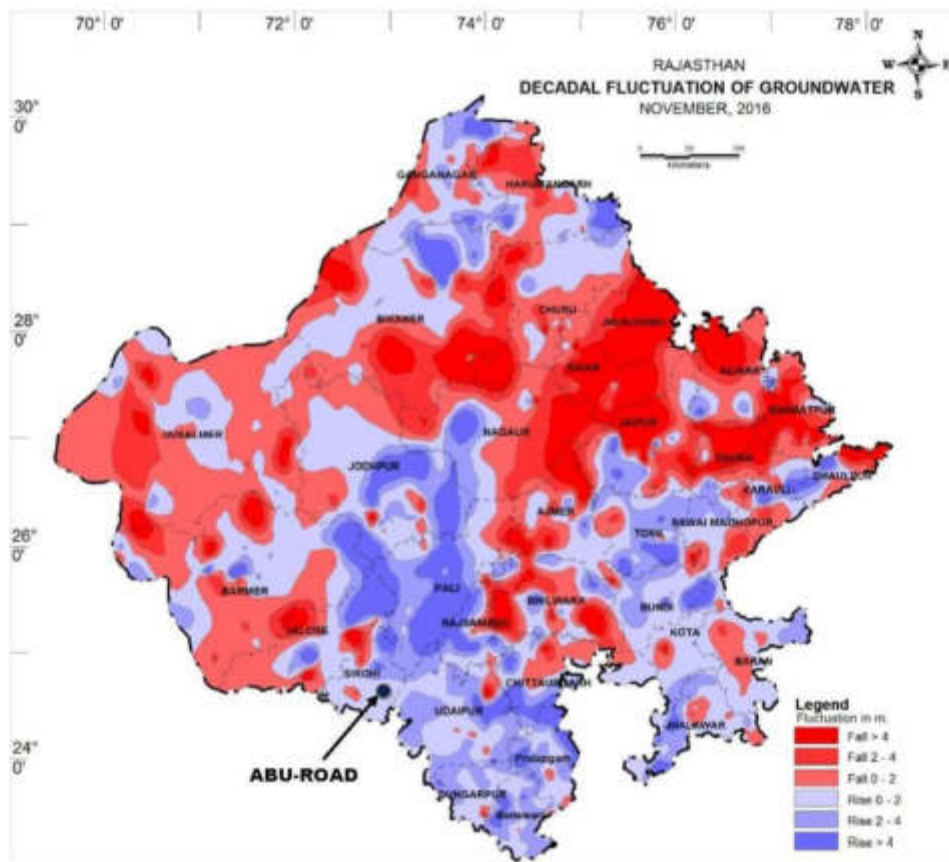


Source-Ground water year book, 2016-17, CGWB, Jaipur, Rajasthan

Figure 14:- Average Annual Rainfall of Rajasthan (2007-2016, 10 years)



Source-Ground water yearbook, 2016-17, CGWB, Jaipur, Rajasthan
Figure 15:- Average Decadal water table fluctuation (2007-2016, 10 years)-Pre-monsoon



Source-Ground water yearbook, 2016-17, CGWB, Jaipur, Rajasthan

Figure 16:- Average Decadal water table fluctuation (2007-2016, 10 years)-Post-monsoon

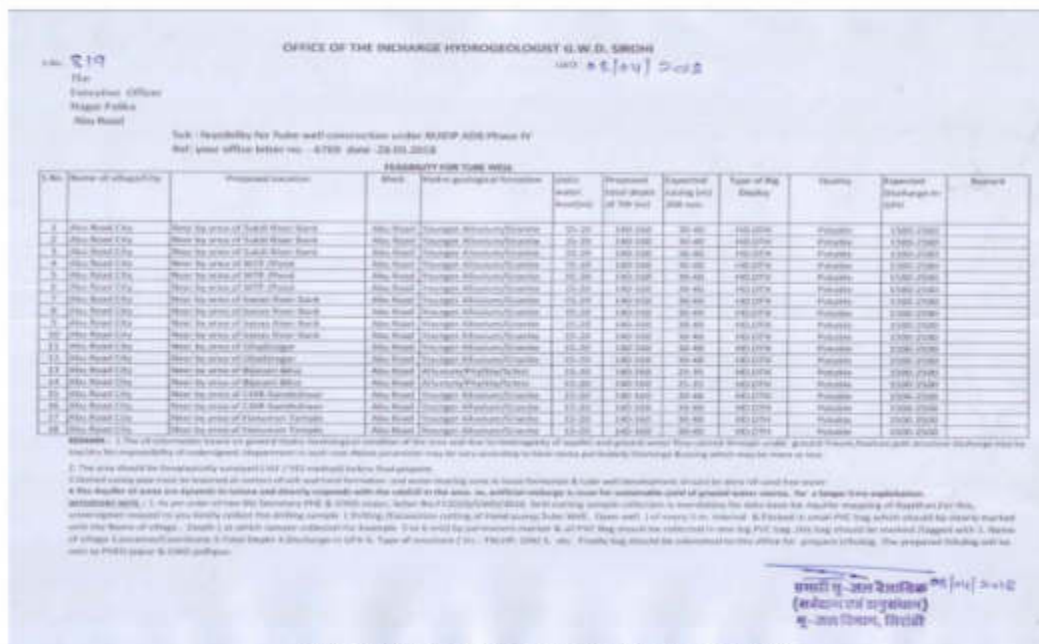


Figure 17:- Hydrogeologist Feasibility Report-18 Proposed Tubewells

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Annexure-1: Water Sample Test Report (Ground Water-Aburoad)

OFFICE OF THE JUNIOR CHEMIST
PUBLIC HEALTH ENGINEERING DEPARTMENT, LABORATORY ABU ROAD
REPORT OF THE CHEMICAL EXAMINATION OF WATER

No. Lab/Tech/Chem/2016-2017/ Dated: To: Assistant Engineer
P.H.E.D. Sub Division District: Sirohi
Aburoad Block: Abu Road

Reference / Your Letter No. Sp.1 Dated: 26/03/2018 Name of Sample Taker: A.En staff
Date of Receipt: 28/03/2018 Ref. ID: 3

Source	TW	TW	GLR	TW
Source Location	Bhanawala, Man dowari	Man road, Mandowari	Buk stand	no.3 Phed
Village/Town	Abu Road (Urban)	Abu Road (Urban)	Siyawa	Awai
Habitation	Abu Road (Urban)	Abu Road (Urban)	Siyawa	Awai
Village Code No.	0	0	0	0
Date of Collection	28/03/2018	28/03/2018	28/03/2018	28/03/2018
Date of Examination	05/04/2018	05/04/2018	05/04/2018	05/04/2018
Lab. Sample No.	17	18	19	20

Note :- All results Except pH are in mg/L

1. pH	7.6	7.9	7.5	7.4
2. Turbidity (NTU)	Clear	Clear	Clear	Clear
3. Colour	None	None	None	None
4. Odour	None	None	None	None
5. Temperature (°C)	25	25	25	25
6. Total Alkalinity (as CaCO ₃)	-	-	-	-
7. Total Hardness (as CaCO ₃)	-	-	-	-
8. Calcium Hardness (as CaCO ₃)	-	-	-	-
9. Magnesium Hardness (as CaCO ₃)	-	-	-	-
10. Chloride (as Cl ⁻)	160	150	160	100
11. Sulphate (as SO ₄ ²⁻)	-	-	-	-
12. Nitrite (as NO ₂ ⁻)	0-	0-	0-	0-
13. Nitrates (as NO ₃ ⁻)	4	3	11	12
14. Fluoride (as F ⁻)	0.6	1.4	1.2	0.6
15. Total Dissolved Solids	740	730	760	560
16. Iron	-	-	-	-
17. Residual Chlorine				

No. Lab/Tech/Chem/2016-2017/ Junior Chemist
Copy to: PHED Lab Abu Road
Dated: 1. The Chief Chemist, Public Health Engineering Department, Rajasthan, Jaipur.
2. The Executive Engineer, PHED Division Sirohi/Abu Road
3. Junior Chemist

P.T.O.

RSTDSP

Aburoad Water Supply

OFFICE OF THE JUNIOR CHEMIST
PUBLIC HEALTH ENGINEERING DEPARTMENT, LABORATORY ABU ROAD
REPORT OF THE CHEMICAL EXAMINATION OF WATER

No. Lab/Tech(Chem)/2016-2017/ Dated :
 To: Assistant Engineer P.H.E.D.Sub Division Aburoad District: Sirohi Block: Abu Road

Reference : Your Letter No. Sp.1 Dated: 28/03/2018 Name of Sample Taker: A. En staff
 Date of Receipt: 28/03/2018 Ref. ID: 4

Source	OW	OW	OW	OW	OW
Source Location	Cheradi Kus	Hanumang Kus	Back side Debar School	Abkan road PHED campus	Andeshwary
Village/Town	Abu Road (Urban)	Abu Road (Urban)	Abu Road (Urban)	Abu Road (Urban)	Abu Road (Urban)
Habitation	Abu Road (Urban)	Abu Road (Urban)	Abu Road (Urban)	Abu Road (Urban)	Abu Road (Urban)
Village Code No.	0	0	0	0	0
Date of Collection	28/03/2018	28/03/2018	28/03/2018	28/03/2018	28/03/2018
Date of Examination	05/04/2018	05/04/2018	05/04/2018	05/04/2018	05/04/2018
Lab. Sample No.	21	22	23	24	25

Note :- All results Except pH are in mg/L

1 pH	7.3	7.8	7.7	7.6	7.8
2 Turbidity (NTU)	Clear	Clear	Clear	Clear	Clear
3 Colour	None	None	None	None	None
4 Odour	None	None	None	None	None
5 Temperature (°C)	25	25	25	25	25
6 Total Alkalinity (as CaCO ₃)	-	-	-	-	-
7 Total Hardness (as CaCO ₃)	-	-	-	-	-
8 Calcium Hardness (as CaCO ₃)	-	-	-	-	-
9 Magnesium Hardness (as CaCO ₃)	-	-	-	-	-
10 Chloride (as Cl ⁻)	250	300	350	500	280
11 Sulphate (as SO ₄ ²⁻)	-	-	-	-	-
12 Nitrite (as NO ₂ ⁻)	0-	0-	0-	0-	0-
13 Nitrates (as NO ₃ ⁻)	21	31	80	8	10
14 Fluoride (as F ⁻)	0.4	0.4	0.5	0.8	0.6
15 Total Dissolved Solids	1160	1280	1540	1920	1480
16 Iron	-	-	-	-	-
17 Residual Chlorine					

Junior Chemist
 PHED Lab Abu Road
 Dated:

No. Lab/Tech(Chem)/2016-2017/
 Copy to:
 1 The Chief Chemist, Public Health Engineering Department, Rajasthan, Jaipur.
 2 The Executive Engineer, PHED Division Sirohi/Abu Road
 3

Junior Chemist

P.T.O.

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Aburoad Water Supply

OFFICE OF THE JUNIOR CHEMIST
PUBLIC HEALTH ENGINEERING DEPARTMENT, LABORATORY ABU ROAD
REPORT OF THE CHEMICAL EXAMINATION OF WATER

No. Lab/Tech(Chem)/2016-2017/ Dated :
 To: Assistant Engineer P.H.E.D. Sub Division Aburoad District: Sirohi Block: Abu Road

Reference : Your Letter No. Sp.1 Dated: 28/03/2018 Name of Sample Taker: A.En staff
 Date of Receipt: 28/03/2018 Ref ID: 4

Source	OW				
Source Location	Benas Pump				
Village/Town	Abu Road (Urban)				
Habitation	Abu Road - (Urban)				
Village Code No.	0				
Date of Collection	28/03/2018				
Date of Examination	05/04/2018				
Lab. Sample No.	26				

Note :- All results Except pH are in mg/L

1 pH	8				
2 Turbidity (NTU)	Clear				
3 Colour	None				
4 Odour	None				
5 Temperature (°C)	25				
6 Total Alkalinity (as CaCO ₃)	-				
7 Total Hardness (as CaCO ₃)	-				
8 Calcium Hardness (as CaCO ₃)	-				
9 Magnesium Hardness (as CaCO ₃)	-				
10 Chloride (as Cl)	280				
11 Sulphate (as SO ₄ ²⁻)	-				
12 Nitrite (as NO ₂ ⁻)	0				
13 Nitrates (as NO ₃ ⁻)	6				
14 Fluoride (as F)	0.6				
15 Total Dissolved Solids	1435				
16 Iron	-				
17 Residual Chlorine					

No. Lab/Tech(Chem)/2016-2017/ Dated:
 Copy to:
 1 The Chief Chemist, Public Health Engineering Department, Rajasthan, Jaipur.
 2 The Executive Engineer, PHED Division Sirohi/Abu Road
 3

Junior Chemist
 PHED Lab Abu Road
 Dated:

Junior Chemist

P.T.O.

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Aburoad Water Supply

Annexure-2: Gauge Level and Water Storage data from WRD (25-07-2014 to 30-09-2014)

Sr. No.	Date	Meter	Mcft	MCM
1	25-07-2014	3.50	41.00	1.16
2	26-07-2014	3.60	42.12	1.19
3	27-07-2014	3.60	42.12	1.19
4	28-07-2014	3.70	43.24	1.22
5	29-07-2014	3.70	43.24	1.22
6	30-07-2014	4.50	53.10	1.50
7	31-07-2014	4.90	58.30	1.65
8	01-08-2014	5.00	59.60	1.69
9	02-08-2014	5.00	59.60	1.69
10	03-08-2014	5.00	59.60	1.69
11	04-08-2014	6.00	75.00	2.12
12	05-08-2014	6.10	76.74	2.17
13	06-08-2014	6.15	77.61	2.20
14	07-08-2014	6.20	78.48	2.22
15	08-08-2014	6.40	81.96	2.32
16	09-08-2014	6.70	87.18	2.47
17	10-08-2014	6.75	88.05	2.49
18	11-08-2014	6.80	88.92	2.52
19	12-08-2014	6.90	90.66	2.57
20	13-08-2014	7.00	92.40	2.62
21	14-08-2014	7.10	94.44	2.67
22	15-08-2014	7.20	96.48	2.73
23	16-08-2014	7.30	98.52	2.79
24	17-08-2014	7.35	99.54	2.82
25	18-08-2014	7.40	100.56	2.85
26	19-08-2014	7.45	101.58	2.88
27	20-08-2014	7.45	101.58	2.88
28	21-08-2014	7.45	101.58	2.88
29	22-08-2014	7.45	101.58	2.88
30	23-08-2014	7.45	101.58	2.88
31	24-08-2014	7.45	101.58	2.88
32	25-08-2014	7.55	103.62	2.93
33	26-08-2014	8.10	115.04	3.26
34	27-08-2014	8.20	117.28	3.32
35	28-08-2014	8.30	119.52	3.38
36	29-08-2014	8.40	121.76	3.45
37	30-08-2014	8.45	122.88	3.48
38	31-08-2014	8.50	124.00	3.51
39	01-09-2014	8.50	124.00	3.51
40	02-09-2014	8.50	124.00	3.51
41	03-09-2014	8.60	126.24	3.57
42	04-09-2014	8.85	131.84	3.73
43	05-09-2014	9.10	137.62	3.90
44	06-09-2014	9.20	140.04	3.97
45	07-09-2014	9.30	142.46	4.03
46	08-09-2014	9.30	142.46	4.03
47	09-09-2014	9.40	144.88	4.10
48	10-09-2014	9.70	152.14	4.31
49	11-09-2014	9.80	154.56	4.38
50	12-09-2014	9.95	158.19	4.48
51	13-09-2014	10.15	162.34	4.60
52	14-09-2014	-	-	-
53	15-09-2014	10.35	166.26	4.71
54	16-09-2014	10.45	168.22	4.76
55	17-09-2014	10.55	170.18	4.82
56	18-09-2014	10.60	171.16	4.85
57	19-09-2014	10.65	172.14	4.87
58	20-09-2014	10.80	175.08	4.96
59	21-09-2014	10.85	176.06	4.99
60	22-09-2014	10.90	177.04	5.01
61	23-09-2014	10.95	179.00	5.07
62	24-09-2014	11.00	179.00	5.07
63	25-09-2014	11.00	179.00	5.07
64	26-09-2014	11.00	179.00	5.07
65	27-09-2014	11.00	179.00	5.07
66	28-09-2014	11.00	179.00	5.07
67	29-09-2014	11.00	179.00	5.07
68	30-09-2014	11.00	179.00	5.07

Source: - Water Resource Department, Sirahi.

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Aburoad Water Supply

Gauge Level and Water Storage data from WRD (15-06-2015 to 30-09-2015)

Sr. No.	Date	Meter	Mcft	MCM
1	15-06-2015	9.80	154.56	4.38
2	16-06-2015	9.80	154.56	4.38
3	17-06-2015	9.80	154.56	4.38
4	18-06-2015	9.80	154.56	4.38
5	19-06-2015	9.90	156.98	4.45
6	20-06-2015	10.00	159.40	4.51
7	21-06-2015	10.00	159.40	4.51
8	22-06-2015	10.10	161.36	4.57
9	23-06-2015	10.10	161.36	4.57
10	24-06-2015	10.10	161.36	4.57
11	25-06-2015	10.20	163.32	4.62
12	26-06-2015	11.10	179.15	5.07
13	27-06-2015	11.10	179.15	5.07
14	28-06-2015	11.05	179.07	5.07
15	29-06-2015	11.05	179.07	5.07
16	30-06-2015	11.05	179.07	5.07
17	01-07-2015	11.00	179.00	5.07
18	02-07-2015	11.00	179.00	5.07
19	03-07-2015	11.00	179.00	5.07
20	04-07-2015	10.95	178.02	5.04
21	05-07-2015	10.95	178.02	5.04
22	06-07-2015	10.93	178.02	5.04
23	07-07-2015	10.93	178.02	5.04
24	08-07-2015	10.93	178.02	5.04
25	09-07-2015	10.93	178.02	5.04
26	10-07-2015	10.93	178.02	5.04
27	11-07-2015	10.90	177.04	5.01
28	12-07-2015	10.90	177.04	5.01
29	13-07-2015	10.90	177.04	5.01
30	14-07-2015	10.90	177.04	5.01
31	15-07-2015	10.90	177.04	5.01
32	16-07-2015	10.90	177.04	5.01
33	17-07-2015	10.90	177.04	5.01
34	18-07-2015	10.90	177.04	5.01
35	19-07-2015	10.90	177.04	5.01
36	20-07-2015	10.85	176.06	4.99
37	21-07-2015	10.90	177.04	5.01
38	22-07-2015	10.90	177.04	5.01
39	23-07-2015	10.90	177.04	5.01
40	24-07-2015	10.90	177.04	5.01
41	25-07-2015	11.00	179.00	5.07
42	26-07-2015	11.05	179.00	5.07
43	27-07-2015	11.30	179.00	5.07
44	28-07-2015	11.30	179.00	5.07
45	29-07-2015	11.40	179.00	5.07
46	30-07-2015	11.93	179.00	5.07

Source: - Water Resource Department, Sirohi.

RSTDSP

Aburoad Water Supply

47	31-07-2015	11.63	179.00	5.07
48	01-08-2015	11.40	179.00	5.07
49	02-08-2015	1.20	179.00	5.07
50	03-08-2015	11.20	179.00	5.07
51	04-08-2015	11.20	179.00	5.07
52	05-08-2015	11.20	179.00	5.07
53	06-08-2015	11.20	179.00	5.07
54	07-08-2015	11.15	179.00	5.07
55	08-08-2015	11.15	179.00	5.07
56	09-08-2015	11.15	179.00	5.07
57	10-08-2015	11.15	179.00	5.07
58	11-08-2015	11.15	179.00	5.07
59	12-08-2015	11.15	179.00	5.07
60	13-08-2015	11.15	179.00	5.07
61	14-08-2015	11.15	179.00	5.07
62	15-08-2015	11.20	179.00	5.07
63	16-08-2015	11.20	179.00	5.07
64	17-08-2015	11.20	179.00	5.07
65	18-08-2015	11.20	179.00	5.07
66	19-08-2015	11.20	179.00	5.07
67	20-08-2015	11.20	179.00	5.07
68	21-08-2015	11.20	179.00	5.07
69	22-08-2015	11.20	179.00	5.07
70	23-08-2015	11.20	179.00	5.07
71	24-08-2015	11.20	179.00	5.07
72	25-08-2015	11.15	179.00	5.07
73	26-08-2015	11.15	179.00	5.07
74	27-08-2015	11.15	179.00	5.07
75	28-08-2015	11.15	179.00	5.07
76	29-08-2015	11.15	179.00	5.07
77	30-08-2015	11.15	179.00	5.07
78	31-08-2015	11.15	179.00	5.07
79	01-09-2015	11.15	179.00	5.07
80	02-09-2015	11.10	179.00	5.07
81	03-09-2015	11.10	179.00	5.07
82	04-09-2015	11.10	179.00	5.07
83	05-09-2015	11.10	179.00	5.07
84	06-09-2015	11.10	179.00	5.07
85	07-09-2015	11.05	179.00	5.07
86	08-09-2015	11.05	179.00	5.07
87	09-09-2015	11.05	179.00	5.07
88	10-09-2015	11.05	179.00	5.07
89	11-09-2015	11.05	179.00	5.07
90	12-09-2015	11.05	179.00	5.07
91	13-09-2015	11.00	179.00	5.07
92	14-09-2015	11.00	179.00	5.07
93	15-09-2015	11.00	179.00	5.07
94	16-09-2015	10.95	179.00	5.07
95	17-09-2015	10.95	179.00	5.07
96	18-09-2015	10.95	179.00	5.07
97	19-09-2015	10.90	177.04	5.01
98	20-09-2015	10.90	177.04	5.01
99	21-09-2015	10.90	177.04	5.01
100	22-09-2015	10.90	177.04	5.01
101	23-09-2015	10.95	179.00	5.07
102	24-09-2015	10.95	179.00	5.07
103	25-09-2015	10.95	179.00	5.07
104	26-09-2015	10.95	179.00	5.07
105	27-09-2015	10.95	179.00	5.07
106	28-09-2015	10.95	179.00	5.07
107	29-09-2015	10.95	179.00	5.07

Source: - Water Resource Department, Sirohi.

RSTDSP

Aburoad Water Supply

Gauge Level and Water Storage data from WRD (15-06-2016 to 30-07-2016)

Sr. No.	Date	Meter	Mcft	MCM
1	15-06-2016	10.50	169.20	4.79
2	16-06-2016	10.60	171.16	4.85
3	17-06-2016	10.60	171.16	4.85
4	18-06-2016	10.70	173.12	4.90
5	19-06-2016	10.85	176.06	4.99
6	20-06-2016	11.00	179.00	5.07
7	21-06-2016	11.00	179.00	5.07
8	22-06-2016	11.00	179.00	5.07
9	23-06-2016	11.00	179.00	5.07
10	24-06-2016	11.00	179.00	5.07
11	25-06-2016	11.00	179.00	5.07
12	26-06-2016	11.00	179.00	5.07
13	27-06-2016	11.00	179.00	5.07
14	28-06-2016	11.00	179.00	5.07
15	29-06-2016	11.00	179.00	5.07
16	30-06-2016	11.00	179.00	5.07
17	01-07-2016	11.00	179.00	5.07
18	02-07-2016	11.00	179.00	5.07
19	03-07-2016	11.00	179.00	5.07
20	04-07-2016	11.00	179.00	5.07
21	05-07-2016	11.00	179.00	5.07
22	06-07-2016	11.00	179.00	5.07
23	07-07-2016	11.00	179.00	5.07
24	08-07-2016	11.00	179.00	5.07
25	09-07-2016	11.00	179.00	5.07
26	10-07-2016	11.00	179.00	5.07
27	11-07-2016	11.00	179.00	5.07
28	12-07-2016	11.00	179.00	5.07
29	13-07-2016	11.00	179.00	5.07
30	14-07-2016	11.00	179.00	5.07
31	15-07-2016	11.00	179.00	5.07
32	16-07-2016	11.00	179.00	5.07
33	17-07-2016	11.00	179.00	5.07
34	18-07-2016	11.00	179.00	5.07
35	19-07-2016	11.00	179.00	5.07
36	20-07-2016		179.00	5.07
37	21-07-2016	11.00	178.02	5.04
38	22-07-2016	10.95	178.02	5.04
39	23-07-2016	10.95	178.02	5.04
40	24-07-2016	10.93	179.00	5.07
41	25-07-2016	10.93	179.00	5.07
42	26-07-2016	11.05	179.00	5.07
43	27-07-2016	11.05	-	-
44	28-07-2016	11.05	-	-
45	29-07-2016	11.00	179.00	5.07
46	30-07-2016	11.00	179.00	5.07

Source: - Water Resource Department, Sirohi.

References:-

1. *Hydrogeological Atlas of Sirohi District, Rajasthan-2013*, Ground Water Department, Rajasthan prepared under European State Partnership Program.
2. *Ground Water Year Book, 2016 – 2017, Rajasthan State by Government of India Ministry of Water Resources, River Development & Ganga Rejuvenation Central Ground Water Board.*
3. *Evaporation Control in Reservoirs-2006, Government of India, Central Water Commission, Basin Planning and Management Organisation, New Delhi.*
4. *Report of UN “Evaporation from artificial lakes and reservoirs”*

Appendix 19: Excerpts from Policy on Reuse

STATE SEWERAGE AND WASTE WATER POLICY- 2016

- viii. Design and performance specifications of wastewater treatment plants shall be as per guidelines given in the manual on sewerage treatment systems published by CPHEEO. Sufficient room in tendering for the construction of new plants shall be provided for competition to take place in both technologies and costs.

5.4. On Reuse of Treated Effluent and Sludge

1. Treated wastewater effluent is considered a water resource and is added to the water stock for reuse.
2. Priority shall be given to agricultural reuse of treated effluent for unrestricted irrigation. Blending of treated wastewater with fresh water shall be made to improve quality where possible. Crops to be irrigated by the treated effluent or blend thereof with freshwater resources shall be selected to suit the irrigation water, soil type and chemistry, and the economics of the reuse operations.
3. Crop nutrient requirements shall be determined taking into consideration the prevailing effluent quality. Overuse of nutrients shall be avoided.
4. Accumulation of heavy metals and salinity shall be monitored, managed and mitigated. Leaching of soils shall be advocated by the irrigation authorities.
5. Farmers shall be encouraged to determine the rate of water application needed for different crops, taking into consideration the value of nutrients in the treated water and other parameters.
6. Farmers shall be encouraged to use modern and efficient irrigation technologies. Protection of on-farm workers and of crops against pollution with wastewater shall be ensured.
7. Treated effluent quality should be monitored and users alerted to any emergency causing deterioration of the quality so that they will not use such water unless corrective measures are taken.
8. Studies should be conducted and projects designed and implemented to store the excess treated wastewater in surface reservoirs but artificial recharge is not permitted . Due attention shall be given to the quality of treated and groundwater and the characteristics of the strata.
9. Plans and studies for power generation from sludge, if proven technically, economically and financially feasible, shall be made with due attention to environment impacts.
10. Sludge produced from the treatment process would be processed so it may be used as fertilizer and soil conditioner. Care shall be taken to conform to the regulations of public health and environment protection norms.

11. **Industry:** Industrial reuse of reclaimed wastewater represents major reuse next only to irrigation in both developed and developing countries. Reclaimed wastewater is ideal for many industrial purposes,. Where effluent is to be used in the industrial processes, it should be the responsibility of the industry to treat it to the quality standards required. Pilot scale feasibility studies carried out in Australia have concluded that it is possible to economically treat the domestic wastewater to achieve adequate quality for reuse as cooling water. Based on the conclusions of the feasibility study, a full-scale treatment plant employing cross-flow membrane microfiltration system may be installed. The membrane filtration system can remove all suspended solids, fecal coliforms, and giardia cysts. It could also significantly reduce human enteric viruses such as *reovirus* and *enterovirus*. The water reclamation plant at Eraring Power Station demonstrates the potential for reuse of wastewater in power generation and other industrial manufacturing facilities.

Industrial uses for reclaimed water include:

- (i) Evaporative cooling water:-
 - (a) Once-through cooling system.
 - (b) Re-circulating cooling system.
 - (c) Cooling water quality requirements.
 - (ii) Boiler –Feed water- The use of reclaimed water differs little from use of conventional public supplies for boiler-feed water, as both require extensive additional treatment quality requirement for boiler feed make up water are dependent upon pressure at which boiler is operated.
 - (iii) Industrial process water-
Suitability of reclaimed water for use in industrial process depends upon particular use like-
 - (a) Pulp and paper.
 - (b) Chemical industry.
 - (c) Textile industry.
 - (d) Petroleum and coal.
12. Whenever possible, other end uses of treated effluents; such as recycling, cooling, power generation, etc. shall be considered.
13. **Re-use Options:** The following options for re-use of effluent have been identified: In general, public health concern is the major issue in any type of reuse of wastewater, be it for irrigation or non-irrigation utilization, especially long term impact of reuse practices. It is difficult to delineate acceptable health risks and is a matter that is still hotly debated. Potential reuse of wastewater depends on the hydraulic and biochemical characteristics of wastewater, which determine the methods and degree of treatment required. While agricultural irrigation reuses, in general, require lower quality levels of treatment, domestic reuse options (direct or indirect potable and non-potable) reuses need the highest treatment level. Level of treatment for other

reuse options lie between these two extremes. The reuse options may be (artificial recharge of aquifers is not permitted):

- i. Irrigation
 - (a) Agriculture and forestry
 - (b) Landscaping
- ii. Fish – farming
- iii. Industry
- iv. Non-potable Domestic Reuse.

The detailed project report should clearly define the best reuse option particular to town and strategy to obtain it. Action plan with clarity should be the part of Detailed Project Report (DPR), while preparing sewerage projects. Before deciding the reuse of treated waste water, authorities must full fill the water quality norms and its legal implications.

- 14. Governing local body can sell the treated waste water and digested sludge to generate the revenue.

5.5. On Pricing, Financing and Investment

- 1. In view of increasing marginal cost of wastewater collection and treatment, wastewater charges, connection fees, sewerage taxes and treatment fees shall be set to cover at least the operation and maintenance costs. It is also highly desirable that part of the capital cost of the services shall be recovered. The ultimate aim is for a full cost recovery.
- 2. Appropriate criteria in order to apply the "polluter pays" principle shall be established.
- 3. Different charges for different areas may be applied. This shall be assessed for each geographical area as a function of end users and effluent quality and will be subject to economic and social considerations.
- 4. Because of the limited financial resources available to Government of Rajasthan, setting investment priorities in wastewater will be compatible with government investment plans.
- 5. Criteria for prioritizing investments in the wastewater sector shall take into account the current and future needs of the state, needs to expand wastewater systems in urban areas and to provide wastewater systems to smaller towns and villages.
- 6. Priorities of wastewater projects shall not be disconnected from water supply projects and urbanization in general. Decisions will be made concerning them to attain optimum solutions to the need for services, availability of finance and availability of trained manpower.

Appendix 20: Guidelines for Sewerage System Operations, Reuse of Treated Effluent and Sludge from STP for Beneficial Purposes

(Source: Manual on Sewerage and Sewage Treatment Systems, CPHEEO, Ministry of Urban Development, Govt. of India)

Health Hazards during Sewage Operations

Labourers working on the sewage treatment and operations may suffer from a number of ailments directly attributed to handling of sewage. In view of this it is desirable to disinfect sewage and where feasible mechanize sewage operations.

The staff of sewage operations must be well educated in the sanitary rules on the utilization of sewage for irrigation as well as with personal hygiene. All persons working in sewage farms must undergo preventive vaccination against enteric infections and annual medical examination for helminthiasis and be provided treatment if necessary.

Sewage treatment plants should be provided with adequate space for canteens with proper sanitation, wash-stands and lockers for irrigation implements and protective clothing. Safe drinking water must be provided for the workers and for population residing within the effective range of the sewage treatment plants.

All workers should be provided with gum boots and rubber gloves, which must compulsorily be worn while at work. They should be forced to observe personal hygiene such as washing after work as well as washing before taking food. The use of antiseptics in the water used for washing should be emphasized. The farm worker should be examined medically at regular intervals and necessary curative measures enforced.

Mitigation measures to avoid Health Hazards

Personal Hygiene against Pathogen

The worker should take precautions because a large number of coliform groups, various kinds of micro-organisms, and egg parasites exist in sewage. The workers should strive to maintain good health by taking care of the following points:

- Wear clean uniform, work boots, etc.
- After work and before having a meal, always wash hands and disinfect them.
- After work, take a shower if possible.
- Do not enter the offices and lounges wearing dirty clothes.
- If necessary, take vaccinations against tetanus, leptospirosis fever and so on

Maintaining Cleanliness The worker should maintain each facility in a clean and neat condition.

- The floors of workrooms, stairs and corridors should be cleaned at the appropriate frequency to maintain them in a clean condition
- Disinfection of relevant locations is to be carried out periodically.

Health Check Workers should receive health check once a year to maintain their health, and prevent illnesses or detect them at an early stage. The results of the health check should be maintained as records. Recommended items to be inspected during the health check are as given below.

- Examine medical history.
- Examine subjective symptoms and other objective symptoms.
- Check height, weight, vision and hearing ability.

- Chest X-ray examination.
- Blood pressure measurement.
- Check for anaemia.
- Check for liver functions.
- Check for lipids in blood.
- Check blood sugar level
- Urine analysis.
- Electrocardiogram analysis

Welfare Measures The Sanitation Workers (Regulation of Employment and Conditions of Service) Act 2012 proposes constitution of a Sanitation Workers State Welfare Board to exercise powers conferred on it and to perform welfare functions such as the following for sanitation workers:

- Provide immediate assistance to a beneficiary in case of an accident
- Sanction of loan and advances
- Medical expenses for treatment of major ailments
- Financial assistance for education of children
- Payment of maternity benefits
- Make provision and improvement of welfare measures and facilities as may be prescribed

Corrective Measures When a worker has symptoms of an illness listed above, the plant engineer should ensure that the worker is checked-up by a specialist doctor and receives proper treatment and care and should take the following actions considering the content of work done by the worker:

- Change the workplace if necessary
- Change the content of the work
- Shorten the working hours
- Perform relevant measurements of the working environment
- Maintain the facility or equipment

Risks in use of treated effluent and sludge in agriculture practices

Cultivation of crops that are eaten raw should be banned. Cultivation of paddy in bunded fields is likely to give rise to sanitation problems and hence is undesirable. Growing of non-edible commercial crops like cotton, jute, fodder, milling varieties of sugarcane and tobacco would be suitable. Cultivation of grasses and fodder legumes, medicinal and essential oil yielding plants like menthol and citronella may be allowed. Cultivation of cereals, pulses, potatoes and other crops that are cooked before consumption may be permitted, if sewage is treated and care is taken in handling the harvests to ensure that they are not contaminated. Cultivation of crop exclusively under seed multiplication programmes would be advantageous as these are not consumed. As an additional safeguard, sewage irrigation should be discontinued at least two months in advance of harvesting of fruits and berries, one month for all kinds of vegetables and a fortnight for all other crops. Direct grazing on sewage irrigated farms should be prohibited.

Risks of Nutrient Loading in Agriculture

Crops receiving excessive dosage of nitrogen show superfluous vegetative growth and decrease in grain or fruit yield. The phosphate deficit of sewage, therefore, should be made good by supplementing with phosphate fertilizers, the extent of phosphate fortification depending upon the nature of crop and its phosphate requirements. As the availability of phosphate is low in the irrigation water it would be desirable to apply the required quantity of phosphatic fertilizer at the

time or even (about a fortnight) before the sowing or planting of the crop. Even when sewage nutrients are balanced by fortification, irrigation with such sewage may supply excessive amount of nutrients resulting in waste or unbalanced growth of plants with adverse effects on yields. It may therefore be necessary to dilute the sewage. Dilution also helps in reducing the concentration of dissolved salts and decomposable organic matter in the sewage thus, decreasing hazards to the fertility of the soil. It is desirable to limit the BOD and total suspended solids of sewage to be disposed on land for irrigation, as per relevant standards. There is a need to take caution on describing nutrient supply capacity of sewage particularly in the case of availability of phosphorus because there is a possible conversion of available phosphorus in unavailable mode in the presence of heavy metals present in the sewerage. This happens commonly in high as well as low pH soils.

Alternative Arrangement during Non-irrigating Periods

During rainy and non-irrigating seasons, agricultural practices may not need any water for irrigation. Even during irrigating season, the water requirement fluctuates significantly. Hence, satisfactory alternative arrangements have to be made for the disposal of sewage on such occasions either by storing the excess sewage or discharging it elsewhere without creating environmental hazards. The following alternatives are generally considered: a) Provision of holding lagoons for off-season storage. They enable irrigation of a fixed area of land to varying rates of crop demand. They may also serve as treatment units such as aerated or stabilization lagoons, provided the minimum volume required for treatment is provided beyond the flow-balancing requirement. b) Provision of additional land where treated sewage is not required on the main plot of land c) Discharge of surplus treated sewage to river or into sea with or without additional treatment. Combining surface discharge facilities with irrigation system is quite common and often quite compatible. d) Resorting to artificial recharge in combination with an irrigation system where feasible.

Treated Sewage into Perennial Rivers

When sewage is treated and discharged into perennial flowing rivers and the blended river water is drawn downstream of the point of such blending as raw water for treatment in public water supply schemes. This is indirect potable use after blending. This is historical and ongoing all around. However, of late, the organic load due to the discharged treated, partially treated and non-point sewage becomes in excess of the self-purifying capacity of the river. Thus, the river water is not actually fresh water. The water quality of Yamuna river for Agra water supply scheme requires to be first treated in MBBR to purify the river water to a level as raw water for the downstream WTP. When it passes through flowing surface water it has the potential disadvantages of contamination by human and animal activities adding organic matter and waterborne pathogens unless the river stretch is protected from such activities. The guiding principle in such cases for the ULBs will be to at least intercept the sewage outfalls and provide adequate STPs and follow the recommended quality criteria for the treated sewage.

Treated Sewage into Non-Perennial / Dry River Courses

There are locations where the rivers are not perennial or almost dry throughout the year except some monsoon runoff. In this case the discharged treated sewage sinks into the aquifer zone and is extracted by infiltration wells or galleries. The advantage of direct dilution from surface water is lost, but the additional purification in the soil and dilution from the aquifer water are happening. An example is the case of the Palar river course in Tamilnadu. The surface water flow in this occurs only for about a week if the monsoon is normal and if the water spills beyond the upstream

impoundments. The aquifer however supports the public water supply of over 30 habitations along its dry tract of nearly 80 km before the sea. The partly treated sewage of the en-route habitations does reach this river course as intervals. So far, no epidemics have been met with. This may be due to the above said additional purification in the soil and dilution by aquifer water. However, if these are exceeded by the contamination load, there can be immediate health problems. The guiding principle in such cases for the ULBs will be (a) to keep a check on the raw water quality from the infiltration wells to detect sudden increase in contaminants and (b) at least intercept the sewage outfalls and provide adequate STPs.

Appendix 21: Preliminary audit noted on existing facilities

Introduction

The objectives of this environmental audit of existing facilities of water supply sub-project are to (i) assess the compliance of the existing OHSRs/GLSRs and TWs to be rehabilitated/augmented during the implementation of RSTDSP with environmental legislation; (ii) improve environmental performance through monitoring the effectiveness of the management system; and (iii) increase the Executing agencies knowledge of itself and its activities, thus increasing its ability to continually improve and minimize future potential liabilities.

The environmental audit was carried out for the existing facilities. The methodology adopted for this audit was to initially review existing plans and technical information and list various activities being carried out in the water supply system. Due diligence was carried out to physically check whether environmental performance, health and safety, etc. were in compliance with national and state prescribed standards and guidelines. Team visited the locations of existing facilities and observed operations. Meetings and discussions with key personnel were held in the various stages of the audit. Various documentations regarding the operational aspects were also checked.

Rehabilitation of existing Tube Wells	The water supply in Abu Road is being made through 11 open wells and 13 tube wells. The well field are in the downstream of Aabkari, Sabji Mandi, Luniyapura, Keserganj and Santpur (naya khera). The present production from these sources is 3750 KLD – 4700 KLD and yield of tube wells/open wells varies from 5000-15000 LPH with the availability of 24 hours power supply ,The details of tube well and open well are as under:-			
	Sr. No.	Location	Open Well	Tube Well
	1	Housing Board	2	-
	2	Sabji Mandi	5	-
	3	Aabkari	1	-
	4	Gandhi Nagar	3	-
	5	Akrabhata	-	1
	6	Amarpuri	-	1
	7	Luniapur	-	1
	8	Gandhi Nagar	-	3
	9	Shantpur	-	1
	10	Chandrwati	-	3
	11	Moongthalia	-	2
	12	Umarni	-	1
		Total	11	13
Rehabilitation of existing tube wells and open wells are proposed to meet the functional parameters as per the hydrologists report for sustainability, including but not limited to replacemnt of pipes, subbmersible pumps, cables, panels, vavles, flow meters and synchronization with SCADA enabled devices after assessment by audit of the existing TW condition and expected design life as per technical specification. Activities are to be executed in these works				
All the existing faulty/old cables shall be replaced with the appropriate rating new cable.				

	All the existing leaked/worn out riser pipe of existing tube wells shall be replaced with GI pipe of appreciate size. All the existing old and damaged panel board shall be replaced with new panel board having all the necessary protection against motor burning. Depth of the tube well will not be increased son no impact on groundwater withdrawal. Flow meter shall be installed at each existing tube well for recording of tube wells discharge for calculation of NRW including non return valve. PHED should collate all available information on the borehole and maintain a copy on site and in the office for future reference and management of the source. Information should include the hydrogeological report, borehole logs and construction details.																																																							
OHSRs:	There are 10 Nos of OHSR/GLSR in Abu Road . Details given below: <table><tr><th>Sr. No.</th><th>Location</th><th>Capacity</th><th>Staging</th><th>Year of Construction</th></tr><tr><td>1</td><td>Housing Board</td><td>450 KL</td><td>15 mt.</td><td>2000</td></tr><tr><td>2</td><td>Manpur</td><td>160 KL 140 KL</td><td>18 mt. GLSR</td><td>2006 1999</td></tr><tr><td>3</td><td>Akrabhatta</td><td>150 KL</td><td>18 mt.</td><td>2016</td></tr><tr><td>4</td><td>Sabji Mandi Area</td><td>225 KL</td><td>18 mt.</td><td>1996</td></tr><tr><td>5</td><td>Aabkari Area</td><td>350 KL</td><td>18 mt.</td><td>2014</td></tr><tr><td>6</td><td>Market Area</td><td>450 KL</td><td>15 mt.</td><td>1970</td></tr><tr><td>7</td><td>Kaserganj Area</td><td>270 KL</td><td>18 mt.</td><td>1996</td></tr><tr><td>8</td><td>Luniyapura Area</td><td>120 KL</td><td>18 mt.</td><td>1996</td></tr><tr><td>9</td><td>Santpur (Naya Kheda)</td><td>70 KL</td><td>18 mt.</td><td>1996</td></tr><tr><td>10</td><td>Gandhi Nagar Area</td><td>450 KL</td><td>GLSR</td><td>2001</td></tr></table> Debris and <u>corrosion causing contaminants</u> can create a sludge like material at the bottoms or on the sides of unclean tanks. Often resulting in <u>oxidation</u>, this can hinder storage tank efficiency. Worse yet, dirty and contaminated tanks can pose increased safety risks to the environment and employees. All concrete and plastering works will be done using mix in higher proportion than the existing, to ensure proper adhesion and strength. It has to be ensured that the new material sticks to existing by using cement slurry and or epoxy/adhesive wherever required. All concrete cracks will be repaired by using pressure grouting as per specifications. Wherever concrete cover has peeled off from concrete (Water retaining) structure, structure needs to be repaired with epoxy mortar with primer. All corroded reinforcement bar shall be replaced with new iron bars. All repairable concrete cracks to be made good by pressure grouting Removal of bushes and planting of trees in the vicinity of existing building/ structure with half brick circular tree guard (distance to be maintained from building/ structures). Subproject components are located away from settlements .Significant amount of demolition waste will be generated due to demolition of old buildings , excavation of existing road, which will be reused in construction and the remaining waste will be used for filling of low lying lands.	Sr. No.	Location	Capacity	Staging	Year of Construction	1	Housing Board	450 KL	15 mt.	2000	2	Manpur	160 KL 140 KL	18 mt. GLSR	2006 1999	3	Akrabhatta	150 KL	18 mt.	2016	4	Sabji Mandi Area	225 KL	18 mt.	1996	5	Aabkari Area	350 KL	18 mt.	2014	6	Market Area	450 KL	15 mt.	1970	7	Kaserganj Area	270 KL	18 mt.	1996	8	Luniyapura Area	120 KL	18 mt.	1996	9	Santpur (Naya Kheda)	70 KL	18 mt.	1996	10	Gandhi Nagar Area	450 KL	GLSR	2001
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CWR	Four RCC CWRs already exist at the scheme, constructed by PHED. The capacity of CWRs are given below: <table><tr><th>Sr. No.</th><th>Location</th><th>Capacity</th><th>Year of Construction</th></tr><tr><td>1</td><td>Housing Board</td><td>450 KL</td><td>2000</td></tr><tr><td>2</td><td>Market Area</td><td>200 KL</td><td>1993</td></tr></table>	Sr. No.	Location	Capacity	Year of Construction	1	Housing Board	450 KL	2000	2	Market Area	200 KL	1993																																											
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	<table><tr><td>3</td><td>Gandhinagar Area</td><td>320 KL</td><td>2001</td></tr><tr><td>4</td><td>Santpur (Naya Kheda)</td><td>90 KL</td><td>1998</td></tr></table> CWRs are in function along with pump houses. This is used to pump the water to related ESRs; from there water is distributed among the consumers through distribution pipe. Wherever concrete cover has peeled off from concrete (water retaining) structure, structure needs to be repaired with epoxy mortar with primer. All repairable concrete cracks to be made good by pressure grouting Removal of bushes and planting of trees in the vicinity of existing building/ structure with half brick circular tree guard (distance to be maintained from building/ structures). Subproject components are located away from settlements .Significant amount of demolition waste will be generated due to demolition of old buildings , excavation of existing road, which will be reused in construction and the remaining waste will be used for filling of low lying lands. Contractor has to take precautions in handling and usage of chlorine to avoid any health hazard to workers from handling and management of chlorine used for disinfection No other hazardous chemicals are expected to be used during construction works	3	Gandhinagar Area	320 KL	2001	4	Santpur (Naya Kheda)	90 KL	1998																																
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Present Condition of Existing Machinery:.	The pump sets installed at pump house have served their useful lives. These sets work at very low efficiency and design data's do not match with these pumps, therefore, proposed to be replaced <table><tr><th rowspan="2">Sr.No.</th><th rowspan="2">Name of the Pump House</th><th colspan="5">Details of Pumping Machineries</th></tr><tr><th>Type</th><th>HP</th><th>Head</th><th>Discharge</th><th>Nos.</th></tr><tr><td>1</td><td>Housing Board</td><td>C/F P/Set</td><td>25 15</td><td>56 mt. --</td><td>600 LPM ---</td><td>2 1</td></tr><tr><td>2</td><td>Market Area</td><td>C/F P/Set</td><td>15</td><td>56 mt</td><td>600 LPM</td><td>2</td></tr><tr><td>3</td><td>Gandhinagar Area</td><td>C/F P/Set</td><td>20</td><td>--</td><td>--</td><td>2</td></tr><tr><td>4</td><td>Santpur (Naya Kheda)</td><td>C/F P/Set</td><td>15 10</td><td>56 mt. 32 mt.</td><td>600 LPM --</td><td>1 1</td></tr></table> Electricity will be used for running equipment otherwise sound proof/super silent diesel Generator set should be used. It will be ensured that no leakage of discharge of fuels like diesel, petrol, and Oil & Grease can effect human health and environment. Short term accidental spills are possible. To avoid contamination from fuel/lubricants, all equipment to be maintained and examined regularly. Required precautions will be taken in storage and handling of hazardous materials, as per the Hazardous Waste (Management and Handling) Rules, 1989	Sr.No.	Name of the Pump House	Details of Pumping Machineries					Type	HP	Head	Discharge	Nos.	1	Housing Board	C/F P/Set	25 15	56 mt. --	600 LPM ---	2 1	2	Market Area	C/F P/Set	15	56 mt	600 LPM	2	3	Gandhinagar Area	C/F P/Set	20	--	--	2	4	Santpur (Naya Kheda)	C/F P/Set	15 10	56 mt. 32 mt.	600 LPM --	1 1
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Transmission main & Distribution system (Type/size/length of pipe	Details of existing transmission mains are given below: <table><tr><th>Sr. No.</th><th>Size of pipe line</th><th>Length of pipe line (Mt.)</th></tr><tr><td>1</td><td>80 mm AC-10 to 250mm AC-10</td><td>35000 mt.</td></tr><tr><td>2</td><td>80 mm CI to 250 mm CI</td><td>9000 mt.</td></tr><tr><td></td><td>Total</td><td>44000 mt.</td></tr></table> Cast Iron (CI) pipe line is about 30 years old and due to fluoride deposit in the pipe line the diameter of pipe has reduced and pipe erodes. Therefore the condition of	Sr. No.	Size of pipe line	Length of pipe line (Mt.)	1	80 mm AC-10 to 250mm AC-10	35000 mt.	2	80 mm CI to 250 mm CI	9000 mt.		Total	44000 mt.																												
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CI/AC pipe line is not satisfactory due to leakage and breakage. Hence proposed replacement by Ductile Iron (DI K-9) pipe.

The old pipe lines for rising mains are at present of Asbestos Cement (AC) material, which leak frequently result the pressure drop in the lines, therefore as per policy, the provision for replacement of these existing AC lines by new Ductile Iron (DI K-9) pipelines have been taken as per design requirement.

There are 8 water supply zones in Town Aburoad. Aburoad is provided with distribution system by gravity fed from respective OHSRs. The total length of existing distribution system is reported as below:-

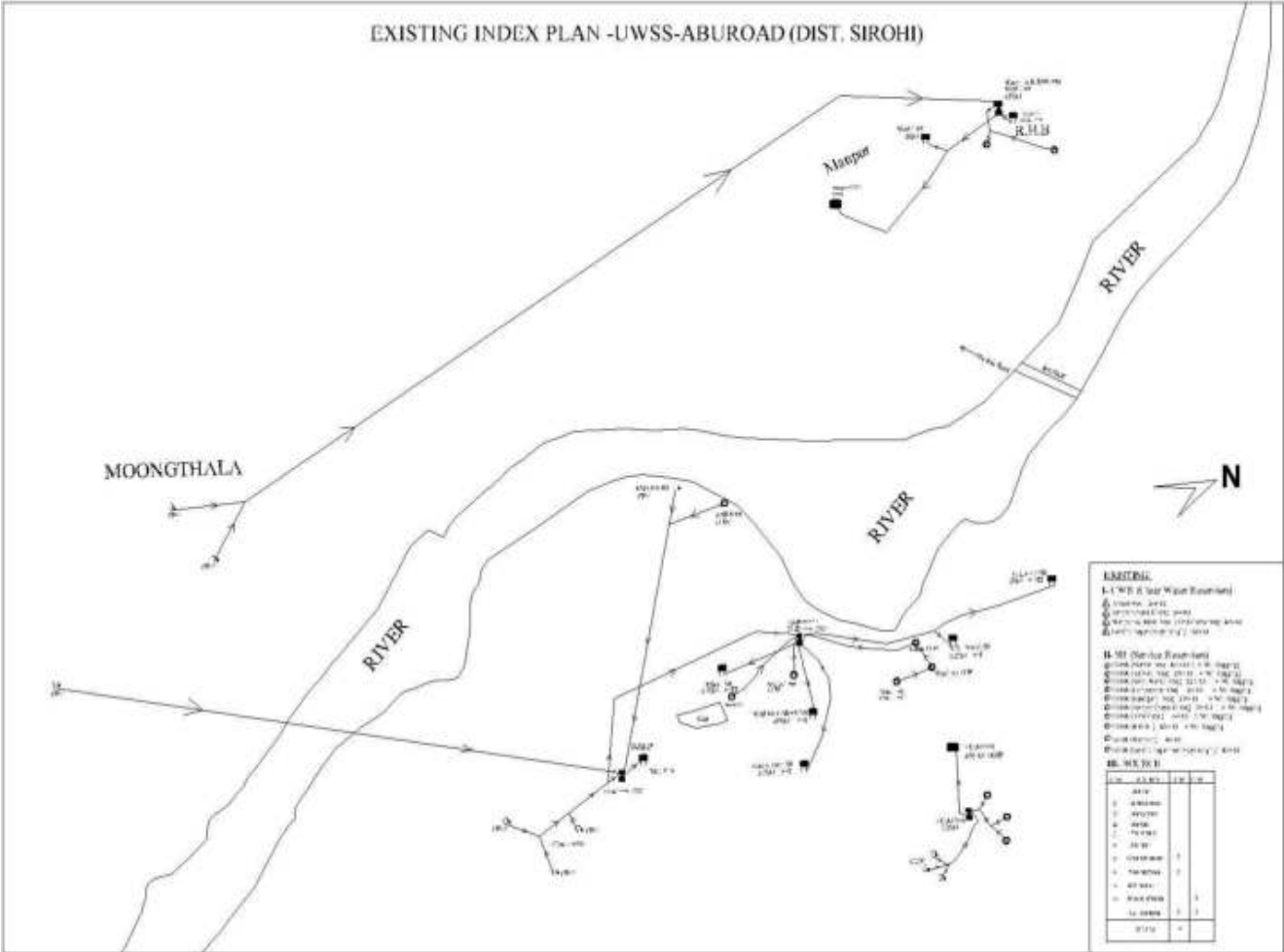
Sr. No.	Size of pipe line	Length of pipe line (Mt.)
1	80 mm AC-10 to 250 AC-10	52000 Mt.
2	90 mm to 140 mm UPVC	57000 Mt.
3	80 mm to 300 mm CI	20000 Mt.
4	50 mm GI	3000 mt.
	Total	132000 mt.

The existing distribution lines of AC/CI and uPVC pipes are very old with heavy leakages due to repeatedly breakages and joints leakages resulting heavy losses of clear water, therefore, need to be replaced by HDPE((high-density polyethylene) pipes. After laying the lines, the provision of road repairs has also been proposed in the project.

The World Health Organisation considered asbestos in drinking water arising from asbestos cement pipe in their 1993 edition of the Guidelines for Drinking Water Quality and it is no longer being used and because of the health risks these will be left in situ and replaced by new pipes. Given the dangerous nature of this material for both workers and citizens, additional measure should be taken to protect the health of all parties in the event (however unlikely) that AC pipes are encountered. This should be done prior to the start of construction works of water supply system, PIU will develop a protocol to be applied in any instance that AC pipes are encountered, to ensure that appropriate action is taken. This should be based on the approach recommended by the United States Environmental Protection Agency (USEPA).

Ductile iron pipe is a pipe made of ductile cast iron commonly used for potable water transmission and distribution. This type of pipe is a direct development of earlier cast iron pipe, which it has superseded. Ductile iron pipe in the developed world is normally manufactured exclusively from recycled material including scrap steel and recycled iron. The pipe can be recycled after use. In November 2012, ductile iron pipe manufactured in the United States received certification as a sustainable product from the Institute for Market Transformation to Sustainability.

The environmental benefits that accompany the use of HDPE in water and wastewater systems begin with its manufacturing. Pipe produced from HDPE resin uses significantly less energy to manufacture when compared to other materials such as iron and concrete. Transporting HDPE piping to municipal water and wastewater jobsites requires far less fuel than competing materials which are much heavier. HDPE is lightweight yet extremely durable. The flexible and lightweight makeup of HDPE bring more environmental benefits through low impact installation practices such as horizontal directional drilling (HDD) and other trenchless operations. HDD is minimally intrusive and well suited for use in highly congested municipalities as well as crossings of environmentally sensitive areas.



Subproject Sites Photographs



GANDHI NAGAR PUMP HOUSEHOUSING BOARD PUMP HOUSE



MARKET AREA PUMP HOUSEMANPURA GLSR



AABKARI ESR



HOUSING BOARD ESR



KESARGANJ ESRLUNIYARPUA ESR





SABJI MANDI ESR

Appendix 22: Sample ACM Management Plan

BACKGROUND OF ASBESTOS

1. The purpose of this Asbestos Management Plan (AMP) is to identify, use appropriate methodology and scientifically handling /disposal of the Asbestos Containing Materials (ACM) in order to comply with the applicable National legislation and International standards in sync with norms of ADB's SPS 2009. ADB has mandated as per Appendix 5 - prohibit the investment activities list - production of, trade in, or use of un-bonded asbestos fibers is deliberated. As per SPS 2009 Safeguard Requirement 1, it is emphasized "that the borrower/client will provide workers with a safe and healthy working environment" in the work areas with accounted risks inherent to the work zone and defined safety instructions and standard operating procedures identifying roles and responsibilities.

2. Asbestos is a collective name given to a group of minerals that occur naturally as fiber bundles and possess high tensile strength, flexibility, heat resistance, non-biodegradability with chemical and physical durability. Asbestos is hydrated silicates with complex crystal structures. It is found in two configurations: chrysotile (derived from serpentine minerals) and amphibole is a naturally occurring mineral with long thin fibers. The most abundant asbestos used in the world is chrysotile. The use of ACM propagated due to its economic viability.

3. The purpose of this AMP is to identify, use appropriate methodology and scientifically handling /disposal of the Asbestos Containing Materials (ACM) in order to comply with the applicable National legislation and International standards in sync with norms of ADB's SPS 2009.. As per SPS 2009 Safeguard Requirement 1, it is emphasized "that the borrower/client will provide workers with a safe and healthy working environment" in the work areas with accounted risks inherent to the sector and defined safety instructions and standard operating procedures identifying roles and responsibilities.

REGULATORY FRAMEWORK, STANDARDS AND PROTOCOL

Table.1

Government of India Laws, Regulations and standards on Asbestos Applicable to the projects	Requirements for the project
IS 11768: 1986/2005: Recommendations for disposal of asbestos waste material	The standard emphasis that every employer who undertakes work which is liable to generates asbestos containing waste, shall undertake adequate steps to prevent and /orreduce the generation of airborne dust during handling, storing, transportation and final disposal of final disposal of asbestos and asbestos containing products. • The crux is waste avoidance: the practice inculcated should focus the on minimal waste generation.

	Waste Collection: In the project circumstance, the waste is referred to the damaged powered asbestos which will be collected in the Permissible plastic bags to be disposed off to the nearest TSDF facilities.
IS 12081: Pictorial Warning to be implemented on equipment containing Asbestos Contaminated Products.	The objective of the caution is to make the person handling to take all pre-cautionary measures and make them aware of all the possible risk.  
IS 11451: Safety and Health Requirements related to Occupational Exposure to Asbestos contaminated Products.	In the project the norms pertaining to limiting number of hours working with ACM will be 8.0 hrs/48 hrs a week and the medical examination has to be periodic, the environmental monitoring has to be done as per the protocol. The safety at work place shall be enforced.
IS 11768: Waste Disposal Procedure for Asbestos Containing Products.	The protocol pertaining to disposal of the waste is emphasized, the collection of ACM powered will be in permissible plastic bags, which will be twisted tight at the neck so that the wear and tear due to abrasion will be minimum and the transportation of the asbestos waste has to be done by the

	authorized vendor to the approved landfill site that in the project case id TSDF.
Sampling of asbestos fiber (as per BIS-11450) has to be done regularly using personal sampler and determined using phase contrast microscope.	The Sampling and analysis protocol is emphasized. Details are given as above.

Further, there are several legislations that regulate the use and handling of asbestos as applicable, namely:

- a. The Supreme Court of India – Banned ACM use in January 21 2011.
- b. National Green Tribunal - In pursuant to the above order, in 2015, NGT issued an order- "that there is no asbestos mining presently operational anywhere in the country and the operations of the mines of associated minerals with asbestos has also been halted."
- c. Environmental (Protection) Act (1986)- Environmental monitoring.

RISK ASSESMENT:

4. The process of evaluation of risk at all the working sites was evaluated with the inventorization of the unscientific storage pipes-in case of worst scenario. The site identified and evaluated was Sardarshar. Site visit was conducted to evaluate the risk associated with the ACM handling and re- handling. Working with or handling AC pipes in manner that produces dust, fibers, air borne particles etc., is very harmful and hazardous to the workers and general public in and around the work sites. The condition of existing underground AC pipes are not known, however, as these are old certain pipes will be in deteriorated conditions. So the Conditions were presumed if it is in friable form or in a condition in which it can release fibers before it is subjected any disturbance or removal, all safeguard measures needs to be adopted. There were certain areas where the AC pipes were subjected to shear and are powered, and AC Pipe ends were damaged these were the high risk zones in the campus. The probability of the air borne asbestos fibers in the areas cannot be over ruled.

5. Thus it is necessitated to draft standard operating procedure for disposal of ACM. The purpose of this standard operating procedure (SOP) is to ensure the safe handling of AMC including protection from hazards associated with uncontrolled distribution, encounter and removal of Asbestos Cement (AC) Pipes and pipe fittings. The scope of this SOP encompasses all aspects of safe AC pipe handling including identification of site, re-handling and encountering of ACM, site selection and proper identification for storage, inventorization, monitoring, final disposal, training and maintenance of records.

6. The fatal health hazard with inhalation of air borne asbestos fibers and its adverse health impact are known and needs a proper attention and planning with defined roles and responsibilities to ensure the work zone is at minimal risk and safe for the workers. It is also necessary to mandate the standard operating procedures with implementation of all requisite safety gears.

7. The assessment of the ACM disposal will be vested with the DOB Operator. The undamaged pipe-where the pipe ends are intact that there is no damaged on the entire length of pipe-to be stored in isolated storage with secured pipe ends either by wrapping the ends with

permissible plastic bags. The damaged/broken pipes/powered pipes will be disposed off, by bagging the same in permissible plastic bags. All the records pertaining to the inventorization has to be kept by the DOB Operator. The same shall be cross verified by RUIDP.

EMERGENCY RESPONSE PLAN & CHANCE FIND PROTOCOL

8. The emergency procedures should include managing an uncontrolled release of asbestos materials into the workplace. The onus of the same shall be ensured with immediate action of the field staff-DOB Operator/ HSE Staff. Steps should be taken to:

- Warn anybody who may be affected.
- Exclude from the area anyone not needed to deal with the release.
- Identify the cause of the uncontrolled release.
- Regain adequate control as soon as possible.
- Make sure anyone in the work area affected, who is not wearing personal protective equipment (PPE), including respiratory protective equipment (RPE), leaves the affected area immediately.
- Minimize the spread of asbestos by ensuring they are suitably decontaminated.
- Clean up dust and debris.
- Decontaminate anyone who is contaminated with dust and debris.
- Ensure rags, clothing or PPE is decontaminated or disposed of as contaminated waste.
- Consider alone and/or remote workers to ensure they can alert someone if necessary.

Check what you're working on before you start:

- Avoid using a sweeping brush as this can spread asbestos.
- Make sure no unauthorised personnel enter the area.
- The clean-up of any accidental release of higher risk materials, eg. asbestos cuttings, powered asbestos that may release the asbestos fibers, to be done by authorized person

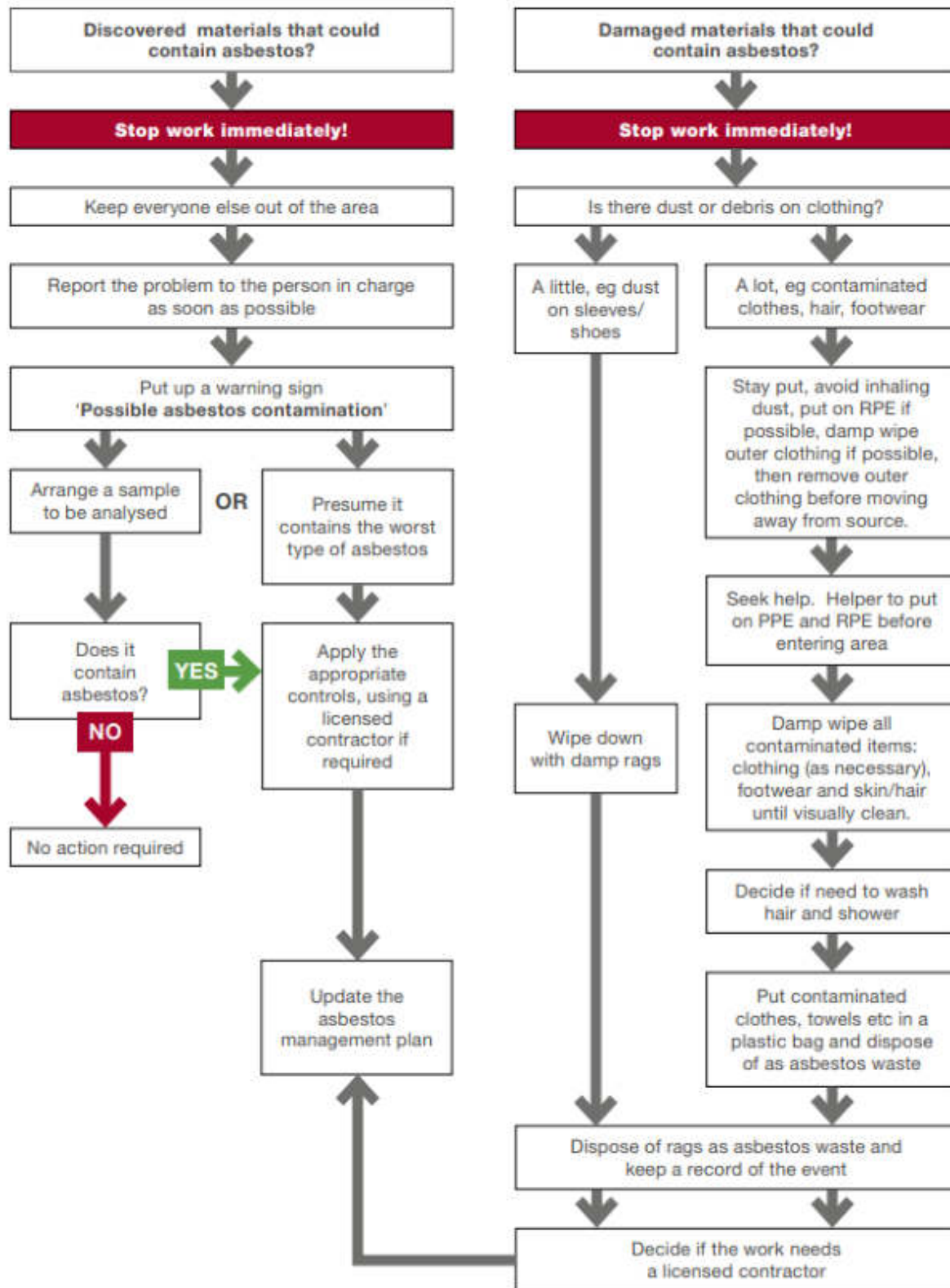


Fig.No.1-Showing Flow chart of ERP

Table.no.2-Roles and Responsibilities

PRE-CONSTRUCTION				
Activities	Responsibilities	Associated Documents	Estimated Cost	Remark
Design to encounter minimal ACM, and then Identification & Inventorization ACM - AC pipes & fittings	RUIDP & DBO CONTRACTOR	Form-I	Rs.100/km	The onus of the minimal encounter of ACM is vested upon the RUIDP and inventory will be with the DOB Operator and has to be annually verified by RUIDP.
Define & confine ACM storage area-in-situ			Rs.65/Sq.m	The storage area made available will be confined and fenced.
Warning signage near the ACM work site, storage and on AC pipes in local language**			Rs.500/label	The signage labels can be printed, sticker pamphlets or painted.
Training of personals handling the AC pipes and fittings	DBO CONTRACTOR	Form-II	Rs.1000/Person	All requisite safety gears should be made available at all sites.
Use of safety Gears			Rs.6000/Person	All the safety gears should be silicon based and suitable for Asbestos protection.
Briefing of Emergency Response Plan			Rs.500/Person	All the risk zones with respect to white card has to be briefed.
Confined storage with access control plan			Rs.5000/site	Inward and outward movement of authorized person must be allowed and has to be guarded or should be under key control.
Pre-history medical records of the ACM handling team			Rs.3000/Person	All requisite medical test, Respiratory test, lungs /Chest X-ray/CT Scan, Blood Test, Lower Abdomen examination etc
CONSTRUCTION PHASE				
Monthly Inspection & Annual Environmental Monitoring.		Form-III	Rs.40,000/sample	The sampling zone should be 500 m from the storage site and personal sampling has to be as per SOP-2
Reporting in SEMR	RUIDP/DBO CONTRACTOR	None	Nil	As per ADB Format
Collection of Health records in compliance to the local laws	DBO CONTRACTOR /RUIDP/PHED/LS G	Form-IV	Nil	For regular evaluation & identification of any abnormality.
Ensure adoption of all standard operating procedure		SOP-1&2	Nil	As revision desired on basis of Site specific information may be upgraded in the SOP

				1&2 if required
Collection, Segregation, Reception and Disposal as per National norms of ACM		Form-V	Nil	Standard Regulatory format has to be filled and disposed off within 90 days.
Use of safety gears prior to handling of ACM based on White Card.		White Card-Page-11	Nil	Periodic training can be site specific
Disposal of ACM to the identified TSDF Facility to be done as per procedure within or prior to 90 days		SOP-2	1500/ton of waste plus freight as per actual.	Within 90 days from the generation of waste, in case of existing waste it has to be disposed off within 90 days from the Project Start.
To inform and fill the returns in the prescribed manifest as per HWMR.		Form-V(Form-10 of the Rule HWMR	Nil	90 days from the start of work
To facilitated a restricted confined storage space with access control with proper inventrization.		Form-II	Nil	Site Specific
In-situ storage of ACM.	DBO CONTRACTOR	Form-VI		The storage of existing and encountered ACM pipes (more than 4.0 ft) will be stacked end to end at 90 deg. With vertical stacks, 8 inches above the ground, covered with permissible plastic sheet. The campus custodian-viz PHED etc should also be informed about the In-situ storage of ACM and its impact.
ACM removal	DBO CONTRACTOR	--	--	Follow ACM Removal
Record maintenance of ACM in-situ and disposed off to TSDF	DBO CONTRACTOR	Form-I & Form-IV	Nil	The copies of inventory generated and collected will have to be shared with Land Custodian (LC), RUIDP and DOB Operator. To distinguish the forms they can be numbered.

				FORM-I(LC),Form-IV(LC)
Transits ACM storage of waste to be disposed off to TSDF	DBO Contractor	Form-IV	50,000/room	An isolated storage room should be constructed with 10x10 with height of 3.5 ft roofed properly for transit disposal of ACM to TSDF. DISPOSABLE ASBESTOS WASTE STORAGE ROOM HAZARDOUS WASTE CATEGORY-15.2 (as per Hazardous waste management & Handling Rules 2015).
POST CONSTRUCTION PHASE				
Compliance of AAQM, Asbestos Fiber monitoring and Soil Quality monitoring and Periodic Work zone monitoring(Asbestos fiber count) records to be maintained	DBO Contractor	SOP-2	Rs.40,000/sample	The Asbestos Fiber count monitoring has to be conducted prior to ACM handling operation and after ACM Handling operation by an Accredited Laboratory. List of accredited laboratory will be available at Rajasthan State Pollution Control Board website- rspcb.nic.in
Health records & Periodic Medical Checkup of the personals handling ACM to be maintained.	PHED/LSG/DBO Contractor	Form-II	Rs.3000/Person	All the concerned employees deputed to handle or deal with ACM has to have Pre medical history and periodic medical examination done

Permissible Levels

9. Permissible Exposure Limit (PEL) for asbestos is 0.1 fibers per cubic centimeter of air as an eight hour time weighted average (TWA), with an excursion limit (EL) of 1.0 asbestos fiber per cubic centimeter over a 30 minutes period.

ACM REMOVAL

ACM Removal has to be checked in sync with the design and emphasis has to be laid to avoid the removal of ACM, in case it is unavoidable, then all the requisite safety gears are to be adopted:

- Inform the Asbestos Expert/HSE Expert prior to removal.
- Isolate the area with access to only trained staff/employees under supervision of Asbestos /HSE Expert.
- Exhibit all warnings



Fig.No.2 Asbestos warning signage

- Undertaken Asbestos fiber Monitoring
- The trained Employees have to be deputed for removal of ACM.
- The removal ACM material has to be check with the status and extent of damage.
- Efforts should be made to remove the ACM as minimal as possible.
- The ACM removal has to be manual; it should neither be cut nor drilled.
- All removal operation should be undertaken with ACM in wet condition.
- The removed ACM will then be labeled and placed on permissible plastic sheet. It should not be put on ground directly.
- The dimension of plastic sheet should be larger than the ACM placed.
- If the ACM pipe is not damaged as about 4.0 ft and above, the ACM will be subjected for in-situ disposal.
- If the ACM is damaged and broken then it has to be packed in permissible plastic bags and disposed off to TSDF.
- Prior to disposal it can be stored in isolated room-showing board of –Hazardous waste storage room.
- The hazardous waste to be disposed off to TSDF should not be stored over 90 days after the removal date of ACM at site.
- All the safety procedures and safety gears should be worn by all the employees engaged in the ACM Removal operation.
- The Asbestos fiber monitoring, soil monitoring has to be undertaken during the operation as well.
- The process of removal of ACM will be completed after the removed ACM and its suitably disposed off either in -situ or to the isolated room prior to disposal at TSDF.
- Post ACM Removal asbestos fiber monitoring has to be undertaken to ensure the work zone

is safe to resume further operations.

Safe Practices in Handling ACM

10. Proper handling and PPE:

- a. Cover up and wear PPE (Personal Protection Equipment). including respirator or dust mask
- b. Make sure the mask has two straps to hold it firmly in place. Don't use masks that only have one
- c. Also wear a Hard hat, gloves, disposable coveralls with a hood, and safety glasses or goggles to protect eyes
- d. Do not eat, drink or smoke in the work area as you may inhale or eat dust. Wash your hands and face with soap and water before meal breaks and when finished work for the day.
- e. Do not use power tools Asbestos fibers can be released if power tools are used for anything other than the removal of screws.
- f. Do not water blast or scrub with a stiff broom or brush. It is illegal to water blast asbestos cement sheets. If the material has been accidentally water blasted or has suddenly deteriorated in some way, you should call a licensed asbestos removal DOB Operator
- g. Wet gently with water when removing asbestos cement pipes, use a pump spray to lightly dampen the pipes and keep the dust down. Remember: Not to waterblast asbestos cement materials.
- h. Avoid drilling and cutting into asbestos products.
- i. Do not drill holes through and never cut Instead remove the entire product and replace it with a non-asbestos product
- j. Don't drop fiber pipes remove them carefully, Lower them to the ground, don't drop them, to minimize breakage.
- k. Lay plastic sheeting under the work area to prevent any dust contaminating the ground. Use 200 micron thick plastic sheeting or bags or as permissble these must not be made from recycled materials or re-used for any other purpose.
- l. The work area has to be barricaded and there should be no un-authorised person allowed. Only Trained ACM expert should be allowed to handle the ACM along with EHS Expert.
- m. Close windows and doors and seal vents to stop dust getting into the house; ask neighbors' to do the same.
- n. Seal off other places where dust can get in.
- o. Remove soft furnishings like rugs, clothes, jute bags from the work area, and seal anything with plastics if it cannot be moved.

- p. All the AC broken pipes have to collected and stacked properly with 200micron plastic wrapping with winning signage.
 - q. Do not leave plastic sheet lying about where they may be further broken or crushed by people or traffic.
 - r. Remove all ACM by the trained handler.
 - s. Since we are amidst of dry climatic conditions due care must be taken to see that no waste broken pipes or fittings are left loose and outside the confined area and may be dampened as required.
 - t. Mark and add signage.
11. Due care has to be taken to collect the dampened waste in a permissible standard bags with proper warning signage's.
12. The wastages packed have to be disposed off to Treatment, Storage or Disposal Facility(TSDF).The plastic bags must have legible note:
- d. Waste Type:
 - e. Date of packing:
 - f. Qty/Numbers:
 - g. Packed by:
 - h. Warning Signage:
 - i. Disposal



Fig.No.3- ACM: In-situ storage warning

13. The AMP procedures-**Standard Operating Procedure-01-** are as follows and are summarized as above
- j. Objectives – to keep the work zone safe and secured.
 - k. Requirements – identify all the requirements needed for handling AC in the specific site and project
 - l. Conduct and ensure awareness and vocational training to ACM handlers
 - m. Conduct a comprehensive identification and risk assessment of ACMs
 - n. Apply restriction / re-handling of ACM on ground-use of PPE. Ensure that workers handling ACM have the right PPEs as follows:
 - i. Hard helmet
 - ii. Overall suit
 - iii. Gloves
 - iv. Mask to be strapped tight

- v. Safety goggles
- vi. Safety shoes
- vii. Ear plugs
- o. Avoid underground encountering of ACM
 - i. Ensure that an authorized person (HSE) are supervising the work
 - ii. Barricade the area with signage
 - iii. Damp ACM
 - iv. Use safety gears
 - v. Dismantle ACM to be labeled, kept on plastic grounding and packed in permissible bags
 - vi. Label the bags properly
 - vii. Ensure shipping to proper disposal sites
- p. Site selection – the disposal site should be ready to handle ACM and protect the nearby people as well The site selection criteria are as follows:
 - i. Away from habitation
 - ii. Avoid low lying areas
 - iii. Away from water storage
 - iv. To be enveloped with minimum of 8-feet height enclosure
 - v. Avoid high vertical stacks
 - vi. Access controlled
 - vii. Proper signage enclosure
- q. Proper re-handling of AMC, labeling and packing
- r. Control access and ensure proper monitoring of records, specifically:
 - i. Environment
 - ii. Health
 - iii. Reporting to regulators

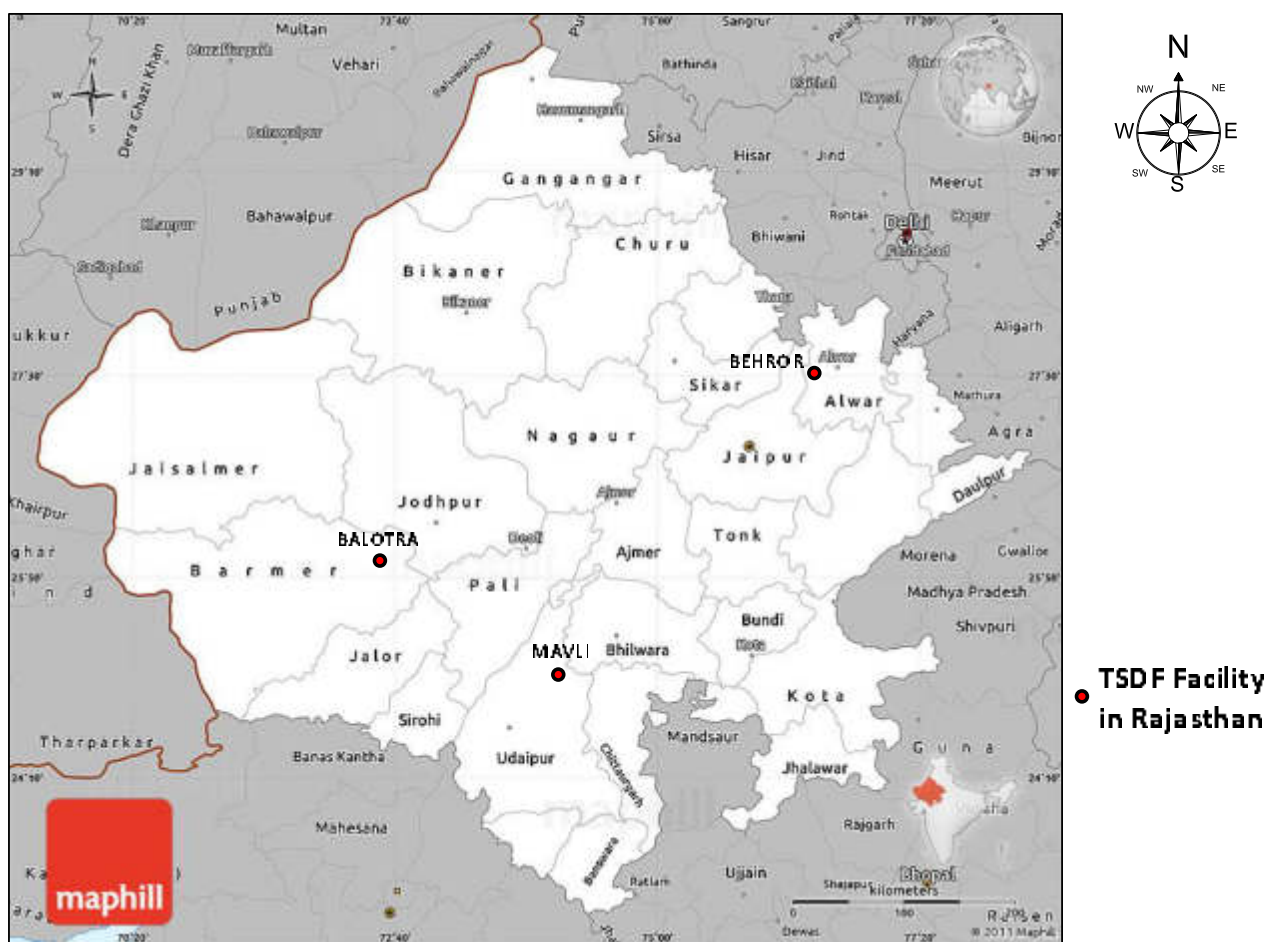
Dispose the ACM through qualified DBO Contractor up to the Total Sanitary Disposal Facility (TSDF)

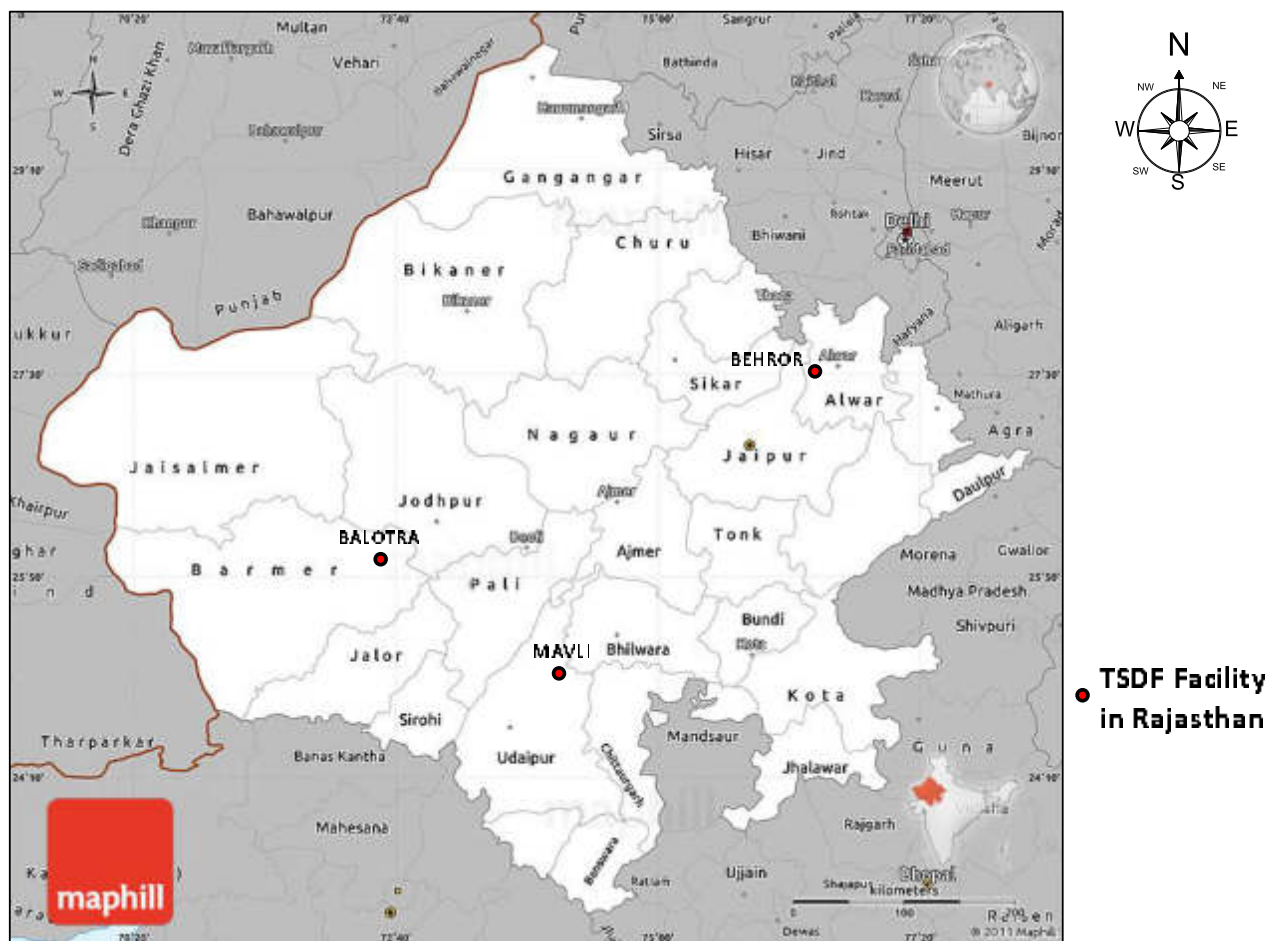
LIST OF APPROVED TSDF OPERATORS IN RAJASTHAN

S.No	Operator	Address	Remark
1.	Rajasthan Waste Management Project (M/s Ramky Enviro Engineers Ltd)	Survey 1018/13, Vill-Gudli, Tehsil-Mavli, Zinc Choraha to Debari Railway Station Road, Dist Udaipur (Rajasthan).	This TSDF is for all kind of hazardous waste as listed in the hazardous waste (Management & Handling) Rules.
2.	Ramky Enviro Engineers Ltd, Balotra	Ramky BWMP Rd, Rajasthan 344032.	This TSDF is for all kind of hazardous waste as listed in the hazardous waste (Management &

			Handling) Rules
3.	Continental Petroleum Ltd	Bheror, Distt- Alwar	Only for Incineration

Label/display for TSDf disposal bags has to have clear display of the content in both English and local language as displayed under:





The above map clearly depicts the location of approved TSD in Rajasthan.

IN-SITU STORAGE ACM PIPES AREA

The removed undamaged ACM pipes have to be stacked properly as shown below to avoid any rolling of the pipes and eventual damage. The existing ACM Pipe stacking has to be re-handled to stack the ACM pipes properly. If the removed ACM Pipes is less than the full length of the ACM pipes, then separate stack of the same should be done with proper pre-caution and safety measures and gears.

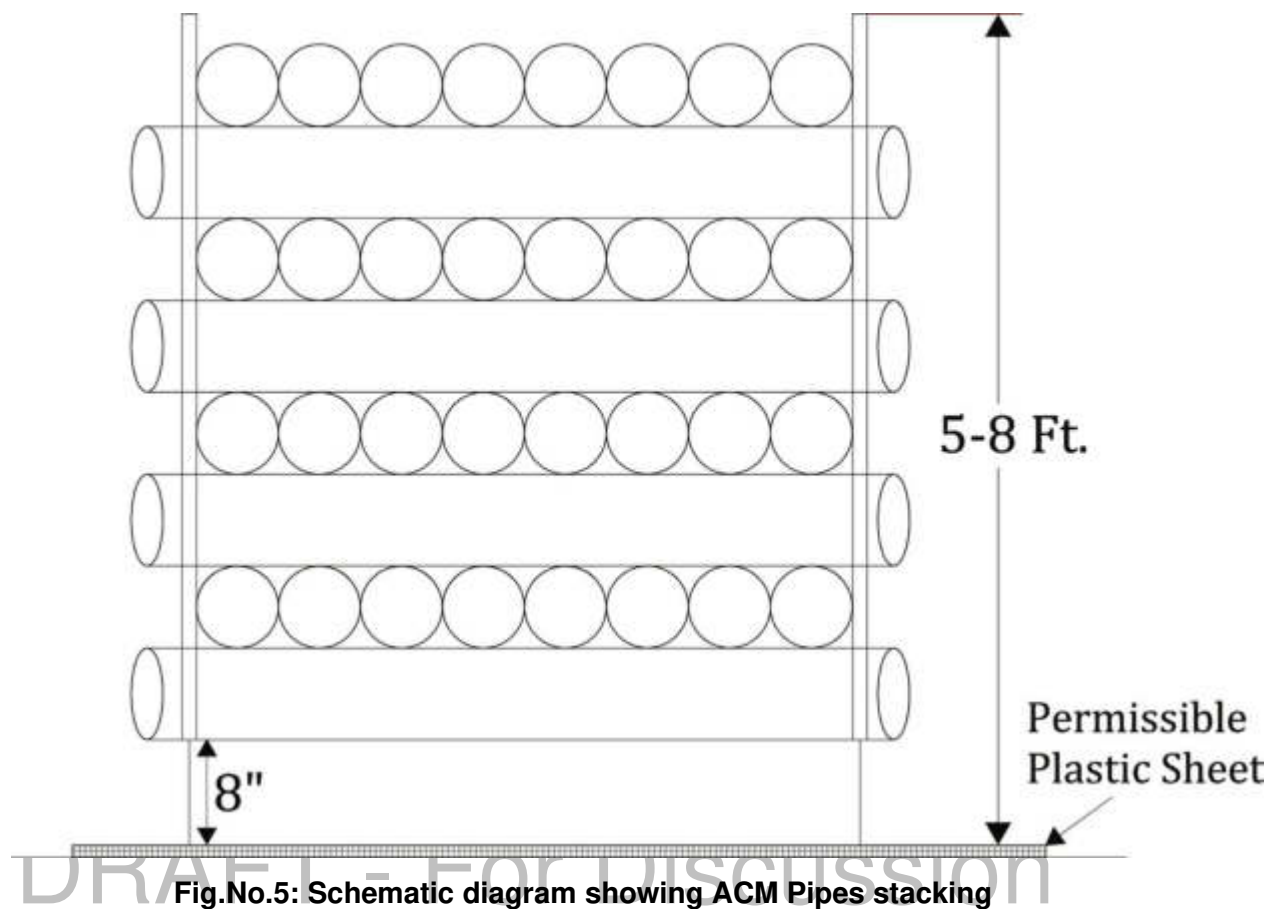


Fig.No.5: Schematic diagram showing ACM Pipes stacking

The ACM stack has to be enveloped with proper fencing showing internal movement of person with 4.0ft corridor all around the stack. The Storage area will have display of all requisite warning and access control of the authorized person's entry and exit.

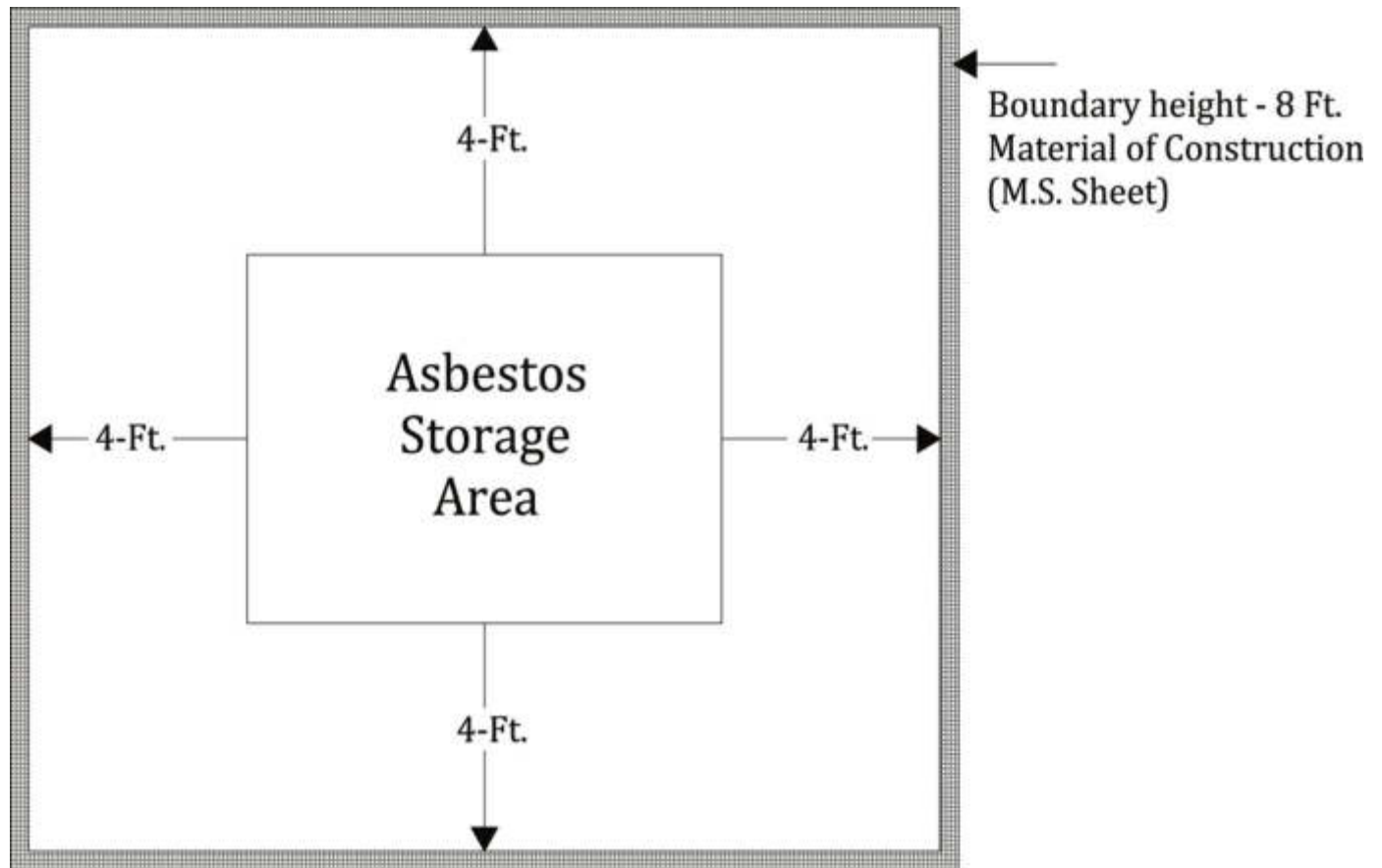


Fig.No.6: Schematic diagram showing ACM Pipes storage area

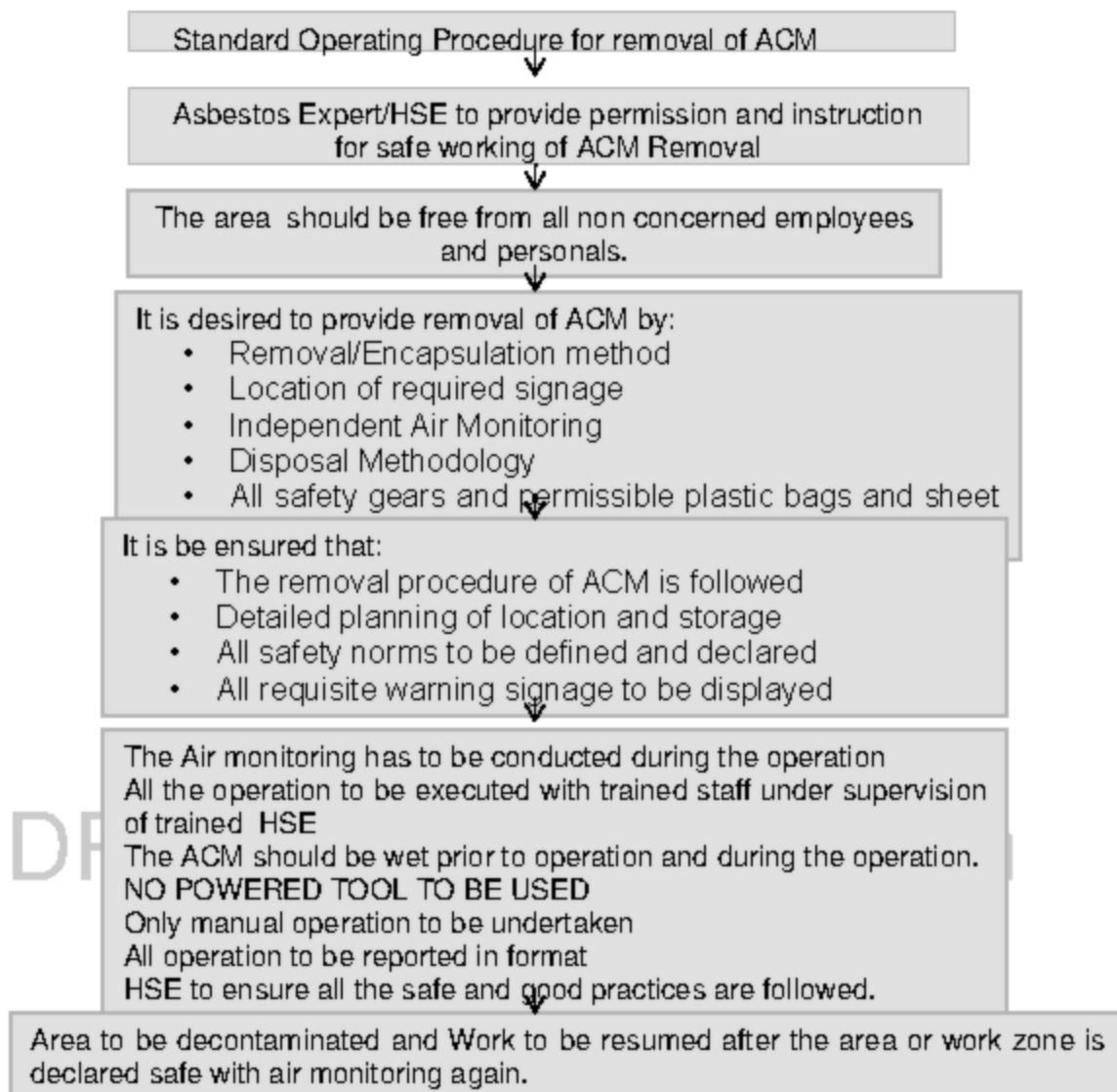


Fig.no.2-Standard Operating Procedure Flow Sheet

14. All the records in the pre-determined format are to be maintained and the disposal as stated in the applicable National legislation is to be followed. Any innovative use of the discarded ACM with the permissible law frame must be approved by respective Regulators prior to practice.

15. The format of Inventorization & records at all locations must be maintained irrespective of generation of ACM waste. The format of documentation must be uniform in order to track and trace the details as desired.

16. Based on the outcome of the workshop it was essential to enumerate the standard operating procedure & define the roles and responsibilities (already discussed as above) and the re-handling cost of the ACM as stated below:

Table.03- Suggestive Protective measures & Estimation of the cost of Re-Handling of ACM

1	Re-Handling			
	Re-handling of AC Pipes scattered/used in the premises.	- Re-Handling of the old AC Pipes in the premises needs to be quantified and a proper inventrization has to be prepared. - The isolated enveloped storage sites should be away from the habitation, the pipes used for fencing, tree guard needs to be re-handled & stored in the nearest isolated storage site and the damaged pipes/broken pipes have to be disposed off to the TSDF with all pre-cautionary measures. NOTE: Only powered/ grounded ACM will have to be disposed off to TSDF.	Manpower engaged: Trained labor, Supervisor, HSE Experts/Asbestos Expert	The re-handling cost will be part of the laying program. The disposal cost is Rs.1500/MT plus freight as per actual
	Removal of encountered AC Pipes	The damaged / broken AC Pipes have to be cautiously handled with prior moistening and packed in plastic bags (permissible plastic bags) and sent for re-use in road making or to TSDF with all signage and precautionary measures as suggested above.	Manpower engaged: Trained labor, Supervisor, HSE Experts/Asbestos Expert	As stated above
	Storage	The existing storage stacks have to be shielded with 8.0 ft height and above ground (min1.0 ft) The Pipes shall be stored in stacks with stoppers provided at the bottom layer to keep the pipe stack stable. The stack, particularly of smaller diameter pipes, shall be in pyramid shape. Pipes shall not be stacked more than 1.5 m high. Each stack shall have pipes of the same type and size only. Removal of pipes shall start from the top layer and by	Manpower engaged: Trained labor, Supervisor, HSE Experts/Asbestos Expert	As on daily wages

		pulling from one end, if required, with all safety precautions. A pipe shall not be stored inside another pipe. The pipes may also be placed alternately length and crosswise. They shall be stored on horizontal racks supported throughout their lengths on a reasonably flat surface free from stones and sharp projections. They should not be stacked in large piles, especially under warm conditions. Open ends of pipes to be sealed with permissible polythene.		
	Transportation	• Full length pipes • Damaged/Broken Pipes	Authorised agency	As per actual.
	Disposal			
	Isolated storage	The storage area should be twice the area required for storage of ACM	Manpower engaged: Trained labor, Supervisor, HSE Experts/Asbestos Expert. Authorised vendor. Boundary, signage, safety aspects etc.	As stated in Table 1.1.
	Sent to TSDF	The damaged/broken pipes will be packed in permissible Poly bags and has to be stored in defined location within the isolated storage. The records pertaining to the disposal (within 90 days of generation) have to be made systematic.	Authorised agency	Freight as per actual.
	Estimation of suggestive protective and preventive measures			
	Air Quality sampling & Analysis- Asbestos fiber count	Personal sampler, phase contrast microscope, In case of asbestos dust, the same shall not exceed 2 mg/Nm ³ . Per the OSHA standards for asbestos, exposure monitoring and medical surveillance of workers is required when the Workers are or will be exposed to airborne concentrations of fibers of asbestos at or above OSHA's	Approved/accredited laboratory	As stated above.

		exposure limits for a combined total of 30 or more days per year; Workers perform work that disturbs asbestos-containing material (ACM) or presumed asbestos-containing material (PACM) for a combined total of 30 or more days per year. Minimum 3 locations (@120deg from each location) at min 500 m from the isolated storage of ACM and one sampling near the encountered site. The frequency of monitoring should be bi-annually.		
	PPE's	Hard helmet, double strapped mask, safety tapes, boots(non laced), gloves, safety suits, goggles, ear plugs,	Standard make, minimum-4 sets at each site	As stated Above
	Education & Training	Awareness, New induction training and inspections	Asbestos expert/HSE Experts	As stated Above
	Medical Check up	As per norms or in consultation with Medical Practitioner.	Medical Doctor	As stated Above

Note:

Efforts should be made to minimize the existing AC water pipes. In areas where ACM are stored, it is required to have induction training of AMP, complete the formats and maintain the records.

Removals of used AC Pipes for fencing, boundary wall etc have to be carefully removed from use and stored in isolated storage.

At certain locations, it was observed that the discarded pipes was used as tree guard, when the sapling was planted as on date the tree is fully grown, in that case the removal of ACM has to be done with all precautions and use of total safety gears. Hand tools or slow-running tools producing coarse dust or chips should be used where practicable rather than high-speed machines or those which cut by abrading the material after wetting. Alternatively, the same can also be bounded properly by bitumen paint.

The coarse dust and pieces in wet conditions will have to be collected in permissible plastic bags with use of all safety gears.

The collected wastes are to be labeled as stated above and disposed off to TSDF. The records of the same will have to be kept on daily basis and summarized to monthly basis.

FORM I – ASBETOS INVENTORY, INSPECTION AND ACTION FORM		
Format: RUIDP/IIA/ LOCATION/NAME OF DOB OPERATOR/HSE 002/YEAR		
Location:		
Site co-ordinates:		
Elevation:	Team:	
Date of visit	Sign:	
Present Status		Indicate if installed, operational, in storage, etc.
Original age		Months or years since installation
Diameter		mm or inches
Length		meters
Volume		
Total packet		
Packing date		
Disposal date		
Existing Site (Photo or illustrations):		
Illustration/ Design of Activities On-site with respect to existing asbestos (include details such as size of new pipes, distance from existing AC pipes, other notable observations)		
DOB Operator Handling Asbestos:		
Number of persons handling waste		
Medical Records		
Safety Gears		
Vocational Training Last Conducted:		
Number of attendees:		
Conducted by		
Schedule:		
Required Actions:		
Remarks		
Conclusion/Remark		
HSE Signatory		

FORM-II – MATRIX FOR TRAINING & RECORDS

Format: RUIDP/INSP.MATRIX/LOCATION/NAME OF DBO CONTRACTOR/HSE 001/YEAR				
S. No.	Aspects of ACM		Check points	Remarks
Training Schedule:				
Trainer Details:				
Date/Location of Training:				
Number of attendees:				
Training Schedule, Training Materials & Attendance Sheet, Feedback of Trainees.				
Understanding of:				
A. DOCUMENTS AND RECORDS				
1.	Site Inventory			
2.	List of ACM storage and installation points			
3.	Structure of ACM management committee			
B. INVENTORY				
1.	Inventorization of ACM			
	Number of ACM/ pipes			
	Dimensions of ACM/ pipes			
	Total volume of ACM/ pipes			
2.	Storage facility/ installation location:			
A.	In-use	Location		
		Condition	Intact/ damaged	
		Purpose		
		Accessibility by the workers		
		Evidence of physical damage and approximate size (length, width, volume) without coming into contact with The damaged ACM		
		Impacts on the environment (Based on Asbestos fiber Monitoring)		
3.	LABELING AND SIGNAGE			
	Notification to workplace safety and health			
	Working instruction			
	The risks associated with exposure to asbestos fibers			
	Cautionary statement to not disturb materials containing asbestos			
4.	PERSONAL PROTECTIVE EQUIPMENT (PEP)			
	Record of pep			
	Mask			
	Eye glasses			
	Gloves			
	Ear muffs			

	Others	
	Training	
	On occupational risks of asbestos to the workers	Date: Time: In-house/ external: Faculty: No of workers attended:
	Training for maintenance, repair and renovation	Date: Time: In-house/ external: Faculty: No of workers attended:
	Training for workers working with asbestos	Date: Time: In-house/ external: Faculty: No of workers attended:
	Periodic air quality monitoring records	• Within the permissible limits • Not within the permissible limits (specify the reason)
	Workers medical check-up records	Date: In-house/ external: Performed by: Remarks: No of workers attended:
Conclusion/Remark HSE Signatory		

The all the data required in Form-II will be filled by the DBO Contractor (HSE-Officer), the records of this document has to be maintained for a pre-decided life. Details of training imparted have to be file with appropriate evidence like photographs, feedback form, videos etc. There has to be a proper documentation of the records kept with highest level of transparency to retrieve, trace and track the records as necessary. The records maintained by the DBO Contractor, has to be audited regularly by the ACM-Expert. Form-I has to be accompanied with Form-II. Defined period of Air Quality monitoring and health will have to be minimum twice a year. Where ever the fiber counts are found/ recorded beyond the permissible norms, corrective action, like:

- ☐ Cordon off the area of ACM
- ☐ HSE team with trained experts to be deputed for the task
- ☐ Moisten the ACM prior to handling
- ☐ Storage area of the ACM stacks to be covered
- ☐ The damaged/deteriorated ACM to be re-handled in presence of Asbestos Expert/ HSE (Trained) with all defined norms and safety gears.
- ☐ Disposal of damaged/deteriorated ACM to be done as per the Norms.
- ☐ Records of disposal to be maintained.
- ☐ Keep all requisite evidence in form of documentation, geo-tagged photographs etc
- ☐ Frequency of health monitoring at such locations to be increased.

Form-III-Air Quality Monitoring and Results

Format: RUIDP/AQMR/ LOCATION/NAME OF DBO Contractor/HSE 003/YEAR				
Vendor details				
Approvals				
S.No	Location	Agency	Results& Norms	Permissible
Conclusion/Remark				
HSE Signatory				

FORM-IV-Medical History

Format: RUIDP/MH/ LOCATION/NAME OF DBO Contractor /HSE 004/YEAR																			
Employee code:																			
Employer Details:																			
PPE Used:																			
Insurance/ESI																			
S.No	Name	Age/Sex/D OB	Address/ Contact details:	Period of Employment/ Job Title	Pre-History	Doctor's comments	HSE Remarks												
					<table border="1"> <tr><td>Height</td><td></td></tr> <tr><td>Weight/BMI</td><td></td></tr> <tr><td>Blood group</td><td></td></tr> <tr><td>X-Ray</td><td></td></tr> <tr><td>CT Scan</td><td></td></tr> <tr><td>others</td><td></td></tr> </table> Smoker: Tobacco: Alcohol Consumption: Family History: Medication if any: Eye sight: Hearing: Others:	Height		Weight/BMI		Blood group		X-Ray		CT Scan		others			
Height																			
Weight/BMI																			
Blood group																			
X-Ray																			
CT Scan																			
others																			

FORM -V

[FORM-10- as per rule 19 (1) of Hazardous waste Handling & Management Rules-2016]
MANIFEST FOR HAZARDOUS AND OTHER WASTE

1.	Sender's name and mailing address (including Phone No. and e-mail)	
2.	Sender's authorisation No.	•
3.	Manifest Document No.	•
4.	Transporter's name and address: (including Phone No. and e-mail)	
5.	Type of vehicle	• (Truck/Tanker/Special Vehicle)
6.	Transporter's registration No.	•

7.	Vehicle registration No.		•										
8.	Receiver's name and mailing address (including Phone No. and e-mail)												
9.	Receiver's	Authorisation	No.										
10.	Waste description		•										
11.	Total quantity No. of Containers		•	m ³ or MT Nos.									
12.	Physical form			(Solid/Semi-Solid/Sludge/Oily/Tarry/Slurry/Liquid)									
13.	Special handling instructions and additional information												
14.	Sender's Certificate			I hereby declare that the contents of the consignment are fully and accurately described above by proper shipping name and are categorised, packed, marked, and labeled, and are in all respects in proper conditions for transport by road according to applicable National Government regulations.									
	Name and stamp:	Signature:	Month		Day				Year				
15.	Transporter acknowledgement of receipt of Wastes												
	Name and stamp:	Signature:	Month		Day				Year				
16.	Receiver's certification for receipt of hazardous and other waste												
	Name and stamp:	Signature:	Month		Day				Year				

FORM –VI
In-situ Storage of ACM

S.No	Activity	Number of Stacks	Area occupied	Details of ACM Pipes		Day/month/year Of storage
Site History						
For existing Stacks, details of re-handling of pipes in number or volume to be mentioned under supervision of Authorized Experts.						
Details of Location of re-handled ACM storage, new area should be						
- Minimum 10-15 ft away from campus habitation. 250m away from the water sources 500-800m away from Children play area						

• The area should be isolated and covered from all the sides with restricted Access for Authorised Experts Only. • Register to be maintained for Entry& Exit of personals. • Register to be maintained for Entry & Exit of ACM • Labels to be displayed in legible format • Specific training of ACM to be inducted in the ACM storage area for residing population in the campus.
Details of transit storage of ACM to be maintained as per norms in an isolated storage room full covered

Standard Operating Procedure-02

Asbestos Fiber Monitoring, Analysis and Identification

Principle

1. The collection of environmental samples including air must follow an appropriate sampling procedure. A review of method for sampling of asbestos fibers has been published (IPCS, 1986). The most commonly used analytical method involves phase contrast optical microscopy (PCOM) in the work place and transmission electron microscopy (TEM) in the general environment. The phase contrast optical microscopy (POCM) is universally recommended for asbestos analysis (Eache and Groff, 1997; Dion and Perrault, 1994) including Bureau of Indian Standard. POCM coupled with polarized light is largely used for asbestos analysis in solid samples (USEPA, 1993). The fiber monitoring has to be done by any NABL/MOEF&CC accredited laboratory either in-house or by third party.

Monitoring of Asbestos Fiber in Air

2. A general survey of inside and outside the storage sites of the work zone has to be conducted to choose the sampling sites. Sampling is to be carried out at visually selected locations appeared more prone to emission or possibility of release of asbestos fiber. The sample collected by drawing a measured quantity of air through cellulose ester a membrane filter by a battery operated sampling pump that was fully charged to operate continuously over the chosen sampling time. The exposed filters will then be placed into plastic petri dishes and transferred carefully to the laboratory.
3. Two types of samples are to be taken, one within the workers breathing zone that is 300 mm radius extending in front of the face, and measured from the midpoint of a line bisecting the ears called *personal samples*. The samples taken at a fixed location mostly near to the source point called *area or static samples*. Personal sampler model "XX 5700000" and low volume vacuum/ pressure pump model "XX5622050" attached with monitor or cowl model "MAWP025AC" of Millipore Corporation, USA are to be used for the collection of personal and area samples, respectively. The flow rate of pump is to be adjusted to 1litre per minute. The flow rate checked before and after in each monitoring, those samples showing the difference by >10 percent from the initial flow rate are to be rejected. In both the samples filter holder (Cowl) always pointed downward

position to avoid the deposition of heavy particles. An ester cellulose membrane filters "AAWP02500" having 0.8 µm-1.2 µm pore size diameter are to be used throughout the sampling for asbestos counts at work environment.

Mounting Procedure

4. Complete filter is to be placed on clean microscopic slide, dust side up at room temperature. Electrostatic force keeps the filter usually on the slide. Filters are to be exposed to acetone fumes and triacetin (Glycerol triacetate, Sigma). In this procedure a small quantity of acetone in round bottom flask (500-1000ml) heated at the boiling point underwater bath, the vapors condensed in a simple condensing column. When the sufficient fumes of acetone become ready then pass it throughout on the filter for 3-5 seconds at a distance of 15-25 mm. put the 1-3 drops of Glycerol Triacetate (Triacetin) on the acetone-cleared filter. Place a cover slip on cleared filter by avoiding the air bubbles. Heat the cleared filter at 50°C for 15 minutes and leave it at room temperature for 24 hours under the action of triacetin to clear entire filter. Alternatively, membrane filter can also be made transparent with immersion oil (Leica Microsystems Wetzlar GmbH, Wetzlar). Using a phase contrast microscope with polarized light, Laborlux S (of M/s Leica, Germany) and then counting has to be done at magnification 400X-500x

$$C = A/a \times N/n \times 1/r \times 1/t$$

Where:

C= concentration in fibers per cubic centimeter rounded to first place of decimal,

N = total no. of fiber counted,

n = number of graticule areas observed,

A= effective filter area in mm²

a= graticule counting area in mm²,

r= flow rate of air through filter in cm³/min., and

t= single sample duration in minutes

5. To rule out the probability of the air borne asbestos in the existing scenario at the said site as well as other similar sites at the different work zones, it is necessary to have the asbestos fiber monitoring and sampling counts to be recorded at regular intervals. The environmental air sampling stations will have to be minimum three at 120 degree angle, within 1000-500 m from the ACM. The sampling frequency has to be in all three stages-Pre-Construction, Construction and Post Construction, while the personal sampling has to be done as stated above.
6. Bureau of Indian Standards (BIS) Guidelines for Safe Use of Products containing Asbestos states that "Asbestos cement products (such as AC pipes) generally contain about 10-15% asbestos fibers in a cement matrix that comprises the rest of the materials and are termed as locked in asbestos products as these products have the asbestos fibers bound in cement. The possibilities of air borne asbestos fiber will be in case of mishandling of encountered pipes with unsafe practice. During storing and installation; recommended work practices shall be followed to avoid harmful exposure". According to Hazardous and Other Wastes (Management and Trans-boundary Movement) Rules, 2016, any waste with asbestos concentration limit of 10,000 mg/kg (i.e. 1%), however this will apply only if the asbestos

containing substances are in a friable, powdered or finely divided state. Under the Basel Convention⁴⁹, asbestos or asbestos waste in the form of dust and fibers is classified as hazardous waste. The applicable legislation under the present scenario are:

⁴⁹ Basel Convention on the Control of Trans-boundary Movements of Hazardous Wastes and their Disposal, adopted in 1989

Summary of Asbestos Management Plan

Field	Anticipated Impact	Mitigation Measures	Responsible for Implementation/ Monitoring	Remark
Clearing, transfer and disposal of ACM pipes	Possibilities of air borne asbestos if handled unsafely, cut, drilled or broken into pieces that may cause: ☐ Inflammation of the lungs ☐ Mesothelioma ☐ Peritoneial mesothelioma ☐ Pleural plaques ☐ Asbestosis ☐ Bronchogenic Carcinoma ☐ Second hand-exposure	Implement the AMP strictly that includes identification of hazards, the use of proper safety gear and disposal methods.	DBO Contractor /RUIDP	There has to be a suitable call to be taken for in-situ disposal if the removed ACM pipes are not damaged, full length or 4.0 ft length not damaged.
Work in narrow streets	Possibilities of air borne asbestos if handled unsafely cut, drilled or broken into pieces that may cause: ☐ Inflammation of the lungs ☐ Mesothelioma ☐ Peritoneialmesothelioma ☐ Pleural plaques ☐ Asbestosis ☐ Bronchogenic Carcinoma Second hand-exposure	Conduct awareness program on safety during the construction work Undertake the construction work stretch-wise; excavation, pipe laying and trench refilling should be completed on the same day Provide barricades, and deploy security personnel to ensure safe movement of people and also to prevent unnecessary entry and to	DBO Contractor /RUIDP	All provision of safe working with proper signage has to be undertaken prior to work initiation, during the work and after the work.

Field	Anticipated Impact	Mitigation Measures	Responsible for Implementation/ Monitoring	Remark
		avoid accidental fall into open trenches Identify risk of intervention with existing AC pipes. If there is significant risk, implement the AMP strictly that includes identification of hazards, the use of proper safety gear and disposal methods.		
Interventions in existing AC pipelines	Possibilities of air borne asbestos if handled unsafely cut, drilled or broken into pieces that may cause: ☐ Inflammation of the lungs ☐ Mesothelioma ☐ Peritoneal mesothelioma ☐ Pleural plaques ☐ Asbestosis ☐ Bronchogenic Carcinoma Second hand-exposure	Appropriate actions as defined in the Asbestos Management Plan will have to be adhered to	DBO /RUIDP	Measure to avoid the encounter & removal has to be prioritized and if the same is not avoided then the measures stated have to be strictly followed.
Documentation /record	Unmonitored ACM might be handled incorrectly and can cause release of airborne asbestos	To be formatted and kept as mentioned in the Asbestos Management Plan	DBO Contractor/RUIDP	To be kept intact for easy tracking and reference in legible format. The same can be kept in soft format as well.

DRAFT - For Discussion

Appendix 23: Sample Outline Spoil Management Plan

- The Spoil Management Plan should be site specific and be part of the monthly Construction Management Plan.
- The contractor, in consultation with the ULB, has to find out appropriate location/s for the disposal of the excess soil generated. The spoils should be deposited only at these sites.
- Further precautions need to be taken in case of the contaminated spoils.
- The vehicle carrying the spoil should be covered properly.
- The spoils generating from each site should be removed on the same day or immediately after the work is complete. The site / road should be restored to the original condition.

I. Spoils information

The spoil information contains the details like a) The type/material, b) Potential contamination by that type, c) Expected volume (site/component specific), d) Spoil Classification etc.

II. Spoils management

The Spoil Management section gives the details of a) Transportation of spoil b) disposal site details c) Precautions taken d) Volume of contaminated spoil, if present, d) Suggested reuse of disposal of the spoil

III. Documentation

The volume of spoil generated (site specific, date wise), site disposed, reuse / disposal details should be documented properly.

Appendix 24: Sample Outline Traffic Management Plan

A. Principles for TMP around the Water Pipes/Sewer Construction Sites

1. One of the prime objectives of this TMP is to ensure the safety of all the road users along the work zone, and to address the following issues:

- (i) the safety of pedestrians, bicyclists, and motorists travelling through the construction zone;
- (ii) protection of work crews from hazards associated with moving traffic;
- (iii) mitigation of the adverse impact on road capacity and delays to the road users;
- (iv) maintenance of access to adjoining properties; and
- (v) Addressing issues that may delay the project.

B. Operating Policies for TMP

2. The following principles will help promote safe and efficient movement for all road users (motorists, bicyclists, and pedestrians, including persons with disabilities) through and around work zones while reasonably protecting workers and equipment.

- (i) Make traffic safety and temporary traffic control an integral and high-priority element of project from planning through design, construction, and maintenance.
- (ii) Inhibit traffic movement as little as possible.
- (iii) Provide clear and positive guidance to drivers, bicyclists, and pedestrians as they approach and travel through the temporary traffic control zone.
- (iv) Inspect traffic control elements routinely, both day and night, and make modifications when necessary.
- (v) Pay increased attention to roadside safety in the vicinity of temporary traffic control zones.
- (vi) Train all persons that select, place, and maintain temporary traffic control devices.
- (vii) Keep the public well informed.
- (viii) Make appropriate accommodation for abutting property owners, residents, businesses, emergency services, railroads, commercial vehicles, and transit operations.

3. **Figure A2 to Figure A12** illustrates the operating policy for TMP for the construction of water pipes and the sewers along various types of roads.

C. Analyze the impact due to street closure

4. Apart from the capacity analysis, a final decision to close a particular street and divert the traffic should involve the following steps:

- (i) approval from the ULB/Public Works Department (PWD) to use the local streets as detours;
- (ii) consultation with businesses, community members, traffic police, PWD, etc., regarding the mitigation measures necessary at the detours where the road is diverted during the construction;
- (iii) determining of the maximum number of days allowed for road closure, and incorporation of such provisions into the contract documents;
- (iv) determining if additional traffic control or temporary improvements are needed along the detour route;

- (v) considering how access will be provided to the worksite;
- (vi) contacting emergency service, school officials, and transit authorities to determine if there are impacts to their operations; and
- (vii) developing a notification program to the public so that the closure is not a surprise. As part of this program, the public should be advised of alternate routes that commuters can take or will have to take as result of the traffic diversion.

5. If full road-closure of certain streets within the area is not feasible due to inadequate capacity of the detour street or public opposition, the full closure can be restricted to weekends with the construction commencing on Saturday night and ending on Monday morning prior to the morning peak period.

Figure A1: Policy Steps for the TMP



D. Public awareness and notifications

6. As per discussions in the previous sections, there will be travel delays during the constructions, as is the case with most construction projects, albeit on a reduced scale if utilities and traffic management are properly coordinated. There are additional grounds for travel delays in the area, as most of the streets lack sufficient capacity to accommodate additional traffic from diverted traffic as a result of street closures to accommodate the works.

6. The awareness campaign and the prior notification for the public will be a continuous activity which the project will carry out to compensate for the above delays and minimize public claims as result of these problems. These activities will take place sufficiently in advance of the

time when the roadblocks or traffic diversions take place at the particular streets. The reason for this is to allow sufficient time for the public and residents to understand the changes to their travel plans. The project will notify the public about the roadblocks and traffic diversion through public notices, ward level meetings and city level meeting with the elected representatives.

7. The PIU will also conduct an awareness campaign to educate the public about the following issues:

- (i) Traffic control devices in place at the work zones (signs, traffic cones, barriers, etc.);
- (ii) Defensive driving behaviour along the work zones; and
- (iii) Reduced speeds enforced at the work zones and traffic diversions.

8. It may be necessary to conduct the awareness programs/campaigns on road safety during construction.

9. The campaign will cater to all types of target groups i.e. children, adults, and drivers. Therefore, these campaigns will be conducted in schools and community centres. In addition, the project will publish a brochure for public information. These brochures will be widely circulated around the area and will also be available at the PIU, and the contractor's site office. The text of the brochure should be concise to be effective, with a lot of graphics. It will serve the following purpose:

- (i) explain why the brochure was prepared, along with a brief description of the project;
- (ii) advise the public to expect the unexpected;
- (iii) educate the public about the various traffic control devices and safety measures adopted at the work zones;
- (iv) educate the public about the safe road user behaviour to emulate at the work zones;
- (v) tell the public how to stay informed or where to inquire about road safety issues at the work zones (name, telephone, mobile number of the contact person; and
- (vi) indicate the office hours of relevant offices.

E. Install traffic control devices at the work zones and traffic diversion routes

10. The purpose of installing traffic control devices at the work zones is to delineate these areas to warn, inform, and direct the road users about a hazard ahead, and to protect them as well as the workers. As proper delineation is a key to achieve the above objective, it is important to install good traffic signs at the work zones. The following traffic control devices are used in work zones:

- Signs
- Pavement Markings
- Channelizing Devices
- Arrow Panels
- Warning Lights

11. Procedures for installing traffic control devices at any work zone vary, depending on road configuration, location of the work, construction activity, duration, traffic speed and volume, and

pedestrian traffic. Work will take place along major roads, and the minor internal roads. As such, the traffic volume and road geometry vary. The main roads carry considerable traffic; internal roads in the new city areas are wide but in old city roads very narrow and carry considerable traffic. However, regardless of where the construction takes place, all the work zones should be cordoned off, and traffic shifted away at least with traffic cones, barricades, and temporary signs (temporary "STOP" and "GO").

12. **Figure A2 to Figure A12** illustrates a typical set-up for installing traffic control devices at the work zone of the area, depending on the location of work on the road way, and road geometrics:

- Work on shoulder or parking lane
- Shoulder or parking lane closed on divided road
- Work in Travel lane
- Lane closure on road with low volume
- Lane closure on a two-line road with low volume (with yield sign)
- Lane closure on a two-line road with low volume (one flagger operation)
- Lane closure on a two lane road (two flagger operation)
- Lane closure on a four lane undivided Road
- Lane closure on divided roadway
- Half road closure on multi-lane roadway
- Street closure with detour

13. The work zone should take into consideration the space required for a buffer zone between the workers and the traffic (lateral and longitudinal) and the transition space required for delineation, as applicable. For the works, a 30 cm clearance between the traffic and the temporary STOP and GO signs should be provided. In addition, at least 60 cm is necessary to install the temporary traffic signs and cones.

14. Traffic police should regulate traffic away from the work zone and enforce the traffic diversion result from full street closure in certain areas during construction. Flaggers/ personnel should be equipped with reflective jackets at all times and have traffic control batons (preferably the LED type) for regulating the traffic during night time.

16. In addition to the delineation devices, all the construction workers should wear fluorescent safety vests and helmets in order to be visible to the motorists at all times. There should be provision for lighting beacons and illumination for night constructions.

Figure A2 & A3: Work on shoulder or parking lane & Shoulder or parking lane closed on divided road

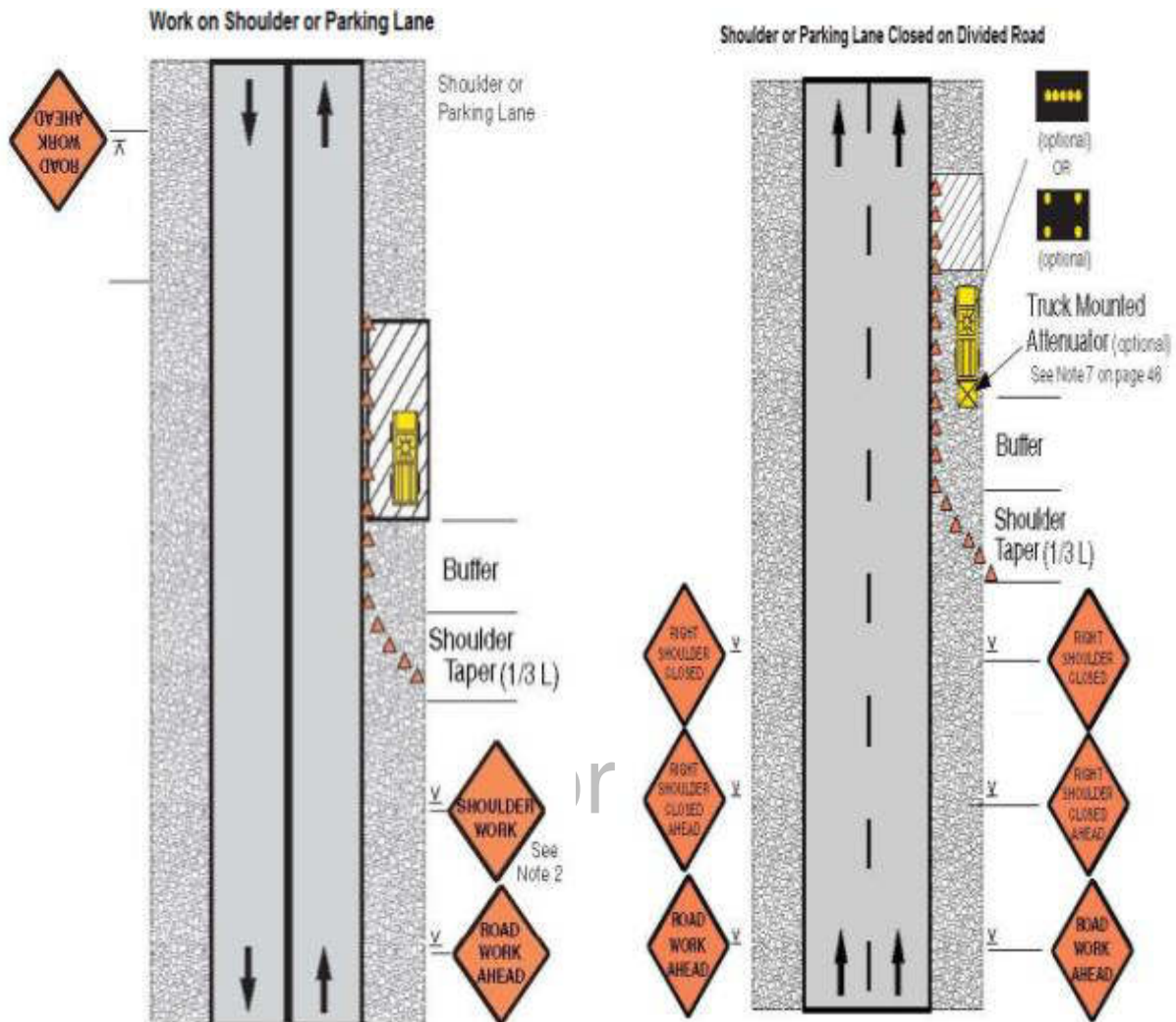


Figure A4 & A5: Work in Travel lane & Lane closure on road with low volume

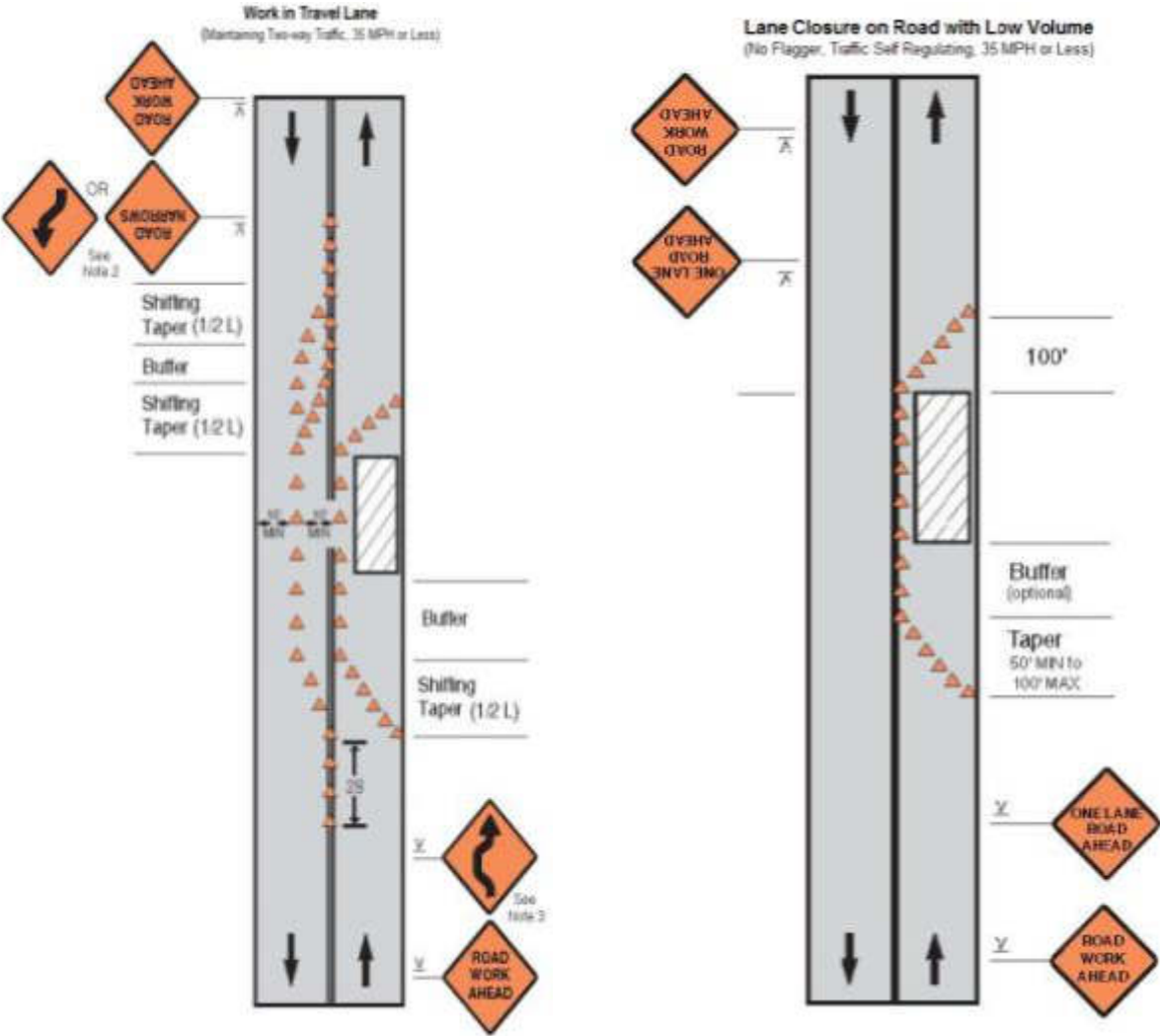


Figure A6 & A7: Lane closure on a two-line road with low volume (with yield sign) & Lane closure on a two-line road with low volume (one flagger operation)

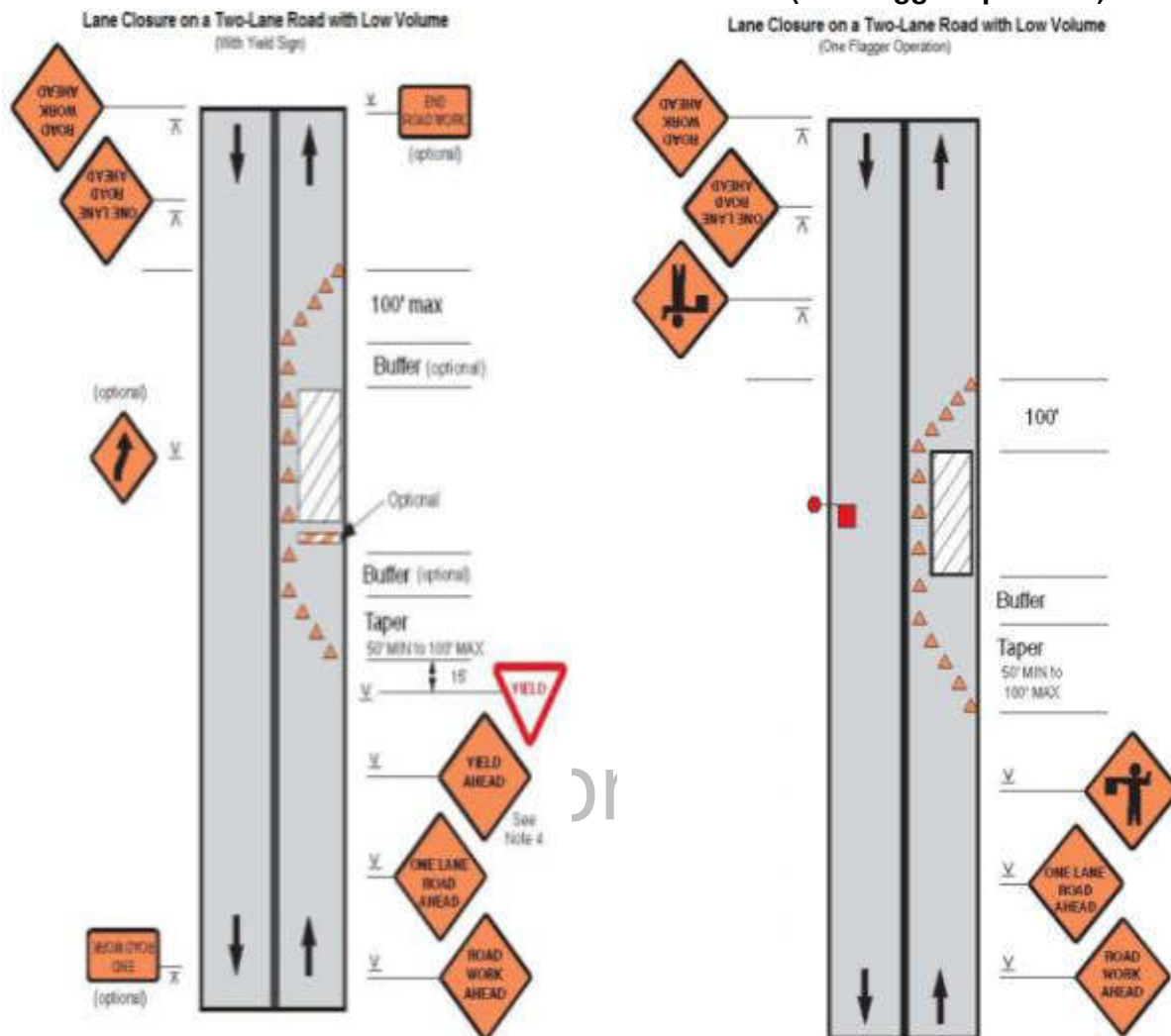


Figure A8 & A9: Lane Closure on a Two-Lane Road (Two Flagger Operation) & Lane Closure on a Four-Lane Undivided Road

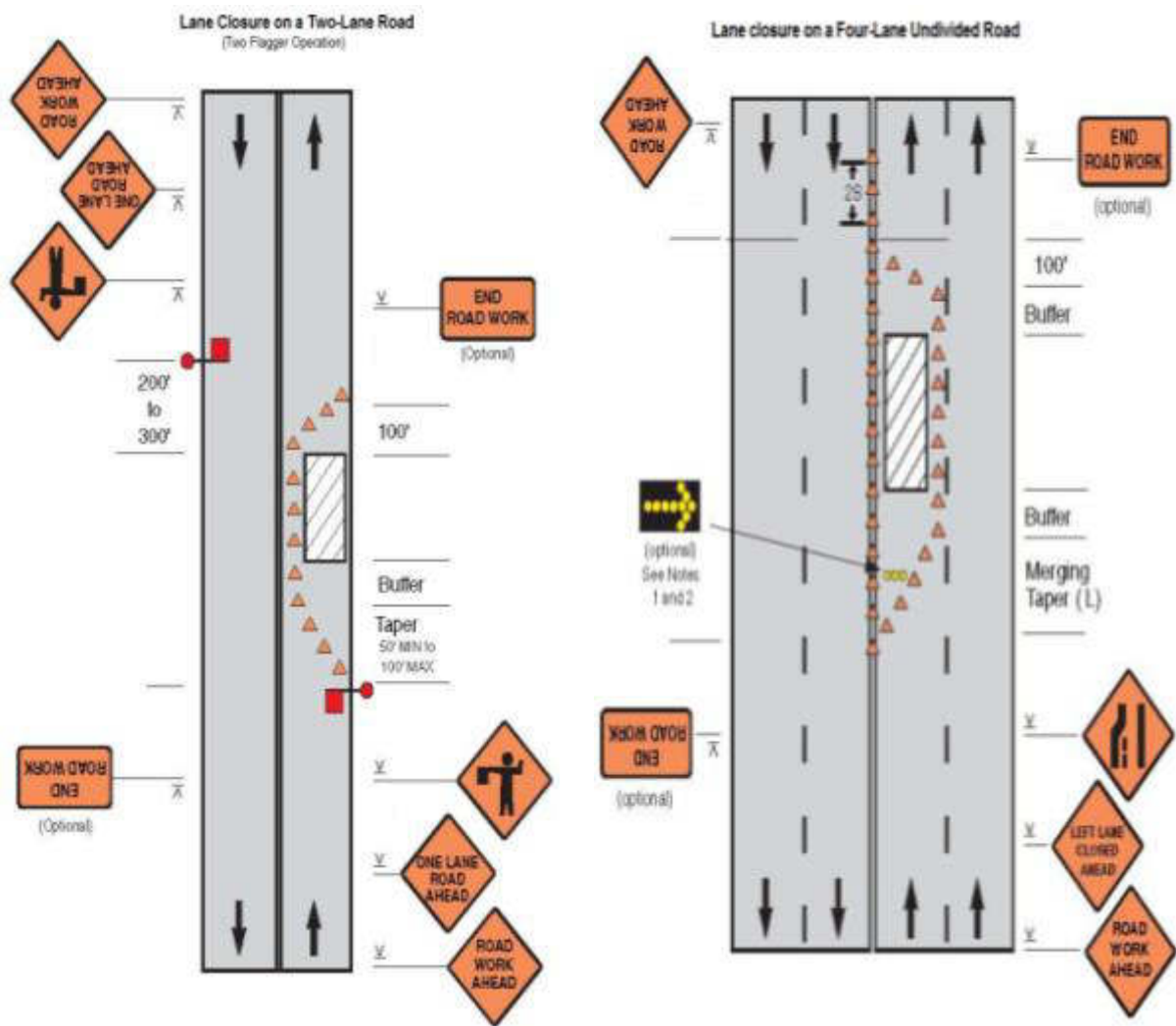


Figure A10 & A11: Lane Closure On Divided Roadway & Half Road Closure On Multi-Lane Roadway

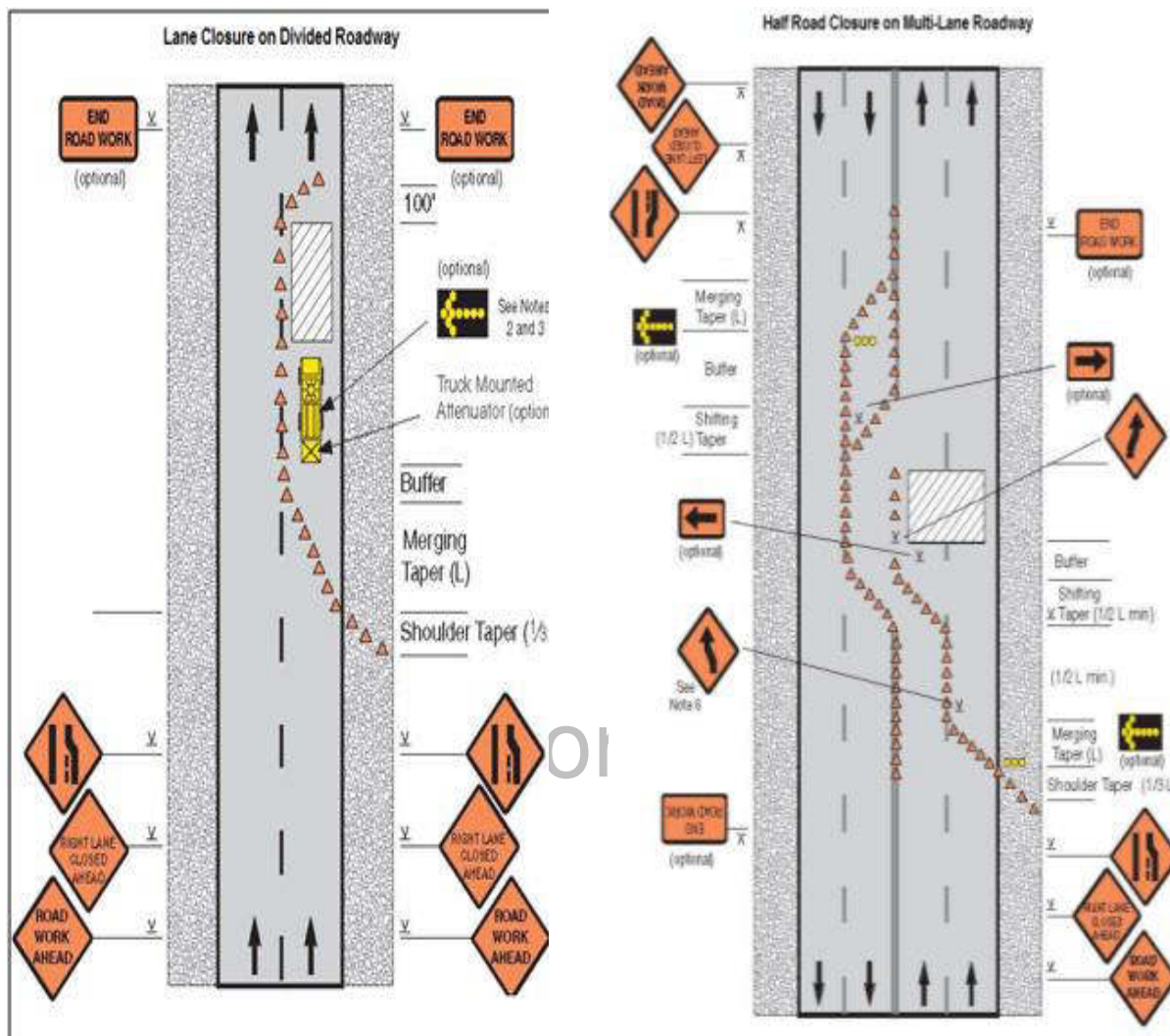
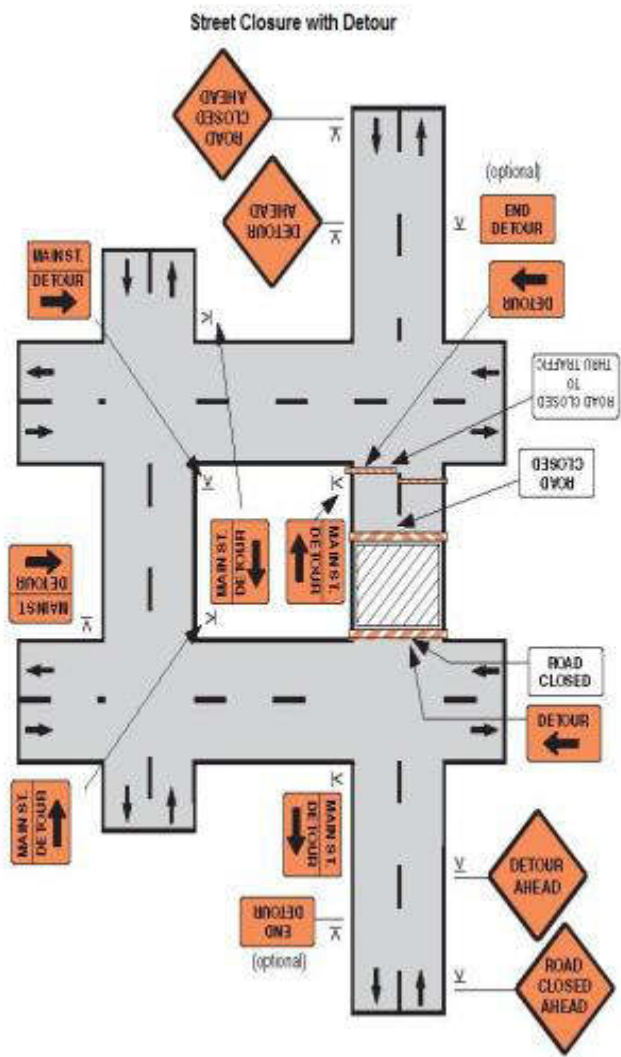


Figure A12: Street closure with detour



Appendix 25: IFC benchmark standards for workers accommodation

August 2009

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PART II: STANDARDS FOR AND MANAGEMENT OF WORKERS' ACCOMMODATION

I. Standards for workers' accommodation

This section looks at the principles and standards applicable to the location and construction of workers' accommodation, including the transport systems provided, the general living facilities, rooms/dormitories facilities, sanitary facilities, canteen and cooking facilities, food safety, medical facilities and leisure/social facilities.

A. National/local standards

The key standards that need to be taken into consideration, as a baseline, are those contained in national/local regulations. Although it is quite unusual to find regulations specifically covering workers' accommodation, there may well be general construction standards which will be relevant. These may include the following standards:

- **Building construction:** for example, quality of material, construction methods, resistance to earthquakes.
- **Housing and public housing:** in some countries regulations for housing and public housing contain requirements on issues such as the basic amenities, and standards of repair.
- **General health, safety and security:** requirements on health and safety are often an important part of building standards and might include provisions on occupation density, minimal air volumes, ventilation, the quality of the flooring (slip-resistant) or security against intrusion.
- **Fire safety:** requirements on fire safety are common and are likely to apply to housing facilities of any type. This can include provision on fire extinguishers, fire alarms, number and size of staircases and emergency exits, restrictions on the use of certain building materials.
- **Electricity, plumbing, water and sanitation:** national design and construction standards often include very detailed provisions on electricity or plumbing fixtures/fittings, water and sanitation connection/equipment.

Benchmark

1. The relevant national and local regulations have been identified and implemented.

B. General living facilities

Ensuring good standards in living facilities is important in order to avoid safety hazards and to protect workers from diseases and/or illness resulting from humidity, bad/stagnant water (or lack of water), cold, spread of fungus, proliferation of insects or rodents, as well as to maintain a good level of morale. The location of the facilities is important to prevent exposure to wind, fire, flood and other natural hazards. It is also important that workers' accommodation is unaffected by the environmental or operational impacts of the worksite (for example noise, emissions or dust) but is sufficiently close that workers do not have to spend undue amounts of time travelling from their accommodation to the worksite. Living facilities should be built using adequate materials and should always be kept in good repair, clean and free from rubbish and other refuse.

Benchmarks

1. Living facilities are located to avoid flooding and other natural hazards.
2. Where possible, living facilities are located within a reasonable distance from the worksite.
3. Transport from the living facilities to worksite is safe and free.
4. The living facilities are built with adequate materials, kept in good repair and kept clean and free from rubbish and other refuse.

Drainage

The presence of stagnant water is a factor of proliferation of potential disease vectors such as mosquitoes, flies and others, and must be avoided.

Benchmarks

1. The building site is adequately drained to avoid the accumulation of stagnant water.

Heating, air conditioning, ventilation and light

Heating, air-conditioning and ventilation should be appropriate for the climatic conditions and provide workers with a comfortable and healthy environment to rest and spend their spare time.

Benchmarks

1. For facilities located in cold weather zones, the temperature is kept at a level of around 20 degrees Celsius notwithstanding the need for adequate ventilation.
2. For facilities located in hot weather zones, adequate ventilation and/or air conditioning systems are provided.
3. Both natural and artificial lighting are provided and maintained in living facilities. It is best practice that the window area represents not less than 5% to 10% of the floor area. Emergency lighting is provided.

Water

Special attention to water quality and quantity is absolutely essential. To prevent dehydration, water poisoning and diseases resulting from lack of hygiene, workers should always have easy access to a source of clean water. An adequate supply of potable water must be available in the same buildings where bedrooms or dormitories are provided. Drinking water must meet local or WHO drinking water standards⁷ and water quality must be monitored regularly. Depending on the local context, it could either be produced by dedicated catchment and treatment facilities or tapped from existing municipal facilities if their capacity and quality are adequate.

Benchmarks

1. Access to an adequate and convenient supply of free potable water is always available to workers. Depending on climate, weather conditions and accommodation standards, 80 to 180 litres per person per day are available.
2. Drinking water meets national/local or WHO drinking water standards.⁸
3. All tanks used for the storage of drinking water are constructed and covered as to prevent water stored therein from becoming polluted or contaminated.

4. Drinking water quality is regularly monitored.

Wastewater and solid waste

Wastewater treatment and effluent discharge as well as solid waste treatment and disposal must comply with local or World Bank effluent discharge standards⁹ and be adequately designed to prevent contamination of any water body, to ensure hygiene and to avoid the spread of infections and diseases, the proliferation of mosquitoes, flies, rodents, and other pest vectors. Depending on the local context, treatment and disposal services can be either provided by dedicated or existing municipal facilities.

Benchmarks

1. Wastewater, sewage, food and any other waste materials are adequately discharged, in compliance with local or World Bank standards – whichever is more stringent – and without causing any significant impacts on camp residents, the biophysical environment or surrounding communities.
2. Specific containers for rubbish collection are provided and emptied on a regular basis. Standards range from providing an adequate number of rubbish containers to providing leak proof, non-absorbent, rust and corrosion-resistant containers protected from insects and rodents. In addition it is best practice to locate rubbish containers 30 metres from each shelter on a wooden, metal, or concrete stand. Such containers must be emptied at regular intervals (to be determined based on temperatures and volumes generated) to avoid unpleasant odours associated with decaying organic materials.
3. Pest extermination, vector control and disinfection are carried out throughout the living facilities in compliance with local requirements and/or good practice. Where warranted, pest and vector monitoring should be performed on a regular basis.

7. www.who.int/water_sanitation_health/dwq/en/
8. Ibid

9. As per the "Pollution Prevention and Abatement Handbook", World Bank Group, July 1998, available from www.worldbank.org

C. Room/dormitory facilities

The standards of the rooms or dormitory facilities are important to allow workers to rest properly and to maintain good standards of hygiene. Overcrowding should be avoided particularly. This also has an impact on workers' productivity and reduces work-related accidents. It is generally acknowledged that rooms/dormitories should be kept clean and in a good condition. Exposure to noise and odour should be minimised. In addition, room/dormitory design and equipment should strive to offer workers a maximum of privacy. Resorting to dormitories should be minimised and single or double rooms are preferred. Dormitories and rooms must be single-sex.

Benchmarks

1. Rooms/dormitories are kept in good condition.
2. Rooms/dormitories are aired and cleaned at regular intervals.
3. Rooms/dormitories are built with easily cleanable flooring material.
4. Sanitary facilities are located within the same buildings and provided separately for men and women.
5. Density standards are expressed either in terms of minimal volume per resident or of minimal floor space. Usual standards range from 10 to 12.5 cubic metres (volume) or 4 to 5.5 square metres (surface).
6. A minimum ceiling height of 2.10 metres is provided.
7. In collective rooms, which are minimised, in order to provide workers with some privacy, only a reasonable number of workers are allowed to share the same room. Standards range from 2 to 8 workers.
8. All doors and windows should be lockable, and provided with mosquito screens where conditions warrant.
9. There should be mobile partitions or curtains to ensure privacy.
10. Every resident is provided with adequate furniture such as a table, a chair, a mirror and a bedside light.
11. Separate sleeping areas are provided for men and women, except in family accommodation.

Additional issue

Irrespective of whether workers are supposed to keep their facilities clean, it is the responsibility of the accommodation manager to ensure that rooms/dormitories and sanitary facilities are in good condition.

Bed arrangements and storage facilities

The provision of an adequate numbers of beds of an appropriate size is essential to provide workers with decent, safe and hygienic conditions to rest and sleep. Here again, particular attention should be paid to privacy. Consideration should be given to local customs so beds could be replaced by hammocks or sleeping mats for instance.

Benchmarks

1. A separate bed for each worker is provided. The practice of "hot-bedding" should be avoided.
2. There is a minimum space between beds of 1 metre.
3. Double deck bunks are not advisable for fire safety and hygiene reasons, and their use is minimised. Where they are used, there must be enough clear space between the lower and upper bunk of the bed. Standards range from 0.7 to 1.10 metres.
4. Triple deck bunks are prohibited.
5. Each worker is provided with a comfortable mattress, pillow, cover and clean bedding.
6. Bed linen is washed frequently and applied with repellents and disinfectants where conditions warrant (malaria).
7. Facilities for the storage of personal belongings for workers are provided. Standards vary from providing an individual cupboard for each worker to providing 475-litre big lockers and 1 metre of shelf unit.
8. Separate storage for work boots and other personal protection equipment, as well as drying/airing areas may need to be provided depending on conditions.

D. Sanitary and toilet facilities

It is essential to allow workers to maintain a good standard of personal hygiene but also to prevent contamination and the spread of diseases which result from inadequate sanitary facilities. Sanitary and toilet facilities will always include all of the following: toilets, urinals, washbasins and showers. Sanitary and toilet facilities should be kept in a clean and fully working condition. Facilities should also be constructed of materials that are easily cleanable and ensure privacy. Sanitary and toilet facilities are never shared between male and female residents, except in family accommodation. Where necessary, specific additional sanitary facilities are provided for women.

Benchmarks

1. Sanitary and toilet facilities are constructed of materials that are easily cleanable.
2. Sanitary and toilet facilities are cleaned frequently and kept in working condition.
3. Sanitary and toilet facilities are designed to provide workers with adequate privacy, including ceiling to floor partitions and lockable doors.
4. Sanitary and toilet facilities are not shared between men and women, except in family accommodation.

Toilet facilities

Toilet arrangements are essential to avoid any contamination and prevent the spread of infectious disease.

Benchmarks

1. An adequate number of toilets is provided to workers. Standards range from 1 unit to 15 persons to 1 unit per 6 persons. For urinals, usual standards are 1 unit to 15 persons.
2. Toilet facilities are conveniently located and easily accessible. Standards range from 30 to 60 metres from rooms/dormitories. Toilet rooms shall be located so as to be accessible without any individual passing through any sleeping room. In addition, all toilet rooms should be well-lit, have good ventilation or external windows, have sufficient hand wash basins and be conveniently located. Toilets and other sanitary facilities should be ("must be" in cold climates) in the same building as rooms and dormitories.

Showers/bathrooms and other sanitary facilities

Hand wash basins and showers should be provided in conjunction with rooms/dormitories. These facilities must be kept in good working condition and cleaned frequently. The flooring for shower facilities should be of hard washable materials, damp-proof and properly drained. Adequate space must be provided for hanging, drying and airing clothes. Suitable light, ventilation and soap should be provided. Lastly, hand washing, shower and other sanitary facilities should be located within a reasonable distance from other facilities and from sleeping facilities in particular.

Benchmarks

1. Shower/bathroom flooring is made of anti-slip hard washable materials.
2. An adequate number of handwash facilities is provided to workers. Standards range from 1 unit to each 15 persons to 1 unit per 6 workers. Handwash facilities should consist of a tap and a basin, soap and hygienic means of drying hands.
3. An adequate number of shower/bathroom facilities is provided to workers. Standards range from 1 unit to 15 persons to 1 unit per 6 persons.
4. Showers/bathrooms are conveniently located.
5. Shower/bathroom facilities are provided with an adequate supply of cold and hot running water.

E. Canteen, cooking and laundry facilities

Good standards of hygiene in canteen/dining halls and cooking facilities are crucial. Adequate canteen, cooking and laundry facilities and equipments should also be provided. When caterers are contracted to manage kitchens and canteens, special attention should be paid to ensure that contractors take into account and implement the benchmarks below, and that adequate reporting and monitoring mechanisms are in place. When workers can individually cook their meals, they should be provided with a space separate from the sleeping areas. Facilities must be kept in a clean and sanitary condition. In addition, canteen, kitchen, cooking and laundry floors, ceilings and walls should be made of easily cleanable materials.

Benchmarks

1. Canteen, cooking and laundry facilities are built in adequate and easy to clean materials.
2. Canteen, cooking and laundry facilities are kept in a clean and sanitary condition.
3. If workers can cook their own meals, kitchen space is provided separate from sleeping areas.

Laundry facilities

Providing facilities for workers to wash both work and non-work related clothes is essential for personal hygiene. The alternative is for the employer to provide a free laundry service.

Benchmarks

1. Adequate facilities for washing and drying clothes are provided. Standards range from providing sinks or tubs with hot and cold water, cleaning soap and drying lines to providing washing machines and dryers.
2. When work clothes are used in contact with dangerous substance (for example, application of pesticide), special laundry facilities (washing machines) should be provided.

Additional issue

When workers are provided with facilities allowing them to individually do their laundry or cooking, it should be the responsibility of each worker to keep the facilities in a clean and sanitary condition. Nonetheless, it is the responsibility of the accommodation manager to make sure the standards are respected and to provide an adequate cleaning, disinfection and pest/vector control service when necessary.

Additional issue

When the employer provides family accommodation, it is best practice to provide each family with a private kitchen or the necessary cooking equipment to allow the family to cook on their own.

Canteen and cooking facilities

Canteen and cooking facilities should provide sufficient space for preparing food and eating, as well as conform to hygiene and safety requirements.

Benchmarks

1. Canteens have a reasonable amount of space per worker. Standards range from 1 square metre to 1.5 square metres.
2. Canteens are adequately furnished. Standards range from providing tables, benches, individual drinking cups and plates to providing special drinking fountains.
3. Places for food preparation are designed to permit good food hygiene practices, including protection against contamination between and during food preparation.
4. Kitchens are provided with facilities to maintain adequate personal hygiene including a sufficient number of washbasins designated for cleaning hands with clean, running water and materials for hygienic drying.
5. Wall surfaces adjacent to cooking areas are made of fire-resistant materials. Food preparation tables are also equipped with a smooth durable washable surface. Lastly, in order to enable easy cleaning, it is good practice that stoves are not sealed against a wall, benches and fixtures are not built into the floor, and all cupboards and other fixtures and all walls and ceilings have a smooth durable washable surface.
6. All kitchen floors, ceiling and wall surfaces adjacent to or above food preparation and cooking areas are built using durable, non-absorbent, easily cleanable, non-toxic materials.
7. Wall surfaces adjacent to cooking areas are made of fire-resistant materials. Food preparation tables are equipped with a smooth, durable, easily cleanable, non-corrosive surface made of non-toxic materials. Lastly, in order to enable easy cleaning, it is good practice that stoves are not sealed against a wall, benches and fixtures are not built into the floor, and all cupboards and other fixtures have a smooth, durable and washable surface.
8. Adequate facilities for cleaning, disinfecting and storage of cooking utensils and equipment are provided.
9. Food waste and other refuse are to be adequately deposited in sealable containers and removed from the kitchen frequently to avoid accumulation.

F. Standards for nutrition and food safety

When cooking for a number of workers, hygiene and food safety are absolutely critical. In addition to providing safe food, providing nutritious food is important as it has a very direct impact on workers' productivity and well-being. An ILO study demonstrates that good nutrition at work leads to gains in productivity and worker morale, prevention of accidents and premature deaths and reductions in health care costs.¹⁰

Benchmarks

1. The WHO 5 keys to safer food or an equivalent process is implemented (see Box 6 below).
2. Food provided to workers contains an appropriate level of nutritional value and takes into account religious/cultural backgrounds; different choices of food are served if workers have different cultural/religious backgrounds.
3. Food is prepared by cooks. It is also best practice that meals are planned by a trained nutritionist.

Box 6 - Five keys to safer food

Keep clean

Wash your hands before handling food and often during food preparation.
Wash your hands after going to the toilet.
Wash and sanitise all surfaces and equipment used for food preparation.
Protect kitchen areas and food from insects, pests and other animals.

While most micro organisms do not cause disease, dangerous micro organisms are widely found in soil, water, animals and people. These micro organisms are carried on hands, wiping cloths and utensils, especially cutting boards and the slightest contact can transfer them to food and cause food borne diseases.

Separate raw and cooked

Separate raw meat, poultry and seafood from other foods.
Use separate equipment and utensils such as knives and cutting boards for handling raw foods.
Store food in containers to avoid contact between raw and prepared foods.

Raw food, especially meat, poultry and seafood, and their juices, can contain dangerous micro organisms which may be transferred onto other foods during food preparation and storage.

Cook thoroughly

Cook food thoroughly, especially meat, poultry, eggs and seafood.
Bring foods like soups and stews to boiling to make sure that they have reached 70°C. For meat and poultry, make sure that juices are clear, not pink. Ideally, use a thermometer.
Reheat cooked food thoroughly.

Proper cooking kills almost all dangerous micro organisms. Studies have shown that cooking food to a temperature of 70°C can help ensure it is safe for consumption. Foods that require special attention include minced meats, rolled roasts, large joints of meat and whole poultry.

Keep food at safe temperatures

Do not leave cooked food at room temperature for more than 2 hours.
Refrigerate promptly all cooked and perishable food (preferably below 5°C).
Keep cooked food piping hot (more than 60°C) prior to serving.
Do not store food too long even in the refrigerator.
Do not thaw frozen food at room temperature.

Micro organisms can multiply very quickly if food is stored at room temperature. By holding at temperatures below 5°C or above 60°C, the growth of micro organisms is slowed down or stopped. Some dangerous micro organisms still grow below 5°C.

Use safe water and raw materials

Use safe water or treat it to make it safe.
Select fresh and wholesome foods.
Choose foods processed for safety, such as pasteurised milk.
Wash fruits and vegetables, especially if eaten raw.
Do not use food beyond its expiry date.

Raw materials, including water and ice, may be contaminated with dangerous micro organisms and chemicals. Toxic chemicals may be formed in damaged and mouldy foods. Take care in selection of raw materials and implement simple measures such as washing.

Source: World Health Organization, Food Safety

www.who.int/foodsafety/publications/consumer/en/5keys_en.pdf

10. C. Wanjek (2005). "Food at Work – Workplace solutions for malnutrition, obesity and chronic disease", International Labour Organization, Geneva.

G. Medical facilities

Access to adequate medical facilities is important to maintain workers' health and to provide adequate responses in case of health emergency situations. The availability or level of medical facilities provided in workers' accommodation is likely to depend on the number of workers living on site, the medical facilities already existing in the neighbouring communities and the availability of transport. However, first aid must always be available on site.

First aid facilities

Providing adequate first aid training and facilities can save lives and prevent minor injuries becoming major ones.

Other medical facilities

Depending on the number of workers living on site and the medical services offered in the surrounding communities, it is important to provide workers with additional medical facilities. Special facilities for sick workers and medical services such as dental care, surgery, a dedicated emergency room can, for instance, be provided.

Benchmarks

1. A number of first aid kits adequate to the number of residents are available.
2. First aid kits are adequately stocked. Where possible a 24/7 first aid service/facility is available.
3. An adequate number of staff/workers is trained to provide first aid.
4. Where possible and depending on the medical infrastructures existing in the community, other medical facilities are provided (nurse rooms, dental care, minor surgery).

Box 7 - UK/HSE First Aid facilities

What should be in a first aid kit?

There is no standard list and it very much depends on the assessment of the needs in a particular workplace:

- a leaflet giving general guidance on first aid, for example HSE leaflet *Basic advice on first aid at work*
- individually wrapped sterile adhesive dressings (assorted sizes)
- two sterile eye pads
- four individually wrapped triangular bandages (preferably sterile)
- six safety pins
- six medium-sized (approximately 12 cm x 12 cm) individually wrapped sterile unmedicated wound dressings
- two large (approximately 18 cm x 18 cm) sterile individually wrapped unmedicated wound dressings
- one pair of disposable gloves.

What should be kept in the first aid room?

The room should contain essential first aid facilities and equipment. Typical examples of these are:

- a sink with hot and cold running water
- drinking water and disposable cups
- soap and paper towels
- a store for first aid materials
- foot-operated refuse containers, lined with disposable yellow clinical waste bags or a container for the safe disposal of clinical waste
- a couch with waterproof protection, clean pillows and blankets
- a chair
- a telephone or other communication equipment
- a record book for recording incidents where first aid has been given.

Source: UK Health and Safety Executive

H. Leisure, social and telecommunication facilities

Basic leisure and social facilities are important for workers to rest and also to socialise during their free time. This is particularly true where workers' accommodation is located in remote areas far from any communities. Where workers' accommodation is located in the vicinity of a village or a town, existing leisure or social facilities can be used so long as this does not cause disruption to the access and enjoyment of local community members. But in any case, social spaces should also be provided on site. Exercise and recreational facilities will increase workers' welfare and reduce the impact of the presence of workers in the surrounding communities. In addition it is also important to provide workers with adequate means to communicate with the outside world, especially when workers' accommodation is located in a remote location or where workers live on site without their family or are migrants. Consideration of cultural attitudes is important. Provision of space for religious observance needs to be considered, taking account of the local context and potential conflicts in certain situations.

Benchmarks

1. Basic collective social/rest spaces are provided to workers. Standards range from providing workers multi-purpose halls to providing designated areas for radio, TV, cinema.
2. Recreational facilities are provided. Standards range from providing exercise equipment to providing a library, swimming pool, tennis courts, table tennis, educational facilities.
3. Workers are provided with dedicated places for religious observance if the context warrants.
4. Workers have access to public phones at affordable/public prices (that is, not inflated).
5. Internet facilities can also be provided, particularly where large numbers of expatriates/Third Country Nationals (TCNs) are accommodated.

Box 8 - Examples of social/leisure facilities

In Qatar there is a newly built 170-hectare complex which accommodates contractors and more than 35,000 workers for a project run by a major oil company. At the heart of this complex, the recreation area includes extensive sport facilities, a safety-training centre, an outdoor cinema and a park. The purpose of those facilities goes beyond providing adequate accommodation to the large numbers of contractors and workers on this project but is designed to provide the same level of services as a small town. The accommodation complex has a mayor, as well as a dedicated welfare team which is responsible for the workers' welfare, cultural festivals and also acts as the community's advocates.

II. Managing workers' accommodation

Once the living facilities have been constructed and are operational, effective ongoing management of living facilities is essential. This encompasses issues such as the physical maintenance of buildings, security and consultation with residents and neighbouring communities in order to ensure the implementation of the housing standards in the long term.

A. Management and staff

Worker camps and housing facilities should have a written management plan, including management policies or plans on health and safety, security, living conditions, workers' rights and representation, relationships with the communities and grievance processes. Part of those policies and plans can take the form of codes of conduct. The quality of the staff managing and maintaining the accommodation facilities will have a decisive impact on the level of standards which are implemented and the well-being of workers (for instance on the food safety or overall hygiene standards). It is therefore important to ensure that managers are competent and other workers are adequately skilled. The manager will be responsible for overseeing staff, for ensuring the implementation of the accommodation standards and for the implementation of the management plans. It is important the accommodation manager has the corresponding authority to do so.

If the facility is being managed by a contractor, as is often the case, the expected housing and management standards should be specified in the relevant contract, and mechanisms to ensure that those standards are implemented should be set up. As part of this process, the accommodation manager (or contractor) should have a duty to monitor the application of the accommodation standards and to report frequently on their implementation to the client.

Benchmarks

1. There are management plans and policies especially in the field of health and safety (with emergency responses), security, workers' rights, relationships with the communities.
2. An appointed person with the adequate background and experience is in charge of managing the workers' accommodation.
3. If contractors are being used, there are clear contractual management responsibilities and monitoring and reporting requirements.
4. Depending on the size of the accommodation, there is a sufficient number of staff in charge of cleaning, cooking and of general maintenance.
5. Such staff are recruited from the local communities.
6. Staff have received basic health and safety training.
7. Persons in charge of the kitchen are trained in nutrition and food-handling and adequately supervised.

B. Charging fees for accommodation and services

Charging fees for the accommodation or the services provided to workers such as food or transport should be avoided where workers do not have the choice to live or eat anywhere else, or if deemed unavoidable, should take into account the specific nature of workers' accommodation. Any charges should be transparent, discussed during recruitment and specified in workers' contracts. Any such charges should still leave workers with sufficient income and should never lead to a worker becoming indebted to an employer.

Benchmarks

1. When fees are charged, workers are provided with clear information and a detailed description of all payments made such as rent, deposit and other fees.
2. When company housing is considered to be part of workers' wages, it is best practice that workers are provided with an employment contract clearly specifying housing arrangements and regulations, in particular rules concerning payments and fees, facilities and services offered and rules of notice.
3. When fees are charged, the renting arrangements are fair and do not cost the worker more than a small proportion of income and never include a speculative profit.
4. Food and other services are free or are reasonably priced, never above the local market price.
5. The provision of accommodation or other services by employers as a payment for work is prohibited.

Additional issue

To avoid that fair renting arrangements turn into unfair ones, any deposit of advance should be set at a reasonable level and it is best practice that renting prices include a fixed fee covering the water needed and the use of the energy required to the functioning of the heating/cooling/ventilation/cooking systems. However, in such cases it might be necessary to raise workers' awareness to ensure that workers will use the facilities responsibly, particularly in areas where water is scarce.

C. Health and safety on site

The company or body in charge of managing the workers' accommodation should have the prime responsibility for ensuring workers' physical well-being and integrity. This involves making sure that the facilities are kept in good condition (ensuring that sanitary standards or fire regulations are respected for instance) and that adequate health and safety plans and standards are designed and implemented.

Benchmarks

1. Health and safety management plans including electrical, mechanical, structural and food safety have been carefully designed and are implemented.
2. The person in charge of managing the accommodation has a specific duty to report to the health authorities the outbreak of any contagious diseases, food poisoning and other important casualties.
3. An adequate number of staff/workers is trained to provide first aid.
4. A specific fire safety plan is prepared, including training of fire wardens, periodic testing and monitoring of fire safety equipment and periodic drills.
5. Guidance on the detrimental effects of the abuse of alcohol and drugs and other potentially harmful substances and the risk and concerns relating to HIV/AIDS and of other health risk-related activities is provided to workers. It is best practice to develop a clear policy on this issue.
6. Workers have access to adequate preventive measures such as contraception (condoms in particular) and mosquito nets.
7. Workers have easy access to medical facilities and medical staff. Where possible, female doctors/nurses should be available for female workers.
8. Emergency plans on health and fire safety are prepared. Depending on the local context, additional emergency plans are prepared as needed to handle specific occurrences (earthquakes, floods, tornadoes).

D. Security of workers' accommodation

Ensuring the security of workers and their property on the accommodation site is of key importance. To this end, a security plan must be carefully designed including appropriate measures to protect workers against theft and attacks. Policies regarding the use of force (force can only be used for preventive and defensive purposes in proportion to the nature and the extent of the threat) should also be

carefully designed. To implement those plans, it may be necessary to contract security services or to recruit one or several staff whose main responsibility is to provide security to safeguard workers and property. Before making any security arrangements, it is necessary to assess the risks of such arrangements to those within and outside the workers' accommodation and to respect best international practices, including IFC PS4 and EBRD PR4 and applicable law.¹¹ Particular attention should be paid to the safety and security of women workers.

Benchmarks

1. A security plan including clear measures to protect workers against theft and attack is implemented.
2. A security plan including clear policies on the use of force has been carefully designed and is implemented.
3. Security staff have been checked to ensure that they have not been implicated in any previous crimes or abuses. Where appropriate, security staff from both genders are recruited.
4. Security staff have a clear mandate and have received clear instruction about their duties and responsibilities, in particular their duties not to harass, intimidate, discipline or discriminate against workers.
5. Security staff have received adequate training in dealing with domestic violence and the use of force.
6. Security staff have a good understanding about the importance of respecting workers' rights and the rights of the communities.
7. Body searches are only allowed in specific circumstances and are performed by specially trained security staff using the least-intrusive means possible. Pat down searches on female workers can only be performed by female security staff.
8. Security staff adopt an appropriate conduct towards workers and communities.
9. Workers and members of the surrounding communities have specific means to raise concerns about security arrangement and staff.

11. See for instance the Voluntary Principles on Security and Human Rights. www.voluntaryprinciples.org/principles

E. Workers' rights, rules and regulations on workers' accommodation

Freedoms and human rights of workers should be recognised and respected within their living quarters just as within the working environment. House rules and regulations should be reasonable and non discriminatory. It is best practice that workers' representatives are consulted about those rules. House rules and regulations should not prevent workers from exercising their basic rights. In particular, workers' freedom of movement needs to be preserved if they are not to become effectively "trapped". To this end it is good practice to provide workers with 24/7 access to the accommodation and free transport services to and from the surrounding communities. Any restriction to this freedom of movement should be limited and duly justified. Penalties for breaking the rules should be proportional and implemented through a proper procedure allowing workers to defend themselves and to challenge the decision taken. The relationship between continuing employment and compliance with the rules of the workers' accommodation should be clear and particular attention should be paid to ensure that housing rules do not create indirect limitation of the right to freedom of association. Best practice might include a code of conduct relating to the accommodation to be signed together with the contract of employment.

Box 9 - Dole housing plantation regulation in Costa Rica

In every plantation there is an internal accommodation regulation that every worker is required to sign together with his/her employment contract. That document describes the behaviour which is expected from workers at all times and basic rules such as the prohibition of alcohol and the interdiction to make noise after a certain time at night. In case there is any problem concerning the application of those internal rules, a set of disciplinary procedures which have been designed with the workers' representatives can be enforced. Workers are absolutely free to enter or leave the site and do not have any restrictions in relation to accessing their living quarters. Families are not allowed in the living quarters unless they have been registered for a visit.

Benchmarks

1. Restriction of workers' freedom of movement to and from the site is limited and duly justified. It is good practice to provide workers 24/7 access to the accommodation site. Any restrictions based on security reasons should be balanced by the necessity to respect workers' freedom of movement.
2. Where possible, an adequate transport system to surrounding communities is provided. It is good practice to provide workers with free transportation to and from local communities.
3. Withholding workers' ID papers is prohibited.
4. Freedom of association is expressly respected. Provisions restricting workers' rights on site should take into account the direct and indirect effect on workers' freedom of association. It is best practice to provide trade union representatives access to workers in the accommodation site.
5. Workers' gender and religious, cultural and social backgrounds are respected. In particular, workers should be provided with the possibility of celebrating religious holidays and observances.
6. Workers are made aware of their rights and obligations and are provided with a copy of the internal workers' accommodation rules, procedures and sanction mechanisms in a language or through a media which they understand.
7. Housing regulations, including those relating to allocation of housing, should be non-discriminatory. Any justifiable discriminatory rules – for example all-male dormitories – should be strictly limited to the rules which are necessary to ensure the smooth running of the worker camp and to maintain a good relationship with the surrounding communities.
8. Where possible, visitor access should be allowed.
9. Decisions should be made on whether to prohibit alcohol, tobacco and third party access or not from the camp and the relevant rules should be clearly communicated to all residents and workers.
10. A fair and non-discriminatory procedure exists to implement disciplinary procedures including the right of workers to defend themselves (see also next section).

F. Consultation and grievance mechanisms

All residents should be made aware of any rules governing the accommodation and the consequences of breaking such rules. Processes that allow for consultation between site management and the resident workers will assist in the smooth running of an accommodation site. These may include a dormitory or camp committee as well as formal processes that allow workers to lodge any grievances about their accommodation.

Benchmarks

1. Mechanisms for workers' consultation have been designed and implemented. It is best practice to set up a review committee which includes representatives elected by workers.
2. Processes and mechanisms for workers to articulate their grievances are provided to workers. Such mechanisms are in accordance with PS2/PR2.
3. Workers subjected to disciplinary proceedings arising from behaviour in the accommodation should have access to a fair and transparent hearing with the possibility to contest decisions and refer the dispute to independent arbitration or relevant public authorities.
4. In case conflicts between workers themselves or between workers and staff break out, workers have the possibility of easily accessing a fair conflict resolution mechanism.
5. In cases where more serious offences occur, including serious physical or mental abuse, there are mechanisms to ensure full cooperation with the police authority (where adequate).

Additional issue

Alcohol is a complex issue and requires a very clear policy from the workers' accommodation management. If a non-alcohol policy is taken, special attention should be paid to clearly communicate the interdiction, how it applies and the consequences for breaching this rule. Special attention should also be paid to enforce it adequately.

G. Management of community relations

Workers' living facilities have various ongoing impacts on adjacent communities. In order to manage these, it is good practice to design a thorough community relations management plan. This plan will contain the processes to implement the findings of the preliminary community impact assessment and to identify, manage, mitigate or enhance ongoing impacts of the workers' accommodation on the surrounding communities.

Issues to be taken into consideration include:

- community development – impact of workers' camp on local employment, possibility of enhancing local employment and income generation through local sourcing of goods and services
- community needs – ways to identify and address community needs related to the arrival of specific infrastructures such as telecommunications, water sanitation, roads, health care, education, housing
- community health and safety – addressing and reducing the risk in the increase in communicable diseases, corruption, trade in illegal substances such as drugs, alcohol (in the Muslim context), petty crimes and other sorts of violence, road accidents
- community social and cultural cohesion – ways to mitigate the impact of the presence of large numbers of foreign workers, often males, with different cultural and religious background, ways to mitigate the possible shift in social, economic and political structures due to changes in access to income generation opportunities.

Benchmarks

1. Community relations plans addressing issues around community development, community needs, community health and safety and community social and cultural cohesion have been designed and implemented.
2. Community relations plans include the setting up of a liaison mechanism allowing a constant exchange of information and consultation with the local communities in order to identify and respond quickly to any problems and maintain good working relationships.
3. A senior manager is in charge of implementing the community relations management plan and liaising with the community.

-
4. The impacts of workers' accommodation on local communities are periodically reviewed, mitigated or enhanced.
 5. Community representatives are provided with an easy means to voice their opinions and to lodge complaints.
 6. There is a transparent and efficient process for dealing with community grievances, in accordance with PS1/PR10.

Box 10 - Examples of community relations management

Community consultation in the Baku-Tbilisi-Ceyhan (BTC) pipeline

The BTC pipeline's Environment and Social Management Plans incorporated a Worker Camp Management Plan to be implemented by the construction contractor. As part of ongoing community liaison over the project as a whole, community liaison officers were appointed for worker camps who were responsible for meeting regularly with communities, identifying issues and addressing community concerns. A particular responsibility was to review HR records and disciplinary logs at worker camps to assess that rules were being implemented effectively and that any community liaison after any incidents was effective.

or Discussion

Appendix 26: Guidelines and Emergency plan for handling and storing chlorine
Instructions for Storage and Handling of Chlorine Cylinders (Based on the 'Manual on Operation and Maintenance of Water Supply Systems' published by the Central Public Health and Environmental Engineering Organization (CPHEEO) in 2005)

1.1 Storage Area

- a) Obtain storage license from controller of explosives under Gas Cylinder Rules 2004 if the quantity of Cl₂ containers to be stored is more than 5 Nos.
- b) Storage area should be cool, dry, well ventilated, and clean of trash and protected from external heat sources. Please refer to Manual on "Water Supply and Treatment", (1999 Edition), for further details.
- c) Ventilation must be sufficient to prevent accumulation of vapour pockets. The exhaust should be located either near the floor or duct be provided extending to the floor. All fan switches should be outside the storage area.
- d) Do not store container directly under the sun.
 - e) Weather cock should be installed near the storage to determine wind direction.
- f) The storage building should be of non-combustible construction with at least two exits opening outside.
- g) Neutralization system should be provided.
- h) Continuous monitoring of chlorine leak detection equipment with alarm should be installed in the storage area.
- i) The area should be free and remote from elevators, gangways or ventilating system to avoid dangerous concentration of Chlorine during leak.
- j) Two portable foam type fire extinguishers should be provided in the premises.
- k) Corrosive substances shall not be stored nearby which react violently with each other.
- l) Unauthorized person should not be allowed to enter into the storage area.
- m) The floor level of storage shed should be preferably 30 cms (at least one foot) higher from the ground level to avoid water logging.
- n) Ensure that all containers are properly fitted with safety caps or hooks.

1.2. Cylinder & Drum Containers

- a. Store chlorine cylinders upright and secure them so that they do not fall.
- b. Drum containers should be stored on their sides on rails, a few inches above the floor. They should not be stacked one upon the other. They should be stored such that the valves are in vertical plane.
- c. Keep enough space between containers so as to have accessibility in case of emergency.
- d. Store the containers in a covered shed only. Keep them away from any source of heat as excessive heat may increase the pressure in container which will result into burst.
- e. Do not store explosives, acids, turpentine, ether, anhydrous ammonia, finely divided metals or other flammable material in the vicinity of Chlorine.
- f. Do not store containers in wet and muddy areas.
- g. Store filled and empty containers separately.
- h. Protective covers for valves are secured even when the containers are empty, except during use in the system.
- i. Never use containers as a roller to move other equipment.
- j. Never tamper with fusible plugs of tonners.
- k. Check leakages every day by means of ammonia torch. However, it should not be touched to brass components like valves of container for safety.
- l. Never carry out any welding work on the chlorine system as combustion of steel takes place at 2510C in presence of chlorine.

m. The boxes containing emergency kit, safety applications and self contained breathing apparatus should be kept in working order in an easily approachable area.

1.3. Use of Cylinders & Drum Containers in Process System

- a. Use containers in the order of their receipt, as valve packing can get hardened during prolonged storage and cause gas leaks.
- b. Do not use oil or lubricant on any valve of the containers.
- c. Badly fitting connections should not be forced and correct tool should always be used for opening and closing valves. They should never be hammered.
- d. The area should be well ventilated with frequent air changes.
- e. Transport the cylinders to the process area by using crane, hoist or railings etc.
- f. The drum containers should be kept in a horizontal position in such a way that the valves are in a vertical plane. The upper valve gives out gas and the lower one gives out liquid chlorine.
- g. The cylinder should be kept in upright position in order to release gas from the valve. For liquid chlorine withdrawal, it should be inverted with the help of an inverted rack.
- h. Connect the containers to the system by using approved accessories.
- i. Use copper flexible tube, with lead washer containing 2 to 4% antimony or bonded asbestos or teflon washer. Use yoke clamp for connecting chlorine container.
- j. Never use rubber tubes, PVC tubes etc. for making connections.
- k. Use the right spanner for operating the valve. Always keep the spanner on the valve spindle. Never use ill fitting spanner.
- l. After making the flexible connection, check for the leakage by means of ammonia torch but it should not come in contact with a valve.
- m. Keep minimum distance between the container valve and header valve so that during change-over of the container, minimum amount of gas leaks.
- n. The material of construction of the adapter should be same as that of valve outlet threads. The valve should not be used as a regulator for controlling the chlorine. During regulation due to high velocity of Chlorine, the valve gets damaged which in turn can cause difficulty in closing.
- o. The tools and other equipment used for operating the container should be clean and free of grease, dust or grit.
- p. The tools and other equipment used for operating the container should be clean and free of grease, dust or grit.
- q. Wear breathing apparatus while making the change-over of the container from the process header.
- r. Do not heat the container to withdraw more gas at faster rate.
- s. Use pressure gauge and flow measuring device to control the flow and to know the quantity of gas left in the container.
- t. Use an inverted U type barometric leg or vacuum breaking arrangement for connecting the container to the process piping.
- u. Withdrawal of the gas should be stopped when the gas pressure inside the container is between 0.1 to 0.5 kg/cm² approximately.
- v. If withdrawal of the gas from the container connected to the process system has to be suspended for long intervals, it should be disconnected from the system, and the valve cap and hood replaced.
- w. Gas containers should be handled by trained persons only.

1.4. Disconnecting Containers from Process System

- a. Use breathing apparatus before disconnecting the container.
- b. First close the container valve fully. After removal of chlorine the process valve should be closed.
- c. Remove the flexible connection, plug the flexible connection in order to avoid entry of humid air. Replace the valve cap or hood on the container.

d. Put the tag on the empty container & bring it to storage area marked for empties. e. Check for the leakage.

1.5. Loading and Unloading of Containers

- a. The handling of containers should be done under the supervision of trained and competent person.
- b. It should be done carefully with a crane, hoist or slanted ramp. Do not use magnet or sharp object for lifting the containers.
- c. Small cylinders should not be lifted by means of valve caps as these are not designed to carry the weight.
- d. The containers should not be allowed to strike against each other or against any hard object.
- e. Vehicles should be braked and isolated against any movement.
- f. After loading, the containers should be secured properly with the help of wooden wedges, rope or sling wire so that they do not roll away.
- g. The containers should never be dropped directly to the ground or on the tyre from the vehicle.
- h. There should be no sharp projection in the vehicle.
- i. Containers must have valve caps and plugs fitted properly.
- j. Check containers for leakage before loading/unloading.

1.6. Transportation of Container

- a. The name of the chemical along with diamond pictorial sign denoting the dangerous goods should be marked on the vehicle.
- b. The name of the transporter, his address and telephone number should be clearly written on the vehicle.
- c. The vehicle should not be used to transport any material other than what is written on it. d. Only trained drivers and cleaners should transport hazardous chemical
- e. The driver should not transport any leaking cylinder.
- f. The cylinder should not project outside the vehicle.
- g. The transporter must ensure that every vehicle driver must carry "Trem Card" (Transport Emergency Card) and 'Instructions in writing booklet' and follow them.
- h. Every driver must carry safety appliances with him, viz; Emergency kit, breathing apparatus etc.
- i. The vehicles must be driven carefully, specially in crowded localities and on bumpy roads. Do not apply sudden brakes.
- j. Check for the leakage from time to time.
- k. In the case of uncontrollable leakage the vehicle should be taken to an open area where there is less population.

1.7. Emergency Kit It consists of various tools and appliances like gaskets, yokes, studs, tie rods hoods, clamps, spanners, mild steel channels, screws, pins, wooden pegs etc. of standard sizes. Separate kits are used for cylinders and tonners. All the gadgets are designed for using in controlling or stopping the leakages from valves, fusible plug and side walls of cylinders and containers used for handling chlorine.

- a. Leakage may occur through the valve. There are basically four types of valve leaks.
 - I. Valve packing
 - II. Valve seat
 - III. Defective inlet thread
 - IV. Broken valve thread
- b. Leakage may occur through container wall. For controlling such leakages, clamps are used for cylinders and chain and yoke arrangement is used for tonner. Sometimes wooden peg is used by driving into the leaking hole as a temporary arrangement.

c. Leakage may occur through fusible plug.

i. If the leakage is through the threads of fusible plug, yoke, hood and cap nut arrangement is used to control the leak.

ii. If fusible metal itself in the plug is leaking, yoke and stud arrangement is used to control the leak.

1. First Aid to be Provided for a Person Affected by Chlorine

a. General Remove the affected person immediately to an uncontaminated area. Remove contaminated clothing and wash contaminated parts of the body with soap and plenty of water. Lay down the affected person in cardiac position and keep him warm. Call a physician for medical assistance at the earliest. Caution: Never attempt to neutralize chlorine with other chemicals.

b. Skin Contact Remove the contaminated clothes, wash the affected skin with large quantity of water. Caution: No ointment should be applied unless prescribed by the physician.

c. Eye Contact If eyes get affected with liquid chlorine or high concentration of chlorine gas, they must be flushed immediately with running water for atleast 15 minutes keeping the eyelids open by hand. Caution: No ointment should be used unless prescribed by an eye specialist.

d. Inhalation If the victim is conscious, take him to a quiet place and lay him down on his back, with head and back elevated (cardiac position). Loosen his clothes and keep him warm using blankets. Give him tea, coffee, milk, peppermint etc. for making good effect on breathing system. If the victim is unconscious, but breathing, lay him down in the position mentioned above and give oxygen at low pressure until the arrival of doctor. If breathing has stopped, quickly stretch him out on the ground or a blanket if available, loosen his collar and belt and start artificial respiration without delay. Neilson arm lift back pressure method is useful. Automatic artificial respiration is preferable if available. Continue the respiration until the arrival of the doctor. Amboo bag can also be used for this purpose.

3. On-Site Emergency Plan to Cover the Leakage of Chlorine

3.1. Introduction As chlorine is a hazardous chemical, handling and storage of it demand adequate precautions to avoid possible hazards. Leakage of chlorine may develop into a major emergency. Therefore the emergency procedure to cover this eventuality is essential. It is drawn in the form of on-site emergency plan. The elements of onsite emergency plan are as follows:

3.2. Identification of Hazard Chart

In this case the site risk is evaluated by the expert and the extent of the probable damage is calculated on the basis of stored chlorine quantity, nearby population, wind direction, type of equipment failure etc. For this purpose hazard analysis is conducted in which case all the hazardous properties of chlorine are considered. If evacuation is required, the range of it is calculated.

3.3. Appointing Key Persons In order to control the incident like chlorine leakage, it is essential to appoint various persons with their well-defined responsibilities. Taking into account the various activities likely to be involved, the following key persons are appointed (i) Site Controller, (ii) Incident controller, (iii) Shift Executive In charge, (iv) Communication Officer, (v) Safety Officer, (vi) Fire and Security Officer, (vii) Utilities and Services In charge, (viii) Traffic Controller, (ix) First Aider

3.4. Assembly Points These points are set up where persons from the plant would assemble in case of chlorine leakage. At these points the in-charge for counting the heads will be available.

3.5. Emergency Control Center

The control centre is the focal point in case of an emergency from where the operations to handle the emergency from are directed and coordinated. It contains site plan, telephone lines, public address system, safety equipment, first aid boxes, loud speaker, torches, list of essential telephone numbers, viz. fire brigade, police, hospital, civil defence, collector, factory inspector,

organizational authorities, chlorine suppliers, mutual aid group, social workers, list of key persons and their addresses, copy of chemical fact sheet, location plan of fire hydrant, details of dispersion model of chlorine gas, population distribution pattern, location of alarm system.

3.6. Procedure to Meet Emergency

The actions to be taken by the staff and authority are given below; Emergency Alarm: An audible emergency alarm system is installed throughout the plant. On hearing the alarm the incident controller will activate the public address system to communicate with the staff about the emergency and give specific instructions for evacuations etc. anyone can report the occurrence of chlorine leakage to section in-charge or incident controller through telephone or intercom or in person.

3.7. Communication

Communication officer shall establish the communication suitable to that incident.

3.8. Services

For quickness and efficient operation of emergency plan the plant is divided into convenient number of zones and clearly marked on the plan. These are emergency services viz. fire fighting, first aid, rescue, alternative source of power supply, communication with local bodies etc. The incident controller will hand over the charge to the site controller of all these coordinating activities, when the site controller appears on the site. The site controller will coordinate all the activities of the key persons. On hearing the emergency alarm system all the key persons will take their charge. In case of their absence other alternatives are nominated. The person nominated for personnel and administration purposes will be responsible for informing all statutory authorities, keeping account of all persons in the plant including contract labour, casual workers and visitors. He will be responsible for giving information to press or any outside agencies. He is also responsible for organizing canteen facilities and keeping informed the families of affected persons. The person nominated as security officer should guide police, fire fighting and control the vehicle entries. The site controller or any other nominated person will announce resumption of normalcy after everything is brought under control. The onsite emergency plan needs to be evaluated by mock drill. Any weaknesses noticed during such drills should be noted and the plan is modified to eliminate the weaknesses.

3.9. Emergency

Measures In case of leakage or spillage of Chlorine, the following emergency measures should be taken:

- a) Take a shallow breath and keep eyes opened to a minimum.
- b) Evacuate the area.
- c) Investigate the leak with proper gas mask and other appropriate Personal protection.
- d) The investigator must be watched by a rescuer to rescue him in emergency.
- e) If liquid leak occurs, turn the containers so as to leak only gas.
- f) In case of major leakage, all persons including neighbours should be warned.
- g) As the escaping gas is carried in the direction of the wind all persons should be moved in a direction opposite to that of the wind. Nose should be covered with wet handkerchief.
- h) Under no circumstances should water or other liquid be directed towards leaking containers, because water makes the leak worse due to corrosive effect.
- i) The spillage should be controlled for evaporation by spraying chilled water having temperature below 9.4°C. With this water crystalline hydrates are formed which will temporarily avoid evaporation. Then try to neutralize the spillage by caustic soda or soda ash or hydrated lime solution carefully. If fluoroprotein foam is available, use for preventing the evaporation of liquid chlorine.
- j) Use emergency kit for controlling the leak.
- k) On controlling the leakage, use the container in the system or neutralize the contents in alkali solution such as caustic soda, soda ash or hydrated lime. Caution: Keep the supply of caustic

soda or soda ash or hydrated lime available. Do not push the leaking container in the alkali tank. Connect the container to the tank by barometric leg.

l) If container commences leak during transport, it should be carried on to its destination or manufacturer or to remote place where it will be less harmful. Keeping the vehicle moving will prevent accumulation of high concentrations.

m) Only specially trained and equipped workers should deal with emergency arising due to major leakage.

n) If major leak takes place, alert the public nearby by sounding the siren.

o) Any minor leakage must be attended immediately or it will become worse.

p) If the leakage is in the process system, stop the valve on the container at once.

3.10. Safety Systems Required at Chlorination Plant

The following safety systems should be kept ready at the chlorination plant:

- a. Breathing apparatus.
- b. Emergency kit.
- c. Leak detectors.
- d. Neutralisation tank.
- e. Siren system.
- f. Display of boards in local language for public cautioning, first aid and list of different authorities with phone numbers.
- g. Communication system.
- h. Tagging system for equipments.
 - i. First aid including tablets and cough mixtures.
 - j. Exhaust fans.
- k. Testing of pressure vessels, chlorine lines etc. every year as per factory act.
- l. Training & mock drill.
- m. Safety showers.
- n. Eye fountain.
- o. Personal protective equipment.
- p. Protecting hoods for ton-containers.
- q. Fire extinguishers.
- r. Wind cock.

Appendix 27: Details of Public Consultations

A. Public Consultation in different locations of Abu Road held on Dated 05/10/2018

S.No	Name of Persons	Location	Topic Discussed	Outcome
1.	Mohammad Hanik, Nadim Mohammad, Ajay Rana, Akash, Sanjay Kumar	Luniya Pura Abu Road	Awareness of the project—including Project Coverage area, Present condition of water supply in the town Present condition of Sewerage in the town. Presence of any forest, wild life or any sensitive/unique environmental components nearby the project, Presence of historical/cultural/religious sites nearby. Unfavorable climatic condition. Occurrence of flood/earthquake etc. Present solid waste collection and	People are aware of the proposed Project of water supply & sewerage in the town. Present water supply is very erratic. The quality of water is poor. People are concerned about the poor supply (intermittent supply on alternate days) and quality of water. Water supply is erratic and quality is poor. People demand 24x7 supply connections to be provided to their area under the proposed. They are willing to pay for getting regular potable water. People are concerned about the poor sewerage conditions in the town. There is not any forest, wildlife or any sensitive /unique environmental, component near the project area. Mt. Abu Wildlife sanctuary is quite remote from the project area. There are not any historical/cultural and religious sites in nearby the subproject area. Abu Road enjoys all types of weather. In Summer, it's hot and humid with an average temperature of 40 Degrees with hot sandy winds. In Winter, it's 7 to 14 degrees, which is quite cold. There are no natural disasters such as flood and earthquake

S.No	Name of Persons	Location	Topic Discussed	Outcome
			disposal problem. Dust and noise pollution and disturbances during construction work. Perception of villagers on tree felling and afforestation Safety of residents during construction phase and applying of vehicle for construction activities. Requirement of enhancement of other facilities Willingness to pay for improved services.	occurred in recent past. The area is not prone for such incidences. Solid waste collection facility is poor in this area. Contractor should use modern machinery and water sprinkler to control dust and noise during construction phase. All the pollution control measures will be adopted at site to control the fugitive emission in the area and for control of noise, PPE's will be provided to workers such as ear muff etc. Plantation activities provide shade, shelter and enhance the local biodiversity in the area. The contractor should take care of the safety arrangement during construction phase and should provide traffic diversion routes to avoid the vehicle congestion. Traffic density in Luniyaura is low but more on the main road. People should be made aware through CAPC and outreach team of contractor before start of work in particular area. The locals feel that Parks play grounds and Community halls are required in this town and in addition. People are willing to pay for the improved services in the town, there will no problem face out by the proposed project of water supply & sewerage in the town but benefitted by the project.
2.	Jai Kumar, Charan Dass, Hariram, Arjun Choudhary, Kamal Kishore	Gandhi Nagar, Abu Road	Awareness of the project-including Project	People are aware of the proposed Project of water supply and sewerage in the town.

S.No	Name of Persons	Location	Topic Discussed	Outcome
			Coverage area. Present condition of water supply & Sewerage. In what way they may associate with the project Presence of any forest, wild life or any sensitive/ unique environmental components nearby the project. Presence of historical/ cultural/religious sites nearby. Drainage and sewerage problem facing. Present drinking water problem- quantity and quality Dust and noise pollution and disturbances during construction work. Public Health by proposed water supply & Sewerage subproject Present solid waste collection and disposal problem.	Sewerage flow in open drains. People are concerned about the poor sewerage conditions and water supply. People are concerned about the poor supply (intermittent supply on alternate days) and quality of water. Water supply is erratic and quality is poor and slightly flouridated. People demand 24x7 supply connections to be provided to their area under the proposed. They want to engage with the project as a job opportunity and want to become beneficiaries. There is not any forest, wildlife or any sensitive /unique environmental, component near the project area. Mt. Abu Wildlife sanctuary is quite remote from the project area. There are not any historical/cultural and religious sites in nearby the subproject area. Drainage and sewerage condition is poor in the town and flow in open drains. People are concerned about the poor supply (intermittent supply on alternate days) and quality of water. Water supply is erratic and quality is poor. People demand 24x7 supply connections to be provided to their area under the proposed. They are willing to pay for getting regular potable water. Contractor should use modern machinery and water sprinkler to control dust and noise during construction phase. PPE's will be mandatory for engaged workers at site. Traffic density is not so high hence the generated noise is not high in the area.

S.No	Name of Persons	Location	Topic Discussed	Outcome
			Setting up worker camp site within the village/ project locality Plantation measures in nearby the area. Safety of residents during construction phase and applying of vehicle for construction activities. Requirement of enhancement of other facilities. Willingness to pay for improved services.	By the proposed project of water supply & sewerage in the town, health of public will be improved. Sanitation will be improved by measures of sewage treatment & Management. There is enough space available nearby the project area to establish labour camp. People suggested to establish the worker camp away from the habitation so there is no conflict and disturbances. People want to plantation programme in the town and ensure the aftercare measures such as watering and manuring etc. The contractor should take care of the safety arrangement during construction phase and should provide traffic diversion routes to avoid the vehicle congestion. People should be made aware through CAPC and outreach team of contractor before start of work in particular area. The local feels that Parks, play grounds and Community halls are required in this town and in addition. People are willing to pay for improved services in the town. By the proposed project, people of the town will be benefitted.
3.	Deepak Raj, Yogesh Kumar, Kanhaiya Lal, Gopal Ram & Anuradha	Housing Board, Abu Road	Awareness of the project-including Project Coverage area. Present condition of water supply & Sewerage. In what way they may	People are aware of the proposed Project of water supply and sewerage in the town. Sewerage flow in open drains. People are concerned about the poor sewerage conditions and water supply. People are concerned about the poor supply (intermittent supply on alternate days) and quality of water. Water supply is erratic and quality is

S.No	Name of Persons	Location	Topic Discussed	Outcome
			associate with the project Presence of any forest, wild life or any sensitive/ unique environmental components nearby the project. Drainage and sewerage problem facing. Present drinking water problem- quantity and quality Presence of historical/ cultural/religious sites nearby. Unfavorable climatic condition. Occurrence of flood, earthquake etc. Present solid waste collection and disposal problem. Dust and noise pollution and disturbances during construction work. Perception of villagers on	poor with slightly flouridated. People demand 24x7 supply connections to be provided to their area under the proposed. They want to engage with the project as a job opportunity and want to become beneficiaries. There is not any forest, wildlife or any sensitive /unique environmental, component near the project area. Mt. Abu Wildlife sanctuary is quite remote from the project area. There are not any historical/cultural and religious sites in nearby the subproject area. Drainage and sewerage condition is poor in the town and flow in open drains. Water supply is very erratic. The quality of water is poor. Fluoride content is reported. They are willing to pay for getting regular potable water. Abu Road enjoys all types of weather. In Summer, it's hot and humid with an average temperature of 40 Degrees with hot sandy winds. In Winter, it's 7 to 14 degrees, which is quite cold. There are no natural disasters such as flood and earthquake occurred in recent past. The area is not prone for such incidences. Solid waste collection facility is poor in this area. Contractor should use modern machinery and water sprinkler to control dust and noise during construction phase. All the pollution control measures will be

S.No	Name of Persons	Location	Topic Discussed	Outcome
			tree felling and afforestation Safety of residents during construction phase and applying of vehicle for construction activities. Requirement of enhancement of other facilities Willingness to pay for improved services.	adopted at site to control the fugitive emission in the area and for control of noise, PPE's will be provided to workers such as ear muff etc. Plantation activities provides shade, shelter and enhance the local biodiversity in the area. The contractor should take care of the safety arrangement during construction phase and should provide traffic diversion routes to avoid the vehicle congestion. Traffic density in ward is very low but slightly more on the main road. People should be made aware through CAPC and outreach team of contractor before start of work in particular area. The locals feel that Parks play grounds and Community halls are required in this town and in addition. People are willing to pay for the improved services in the town, there will no problem face out by the proposed project of water supply & sewerage in the town but benefitted by the project.
4.	Harish Rana, Avinash, Naval Kishore, Ganesh Rana & Bhupesh Kumar	Manpur, Abu Road	Awareness of the project-including Project Coverage area. Present condition of water supply & Sewerage. In what way they may associate with the project	People are aware of the proposed Project of water supply and sewerage in the town. Sewerage flow in open drains. People are concerned about the poor sewerage conditions and water supply. People are concerned about the poor supply (intermittent supply on alternate days) and quality of water. Water supply is erratic and quality is poor with slightly flouridated. People demand 24x7 supply

S.No	Name of Persons	Location	Topic Discussed	Outcome
			Presence of any forest, wild life or any sensitive/ unique environmental components nearby the project. Drainage and sewerage problem facing. Present drinking water problem- quantity and quality Presence of historical/ cultural/religious sites nearby. Unfavorable climatic condition. Occurrence of flood, earthquake etc. Present solid waste collection and disposal problem. Dust and noise pollution and disturbances during construction work. Perception of villagers on tree felling and afforestation	connections to be provided to their area under the proposed. They want to engage with the project as a job opportunity and want to become beneficiaries. There is not any forest, wildlife or any sensitive /unique environmental, component near the project area. Mt. Abu Wildlife sanctuary is quite remote from the project area. There are not any historical/cultural and religious sites in nearby the subproject area. Drainage and sewerage condition is poor in the town and flow in open drains. People are concerned about the poor supply (intermittent supply on alternate days) and quality of water. Water supply is erratic and quality is poor & flouridated. People demand 24x7 supply connections to be provided to their area under the proposed. They are willing to pay for getting regular potable water. Abu Road enjoys all types of weather. In Summer, it's hot and humid with an average temperature of 40 Degrees with hot sandy winds. In Winter, it's 7 to 14 degrees, which is quite cold. There are no natural disasters such as flood and earthquake occurred in recent past. The area is not prone for such incidences. Solid waste collection facility is poor in this area. Contractor should use modern machinery and water sprinkler to

S.No	Name of Persons	Location	Topic Discussed	Outcome
			Safety of residents during construction phase and applying of vehicle for construction activities. Requirement of enhancement of other facilities Willingness to pay for improved services.	control dust and noise during construction phase. All the pollution control measures will be adopted at site to control the fugitive emission in the area and for control of noise, PPE's will be provided to workers such as ear muff etc. No need to cut the trees, plantation activities provides shade, shelter and enhance the biodiversity in the area. The contractor should take care of the safety arrangement during construction phase and should provide traffic diversion routes to avoid the vehicle congestion. Traffic density in colony is very low but slightly more on the Revdar road. People should be made aware through CAPC and outreach team of contractor before start of work in particular area. The locals feel that Parks play grounds and Community halls are required in this town and in addition. People are willing to pay for the improved services in the town, there will no problem face out by the proposed project of water supply & sewerage in the town but benefitted by the project.
5.	Raghunath Singh, Jaakar Khan, Mukesh Modi & Jeevan Kumar	Santpur, Abu Road	Awareness of the project-including Project Coverage area. Present condition of water supply & Sewerage.	People are aware of the proposed Project of water supply and sewerage in the town. Sewerage flow in open drains. People are concerned about the poor sewerage conditions and water supply. People are concerned about the poor supply (intermittent supply on alternate

S.No	Name of Persons	Location	Topic Discussed	Outcome
			In what way they may associate with the project Presence of any forest, wild life or any sensitive/ unique environmental components nearby the project. Drainage and sewerage problem facing. Present drinking water problem- quantity and quality Presence of historical/ cultural/religious sites nearby. Unfavorable climatic condition. Occurrence of flood, earthquake etc. Present solid waste collection and disposal problem. Dust and noise pollution and disturbances during construction work.	days) and quality of water. Water supply is erratic and quality is poor with slightly flouridated. People demand 24x7 supply connections to be provided to their area under the proposed. They want to engage with the project as a job opportunity and want to become beneficiaries. There is not any forest, wildlife or any sensitive /unique environmental, component near the project area. Mt. Abu Wildlife sanctuary is quite remote from the project area. There are not any historical/cultural and religious sites in nearby the subproject area. Drainage and sewerage condition is poor in the town and flow in open drains. Water supply is very erratic. The quality of water is poor. Fluoride content is reported. Abu Road enjoys all types of weather. In Summer, it's hot and humid with an average temperature of 40 Degrees with hot sandy winds. In Winter, it's 7 to 14 degrees, which is quite cold. There are no natural disasters such as flood and earthquake occurred in recent past. The area is not prone for such incidences. Solid waste collection facility is poor in this area. Contractor should use modern machinery and water sprinkler to control dust and noise during construction phase. All the pollution control measures will be

S.No	Name of Persons	Location	Topic Discussed	Outcome
			Perception of villagers on tree felling and afforestation Safety of residents during construction phase and applying of vehicle for construction activities. Foul Smell & Vector Borne diseases etc. Environmental Health & Hygiene STP treated water management Requirement of enhancement of other facilities Willingness to pay for improved services.	adopted at site to control the fugitive emission in the area and for control of noise, PPE's will be provided to workers such as ear muff etc. No need to cut the trees, plantation activities provides shade, shelter and enhance the biodiversity in the area. The contractor should take care of the safety arrangement during construction phase and should provide traffic diversion routes to avoid the vehicle congestion. Traffic density in colony is very low but slightly more on the Revdar road. People should be made aware through CAPC and outreach team of contractor before start of work in particular area. Foul smell and vector borne diseases will be mitigated by the proposed project of sewerage in the town. All the municipal waste will be properly treated and managed. This will improve the quality of environment. By the proposed project of water supply and sewerage in the town, improve the quality of environment, health and hygiene. Treated water from STP will be use in agricultural activities etc. The locals feel that Parks play grounds and Community halls are required in this town and in addition. People are willing to pay for the improved services in the town, there will no problem face out by

S.No	Name of Persons	Location	Topic Discussed	Outcome
				the proposed project of water supply & sewerage in the town but benefitted by the project.
6.	Arun Sen, Pyarelal, Ramesh Kumar, Jitendra Kumar & Surendra Kumar	Market Area, Abu Road	Awareness of the project—including Project Coverage area, Present condition of water supply in the town Present condition of Sewerage in the town. Presence of any forest, wild life or any sensitive/unique environmental components nearby the project, Presence of historical/cultural/religious sites nearby. Unfavorable climatic condition. Occurrence of flood/earthquake etc. Present solid waste collection and disposal problem.	People are aware of the proposed Project of water supply and sewerage in the town. Present water supply is very erratic. The quality of water is poor. People are concerned about the poor supply (intermittent supply on alternate days) and quality of water. Water supply is erratic and quality is poor & fluoridated. People demand 24x7 supply connections to be provided to their area under the proposed. They are willing to pay for getting regular potable water. People are concerned about the poor sewerage conditions in the town. There is not any forest, wildlife or any sensitive /unique environmental, component near the project area. Mt. Abu Wildlife sanctuary is quite remote from the project area. There are not any historical/cultural and religious sites in nearby the subproject area. Abu Road enjoys all types of weather. In Summer, it's hot and humid with an average temperature of 40 Degrees with hot sandy winds. In Winter, it's 7 to 14 degrees, which is quite cold. There are no natural disasters such as flood and earthquake occurred in recent past. The area is not prone for such incidences.

S.No	Name of Persons	Location	Topic Discussed	Outcome
			Dust and noise pollution and disturbances during construction work. Perception of villagers on tree felling and afforestation Safety of residents during construction phase and applying of vehicle for construction activities. Requirement of enhancement of other facilities Willingness to pay for improved services.	Solid waste collection facility is poor in this area. Contractor should use modern machinery and water sprinkler to control dust and noise during construction phase. All the pollution control measures will be adopted at site to control the fugitive emission in the area and for control of noise, PPE's will be provided to workers such as ear muff etc. No need to cut the trees, plantation activities in the area provides shade. The contractor should take care of the safety arrangement during construction phase and should provide traffic diversion routes to avoid the vehicle congestion. Traffic density in ward is low but slightly more on the main road. People should be made aware through CAPC and outreach team of contractor before start of work in particular area. The locals feel that Parks play grounds and Community halls are required in this town and in addition. People are willing to pay for the improved services in the town, there will no problem face out by the proposed project of water supply & sewerage in the town but benefitted by the project.

Photographs of Public Consultation





Gandhi Nagar



Housing Board



Luniyapura



Manpur



Market Area



Santpur

Attendance Sheet-Abu Road

Project Town: _____

Date: 05/10/17

Consultation with Stakeholders (Project Planning Phase)

Name of the project: _____

Place of consultation: _____

S.No.	Name and mobile no.	Designation and/or Address	Signature
1	मोहम्मद हसन ३/० इन्जिनियर खान 9452688789	रेलवे स्टेशन के पास लखनऊ काठवाड़ा	
2	मोहम्मद मोहम्मद ३/० लखनऊ मोहम्मद 7296724456	_____	
3	मोहम्मद लखन ३/० इन्जिनियर खान 7568956909	_____	
4	मोहम्मद ३/० प्रमोद 8167311599	_____	
5	मोहम्मद ३/० इन्जिनियर खान 7665846140	_____	

Any special issue noted at site: _____

Project Town: _____

Date: 05/10/18

Consultation with Stakeholders (Project Planning Phase)

Name of the project: _____

Place of consultation: _____

S.No.	Name and mobile no.	Designation and/or Address	Signature
1	मोहम्मद ३/० लखन लखनऊ काठवाड़ा 9281374128	रेलवे स्टेशन के पास लखनऊ काठवाड़ा	
2	मोहम्मद ३/० लखन लखनऊ काठवाड़ा 9985243822	_____	
3	मोहम्मद ३/० लखन लखनऊ काठवाड़ा 9571385581	_____	
4	मोहम्मद ३/० लखन लखनऊ काठवाड़ा 97259901136	_____	
5	मोहम्मद ३/० लखन लखनऊ काठवाड़ा 7574860380	_____	

Any special issue noted at site: _____

Consultation with Stakeholders (Project Planning Phase)

Project Town: _____

Date: 05/10/18 _____

Name of the project: _____

Place of consultation: डीडी 121 मोटे (मानपुर)

S.No.	Name and mobile no.	Designation and/or Address	Signature
1	दिक्कनर डी/० मोहन मुक्ता जी 7350409092	डीडी 121 मोटे (मानपुर)	
2	गोरेगा डी/० शिवश्याम जी 991398492	मानपुर मोटे (मानपुर)	
3	कान्हीपाला डी/० मंगलदास जी 9274651393	_____	
4	विपिन शर्मा डी/० विजय जी 9444 6744 44	_____	
5	मानपुरा डी/० गेहेरा 89901 666 96	_____	

Any special issue noted at site: _____

Consultation with Stakeholders (Project Planning Phase)

Project Town: _____

Date: 05/10/2018 _____

Name of the project: _____

Place of consultation: मानपुर (आधुरोड)

S.No.	Name and mobile no.	Designation and/or Address	Signature
1	दरीदाश गाँगा डी/० लालाजी 78 वा 822126	गणेश मंदिर के पक्ष मानपुर आधुरोड	
2	अविनाश डी/० गोवर्धनजी 7270861316	रेवदर रोड के पक्ष मानपुर आधुरोड	
3	नवल मिश्र डी/० हेलरामजी	मानपुर बस्ती आधुरोड	
4	गणेशराव डी/० रामदासजी 8290287895	_____	
5	भूवेश कुमार डी/० लक्ष्मणजी 8058012132	_____	

Any special issue noted at site: _____

Consultation with Stakeholders (Project Planning Phase)

Project Town: _____

Date: 05/10/2018

Name of the project: _____

Place of consultation: सांगपुर (भाबुरोड)

S.No.	Name and mobile no.	Designation and/or Address	Signature
1	रघुनाथ सिंह S/o हरिनाथ सिंह 9983443893	विष्णु के पास सांगपुर भाबुरोड	
2	जादव रघुनाथ S/o जादव रघुनाथ 9686183118	सुंदर के पास सांगपुर भाबुरोड	
3	राहुल S/o आशंकर 7976453093	— > —	
4	मुरारी मोदी S/o रमेश मोदी 9461444987	— > —	
5	जीवन कुमार S/o अमृतलाल जी 9783374720	सांगपुर मनोनी भाबुरोड	

Any special issue noted at site: _____

Consultation with Stakeholders (Project Planning Phase)

Project Town: _____

Date: 05/10/2018

Name of the project: _____

Place of consultation: भाईर परिया (भाबुरोड)

S.No.	Name and mobile no.	Designation and/or Address	Signature
1	अरुण सेन 9982087457	भाईर परिया मनोनी भाबुरोड	
2	मनोरेलाल S/o मनोजी 9001194201	— > —	
3	रमेश कुमार S/o श्रीलाल जी 9929170710	पारसी अवन के पीछे भाबुरोड	
4	जितेंद्र कुमार S/o बाबुलाल जी 9166290177	भाईर परिया	
5	सुन्दर कुमार S/o रतन लाल जी 97993884	— > —	

Any special issue noted at site: _____

B. Stakeholder Consultation Conducted in April 2018

During design stage site visit was conducted to assess potential social and environmental impacts of proposed components. Discussions with public including vendors, shopkeepers and hawkers were held to understand their perception about the proposed works and their co-operation during implementation of project. During consultations it was found that most of the public is aware about the proposed works and shown their interest to co-operate during construction works. Details of public consultations are given below

Outcomes during Stakeholder Consultation Meeting in April 2018

S.No	Name of Persons	Location	Topic Discussed	Outcome
1	PK Mathur Xen, PHED, Hemant kumar, A.En, PHED, Nilesh Patel, Vikas Meena, J.En MB Abu road,	Nagar Palika & Campus PHED	Proposed water supply works and availability of land, R&R issues etc.	Meeting with PHED and Nagar Palika officials and discussion were done about Proposed project under phase-4. PHED officers assured of their full cooperation with RUIDP during planning and implementation of the project
2	Devendra Bhai, Jagdish, Mahesh Kumar, Aslam Khan	Abkari ILaka	1) Present Status of Water Supply in the town 2) Work Proposed by RUIDP 3) Quality of present Water Supply. 4) Willingness to pay for improved services	1) People are concerned about the poor supply (intermittent supply on alternate days) and quality of water. No sewerage exist. 2) People are supportive of the project. 3) People are willing to pay for improved services.
3	Abida Begum, Imran Khan, Jai Baghela, Jugalkishor, Sarwanrana	Idgaha Basti	1) Present Status of Water Supply in the town 2) Work Proposed by RUIDP 3) Quality of present Water Supply. 4) Willingness to pay for improved services.	1) Water supply is intermittent and on alternate days. . 2) People are willing to pay for the improved quality of water and sewerage.
4	Jitender Parihar, Kanti Bhai Parihar, Ishwar Bhai, Shayam Lal, Maqsud Shah	Gandhi Nagar	1) Present Status of Water Supply in the town 2) Work Proposed by RUIDP 3) Quality of present Water Supply.	1) People are supportive of the project and indicated their willingness to participate in the project to make it successful. (especially women). 2) People understand direct benefits along with latent benefits of the project.

S.No	Name of Persons	Location	Topic Discussed	Outcome
			4) Willingness to pay for improved services	
	Hira Ram, Bhura Ram, Mohan Lal, Tekchand, Sugti Bai, Deva Ram	Manpur	1) Present Status of Water Supply in the town 2) Work Proposed by RUIDP 3) Quality of present Water Supply. 4) Willingness to pay for improved services	1) Poor supply and quality of water are persistent problem. No sewer exists in the town. 2) People are supportive of the project and indicated their willingness to participate (especially women); they are willing to pay for improved services.

Photographs during Stakeholder Consultation Meeting



Meeting at Nagar Palika



Meeting with stakeholder



Attendance Sheet

DRAFT - For Discussion

Date: 12.04.2018
 Stakeholder Consultation Meeting
ABU ROAD

Location	Name of Participants	Age	Occupation	Signature
Aburam	Deepak Saini	30	Contractor	Deepak Saini
"	Yogesh Dighay	39	"	Yogesh Dighay
"	Mahendra Singh	35	E.O.	Mahendra Singh
"	Gurdeep Kumar	30	Driver	Gurdeep Kumar
"	Vinod Kumar	23	L.DC	Vinod Kumar
"	LAXMAN SINGH	29	C.O. ^{Comp.} _{operator}	LAXMAN SINGH
"	Ramraj Singh	42	L.D.C.	Ramraj Singh
"	Rudha Ram	22	"	Rudha Ram
"	Pamraj Podd	55	Contractor	Pamraj Podd
"	IMRAN KHAN	24	C.O (NOCM)	IMRAN KHAN
	Sohani	20	"	Sohani
	Kan Singh	23	"	Kan Singh
	Devil Kumar	21	"	Devil Kumar
Haripur	Pragya Bhatnagar	32	ST	Pragya Bhatnagar
ABR	Amir Bhatnagar	25	Contractor	Amir Bhatnagar
ABR (P.P)	Vidyal Kumar	26	C.O. sp	Vidyal Kumar
Aburam	Shailendra Kumar	33	Spent comp	Shailendra Kumar
ABURAM	ABURAM	42	"	ABURAM
ABURAM	CHANDRA	42	ST	CHANDRA

Date: 12.04.2018
 Stakeholder Consultation Meeting ET Road
ABU ROAD

Location	Name of Participants	Age	Occupation	Signature
Aburamul	Deepak Saini	30	Contractor	Deepak Saini
"	Yogesh Dighay	39	"	Yogesh Dighay
"	Mahendra Singh	33	C.O.	Mahendra Singh
"	Gurdeep Kumar	30	Driver	Gurdeep Kumar
"	Vinod Kumar	29	L.DC	Vinod Kumar
"	LAXMAN SINGH	29	C.O. ^{Comp. operator}	LAXMAN SINGH
"	Parman Singh	42	L.D.C	Parman Singh
"	Rudha Ram	22	"	Rudha Ram
"	Pam Singh	55	Contractor	Pam Singh
"	IMRAN KHAN	24	C.O (NOC)	IMRAN KHAN
"	Sophia	20	"	Sophia
"	Kan Singh	23	"	Kan Singh
"	Dev Kumar	21	"	Dev Kumar
Aburamul	Arjun Bhatnagar	32	ST	Arjun Bhatnagar
ABR	Amir Bhatnagar	25	Contractor	Amir Bhatnagar
ABR (P.P)	Vidyal Kumar	26	C.O.	Vidyal Kumar
Aburamul	Shailendra Kumar	33	Contractor	Shailendra Kumar
ABURAMUL	Shailendra Kumar	42	"	Shailendra Kumar
ABURAMUL	Shailendra Kumar	42	"	Shailendra Kumar
ABURAMUL	Shailendra Kumar	42	"	Shailendra Kumar

Appendix 28: Minutes of City level Stakeholder Committee (CLC) Meeting

City stakeholder committee meeting was organized in Udaipur on Dtd. 25.08.2017 to discuss the matter of proposed sewerage works in Abu Road under the chairmanship of District Collector, Sirohi in presence of consultants, RUIDP officials, PHED officials and other invitee members. Proposed scope of works and technology was discussed in the meeting and it was decided that treated effluent shall be reused by Municipal Council in beneficial uses.



Meeting with Chairman and EO Abu Road



राजस्थान सरकार
कार्यालय अधिशाही अभियन्ता, उदयपुर

राजस्थान शहरी आधारभूत विकास परियोजना (आर.यू.आई.डी.पी.)

173, Vakli Colony, Opp. Income Tax Colony, Hiran Magri Sec. No. 11, Udaipur- 313002

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सिटी लेवल कमेटी मिटिंग दिनांक 25.08.2017 सिरौही आर.यू.आई.डी.पी. फेस चतुर्थ की बैठक कार्यवाही विवरण

आर.यू.आई.डी.पी. चतुर्थ चरण के अन्तर्गत जलप्रदाय एवं सीवररेज योजना पर विस्तृत चर्चा हेतु जिला कलेक्टर, सिरौही की अध्यक्षता में दिनांक 25.08.2017 को सिटी लेवल कमेटी की बैठक आयोजित की गई। सलाहकार फर्म द्वारा प्रजेन्टेशन के माध्यम से योजना के अन्तर्गत किए जाने वाले कार्यों की विस्तृत जानकारी दी गई। नगर पालिका, आबूरोड एवं सिरौही द्वारा नियुक्त सलाहकार फर्म के द्वारा जलप्रदाय एवं सीवररेज योजना की विस्तृत परियोजना रिपोर्ट बनवाई जा रही है। आर.यू.आई.डी.पी. द्वारा इन विस्तृत परियोजना रिपोर्ट की समीक्षा की जायेगी। बैठक में उपस्थित जनप्रतिनिधियों एवं अधिकारियों की सूची अनुच्छेद-अ पर संलग्न है। सलाहकार द्वारा निम्नलिखित प्रस्तावित जलप्रदाय व सीवररेज योजना के कार्यों पर प्रस्तुतिकरण दिया गया:-

आबूरोड

(अ) जल प्रदाय कार्य :- शहरी क्षेत्र में पानी की छीजत (NRW-Non Revenue Water) को कम करने के साथ उचित दबाव के साथ निर्बाध जल वितरण करने का प्रावधान रखा गया है। इस जल वितरण प्रणाली के अन्तर्गत निम्नलिखित कार्य प्रस्तावित किये गये हैं :-

- वाटर ट्रीटमेंट प्लांट - 10 एम.एल.डी. (Near Santpur)
- ट्रांसमिशन मेन - डीआई के-9 (100 एम.एम से 450 एम.एम व्यास) की पाईप लाईन - 53 किमी
- सी.डब्ल्यू.आर. - 6.2 एम.एल.
- डिस्ट्रीब्यूशन मेन - एच.डी.पी.ई. (75 एम.एम से 355 एम.एम व्यास) की पाईप लाईन - 127 किमी
- हाउस सर्विस कनेक्शन - 15500 कनेक्शन

(ब) सीवररेज कार्य :- इस परियोजना के अन्तर्गत निम्नलिखित निर्माण कार्य प्रस्तावित किये गये हैं :-

- एच.डी.पी.ई. - (200 एम.एम से 315 एम.एम व्यास) की पाईप लाईन - 103.5 किमी
- आर.सी.सी एन.पी-4 - (400 एम.एम से 500 एम.एम व्यास) की पाईप लाईन - 2.1 किमी
- एच.डी.पी.ई. (Trenchless) - (200 एम.एम से 700 एम.एम व्यास) की पाईप लाईन - 5.2 किमी
- सीवररेज ट्रीटमेंट प्लांट (एसबीआर टेक्नोलॉजी) - 7.0 MLD (Near Santpur)

2.0 MLD (Near Aakhar Bhata)

उपरोक्त कार्यों की विस्तृत परियोजना रिपोर्ट की अनुमानित लागत राशि रुपये 167 करोड़ है।

सिरौही

(अ) जल प्रदाय कार्य :- जिसके अन्तर्गत शहरी क्षेत्र में पानी की छीजत (NRW-Non Revenue Water) को कम करने के साथ उचित दबाव के साथ निर्बाध जल वितरण करने का प्रावधान रखा गया है। इस जल वितरण प्रणाली के अन्तर्गत निम्नलिखित कार्य प्रस्तावित किये गये हैं :-

- वाटर ट्रीटमेंट प्लांट - 8 एम.एल.डी.
- ट्रांसमिशन मेन - डीआई के - 9 (100 एम.एम से 450 एम.एम व्यास) की पाईप लाईन - 27 किमी
- सी.डब्ल्यू.आर. - 5.0 एम.एल.
- डिस्ट्रीब्यूशन मेन - एच.डी.पी.ई. (75 एम.एम से 355 एम.एम व्यास) की पाईप लाईन - 95 किमी
- हाउस सर्विस कनेक्शन - 12000 कनेक्शन

(ब) सीवररेज कार्य :- इस परियोजना के अन्तर्गत निम्नलिखित निर्माण कार्य प्रस्तावित किये गये है :-

- एच.डी.पी.ई. - (200 एम.एम से 315 एम.एम व्यास) की पाईप लाईन - 98 किमी
- आर.सी.सी एन.पी-4 - (350 एम.एम से 500 एम.एम व्यास) की पाईप लाईन - 2.6 किमी
- एच.डी.पी.ई. (Trenchless) - (200 एम.एम से 450 एम.एम व्यास) की पाईप लाईन - 5.6 किमी
- सीवररेज ट्रीटमेंट प्लांट (एमबीआर टेक्नोलॉजी) - 4.0 MLD(Near Nehru Nagar)

1.5 MLD (On Revdar road)

उपरोक्त कार्य की विस्तृत परियोजना रिपोर्ट की अनुमानित लागत राशि रुपये 129 करोड़ है।

बैठक में निम्न बिन्दुओं पर चर्चा की गई एवं निर्णय लिया गया -

1. घेयमैन, नगर पालिका द्वारा आबूरोड शहर के समीप 6 गांवों की भी मांग को इस परियोजना में सम्मिलित करने की मांग भी गई। चूंकि शहर के समीप मैसासिंह बांध के अलावा अन्य कोई स्रोत उपलब्ध नहीं है तथा यह 6 गांव शहर के समीप स्थित है अतः समिति द्वारा बैठक में चर्चा के दौरान इस मुद्दे पर विचारविमर्श कर इन 6 गांवों को जो कि इस परियोजना में सम्मिलित करने का निर्णय किया गया। इस हेतु पीने योग्य पानी को स्वच्छ जलाशय के आउट लैट पर उपलब्ध करवाया जावेगा एवं गांवों को पेयजल उपलब्ध करवाने के समस्त कार्य जन.स्वा.अभि. विभाग द्वारा करवाए जायेंगे क्योंकि आर.यू.आई.डी.पी द्वारा शहरी क्षेत्र के लिए ही कार्य किए जाने का प्रावधान है।
2. परियोजना के अन्तर्गत अण्गीर बांध से 95 MCFT पानी का प्रावधान रखा गया है, लेकिन सिरोही शहर की जलापूर्ति हेतु जल संसाधन विभाग द्वारा विगत वर्षों में औसतन 65 MCFT पानी ही अण्गीर बांध से जलदाय विभाग को दिया जाता है। अण्गीर बांध में विगत कुछ वर्षों में पानी की आवक कम होने के कारण वर्ष 2014-15 में मात्र 65 MCFT पानी ही उपलब्ध हो पाया था अतः अण्गीर बांध से 95 MCFT पानी का प्रावधान उचित नहीं होगा। बैठक में विचारविमर्श कर उपरोक्त परिस्थिति के मद्देनजर शहर के समीप कालका बांध को भी स्रोत के रूप में उपयोग किये जाने हेतु निर्णय लिया गया है। जिसमें 53 MCFT जल उपलब्धता बताई गई। अतः शेष पानी 53 MCFT कालका बांध से लेकर प्रस्तावों में संशोधन किया जावे।
3. आबूरोड/सिरोही शहर की जलापूर्ति/सीवररेज योजना में प्रस्तावित वाटर ट्रीटमेंट प्लांट, सीवररेज ट्रीटमेंट प्लांट एवं स्वच्छ जलाशय हेतु जमीन नगरपरिषद/नगरपालिका के द्वारा सम्बन्धित विभाग को प्रस्तावों की स्वीकृति से पूर्व उपलब्ध करवाई जावेगी एवं सम्बन्धित नक्शे खसरा संख्या एवं क्षेत्रफल दर्शाते हुए उपलब्ध करवाए जायेंगे।

4. परियोजना के अन्तर्गत जलापूर्ति योजना हेतु SCADA system काम में लिया जावेगा एवं पम्पिंग स्टेशन पर डी.जी. सेट का प्रावधान लिया जावेगा।
5. सीवररेज योजना हेतु S.T.P. पर SCADA system काम में लिया जावेगा एवं मैनहोल पर आवश्यकता अनुसार सेन्सर लगाए जावेंगे। सीवररेज योजना में सीवररेज ट्रीटमेंट प्लॉट में शोधित सीवररेज के पूर्ण उपयोग का प्रावधान लिया गया है।
6. पुराने उच्च जल्लाशय जो काम में आ सकते हैं उनको काम में लेत हुए अन्य क्षेत्रों में वी.एफ.डी. पम्पों के द्वारा जल वितरण प्रस्तावित किया गया है। इस योजना के अन्तर्गत शहर के सभी House service connection के साथ वाटर मीटर लगाने का भी प्रावधान किया गया है। अवैध जल सम्बन्धों को नियमित किया जावेगा।
7. 3.5 मीटर से अधिक गहरी सीवर लाईनों को ड्रिंचलेस द्वारा ढाला जायेगा जिससे शहरवासियों को असुविधाओं का सामना न करना पड़े। 4.0 मीटर चौड़ाई तक सभी सड़कों का पूर्ण चौड़ाई में रोड रेस्टोरेसन किया जावेगा।
8. सभी कार्यों का संचालन एवं संधारण कॉन्टेक्टर फर्म द्वारा 10 वर्ष तक किया जायेगा। जिसमें पानी तथा सीवररेज लाईनों का भी रखरखाव शामिल है।

25/09/17
अधिसापी अभियन्ता,
आर.यू.आई.डी.पी. (पी.आई.यू.)
उदयपुर

कमांक : आर.यू.आई.डी.पी. / पी.आई.यू. / उदयपुर / CLC Meeting / 2017-18 / 227 - 241

दिनांक: 06.09.2017

प्रतिनिधि निम्नांकित को सूचनाई :-

- 1- माननीय श्री देवजी भाई पटेल, लोकसभा सदस्य, सिरोंही
- 2- माननीय श्री ओटाराम देवारी, विधायक एवं मंत्री गृहोदय, सिरोंही
- 3- श्रीमान् परियोजना निदेशक, आर.यू.आई.डी.पी., एवीएस बिल्डिंग, जवाहर सर्किल, जयपुर
- 4- श्रीमान् जिला कलक्टर एवं अध्यक्ष, सिटी लेवल कमेटी, सिरोंही
- 5- अध्यक्ष/उपाध्यक्ष/आयुक्त, नगर परिषद, सिरोंही
- 6- अधीक्षण अभियन्ता (वेस्ट वाटर) आर.यू.आई.डी.पी., जयपुर।
- 7- अधीक्षण अभियन्ता (वाटर सप्लाई) आर.यू.आई.डी.पी., जयपुर।
- 8- अधीक्षण अभियन्ता, सा.नि.वि./जन.स्वा.अभि.विभाग/जल संसाधन विभाग, सिरोंही
- 7- वरिष्ठ नगर नियोजक, उदयपुर
- 8- अधिसापी अभियन्ता, नगर परिषद, सिरोंही
- 9 - प्रमुख जन, सिरोंही

25/09/17
अधिसापी अभियन्ता,
आर.यू.आई.डी.पी. (पी.आई.यू.)
उदयपुर

Transcript

A city level committee meeting was held under the chairmanship of District Collector, Sirohi on dated 25.08.2017. Project Consultant briefed them about the proposed water supply and sewerage works and informed that main objective of proposed water supply works is to reduce Non-Revenue Water.

For ABU ROAD

- Water supply works – to reduce the non revenue water following works are proposed under water supply scheme
 - Water treatment plant – 10 MLD (Near Santpur)
 - Transmission main – DI K9 (100 mm to 450 mm dia) pipeline – 53 km

- CWR – 62 MLD
- Distribution main – HDPE (75 mm to 355 mm dia) pipeline – 127 km
- House service connection 15500
- Sewerage works – following works proposed under sewerage scheme
 - HDPE (200 mm to 315 mm dia) pipeline – 103.5 km
 - RCC NP-4- (400 mm to 500 mm dia) pipeline – 2.1 km
 - HDPE (trenchless) – (200 mm to 700 mm dia) pipeline – 5.2 km
 - STP (SBR technology) – 7.0 MLD (Near Santpur)
2.0 MLD (Near Aakar Bhata)

As per detailed project report the estimated cost of above works is INR 167 crore

For Sirohi

- Water supply works – to reduce the non revenue water following works are proposed under water supply scheme
 - Water treatment plant – 8 MLD
 - Transmission main – DI K9 (100 mm to 450 mm dia) pipeline – 27 km
 - CWR – 50 MLD
 - Distribution main – HDPE (75 mm to 355 mm dia) pipeline – 95 km
 - House service connection 12000
- Sewerage works – following works proposed under sewerage scheme
 - HDPE (200 mm to 315 mm dia) pipeline – 98 km
 - RCC NP-4- (400 mm to 500 mm dia) pipeline – 2.6 km
 - HDPE (trenchless) – (200 mm to 700 mm dia) pipeline – 5.6 km
 - STP (SBR technology) – 4.0 MLD (Near Nehru Nagar)
1.5 MLD (Near Revdar Road)

As per detailed project report the estimated cost of above works is INR 129 crore

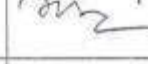
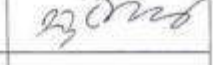
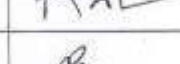
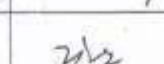
Following points are discussed in the meeting

1. Chairmen ULB, Abu Road has requested to provide water to 6 villages near Bhaisa Singh Dam, which will be provided by PHED as RUIDP is entitled to work only in urban area.
2. Water demand for Sirohi water supply is 95 MCFT from Angore dam, but due to average availability of water in Angore dam is only 65 MCFT. The suggestion of using the Kalka dam for additional demand was approved in meeting. The Kalka dam has average availability of 53 MCFT water.
3. Land for proposed WTP, STP, CWR in Abu road/ Sirohi water supply/ sewerage scheme will be provided by ULB along with revenue map and land records.
4. SCADA system will be used in water supply scheme and DG sets will be used at pumping stations
5. For sewerage system SCADA system will installed at STP and as per requirements sensors will be installed at man holes. The entire treated sewer in sewerage scheme will be used.
6. Useable old water structures will be used with VFD pumps. Under this scheme all houses will be connected to House service connection and all illegal connections will be regularized.
7. All sewer lines below 3.5 m will be laid using trenchless technique to avoid discomfort to people. Roads up to 4 m will be resorted completely.

8. The O&M of all works will be done by contractor firm for 10 years. Including maintenance of water supply and sewerage pipelines.

DRAFT - For Discussion

दिनांक 25.08.2017 को जिला कलक्टर महोदय के अध्यक्षता में आयोजित बैठक
(रूडीफ फेज -II) के संदर्भ में उपस्थित जन प्रतिनिधि / अधिकारीगण ।

क्रम सं.	नाम जन प्रतिनिधि / अधिकारी	पदनाम	हस्ताक्षर
1	Shri. Ota Ramji Devani	Minister & MHA Sirohi	
2	Devji M. Patel	M.P. Jodhpur	
3	गोलमराह कोल	विद्यार्थी	
4	Jawahan chandelgaj	ADM, Sirohi	
5	Taxkar R. muni	C.N.P. Sirohi	
6	SURESH KOTHARI	Chairman UIT ARJ	
7	सुरेश सिरोही	अध्यक्ष नगर पालिका आश्रित	
8	Praveen Ankod via	SE(ws), RUIDP, Jaipur	
9	Bharat Tejra.	Gen-Recd Jaipur	
10	Mahendra Singh	E.O M.B. Asumad	
11	Ashok Chandra	SE (PHED) Sirohi	
12	पुष्पाक्षर राय वर्मा	आयुक्त नगर परिषद सिरोही	
13	Nemichand Gethof	AEN, PHED Project Dir. Sirohi	
14	VISHNU Khedi	CMV Eng Cad Con	
15	VINOD MENTA	Director Cad con consultt for PHED	

16	P. K. Mathur	XEN PHED Dm. Abu Road	42
17	B. K. Goyal	XEN PHED Dm. Sirola	and
18	V. R. Garg	Abu PHED Sirola	41
19	A. K. JAIN	CE RUIDP	8
20	Limber Chaudhry. 1st Brest BJP		mead

Appendix 29: Sample Grievance Registration Form

(To be available in Hindi and English)

The _____ Project welcomes complaints, suggestions, queries, and comments regarding project implementation. We encourage persons with grievance to provide their name and contact information to enable us to get in touch with you for clarification and feedback.

Should you choose to include your personal details but want that information to remain confidential, please inform us by writing/typing *(CONFIDENTIAL)* above your name. Thank you.

Date	Place of registration	Project Town			
		Project:			
Contact information/personal details					
Name		Gender	* Male * Female	Age	
Home address					
Place					
Phone no.					
E-mail					
Complaint/suggestion/comment/question Please provide the details (who, what, where, and how) of your grievance below:					
If included as attachment/note/letter, please tick here:					
How do you want us to reach you for feedback or update on your comment/grievance?					

FOR OFFICIAL USE ONLY

Registered by: (Name of official registering grievance)	
Mode of communication: Note/letter E-mail Verbal/telephonic	
Reviewed by: (Names/positions of officials reviewing grievance)	
Action taken:	
Whether action taken disclosed:	Yes No
Means of disclosure:	

Appendix 30: Office order for establishing GRM

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RUIDP
Government of Rajasthan
Office of Project Director
Rajasthan Urban Infrastructure Development Project
 AVS Building, Jawahar Circle, JLN Marg, Jaipur - 302017
 Tel No.: 0141-2721966, Fax No.: 0141-2721919, email : mail@ruidp.gov.in, web site : www.ruidp.gov.in
 F3(301)(50)RUIDP/PMU/PH-IV/WS/GENERAL/ 12 8 2 Dated: 04-2018-04/05/18

Office - Order

Subject:- Grievance Redress Mechanism for Rajasthan Secondary Town Development Investment Program (RSTDIP) - RUIDP Phase IV

Reference:- Agreed Resettlement & Environmental framework -3183 IND (RUIDP Phase III) - <https://www.adb.org/projects/42267-026/main/project-documents>

It is directed that Grievance Mechanism of RUIDP Phase III will be replicated in RUIDP Phase IV and accordingly, PIU will maintain/ ensure proper records of safeguard related Grievances received in their town. PIU will also ensure that the safeguard related Grievances received are resolved as per Grievance Redress Mechanism (GRM) prescribed in RP which is summarized as under (for ready reference) :-

Methodology of multi-tier GRM	Responsibility/Action to be taken	Time Frame	Record Keeping
1st level: Grievances that are immediate and urgent in the perception of the complainant, the contractor, and supervision personnel from PIU will provide the most easily accessible or first level of contact for quick resolution of grievances	SE/EE PIU will resolve issues in consultation with supervision personnel, Contractor.	PIU will resolve issues within 3 days of receipt of a complaint/ grievance.	The grievance register will be endorsed by all field agencies involved in implementation of EMP and RP.
2nd level: All grievances that cannot be redressed within 3 days at field will be referred to PMU through PO Social/Environment by PIU.	Project Officers (Environment/Social) PMU in consultation with PMU, PIU and the Contractor will resolve the issues referred.	PMU will resolve issues within 7 days of receipt of a complaint/ grievance.	PIU will keep records of the matter referred to PMU and will document the outcome of each grievance resolved in the Grievance Register.
3rd level: All the grievances that are not addressed by PMU within 7 days, will be brought to the notice of Grievance Redress Committee (GRC). The City Level Committee (CLC), which will be established in every project town will act as GRC.	SE/EE PIU will coordinate with PO Social/ Environment or other official of PMU and will prepare agenda for the GRC meeting accordingly and ensure keeping the same in GRC.	The GRC will resolve the grievance within 15 days of receiving the complaint.	PIU will be responsible to see through the process of redress of each grievance and document the outcomes.
4th level: Very major issues that are beyond the jurisdictional authority of the CLC or those that have the potential to cause social conflicts or environmental damage or those that remain unresolved at PMU/CLC level, will be referred to the Empowered Committee (EC).	SE/EE PIU will assist PMU officials to prepare agenda for the Empowered committee meeting.		SE/EE PIU will keep records of Empowered committee meeting and will ensure documentation of outcome.

Please note that an aggrieved person shall have access to the country's legal system at any stage, and accessing the country's legal system can run parallel to accessing the GRM and is not dependent on the negative outcome of the GRM.

PIUs will be responsible to ensure redressal of grievances as per GRM procedures summarized above and intimate to the complainant.

Contractor's will keep information board depicting Grievance registration numbers at each working site, Grievance registration form and will maintain Grievance Registers (refer annexure 1 & 2).

Addl. Project Director, RUIDP
 Dated: 04-2018-04/05/18

F3(301)(50)RUIDP/PMU/PH-IV/WS/GENERAL/ 12 83-84
 Copy to following for information and necessary action.
 1) PA to PD /CE /FA/DyPD(A)/SE(WS)/SE(WW)/PO(Environment)/PO(Social), RUIDP, Jaipur
 2) All EE, PIU, Phase-IV for ensuring maintenance of the Grievance register and helpline and for resolving of Grievances.

(K. M. Mandawaria)
 PO(Co-ord.&Social)

Appendix 31: Sample Environmental Site Inspection Report

Project Name
Contract Number

NAME: _____ DATE: _____
TITLE: _____ DMA: _____
LOCATION: _____ GROUP: _____

WEATHER: _____

Project Activity Stage	Survey	
	Design	
	Implementation	
	Pre-Commissioning	
	Guarantee Period	

Monitoring Items	Compliance
Compliance marked as Yes / No / Not applicable (NA) / Partially Implemented (PI)	
EHS supervisor appointed by contractor and available on site	
Construction site management plan (spoils, safety, schedule, equipment etc.,) prepared	
Traffic management plan prepared	
Dust is under control	
Excavated soil properly placed within minimum space	
Construction area is confined; no traffic/pedestrian entry observed	
Surplus soil/debris/waste is disposed without delay	
Construction material (sand/gravel/aggregate) brought to site as & when required only	
Tarpaulins used to cover sand & other loose material when transported by vehicles	
After unloading , wheels & undercarriage of vehicles cleaned prior to leaving the site	
No chance finds encountered during excavation	
Work is planned in consultation with traffic police	
Work is not being conducted during heavy traffic	
Work at a stretch is completed within a day (excavation, pipe laying & backfilling)	
Pipe trenches are not kept open unduly	
Road is not completely closed; work is conducted on edge; at least one line is kept open	
Road is closed; alternative route provided & public informed, information board provided	
Pedestrian access to houses is not blocked due to pipe laying	
Spaces left in between trenches for access	
Wooden planks/metal sheets provided across trench for pedestrian	
No public/unauthorized entry observed in work site	

Children safety measures (barricades, security) in place at works in residential areas	
Prior public information provided about the work, schedule and disturbances	
Caution/warning board provided on site	
Guards with red flag provided during work at busy roads	
Workers using appropriate PPE (boots, gloves, helmets, ear muffs etc)	
Workers conducting or near heavy noise work is provided with ear muffs	
Contractor is following standard & safe construction practices	
Deep excavation is conducted with land slip/protection measures	
First aid facilities are available on site and workers informed	
Drinking water provided at the site	
Monitoring Items	Compliance
Toilet facility provided at the site	
Separate toilet facility is provided for women workers	
Workers camps are maintained cleanly	
Adequate toilet & bath facilities provided	
Contractor employed local workers as far as possible	
Workers camp set up with the permission of PIU	
Adequate housing provided	
Sufficient water provided for drinking/washing/bath	
No noisy work is conducted in the nights	
Local people informed of noisy work	
No blasting activity conducted	
Pneumatic drills or other equipment creating vibration is not used near old/risky buildings	

Signature

Sign off

Name
Position

Name
Position

Appendix 32: Semi Annual Environmental Monitoring Report Format

I. INTRODUCTION

- Overall project description and objectives
- Environmental category as per ADB Safeguard Policy Statement, 2009
- Environmental category of each subproject as per national laws and regulations
- Project Safeguards Team

Name	Designation/Office	Email Address	Contact Number
1. PMU			
2. PIUs			
3. Consultants			

- Overall project and sub-project progress and status
- Description of subprojects (package-wise) and status of implementation (preliminary, detailed design, on-going construction, completed, and/or O&M stage)

Package Number	Components/ListOf Works	Status of Implementation (Preliminary Design/Detailed Design/On-going Construction/Completed/O&M) ^a	Contract Status (specify if under bidding or contract awarded)	On-going Construction	
				%Physical Progress	Expected Completion Date

^a If on-going construction, include %physical progress and expected date of completion.

II. COMPLIANCE STATUS WITH NATIONAL/STATE/LOCAL STATUTORY ENVIRONMENTAL REQUIREMENTS^a

Package No.	Subproject Name	Statutory Environmental Requirements ^b	Status of Compliance ^c	Validity if obtained	Action Required	Specific Conditions that will require

						environmental monitoring as per Environment Clearance, Consent/Permit to Establish^d

^a All statutory clearance/s, no-objection certificates, permit/s, etc. should be obtained prior to award of contract/s. Attach as appendix all clearance obtained during the reporting period. If already reported, specify in the "remarks" column.

^b Specify (environmental clearance? Permit/consent to establish? Forest clearance? Etc.)

^c Specify if obtained, submitted and awaiting approval, application not yet submitted.

^d Example: Environmental Clearance requires ambient air quality monitoring, Forest Clearance/Tree-cutting Permit requires 2 trees for every tree, etc.

III. COMPLIANCE STATUS WITH ENVIRONMENTAL LOAN COVENANTS

No. (List schedule and paragraph number of Loan Agreement)	Covenant	Status of Compliance	Action Required

IV. COMPLIANCE STATUS WITH THE ENVIRONMENTAL MANAGEMENT PLAN (REFER TO EMP TABLES IN APPROVED IEE/S)

- Confirm if IEE/s require contractors to submit site-specific EMP/construction EMPs. If not, describe the methodology of monitoring each package under implementation.

Package-wise Implementation Status

Package Number	Component s	Design Status (Preliminary Design Stage/Detailed Design Completed)	Final IEE based on Detailed Design				Site-specific EMP (or Construction EMP) approved by Project Director? (Yes/No)	Remarks
			Not yet due (detailed design not yet completed)	Submitted to ADB (Provide Date of Submission)	Disclosed on project website (Provide Link)	Final IEE provided to Contractor/s (Yes/No)		

- Identify the role/s of Safeguards Team including schedule of on-site verification of reports submitted by consultants and contractors.

- For each package, provide name/s and contact details of contractor/s' nodal person/s for environmental safeguards.
- Include as appendix all supporting documents including **signed** monthly environmental site inspection reports prepared by consultants and/or contractors.
- With reference to approved EMP/site-specific EMP/construction EMP, complete the table below
- Provide the monitoring results as per the parameters outlined in the approved EMP (or site-specific EMP/construction EMP when applicable).
- In addition to the table on EMP implementation, the main text of the report should discuss in details the following items:
 - (i) **Grievance Redress Mechanism.** Provide information on establishment of grievance redress mechanism and capacity of grievance redress committee to address project-related issues/complaints. Include as appendix Notification of the GRM (town-wise if applicable).
 - (ii) **Complaints Received during the Reporting Period.** Provide information on number, nature, and resolution of complaints received during reporting period. Attach records as per GRM in the approved IEE. Identify safeguards team member/s involved in the GRM process. Attach minutes of meetings (ensure English translation is provided).
- Confirm if any dust was noted to escape the site boundaries and identify dust suppression techniques followed for site/s.
- Identify muddy water was escaping site boundaries or muddy tracks were seen on adjacent roads.
- Identify type of erosion and sediment control measures installed on site/s, condition of erosion and sediment control measures including if these were intact following heavy rain;
- Identify designated areas for concrete works, chemical storage, construction materials, and refueling. Attach photographs of each area.
- Confirm spill kits on site and site procedure for handling emergencies.
- Identify any chemical stored on site and provide information on storage condition. Attach photograph.
- Describe management of stockpiles (construction materials, excavated soils, spoils, etc.). Provide photographs.
- Describe management of solid and liquid wastes on-site (quantity generated, transport, storage and disposal). Provide photographs.
- Provide information on barricades, signages, and on-site boards. Provide photographs.
- Provide information on
- Checking if there are any activities being under taken out of working hours and how that is being managed.

Summary of Environmental Monitoring Activities (for the Reporting Period)^a

Impacts (List from IEE)	Mitigation Measures (List from IEE)	Parameters Monitored (As a minimum those identified in the IEE should be monitored)	Method of Monitoring	Location of Monitoring	Date of Monitoring Conducted	Name of Person Who Conducted the Monitoring
Design Phase						
Pre-Construction Phase						
Construction Phase						
Operational Phase						

^a Attach Laboratory Results and Sampling Map/Locations

Overall Compliance with CEMP/EMP

No.	Sub-Project Name	EMP/ CEMP Part of Contract Documents (Y/N)	CEMP/ EMP Being Implemented (Y/N)	Status of Implementation (Excellent/ Satisfactory/ Partially Satisfactory/ Below Satisfactory)	Action Proposed and Additional Measures Required

V. APPROACH AND METHODOLOGY FOR ENVIRONMENTAL MONITORING OF THE PROJECT

- Brief description on the approach and methodology used for environmental monitoring of each sub-project

VI. MONITORING OF ENVIRONMENTAL IMPACTS ON PROJECT SURROUNDINGS (ambient air, water quality and noise levels)

- Brief discussion on the basis for monitoring
- Indicate type and location of environmental parameters to be monitored
- Indicate the method of monitoring and equipment to be used
- Provide monitoring results and an analysis of results in relation to baseline data and statutory requirements

As a minimum the results should be presented as per the tables below.

Air Quality Results

Site No.	Date of Testing	Site Location	Parameters (Monitoring Results)			
			PM10 µg/m ³	PM2.5 µg/m ³	SO2 µg/m ³	NO2 µg/m ³

Surface Water Quality Results

S.No.	Parameters	Results		
		Location-1 (Name)	Location-2 (Name)	Location-3 (Name)
1.	pH			
2.	Turbidity			
3.	Total Hardness			
4.	DO			
5.	BOD			
6.	COD			
7.	Chloride			
8.	Iron			
9.	TSS			
10.	Arsenic			
11.	Cadmium			
12.	Fluoride			

13.	Potassium			
14.	Sodium			
15.	Calcium			
16.	Zn			
17.	Cr ⁺⁶			
18.	Magnesium			
19.	Copper			
20.	Manganese			
21.	Sulphate			
22.	Cyanide			
23.	Nitrate			
24.	Lead			
25.	Boron			
26.	Selenium			
27.	Aluminium			
28.	Total residual Chlorine			

Ground Water Quality Results

S.No.	Parameters	Results		
		Location-1 (Name)	Location-2 (Name)	Location-3 (Name)
1.	pH			
2.	Total Alkalinity			
3.	Total Hardness			
4.	Chloride			
5.	Iron			
6.	TDS			
7.	Arsenic			
8.	Fluoride			
9.	Zn			
10.	Cr+6			
11.	Copper			
12.	Manganese			
13.	Sulphate			
14.	Phosphate			
15.	Nitrate			
16.	Lead			
17.	Phenolic Compound			

Noise Quality Results

Site No.	Date of Testing	Site Location	LA _{eq} (dBA) (Monitoring Results)	
			Day Time	Night Time

VII. ASBESTOS MANAGEMENT

Information on encountered or potential asbestos materials and capacity building activities on project sites should be included in this section.

FORM I – ASBESTOS INVENTORY, INSPECTION AND ACTION FORM		
Format: RUIDP/IIA/ LOCATION/NAME OF DBO CONTRACTOR/HSE 002/YEAR		
Location:		
Site coordinates:		
Elevation:		Team:
Date of visit:		Sign:
Present Status		Indicate if installed, operational, in storage, etc.
Original age		Months or years since installation
Diameter		mm or inches
Length		meters
Volume		
Total packet		
Packing date		
Disposal date		
Existing Site (Photo or illustrations):		
Illustration/ Design of Activities On-site with respect to existing asbestos (include details such as size of new pipes, distance from existing AC pipes, other notable observations)		
DBO Contractor Handling Asbestos:		
Number of persons handling waste		
Medical Records		
Safety Gears		
Vocational Training Last Conducted:		
Number of attendees:		
Conducted by Schedule:		
Required Actions:		
Remarks		
Conclusion/Remark		
HSE Signatory		

MATRIX FOR TRAINING & RECORDS

Format: RUIDP/INSP.MATRIX/LOCATION/NAME OF DBO CONTRACTOR/HSE 001/YEAR			
S. No.	Aspects of Asbestos Materials	Check points	Remarks
Training Schedule:			
Trainer Details:			
Date/Location of Training:			

Number of attendees:			
Training Schedule, Training Materials & Attendance Sheet, Feedback of Trainees.			
Understanding of:			
C. DOCUMENTS AND RECORDS			
4.	Site Inventory		
5.	List of Asbestos materials storage and installation points		
6.	Structure of Asbestos materials management committee		
D. INVENTORY			
1.	Inventory of Asbestos materials		
	Number of Asbestos materials/ pipes		
	Dimensions of Asbestos materials/ pipes		
	Total volume of Asbestos materials/ pipes		
2.	Storage facility/ installation location:		
A.	In-use	Location	
		Condition	Intact/ damaged
		Purpose	
		Accessibility by the workers	
		Evidence of physical damage and approximate size (length, width, volume) without coming into contact with The damaged Asbestos materials	
		Impacts on the environment (Based on Asbestos fiber Monitoring)	
3.	LABELING AND SIGNAGE		
	Notification to workplace safety and health		
	Working instruction		
	The risks associated with exposure to asbestos fibers		
	Cautionary statement to not disturb materials containing asbestos		
4.	PERSONAL PROTECTIVE EQUIPMENT (PPE)		
	Record of PPE		
	Mask		
	Eye glasses		
	Gloves		
	Ear muffs		
	Others		
	Training		
	On occupational risks of asbestos to the workers		Date: Time: In-house/ external: Faculty: No of workers attended:
	Training for maintenance, repair and renovation		Date: Time:

		In-house/ external: Faculty: No of workers attended:
	Training for workers working with asbestos	Date: Time: In-house/ external: Faculty: No of workers attended:
	Periodic air quality monitoring records	• Within the permissible limits • Not within the permissible limits (specify the reason)
	Workers medical check-up records	Date: In-house/ external: Performed by: Remarks: No of workers attended:
Conclusion/Remark:		
EHS Officer Signatory:		

ASBESTOS MANAGEMENT

In-situ Storage of Asbestos materials

S.No	Activity	Number of Stacks	Area occupied	Details of Asbestos materials Pipes	Day/month/year Of storage

Site History

For existing Stacks, details of re-handling of pipes in number or volume to be mentioned under supervision of Authorized Experts.

Details of Location of re-handled Asbestos materials storage, new area should be

- Minimum 10-15 ft away from campus habitation.
- 250m away from the water sources
- 500-800m away from Children play area
- The area should be isolated and covered from all the sides with restricted Access for Authorised Experts Only.
- Register to be maintained for Entry& Exit of personals.
- Register to be maintained for Entry & Exit of Asbestos materials

• Labels to be displayed in legible format • Specific training of Asbestos materials to be inducted in the Asbestos materials storage area for residing population in the campus.
Details of transit storage of Asbestos materials to be maintained as per norms in an isolated storage room full covered

VIII. SUMMARY OF KEY ISSUES AND REMEDIAL ACTIONS

- Summary of follow up time-bound actions to be taken within a set timeframe.

APPENDIXES

- Photos
- Summary of consultations
- Copies of environmental clearances and permits
- Sample of environmental site inspection report
- Other

Appendix 33: WHO Interim Guidance on Water, Sanitation, Hygiene and Waste

Management for the COVID19 virus



Water, sanitation, hygiene, and waste management for the COVID-19 virus

Interim guidance
19 March 2020

Background

This interim guidance supplements the infection prevention and control (IPC) documents by summarizing WHO guidance on water, sanitation and health care waste relevant to viruses, including coronaviruses. It is intended for water and sanitation practitioners and providers and health care providers who want to know more about water, sanitation and hygiene (WASH) risks and practices.

The provision of safe water, sanitation, and hygienic conditions is essential to protecting human health during all infectious disease outbreaks, including the COVID-19 outbreak. Ensuring good and consistently applied WASH and waste management practices in communities, homes, schools, marketplaces, and health care facilities will help prevent human-to-human transmission of the COVID-19 virus.

The most important information concerning WASH and the COVID-19 virus is summarized here.

- Frequent and proper hand hygiene is one of the most important measures that can be used to prevent infection with the COVID-19 virus. WASH practitioners should work to enable more frequent and regular hand hygiene by improving facilities and using proven behavior-change techniques.
- WHO guidance on the safe management of drinking-water and sanitation services applies to the COVID-19 outbreak. Extra measures are not needed. Disinfection will facilitate more rapid die-off of the COVID-19 virus.
- Many co-benefits will be realized by safely managing water and sanitation services and applying good hygiene practices.

Currently, there is no evidence about the survival of the COVID-19 virus in drinking-water or sewage. The morphology and chemical structure of the COVID-19 virus are similar to those of other human coronaviruses for which there are data about both survival in the environment and effective inactivation measures. This document draws upon the evidence base and WHO guidance on how to protect against viruses in sewage and drinking-water. This document will be updated as new information becomes available.

1. COVID-19 transmission

There are two main routes of transmission of the COVID-19 virus: respiratory and contact. Respiratory droplets are generated when an infected person coughs or sneezes. Any person who is in close contact with someone who has respiratory symptoms (sneezing, coughing) is at risk of being exposed to potentially infective respiratory droplets.¹ Droplets may also land on surfaces where the virus could remain viable; thus, the immediate environment of an infected individual can serve as a source of transmission (contact transmission).

Approximately 2–10% of cases of confirmed COVID-19 disease present with diarrhoea,^{2,4} and two studies detected COVID-19 viral RNA fragments in the faecal matter of COVID-19 patients.^{5,6} However, only one study has cultured the COVID-19 virus from a single stool specimen.⁷ There have been no reports of faecal–oral transmission of the COVID-19 virus.

2. Persistence of the COVID-19 virus in drinking-water, faeces and sewage and on surfaces.

Although persistence in drinking-water is possible, there is no evidence from surrogate human coronaviruses that they are present in surface or groundwater sources or transmitted through contaminated drinking water. The COVID-19 virus is an enveloped virus, with a fragile outer membrane. Generally, enveloped viruses are less stable in the environment and are more susceptible to oxidants, such as chlorine. While there is no evidence to date about survival of the COVID-19 virus in water or sewage, the virus is likely to become inactivated significantly faster than non-enveloped human enteric viruses with known waterborne transmission (such as adenoviruses, norovirus, rotavirus and hepatitis A). For example, one study found that a surrogate human coronavirus survived only 2 days in dechlorinated tap water and in hospital wastewater at 20°C.⁸ Other studies concur, noting that the human coronaviruses transmissible gastroenteritis coronavirus and mouse hepatitis virus demonstrated a 99.9% die-off in from 2 days⁹ at 23°C to 2 weeks¹⁰ at 25°C. Heat, high or low pH, sunlight, and common disinfectants (such as chlorine) all facilitate die off.

It is not certain how long the virus that causes COVID-19 survives on surfaces, but it seems likely to behave like other coronaviruses. A recent review of the survival of human

coronaviruses on surfaces found large variability, ranging from 2 hours to 9 days.¹¹ The survival time depends on a number of factors, including the type of surface, temperature, relative humidity, and specific strain of the virus. The same review also found that effective inactivation could be achieved within 1 minute using common disinfectants, such as 70% ethanol or sodium hypochlorite (for details, see Cleaning practices).

3. Keeping water supplies safe

The COVID-19 virus has not been detected in drinking-water supplies, and based on current evidence, the risk to water supplies is low.¹² Laboratory studies of surrogate coronaviruses that took place in well-controlled environments indicated that the virus could remain infectious in water contaminated with faeces for days to weeks.¹⁰ A number of measures can be taken to improve water safety, starting with protecting the source water, treating water at the point of distribution, collection, or consumption; and ensuring that treated water is safely stored at home in regularly cleaned and covered containers.

Conventional, centralized water treatment methods that use filtration and disinfection should inactivate the COVID-19 virus. Other human coronaviruses have been shown to be sensitive to chlorination and disinfection with ultraviolet (UV) light.¹³ As enveloped viruses are surrounded by a lipid host cell membrane, which is not robust, the COVID-19 virus is likely to be more sensitive to chlorine and other oxidant disinfection processes than many other viruses, such as coxsackieviruses, which have a protein coat. For effective centralized disinfection, there should be a residual concentration of free chlorine of ≥ 0.5 mg/L after at least 30 minutes of contact time at pH < 8.0 .¹² A chlorine residual should be maintained throughout the distribution system.

In places where centralized water treatment and safe piped water supplies are not available, a number of household water treatment technologies are effective in removing or destroying viruses, including boiling or using high-performing ultrafiltration or nanomembrane filters, solar irradiation and, in non-turbid waters, UV irradiation and appropriately dosed free chlorine.

4. Safely managing wastewater and faecal waste

There is no evidence that the COVID-19 virus has been transmitted via sewerage systems with or without wastewater treatment. Further, there is no evidence that sewage or wastewater treatment workers contracted the severe acute respiratory syndrome (SARS), which is caused by another type of coronavirus that caused a large outbreak of acute respiratory illness in 2003. As part of an integrated public health policy, wastewater carried in sewerage systems should be treated in well-designed and well-managed centralized wastewater treatment works. Each stage of treatment (as well as retention time and dilution) results in a further reduction of the potential risk. A waste stabilization pond (an oxidation pond or lagoon) is generally considered a practical and simple wastewater treatment technology particularly well suited to destroying pathogens, as relatively long retention times (20 days or longer) combined with sunlight, elevated pH levels, biological activity, and other factors serve to accelerate pathogen destruction. A final disinfection step may be considered if existing wastewater treatment plants are not optimized to remove viruses. Best practices for protecting the health of workers at sanitation treatment facilities should

be followed. Workers should wear appropriate personal protective equipment (PPE), which includes protective outerwear, gloves, boots, goggles or a face shield, and a mask; they should perform hand hygiene frequently; and they should avoid touching eyes, nose, and mouth with unwashed hands.

WASH in health care settings

Existing recommendations for water, sanitation and hygiene measures in health care settings are important for providing adequate care for patients and protecting patients, staff, and caregivers from infection risks.¹⁴ The following actions are particularly important: (i) managing excreta (faeces and urine) safely, including ensuring that no one comes into contact with it and that it is treated and disposed of correctly; (ii) engaging in frequent hand hygiene using appropriate techniques; (iii) implementing regular cleaning and disinfection practices; and (iv) safely managing health care waste. Other important measures include providing sufficient safe drinking-water to staff, caregivers, and patients; ensuring that personal hygiene can be maintained, including hand hygiene, for patients, staff and caregivers; regularly laundering bedsheets and patients' clothing; providing adequate and accessible toilets (including separate facilities for confirmed and suspected cases of COVID-19 infection); and segregating and safely disposing of health care waste. For details on these recommendations, please refer to Essential environmental health standards in health care.¹⁴

1. Hand hygiene practices

Hand hygiene is extremely important. Cleaning hands with soap and water or an alcohol-based hand rub should be performed according to the instructions known as "My 5 moments for hand hygiene".¹⁵ If hands are not visibly dirty, the preferred method is to perform hand hygiene with an alcohol-based hand rub for 20–30 seconds using the appropriate technique.¹⁶ When hands are visibly dirty, they should be washed with soap and water for 40–60 seconds using the appropriate technique.¹⁷ Hand hygiene should be performed at all five moments, including before putting on PPE and after removing it, when changing gloves, after any contact with a patient with suspected or confirmed COVID-19 infection or their waste, after contact with any respiratory secretions, before eating, and after using the toilet.¹⁸ If an alcohol-based hand rub and soap are not available, then using chlorinated water (0.05%) for handwashing is an option, but it is not ideal because frequent use may lead to dermatitis, which could increase the risk of infection and asthma and because prepared dilutions might be inaccurate.¹⁹ However, if other options are not available or feasible, using chlorinated water for handwashing is an option.

Functional hand hygiene facilities should be present for all health care workers at all points of care and in areas where PPE is put on or taken off. In addition, functional hand hygiene facilities should be available for all patients, family members, and visitors, and should be available within 5 m of toilets, as well as in waiting and dining rooms and other public areas.

2. Sanitation and plumbing

People with suspected or confirmed COVID-19 disease should be provided with their own flush toilet or latrine that has a door that closes to separate it from the patient's room. Flush toilets should operate properly and have functioning drain traps. When possible, the toilet should be flushed with the lid down to prevent droplet splatter and aerosol clouds. If it is not possible to provide separate toilets, the toilet should be cleaned and disinfected at least twice daily by a trained cleaner wearing PPE (gown, gloves, boots, mask, and a face shield or goggles). Further, and consistent with existing guidance, staff and health care workers should have toilet facilities that are separate from those used by all patients.

WHO recommends the use of standard, well-maintained plumbing, such as sealed bathroom drains, and backflow valves on sprayers and faucets to prevent aerosolized faecal matter from entering the plumbing or ventilation system,²⁰ together with standard wastewater treatment.²¹ Faulty plumbing and a poorly designed air ventilation system were implicated as contributing factors to the spread of the aerosolized SARS coronavirus in a high-rise apartment building in Hong Kong in 2003.²² Similar concerns have been raised about the spread of the COVID-19 virus from faulty toilets in high-rise apartment buildings.²³ If health care facilities are connected to sewers, a risk assessment should be conducted to confirm that wastewater is contained within the system (that is, the system does not leak) before its arrival at a functioning treatment or disposal site, or both. Risks pertaining to the adequacy of the collection system or to treatment and disposal methods should be assessed following a safety planning approach,²⁴ with critical control points prioritized for mitigation.

For smaller health care facilities in low-resource settings, if space and local conditions allow, pit latrines may be the preferred option. Standard precautions should be taken to prevent contamination of the environment by excreta. These precautions include ensuring that at least 1.5 m exists between the bottom of the pit and the groundwater table (more space should be allowed in coarse sands, gravels, and fissured formations) and that the latrines are located at least 30 m horizontally from any groundwater source (including both shallow wells and boreholes).²⁵ If there is a high groundwater table or a lack of space to dig pits, excreta should be retained in impermeable storage containers and left for as long as feasible to allow for a reduction in virus levels before moving it off-site for additional treatment or safe disposal, or both. A two-tank system with parallel tanks would help facilitate inactivation by maximizing retention times, as one tank could be used until full, then allowed to sit while the next tank is being filled. Particular care should be taken to avoid splashing and the release of droplets while cleaning or emptying tanks.

3. Toilets and the handling of faeces

It is critical to conduct hand hygiene when there is suspected or direct contact with faeces (if hands are dirty, then soap and water are preferred to the use of an alcohol-based hand rub). If the patient is unable to use a latrine, excreta should be collected in either a diaper or a clean bedpan and immediately and carefully disposed of into a separate toilet or latrine used only by suspected or confirmed cases of COVID-19. In all health care settings, including those with suspected or confirmed COVID-19 cases, faeces must be treated as a biohazard and handled as little as possible. Anyone handling

faeces should follow WHO contact and droplet precautions¹⁸ and use PPE to prevent exposure, including long-sleeved gowns, gloves, boots, masks, and goggles or a face shield. If diapers are used, they should be disposed of as infectious waste as they would be in all situations. Workers should be properly trained in how to put on, use, and remove PPE so that these protective barriers are not breached.²⁵ If PPE is not available or the supply is limited, hand hygiene should be regularly practiced, and workers should keep at least 1 m distance from any suspected or confirmed cases.

If a bedpan is used, after disposing of excreta from it, the bedpan should be cleaned with a neutral detergent and water, disinfected with a 0.5% chlorine solution, and then rinsed with clean water; the rinse water should be disposed of in a drain or a toilet or latrine. Other effective disinfectants include commercially available quaternary ammonium compounds, such as cetylpyridinium chloride, used according to manufacturer's instructions, and peracetic or peroxyacetic acid at concentrations of 500–2000 mg/L.²⁶

Chlorine is ineffective for disinfecting media containing large amounts of solid and dissolved organic matter. Therefore, there is limited benefit to adding chlorine solution to fresh excreta and it is possible that this may introduce risks associated with splashing.

4. Emptying latrines and holding tanks, and transporting excreta off-site.

There is no reason to empty latrines and holding tanks of excreta from suspected or confirmed COVID-19 cases unless they are at capacity. In general, the best practices for safely managing excreta should be followed. Latrines or holding tanks should be designed to meet patient demand, considering potential sudden increases in cases, and there should be a regular schedule for emptying them based on the wastewater volumes generated. PPE (long-sleeved gown, gloves, boots, masks, and goggles or a face shield) should be worn at all times when handling or transporting excreta off-site, and great care should be taken to avoid splashing. For crews, this includes pumping out tanks or unloading pumper trucks. After handling the waste and once there is no risk of further exposure, individuals should safely remove their PPE and perform hand hygiene before entering the transport vehicle. Soiled PPE should be put in a sealed bag for later safe laundering (see Cleaning practices). Where there is no off-site treatment, in-situ treatment can be done using lime. Such treatment involves using a 10% lime slurry added at 1-part lime slurry per 10 parts of waste.

5. Cleaning practices

Recommended cleaning and disinfection procedures for health care facilities should be followed consistently and correctly.¹⁹ Laundry should be done and surfaces in all environments in which COVID-19 patients receive care (treatment units, community care centres) should be cleaned at least once a day and when a patient is discharged.²⁷ Many disinfectants are active against enveloped viruses, such as the COVID-19 virus, including commonly used hospital disinfectants. Currently, WHO recommends using:

- 70% ethyl alcohol to disinfect small areas between uses, such as reusable dedicated equipment (for example, thermometers);
- sodium hypochlorite at 0.5% (equivalent to 5000 ppm) for disinfecting surfaces.

All individuals dealing with soiled bedding, towels, and clothes from patients with COVID-19 infection should wear appropriate PPE before touching soiled items, including heavy duty gloves, a mask, eye protection (goggles or a face shield), a long-sleeved gown, an apron if the gown is not fluid resistant, and boots or closed shoes. They should perform hand hygiene after exposure to blood or body fluids and after removing PPE. Soiled linen should be placed in clearly labelled, leak-proof bags or containers, after carefully removing any solid excrement and putting it in a covered bucket to be disposed of in a toilet or latrine. Machine washing with warm water at 60–90°C (140–194°F) with laundry detergent is recommended. The laundry can then be dried according to routine procedures. If machine washing is not possible, linens can be soaked in hot water and soap in a large drum using a stick to stir and being careful to avoid splashing. The drum should then be emptied, and the linens soaked in 0.05% chlorine for approximately 30 minutes. Finally, the laundry should be rinsed with clean water and the linens allowed to dry fully in sunlight.

If excreta are on surfaces (such as linens or the floor), the excreta should be carefully removed with towels and immediately safely disposed of in a toilet or latrine. If the towels are single use, they should be treated as infectious waste; if they are reusable, they should be treated as soiled linens. The area should then be cleaned and disinfected (with, for example, 0.5% free chlorine solution), following published guidance on cleaning and disinfection procedures for spilled body fluids.²⁷

6. Safely disposing of greywater or water from washing PPE, surfaces and floors.

Current WHO recommendations are to clean utility gloves or heavy duty, reusable plastic aprons with soap and water and then decontaminate them with 0.5% sodium hypochlorite solution after each use. Single-use gloves (nitrile or latex) and gowns should be discarded after each use and not reused; hand hygiene should be performed after PPE is removed. If greywater includes disinfectant used in prior cleaning, it does not need to be chlorinated or treated again. However, it is important that such water is disposed of in drains connected to a septic system or sewer or in a soakaway pit. If greywater is disposed of in a soakaway pit, the pit should be fenced off within the health facility grounds to prevent tampering and to avoid possible exposure in the case of overflow.

7. Safe management of health care waste

Best practices for safely managing health care waste should be followed, including assigning responsibility and sufficient human and material resources to dispose of such waste safely. There is no evidence that direct, unprotected human contact during the handling of health care waste has resulted in the transmission of the COVID-19 virus. All health care waste produced during the care of COVID 19 patients should be collected safely in designated containers and bags, treated, and then safely disposed of or treated, or both, preferably on-site. If waste is moved off-site, it is critical to understand where and how it will be treated and destroyed. All who handle health care waste should wear appropriate PPE (boots, apron, long-sleeved gown, thick gloves, mask, and goggles or a face shield) and perform hand hygiene after removing it. For more information refer to the WHO guidance, Safe management of wastes from health-care activities.²⁸

Considerations for WASH practices in homes and communities.

Upholding best WASH practices in the home and community is also important for preventing the spread of COVID-19 and when caring for patients at home. Regular and correct hand hygiene is of particular importance.

1. Hand hygiene

Hand hygiene in non-health care settings is one of the most important measures that can prevent COVID 19 infection. In homes, schools and crowded public spaces – such as markets, places of worship, and train or bus stations – regular handwashing should occur before preparing food, before and after eating, after using the toilet or changing a child's diaper, and after touching animals. Functioning handwashing facilities with water and soap should be available within 5 m of toilets.

2. Treatment and handling requirements for excreta.

Best WASH practices, particularly handwashing with soap and clean water, should be strictly applied and maintained because these provide an important additional barrier to COVID-19 transmission and to the transmission of infectious diseases in general.¹⁷ Consideration should be given to safely managing human excreta throughout the entire sanitation chain, starting with ensuring access to regularly cleaned, accessible, and functioning toilets or latrines and to the safe containment, conveyance, treatment, and eventual disposal of sewage.

When there are suspected or confirmed cases of COVID-19 in the home setting, immediate action must be taken to protect caregivers and other family members from the risk of contact with respiratory secretions and excreta that may contain the COVID-19 virus. Frequently touched surfaces throughout the patient's care area should be cleaned regularly, such as beside tables, bed frames and other bedroom furniture. Bathrooms should be cleaned and disinfected at least once a day. Regular household soap or detergent should be used for cleaning first and then, after rinsing, regular household disinfectant containing 0.5% sodium hypochlorite (that is, equivalent to 5000 ppm or 1-part household bleach with 5% sodium hypochlorite to 9 parts water) should be applied. PPE should be worn while cleaning, including mask, goggles, a fluid-resistant apron, and gloves,²⁹ and hand hygiene with an alcohol-based hand rub or soap and water should be performed after removing PPE.

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WHO continues to monitor the situation closely for any changes that may affect this interim guidance. Should any factors change, WHO will issue a further update. Otherwise, this interim guidance document will expire 2 years after the date of publication.

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This interim guidance was written by staff from WHO and UNICEF. In addition, a number of experts and WASH practitioners contributed. They include Matt Arduino,

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