Environmental Assessment and Environmental Management Framework for the state of Bihar

Draft Final Report

Submitted to

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Table of Contents

Abbreviations

AE	Assistant Engineer
BWSC	Block Water Supply and Sanitation Committee
CCDDU	Community and Capacity Development Unit
DWSM	District Water and Sanitation Mission
DWSC	District Water and Sanitation Committee
EDS	Environmental Data Sheet
ECOPS	Environmental Codes of Practices
EIA	Environmental Impact Assessment
EE	Executive Engineer
EMF	Environmental Management Framework
GP	Gram Panchayat
GPWSC	Gram Panchayat Water Supply and Sanitation Committee
IEC	Information, Education and Communication
ISL	Individual Sanitary Latrine
IHL	Individual Household Latrine
JE	Junior Engineer
MVS	Multi Village Scheme
NSS	Not Safe Sources
O&M	Operation and Maintenance
PRI	Panchayat Raj Institution
RWSS	Rural Water Supply and Sanitation
RWSM	Rural Water and Sanitation Mission
SO	Support Organizations
SVS	Single Village Scheme
TOR	Terms of Reference
TSC	Total Sanitation Campaign
TPPF	Twin Pit Pour Flush
VWSC	Village Water Supply and Sanitation Committee

Executive summary of the Environmental Management Framework (EMF)

In order to ensure that the environmental issues are systematically identified and addressed in the various stages of the implementation of the schemes, an Environment Management Framework (EMF) has been developed for the proposed BSWSM schemes. The specific objectives of the EMF are:

- To design a set of procedures, designate the roles and responsibilities of various Stakeholders, and develop institutional structure in the implementation of sub-projects along with the capacity building and staffing requirements for mainstreaming environmental management in project planning, implementation and O&M processes.
- To identify appropriate mitigation measures for addressing the identified environmental impacts at various stages of the projects.

In order to facilitate the effective implementation of the EMF, the Schemes will be classified either as Class I (limited environmental impact) or Class II (significant environmental impact) scheme. A screening tool for the categorization of schemes will be used to decide whether a scheme is a category I or category II scheme. The environmental classification of schemes by using the screening tool will be undertaken by the EE of PHED. The classification of the schemes is an essential component of the EMF and it requires the data on source of water supply, water quality, proposed water treatment, sanitation facilities, sullage disposal, solid and liquid waste disposal etc.. For recording all these details, Environmental Data Sheets (EDS) for schemes on water supply, sanitation, solid and liquid waste management etc., have been formulated. The EDS will be filled at the field data collection stage of the proposed Water Supply and Sanitation Schemes. The available environmental information recorded in the EDS will be evaluated and examined. Based on the level of expected environmental and public health impacts for the schemes, the proposed scheme(s) would be classified as category I or category II scheme.

Environmental Appraisal and Approval

For the category I schemes, there will be no separate environment appraisal other than the EDS. For category II schemes, detailed environmental appraisals of the proposed schemes will be required. This will be done by the DPSU/DPMU with the support of Environmental Experts at the state level, if necessary. The environmental appraisal for category II schemes should be done within a month.

Based on the category under which a scheme is classified, suitable environmental assessment and mitigation measures should be applied based on the Environmental Management Plan (EMP). The procedures will be different for different category of schemes. For low impact category (Category I), a set of simple mitigation measures have to be incorporated in the project plan based on the Environmental Codes of practices and technical guidelines. The Detailed Project Report (DPR) for Category I schemes should be accompanied by the Environmental Data Sheet (EDS). The EE will ensure this. For category II schemes, detailed environmental appraisals of the proposed schemes will be required. In this case, an appropriate ToR and consultant profile for hiring such an expert should be prescribed. The Detailed Project Report (DPR) for Category II schemes should be

accompanied by the Environmental Data Sheet (EDS) as well as the detailed environmental appraisals. The EE of PHED will ensure this. Environmental appraisal study for any category of schemes as specified by BSWSM shall be conducted and reported to the SPMU of BSWSM before awarding of the contract.

Environmental supervision, monitoring and evaluation plan

The implementation of water supply and sanitation schemes is likely to result in varying level of environmental impacts that would require supervision and monitoring to ensure that mitigation measures (including construction stage) have actually been adopted by the BSWSM as per the responsibility matrix. This exercise can also act as a means whereby any impacts which were subject to uncertainty at the time of preparation of the EA, or which were unforeseen, can be identified. This also provides a basis for formulating appropriate additional impact control measures. Regular supervision and monitoring (internal and external audits) are to be conducted, as a part of the overall project monitoring program.

The prescribed environmental mitigation as identified through the environmental appraisal process are to be adequately implemented. The Implementation Completion Report of each scheme will include an Environmental Compliance Certificate given by the VWSC/GPWSC for SVS and BWSC for MVS indicating that the mitigation measures identified in the appraisal are implemented. A sample of the completed schemes will be visited at six monthly/bi-monthly1 intervals by a team from the BSWSM to check if all safeguard requirements are met and to identify any issues that need to be addressed. The selected sample will have representation of both Category I and Category II schemes. An EMO (Environmental Management Officer) at the SPMU will be appointed for the overall supervision of the environmental issues at the state level. The EMO will supervise the field plans and will receive reports from the District Environmental Officer (DEO) and the DPMU. At the block level, Block Water and Sanitation Committee (BWSC) will be formed for the management of Drinking water and sanitation related schemes at the block level. A Block Environmental Officer (BEO) will be appointed for the supervision and evaluation of implemented schemes. The BEO will report to the DEO at DPMU. Gram Panchayat Water and Sanitation Committee (GPWSC) and Village Water Supply and Sanitation Committee (VWSC) will be formed for the management of Drinking water and sanitation related schemes at the village and panchayat levels, respectively. The Director of BSWSM will supervise the overall EMF implementation, and coordinate with SPMU and DPMU. There would also be periodic monitoring and supervision by the World Bank, to ensure compliance with the respective safeguard policies.

Institutional arrangements for environmental management

The personnel and agencies with the responsibility for environmental management will be located as follows in the project institutional structure: The Director, SPMU will hold co-charge for environment aspects and will be assisted by the EMO in the SPMU. Jointly they will be overall responsible for implementation of the EMF. In particular their responsibilities will include but not be limited to (a) the monitoring, supervision and audits linked to EMF compliance, (b) the selection of experts for undertaking the EIAs of high impact schemes and (c) the provision of overall guidance and technical support to the DPMU engineers.

[1] Six monthly for SVS and Bi-monthly for MVS

Each of the DPMUs will be staffed with DEO who will be overall responsible for EMF implementation at the district level. The DEO will conduct technical reviews and approvals of scheme-specific environmental appraisal reports as well as the monitoring and supervision linked to EMF implementation at the district level.

The engineers appointed to each block will be responsible at the GP Level. They will assist the support organizations (SO) and beneficiary communities to prepare the environmental appraisal documentation as part of the engineering designs; and a panel of technical experts at the state and district level will be constituted to provide technical support to the SPMU and the DPMUs.

Training and capacity building

The objective of training and capacity building initiatives is to build and strengthen the capability of rural water and sanitation service delivery institutions (Communication and Capacity Development Unit-CCDU and PRANJAL) and other partners (NGOs, Contractors, Engineers, Consultants in the Water and Sanitation sector and other field level stake holders) to ensure tangible skill enhancement of the stakeholders and to integrate sound environmental management into water and sanitation service delivery. Systematic capacity building initiatives will be introduced after the completion of training needs assessment for the government officials and other stakeholders. The training will be in a cascade mode. All the trained staff will in turn conduct further trainings at State, District, Block, Gram Panchayat and village levels for improved service delivery.

In Bihar, it is required to empower Village Water and Sanitation Committee (VWSC) and to measure the impact of training and progress of sanitation in the state. The training programme could be based on the felt need, relevance and principle of sustainability as well as the recommendations from the training need assessment workshops. Workshops need to be organized periodically for training needs assessment of various stake holders with the following objectives:

- Identifying gaps in the existing set of knowledge, skills and capabilities of the Public Health Engineers, Sanitation Coordinators, VWSC, GPWSC, BWSC etc.
- Identifying issues and means to upgrade the existing set of knowledge and skills in order to upgrade the efficiency of the various stake holders

An enabling condition should be created for stakeholders to understand and implement programmes on rural drinking water and sanitation (as per NRDWP guidelines). Special emphasis needs to be given to participatory techniques, community facilitation and communication skills and gender based approaches.

1. Introduction

1.1 Background

As part of the National Rural Drinking Water Programme (NRDWP), the state departments responsible for drinking water supply and sanitation have prepared long term strategic plans (2011-2022) for ensuring drinking water security to all rural households. This strategy supports the creation of an environment for the Panchayati Raj Institutions and local communities to manage rural drinking water sources and systems highlighting source sustainability measures, water quality safety, monitoring and surveillance, service agreements with operators, synergy among different development programs, and professional capacity building.

Bihar being one of the four lagging states in terms of piped water supply coverage faces constraints in institutional and technical capacity at the state, district, block and GP (Gram Panchayat) levels for implementing sustainable rural water supply projects. This World Bank supported project is expected to bring about positive health and environmental benefits through supply of 'safe' drinking water and creation of sanitary conditions in the villages. The key elements of the RWSS program include the use of community or local government managed models for intra-GP RWSS schemes and State-PRI partnership models for multi-GP schemes, water resources security, recovery of the RWSS sector and establishment of metered household connections with 24/7 water supply where feasible. Other components of the program are the promotion of professionalized service provision management models, and/or back-up support functions for the different market segments. The project would be having components related to improved water quality monitoring, health and hygiene education as well as groundwater recharge for water supply source protection and environmental mitigation measures which includes solid and liquid waste management.

To contribute to the environmental sustainability of the project, an Environmental Assessment (EA) study, as required by the World Bank's safeguards policies, has been planned. The study has collected and analysed information regarding the environmental issues related to the project from the concerned state in the Phase-I and finally prepared an Environmental Management Framework (EMF).

1.2 World Bank Assisted Rural Water Supply and Sanitation Project

In India, rural water supply and sanitation are the constitutional responsibilities of state governments. However, in the last two decades these services have become a national priority. Currently, annual investment by the Government of India (GoI) in rural drinking water supply exceeds USD one billion. Together, the Government of India and state governments have spent about USD 25 billion in the last 20 years, providing rural drinking water services to 700 million people in 1.5 million villages. This has been channeled through the Accelerated Rural Water Supply Programme (ARWSP) launched in 1972 and renamed the National Rural Drinking Water Programme (NRDWP) in 2009.

Historically, Government of India's approach to drinking water supply has focused on financing investment for asset creation to enhance access to drinking water services. Although this has led to over 95% access in rural areas, concern has been raised over the sustainability of this approach. As a result, since the 1990s, GoI has been identifying and

testing reform options, such as the Sector Reform Project and the Swajaldhara Program, to attempt to ensure 100 percent access to safe and sustainable drinking water.

Government of India along with seven states, have partnered with the World Bank in implementing rural water supply and sanitation (RWSS) projects. Till now World Bank has assisted 9 projects on RWSS (listed in Table.1). While implementation of these projects, the principles for the World Bank Support to Sector-wide Approaches (SWAps) was as follows:

1.2.1 Institutional

- Decentralized service-delivery approach providing a central institutional role to village-level rural local governments (GPs), in partnership with user groups, in RWSS service provision, including scheme implementation (planning, design, procurement, and construction) and O&M of SVSs. Investment funds are to be provided to and managed by GPs/user groups.
- Transfer of RWSS functions, particularly SVSs, and all sanitation functions, to GPs, with associated support interventions to build capacity of PRIs and user groups.
- Demand-responsive approach adopting self-selection of villages based on demand expressed by GPs/user groups, using transparent eligibility and prioritization criteria, and providing technology choices.

1.2.2 Sanitation and Hygiene Promotion

- Integrated approach to water supply, environmental sanitation works, and changing hygiene behaviour, including common support mechanism. There is an emphasis on sanitation promotion and hygiene education.

1.2.3 Financing

- 100 % recurrent O&M costs of RWSS services (to cover all operating costs, preventive maintenance and minor repairs) to be recovered through user charges (except for multi-village schemes and water quality-affected habitations, where a partial subsidy may be necessary).
- Capital-cost sharing by users, in proportion to service levels demanded. Partial subsidy for basic water supply service (40 lpcd), and 100% user-financing of incremental service levels over basic service level. Provide flexibility in capital-cost sharing to socially disadvantaged populations for providing basic service levels. Declining and targeted subsidies to households for sanitation.

1.2.4 Water Source Protection, Development and Management

- Developing and adopting satisfactory water policies (and associated actions) relevant to the sustainability of water sources used for drinking water schemes.

Table 1.1 Summary of Key Features of World Bank-Assisted Rural Water Supply and Sanitation Projects [4]

Project	Objective	Technology	Output	Cost (US$ million)
Maharashtra 1 1991-1998	Raise the standard of living via better health and productivity from access to WS & ES.	Hand pumps: population <1000. Piped system: population >2000. VIP latrines	1.7 million people in 1060 villages	WS:86.0 ES: 9.0 HSP: 5.0 IS: 5.0
Karnataka 1 1993-2000	Raise the standard of living via better health and productivity from access to WS & ES.	Combination of HPs and stand posts. Provided individual connections, power line extensions for electric pumps, and devices to control power and voltage changes. VIP latrines and sullage drains	4.5 million people in 1200 villages	WS:$71m ES: $29m HSP: $1m IS: $17m
Uttar Pradesh 1996-2002	Sustainable health and hygiene via time savings and extra income from improved WS & ES.	400 to 2000 people/scheme. Mix of technologies employing surface and groundwater, gravity and pumped schemes. VIP and pour flush latrines, sullage drains.	1.2 million people in 1000 villages	IS: $8m WS&ES: $60m SD: $2.5m
Kerala 1 2000-2008	Improve WS & ES through cost recovery and building the state's capacity to scale up decentralized service delivery.	Mostly piped systems for settlements serving about 250 people based on groundwater. 70% household connections. New and upgraded latrines. Drainage for rainwater and sullage.	1.1 million people in 3,700 villages 100% household with water connections	IS: $11m WS&ES:$75m SD: $4m
Karnataka 2 2002-2013	Increase access to improved & sustainable WS & ES. Institutionalize decentralized WS services.	Springs, HPs and open wells used for villages with <500 people. Piped systems based on level of service affordable to community. Drainage and lane improvement. Twin pit, pour-flush latrines.	5 million people in 2100 villages, 47% household with water connections	WS&ES:$166 m IS: $21m SD: $6m

Project	Objective	Technology	Output	Cost (US$ million)
Maharashtra 2 2003-2009	Increase access to improved/ sustainable WS institutionalize decentralized WS service delivery in districts and communities.	HPs and piped systems with stand posts and house connections. Attention to source sustainability and ground water recharge. Latrines, solid waste, and drainage.	6.7 million people in 2300 villages- 61% project GPs (ODF) -3000 GPs	WS&ES:$187 m IS:$55m SD:$5m Pilot:$5m
Uttarakhand 2006-2014 .	Improve effectiveness of RWSS services through decentralization and increased role of PRIs and involvement of local communities	Piped water systems with spring/stream sources in hilly areas and surface water sources in the plain areas, and distribution with stand posts and private connections. Household toilets, solid and liquid waste management. Integrated approach for source sustainability, water supply, and sanitation.	1.2 million people expected in 3750 villages	WS&ES:$103.4m IS: $11.6m SD: $5m
Punjab 2007-2013	Increase access of rural communities to improved and sustainable rural water supply and sanitation services.	New/upgraded piped systems with tube well and canal sources providing at least 40 lpcd. Sullage drains where septic tank overflows are a problem.	Bank component 1.5 million people expected in 1,200 villages	IS: $32m CD: $24m WS&ES:$20m
Andhra Pradesh 2009-2014	Improve rural water supply and sanitation services through progressive decentralization, community participation and enhanced accountability	Piped systems, using mostly groundwater for SVS and surface water for MVS with source protection sustainability measures. Household toilets, solid and liquid waste management.	1.2 million people expected in 1000 villages	SD:$12m WS&ES:$154 m IS:$14m

* WS-Water Supply; ES-Environmental Sanitation; HSP-Household (Health/Hygiene) Sanitation Program; IS-Implementation Support;

SD-Sector Development; CD- Capacity Development; HP – hand pumps; ODF- Open Defecation Free

Thus, its main contributions to the sector during the last two decades cover a wide array of project activities across the following sectoral themes:

- Implementing new institutional models at scale;
- Demonstrating inclusive community-based, participatory, demand-responsive approaches;
- Building the capacity of state RWSS departments, sector institutions, local governments, NGOs and the local private sector, and communities;
- Integrating governance and accountability aspects into project designs;
- Improving sustainability—financial sustainability of programs, water source sustainability, service delivery sustainability—and ongoing community satisfaction;
- Designing and implementing consistent sector-wide approaches at the state and district level to scale up reforms; and

Enabling the achievement of 'open defecation free' villages through effective sanitation programs, advancing the household sanitation agenda and starting to tackle next generation sanitation challenges of community-centric solid and liquid waste management.

1.2.5 Proposed Development Objective(s)[2]

The development objective of the Rural Water Supply and Sanitation Project for Low Income States is to increase access to improved piped water and sanitation services for selected rural communities in the target states through decentralized delivery systems.

The key PDO level results indicators for the proposed project are the following:

1. Number of rural households having access to piped water services;
2. Improvements in O&M cost recovery and collection efficiency;
   - Number of GPs with drains and lane improvements; and
   - Number of rural households adopting improved hygiene and sanitation practices.

1.3 Scope of the Project

The specific tasks of the study will be to:

1. Conduct an analysis of the environmental status and issues in the program area for the state.
2. Identify the potential environmental impacts of the range of activities to be undertaken through the state projects, review the effectiveness of environmental management through the program systems.
3. Assess the country and state policy, legal and regulatory requirements relevant to the WSS program, the performance of the program in this context, and identify provisions to ensure compliance.

[2] As per information provided in the World Bank's, 'Project Information Document (PID): Concept Stage', Report No.: PIDC634 (2012)

4. Review of the existing capacity and institutional arrangements for environmental management in the program.
5. Develop an Environmental Management Framework for the state.

Task 1: Analysis of Environmental Status and Issues

It is necessary to conduct a review of the proposed project in the Bihar, one of the lagging states to understand the natural resource conditions (including natural habitats and physical cultural resources) as well as the vulnerability to the likely environmental impacts of activities to be supported under proposed project. To this end the Consultant will do the following:

a. Collect and compile district/block level data on water resources and water quality for assessing the availability of safe drinking water from surface/groundwater sources. In addition to presenting the present status, the consultant shall undertake a trend analysis such as depleting sources, declining ground water tables, degrading water quality and drying of surface sources in various districts/blocks. District level maps need to be prepared by categorizing the water sources into district categories such as safe for drinking, safe with treatment and unsafe for drinking purpose.

b. Examine the extent and possible cause of chemical and biological contamination of drinking water sources (district level) and propose mitigation plan for the same. Wherever applicable the consultant should also identify any policy/regulatory measures that may be required to protect the water resources from further contamination. The consultant shall also recommend various cost effective treatment options for contaminations that are very common in the state. The Consultant should collect information from secondary sources to examine possible point and non-point sources of contamination. The water quality hotspots need to be clearly identified for each district.

c. Assess adequacy of current water quality monitoring programs and institutional capacity in the State, and provide recommendations for enhancing these as well as disseminating water quality information to the rural public.

d. Assess household and environmental sanitation issues, including personal hygiene, health, household environment and sanitation issues. Collected information on major diseases and their causes, and assess how these can be reduced through various project interventions. Assess need for personal health and hygiene programs;

e. Assess environmental sanitation issues pertaining to the rural areas, including need for pavement of internal village roads and properly design network of sullage and water drains.

Task 2: Review of Effectiveness of Environmental Management of Water Supply and Sanitation (WSS) Activities

It is necessary to provide a review of the anticipated individual and cumulative environmental impacts of the activities supported under the proposed National Project and the effectiveness with which these are currently being addressed in the state programs. This analysis will rely primarily on a review of relevant information on environmental management in the state programmes on WSS based on field study. The field study will focus especially on multi village or regional water supply schemes,

construction/upgrading of RWSS infrastructure in large/peri-urban villages, water treatment plants, sewage treatment plants, interventions increasing energy efficiency, etc.). The sample for the state-specific field study will be representative with respect to water availability and water quality, presence of critical natural habitats, etc. Furthermore, the review will include the extent to which program activities can adversely affect and to what degree do program systems include safeguard measures relevant to the following:

a. Important biodiversity sites

b. Important cultural resource sites

c. Natural and critical natural habitats

d. Physical cultural property

e. Community and worker safety against potential risks during construction and operations of schemes

f. Exposure to toxic chemicals and hazardous waste, including polluted industrial areas

g. Reconstruction or rehabilitation of schemes in natural hazard prone areas

h. Technically sound environmental engineering practices employed for all schemes to ensure sustainability of water quantity and quality.

The output of this component is a profile of the WSS schemes to be taken up with details on the nature and scale of the activities, remarks and field observations on environmental impact, and remarks on the effectiveness with which impacts are currently being addressed through the program systems. Activities that pose a risk of potentially significant and irreversible adverse impacts on the environment (classified Category A schemes under IL) will be clearly identified and criteria for exclusion from the program will be developed.

Task 3: Analysis of Performance of the Legal, Regulatory and Policy Framework

a. A review of the relevant policy, legal and regulatory requirements will be undertaken.

   This task will include an examination of the existing policies, laws and regulations of the Government of India and the Bihar State Government relevant to the WSS program. The review will identify the legal, regulatory and policy bases for environmental management in the WSS program; assess the performance of the program systems in this context; and state clearly the provisions that need to be included in the Environmental Management Framework to ensure that the activities supported under the National Project are in compliance with the legal and regulatory requirements of the Government and with the safeguard policy of the World Bank.

b. The output from this component is expected to be a detailed, up-to-date listing of all relevant policies as well as legal and regulatory requirements of the Government of India and the State Government and the relevant safeguard policies of the World Bank specifying the gaps and relevance to the activities undertaken under the proposed National Project for lagging states.

Task 4: Review of Existing Capacity and Institutional Arrangements on Environmental Safeguards

This will include a review of the existing capacity and institutional arrangements for environmental management and compliance in the program implementing institutions will be undertaken including an identification of a strategy and plan to strengthen the same. The analyses should cover but not be limited to:

a. Description of existing systems, identification of gaps and recommendations for strengthening the following key organizational dimensions: (i) Authority and capacity of the implementing agency to manage the environmental effects of the program, (ii) Adequacy of staffing and skills with respect to environmental management, (iii) Program coordination systems, (iv) Nature and effectiveness of the monitoring systems for environmental management and compliance. A special focus will be given to the environmental management experience and institutional capacity of the state agencies that is responsible for large water supply schemes in the state.

b. Interagency coordination arrangements for environmental management: This will include an analysis of the key partners involved in the WSS sector in the states for (i) Water Availability – (ii) Sanitation and Water Quality (iii) Waste management – (iv) Community Based organizations.

c. The output of this component is an analysis of implementation capacity and experience on environmental safeguards in WSS program in the states with lessons and recommendations for the EMF.

Task 5: Development of an Environmental Management Framework (EMF)

Based on the outputs of Tasks described above, an EAP should be prepared containing, but not limited to, the components as described below:

a. *Environmental appraisal procedures:* Detailed procedures and tools - a negative list, a screening tool and mitigation guidelines (or scheme-specific environmental codes of practice 1) need to be developed to ensure that (a) all relevant policy, legal and regulatory requirements are met (b) activities requiring further detailed environmental assessment are identified and go through the same (c) the environmental sustainability of the interventions is enhanced. This section will be informed by the outputs of Tasks 1, 2 and 3.

b. *Legal, policy and regulatory measures:* This will contain (based on the outputs of Task 3) a listing of the legal and regulatory measures to be complied with and a description of any new measures (e.g., new GOs) required ensuring the effectiveness of environmental planning and action.

c. *Institutional roles and responsibilities:* This must contain (based on the outputs of Task 4) a detailed description of roles and responsibilities within the Program Management Unit in the national and state level, and within the PRIs and community institutions for implementation of the EMF. It must give a clear picture of roles and responsibilities with respect to screening, environmental assessment, capacity building and monitoring.

d. *Capacity building:* This section must include (i) a description of training needs of program staff, PRIs and community institutions at the various levels (ii) description of the training modules and delivery process (iii) description of mentoring through

Support Organizations (iv) details of the IEC (Information, Education, Communication) strategy for raising awareness on integrating environmental sustainability in WSS planning.

e. *Monitoring:* This component needs to have details of (i) the verification requirements for environmental compliance, specifying roles and responsibilities, to ensure that the procedures defined for screening and assessment are effectively applied, (ii) the process of assessing cumulative environmental impacts, (iii) the reporting requirements on the EMF implementation including specification of the performance indicators, and, integration of the performance indicators into the program MIS.

The final output will be an Environmental Management Framework providing detailed recommendations and actions, including actions.

1.4 Need for Environmental Assessment

In order to improve the environmental health and hygiene in rural areas, it is a necessity to provide them with proper water supply and sanitation system. Past studies indicate that the existing water supply conditions in the rural areas of the states are not satisfactory, particularly in terms of quality. The existing sanitation system in rural areas is also very poor.

The proposed water supply and sanitation project is to provide good water quality and better hygenic conditions, in the rural 4 districts of Bihar. The implementation of water supply and sanitation schemes is likely to result into varying level of environmental impacts that would also require supervision and monitoring. The environmental monitoring and supervision will be undertaken based on the key environmental issues associated with such type of work. Assessment of the existing condition of the water supply and sanitation needs to be taken up in the project area to identify:

- Current water supply scenario
- Current disposal systems of the wastewater as well as Solid waste
- Personal health and hygiene.
- Prevailing disease due to lack of good water supply and sanitation facilities.

The consultancy assignment is intended to provide assistance to the implementers in performing their duties for smooth implementation of the project. An EMF is to be prepared which will be used by the Engineers as a ready reference to screen the project interventions, impact evaluation, and adopting the mitigation measures in the design stage itself. This will help not only the GP/ implementing authority but also to the engineers who are involved in the preparation of various schemes. This will help to reduce the intensity of impacts at planning stage as well as during implementation and post implementation phase.

1.5 Objectives of Environmental Assessment

The key objective of the study is to undertake and prepare a Bihar State-specific Environmental assessment/Environment Management Framework (EA/EMF) Report with a view to identify the critical environmental concerns in the RWSS sector and address them as an integral part of project design.

The specific objective includes:

1. To assess the existing status of environment in the Bihar State and to identify threats and issues which have effect on RWSS sector.
2. To identify the environmental issues associated with implementation of RWSS schemes (single village & multi village schemes) and develop environmental codes of practices that need to be followed during various stages such as planning, construction and operation and maintenance.
3. To identify generic environmental issues that are beyond the scope of RWSS schemes, but related to the sector and recommend remedial measures to address them as part of the project.
4. To identify existing good behaviour in recycling of water, use of traditional method of liquid and solid waste management.
5. To identify traditional habitation this results into lower per capita consumption of water.
6. To identify household and environmental sanitation issues as well as to make an assessment of pollution level with regard to water supply and its usages & propose appropriate sanitation technology options.
7. To prepare an Environment Management Framework including well-defined performance indicators for addressing the identified issues, through the various activities/tasks under the proposed project, and strategy for its implementation to achieve sustainable sources for water supply schemes and environmental sanitation benefits.

1.6 Approach and Methodology

1.6.1 Approach

A participatory integrated approach will be adopted for achieving the specified objectives. This approach will include collection and analysis of both primary and secondary data on environmental issues of RWSS sector, relevant policies/laws/regulations of the Government of India and the Government of Bihar, and this shall be supplemented with multi-stakeholder consultation process which will include in-depth discussions with officials in the various water sector institutions. This approach will also involve thorough review and integration of scientific knowledge from various sources. It is also envisaged to include satellite data to map the water resources including water quality for each district. Following diagram describes the approach of the study.

1.6.2 Methodology

A very important component of this study will be based on secondary published data by Government Departments (State and Central) and other sources.

An environmental baseline chapter will highlight the environmental issues of the state in general, and the important aspects of environment issues associated with RWSS sector in particular. The various schemes envisaged under the RWSS were elicited through stakeholder consultations and their environmental implications in project

districts which will be assessed on the basis of inherent characteristics of each activity, consultations with stakeholders, field surveys and open interviews.

Stakeholder consultations and field surveys will be key activities in this Environmental Assessment study to assess the environmental feasibility of the proposed sub projects and associated impacts. The stakeholders include the government officials, PHED, Rural Development, Watershed Directorate, SWSM/PMU, relevant R&D institutions/ organizations in the State, CGWB, SPCB and local village communities etc. Experts of the World Bank will also be consulted at various crucial study points. The detailed methodology for this study is as given below;

Secondary Data Collection and Literature Review

Both quantitative and qualitative secondary data are to be collected from government departments, World Bank documents, state departments (PHED, Pollution Control Board, Ground Water Board, Department of Agriculture) etc. Literature review to also be carried out to assess the current environmental conditions in the project area, and ascertain the impacts of the schemes with focus on the vulnerability to these impacts on each region. Other successful EMFs, State and National Reports on Drinking Water and Sanitation and the World Bank's Project Implementation Document (PID), will be referred to in particular to understand the & analyse the design of the EMF, its implementation and to come up with the necessary mitigation measures.

Details of the tasks under this activity include:

- Compilation of district/ block level data on water resources availability and quality
- Collection of water quality data (district and block level)
- Assessment of adequacy of current water quality monitoring setup
- Collection of information on sanitation programs/schemes
- Identification of WSS schemes under the proposed National Project.
- identification of activities that pose a threat to environment

Review of Policy and Regulatory Systems

Following a review of the environmental settings, a comprehensive assessment of the policies, guidelines (of the Government of India and Government of Bihar) and the overall regulatory status of the RWSS sector project will be carried out.

As part of this activity:

- Review of secondary information on existing State and National policies and programs as well as safeguard Policies of the World Bank will be conducted and documented in a detailed, up-to-date, tabular form including relevant description.

- Assessment of the effectiveness of policies and programs will be undertaken with focus on relevance to WSS and identification of gaps.
- Based on the assessment, provisions which should be included in the Environmental Management Framework will be identified.

Stakeholder Consultations

All the identified stakeholders will be consulted and the findings of the consultations are to be incorporated into the final EMF report. The stakeholder consultations will involve:

- Discussions with key informants (Executive Engineer, Assistant Engineer, Junior Engineers, District Coordinators),
- Public consultation meetings involving Village Mukhiya, teachers, lawyers, farmers, and women (includes Environmental Survey)
- Household survey involving 10-15% of beneficiary households in the villages visited.
- Another important criterion under the stakeholder consultation is participation and feedback-integration from workshops led by the National and State Governments. These multi-stakeholder workshops will help to solicit the stakeholder's recommendations and comments on the draft final report.
- In addition to the above mentioned tools, open informal interviews were conducted with stakeholders during the course of the study.

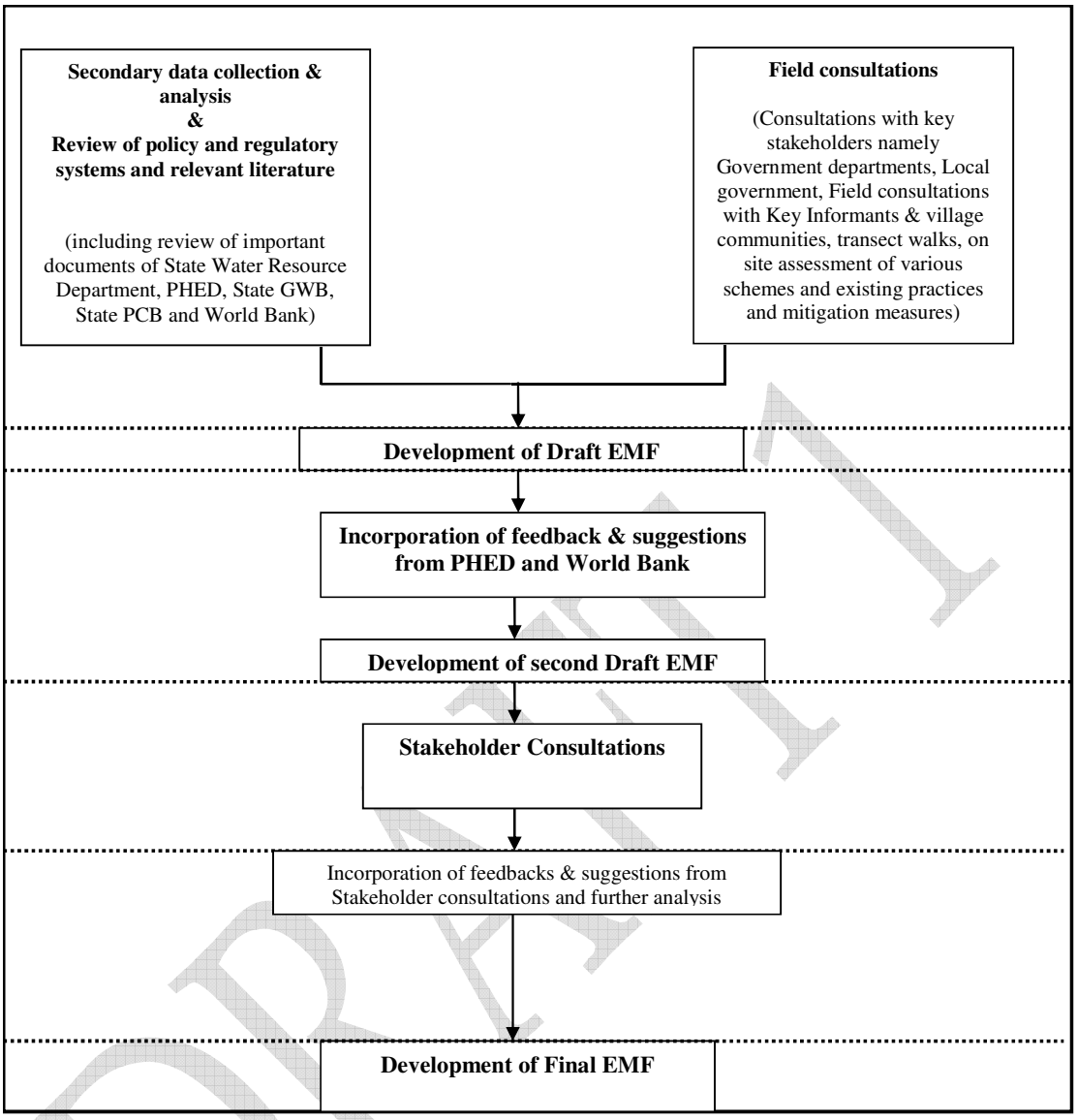


Figure 1.1 Approach for development of EMF

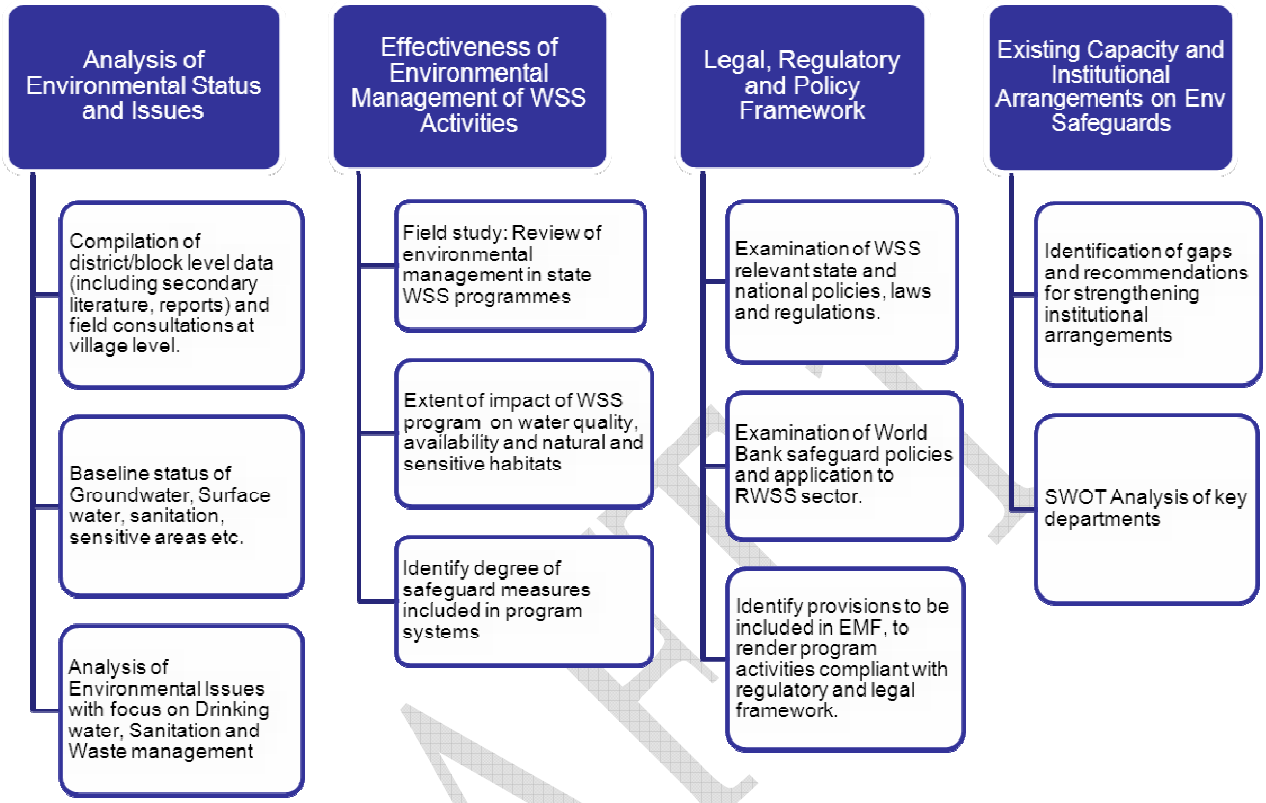


Figure 1.2 Breakup of components for EMF

1.7 Site selection

1.7.1 Criteria for selecting villages for field study

The districts in Bihar for this study have been selected based on following criteria

1. Agro-climatic zones,
2. Water quality (Arsenic, Fluoride, Iron, Chloride and Nitrate)
3. Schemes (Hand Pump, Mini water supply scheme (MWSS), Rural water supply scheme (RWSS), Multi village scheme (MVS), Small multi village scheme (SMVS), Hand pump with attachment unit. Single, multi-village & Hand pump),
4. Source (Ground water & Surface water)
5. Other (Flood & Drought affected area).

The selected villages should cover all the three agro-climatic zones of the state of Bihar, should have water quality issues, and should include aforementioned schemes.

The 10 districts selected by PHED, Bihar for this study are:

- Patna
- Nalanda,
- Nawada,
- Begusarai,
- Mujafferpur,
- West Champaran,
- Saran,
- Munger,
- Banka,
- Purnea.

Out of the 10 districts, four districts were selected by TERI (in consultation with PHED), as sample sites, based on the above mentioned criteria. These four districts are:

1. West Champaran (Agro-climatic zone 1[3])
2. Purnea (Agro-climatic zone 2)
3. Begusarai (Agro-climatic zone 2)
4. Nawada (Agro-climatic zone 3)

1.7.2 Details of Selected villages

District: Begusarai

Water quality issue: As (Arsenic), Iron (Fe), Chloride (Cl)

Other issues: Back wash from Iron & Arsenic treatment systems

Name of villages for study:

1. Sushil nagar (Panchyat: Amraur Kirathpur, Block:Begusarai):

   Scheme: Hand pump and Mini water supply scheme with Iron treatment attachment unit & solar pump

2. Siuri (Panchyat: Manjhaul-4,Block :Cheria Bariyarpur):

   Scheme: Hand pump & Singal village scheme (RWSS), not started yet (Under testing)

3. Kawakol: (Panchyat: Gurgawan,Block: Matihani):

   Scheme: Hand pump & Mini water supply scheme with Arsenic treatment attachment unit & Solar pump (under construction)

3 Department of Agriculture, Govt. Of Bihar
< http://www.krishi.bih.nic.in/pdf/zones.pdf>

4. SinghPur (Panchyat: Balahpur-1,Block: Matehani):

   Scheme: Hand pump & Mini water supply with solar pump & Iron treatment attachment unit (14 to 20 taps provided along the boundary wall of the scheme, no pipe lines laid in the village)

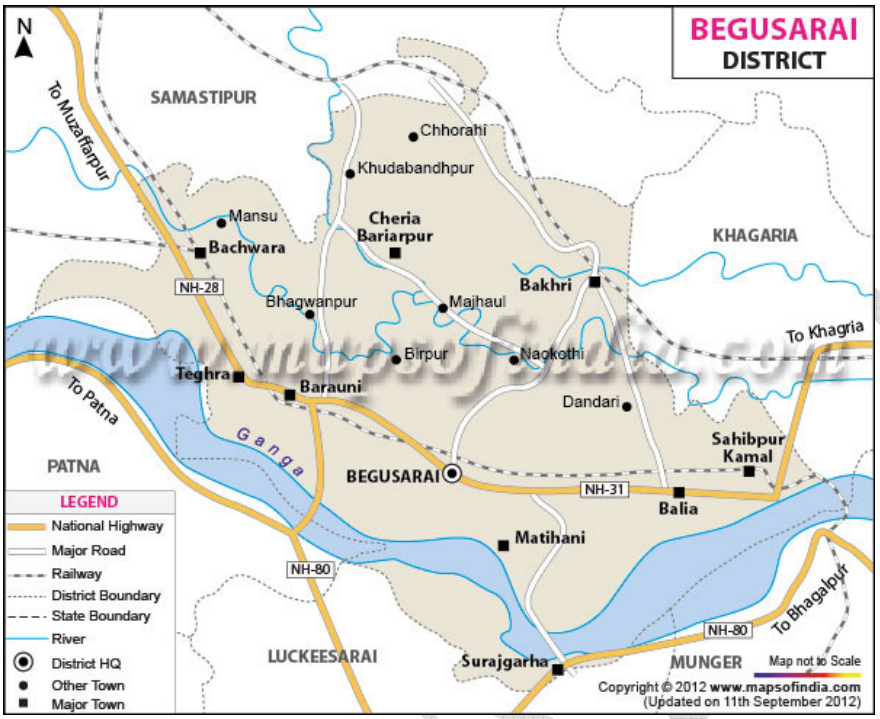


Figure 1.3 District map of Begusarai

District: Purnia

Water quality issue: Iron (Fe)

Other issues: Flood affected & backwash from Iron treatment systems

Name of villages for study:

1. Banbagh (Panchyat: Banbagh chunapur,Block: K Nagar,Dist Purnia)

   Scheme: Hand pump and Mini water supply scheme with Iron treatment attachment unit & solar pump

2. Dhamdha north (Panchyat dhamdha north,Block: Dhamdha,District Purnia)

   Scheme: Hand pump and Singal village scheme (RWSS) with Iron treatment attachment unit.

3. Barbatta (Panchyat: Amour,Block: Baisi,Diistrict:Purnia)

   Scheme: Hand pump and Mini water supply scheme with Iron treatment attachment unit & solar pump

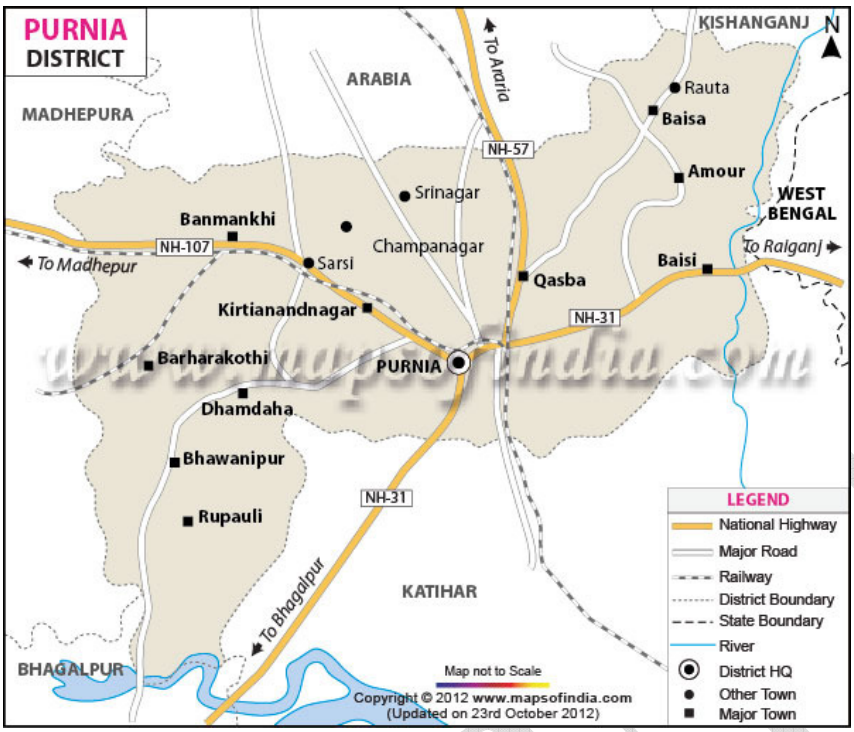


Figure 1.4 District map of Purnia

District: Nawada

Water quality issue: Fluoride

Other issues: Draught (water scares area) & back wash from Fluoride treatment systems

Name of villages for study:

1. Kachariyadih (Panchyat: Hardia, Block: Rajuli):

   Scheme: Mini water supply system with fluoride treatment system & solar pumps

2. Bhola khura: (Panchyat: Sandhmanjgaon,Block: Sirdala)

   Scheme: Hand pump & Mini water supply system with fluoride treatment system & solar pumps

3. Khadhar (Panchyat: Kharsari, Block: Kauakol):

   Scheme: Hand pump & Mini water supply system with fluoride treatment system & solar pumps

4. Pali (Panchyat:Pali,Block: Kauakol)

   Scheme: Hand Pump, Hand pump with fluoride attachment unit & Mini water supply system with fluoride treatment system & solar pumps

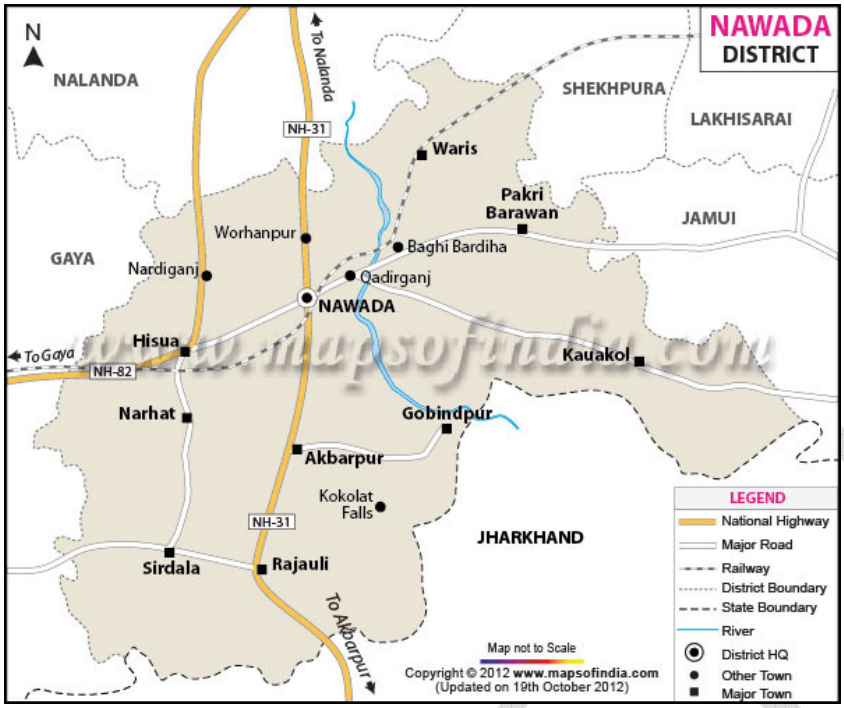


Figure 1.5 District map of Nawada

District: West Champaran (Bettiah)

Water quality issue: No, as per PHED

Other issues: Tribal & Opportunity for surface water supply system schemes

Name of villages for study:

1. Nautan (Panchyat: Nautan,Block :Nautan)

   Scheme: Hand pump & RWSS (Rural water supply scheme)

2. Ghoghaghat (Panchyat: Ghogha, Block: Chanpatia)

   Scheme: Existing scheme only hand pumps, Proposed place for multi village scheme & source of water will be Gandak river.

3. Gowardhana (Panchyat: Manchangwa,Block: Ramnagar)

   Scheme: Existing scheme only hand pumps.

Figure 1.6 District map of West Champaran

1.8 Organization of the Report

The draft EA & EMF report has been outlined as per the following structure.

Chapter 1 – Introduction presents a brief description of the report discussing project background; objective of the project and its major components, scope of the project, need of Environmental Assessment and objectives of it and Methodology.

Chapter 2 – Rural Water supply and Sanitation - Policy, Regulatory Framework, Mission and Programmes discusses State RWSS vision, RWSS coverage in the state, relevant laws/ acts, WB safeguard policies, existing institutional setup.

Chapter 3 – Baseline Environmental Status gives existing set-up, overview of existing environmental condition of the villages of 4 districts of Bihar and their issues, existing water supply status and sanitation amenities etc.

Chapter 4 – Environmental Management Framework includes a benchmark EMF suggesting different environmental enhancement measures for water supply and sanitation schemes keeping in mind key environmental issues identified and assessed, budgetary cost estimates along with its implementation and responsibility of different institutions.

Furthermore, EMF is to be prepared with a special focus on state water supply and sanitation schemes, suggesting environmental data collection sheets (EDS),

implementation of EMF in project cycle, Environmental code of Practices (ECOPs), Roles and Responsibility matrix, environmental supervision, monitoring, evaluation plan, options for safe liquid and solid waste disposal, implementation plan including training and capacity building, training needs, budget for training and EMP, has been presented in this section.

2. RWSS – Policy, Regulatory Framework, Missions and Programmes

2.1 State RWSS Vision

For ensuring delivery of drinking water to rural areas, various State/Centrally sponsored programs are being operated in the Bihar state. Some of the schemes under Accelerated Rural Water Supply Programme (**ARWSP**) are as follows:

- Deployment of hand-pumps at partially covered/uncovered tolas.
- Replacement of old/non-functional hand-pumps by new ones of better technology.
- Running of water harvesting schemes for better usage of rain water.
- Reorganisation of old/new pipe based delivery of drinking water to rural areas.
- Installation of new hand-pumps at all the Primary and Middle Schools.

Bihar government ensures availability of at least one source of drinking water for each group of 250 people in rural areas as per the guidelines of Govt. of India. It also follows the norm of 40 liter per day per person water consumption for all schemes. Bihar state drinking water coverage in rural areas has been given as under

By 2001, all rural areas identified through 1993-94 survey were covered completely. However, due to expiry of the life-span of old hand-pumps, some areas have once again become partially covered.

As per 2008-09 survey, the status of rural localities is as follows:

- Fully covered localities - 59,602
- Partially covered localities - 48,040
- By the end of 2009-10, a total of 79,541 localities were brought under coverage.

Following additional State/Centrally sponsored Programmes are being implemented in the state.

- National Rural Drinking Water Programme.
- Plans for Water Quality affected Areas.
- Centrally Sponsored Urban Water Supply Plans.
- Drinking Water Sanitation Schemes for Government Buildings.
- Total Sanitation Campaign.
- Lohiya Swachhata Yojana

Source: http://phed.bih.nic.in/

Future plans (infrastructure & finance) of RWSS schemes has been given in Table 2.1, 2.2 and 2.3.

Table 2.1 RWSS Infrastructure Component Phasing (Physical)

Project Components	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	TOTAL
New Schemes							
- SHS/ SGS Schemes	7	14	50	50	21	-	142
- Small MVS	1	1	5	5	2	-	14
- Large MVS	-	1	2	2	1	-	6
- SGS Schemes	1	3	10	10	4	-	28
Sanitation - **Hardware** - **Software**	Will be in all GPs and covered in coordination with NBA and MNREGA for IHHL, SLWM, IEC, Construction works for drainage, lane improvement, soak pits, etc. Details will be worked out during preparation of Batch 1						

Table 2.2 Batch wise Implementation of RWSS Schemes

Batch	Small Schemes (SHS/ SGS)	Small MVS	Large MVS	Sanitation
Batch 1 (~30%) (Aug 2013- Aug 2016)	49	4	2	All Batch 1 GPs will be covered
Batch 2 (~35%) (April 2015-July 2018)	63	5	2	All Batch 2 GPs will be covered
Batch 3 (~35%) (April 2017-July 2019)	58	5	2	All Batch 3 GPs will be covered

Table 2.3 Sanitation Infrastructure Finance Component (*in Rs. Crore)*

Project Component	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	TOTAL
HH Sanitation							
Dysfunctional IHHL (Program funds)	3.8	3.8	3.8	3.8	3.8	3.8	22.6
New IHHL (NBA funds)	**44.0**	**48.4**	**53.2**	**58.6**	**64.4**	**70.9**	**339.5**
New IHHL (MNREGA funds)	**3.0**	**3.0**	**3.0**	**3.0**	**3.0**	**3.0**	**18.2**
SLWM (Program funds)	3.3	6.6	23.2	23.2	6.6	3.3	66.2

Project Component	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	TOTAL
SLWM & community components (NBA funds)	11.0	12.1	13.3	14.6	16.1	17.7	84.9
Total	65.1	73.9	96.5	103.2	94.0	98.7	531.4

2.1.1 RWSS at National Context

In 1950, the Constitution of India specifies water as a State subject. From 1951-2012, the Government of India (GoI) and the State governments have spent Rs 1,56,580 crores in the domestic water and sanitation sector of the country. Also, about USD 2 billion per annum are spent through various programs for improving access to rural water supply and sanitation (RWSS). But still only 31 percent of rural households have access to piped water and 31 percent households have access to sanitation (2011 Census).

In 1972-73, GoI introduces the Accelerated Rural Water Supply Program (ARWSP) by to assist states and union territories to accelerate the pace of coverage of drinking water supply, in 1981 India enters the International Drinking Water Supply and Sanitation. In, 1986 The National Drinking Water Mission (NDWM) was launched to accelerate the process of coverage of the country with drinking water. In, 1987 first national water policy was drafted by Ministry of Water Resources giving first priority to drinking water supply. In 1994 the 73rd Constitution Amendment made provision for assigning the responsibility of providing drinking water to the Panchayati Raj Institutions. In 1999 a separate Department of Drinking Water Supply in the Ministry of Rural Development, Govt. of India was made. In 2002 Swajaldhara programme comes up and also, India commits to the Millennium Development Goals to halve the proportion of people without sustainable access to safe drinking water and basic sanitation by 2015, from 1990 levels. In 2009, National Rural Drinking Water Programme launched from 1/4/2009 by modifying the earlier Accelerated Rural Water Supply Programme and subsuming earlier sub Missions, Miscellaneous Schemes and mainstreaming Swajaldhara principles. In 2010 Department of Drinking Water Supply renamed as Department of Drinking Water and Sanitation. And in 2011 Department of Drinking Water and Sanitation upgraded as separate Ministry of Drinking Water and Sanitation.

In order to improve the water supply and sanitation conditions of the rural sector of India, the Working Group of 12th five year plan (2012-2017) plans to make water accessible to people from at least a radial distance of 50 meters, introduce piped water supply schemes which are designed to carry a minimum of 55 lpcd for stand posts and 70 lpcd for house connection/yard taps, villages affected by quality of water such as fluoride, arsenic, iron and other chemical and natural contaminants would be given priority, incorporation of public participation by the State Departments, Panchayats and other local bodies in all aspects of drinking water supply, right from its planning, formulation of strategies, implementation, monitoring and on operation and maintenance of systems, Village Water and Sanitation Committees (VWSCs) will have more than 50% women members from all communities, in order to ensure water security for drinking purposes no bore well other than for household consumption would be allowed at least in 500 meters radius of the existing drinking water sources, the Water

Quality Assessment Authority, which is under the Ministry of Environment and Forests, will be converted into separate Drinking Water Quality Assessment Authority, which should be constituted and brought under the purview of Ministry of Drinking water and Sanitation or Ministry of Health and Family Welfare, conjoint approach to water and sanitation would be implemented, etc.

2.1.2 Sector Reforms Project

Development of policies and the administration of the rural drinking water sector were started by Rajiv Gandhi National Drinking Water Mission (RGNDWM). Accelerated Rural Water Supply Programme (ARWSP) was also started by RGNDWM, and is funded by government of India and state governments. It was first introduced in 1972 and it continues to provide the basis for the union government's interventions in rural drinking water. During the Ninth plan (1997-2002), guidelines were revised to achieve full coverage of all rural habitations. Project which came up with revised guidelines was known as Swajal project which was implemented on then undivided Uttar Pradesh. By 1999, the union government decided to broaden the Swajal experiment throughout the country which came up as the Sector Reform Project (SRP) which sought to implement in 67 districts. The project had a paradigm shift from the regular supply based approach to the demand based approach and stressed on community involvement by making the community bear 10% of the capital cost either in cash or kind (labour, material or land) and also the entire operation and maintenance (O&M) cost.

Immediately after the completion of Swajal Project, SRP was extended to the whole country in the guise of Swajaldhara Guidelines.

2.1.3 Swajaladhara

Swajaldhara Programme, an extension of Sector Reform Programme, was launched on 25th December'02. It emphasized on the need for an increase in people's participation, treatment of water as a socio-economic good and the use of 20% of available funds for states promoting reforms along these lines. It introduced a paradigm shift towards demand-led schemes from supply-led schemes, centralized to de- centralized implementation and Government's role from service provider to facilitator.

Principles of "Swajaldhara" programme are:

i. Adoption of a demand-responsive, adaptable approach along with community participation based on empowerment of villagers to ensure their full participation in the project through a decision making role in the choice of the drinking water scheme, planning, design, implementation, control of finances and management arrangements;

ii. Full ownership of drinking water assets with appropriate levels of Panchayats,

iii. Panchayats / communities to have the powers to plan, implement, operate, maintain and manage all Water Supply and Sanitation schemes,

iv. Partial capital cost sharing either in cash or kind including labour or both, 100% responsibility of operation and maintenance (O&M) by the users;

v. An integrated service delivery mechanism;

vi. Taking up of conservation measures through rain water harvesting and ground water recharge systems for sustained drinking water supply; and

vii. Shifting the role of Government from direct service delivery to that of planning, policy formulation, monitoring and evaluation, and partial financial support.

In June 2003 new guidelines were formulated, according to which Swajaldhara was to have two Dharas (streams). First Dhara (Swajaldhara I) is for a Gram Panchayat (GP) or a group of GPs or an intermediate Panchayat (at Block / Tehsil level) and the Second Dhara Swajaldhara II) has a District as the Project area. In the Tenth Plan, it was suggested to discontinue with Swajaldhara Project and reformulate tits guidelines to overcome the difficulties in the collection of community contribution. It was eventually decided to allocate 20% ARWSP funds for Swajaldhara Projects during the Eleventh Plan.

Guidelines for environmental safety as per Swajaldhara Projects

a. States would need to enact and implement law on effective groundwater extraction control, regulation and recharge

b. State Government should integrate water conservation and rainwater harvesting schemes with drinking water supply schemes

c. Rural drinking water, sanitation, health and hygiene programmes need to be integrated at the State, District, Block and GP levels

d. RPMU/KRWSA should arrange for periodic monitoring and review of the functioning of completed water supply schemes by officers, experts, NGOs, Institutions etc.

e. Suitable monitoring mechanism and systems may be put in place in this regard by State Government

2.1.4 Sub – Mission Project (SMP)

Sub-Mission projects were taken up to ensure safe and sustainable water supply, through rain water harvesting, artificial recharge, etc. particularly to the rural habitations which are suffering from water quality problems like arsenic, fluorides, iron, etc. The schemes were funded by central and state governments in the ratio of 75:25.

2.1.5 Other Related Programmes

There are various popular schemes being implemented in Bihar state by the state government. Following list shows these schemes:

- Mukhyamantri Balika Poshak Yojana
- Mukhyamantri Balika Cycle Yojana
- Mukhyamantri Kanya Suraksha Yojana
- Mukhyamantri Kanya Vivah Yojna
- Mukhyamantri Awas Yojana
- Mukhyamantri Zila Vikas Yojana
- Mukhyamantri Gram Sadak Yojana

- Mukhyamantri Setu Nirman Yojana
- Mukhyamantri Tivra Beej Vistar Yojana
- Samudai Adharit Samanvit Van Prabandhan Evam Sanrakshan Yojana of Bihar State
- Jawahar Gram Samriddhi Yojna
- National Health Insurance Scheme
- Mamta Scheme
- Aam Aadmi Bima Yojanaa
- Vidya Sagar Project
- Welfare Schemes
- MP Local Area Development Scheme
- Community Development
- Basic Minimum Services
- Minority welfare schemes
- Flood protection schemes

Samudai Adharit Samanvit Van Prabandhan Evam Sanrakshan Yojana of Bihar State

A Planning Commission, Government of India sponsored project titled "Samudai Adharit Samanvit Van Prabandhan Evam Sanrakshan Yojana of Bihar State" (Bihar Project) is being implemented by ICFRE. The 1st phase of the project involves implementation of agroforestry component in Vaishali district, North Bihar and RDF through JFM component in Banka and Jamui Division of South Bihar. The duration of 1st phase of the project is from 2005-06 to 2006-07. The outlay for ICFRE component is Rs. 18.94 crore out of the total outlay of Rs. 51.00 crore for implementation of the 1st phase. ICFRE has taken up project programme related to agrogorestry with help and support of SFD, Bihar and implemented it on farmer's fields in North Bihar by providing technical knowledge, quality planting stock, training and extension, establishment of hi-tech nursery, kisan nursery and demonstration trials. In JFM linked RDF programme in Banka and Jamui Divisions, ICFRE is helping in establishing hi-tech nursery cum demonstration centre, providing training support and helping in conducting study tours.

Various activities being implemented in this scheme are as follows:

1. Socio-economic Survey
2. Impact Assessment
3. Selection of Suitable Plant Species and their Propagation
4. Raising Quality Planting Stock through Establishment of Model Nurseries and Kisan Nursery
5. Planting Trees an Farmlands
6. Establishment of Field Demonstration
7. Trainings, Extension and NGO Involvement

8. Establishment of Orchards, Hedge Garden
9. Identification of VAM fungi and Inoculation
10. Protection
11. Develop Extension Material/Packages Field Manuals in Vernacular Language
12. Establishment of Center and Appointment of staff
13. Engagement of Consultants for Agroforestry, Joint Forest Management, Planting Stock Improvement, Socio-economic Studies
14. National Seminar/ Workshop and Study Tours
15. Monitoring and Evaluation, Documentation and Data Base
16. Utilization of Agroforestry/Forestry Produce

Source:
http://www.biharonline.gov.in/Site/Content/Government/Government.aspx?u=l

In addition to schemes mentioned above following are some of the important schemes being implemented by Rural Development, State Government of Bihar:

- National Rural Employment Guarantee Scheme - Bihar
- Swarna Jayanti Gram Swarojgar Yojana
- Indira Aawas Yojana
    - Credit-cum-Subsidy Scheme for Rural Housing
- Hariyali
    - Integrated Waste-Land Development Project
    - Drought-Prone Area Programme

Integrated Waste-Land Development Project

The Integrated Wastelands Development Project Scheme strives to develop non-forest wasteland on village/micro-watershed basis. The scheme also helps generate employment in rural areas besides, enhancing people's participation in wasteland development leading to equitable sharing of benefits and sustainable development.

Scope

Watershed Development approach has been adopted for all area development programmes. This approach has also been adopted for implementation of this scheme. Integrated Wasteland Development based on village/micro-watershed plans is taken up after taking into consideration the local capabilities, site condition and local needs of the people.

Funding

The Government of India provides 100% grant. Project cost not to exceed Rs. 5 crore per project at a rate of Rs. 4,000/- per hectare for a period of four years.

Strategy

Major activities taken up under this scheme are soil and moisture conservation, afforestation and pasture development, promotion of horticulture/agro-forestry, encouraging natural regeneration, wood substitution and fuel wood conservation

measures, and dissemination of technology, as decided by the user group living in or around the project area.

Source: http://rdd.bih.nic.in/schemes.htm

2.1.6 Total sanitation Campaign (TSC)

Water, sanitation and health, all three are inter-related. Consumption of unsafe drinking water, improper disposal of human excreta, improper environmental sanitation, lack of personal and food hygiene, prevailing High Infant Mortality Rate are major causes of many diseases in developing countries like India. In this context and primarily with the objective of improving the quality of life of the rural people and also to provide privacy and dignity to women, Central Rural Sanitation Programme (CRSP) was launched in 1986.

CRSP was a supply driven, highly subsidy and infrastructure oriented. As a result of these deficiencies and low financial allocations, the CRSP had little impact on the gigantic problem. The results of evaluation of CRSP and the experience of community-driven, awareness generating campaign based programmes in some states, led to the formulation of the Total Sanitation Campaign (TSC) approach in 1999. TSC has identified total 58 districts from 9 states in LWE.

The main goal of Total Sanitation Campaign is to eradicate the practice of open defecation by 2017. Community-led total sanitation is not focused on building infrastructure, but on preventing open defecation through peer pressure and shame. In Maharashtra where the program started more than 2000 Gram Panchayats have achieved 'open defecation free' status. To give boost to the campaign, the GOI has launched a program called Nirmal Gram Puraskar under which individuals and institutions which will significantly contribute in ensuring attainment of full sanitation coverage status of an area will receive monetary rewards and high publicity under the program.

The main objectives of the TSC are as under:

- Bring about an improvement in the general quality of life in the rural areas.
- Accelerate sanitation coverage in rural areas.
- Generate felt demand for sanitation facilities through awareness creation and health education.
- Cover schools/ Anganwadi's in rural areas with sanitation facilities and promote hygiene education and sanitary habits among students.
- Encourage cost effective and appropriate technologies in sanitation.
- Eliminate open defecation to minimize risk of contamination of drinking water sources and food.
- Convert dry latrines to pour flush latrines, and eliminate manual scavenging practice, wherever in existence in rural areas.

Source:
http://rural.nic.in/sites/downloads/pura/Total%20Sanitation%20Campaign%20-%20DDWS.pdf

2.1.7 Nirmal Bharat Abhiyan (NBA)

With the objective to accelerate sanitation coverage in the rural areas so as to comprehensively cover the rural community through renewed strategies and saturation approach, TSC has been renamed as "Nirmal Bharat Abhiyan" (NBA).

NBA envisages covering the entire community for saturated outcomes with a view to create Nirmal Gram Panchayats with following priorities:

- Provision of Individual Household Latrine (IHHL) of both Below Poverty Line (BPL) and identified Above Property Line households within a Gram Panchayat (GP).
- Gram Panchayats where all habitations have access to water to be taken up. Priority may be given to Gram Panchayats having functional piped water supply.
- Provision of sanitation facilities in Government Schools and Anganwadis in Government buildings within these GPs
- Solid and Liquid Waste Management (SLWM) for proposed and existing Nirmal Grams.
- Extensive capacity building of the stake holders like PRIs, VWSCs and field functionaries for sustainable sanitation.
- Appropriate convergence with MGNREGS with unskilled man-days and skilled man-days.

The main objectives of NBA are as under:

- Bring about an improvement in the general quality of life in the rural areas.
- Accelerate sanitation coverage in rural areas to achieve the vision of Nirmal Bharat by 2002 with all gram Panchayats in the country attaining Nirmal status.
- Motivate communities and PRIs promoting sustainable sanitation facilities through awareness creation and wealth education.
- To cover the remaining schools not covered under Sarva Shiksha Abhiyan (SSA) and Anganwadi Centres in the rural areas with proper sanitation facilities and undertake proactive promotion of hygiene education and sanitary habits among students.
- Encourage cost effective and appropriate technologies for ecologically safe and sustainable sanitation.
- Develop community managed environmental sanitation systems focusing on solid and liquid waste management for overall cleanliness in the rural areas.

Implementation

Implementation of NBA is proposed with 'Gram Panchayat' as the base unit. The project proposal originates from a district and is examined and consolidated by the State Government and send out to the Government of India (Ministry of Drinking Water and Sanitation) as a State Plan. NBA is implemented in phases with start-up activities and funds are to be made available for preliminary IEC work. The physical implementation is oriented towards satisfying the felt-needs, where-in individual households choose from a menu of options to their household latrines. The built-in flexibility in the menu of options gives people the opportunity for subsequent up gradation depending upon their

requirements and financial position. In the "campaign approach", a synergistic interaction between the Government agencies and other stakeholders is a necessity. To bring about the desired behavioural changes for relevant sanitary practices, intensive IEC and advocacy, with participation of NGOs/ PRIs/ resource organizations is envisaged.

Components of NBA

- Start-Up activities
- IEC Activities
- Capacity Building
- Construction of Individual Household Latrines
- Rural Sanitary Marts and Production Centres
- Provision of Revolving Fund in the District
- Community Sanitary Complex
- Institutional Toilets – School and Anganwadi toilets
- Solid and Liquid Waste Management
- Maintenance of facilities created under NBA
- Administrative charges

Source: Ministry of Drinking Water and Sanitation 2012, Nirmal Bharat Abhiyan, Government of India, New Delhi.

2.2 RWSS Coverage in Bihar

2.2.1 Drinking Water

Rural Water Supply and Sanitation schemes covered 107,642 habitations and out of these habitations, numbers of habitations with 100% population coverage were 87394 and partially covered habitations were 202480 as of 2-02-2013. At the same time 4163 schemes were still ongoing with 16 % ongoing schemes older than 5 years and 32% schemes between 3 to 5 years old. As of 01-04-2012, out of total 14580 water quality affected habitations there were 2698 habitations contaminated with fluoride, 1004 habitations contaminated with arsenic, 10877 habitations contaminated with iron and one habitation contaminated with nitrate. Out of total 107642 habitations with RWSS schemes, 34384 schemes have their 100%sources tested in laboratory and 5527 schemes have part of total water samples tested in laboratories. As of 2012-2013, 67731 schemes were still had no of their water samples tested in laboratories. Under 'Jalmani' programme, which was implemented by states through GP/VWSC/SHG's etc. total money released and utilized were Rs. 766.16 lakh and Rs. 766.15 lakh, respectively. Using these money facilities were created in 3331 schools while target was for 3831 schools. Bihar State Information pertaining to Rural Drinking Water Supply, their coverage in state with expenditure has been given in different tables as follows

Table 2.4 Overview of Bihar state related to water sector

No of Districts	38
No of Blocks	532
No of Panchayats	8741
Rural Population as on 01/04/12 (In Crore)	9.04 [SC-1.49 (16.48%) ST-0.08 (0.88%) GEN-7.47 (82.63%)]
Population Managing Water Supply Scheme	54.20%
Stage of Ground Water Development	39%

Table 2.5 Coverage of SC/ST/Minority Habitations (Coverage as on 02/02/2013)

Particulars	Total Habitations	Coverage	% Coverage
SC Concentrated Habitations	23520	21987	93.48
ST Concentrated Habitations	1952	1885	96.57
Habitations in Minority Concentrated Districts	21514	20318	94.44
LWE Concentrated Habitations	28784	27064	94.02

Table 2.6 Different Scheme Details in Bihar state as on 02/02/2013

S.N.	Particulars	State No	State Percentage	India No	India Percentage
1	Habitations covered by PWSS	3643	3.38	497964	29.89
2	Habitations covered by Handpumps / Bore wells	85819	79.73	742067	44.54
3	Habitations covered by Others	16812	15.62	42878	2.57
4	Habitations where scheme detail Not entered in IMIS	1368	1.27	383166	23.00
5	Total	107642	100.00	1666075	100.00

Table 2.7 Physical Progress during 2012-13 as on 02/02/2013

S.N.	Particulars	20pt Target	Target Marked	Achievement	% Against 20pt
1	Partially Covered	8915	8915	4699	52.71
2	Quality Affected	6100	6100	1428	23.41
3	Minority Districts	0	2495	731	0.00
4	Minority Blocks	0	2264	690	0.00
5	LWE Districts	0	2585	1470	0.00
6	SC Dominated	0	2904	965	0.00
7	ST Dominated	0	264	111	0.00

Table 2.8 Financial Progress Program funds (Rs in Crore) as on 02/02/2013:

Year	Opening Balance	Central Allocation	Central Release	State Release	Exp. of Avail. Central fund	% Exp. of Avail. Central fund
2010-2011	572.68	324.39	162.19	177.87	421.40	57.34
2011-12 Total	313.48	347.59	314.89	138.41	364.22	57.96
2011-12 SC	0.00	81.99	81.08	0.00	110.98	136.88
2011-12 ST	0.00	2.93	3.60	0.00	4.70	130.60
2011-12 GEN	313.48	262.67	230.22	138.41	248.54	45.71
2012-13 Total	264.15	406.79	203.39	192.20	264.59	56.59
2012-13 SC	0.00	102.12	51.06	0.00	58.86	115.28
2012-13 ST	0.00	3.81	1.90	0.00	2.99	157.01
2012-13 GEN	264.15	300.86	150.43	192.20	202.74	48.90

Table 2.9 Financial Progress Support Activities (Rs in Crore) as on 02/02/2013

Year	Opening Balance	Central Allocation	Central Release	State Release	Exp. of Avail. Central fund	% Exp. of Avail. Central fund
2010-2011	5.42	17.07	8.54	0.00	4.51	32.33
2011-2012	9.44	16.05	8.89	0.00	1.98	10.80
2012-2013	16.35	26.61	0.00	0.00	8.89	54.34

Table 2.10 RFD Targets and Achievements (up to 02/02/2013) 2012-2013

S.No.	Activity	Target	Ach	% age
1	No. of Persons to be Trained for water quality testing using FTKs	42210	0	0.00
2	No. of water quality tests done in labs	114000	56116	49.22
3	No. of water quality tests done using FTKs	50000	270	0.54
4	No. of Sub division Labs set up	76	0	0.00

S.No.	Activity	Target	Ach	% age
5	Provision of Water Supply in Schools	3000	1716	57.20
6	No of Sustainability structures constructed	3260	43	1.32
7	No PWSS handed over to panchayats	50	95	190.00
8	No. of VWSC members Trained	6000	0	0.00

Source for all above tables: NRDWM website at
http://indiawater.gov.in/IMISReports/Reports/Profile/rpt_StateProfile.aspx?Rep=1

2.2.2 Sanitation

Numbers of beneficiary households incentivized for 'Individual Household Latrines (IHHL)' under 'Total Sanitation Scheme' in Bihar in the years 2009-10, 2010-11 and 2011-12 were 472722, 545770, and 646052, respectively. As on 31.03.2012, State Government of Bihar constructed 3837803 'Individual Household Latrines', 777 'Sanitary Complexes' and 74003 school toilets and 2876 Anganwadi toilets under TSC. In the year 2000-01, 2001-02, 2002-03, 2005-06 and 31.12.2007 total school toilets sanctioned under TSC in Bihar were 4120, 5804, 3000, 2329 and 7492, respectively. For these school toilets central government spent 494.4, 696.48 and 360.0 lakh Rs. in the year 2000-01, 2001-02, and 2002-03, respectively. Additional information pertaining to sanitation sector is presented in following different tables which also includes coverage in state and expenditure.

Table 2.11 Individual Household Latrines (IHHL) Project Objectives and Achievements under Total Sanitation Campaign (TSC) in Bihar (As on March, 2012)

State	Objectives (IHHL Total)	Achievement (Up to March, 2012)
Bihar	11171314	3839093
India	125726727	87362100

Table 2.12 Number of toilets Constructed under TSC in Bihar (2008-2009 to 2011-2012-upto August 2011)

Year	IHHL	School Toilet	Anganwadi Toilet	Community Sanitary Complex
2008-2009	756465	15065	272	52
2009-2010	640359	4010	216	17
2010-2011	717792	8679	309	63
2011-2012 (Up to Aug 11)	203225	2705	87	19

Table 2.13 Release of Funds under TSC in Bihar (2010-2011) (Rs. in Crore)

State	Release through Consolidated Fund of State	Release Outside Consolidated Fund of State	Total
Bihar	0	112.6	112.6
India	0	1302.15	1302.15

Table 2.14 Physical Progress under TSC in Bihar (2009-2010, Upto December 2009) In Number

State	IHHL (BPL)	IHHL (APL)	IHHL Total	Sanitary Comp	School Toilets	Balwadi Toilets	RSM
Bihar	368714	150902	519616	7	3403	161	0
India	3405425	3808617	7214042	1239	95081	34052	36

Table 2.15 Financial and Physical Achievements under TSC in Bihar (2008-2009)

State	Rs. in Lakh		Number of units Constructed			
	Release Amount	Expenditure Amount	IHHL	Sanitary Complex	School Toilets	Anganwadi Toilets
Bihar	7150.57	7140.02	756465	52	15065	272
India	97755.50	83745.04	11668332	3281	253799	69045

Table 2.16 State-wise Number of Proposals Received, Cleared and Assistance Provided for TSC Projects in Eastern India (2001-2002 to 2008-2009)

States	Year	Proposal Received	Proposal Cleared	Assistance Provided (Rs. in Lakh)
Bihar	2001-02	5	5	2862.82
	2002-03	6	6	1548.7
	2003-04	0	0	0
	2004-05	12	0	0
	2005-06	-	-	5796.27
	2006-07	-	-	830.23
	2007-08	-	-	9554.97
	2008-09	-	-	7150.57
India	2001-02	65	65	17750.82
	2002-03	116	116	13836.21
	2003-04	132	132	19918.49
	2004-05	152	28	18302.09
	2005-06	-	-	59532.28
	2006-07	-	-	72097.46
	2007-08	-	-	91169.88
	2008-09	-	-	81360.67

Table 2.17 Financial and Physical Achievements under TSC in Bihar (2007-2008)

State	Release Amount	Expenditure Amount	IHHL	Sanitary Complex	School Toilets	Anganwadi Toilets
Bihar	9554.97	5794.58	513050	66	11836	474
India	90913.37	79070.63	11527890	3006	236289	86493

Table 2.18 District-wise Physical Progress under TSC in Bihar (As on 5.1.2003)

Districts	Sanction Month/ Year	Reported Month/ Year	Project Objectives					
			IHHLs	Sanitary Complex	School Toilets	Toilets for Balwadis	RSM/ PCs	Total San. Of Villages
Vaishali	11/99	9/02	190598	662	1300	0	10	0
Pb Champaran	2/01	9/02	180000	625	1090	0	10	0
Patna	2/01	9/02	190000	659	1100	0	10	0
Gaya	2/01	9/02	190000	655	1095	0	10	0
Banka	2/01	9/02	144396	500	835	0	10	0
Muzaffarpur	5/01	9/02	180000	371	995	0	10	0
Chapra (Saran)	5/01	9/02	170000	590	1030	0	10	0
Madhubani	3/02	9/02	160000	600	1500	0	10	14707
Katihar	3/02	9/02	170000	600	1158	0	10	0
Begusarai	3/02	9/02	170000	600	1121	0	10	0
Bihar			1744994	5862	11224	0	100	14707

Source for all above tables:
http://www.biharstat.com/googlesearch.aspx?q=&cx=012488167769036444254:muc_jmckdka&cof=FORID:9

Table 2.19 Sanitation Financial Progress under Nirmal Bharat Abhiyan (NBA) for five years (Rs. in crores)

Financial Year	Fund released				Expenditure			
	Center	State	Beneficiary	Total	Center	State	Beneficiary	Total
2007-2008	95.55	19.94	6.61	122.10	57.19	14.49	49.5	76.64
2008-2009	71.50	39.14	6.89	117.54	71.14	38.33	6.85	116.33
2009-2010	90.46	43.40	10.08	143.95	90.14	35.95	8.18	134.27
2010-2011	112.59	69.51	5.57	187.67	124.21	54.69	6.55	185.46
2011-2012	172.19	74.81	4.81	251.82	167.61	74.44	5.77	247.83
TOTAL:-	951.28	273.08	40.76	1265.13	618.46	238.21	38.44	895.12

Source: PHED, Govt. of Bihar

2.3 Regulatory and Policy Framework

2.3.1 National Policies and Regulation

We will find that early civilizations were built near water sources. Water sources like river, pond, oasis, open wells etc. were very important to the development of civilizations. They provided water for farming crops and for other uses. With development of society, management started shifting from private to community level to the local governments. Maintaining this basic characteristic of civilization, Government of India's, provides drinking water supplies through different mechanisms. Following table shows Progress of The Rural Water Supply (RWS) sector driven by Government of India.

Table 2.20 Progress of RWSS Programme, Government of India[4]

Development Stage	Year	Major Thrust
The first government-installed rural water supply schemes	**1952**	Basic drinking water supply facilities to the rural population
Government of India's effective role	**1972-73**	Launch of Accelerated Rural Water Supply Programme (ARWSP).
The First generation programme	**1972-1986**	Provision of adequate drinking water supply to the rural community through the Public Health Engineering System.
The second generation programme	**1986-87, 1991-92**	Technology Mission renamed in 1991-92 as Rajiv Gandhi National Drinking Water Mission Stress on water quality, appropriate technology intervention, human resource development support and other related activities
The third generation programme	**1999-2000, 2002**	Sector Reform Projects evolved to involve community in planning, implementation and management of drinking water related schemes, later scaled up as Swajaldhara in 2002
Fourth phase	**2012-13**	Ensuring sustainability of water availability in terms of potability, adequacy, convenience,

4 National Rural Drinking Water Programme: Framework for Implementation, Department of Drinking Water Supply, Ministry of Rural Development, Government of India http://rural.nic.in/sites/downloads/pura/National%20Rural%20Drinking%20Water%20Programme.pdf

Development Stage	Year	Major Thrust
		affordability and equity while also adopting decentralized approach involving PRIs and community organizations. Decentralization & conjunctive use of water etc.

2.3.2 National Policy Framework5

Following figure gives snapshot of framework for national rural drinking water programme (NRDWP).

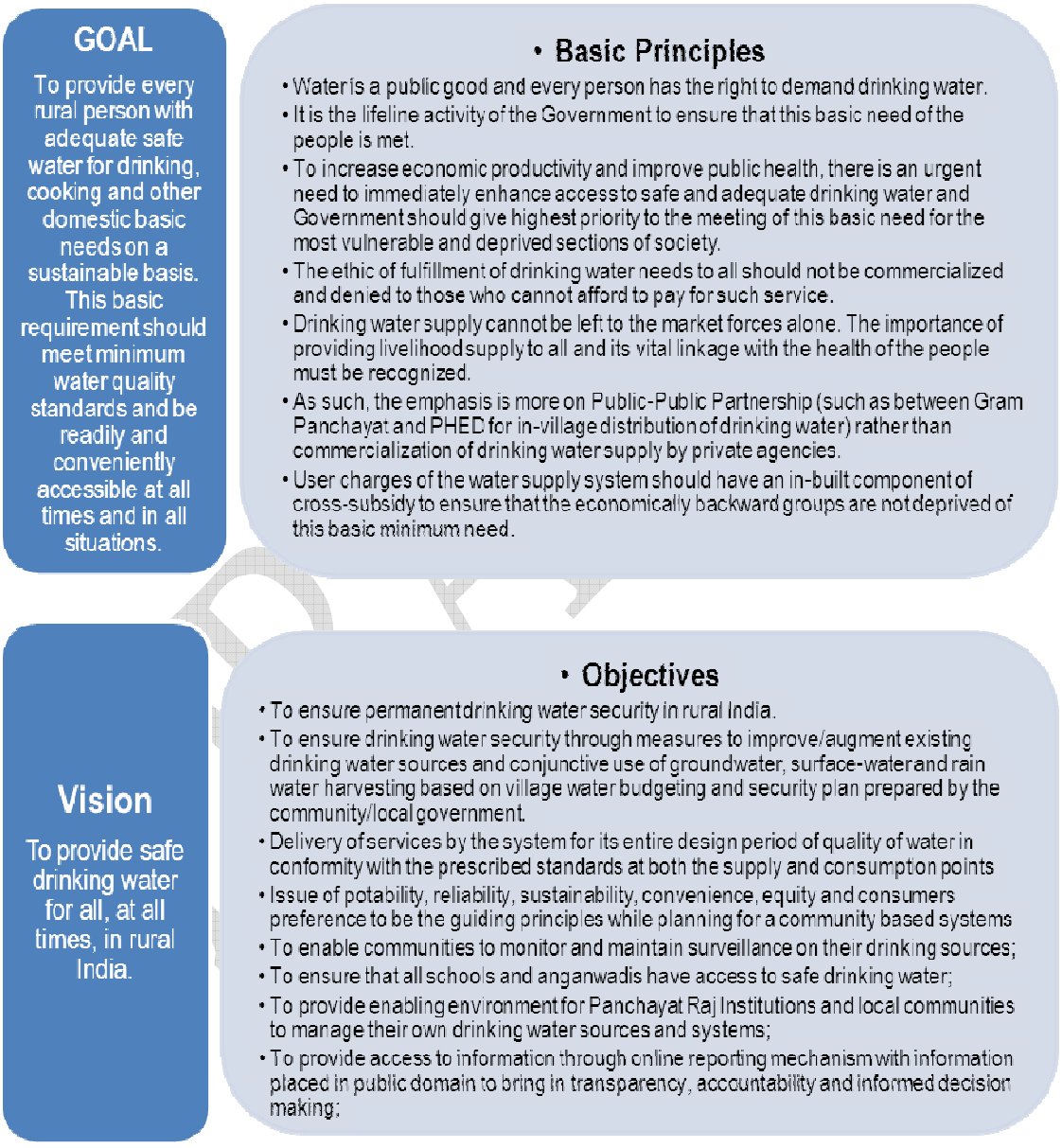


Figure 2.1 Overview of National Policy Framework

5 National Rural Drinking Water Programme: Framework for Implementation, Department of Drinking Water Supply, Ministry of Rural Development, Government of India
http://rural.nic.in/sites/downloads/pura/National%20Rural%20Drinking%20Water%20Programme.pdf

2.3.3 Recent changes in the policy framework

National drinking water mission has progressed through different stage (Table 2.29) to achieve the present stage. Following are the major paradigm shifts in the policy framework to ensure inclusive & sustainable growth.

- Providing 40 lpcd for the entire population in a habitation to providing adequate drinking water to people living at the tail end of the schemes or throughout the year
- Conventional norms of litres per capita per day (lpcd) to ensure drinking water security for all in the community
- To ensure that the basic minimum requirement at the household level for drinking and cooking needs
- Maintain quality as per the prescribed as per BIS standards
- To prevent contamination of drinking water in the conveyance system
- Drinking water quality standards both at the production (water treatment plant) as well as at the consumption points (household level).
- Focus on personal hygiene
- Bureau of Indian Standard (BIS) IS: 10500 and World Health Organization issued modified Guidelines for Drinking Water Quality (2004) and Guidelines for safe use of wastewater and grey water (2006) adopted for health based target setting approach
- Risk assessment and risk management of water supplies commonly known as 'water safety plan'.
- Linking water quality problem with a water safety solution
- Actual water use rather than the source should determine the quality of the water supplied
- Water Quality Monitoring & Surveillance Programme

In addition to above major changes in thoughts, since year 2012-13 Government of India through its notification no. D.O. No. W-11011/07/2012-WQ dated July 17, 2012 has modified NRDWP. According to these modifications utilization of 5% water quality fund under NRDWP for inhabitation's having chemical contamination of drinking water sources and for Japanese Encephalitis (JE)/ Acute Encephalitis Syndrome (AES) affected priority districts is mandatory. Out of earmarked 5% water quality find, 75% will be allocated to states with habitations with chemical contamination (arsenic, fluoride, nitrate, salinity and iron in that order of priority) and the remaining 25% fund will be allocated to the five states with 60 high priority districts affected with JE/AES viz. Assam, Bihar, Tamil Nadu, Uttar Pradesh and West Bengal. Detailed guidelines to follow these instructions have also been provided.

2.3.4 Applicable Legal and Regulatory system

A) Water

National water policy (NWP) 2002, presents the framework for the policy, including the present scenario, concerns, and basic principles of water resource management. This also mentions the interdependence of all elements of the hydrological cycle, and of the

need for equity. In pursuance of the strategies identified in National Water Mission Document as well as deliberations in National Water Board, Ministry of Water Resources had initiated the process of reviewing the NWP 2002. Accordingly, the Drafting Committee on National Water Policy has evolved the draft policy after taking into consideration recommendations of various stake holders. Resultant is called as Draft National Water Policy (NWP, 2012). Even while recognizing that the States have the right to frame suitable policies, laws and regulations on water, the draft NWP, 2012 lays emphasis on the need for a national water framework law, comprehensive legislation for optimum development of inter-State rivers and river valleys, public trust doctrine, amendment of the Indian Easements Act, 1882, etc. Hence all water related issues shall be handled by NWP-2012 at national level and by Bihar State Water Policy - 2010 at state level. For water quality following regulations are applicable:

- Bureau of Indian Standard (BIS) IS: 10500 and
- World Health Organization issued modified Guidelines for Drinking Water Quality (2004) and Guidelines for safe use of wastewater and grey water (2006)
- For sustainability of drinking water projects guidelines "Mobilising Technology for Sustainability" issued by the Department of Drinking Water Supply, Government of India

B) Environment

The following are the laws and regulations that are applicable to the environmental and social aspects of the projects:

- Policy and Regulatory Framework of Government of India (GoI)
- Environmental Policy and Regulations of the Bihar State Government.
- Legislations/norms applicable to construction projects.
- Operational Policies of the World Bank

Table 2.21 Applicable National and State Policies and Regulatory Frameworks

S. No	Act / Rules	Purpose	Applicable Yes/ No	Reason for Applicability	Authority
1	Environment Protection Act-1986	To protect and improve overall environment	Yes	As all environmental notifications, rules and schedules are issued under this Act.	MoEF, GoI, DoE, State Gov. CPCB, SPCB
2	Environmental Impact Assessment Notification 14th Sep-2006	To provide environmental clearance to new development activities following environmental impact assessment	No	All projects listed under Schedule-I of the Notification requires environmental clearance from the MoEF. Water	MoEF, EIAA

S. No	Act / Rules	Purpose	Applicable Yes/ No	Reason for Applicability	Authority
				supply and sanitation projects, however, are not covered in the Schedule.	
5	The Land Acquisition Act 1894 (As amended in 1985)	Set out rule for acquisition. of land by government	Yes	This Act will be applicable as there will be acquisition of land for scheme construction.	Revenue Department, State Government
6	The Forest (Conservation) Act. 1980	To check deforestation by restricting conversion of forested areas into non- forested areas	Yes	Applicable if there is diversion of forest land for non-forest activities i.e. forest land if required for any of the schemes.	Forest Department, State Government and Ministry of Environment and Forests, Government of India
7	Wild Life Protection Act 1972	To protect listed species of flora and fauna and establishment of a network of ecologically-important protected areas	Yes	This Act is will be applicable, if there are any points of wildlife crossings in proximity to project locations.	Chief Conservator Wildlife, Wildlife Wing, State Forest Department and Ministry of Environment and Forests, Government of India
8	Air (Prevention and Control of Pollution) Act, 1981	To control air pollution by controlling emission of air pollutants as per the prescribed standards.	Yes	This Act will be applicable during construction.	SPCBs
9	Water Prevention and Control of Pollution) Act1974	To control water pollution by controlling discharge of pollutants as per the prescribed standards	Yes	This Act will be applicable during construction.	SPCBs

S. No	Act / Rules	Purpose	Applicable Yes/ No	Reason for Applicability	Authority
10	The Noise Pollution (Regulation and Control) Rules, 2000	The standards for noise for day and night have been promulgated by the MoEF for various land uses.	Yes	This act will be applicable for all construction equipment deployed at worksite.	SPCBs
11	Ancient Monuments and Archaeological Sites and Remains Act1958	Conservation of cultural and historical remains found in India	Yes	This act will be applicable, only if any scheme site is in proximity to any Ancient Monument, declared protected under the act.	Archaeological Department Gol, Indian Heritage Society and Indian National Trust for Art and Culture Heritage (INTACH).
12	Public Liability and Insurance Act 1991	Protection form hazardous materials[6] and accidents.	Yes	Contractor may need to stock hazardous material like diesel, Bitumen, Emulsions etc.	SPCBs
13	Explosive Act 1984	Safe transportation, storage and use of explosive material	Yes	For transporting and storing diesel, oil and lubricants etc.	Chief Controller of Explosives
14	Minor Mineral Concession Rules	For opening new quarry.	No	Regulate use of minor minerals like stone, soil, river sand etc.	District Collector
15	Central Motor Vehicle Act 1988	To check vehicular air and noise pollution.	Yes	This rule will be applicable to vehicles deployed for construction activities and construction machinery.	Motor Vehicle Department
16	National Forest Policy, 1988	To maintain ecological stability through preservation and restoration of biological diversity.	Yes	This policy will be applicable if any eco sensitive feature exists in and around the scheme sites.	Forest Department, State Government and Ministry of Environment

6 "Hazardous substance" means any substance or preparation which is defined as hazardous substance under the Environment (Protection) Act, 1986 (29 of 1986).

S. No	Act / Rules	Purpose	Applicable Yes/ No	Reason for Applicability	Authority
					and Forests, Government of India
17	The Mines Act 1952	The Mines Act has been notified for safe and sound mining activity.	No	If the construction activities will require aggregates, only then applicable. These will be procured through mining from approved quarries.	Mines Department, State Government.

2.3.5 The World Bank's environmental and social safeguard policies

The World Bank's environmental and social safeguard policies are a cornerstone of its support to sustainable poverty reduction. The objective of these policies is to prevent and mitigate undue harm to people and their environment in the development process. These policies provide guidelines for bank and borrower staffs in the identification, preparation, and implementation of programs and projects. The effectiveness and development impact of projects and programs supported by the Bank has substantially increased as a result of attention to these policies. Safeguard policies have often provided a platform for the participation of stakeholders in project design, and have been an important instrument for building ownership among local populations.[7]

The World Bank has 10 Safeguard Policies. These include:

- Environmental Assessment
- Natural Habitats
- Forests
- Pest Management
- Physical Cultural Resources
- Involuntary Resettlement
- Indigenous Peoples
- Safety of Dams
- International Waterways
- Disputed Areas

In the context of the current project objectives, the applicability of the Bank's Safeguard Policies have been described in the Table below.

7 http://go.worldbank.org/WTA1ODE7T0 (Last accessed on 1/2/2013)

One of the most applicable OPs is OP 4.01 on 'Environmental Assessment'. Environmental Assessment is one of the 10 environmental, social, and legal Safeguard Policies of the World Bank, as described above. Environmental Assessment is used to identify, avoid, and mitigate the potential negative environmental impacts associated with Bank lending operations. The World Bank's environmental assessment policy and recommended processing are described in **Operational Policy (OP)/Bank Procedure (BP) 4.01: Environmental Assessment.** This policy is considered to be the umbrella policy for the Bank's environmental 'safeguard policies' which among others include: Natural Habitats (OP 4.04), Forests (OP 4.36), Pest Management (OP 4.09), Physical Cultural Resources (OP 4.11), and Safety of Dams (OP 4.37).[8]

Table 2.22 Applicable world Bank Policies & Regulations

Policy	Key Features	Applicability to this project
OP/BP 4.01 Environmental Assessment	Potential environmental consequences of projects identified early in project cycle. EAs and mitigation plans required for projects with significant environmental impacts or involuntary resettlement. EAs should include analysis of alternative designs and sites, or consideration of "no option" Requires public participation and information disclosure before Board approval.	Applicable to this project. The EMF includes a details description of assessment procedures for each of the activities proposed under the BSWSM project. Screening and assessment tools as well as detailed guidelines have been developed for all proposed schemes.
OP/BP 4.04 Natural Habitats	Prohibits financing of projects involving "significant conversion of natural habitats unless there are no feasible alternatives". Requires environmental cost benefit analysis. Requires EA with mitigation measures.	Applicable to this project as natural habitats are major concerns of state. Many schemes have been launched by state government to achieve compliance.
OP/BP 4.36 Forestry	Prohibits financing for commercial logging operation or acquisition of equipment for use in primary moist tropical forests.	Applicable to this project as moist tropical forests are found in many districts bordering to Nepal and North-Eastern states.
OP 4.09 Pest Management	Supports environmentally sound pest management, including integrated pest management, but does not prohibit the use of highly hazardous pesticides. Pest Management is the borrower/s responsibility in the context of a project's EA.	Applicable to this project as IPM and other policies are major policies for agriculture in Bihar state
OP/BP 4.12 Involuntary Resettlement	Implemented in projects which displace people. Requires public participation in resettlement planning as part of EA for projects. Intended to restore or improve income earning capacity of displaced	Applicable to this project as frequent floods and other natural calamities require resettlement.

[8] http://go.worldbank.org/OSARUT0MP0 (Last accessed on 1/2/2013)

Policy	Key Features	Applicability to this project
	populations.	
OP/BP 4.11 Physical Cultural Resources	Purpose is to assist in the preservation of cultural property, such as sites having archaeological, paleontological, historical, religious and unique cultural values. Generally seeks to assist in their preservation and avoid their elimination. Discourages financing of projects that will damage cultural property.	Applicable to this project as Bihar state contains many site for Harappan and Mohenjo daro sites, Gautam Buddha and other important sites like Nalanda, Takshashila, Vaishali, Magadha etc.
OP/BP 4.37 Safety of Dams	Applies to large dams (15 meters or more in height). Requires review by independent experts throughout project cycle. Requires preparation of EA and detailed plans for construction and operation, and periodic inspection by the Bank.	Applicable to this project as Bihar state contains many large dams having height more than 15 meter.
OP/BP 7.50 Projects on International Waterways	Covers riparian waterways that form boundary between two or more states, as well as any bay, gulf, strait or channel bordered by two or more states. Applies to dams, irrigation, flood control, navigation, water, sewage and industrial projects. Requires notification, agreement between states, detailed maps, and feasibility surveys.	Applicable to this project as Bihar state has riparian waterways bay, gulf, strait or channels sharing with West-Bengal and Bangladesh.
OP/BP 7.60 Projects in Disputes Areas	Applies to projects where there are territorial disputes present. Allows Bank to proceed if governments agree to go forward without prejudice to claims. Requires early identification of territorial disputes and description in all Banks documentation.	Not applicable to current projects

2.4 State Sector institutions

The Public Health Engineering Department of Bihar is entrusted with the mandate to provide drinking water and sanitation services in the state. The PHED was established in the year 1972 for purposes of planning, implementing, monitoring and supervision of approved schemes. The department has created a State Water and Sanitation Mission (registered as a Society under it) for management of Rural Water supply and sanitation at the state level and District Water and Sanitation Mission at each of its 38 districts.

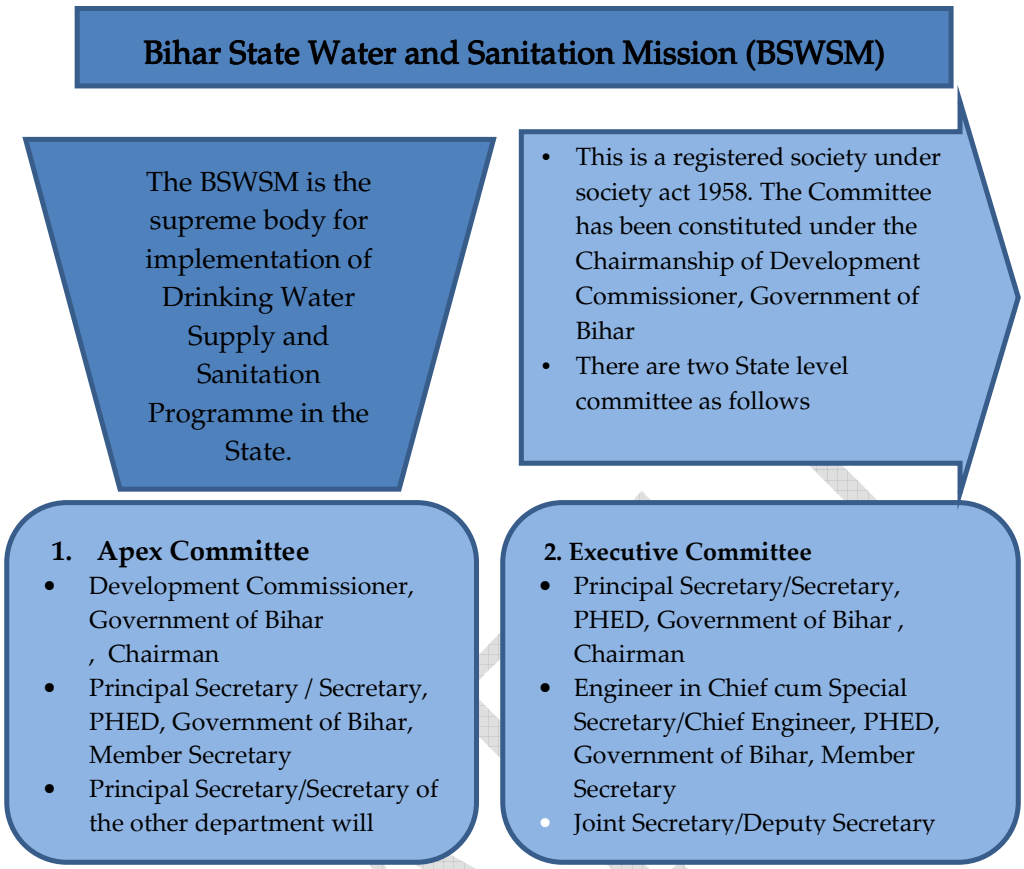


Figure 2.2 BSWSM status & organization of committees

2.4.1 Resolution

As per Para 2.2 la of Restructured Central sponsored Rural Sanitation Programme (RCRSP) guidelines and under Rajiv Gandhi National Drinking Water Mission, GOI, New Delhi; Bihar state water & sanitation mission (BSWSM) is constituted as a registered society. For this purpose, approval on constitution of BSWSM and its registration was given by Apex committee of the government body in its meeting on 7th Oct. 2004 and by executive of the BSWSM in its meeting on 22nd Sept. 2004.
It is in this connection a resolution has taken to register BSWSM. The organizational structure of the Bihar State Water & Sanitation Mission (BSWSM) is as shown in Figure 2.3.

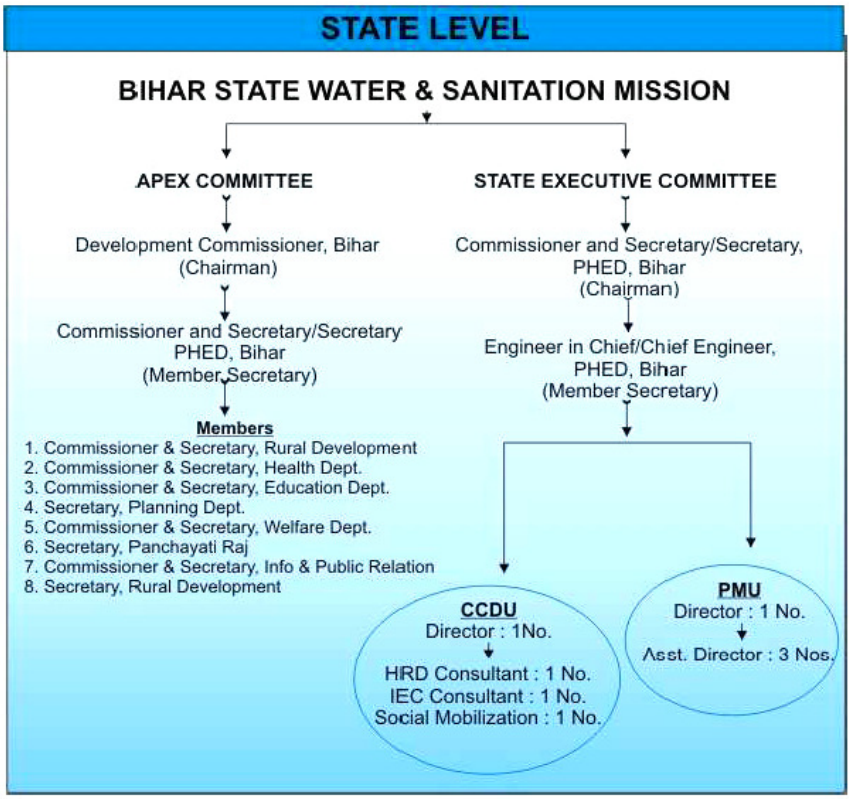


Figure 2.3 Organizational structure of the BSWSM

2.4.2 Power / Functions of the Mission

A. Governing Body

- Overall policy guidance & Co-ordination of programmes implemented by the District WATSAN missions / Zila Parishads.
- To ensure co-ordination with various departments, agencies and convergence of different activities related to water supply & sanitation in rural areas.
- To approve and sanction the Annual Plan, Budget and Audited Accounts.
- Make, alter and amend the objectives, rules and regulations by laws of the Mission, constitute committees from time to time as and when considered necessary for effective execution of the programmes and schemes.
- Delegate powers and function to the employees committees and the consultants of the missions.

B. Executive Body: Subject to the general control and supervision of the Government Body,

- Implement the policies / decision of the Government Body.
- Interact with GOI/RGNDWM and support the implementation of directly implement, various Rural Water Supply and Sanitation schemes and other

related activities as well as programmes funded by external donors like DFID, UNICEF, DANIDA etc.

- Liaise & Co-ordinate with various line departments, State Govt. & other sector partners and ensuring participation of the SHGs and the communities in different projects.
- Identify; mobilize NGO's to undertake work as per schemes notified by the Department of Rural Development.This would include providing technical assistance, guidance and training.
- Ensure establishment and constitution of Missions in the District Level and Panchayat Level.
- Ensure opening of separate Bank account at District Level and Panchayat Level.
- Organize meeting/ Workshop/ Study tours/ Seminars with involvement of all concerned prepare IEC/ Publicity materials for Sanitation and Sector reforms projects and other related activities.
- To promote adoption of demand driven & participatory approach, service delivery maximizing empowerment of villagers in decision making on the choice of service levels.
- Monitor and evaluate the implementation of the schemes by the various agencies including NGO's.
- Consider and approve the annual accounts ensuring proper auditing of the expenditure by competent authority.
- Undertake any other activities that are consistent with the aims & objectives of the Mission.

2.4.3 The Proposed Policy

Water Allocation Priorities

The order of priorities of water allocation for effective water resource management will be as follows:

1. **Priority rankings: from high to low**

- Drinking water for Human beings
- Drinking water for Livestock
- Other domestic, commercial and municipal water uses
- Agriculture
- Power generation
- Environmental and ecological Industrial Non-consumptive uses, such as cultural, leisure and tourist uses.
- Others *(Lowest priority)* any departure from the above priorities will require consideration on a case-by-case basis.

Drinking Water Supply

- The State Government will ensure the provision of adequate potable drinking water to every citizen, shifting from habitation based norms to family level water security. The service level for rural areas will be at least 70 lpcd.
- Formation of special task force with budgetary provisions to manage arsenic, fluoride and excess iron in drinking water.
- As a long term solution, cover all the habitations affected with arsenic, fluoride and iron with piped water supply in next five years
- Promotion of the principles of Reduce, Recycle and Reuse of water
- Sufficient funds and functionaries will be provided to PRI and Local Bodies for regulation and distribution of drinking water in villages, Tolas and towns.
- The capacities of PRIs and Urban bodies will be enhanced in a phased manner so that these institutions can regulate and distribute the drinking water.
- Drinking water needs of humans and livestock will be the first charge on any available water source.
- In multi-purpose Irrigation projects top priority will be given to drinking water.
- Future and existing irrigation and multi-purpose projects will include a drinking water component wherever there is no dependable alternative source of drinking water.

Optimizing Water Availability

- A comprehensive inventory of potential and actual water resources, perennial and ephemeral will be fully identified and quantified. Funds will be provided, on priority basis, to implement programmers of optimum water utilization.
- The watershed approach will be considered in planning of new irrigation projects.
- Basin, sub-basin, aquifer and State-level water resources development and environmental plans will be prepared with stakeholder participation.

Surface water

- Roof top rain water harvesting, storm-water harvesting, recycling and reuse of waste waters will be promoted in water stressed areas
- Efficient crop-water application and utilization practices shall be encouraged by adopting modern water conservation techniques.
- The economic and technical potential for the re-use of treated wastewater will be assessed in all basins.

Groundwater

- Exploitation of groundwater for agriculture and purposes other than drinking will be so managed by public participation so as not to exceed the average long-term recharge potential.

- The cost-effectiveness of various technologies, under varying conditions, for brackish groundwater will be explored. Pilot projects will be undertaken to evaluate these technologies under field conditions.
- Aquifer wise planning based on modern technology will be introduced and community organizations would be set up at village and aquifer level to plan and manage ground water resources with focus on drinking water supply

Project Planning and Implementation

- Water resources development projects will be prioritized on the basis of economic, social, environmental and financial criteria.
- Wherever possible, projects will integrate surface and ground water resources.
- Quantitative estimates of future water demands will be estimated by stakeholders with line-departments technical assistance.
- Public Private Partnership in development and management of water systems will be encouraged.

Source: for information regarding BSWSM (http://www.bswsmpatna.org/aboutbswsm.html) and for proposed policy http://www.bswsmpatna.org/Pdf%20file/Updated%20proposed%20draft%20for%20Drinking%20water%20and%20Sanitation.pdf Last accessed on February 13, 2013.

2.5 Converging departments

Departments which work together with BSWSM or PHED by joining or side by side in achieving water and sanitation related works are called as converging departments. As water and sanitation are basic requirements for human beings, support in different form and ways can be provided to fulfill the requirements. Hence many water and sanitation related targets will be seen in many departments and programs. Following are some of the important converging departments

2.5.1 Central Ground Water Board

The Central Ground Water Board is responsible for activities as mentioned below:

i. Hydrogeological Surveys: Central Ground Water Board carries out regional hydrogeological studies which provide information on ground water occurrence in different terrains and are essential for future planning of ground water development and management.

ii. Ground water Management Studies (GWMS): They are essential to update the scenario of ground water occurrence, availability and utilization in term of quality and quantity

iii. Ground water exploration aided by drilling: It is one of the major activities of the Board with an objective to discover aquifers in different hydrogeological conditions and determination of hydraulic parameters.

iv. Ground Water Monitoring: Ground water levels are being measured four times a year during January, April/ May, August and November by the Central Ground Water Board through observation wells.

v. Ground Water Resources Assessment: Quantification of ground water resources is one of the major inputs in planning ground water development and management. The resource assessment and the categorisation of assessment units forms a basis for implementing various ground water management plans and programmes.

vi. Ground Water Quality Monitoring: Monitoring of ground water quality is an effort to obtain information on chemical quality through representative sampling in different hydrogeological units. The chemical quality is being monitored by Central Ground Water Board once in a year.

2.5.2 Bihar State Pollution Control Board

Bihar State Pollution Control Board was constituted in the year 1974 under the provisions of the Water (prevention and Control of pollution) Act, 1974. Since inception Bihar State Pollution Control Board, like other State Boards has been performing its functions as enumerated under section 17 of the Water (Prevention and Control of Pollution) Act, 1974. Functions, so entrusted to the Board are:

1. Planning programme for prevention and control of pollution in the state;
2. Advising the State Government from time to time in the matters of pollution;
3. Collection and dissemination of information with regard to pollution control;
4. Conduction and participation in Research & Development (R&D) relating to water pollution;
5. Collaboration with Central Board in organizing training and mass awareness programme of grant of consent;
6. Inspection of Treatment plant and their review for the purpose;
7. Laying down standards of sewage and trade effluents;
8. Evolving economical and reliable methods of effluent treatment;
9. Evolving methods of utilisation of sewage and trade effluent for agriculture;
10. Evolving methods of disposal of sewage and trade effluents on land;
11. Laying down standards of treatment of sewage and trade effluent;
12. Making any suitable order concerning prevention and control of discharges of effluent into streams or concerning construction of systems for their disposal;
13. Laying down effluent standards to be observed by any person causing discharge of sewage or sludge;
14. Advising the State Government with respect to the location of any industry;
15. Performing such other functions, as may be prescribed by the Central Board of the State Government; and
16. Establishment or recognition of laboratories for the analysis of discharges of effluent.

Besides this there are many converging departments mentioned below

- Primary and Secondary Health Centres,

- Minor Irrigation Dept.
- Water Resources Dept.
- Dept. of Agriculture,
- Dept. of Rural Development
- Panchayati Raj Institutes (Gram Panchayat, Block Development Officie, Zilla Parishad etc.)

2.6 Proposed World Bank Assisted Project

The proposed World Bank assisted RWSS project would aim to scale up demand responsive and decentralized service delivery approach across the state. The project will cover all the 38 districts in Bihar.

A unique feature of the proposed project is its bottom up planning process through decentralization and devolution of powers, where-in the Panchayat Raj institutions and the local communities are actively involved in all stages of development of the project and its implementation including O&M of the facilities created under the project.

The key objectives of the proposed project are:

a) To improve the quality of rural water supply and sanitation services and to achieve Sustainable development, Poverty reduction, Sustainable health and hygiene benefits to the rural population, Empowerment and inclusion of community in general and rural poor and women in particular, and Strengthening the decentralization process.

b) To promote the long term sustainability of the rural water supply and sanitation sector by identifying and implementing an appropriate policy framework and strategic plan.

These objectives will be achieved through:

- Adopting a demand responsive approach and use of participatory process for delivery of sustainable service to project communities,
- Phased implementation of appropriate policy and institutional reforms for changing role of the government from provider to facilitator,
- Community and Village Panchayat capacity building, Women's development initiatives built into the project, Targeted Tribal Development Plan.
- Construction and up-gradation of drinking water supply, drainage and sanitation schemes, including water quality monitoring programs, Groundwater recharge and rainwater harvesting will be integral parts of drinking water source development.
- This will also involve promoting integrated water resource management, and Establishing financial viability and sustainability of rural water supply and sanitation services.

3. Baseline Environmental Status

3.1 Introduction

This chapter provides a detailed description of the existing environmental conditions and status of the state of Bihar, with special attention paid to the 4 representative districts that were selected for field surveys. These districts include Begu Sarai, Nawada, Purnea and West Champaran.

3.2 Brief profile of State

Bihar, the land locked state, lies in the eastern part of the country between 83 -30' to 88 -00' longitude. The state shares its international border with Nepal in the North and state borders with Jharkhand in the South, West Bengal in the East and Uttar Pradesh in the West. The River Ganga flows from west to east through the state and divides the plains of Bihar into two unequal halves[9].

The state (old Bihar state) was bifurcated in the year 2000 into the present Bihar and Jharkhand state. The total area of the state is 94,163 sq kms, out of which around 97% is rural and only 3% is urban area. Administratively the state is divided into 9 divisions and 38 districts.

Table 3.1 Key statistics of Bihar[10]

Key Statistics - as per 2011 Census (Provisional)			
1	Population		10,38,04,637
2	Literacy	In Absolute Numbers	5,43,90,254
		Male	3,27,11,975
		Female	2,16,78,279
3	Percentage of Population	Total	63.82%
		Male	73.39%
		Female	53.33%
4	Decadal Population Growth (2001-2011)	Absolute	2,08,06,128
		As Percentage	25.07%
5	Highest Decadal Growth at		Madhepura District (30.65%)
6	Lowest Decadal Growth at		Gopalganj District (18.83%)
7	Density of Population		1,102 per sq kms
		Highest Density	Sheohar, 1882 per sq kms
		Lowest Density	Kaimur, 488 per sq kms
8	Most Populous District		Patna: 57,72,804
9	Least Populous District		Sheikhpura: 6,34,927
10	Sex Ratio (Females/Thousand Males)		916
		Highest Ratio	(Gopalganj) 1,015
		Lowest Ratio	(Munger and Bhagalpur) 879
11	Highest Literacy Rate		Rohtas, 75.59%

9 http://gov.bih.nic.in/Profile/default.htm
10 ibid

Key Statistics - as per 2011 Census (Provisional)		
12	Lowest Literacy Rate	Purnia, 52.49%
13	Average Population of a District	27,31,701

Figure 3.1 Map showing districts of Bihar state[11]

3.3 Physical Environmental

3.3.1 Location

Bihar is located in the eastern part of the country (between 83 -30' to 88 -00' longitude) and is an entirely land–locked state. The nearest outlet to the sea is through the port of Kolkata. Bihar is situated mid-way between the humid West Bengal in the east and the sub-humid Uttar Pradesh in the west which provides it with a transitional position in respect of climate, economy and culture. It is bounded by Nepal in the north and by Jharkhand in the south. The Bihar plain is divided into two unequal halves by the river Ganga which flows through the middle from west to east.

3.3.2 Geomorphology

The geomorphology of an area is based on broad parameters such as relief, drainage pattern and geology. The three geomorphic domains are such as:[12]

11 Source: http://www.imd.gov.in/section/nhac/distforecast/bihar.htm
12 State of the Environment Report, Bihar (2007)

(i) Uplifted block of hilly southern highlands comprising the northern part of the Kodarma- Santhal Pargana planation surface, falling in parts of Bihar, northern fringe or escarpment of Chotanagpur plateau and Rohtas plateau

(ii) The transition zone between the southern highlands and the Great Ganga Plains, constituting the central Bihar Plains, and

(iii) The Ganga foredeep of the North Bihar Plains bounded by the rising Himalaya in the north and the Ganga R. in the South.

The geomorphic units (ii) and (iii) constitutes the part of Middle Ganga basin. The Southern hills demarcate the Mid-Ganga basin along the 150 m contour.

Rohtas Plateau: This plateau rises sharply above Sone river to an height of over 500 m above msl. This plateau slopes down to the north and manifests steep faulted escarpment to the south.

Koderma Santhal Pargana Plateau: This plateau has a gentler easterly slope into the Santhal Pargana plains, which has elevation in the range of 150-300 m above msl except for isolated hills.

Indo-Gangetic Plains : The Ganga foredeep basin as a whole and the river systems e.g. Gandak-Son, Ganga-Gandak & Kosi in particular have been studied in an effort to evaluate the alluvial geology and cause of natural disaster and other hazards

The figures below state the soil profile of the selected districts in Bihar.

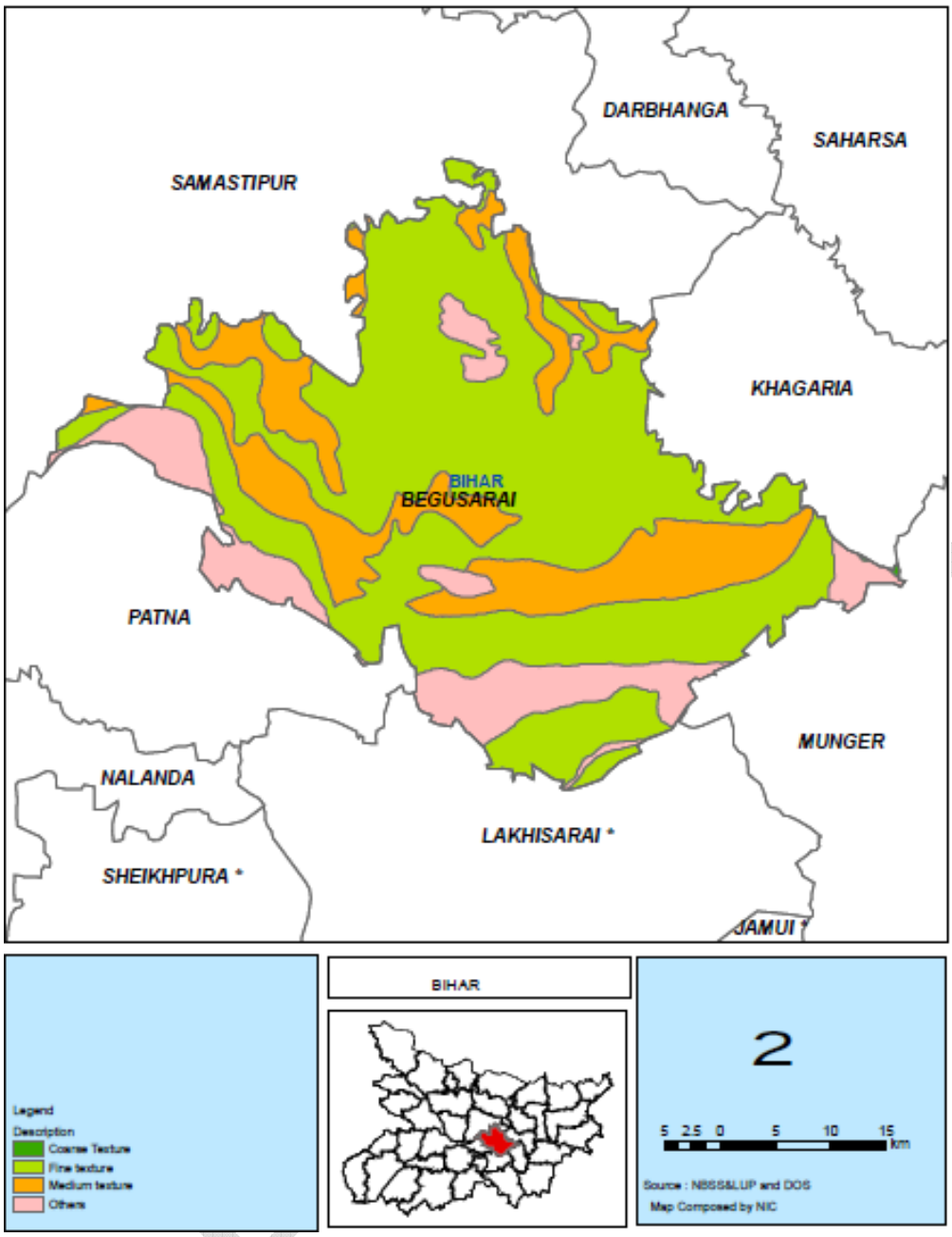


Figure 3.2 Soil Profile of Begusarai district[13]

13 Source: http://gisserver.nic.in/atlas/dsect.asp

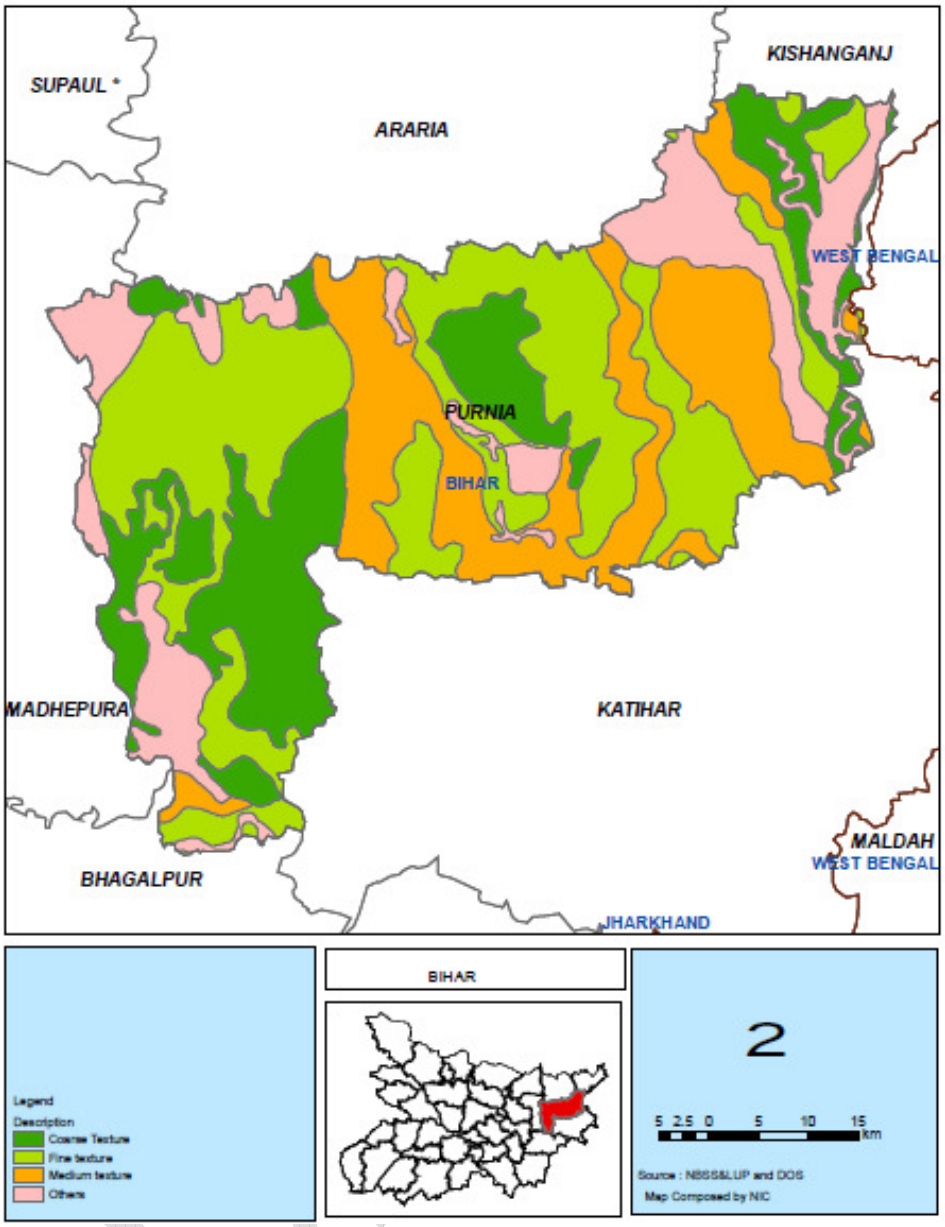


Figure 3.3 Soil Profile of Purnia district[14]

14 http://gisserver.nic.in/atlas/dsect.asp

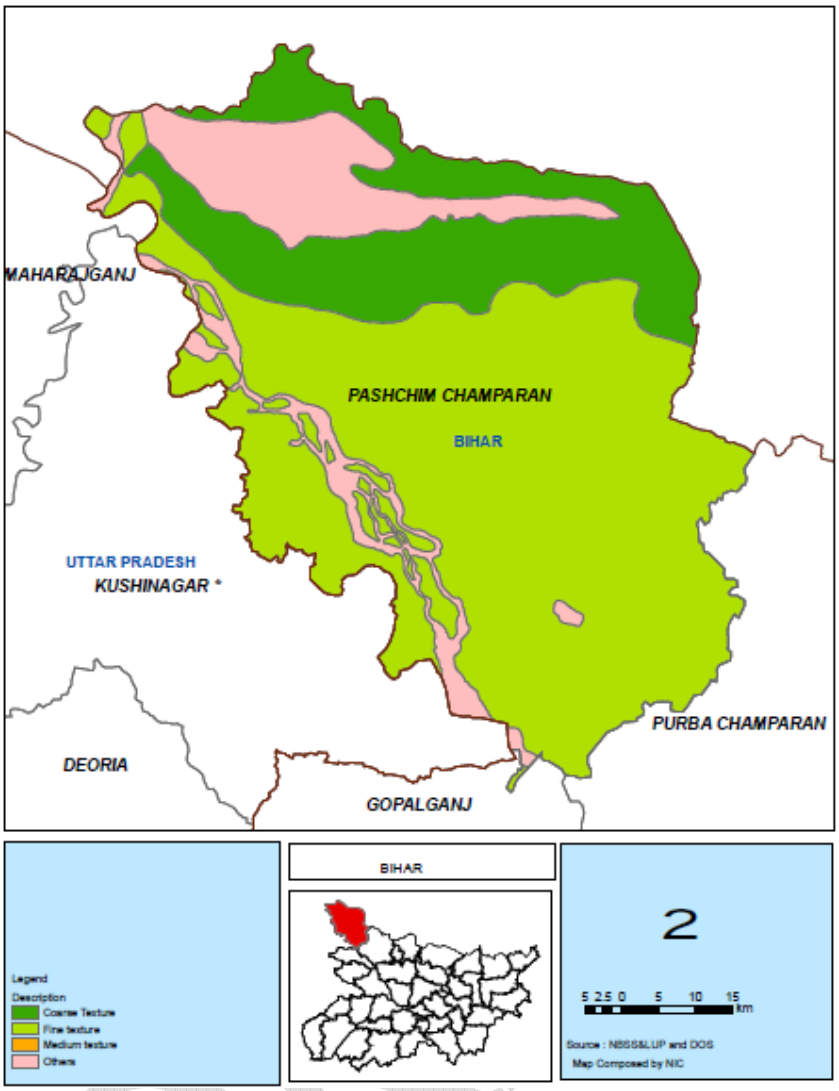


Figure 3.4 Soil Profile of West Champaran district[15]

15 http://gisserver.nic.in/atlas/dsect.asp

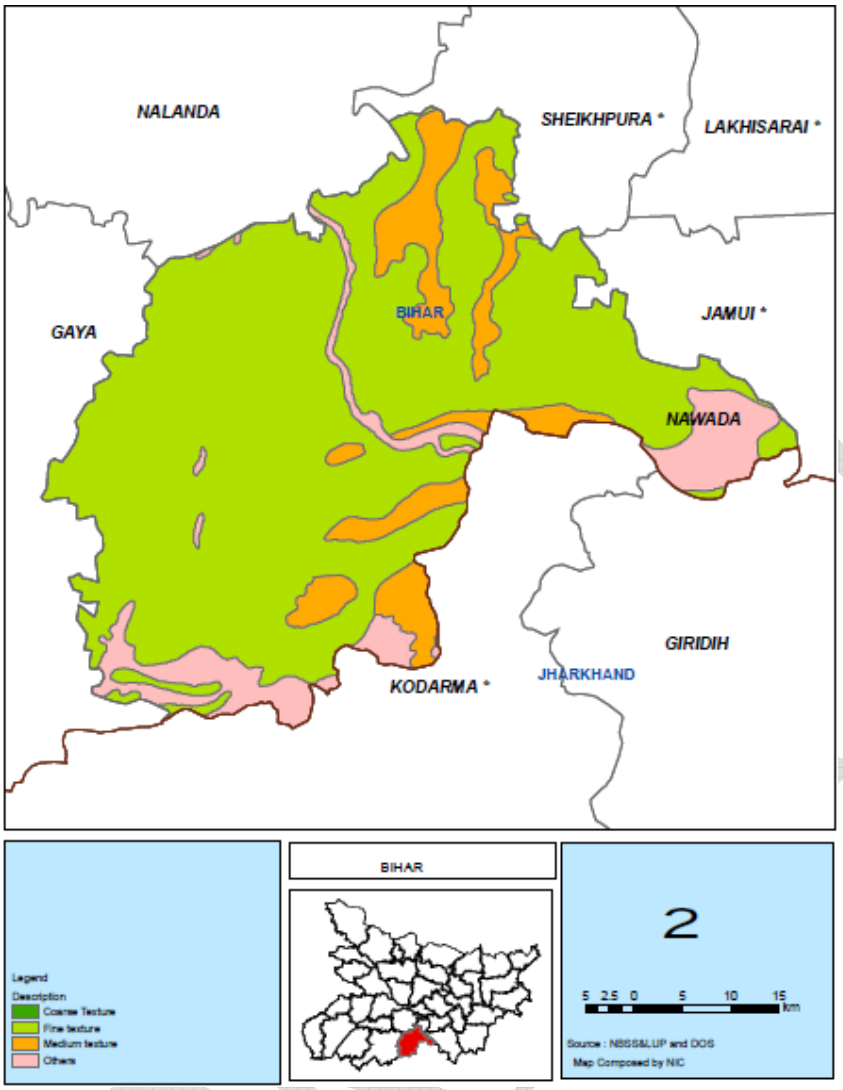


Figure 3.5 Soil Profile of Nawada district*16*

3.3.3 Ecologically Sensitive Areas

The state of Bihar is well endowed with natural vegetation and wildlife. The recorded forest area (as compared to total geographical area) is 6.87%. There are currently 11 sanctuaries, 1 national park and a total of 3,208.47 km^2 of protected forest area.[17] Details of protected areas of the state are shown in the table below:

16 http://gisserver.nic.in/atlas/dsect.asp
17 Environment and Forest Department, Government of Bihar <http://forest.bih.nic.in/>

Table 3.2 Names and locations of protected areas in Bihar[18]

Nr.	Name of Park/Sanctuary	District	Type
1	Barela SAZS Sanctuary	Vaishali	Sanctuary
2	Bhimbandh Sanctuary	Monghyr	Sanctuary
3	Gogabil Pakshi Vihar	Katihar	Closed Area
4	Gautambuddha Sanctuary	Gaya	Sanctuary
5	Kaimur Sanctuary	Rohtas	Sanctuary
6	Kanwar Jheel Bird Sanctuary	Begusarai	Sanctuary
7	Kusheshwarsthan	Darbhanga	Closed Area
8	Nagi Dam Bird Sanctuary	Jamui	Sanctuary
9	Nakti Dam Bird Sanctuary	Jamui	Sanctuary
10	Rajgir Sanctuary	Nalanda	Sanctuary
11	Sanjay Gandhi Botanical Garden	Patna	Botanical Garden
12	Udaypur Sanctuary	West Champaran	Sanctuary
13	Valmiki National Park	West Champaran	National Park
14	Valmiki Sanctuary	West Champaran	Sanctuary
15	Vikramshila Gangetic Dolphin	Bhagalpur	Sanctuary

3.3.4 Climate and Rainfall

Bihar has a continental monsoon type of climate. It is located in tropical to sub-tropical zone. The Himalayas Mountains in the north significantly affect the distribution of monsoon rainfall in the state. Bihar experiences the four seasons: the seasons and their duration are mentioned below[19].

- Cold Weather season extends from December to February
- Hot weather season extends from March to May
- Southwest monsoon extends from June to September
- Retreating southwest monsoon extends from October to November

Rainfall Pattern in Bihar

The figure below illustrates that the state receives the maximum rainfall in the southwest Monsoon which extends from June to September. As, shown in the decadal variation of Rainfall, the trend in the average annual rainfall is seen to be decreasing over the last hundred years.

18 Government of Bihar, ibid
19 http://gov.bih.nic.in/Profile/climate.htm#pagetop

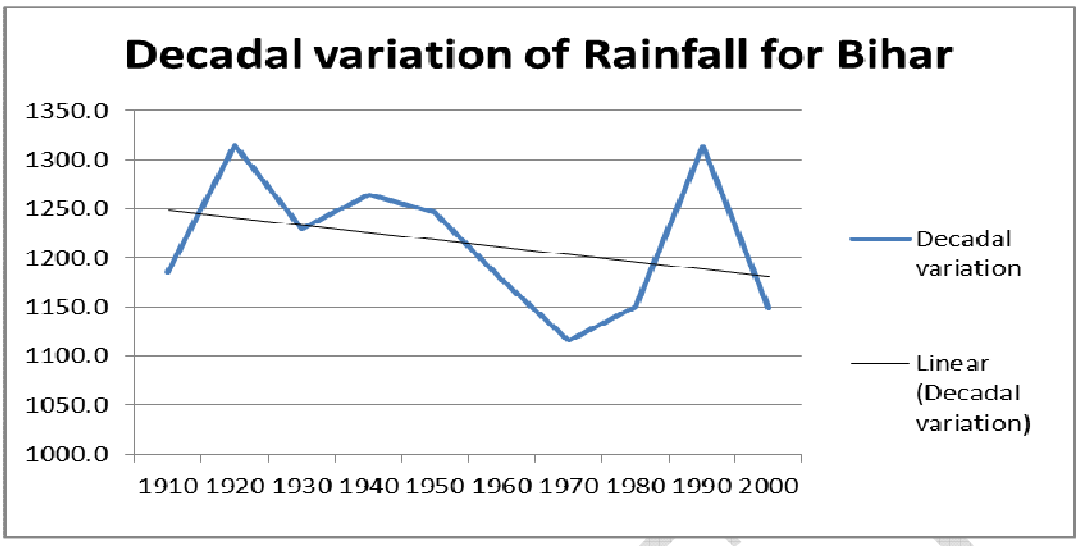


Figure 3.6 Decadal variation of Rainfall of Bihar state

Temperature trend in Patna: the monthly mean maximum and minimum temperature for Patna is shown below. It 50 year data averaged monthly demonstrates the warmest months from April till July.

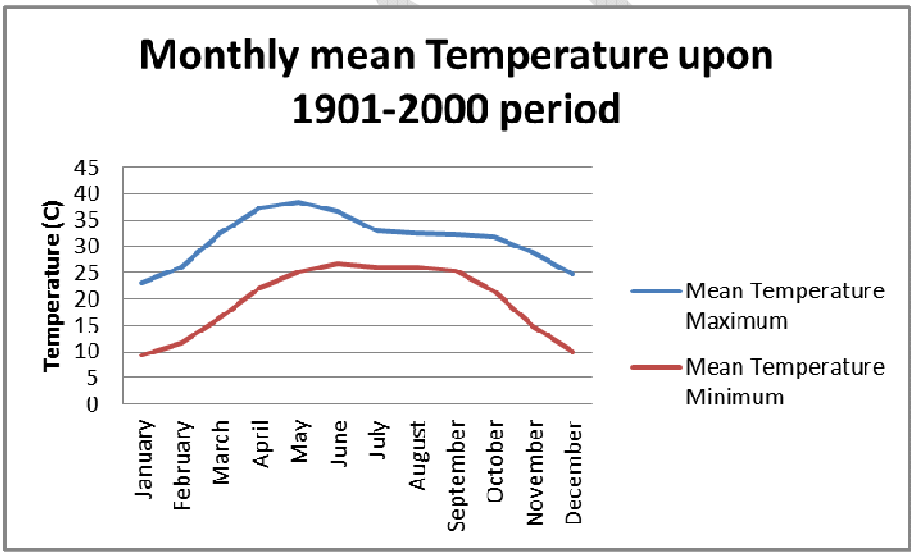


Figure 3.7 Monthly mean maximum and minimum temperatures during 1901-2000 period in Patna.

3.3.5 Demographic Status

Bihar is the third most populous state in India after Uttar Pradesh and Maharashtra. According to the provisional population by census 2011, the population of the Bihar is 10.38 crore, out of which around 5.3 crore are males and 4.96 crore are females. A slight decrease in the percentage decadal growth from 1991-2001 to 2001-2011 was observed

i.e. the decadal population growth was 28.6% and 25.1% in 1991-2001 and 2001-2011 respectively.

The total literate population in the state is 5.4 crore out of 10.38 crore in 2011, out which 3.2 crore men and 2.1 crore females are literate. The literacy rate in the state has shown improvements over the past decade. In 2001, out of the total population only 47% people were literate which has increased to 63.82% in 2011. The percentage of males and females literate has also increased over the same period. In 2001, 59.68% males and 33.12% females were literate which has increased to 73.39% males and 53.33% females respectively.

The sex ratio of Bihar state has slightly decreased from 919 in 2001 to 916 in 2011. The statistics shows an increase in the population density from 881 to 1102 from 2001 to 2011 respectively.

Table 3.3 Population of 38 districts of Bihar by sex and percentage share in the total population[20]

Population of State/Districts by sex and percentage share of population in total population					
District Code	State/Districts	Total Population			Percentage share in total population
		Persons	Males	Females	
	Bihar	103,804,637	54,185,347	49,619,290	100
1	Pashchim Champaran	3,922,780	2,057,669	1,865,111	3.78
2	Purba Champaran	5,082,868	2,674,037	2,408,831	4.9
3	Sheohar	656,916	347,614	309,302	0.63
4	Sitamarhi	3,419,622	1,800,441	1,619,181	3.29
5	Madhubani	4,476,044	2,324,984	2,151,060	4.31
6	Supaul	2,228,397	1,157,815	1,070,582	2.15
7	Araria	2,806,200	1,460,878	1,345,322	2.7
8	Kishanganj	1,690,948	868,845	822,103	1.63
9	Purnia	3,273,127	1,695,829	1,577,298	3.15
10	Katihar	3,068,149	1,601,158	1,466,991	2.96
11	Madhepura	1,994,618	1,042,373	952,245	1.92
12	Saharsa	1,897,102	995,502	901,600	1.83
13	Darbhanga	3,921,971	2,053,043	1,868,928	3.78
14	Muzaffarpur	4,778,610	2,517,500	2,261,110	4.6
15	Gopalganj	2,558,037	1,269,677	1,288,360	2.46
16	Siwan	3,318,176	1,672,121	1,646,055	3.2
17	Saran	3,943,098	2,023,476	1,919,622	3.8
18	Vaishali	3,495,249	1,847,058	1,648,191	3.37
19	Samastipur	4,254,782	2,228,432	2,026,350	4.1
20	Begusarai	2,954,367	1,560,203	1,394,164	2.85
21	Khagaria	1,657,599	880,065	777,534	1.6
22	Bhagalpur	3,032,226	1,614,014	1,418,212	2.92
23	Banka	2,029,339	1,064,307	965,032	1.95

20 Source: Census of India, 2011

Population of State/Districts by sex and percentage share of population in total population					
24	Munger	1,359,054	723,280	635,774	1.31
25	Lakhisarai	1,000,717	526,651	474,066	0.96
26	Sheikhpura	634,927	329,593	305,334	0.61
27	Nalanda	2,872,523	1,495,577	1,376,946	2.77
28	Patna	5,772,804	3,051,117	2,721,687	5.56
29	Bhojpur	2,720,155	1,431,722	1,288,433	2.62
30	Buxar	1,707,643	888,356	819,287	1.65
31	Kaimur (Bhabua)	1,626,900	847,784	779,116	1.57
32	Rohtas	2,962,593	1,547,856	1,414,737	2.85
33	Aurangabad	2,511,243	1,310,867	1,200,376	2.42
34	Gaya	4,379,383	2,266,865	2,112,518	4.22
35	Nawada	2,216,653	1,145,123	1,071,530	2.14
36	Jamui	1,756,078	914,368	841,710	1.69
37	Jehanabad	1,124,176	586,202	537,974	1.08
38	Arwal	699,563	362,945	336,618	0.67

3.3.6 Agriculture

Bihar has a total geographic area of 234 Lakh Acres. Out of this the majority of land comes under net cultivated area, amounting to 60.03%, which indicates that Bihar is a primarily agricultural state. However, the agriculture is prone to natural disasters, particularly floods in northern parts of Bihar and droughts in the south. Based on soil characterization, rainfall, temperature and terrain, four main agro-climatic zones in Bihar have been identified. These are: Zone-I, North Alluvial Plain, Zone-II, north East Alluvial Plain, Zone-III A South East Alluvial Plain and Zone-III B, South West Alluvial Plain, each with its own unique prospects.

Table 3.4 Status of land utilization in Bihar

Item	Current status (Lakh Acre)
Total geographical area	234
Forest	15.55
Land put to non-agricultural use	41.15
Barren and uncultivated land	10.9
Permanent pastures	0.425
Land under miscellaneous trees and groves	5.975
Culturable wasteland	1.15
Current fallow land	3.3
Other fallow land	15.075
Net cultivated area	140.475

The principal agricultural crops of Bihar include rice, paddy, wheat, jute, maize and oil seeds. Amongst horticulture products, cauliflower, cabbage, tomato, radish, carrot, beat etc. are some of the vegetables grown in the state. Sugarcane, potato and barley are some of the non-cereal crops grown. The entire agricultural operations are divided into two

crop seasons Kharif and Rabi. The Kharif season starts from the third week of May and lasts till the end of October followed by the Rabi season.[21]

Figure 3.8 Agricultural practices and distribution of major crops in Bihar[22]

3.4 Water Resources of Bihar

3.4.1 Surface water resource

Ganga is the main river in the state which receives tributaries like Saryu, Gandak, Budhi-Ganda, Kamla-Balan, Mahananda, etc. These rivers join the Ganges from the north.

While other rivers like Sone, UttariKoyal, Punpun, Panchane and Karmnasha start from the plateauarea and meet in Ganges or its associate rivers from the south.

River in the state is the source of water for domestic, irrigation, industries and hydro-thermal power production. Also, it is a medium for water transport, a source of livelihood for fishery industry and recharges the underground water.

The map below presents major river basins flowing in the state of Bihar

21 Department of Agriculture, Govt of Bihar <http://www.krishi.bih.nic.in/introduction.html>
22 ibid

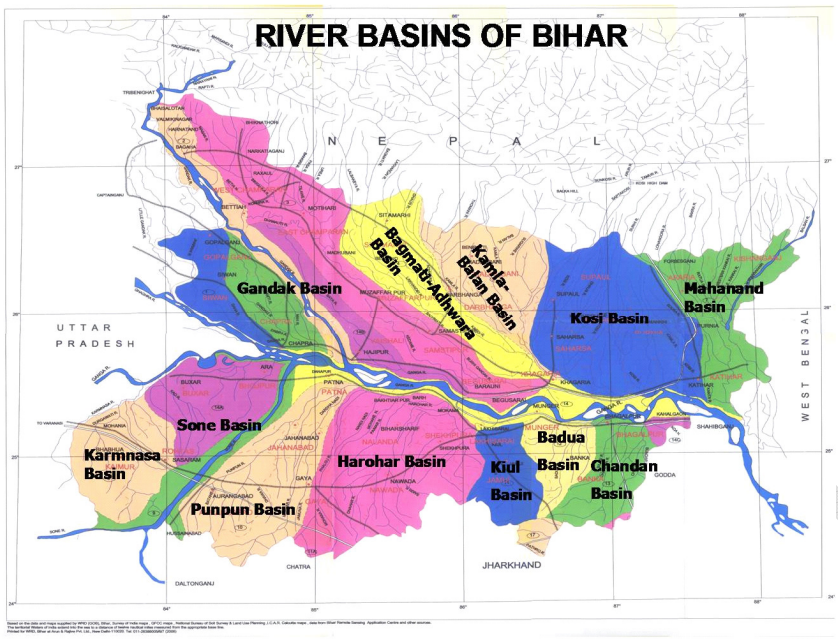


Figure 3.9 Major river basins flowing in the state of Bihar

The Ganges in Bihar

Ganga is the major river basin of the state. It has the maximum catchment area and length of flow in the state. River Ganga is a snow fed and has its source at Gaumakh in the southern Himalayan Glaciers on the Indian side of the Tibetan border. It crosses few cities in Uttar Pradesh and enters in the boundary of Bihar at Chausa, near Buxar after its confluence with Karmanasa. It is joined by the three great effluents - the Ghaghra, the Gandak, and the Son and their tributaries in Patna district. Further Punpun joins it at Fatuha in Patna district; Koshi joins it at Khagaria district while the Harohar and the Kiul join it near Surajgarha, Distrct - Lakhisarai. It passes through the cities& towns like Patna, Barh, Mokama, Begusarai, Munger, Khagaria, Bhagalpur, Kahalgaon, Pirpainti, in Bihar and exit to Sahebganj in Jharkhand and then to West Bengal.

Tributaries of Ganga River in Bihar

GHAGHARA

Ghaghara is a perennial trans-boundary river, originating from the Tibetan Plateau near Lake Mansarovar in Nepal. It is a major left bank and largest tributary of the Ganges. After meeting with tributaries in Uttar Pradesh it enters into Bihar near Guthani of Siwan district and joins Ganga at Revilganj (Chapra) in district Saran. It carries more water than the Ganges before its confluence. Towns of Ghaghra River catchment area are Siwan, Saran (Chapra) and Sonepur in Bihar.

GANDAK

The Gandak river originates from melting of snow, glaciers and from lakes of Himalayan streams in Nepal and its border with Tibet, which contribute substantially to

the lean season flows of the river. It enters into Bihar at the Indo-Nepal border Triveni (in Nepal) and Valmikinagar in Baghasub division of District-West Champaran, Bihar. The Gandak flows through West Champaran, East Champaran, Gopalganj, Saran, Muzaffarpur and Vaishali districts. It joins the Ganges near Patna just downstream with one of river bank at near KaunharaGhat, Hajipur, District-Vaishali and another at near Hariharnath Mandir, Sonepur, District-Saran.

SONE

The Sone originates from the hills of Madhya Pradesh near Amarkantak. After flowing through the states Madhya Pradesh, Uttar Pradesh and Jharkhand it enters to Bihar, near south of District - Kaimur. It passes through Aurangabad, Rohtas, Daudnagar (Jahanabad), Koilwer, and rural areas of Patna district and finally joins the Ganges in downstream of Chapra, nearby Doriganj, Distrct - Saran.

PUNPUN

The Punpun River is a tributary of the Ganges. It originates in Palamu district of Jharkhand and flows through Chatra (Jharkhand), Aurangabad, Gaya and Patna districts of Bihar. The river joins the Ganges at Fatuha, 25km downstream of Patna. The river is mostly rain fed and carries little water in the dry season, however, during rains the Punpun often causes heavy flood in the Patna area.

KOSI

The Kosi is a trans-boundary river flowing through Nepaland India. In Nepal it emerges from the mountains with other tributaries and becomes the Koshi. After flowing through Biratnagar& other places in Nepal it enters into Bihar near Bhimnagar, district Supaul and after flowing approx. 260 km joins the Ganges near Kursela, district Katihar.

It is a river of unstable nature and shifts its course frequently. The river, which flowed near Purnea in the earlier, now flows west of Saharsa. Its unstable nature has been attributed to the heavy silt carried during the monsoon season. Koshi has been the main responsible river for extreme flooding in Bihar. For this reason, the Koshi River is known as “The Sorrow of Bihar” as it has been causing huge damage of lives and property through flooding and very frequent changes in course. The worst flood affected districts includes Supaul, Araria, Saharsa, Madhepura, Purnea, Katihar, parts of Khagaria and northern parts of Bhagalpur, as well as adjoining regions of Nepal also.

BAGMATI

The Bagmati originates from Shivapuri Hills about few kms from Kathmandu in Nepal. It is a rain fed river and passes the center of Kathmandu, Tarai then enters into India near Dheng, district Sitamarhi, Bihar. It flows across Sitamarhi, Sheohar, Muzaffarpur and Darbhanga districts. Main tributaries of this river are Manusmar, Lakhandei and KamlaBalan. It finally joins Budhi-Gandak near Hayaghat,District-Darbhanga.

BUDHI GANDAK

The Budhi-Gandak originates from ChautarwaChaur near Bisambharpur, West Champaran, Bihar. It is a rain fed river and flows through West Champaran, East Champaran, Muzaffarpur, Samastipur, Begusarai and ultimately flows in to the Ganges in Khagaria. This river initially is known as Sikrahana River uptoLalbagiaGhat, East

Champaran. From it's downwards journey it is known as Budhi-Gandak. The main tributaries of this river are Ramrekha, Harboura, Kohra, Sirisia and Bagmati.

MAHANANDA

Mahananda River is one of the tributaries of the Ganga. The origin of this mighty Mahananda River is hills of Darjeeling, West Bengal. The Mahananda River flows through Siliguri, then enters to Thakurganj, District-Kishanganj, Bihar and flows through the fertile agricultural area of Purnea&Katihar and then leaves to West Bengal. The Mahananda River is mainly rain fed in the monsoon and flood also occurs by this river. It has a low water level during the summer or winter.

FALGU RIVER

Falgu River has historical importance as Gaya is located on the bank of this river. Falgu is not a separate river. It finds its existence by combination of Niranjana and Mohanarivers. Niranjana originates from Simaria region of western Hazaribagh District of Jharkhand. Mohana River also originates from Shila village region of Hazaribagh District .Niranjana joins Mohanariver in downstream of Bodh Gaya and known as Falgu River in it's downwards journey. It is rain fed river and almost find dry in summer season.

Table below presents river basins in Bihar along with their length, flood prone area and protected area.

Table 3.5 Details of river basins in Bihar

Name of the Basin	Catchment Area	Length of River in Bihar	Embankment Constructed	Flood Prone Area	Protected Area
	(Sq. Km)	(Km)	(Km)	(Sq.Km)	(Sq. Km)
Ganga	19322	445	596.92	12920	4300
Kosi	11410	260	387.51	10150	9300
BurhiGandak	9601	320	704.26	8210	4010
KiulHarohar	17225		14	6340	NIL
Punpun	9026	235	37.62	6130	260
Mahananda	6150	376	225.33	5150	1210
Sone	15820	202	59.54	3700	210
Bagmati	6500	394	400.79	4440	3170
KamlaBalan	4488	120	184.9	3700	2810
Gandak	4188	260	511.66	3350	3350
Ghaghra	2995	83	132.9	2530	790
Chandan	4093	118	83.18	1130	80
Badua	2215	130	NIL	1050	NIL
Lalbakeya			54.35		
Adhwara			181.5		
Bhuthi			54.7		
Total			**3629.16**	**68800**	**29490**

Other surface water bodies in surveyed/sampled districts

District: Purnia

The district lies in the Gangatic Alluvial Plain. Purnia district is a part of Purnia Division. The river Kosi is the extreme west boundary of the district. The Mahananda forms the boundary between Purnia and Bengal. The Ganga forms the southern boundary of the district. The district extends from the Ganges river northwards to the frontier of Nepal. Geo-coordinates are N-E26 06'40"/ 86 59'28" and S-W 25 25'40"/87 52'23". Total area is 3229.23 km2 and has population 18,78,885 (Census).

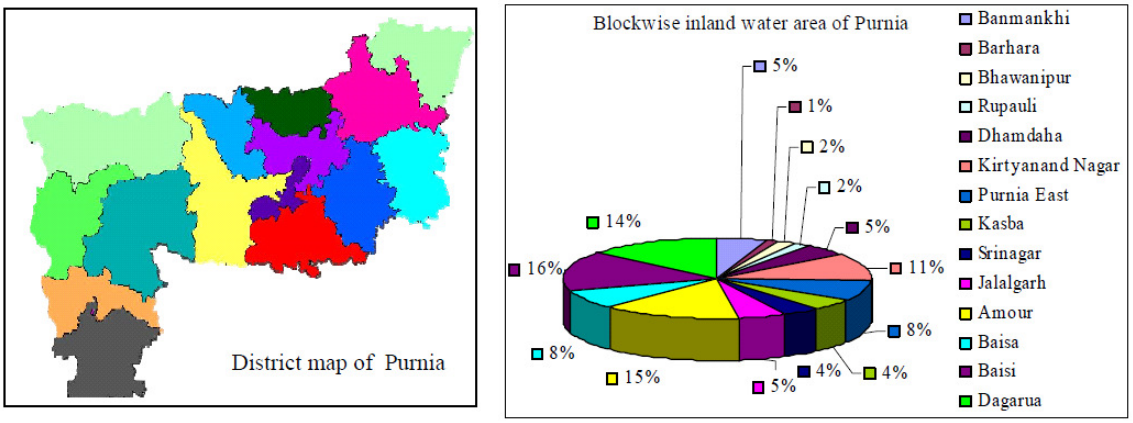


Figure 3. 10 showing district map and blockwise inland water area in Purnia district

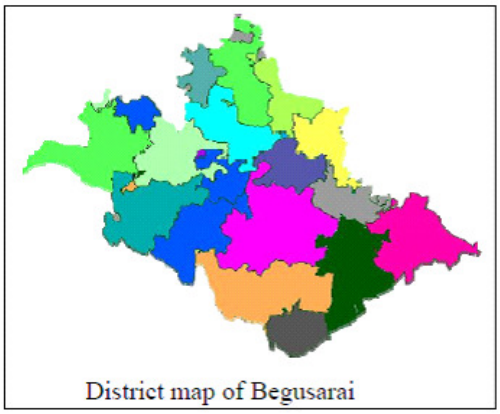
Table 3.6 Block-wise distribution of water bodies

S. No.	Block ID Code (Census 2001)	Block name	No. of water bodies	Area of water bodies (ha)
1	0001	Banmankhi	130	149.24
2	0002	Barhara	31	32.86
3	0003	Bhawanipur	41	53.17
4	0004	Rupauli	18	56.72
5	0005	Dhamdaha	91	138.65
6	0006	Kirtyanand Nagar	146	311.65
7	0007	Purnia East	101	236.68
8	0008	Kasba	85	127.14
9	0009	Srinagar	74	117.16
10	0010	Jalalgarh	78	137.27
11	0011	Amour	200	413.91
12	0012	Baisa	68	222.34
13	0013	Baisi	162	451.7
14	0014	Dagarua	115	401.34
	Total		**1340**	**2849.83**

District: Begusarai

Begusarai was formed in the year 1972. Begusarai is situated in the middle of NorthBihar and is surrounded on the north by Samastipur, on the south by Ganga and

Lakhisarai district, on the east by Khagaria and Munger, on the west by Samastipur and Patna district. Geocoordinates of the district are N-E 25 46'29"/ 85 44'30" and S-W 25 15'01"/86 30'45". Total area is 1912.79 km2.



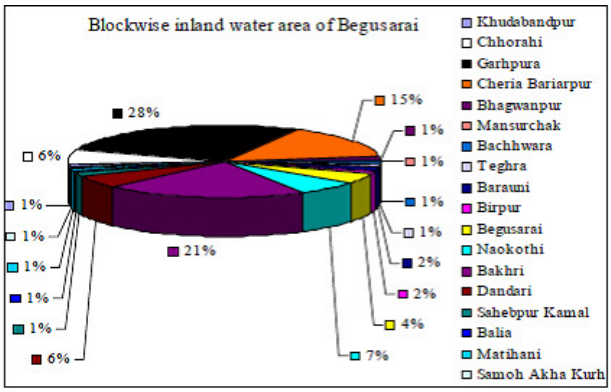


Figure 3.11 showing district map and blockwise inland water area in Begusarai district

Table 3.7 Block-wise distribution of water bodies

S. No.	Block ID Code (Census 2001)	Block name	No. of water bodies	Area of water bodies (ha)
1	0001	Khudabandpur	18	54.11
2	0002	Chhorahi	44	247.05
3	0003	Garhpura	24	1105.04
4	0004	CheriaBariarpur	28	597.28
5	0005	Bhagwanpur	22	48.42
6	0006	Mansurchak	17	33.71
7	0007	Bachhwara	14	51.29
8	0008	Teghra	15	27.52
9	0009	Barauni	19	75.02
10	0010	Birpur	10	74.08
11	0011	Begusarai	37	157.37
12	0012	Naokothi	16	267.91
13	0013	Bakhri	56	825.56
14	0014	Dandari	12	225.11
15	0015	Sahebpur Kamal	5	58.16
16	0016	Balia	5	30.23
17	0017	Matihani	4	34.50
18	0018	SamohAkhaKurh	3	27.01
	Total		**349**	**3939.37**

District: Nawada

Nawada town is the administrative headquarters of this district. It is located in between N-E 25 06'54"/ 85 16'34" and S-W 24 31'18"/86 03'10". Total area is 2484.91 km2

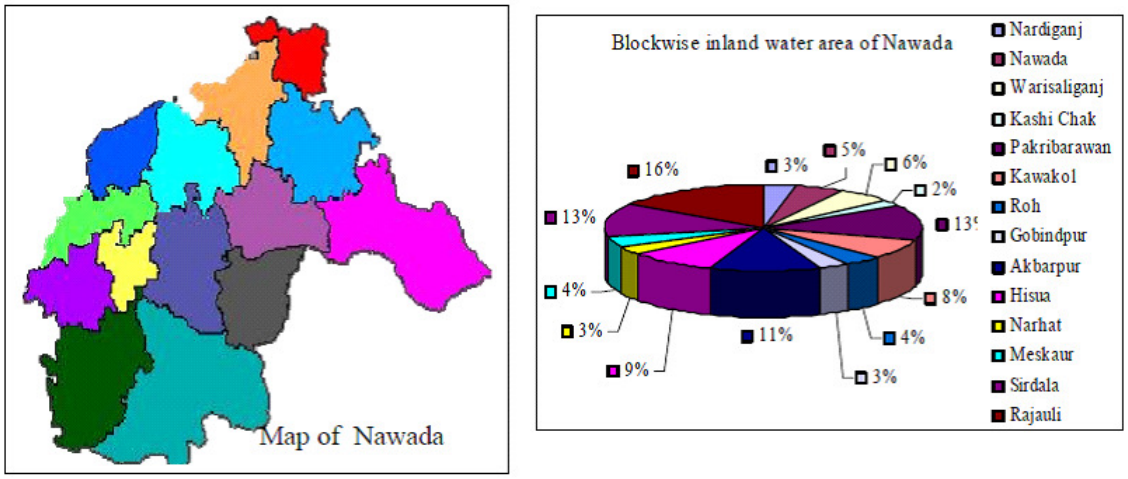


Figure 3.12 showing district map and blockwise inland water area in Nawada district

Table 3.8 Block-wise distribution of water bodies

S. No.	Block ID Code (Census 2001)	Block name	No. of water bodies	Area of water bodies (ha)
1	0001	Nardiganj	44	138.02
2	0002	Nawada	68	205.75
3	0003	Warisaliganj	62	226.5
4	0004	KashiChak	40	88.78
5	0005	Pakribarawan	129	544.99
6	0006	Kawakol	88	313.03
7	0007	Roh	57	158.33
8	0008	Gobindpur	20	127.33
9	0009	Akbarpur	84	454.08
10	0010	Hisua	70	363.93
11	0011	Narhat	36	134.09
12	0012	Meskaur	44	151.44
13	0013	Sirdala	106	524.33
14	0014	Rajauli	37	644.14
	Total		**885**	**4074.74**

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3.4.2 Groundwater

Based upon geological diversities, geomorphological set up and relative groundwater potentialities, hydrogeologically, the various litho-units of the State can be grouped as

- Unconsolidated / Alluvial formation,
- Semi-consolidated formations and
- Consolidated/fissured formations

The main alluvial tract covers entire north Bihar and a sizeable area south of the Ganga River. These alluvial formations constitute prolific aquifers where the tubewell can yield between 120-247 m3/hr. The potential of these aquifers decreases due south in the marginal tract. Auto flow conditions occur in the sub-Tarai region of Madhubani, Sitamarhi and West Champaran districts. In the hard rock areas of South Bihar, borewells located near lineaments/fractures can yield between 10-50 m3/hr.

Table 3.9 Details of groundwater resources of Bihar state

Dynamic Ground Water Resources	
Annual Replenishable Ground water Resource	29.19 BCM
Net Annual Ground Water Availability	27.42 BCM
Annual Ground Water Draft	10.77 BCM
Stage of Ground Water Development	39%

As shown in the table above, the stage of ground water development is only 39%, which when compared to the CGWB categorization of assessment units i.e. (<=70% is 'safe') is below the threshold of concern (over exploited, critical and semi-critical). Out of 533 assessment units (blocks), 529 have been categorized as Safe and 4 blockshave been categorized as Semi-critical. Though the ground waterdevelopment is comparatively low in major part of the State, the higherdevelopment areas are mostly located in isolated patches.

The drilling data of CGWB indicates presence of potential aquifer down to a depth of 300 m bgl in the northern part of South Ganga alluvial plain and in major part of North Ganga alluvial plain.

Table 3.10 Details of Stage of Development of Groundwater in Bihar state

Stage of Development of Ground water	**Number of District**	**Percentage of District**	**Name of District**
Less than 30%	4	10.53	Aurangabad, Kishanganj, Munger, West Champaran
30-40%	10	26.32	Araria, Banka, Bhabua, Bhagalpur, Buxar, Jamui, MadhubaniRohtas, Saharsha, Supaul
41-50%	11	28.95	Arwal, Bhojpur, Darbhanga, East Champaran, Gaya, Khagaria, Lakhisarai, Nawada, Purnea, Samastipur, Sitamarhi
51-60%	11	28.95	Begusarai, Gopalganj, Katihar, Madhepura, Muzaffarpur, Patna, Saran, Shekhpura, Sheohar, Siwan, Vaishali
61-70%	2	5.26	Jahanabad, Nalanda

With regard to groundwater recharge, there is significant natural recharge to the aquifers from the vast surface water bodies in the state, especially from the rivers. In addition, an area of 1650 sq.km.has been identified for artificial recharge, as shown in the Table below.

Table 3.11 Details of Groundwater Development and Management in Bihar state.

Ground Water Development & Management	
Over Exploited	NIL
Critical	NIL
Semi- critical	4
Ground Water User Maps	38 districts
Artificial Recharge to Ground Water (AR)	Area identified for AR: 1650 sq. km.
	Quantity of Surface Water to be Recharged: 574 MCM
	Feasible AR structures: 891 Percolation Tanks, 2260 Check Dams, 1630 Recharge Shaft, 1303 Contour Bunding, RWH in Urban Areas

Table 3.12 Semi critical blocks of Bihar

District	**Semi critical blocks**
Gaya	Gaya Sadar
Nalanda	Nagarnausa, Rajgir
Nawada	Meskaur

3.4.3 Water Quality

Surface water quality

Central Pollution Control Board (CPCB) classifies river water quality in five classes according to fitness as following. The standards of these classes have been specified on the basis of chemical and biological parameters.

Table 3.13 Central Pollution Control Board (CPCB) classification of river water quality

Classification	**Class**	**Tolerance limit**
Drinking water source without conventional	A	Total coliform organisms MPN/100 ml shall be 50 or less

Classification	Class	Tolerance limit
treatment but after disinfections		pH between 6.5 and 8.5 Dissolved Oxygen 6mg/l or more Biochemical oxygen demand 5 days 20 degreesCelsius2 mg/l or less
Outdoor bathing (organized)	B	Total coliform organisms MPN/100 ml shall be 500 or less pH between 6.5 and 8.5 Dissolved Oxygen 5 mg/l or more Biochemical oxygen demand 5 days 20 degrees Celsius 3 mg/l or less
Drinking water source after conventional treatment and disinfections	C	Total coliform organisms MPN/100 ml shall be 5000 or less pH between 6.5 and 8.5 Dissolved Oxygen 4 mg/l or more Biochemical oxygen demand 5 days 20 degrees Celsius 3 mg/l or less

The Table below describes the water quality of surface water sources in Bihar.

Table 3.14 Water quality details of major surface water sources in Bihar

SI. No.	River	PH	DO (mg/l)	BOD (mg/l)	TC (MPN/100ml)	FC (MPN/100 ml)
1	Ganga at Buxar	8.26	8.25	2.8	6275	2033
2	Sone at Koelwar	8.1	8	2.4	1416	675
3	Ghaghara at Chhapra	7.61	8.15	2.5	2208	950
4	Gandak at Sonpur	7.48	8.12	2.35	1633	717
5	Sikrahna at Chanpatia	7.71	8.35	2.57	1950	925
6	Daha at Siwan	7.99	7.8	2.75	2825	1100

SI. No.	River	PH	DO (mg/l)	BOD (mg/l)	TC (MPN/100ml)	FC (MPN/100 ml)
7	Dhos at Madhubani	8.09	6.9	2.83	2166	1133
8	Sirsia at Raxaul	7.27	6.8	3	2425	1150
9	Parmar at Jogwani	7.39	7.75	2.62	1525	725

Limit for faecal coliform in the water sample exceeds the tolerance limit as specified in Class A and Class B of designated best use of water by CPCB. For class A which is classified on the basis of its use for drinking water without conventional treatment tolerance limit is total coliform organism shall be 50 or less and for class B which is classified on the basis of its use for bathing, tolerance limit is total coliform organism shall be 500 or less.

Ground water quality

Ground water in Bihar is affected in many districts. Fluoride, Iron, Nitrate and Arsenic are present in excess in many of the districts as presented in the table below.

Table 3.15 Groundwater quality issues in Bihar

Ground Water Quality Problems	
Contaminants	**Districts affected (in part)**
Fluoride (>1.5 mg/l)	Aurangabad, Banka, Buxar, Bhabua(Kaimur), Jamui, Munger, Nawada, Rohtas, Supaul
Iron (>1.0 mg/l)	Aurangabad, Begusarai, Bhojpur, Buxar, Bhabua(Kaimur), East Champaran, Gopalganj, Katihar, Khagaria, Kishanganj, Lakhiserai, Madhepura, Muzafferpur, Nawada, Rohtas, Saharsa, Samastipur, Siwan, Supaul, West Champaran
Nitrate (>45 mg/l)	Aurangabad, Banka, Bhagalpur, Bhojpur, Bhabua, Patna, Rohtas, Saran, Siwan
Arsenic (>0.05 mg/l)	Begusarai, Bhagalpur, Bhojpur, Buxar, Darbhanga, Katihar, Khagaria, Kishanganj, Lakhiserai,Munger, Patna, Purnea, Samastipur, Saran, Vaishali

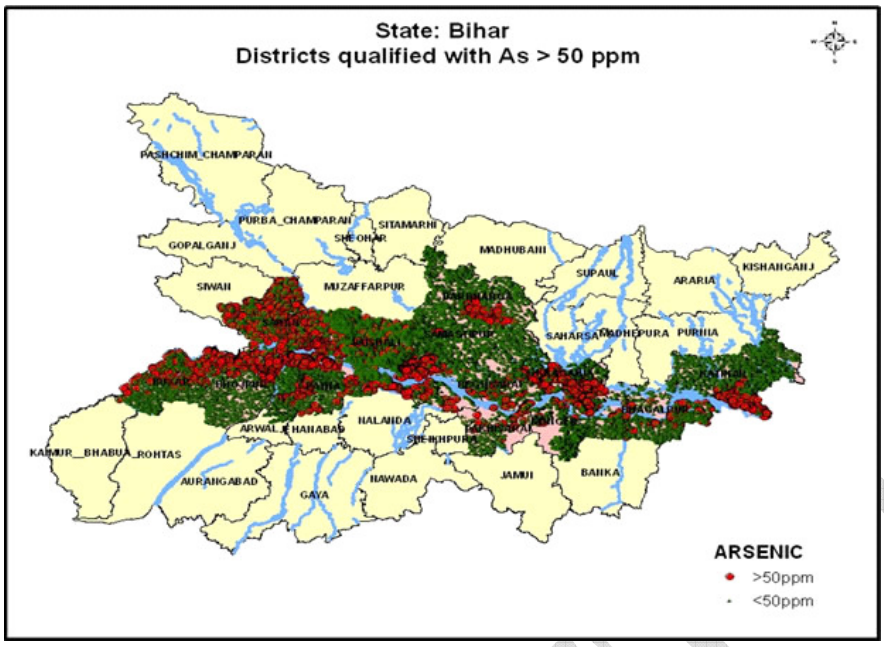


Figure 3.13 Arsenic affected areas in Bihar

Arsenic is a serious quality concern for many districts in Bihar like Begusarai, Bhagalpur, Bhojpur, Buxar, Darbhanga, Katihar, Khagaria, Kishanganj, Lakhiserai, Munger, Patna, Purnea, Samastipur, Saran, Vaishali. All of these districts have been reported by CGWB to be affected by arsenic with a concentration of more than 50 ppm.

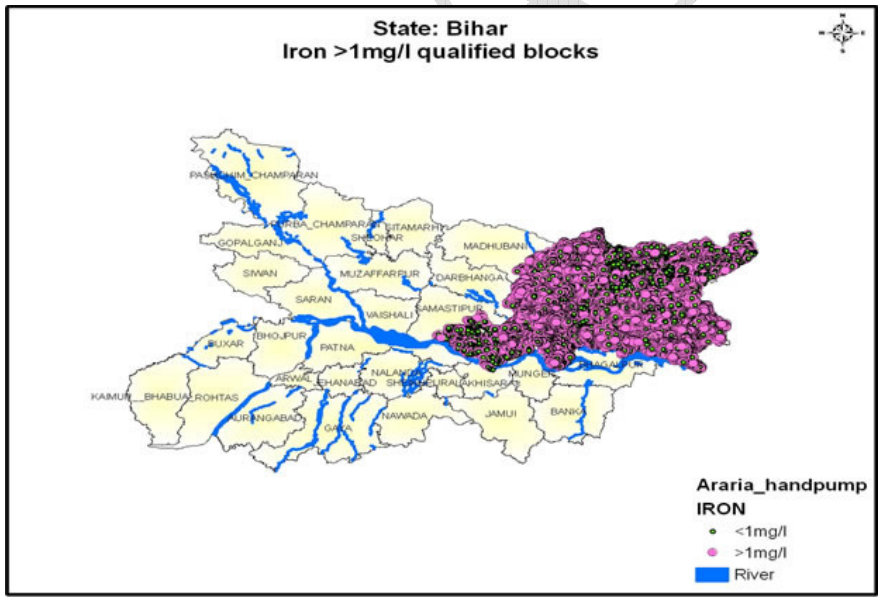


Figure 3.14 Iron affected areas in Bihar

Aurangabad, Begusarai, Bhojpur, Buxar, Bhabua(Kaimur), East Champaran, Gopalganj, Katihar, Khagaria, Kishanganj, Lakhiserai, Madhepura, Muzafferpur, Nawada, Rohtas, Saharsa, Samastipur, Siwan, Supaul, West Champaran districts of the state have been identified by CGWB to be affected by iron contamination of more than 1mg/l in groundwater.

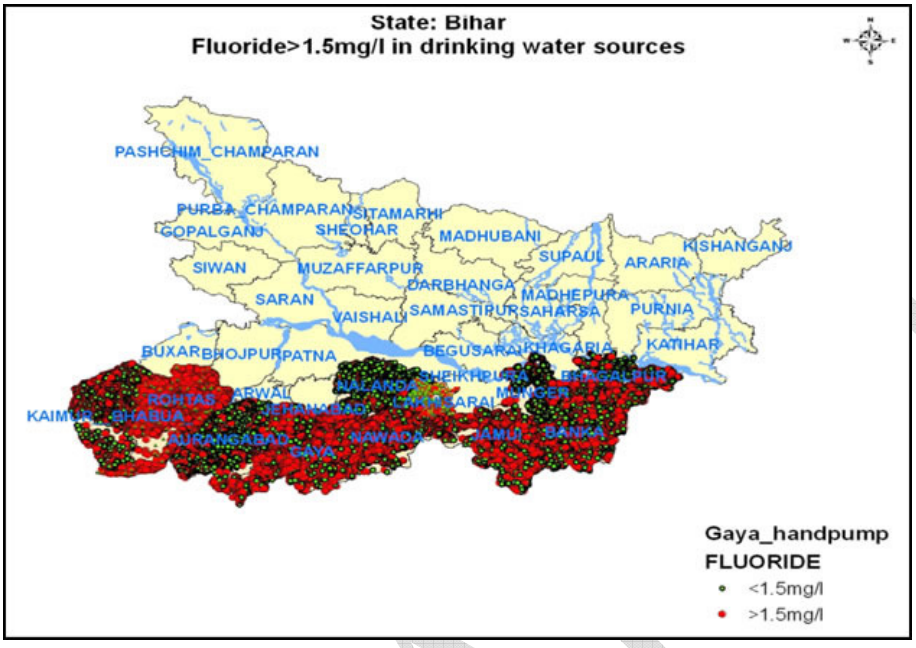


Figure 3.15 Fluoride affected areas in Bihar

Southern belt of the state is affected by fluoride, with districts like Aurangabad, Banka, Buxar, Bhabua(Kaimur), Jamui, Munger, Nawada, Rohtas, Supaul having concentration more than the standard limit of 1.5mg/L

3.4.4 Current Water Supply Practices

Status of rural water supply situation in Bihar

Table 3.16 Status of rural water supply situation in Bihar

Type of Scheme	Key Factors
Hand Pump (Singur / India Mark II / India Mark III)	I HP for 250 population
Mini Water Supply (Solar-based / Electricity-based)	1 scheme for 1000-1500 population
Single Village	1 scheme for 5000 – 15000 population
Multi Village in Single GP	Coverage of more than 1 village in 1 GP

Type of Scheme	Key Factors
Multi Village in Multi GP	Coverage of more than 1 GP
Quality-affected	Any of the above schemes to tackle contamination problem

Coverage status of habitations as of February 2013

Table 3.17 Status of water supply coverage in the state of Bihar

Total No of Habitation	No of Habitations with Partial Population Coverage	No. Of Habitations with 100% Population Coverage
107642	20248	87394

As shown in the figure above around 80% of the habitations have 100% population coverage.

Table 3.18 Overall drinking water coverage in the state of Bihar

	Total	Rural
Percentage of households using Hand pump/ Tube well as source of drinking water	89.6	95.6
Percentage of households using Tap water as source of drinking water	4.4	2.3
Percentage of household getting tap water from treated source	3.07	1.5
Percentage of households having source of water within the premises	50.1	47.1
Percentage of households getting water from a source located within 500 meters	37.9	39.6
Percentage of household need to fetch drinking water from a source located more than 500 m away	12.0	12.6

According to the latest figures available from census 2011, most of the households in Bihar rural areas are using hand pump or tube well as a source of drinking water. The total percentage in the state is 89.6, it is 95.6 in rural areas for the households using hand pump or tube well as the source. While the percentage is very less (1.5%) for the households getting tap water from the treated source. In terms of access, around 47 %

households have water source within the premise, while around 40% have water source located within 500 meters. Bihar has still a long way to go in terms of access of water from safe sources.

Quality status

Table 3.19 Quality Affected Habitations Contamination Wise as on 01/04/2012

Total	Fluoride	Arsenic	Iron	Salinity	Nitrate
14580	2698	1004	10877	0	1

3.4.5 Current Water Treatment Practices

Mini piped water supply treatment scheme: The Mini piped water supply scheme is designed to have a Water treatment plant along with stand posts (for supplying water) spread out inside the village through which filtered water is supplied. The water treatment plant will have a 3 or 4 stage Contaminant Removal Unit (Iron, Fluoride, Arsenic, etc.), a submersible reciprocating pump (mostly powered by solar panels), and an overhead tank along with 2-3 value addition tanks (VATs). The Contaminant Removal Unit filters out the chemical as well as the biological contaminants. The maintenance of this unit requires carrying out a backwash process regularly, which releases wastewater containing the filtered contaminants and this needs to be disposed safely.

3.4.6 Incidence of water and sanitation related diseases

Poor water quality is a serious threat. It hampers socio-economic development. Water contamination weakens or destroys natural ecosystems that support human health, food production, and biodiversity.

Arsenic in drinking water

Arsenic is introduced into water through the dissolution of rocks, minerals and ores, from industrial effluents, including mining wastes, and via atmospheric deposition. Arsenicosis or arsenic poisoning occurs when ground drinking water is contaminated with the element, either by natural occurrence or human influence such as mining, metal refining and timber treatment. People consuming water contaminated with arsenic could experience skin damage or problems with their circulatory system, and may have an increased risk of getting cancer.

Fluoride in drinking water

Naturally occurring fluorides in groundwater are a result of the dissolution of fluoride containing rock minerals by water while artificially high soil fluoride levels can occur through contamination by application of phosphate fertilizers, sewage sludge, or pesticides.

Table 3.20 Concentration of fluoride in drinking water and its effects on human health

Fluoride Concentration (mg/L)	Effect
Nil	Limited growth and fertility
< 0.5	Dental caries
0.5 - 1.5	Promotes dental health, prevents tooth decay
1.5 - 4.0	Dental fluorosis (mottling and pitting of teeth)
4.0 - 10.0	Dental fluorosis, skeletal fluorosis (pain in neck bones and back)
> 10.00	Crippling fluorosis

Source: International Drinking Water Standards (1971), WHO, Geneva.

4. Environmental Management Framework

4.1 Environmental Analysis

This chapter presents an overview of the key environmental issues related to the proposed BSWSM project and the Environment Management Framework (EMF). An analysis of the baseline environmental situation, observations during site visits, discussions with state, district and village level functionaries as well as the public consultations have clearly brought out the following key environmental issues that need to be addressed in the project design and implementation.

4.2 Key Environmental Issues

4.2.1 Water Availability

Groundwater has been the major source of water for drinking in Bihar. For a large number of rural households which are dependent on hand pumps, the declining and fluctuating groundwater levels are adversely affecting the water supply.

Most of the current schemes in Bihar are based on groundwater sources. Some of these sources show declining water levels during summer season (dry period). The potential of surface water source for drinking purposes has not been fully explored in Bihar.

Environmental Issues

Inadequate and disrupted water supply affects human health and environmental sanitation. Tapping of semi-critical aquifers may cause quality deterioration with increased concentration of harmful substances like fluoride, Arsenic and Iron.

Measures to Augment Water Supplies

Intensification of existing water supplies can be achieved through various ways as mentioned below.

Rehabilitation/ upgrading of existing water supply schemes should be made a priority wherever feasible.

The existing resources should be conserved and the availability augmented by maximizing retention through rainwater harvesting, creation of bunds and check-dams; eliminating pollution through appropriate mitigation measures; and minimizing losses through water-use efficiency by generating awareness on good practices.

In addition, measures like rehabilitation of existing water bodies for storing rainwater and groundwater recharge need to be taken up.

The potential for the use of surface water from river sources should be explored in some regions to augment water supply.

In cases where the drinking water supply source involves extraction from a semi-critical aquifer the emphasis must be on water conversation (including ground water recharge and rainwater harvesting). In the long term, regulation of extractions from groundwater aquifers for irrigation needs to be ensured. Efficiency of use of water should be promoted through education, regulation, incentives and disincentives. IEC campaigns to improve water use efficiency.

4.2.2 Water Quality

Surface Water Quality

Environmental Issues

Non point sources of pollution in the catchment areas due to the widely prevalent practice of open defecation, and agricultural run-off containing fertilizers and pesticides, washing, bathing and other human activities in rivers/ irrigation canals serving as water supply sources. In addition to this, sewerage from cities/towns and industrial effluents discharged into the surface water bodies form a major source of contamination.

Ground Water Quality

Environmental Issues

The shallow groundwater quality in many parts of Bihar is poor owing to natural presence of contaminants like Iron, Fluoride, Arsenic, Chloride, Nitrate etc. at concentrations exceeding the permissible levels for drinking water use. In addition, the quality of groundwater may also indicate bacteriological contamination due to disposal of sullage into *kaccha* drains and pits, deep toilet pits, effluent from septic tanks, water logging near hand pumps, open defecation. According to PHED estimates, 13 districts in Bihar suffer from Arsenic contamination, 11 districts with Fluoride contamination and 9 districts with Iron contamination.

Mitigation Measures

It needs to be taken into consideration during the planning and design stage of the schemes that the selection of the source is conducted with due regard to water quality of the source, and also that the water quality at household delivery level meets the drinking water norms. More specifically:

1. Selection of the source for the water supply should be made after detailed examination of both surface and groundwater sources in the region; priority needs to be based on the guidelines provided in Annexures 1. These sources need to be tested for their water quality prior to the selection of source for the water supply schemes.

Sanitary protection of water supply sources is prescribed in Annexure 6. Annexure 7 describes ECOPs for sustainability of groundwater sources.

2. Depending on the water quality characteristics in the vicinity, advanced treatment options like Iron removal units, Fluoride removal units, Arsenic removal units, disinfection systems can be opted.

3. Regular cleaning of storage tank and disinfection of supply water using chlorination needs to be ensured.

4. Development of an Institutional arrangement for preventive and corrective maintenance of water distribution system (leak detection and repair, reinstallation of damaged/missing taps) and for preparedness in crisis management during major breakdowns.

5. Water supply sources need to be protected as per the guidelines given in Annexure 6.

6. A protocol for regular water quality testing and control (refer Annexure 8) has

been developed by PHED (Bihar), which will be implemented through the operations phase of the water supply schemes. Water quality testing for industrial and agricultural chemical contaminants shall be conducted by the PHED (District and state level), in a phased manner based on an initial sampling of groundwater and river/ canal waters in all districts of the state before taking up subprojects in that area. This cost will be included in the project preparation cost.

4.2.3 Environmental Sanitation

The present level of sanitation coverage in the rural areas of the state is less than 25 % with usage percentage much lower. This implies that still nearly a large fraction of the rural population resorts to open field defecation with its associated risk to water supply sources and public health. Open defecation constitutes a major non-point source of pollution of surface and ground water sources. Poor environmental sanitation conditions and lack of adequate supply of safe water are factors responsible for high incidence of water borne and water related diseases among the rural population.

Environmental Issues

1. Large percentage of the population still resort to open field defecation due to inadequate latrines, low usage of latrines and low levels of awareness, which leads to bacteriological contamination of soil and groundwater bodies.

2. Presence of deep leach pit latrine (>6 ft.) can lead to bacteriological contamination of groundwater.

3. Open field defecation leads to health problems among the community through vectors.

Mitigation Measures

- Construction of latrines and awareness generation among the community for their increased usage.
- Selection of safe sanitation technologies and environmental considerations in location of toilets as given in Annexure 8.
- Annexure 9 presents recommended construction practices and pollution safeguards for Twin Pit Pour Flush Latrines.

4.2.4 Liquid waste disposal

The liquid waste is generated from households, usually containing wastes such as detergents, soap, kitchen waste and others, apart from this over-flow of water from hand-pumps and public stand posts also adds to the wastewater generated.

Environmental Issues

1. Liquid waste generated by the households, including liquid-waste from cattle-sheds, flows into open surface drains leading to stagnation of water near houses and road side.
2. The lack of infrastructure for treatment and disposal of this liquid waste leads to contamination of groundwater through stagnation of wastewater inside the village, near water supply stand-posts, hand pumps, etc.

3. The presence of stagnant water in the villages combined with poor personal hygiene leads to the incidence of malaria and other vector borne diseases, like diarrhoea, etc.

Mitigation Measures

1. Construction of latrines and awareness creation for increased usage. Selection of safe sanitation technologies and environmental considerations in location of toilets is given in Annexure 9. Annexure 10 presents recommended construction practices and pollution safeguards for Twin Pit Pour Flush Latrines.
2. Efficient design of surface sullage drains and adoption of good construction practices, along with a system of regular maintenance can ensure that stagnant pools of sullage are eliminated. Guidelines for safe sullage disposal at household and community levels are given in Annexure 11.
3. Placement of water supply pipeline at a safe distance away from the sullage lines on different sides of the road would reduce the risk of cross contamination.
4. Construction of oxidation ponds/root-zone treatment system for treating the sullage flowing from the village and this treated sullage can be used for agriculture, horticulture, aquaculture and agro-forestry purposes.
5. Vector control measures need to be adopted for the ponds and drains carrying sullage by way of avoiding stagnation and spraying with non-hazardous insecticides in accordance with the World Bank safeguard policy, i.e. OP 4.09.
6. The project needs to focus on improving personal hygiene standards, by supporting sustained IEC campaign to create and enhance awareness on hygiene aspects pertaining to hand washing, safe water collection, storage and handling practices.

4.2.5 Solid waste disposal

There are different types of solid waste generated like, cattle-dung, kitchen waste, agriculture waste, plastic and paper, etc. These are usually dumped in open spaces close to the household.

Environmental issues

Solid wastes of biodegradable and non-biodegradable nature are directly disposed by mere dumping along roads and open places leading to vector breeding, odour generation, and this gets aggravated during rainy season leading to health problems and contamination of soil and groundwater through leaching.

Mitigation measures

A good Solid waste management system needs to be put in place including the following features-

- Segregation of wastes at source
- Provision of household/cluster dust-bin
- Recycling of non-degradable wastes through authorized waste-handling vendors.
- Vermi-composting of biodegradable wastes

Guidelines for community solid waste management are given in Annexure 12.

4.2.6 Construction Stage Environmental Impacts

The project activities during its construction stage are likely to have temporary negative externalities on the environment, which will need to be addressed. Construction of project components like water supply schemes, underground drainage, drains and sanitation facilities would have the following impacts-

- Erosion of top-soil due to earth work
- Air pollution due to excavated soil and drilling operations
- Cutting of trees or clearing of forest area
- Noise pollution during drilling of bore-wells, movement of trucks
- Soil contamination due to spillage of oil and fuel from the construction machinery and vehicles
- Possible damage to places of cultural, heritage and recreational/aesthetic importance
- Impact on human health and safety due to dust and noise pollution, and inadequate safety measures.

Mitigation Measures

All project interventions will be appropriately designed to ensure minimum impact on the environment.

- Safe storage of top soil for preservation of its nutrients, so as to ensure its reuse later
- Use of curtains/barriers to minimize air and noise pollution during construction activities
- All the physical works should be constructed on Common property/Panchayat lands so as to avoid usage of forest areas and areas with a good tree cover. In the absence of an alternate location, permission from the forest department shall be obtained for felling of trees and the department's guidelines on compensatory afforestation will be followed.
- In case of some physical works associated with construction and maintenance, there might be presence of objects of cultural/ archaeological importance. In such cases, the regional offices of the relevant agency (e.g. the Archaeological Survey of India) will be immediately notified.

4.2.7 Operation Stage- Environmental Impacts

The project activities during its Operation stage are likely to have negative externalities on the environment, which will need to be addressed. Operation of project components like water supply schemes, drains and sanitation facilities would have the following impacts-

- Back wash water from specific contamination treatment system like fluoride, arsenic & iron etc. in case of pipe water supply system (single village scheme &

multi village scheme). This back wash may contaminate soil & water (surface and ground).

- Disposal of sludge generated during water treatment processes in case of multi village scheme, may contaminate soil & ground water.
- Water logging problem due to leakages from pipe lines & damaged taps.
- Adverse impact on downstream flora & fauna in case of surface water source for multi village scheme.
- Loss of supply water due to leakages in pipe line.
- Degradation of water quality during non-supply time - suction of external logged water through leakages may contaminate the water.

Mitigation Measures

All project interventions will be appropriately designed to ensure minimum impact on the environment by ensuring.

- Safe disposal of back wash water through evaporation pond.
- Safe disposal of sludge through specific treatment method & safe Land fill site.
- Proper maintenance of distribution pipe lines & treatment system.

4.3 Issues identified during field visits and consultations

- Based on people's perception in the villages surveyed, the groundwater level has decreased during the last 10 years. During summer season water level goes down and most of the hand pumps run dry to shallow depth of the hand pumps.
- In most of the surveyed villages there is no awareness about the water conservation and efficient water use practices which leads to wastage of precious water resources.
- People remove the treatment attachment units from the hand pumps to get more water from the hand pumps with less effort.
- Water quality of shallow hand pumps was perceived to be bad & poor in almost all surveyed villages in terms of color, odor & taste.
- Use of pesticide in agricultural field was also reported in all surveyed village which may contaminate water sources.
- Disposal of backwash water & sludge from treatment system into the open field & pond was reported in surveyed villages which may contaminate soil & water bodies.
- Water logging in shallow open pits in front of hand pumps & stand posts was also observed during field visit which may contaminate the ground water quality. Also, malaria and water borne diseases are rampant in the villages surveyed.
- In many habitations, hand pumps and latrines are observed to be closer to each other than the recommended minimum distances between hand pump and latrine. This is due to lack of awareness about water contamination and lack of sufficient land available.

- Sanitation standards and practices in the villages are still poor. Many of them still go for open defecation due to non-availability and bad maintenance (filling up of pits) of the toilets.
- As per villager's perception, many of the toilets constructed in the village under the government scheme are of shallow depth, which lead to the filling up of the pits in a short duration, causing the villagers to go for open defecation.
- Most of the villages do not have a drainage facility for disposal of wastewater that leads to logging of wastewater inside the village, close to the households and hand-pumps.
- It was observed in some of the villages that the wastewater is discharged into ponds inside the village leading to seepage of wastewater into the soil and causing further contamination of surface and groundwater.
- Solid waste generated from the households is disposed of in the open space that leads to vector breeding, and this gets aggravated during the rainy season where rainwater mixes with the solid waste to further cause contamination and pollution.
- It was observed in one of the visited villages that during construction of a treatment plant under the scheme had led to cutting of 8 palm trees.
- One of the sites visited for proposed MVS, has an Orchard on the bank of the river Budhi Gandak, which may require clearing/felling.
- At one specific site where a MVS is being proposed with River Ganga as water source, it was observed that river had changed course in the past and this may occur in the future, thus impacting sustainability of the water source for the scheme.

4.4 Objectives of EMF

The proposed Bihar Rural Water Supply and Sanitation Project will finance investments in rural water supply and sanitation improvement schemes to serve the rural populations in Bihar. The project interventions are, therefore, expected to result in public health benefits in the rural communities, through improved quality and delivery levels of RWSS services. Some of the main environmental health benefits expected under the project include: increased and better quality water supply for drinking, cooking, washing, bathing and cleaning purposes; time and energy savings through providing water supply closer to homes; improvements in personal hygiene and village sanitation levels; and reduced faecal oral contamination of drinking water resulting in lower occurrence of diseases. While the proposed project interventions are expected to result in overall environmental and public health improvements in the state, potential adverse environmental impacts can occur if the schemes are not properly designed, sited, implemented, and maintained. In order to ensure that the environmental issues are systematically identified and addressed in the various stages of the implementation of subprojects, an Environment Management Framework (EMF) has been developed for this project. The specific objectives of the EMF are as under:

- To provide a systematic approach for identifying the various possible environmental impacts at the different stages of the scheme cycle.

- To identify appropriate mitigation measures for addressing the identified environmental impacts.
- To devise an institutional arrangement for mainstreaming environmental management in project implementation processes.

4.5 Components of EMF

4.5.1 Main Elements of the EMF

The main elements of the EMF that may be applied to the BSWSM sponsored scheme are discussed below:

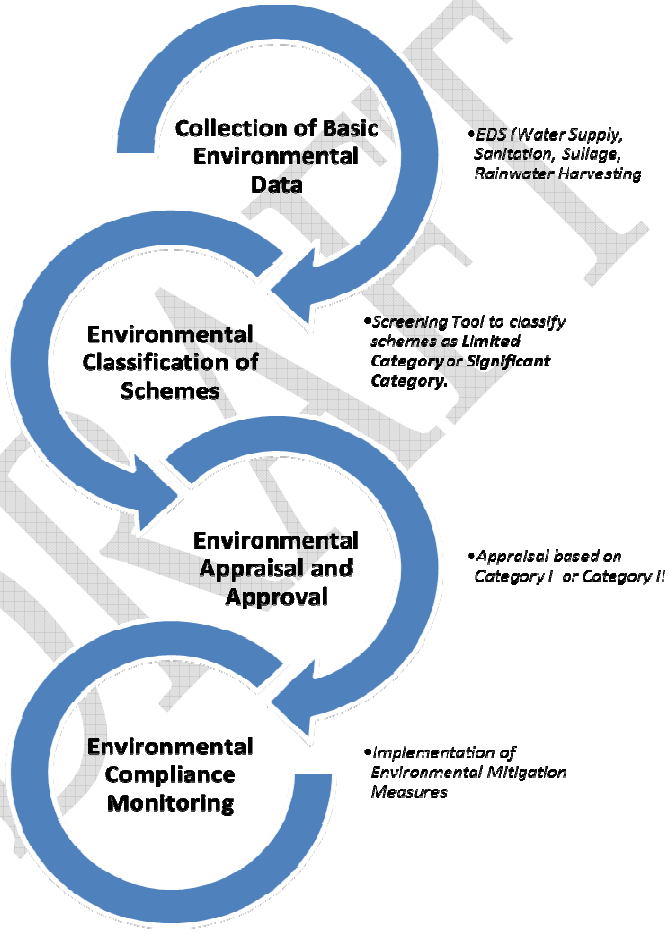


Figure 4.1 Flow of activities for EMF implementation

Basic Environmental Data Collection:

The EMF requires that basic environmental data related to the proposed scheme(s) be recorded at the initial field data collection stage. For this purpose, Environmental Data Sheets (EDS) have been formulated for schemes on water supply, sanitation, solid and liquid waste management, etc. The formats for the EDSs for different types of schemes have been provided in Annexure 14. The AE/EE of PHED will take the lead in the compilation of the information in the EDS in consultation with the VWSC and with the inputs from the District Level Environmental Expert (DEO, as described later in this chapter).

Environmental Classification of Schemes:

At the Detailed Project Report (DPR) preparation stage, the available environmental information in the EDS will be evaluated and examined. Based on the level of expected environmental and public health impacts, the proposed scheme(s) would be classified as either Class I (limited environmental impact) and Class II (significant environmental impact) Projects. For Class II schemes, detailed environmental appraisal will be required. The screening tool for the categorization of schemes is provided below (Table 4.2). The environmental classification of schemes by using the screening tool will be undertaken by the EE of PHED.

Environmental Appraisal and Approval

For the category I schemes, there will be no separate environment appraisal other than the EDS. For category II schemes, detailed environmental appraisals of the proposed schemes will be required. This will be done by the DEO (DPMU). In extreme cases, where the district level resources are not enough for conducting the environmental appraisal and formulating the appropriate mitigation measures, support from the Environmental Experts at the state level (EMO, as described later in this chapter) will be sought. The environmental appraisal for category II schemes should be done within a month.

The Detailed Project Report (DPR) for category I schemes should be accompanied by the Environmental Data Sheet (EDS). This is the responsibility of the EE of PHED. The Detailed Project Report (DPR) for category II schemes should be accompanied by the Environmental Data Sheet (EDS) as well as the environmental appraisal. The EE of PHED will confirm that these are taken care of.

Environmental Compliance Monitoring during Implementation and O&M phases

The EMF will ensure that:

1. The prescribed environmental mitigation as identified through the environmental appraisal process are to be adequately implemented. The Implementation Completion Report of each scheme will include an Environmental Compliance Certificate given by the VWSC/GPWSC for SVS and BWSC for MVS indicating that the mitigation measures identified in the appraisal are implemented.

2. Regular supervision and monitoring including an independent external audit (forms attached) is to be conducted, as a part of the overall project monitoring program.

3. Capacity building and IEC activities are to be conducted to make sure that the EMF including evaluation, supervision, and monitoring have been implemented. This will

also help community awareness on personal hygiene, environmental sanitation, water conservation, etc.

4.5.2 Application of EMF to Project

In order to mainstream environmental management and ensure that the EMF is properly implemented for all the Drinking Water and Sanitation schemes, the EMF needs to be integrated in the scheme cycle for all stages including Development, Implementation and O&M. The table below provides an overview of various EMF activities of the proposed scheme cycle for the project sponsored schemes. The responsibilities and expected outcomes are mentioned against the respective tasks.

Table 4.1 Matrix of Roles and Responsibilities for EMF implementation

Phase	EMF Activity	Objectives	Process	Responsibility	Result
Design and Development	Environment related Data Collection	Baseline environmental data collection related to proposed schemes to assess environmental impacts.	Field visit, discussion with the community to be benefitted from the schemes to identify environmental issues and complete the EDS.	JE, AE, SDO of PHED in consultation with DEO, BEO, and with the help of VWSC, GPWSC, BWSC .	Environmental data sheet filled up and attached to PSR and DPR.
	Environmental Screening of schemes	To identify environmental issues early in the project intervention cycle, designing environmental improvements into projects.	Study of the environmental impacts of various stages of project intervention activities. Schemes will be categorized as category I and category II based on the magnitude of the environmental issues.	JE, AE, SDO of PHED in consultation with DEO, BEO, and with the help of VWSC, GPWSC, BWSC	Identification of environmental issues, and scheme categorization (Category I and category II)
	Environmental Appraisal and Approval	To ensure that relevant environmental issues have been identified and appropriate mitigation measures have been developed	For category I schemes, there shall be no separate environment appraisal but the environmental issues will be included in the normal appraisal and evaluation process for the proposed scheme, based on the EDS	The environmental assessment for category I will be done by the District Environment Officer (DEO) /SDO deployed at DPMU. For Category II appraisal will be	Environmental appraisal and approval of the proposed scheme, with decision to (i) accept scheme as submitted, or (ii) accept scheme with modifications suggested in the

Phase	EMF Activity	Objectives	Process	Responsibility	Result
		to address them.	For Category II schemes, an independent environmental appraisal of the proposed scheme is required. This includes evaluation of environmental and public health impacts and risk assessment	done by the EMO.	environmental appraisal.
		To ensure that mitigation measures and their costs are integrated in scheme design and implementation plans	Environmental Clearance from DPMU will be required for Technical Approval for the schemes	Executive Engineer	Technical approval for scheme with environmental mitigation measures and accordingly its costs are integrated in scheme design and implementation plans.
Implementation	Implementation of Environmental mitigation measures	To ensure that the prescribed environmental mitigation measures are implemented	Implementation Completion Report (ICR) for scheme will need to include compliance certificate that all prescribed environmental mitigation measures have been implemented.	VWSC for single-village schemes; BWSC for multi-village schemes and sewerage schemes.	ICR completed with environmental compliance information
O&M	Environmental supervision, monitoring, and evaluation, IEC and capacity building on hygiene and environmental health	To ensure that environmental aspects are integrated in the O & M phase	• Water Quality monitoring as per project water quality monitoring protocol, effluent quality monitoring • Public Awareness on water supply schemes, water quality, water conservation, solid and liquid waste disposal, hygiene, sewerage schemes,	SDO/AE and DEO (DPMU), BEO, BWSC, GPWSC, VWSC.	Periodic environmental monitoring reports

Phase	EMF Activity	Objectives	Process	Responsibility	Result
	issues				

4.5.3 Screening Checklist

Presented below is a checklist for screening the proposed schemes as category I and category II projects.

Table 4.2 Screening checklist for proposed schemes

Category I	Category II
A. *Water Supply Schemes*	
• SVS with source in shallow aquifer in safe and semi-critical zone • SVS with source in deep aquifer located in safe zone of exploitation • SVS with perennial surface water source requiring sand filtration only • SVS involving pumping, construction of storage tanks and piped distribution networks, with source as bore well. • SVS/MVS with voluntary rehabilitation • Roof water harvesting units, where the households cannot be served by piped network.	• Direct discharge of construction run-off, improper storage and disposal of excavation spoils, wastes and other construction materials adversely affecting water quality and flow regimes. • Flooding of adjacent areas • Safety hazards during construction • SVSs/MVSs with shallow groundwater source located in either critical or over exploitation zones of groundwater exploitation and deep groundwater source in semi-critical and over exploited zones. • SVS/MVS with involuntary rehabilitation • SVSs/MVSs with sources located at or nearer (within 1 km) to natural habitats/sensitive ecosystem such as National Park and Wildlife Sanctuaries (Forest Department approval required) • Impacts to water quality due to effluent discharge and backwash from treatment units • SVSs/MVSs with the water quality at the source not treatable with conventional treatment, and involves special treatment/RO treatment. • MVSs with surface water source requiring treatment • SWSS with water source requiring special treatment for removal of iron, fluoride, and salinity • SVSs/MVSc with source as river where water will have to be conveyed from long distances. • SVSs/MVSc with source located close to natural habitat/ sensitive ecosystems such as National parks, Wild life sanctuaries (Forest

	permission/clearance required)
B. Artificial Recharge Structure	
• Individual house hold roof top rainwater harvesting • Ground water recharge measures.	• All types of rain water harvesting structures to augment water supply sources
Underground Drainage Schemes	
	• All types of underground drainage schemes
Sanitation Schemes	
• Construction of ISL where subsurface strata is favourable for adopting twin pit pour flush toilet and groundwater table is at depth greater than 3.0m below ground level. • Construction of group owned latrines where the subsoil strata is favourable for adoption of twin pit pour flush toilets and groundwater table is at depth greater than 3.0 m below ground level.	• Construction of ISL/community latrines where subsoil strata is not favorable (hard rock or low infiltration capacity) • Disposal of sewage through soak pits where ground water table is less than 3 m below ground level • Construction of ISL/community latrines in water logged areas. • Construction of group owned latrines where subsoil strata is not favourable for adoption of twin pit pour flush toilets • Construction ISL or group owned latrines where groundwater table is at depth lesser than 3.0 m below ground level
Storm water /Sullage Drains	
If all the following conditions are satisfied: • Construction of drains where groundwater table is greater than 3 m • Subsoil is having sufficient bearing capacity	If any of the following conditions are satisfied: • Construction of drains where groundwater table is at depths < 3.0m • Construction of drains in water logged areas • Subsoil is not having sufficient bearing capacity
F. Solid Waste Management	
• Household biogas plant • Household vermin-composting plant	• Community based biogas plant • Processing unit for plastic waste

4.5.4 Environmental Management Plan

The Table below summarizes the environmental management plan that identifies the potential issues of various activities that are anticipated in the design and development, construction, and operation phases of the upcoming drinking water and sanitation schemes in Bihar state. The environmental management plan ensures to suggest appropriate mitigation measure against the issues/concerns identified for different stages of project implementation viz. design and development, implementation, and O&M stage.

Table 4.3 Environmental management plan for stages of project implementation (design and development, implementation, and O&M stage)

Activity/consideration	Impact	Mitigation
Location of scheme site in a sensitive forest area	• Felling of trees may be necessary • Soil erosion due to trenching • Loss of top soil • Loss of flora/fauna • Human-wildlife conflict	• Ensure that construction activity is planned in adherence to Legal and Regulatory norms, as prescribed in EMF.
Location of scheme site in a sensitive forest area	• Damage may be caused to trees • Loss of flora/fauna • Soil erosion due to trenching • Human-wildlife conflict	• Damage to roots should be minimized during trenching, placing backfill, driving of heavy equipment, dumping of oil and trash etc. Restrict these activities outside the canopy of the tree. Also avoid cut and fill in the root zones, through delineating and fencing the drip line. • To prevent excessive disturbance of natural vegetation, the top soil excavated should be stockpiled and utilized for re-vegetation after completion of work. • Prevent construction within protected forest area.
Excavation/trenching	• Top- Soil erosion due to excavation activities	• Topsoil and subsoil must be stockpiled, in driest possible conditions, on opposite sides of the trench and must be kept separate throughout construction and rehabilitation. • Proper stock piling of excavated soil and must be bordered by berms. • Shoring trench sides by placing sheeting, timber shores, trench jacks, bracing, piles, or other

		materials to resist pressures surrounding the excavation.
Spillage of oils/grease from machinery/engines	• Oils and grease may be released and lead to groundwater as well as surface water contamination.	• Store tanks and drums for excess capacity; forbid pouring into soils or drains; enforce adequate equipment maintenance procedures
Workers Health and Safety	• Negative health impacts on workers/locals by inhaling of particulate matter. • Injuries or death due to on-site accidents	• Setting up barricades and signposts • Use of and safety gear (helmets/earmuffs/eye protection)
Air pollution due to construction	• Suspended particulate matter (SPM, RSPM), NOx, S0x • Fumes from diesel/kerosene • Soot from burning of oils and fuel used in machinery/engines	• Providing curtains around construction site, control spreading of dust, sprinkling of water to suppress dust, preventive maintenance of construction equipment and vehicles to meet emission standards.
Disposal of Construction waste	• Unorganized dumping of construction wastes may lead to contamination of surface, groundwater and flooding.	• The construction waste material should be stored on the higher lying areas of the site and not in any storm water run-off channels or any other areas where it is likely to cause erosion or where water would naturally accumulate causing flooding.
Proximity between drinking water source (handpump and borewell) and rural toilet	• Contamination by fecal coliform from leach pit toilet to shallow aquifer	• Ensure safe distance (>10m as per MoRD[23]) between leach pit toilet and water source.
Disposal of sludge from Treatment Units	• Improper Sludge disposal may contaminate	• Assign authorized hazardous waste handling agencies or BSPCB.

23 Technology Options for Household Sanitation - A report by Ministry of Rural Development and UNICEF (2010)

	surrounding natural water bodies	• Incineration of waste by authorized agencies
Backwash from treatment units	• Backwash containing high concentration of As, Fe and F may contaminate surrounding natural water bodies and infiltration to groundwater and soil.	• Proper disposal facility • Solar evaporation ponds at village level • Assign authorized hazardous waste handling agencies or BSPCB.
Leakages and bursts	• Waterlogging due to leakage • Water logging leading to infestation of pests	• Fix all leakages at regular intervals (weekly)
Timing of supply	• Overflowing of water due to irregular supply timings	• Ensure regular supply timings and disseminate information regarding timings to users, in advance.
Use of pipe water for non-domestic purposes	• Over-exploitation of groundwater resources • Operation cost and lifecycle cost of treatment medium increase due to excessive usage	• Ensure that treated piped water is used only for drinking, cooking and bathing purposes. • Ensure that bathing of cattle and cattle drinking/feeding is not encouraged near the stand posts and hand pumps.
Aquifer characteristics	• Overexploitation may lead to Critical, semi-critical or over exploited aquifers	• Explore opportunities to recharge groundwater and use surface water as primary source.

In addition to the above EMP, for Multi-Village Schemes, the following additional considerations have to be made:

Table 4.4 Environmental Management Plan (Additional) for Multi Village Schemes

MULTI VILLAGE SCHEMES			
Activity/consideration	**Impact**	**Mitigation**	**Cost**
Source sustainability	• Source may be exhausted due to increase in water demand for MVS	• Conduct prospecting for different water sources to ensure a minimum of 1 surface water source and 1 safe groundwater source. • Pre-feasibility study for river as source (for example drying up of river during dry season and change in river course). • Ensure implementation of rainwater harvesting to augment groundwater recharge.	
Land requirement	• Land acquisition may lead to loss of agricultural land, encroachment into forest area, loss of livelihood, resettlement of communities.	• Follow norms and regulations for Land Acquisition and Rehabilitation as well as Forest clearance as per EMF.	
Downstream users and ecosystems	• Withdrawal of water upstream may lead to loss of minimum flows downstream.	• Consider planning for multiple sources of water in order to sustain freshwater ecosystems and the human livelihoods and wellbeing for downstream users.	
Industrial pollution upstream of source	• Industrial pollution upstream of source may lead to contamination of source which will require additional treatment before supply. Contamination may be beyond	• Phase-I and Phase- II Environmental Site Assessment (ESA) to assess the contamination by industrial effluent/waste to the surrounding ground and surface water source, the extent, quantity and characteristics of contamination.	

MULTI VILLAGE SCHEMES	
	the scope of drinking water treatment technologies and may require more advanced treatment.

4.5.5 Arrangements for Supervision, Monitoring and Performance Evaluation of Schemes

Environmental supervision

State Level

A sample of the completed schemes will be visited at six monthly/bi-monthly[24] intervals by a team from the BSWSM to check if all safeguard requirements are met and to identify any issues that need to be addressed. The selected sample will have representation of both Category I and Category II schemes in water supply, sanitation and waste management.

An environmental management officer (EMO) will be employed at the state level. His/her qualifications will be M.Tech in Environmental Engineering with experience in Environmental Management.

District Level

The EMO will supervise the field plans and will receive reports from the District Environmental Officer (DEO). Roles and responsibilities of the EMO will include:

- Monitor EMF
- Identify training needs for DPMU and provide necessary capacity building
- Liaise with regulatory and project implementing agencies

Block Level

Block Water and Sanitation Committee (BWSC) will be formed for the management of Drinking water and sanitation related schemes at the block level. A Block Environmental Officer (BEO) will be appointed for the supervision and evaluation of implemented schemes. The BEO will report to the DEO at DPMU.

Village and Panchayat Levels

Gram Panchayat Water and Sanitation Committee (GPWSC) and Village Water Supply and Sanitation Committee (VWSC) will be formed for the management of Drinking water and sanitation related schemes at the village and panchayat levels, respectively.

24 Six monthly for SVS and Bi-monthly for MVS

Overall coordination

The Director of BSWSM will supervise overall EMF implementation, and coordinate with SPMU and DPMU. There would also be periodic monitoring and supervision by the World Bank, to ensure compliance with the respective safeguard policies.

Monitoring of the water supply and sanitation schemes will be conducted by the use of certain performance indicators (Table 4.5). These indicators will be evaluated as follows:

Table 4.5 Monitoring of Performance Indicators during Operation Phase

Monitoring of Performance Indicators during Operation Phase				
Sl. #	**Project Intervention/ Component**	**Performance Indicators**	**Frequency**	**Monitoring Agency**
Water Supply Schemes				
1	Water Availability	Safe drinking water supply of a minimum of 70 lpcd to the target communities	Once every 2 weeks (for 1st 6 months) followed by once per month.	VWSC and GPWSC (for SVS), BWSC (for MVS) with supervision from DPMU
2	Water Quality	Water (drinking water and sanitation) quality testing	Monthly	GPWSC/VWSC/BWSC with supervision from DPMU
		Independent water quality monitoring	Half yearly	Independent WQ consultant appointed by PHED/BSWSM
3	Groundwater Table	For schemes with groundwater as the source of water supply.	Monthly	GPWSC/VWSC/BWSC with supervision from DPMU
4	Water Treatment Backwash quality and disposal practice	Monitoring of backwash quality and the manner in which it is disposed.	Monthly	GPWSC/VWSC/BWSC with supervision from DPMU
Sanitation System				
5	Sanitation (Public)	Increased access of household to common sanitation system.	Half Yearly	BWSC
6	Sanitation (HH)	Increased access of individuals to HH latrines.	Half Yearly	BWSC
7	Health	Improvement in Key Health Indicators such as reduced faecal contamination.	Monthly	BEO (BWSC) and DEO (DPMU)
8	Better External environment	Aesthetic value of surrounding environment to be monitored including odor, flies, pestilence etc.	Monthly	BEO (BWSC) and DEO (DPMU)

Monitoring of Performance Indicators during Operation Phase				
9	Industrial waste discharge, if any	Checking of pretreatment of waste and its characteristics	Quarterly	BEO (BWSC) and DEO (DPMU)
10	Sludge Quality	pH, BOD, COD, Sodium, Potassium, Nitrogen, Phosphorous, alkalinity/acidity, and Heavy metals such as Cd, Ag, Zn, and Cu	Half Yearly	BEO (BWSC) and DEO (DPMU)

4.6 Institutional Arrangement

4.6.1. Village level Institutions

Village Water & Sanitation Committee (VWSC)

VWSC will be the village level institution set up as a subcommittee of the Gram Panchayat led by the Head of the Gram Panchayat. These committees are expected to take the responsibility for all activities related to BSWSM at the village level. The VWSC will be the implementing entity for SVS and monitoring entity for intra-habitation aspects of all other water schemes. The VWSCs will be supported by (non-government) Support Organizations (SOs), selected for a cluster of villages within a particular geographical boundary. These SOs (who are part of outsourced DPMC firm) would shoulder responsibility for supporting the VWSCs in all activities from the initial planning to later monitoring, providing support for community development and external liaison support to the VWSCs.

The responsibility of facilitating, planning and implementation of EMF activities at the village level is vested with the VWSC and SOs. The SOs would also include particular responsibilities concerning the EMF, like facilitation of the VWSC's participation in filling up the EDS, in certifying the implementation of the environmental mitigation measures, in identifying and meeting capacity building needs, etc. The JE/AE/EE will support the VWSC and SOs in the execution of these functions. BSWSM will develop capacities of both VWSC and SO through training and other information sharing measures to execute these functions effectively.

Gram Panchayat (GP)

GPWSC will be responsible at the GP level for a number of activities including all approvals required through the passing of resolutions, tariff fixation and guidance to the VWSCs.

Scheme Level Committee (SLC) for MVSs

The Scheme Level Committee will have one member from each of the VWSCs within the GPs covered by the Multi Village Schemes (MVS). This committee will be chaired by the Executive Engineer, PHED. With regard to the MVSs, the decisions regarding environmental appraisal, implementation of mitigation measures, supervision will be jointly taken up by the BWSC and PHED department/BSWSM in consultation with the SLC.

Block Level

BWSC will be established and made functional with the appointment of Block coordinators and cluster coordinators. BWSC will coordinate in providing necessary support for the capacity building of VWSC and GPWSC in the area of Information, Education and Communication (IEC).

District Level

The district level institutions comprises of the District Water & Sanitation Mission (DWSM), which would look upon the overall aspects of all Rural Water and Sanitation Programs and activities in the District, along with the District Water. District Project Monitoring Units (DPMUs) would be set up at the district level in all World Bank Program districts on a priority basis. These District Project Monitoring Units would have personnel with expertise in financial Management, Procurement, Community Mobilization, water and sanitation, etc. DPMU will ensure that the RWSS plans are executed in accordance with the EMF. DPMU will also ensure proper planning and monitoring of EMF activities at the district level, and coordinate between the District and SPMU. In addition to all this, PHED would provide guidance through its Executive Engineers at the District level.

The DEOs will be responsible for ensuring EMF implementation within the district. He will also select the external experts for appraisal of Category II schemes, if required. There will be a District Support Unit (DSU) at the district level under the control of the SE. This DSU will be responsible for implementation of the environmental management activities in accordance with the EMF at the district level under the supervision of DEO.

State Level

BSWSM would be the overall body for policy guidance and oversight aspects on RWSS activities across the State. The Public Health and Engineering Department (PHED) which is a statewide technical agency, will work as an implementer in all MVS (including small and large MVS) and facilitator in all SVS schemes.

State PMU (SPMU) will be staffed with professionals in Financial management, Procurement, Environment, M & E, Communications, etc. on a full time basis. Pranjal within BSWSM will become the primary institution to undertake capacity building, training and research activities in the RWSS sector.

At the State level the EC committee prepares the environment policy and sets the guidelines for the EMF implementation, monitoring and evaluation. This committee also liaises with other departments with regard to environmental issues. The Project Director, BSWSM will be responsible for ensuring the implementation of the EMF across the state. One State Level Environmental Expert (EMO) in the state PSU will ensure that environmental management activities are in conformity with the EMF and that necessary guidance and budget is provided to implement these plans.

The following table details out the roles and responsibilities of the institutions and personnel at various levels in implementing the EMF.

Table 4.6 Roles and responsibilities of institutions and personnel at various levels in EMF implementation

Level	Institution	Function	Responsibility
State	Bihar State Water and Sanitation Mission (BSWSM)	• Ensure overall implementation of the EMF in the project. • Arrange funds and personnel required for implementing the provisions of EMF. • Ensure that recommendations from supervision and monitoring are integrated into the project and the EMF is updated periodically as necessary. • Recruit external experts for conducting Environmental Audit and ensure that the relevant recommendations are integrated into the project. • Conduct environmental supervision of all Under Ground Drainage/ Sewerage schemes.	Director(SPMU), EMO, SE
District	District Water and Sanitation Mission (DWSM)	• Training and Capacity Building of SOs, VWSC, BEO, BWSC • Environmental Management on EMF. • Coordination among various organizations and personnel involved in EMF. • Coordinate with other line departments on environment related issues	SE, EE, AE, DWSM supported by DEO, DPMU
	District Project Management Unit (DPMU)	• Day-to-day management, responsible for undertaking all activities necessary for implementation of the EMF. • Carry out regular monitoring and supervision of the EMF implementation through appropriate mechanisms • Supervising the accuracy of the environmental appraisal conducted by EE/AE, PHED as part of the scrutiny of the schemes - including checking if the screening is accurate, if the Environmental Data Sheet has been filled in as required etc. • Evaluation of EDS and categorize the scheme into one of the categories I (limited) & II (significant). • Conduct Category II environmental appraisal using the Detailed Appraisal Sheet, if required or in cases where external technical support is required for conducting Category II appraisal - forwarding to the SE for decision on selection of suitable expert for conducting detailed appraisal for category II schemes and preparation of Detailed Appraisal Sheet (DAS) to identify	SE, EE, DWSM, DEO expert), DPMU

		the environmental impacts and designing mitigation measures. The mitigation measures are included in Environmental Management Plan (EMP) to be implemented along with various components of the scheme. • Conduct supervision visits to 20% of the completed schemes twice in the year (in coordination with the PMU). • Provide technical advice and guidance on environmental management to SO, GPWSC, VWSC, BWSC. • Provide inputs to DWSC on relevant environmental policies. • Ensure capacity building of all stakeholders in environmental management. • Design and implement IEC campaigns on environmental management. • Maintain a database consisting of relevant baseline environmental information of the district, environmental appraisal of the various ongoing and completed schemes, • Coordinate with institutions, agencies and individuals relating to environmental management including the regional offices of the BPCB, Water Resources Department, Minor irrigation department, Central Ground Water Board, Forest Department etc. • Collect, collate and publish data and information on EMF implementation in the project	
Block	Block Water and Sanitation Committee (BWSC)	• Environmental management and monitoring of projects at the Block level. • As part of the scrutiny of the schemes submitted by the GP- will check if environmental screening and appraisal has been properly done before forwarding them to the DPMU. • Coordination with NGOs for ensuring integration of EMF in all relevant project activities including capacity development, communication, project management and supervision.	BWSC, AE and JE (PHED)
Village	Village Water and Sanitation Committee (VWSC)	• Participation in preparation of Environmental Data Sheet (EDS) to be enclosed to Detailed Scheme Report (DSR). • The committee shall deliberate on environmental safeguards relevant to the	VWSC, SO, JE (PHED)

		schemes and adopt the same during construction and implementation • Certifying the implementation of environmental mitigation measures as part of the implementation completion report. • Facilitate IEC activities regarding water conservation, sanitation and hygiene among the villagers.	
	Support Organizations (SO)	• Provide support to the AE/JE, PHED in preparing the EDS. • Facilitating participation of the community in preparation of EDS and in certification process (for environmental mitigation measures) for implementation completion report. • Liaison with BPCB, Water Resources Department, Minor irrigation department, Central Ground Water Board, Forest Department and other related departments at scheme level for ensuring implementation of identified mitigation measures (permissions, technical support, etc.). • Provide support in execution of the IEC activities on EMF. • Provide support to the PHED in the supervision, monitoring and audit activities of the EMF. • Train the VWSC/BWSC in conforming to EMF requirements in operation and maintenance of Under Ground Drainage Sewerage schemes.	Directors/Heads of SO
	Scheme Level Committee	• Participation in EDS preparation of MVS. • Participation in certification process for implementation of environmental mitigation measures as part of implementation completion report. • To make efforts for spreading awareness regarding sanitation and hygiene among the member villages of the MVSs.	President, VWSC, SO, AE/JE (PHED)

4.7 Training and Capacity Building

4.7.1 Objectives

The objective of training and capacity building initiatives is to build and strengthen the capability of rural water and sanitation service delivery institutions (CCDU and PRANJAL) and other partners (NGOs, Contractors, Sanitation coordinators, Consultants in the Water and Sanitation sector and other field level stake holders) to ensure tangible

skill enhancement of the stakeholders and to integrate sound environmental management into water and sanitation service delivery.

4.7.2 Training Needs Assessment (TNA)

In Bihar, it is required to empower Village Water and Sanitation Committee (VWSC) and to measure the impact of training and progress of sanitation in the state. Workshops need to be organized periodically for Training Needs Assessment of various stake holders with the following objectives:

i.) Identifying gaps in the existing set of knowledge, skills and capabilities of the existing Public Health Engineers, Sanitation Coordinators, different stake holders of VWSC etc.

ii.) Identifying issues and means to upgrade the existing set of knowledge and skills in order to upgrade the efficiency of the various stake holders; and

4.7.3 Training Approach

The training programme could be based on the felt need, relevance and principle of sustainability as well as the recommendations from the Training Need Assessment workshops.

An enabling condition should be created for stake holders to understand and implement programmes on rural drinking water and sanitation (as per NRDWP guidelines). Special emphasis needs to be given to participatory techniques, community facilitation and communication skills and gender based approaches.

4.7.4 Institutions for Training

In view of the specialized training and capacity building envisaged under the EMF of the project, it is necessary to identify nodal training institutes that will work closely work with capacity building of Bihar State Water Sanitation Mission (BSWSM) for conceptualizing, designing, conducting and managing training programs on the EMF.

Some such specialized institutions are:

- Communication and Capacity Development Unit (CCDU)
- Bihar Institute of Rural Development (BIPARD)
- PRANJAL
- Key Resource Centres in Water and Sanitation (KRCs)

4.7.5 Training Programmes

Table 4.7 Number of functionaries to be trained during the program period 2013-19

Sl No	Training Topic	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	Total number
1	Village Level	348	869	869	869	348	174	3477
2	District Level	51	126	126	126	51	25	505
3	State Level							
a	SPMU/WSSO	16	8	8	8	8	8	56
b	PHED	115	288	288	288	115	58	1152
4	Total	530	1291	1291	1291	522	265	5190

Table 4.8 Estimated Cost of Training for the duration of the program period 2013-19 (Amount in Rs Crores)

Sl No.	Project Component	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	Total
1	**Preparatory Studies** incl. sector studies, Environment Sanitation Plans & Water Security Plans	5.15	3.82	2.00	0.72	-	-	**11.69**
2	**Capacity Building & Training for SWSM (Workshops)**	0.04	0.04	0.05	0.05	0.06	0.06	**0.30**
3	**Strengthening of WSSO (incl. SPMU)** Includes Training Programs, Exposure Visits and Twinning Arrangements	0.93	1.00	1.10	1.21	1.33	1.46	**7.03**
4	**Capacity Building of PHED** Includes Training Programs, Exposure Visits and Twinning Arrangement costs	1.06	1.51	1.67	1.83	1.55	1.54	**9.16**
5	**Strengthening of DWSMs/ DWSCs/ DPMUs** Includes workshops for DWSMs, Training Programs and Exposure Visits	0.71	0.89	0.98	1.07	1.03	1.08	**5.76**
6	**Strengthening of GPs/ VWSCs** Includes Training Programs and Exposure Visits	0.5	0.91	1.00	1.10	0.81	0.74	**5.11**

Sl No.	Project Component	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	Total
7	**Support Organizations**	0.52	1.78	6.01	10.3	7.27	3.44	**29.32**
8	**IEC Activities***	5.06	5.06	5.06	5.06	5.06	5.06	**30.36**
9	**Strengthening of existing Govt. owned Training Institutions**	2.50	2.50	0.25	0.25	0.25	0.10	**5.85**
	Total Capacity Building Cost	**16.52**	**17.5**	**18.1**	**21.59**	**17.36**	**13.49**	**104.58**

*Cost of IEC activities provided under the program are over and above the provisions made by GoI/State Government under NBA

It is proposed to organize capacity building and training workshop for the years 2013-19 with a proposed budget of Rs 105 Crores, which is about 6% of the total project component.

The total estimated cost of training on environmental management for members of SWSM, WSSO including SPMU, DWSM, DWSC, DPMU, GP, Support Organizations, Engineers of PHED, District and Block Sanitation Coordinators, Masons and artisans, under the proposed EMF is presented in the table below:

4.8 Environmental Codes of Practice

4.8.1 Guidelines/Environmental Code of Practices

1. Guidelines/ Environmental Code of Practices (ECOP) have been prepared for addressing the following environmental issues and are furnished in the Annexures as indicated.
2. Guidelines for Identification and Selection of water supply sources: The criteria for the selection of source for water supply are specified in Annexure 5.
3. Guideline for sanitary protection of water supply sources: The well to tap groundwater sources and intake arrangements to tap surface water sources are located at certain distance away from the pollution existing sources and the structures are protected with certain measures to protect the quality of water from getting contaminated. The detailed guidelines are furnished in Annexure 6.
4. Guidelines for Sustainability of Sources: The yield from the sources in general and ground water source in particular is likely to decrease during summer. In order to ensure sustainable yield throughout the year certain measures such as artificial recharge of the groundwater source with rainwater harvesting structures are necessary. These measures are furnished in Annexure 7.
5. Guideline for Water Quality Monitoring and Surveillance: The water quality of the sources and in the distribution system is deteriorating due to contamination especially after rains in surface water sources and in summer months in groundwater sources. Water quality monitoring should be undertaken

periodically in order to take corrective measures if the quality changes. The procedure and protocol for water quality monitoring and surveillance are described in Annexure 8.

6. Selection and installation of safe sanitation technologies; the checklist for choice of technology and selection of location are furnished in Annexure 9.
7. Recommended Construction Practice and Pollution Safeguards for Twin Pit Pour Flush toilets: Twin Pit Pour Flush Latrines (TPPFL) are the most commonly adopted sanitation technology which is suitable in most of the environmental conditions except coastal areas with high groundwater table. Recommended construction practice and Pollution Safeguards for TPPFTs are described in Annexure 10.
8. Guidelines for Safe Sullage Disposal at Household and Community Levels: greywater/sullage disposal at village level is very important for maintaining the hygiene in and around the place; the guidelines for safe sullage disposal are described in Annexure 11.
9. Guidelines for Community Solid Waste Management: the guidelines for managing solid waste disposal at household and community levels are described in Annexure 12.

Annexure 1 Environmental Assessment Questionnaire (Village level)

Environmental Assessment Questionnaire (Village level)			
Name of district:		**Name of block:**	
Name of Gram panchayat:		**Name of village:**	
Date of survey:		**Name of respondent:**	
Interviewer's name:		**Respondent's Contact no:**	
General Information			
1	Terrain of the area	Plain	Rolling Hilly
2	Area in Acres		
3	Population	Total:	(SC…….,ST……..,OBC…….GEN…….)
4	Total number of Households		
5	Historical/Cultural important sites		
6	Critical natural habitats (forest, lake recognized by govt.)		
6	Type of Roads	Bituminous/Cemented/Brick paved/Kachcha/others	
7	Average width of Road in m		
8	Type of soil	Alluvial ____ Silt ____ Silty clay ____ Sandy _____ Sandy clay _____ other _____	
Water Supply			
1	**Sources of water (no. of sources)**	**Canal/River Groundwater Other**	
2	**Whether the proposed water supply scheme is**	**Single Village: Mini WSS / Rural WSS** **Multi village: Small MV / Large MV** **Hand pump : with attachment / without attachment unit**	

3	**Any up gradation of the existing scheme**	**Yes / No, If yes, what type of upgradation……**
4	**Type of Water Supply & number of units (working & non-working)**	**1. Open Well 2. Tube well 3. Public Tap/Departmental supply 4. Hand pump 5. Any Other** *(Pl specify)*
5	**Is there problem of water shortage/scarcity?** **If yes, which season?**	
6	**In case of piped water supply, capacity of overhead tank**	
7	**Service Level of Water Supply in lpcd**	
9	**Groundwater Level** **Is there any change in GW level in last 5-10 years?**	**a)Shallow (0-20ft.) b)Moderate (20-40 ft.)** **c) Deep aquifer (40 – 80 ft.) d) Very Deep (above 80 ft.)** **Yes/No, If yes, increase or decrease?**
10	**Intensity of Rainfall**	**Low Medium High**
11	**Has your village faced any such problems in past 5-10 years?**	**Drought Yes / No.** **Flood Yes / No.** **If yes, in which month and year?**
11	**Any water treatment system (for any specific contamination)**	**Yes No** **If yes, what type of treatment system:** **Is it cost effective? Yes / No Capital cost Rs._____O&M cost Rs.___** **Who takes care of O&M?**

12. Mention the appropriate nature of the quality problem	☐ Fluoride	☐ Iron	☐ Heavy Metals
	☐ Bacteriological	☐ TDS	☐ Pesticide
	☐ Nitrate	☐ Others	☐ No Problem

13. Is there potential risk of contamination of source due to	a. Industrial contaminants b. Human waste discharge c. Solid waste dumping

If yes, whether appropriate preventive/ corrective actions taken? (Write a note)	d. Use of agro chemicals (Fertilizers, pesticides etc?) e. Land fill f. Mining site

17. Institution responsible for providing water supply and sanitation service?

a. Implementation_____

b. O & M _____

18. Quality of service provided under O&M: Good_____ Moderate _____ Bad _____

Existing Sewerage and Sanitation Parameters					
Presence of drainage facilities			Sullage	Sewerage	
Current Sanitation Practices	a)Borehole latrine	b) Single Pit Toilet	c)Twin Pit Toilet	d) Toilet with Septic tanks	e)Others (Open Defecation)
Specify the Numbers of above in respective columns					
Whether Existing Ponds are being used for Sewage Discharge			a) Yes		b) No
Is there water logging problem inside the village? How many sites? Causes diseases?			Yes		No

Sewage Treatment (if any)		Yes No
How do you dispose your waste water?		a. Earthen (Kattacha) drainage channel along the streets b. Pukka drainage channel along the streets c. Soak pit d. Kitchen Garden e. Any Other *(please specify)*
Is there any health & hygiene issue due to sanitary discharges (or existing sanitation practices)		
Solid waste		
1	How do you dispose your solid waste?	a. Throwing in open places. b. Disposing in open pits. c. Disposing through burning d. Any other ……
2	What are the different types of solid waste generated?	

3	Where do you dispose of fodder waste dung?	
4	Do you have compost pit for fodder waste dung?	Yes or no If yes; Location and distance from the house/village:
5	Is there any health & hygiene issue due to disposal of fodder waste dung	
Health		
1	What are the frequent illnesses in your village and who is most affected?	
2	How often is the disease outbreak?	
3	Was there a health epidemic due to contaminated water in the past 2 yrs?	

Diseases	Reason perceived
Diarrhoea	
Malaria	
Typhoid	
Any Skin disease	
Others specify	

Potential environmental Risks during implementation & operation of schemes	
1. Noise pollution during construction of schemes 2. Air pollution (dust) 3. Soil quality/pollution 4. Clearance/cutting of trees 5. Pipe network crossing forest/ sensitive/ sewrage lines/ agricultural area	Yes/No Yes/No Yes/No Yes/No
Operation 1. Disposal of backwash water & sludge generated during treatment process	
Awareness	
Any awareness programs regarding water & sanitation taken up?	**Yes / No**
How do you protect drinking water sources?	

	Is there any occasion where the whole village is cleaned & sanitized compulsorily	
Acceptance of interventions		
1	Willingness to partially contribute for an intervention applied to your village or area	Yes No
Suggestions/Comments		
3	Any other comments or suggestions	
4	Perception on environmental Issues related to RWSS	
5	Self-perception and suggestions on Environmental Impacts and issues	

Annexures 2 Household Survey Questionnaire

Household Survey Questionnaire			
Village:		**Serial number:**	
Name of Gram Panchayat:		**Name of District:**	**Block:**
Date of survey:		**Name of respondent:**	
Interviewer's name:		**Respondent's Contact no:**	
General Information			
1	**Category**	General OBC SC ST Others	
2	**Address of house owner**		
3	**Members in family**	Male: Female: **Total:**	
4	**Occupation**		
6	**Education level**	*(Pl specify)*: *Above Matriculate (Nos.):* *Illiterate (Nos.):*	
8	**Type of household**	a. Pucca, b. Kattcha, c. Semi-pucca , Total roof area: _____(approx)	
Water			
1	**Sources of drinking water for household**	**1. Open Well 2. Tube well 3. Public Tap 4. Hand pump 5. Any Other** *(Pl specify)*	
2	**How far is the water source from your house?**	1. Inside the house 2. Within 100 meters 3. Between 100-500 meters 4. More than 500 meters	
3	**How much time is spent in collection of water from sources outside the house?**	....*(minutes)*	
4	**In case of piped water supply or public tap**	a. What is the duration and timing of supply? *b.* Water supply pressure *(pl tick):* High. ....., Medium....., Low…….	
6	**Do you store water in the house?**	Yes No If yes, what is the storage arrangement? What is the period of storage?	

<table>
<tr><td>7</td><td>Amount of water used for households purposes
(Liters/day)</td><td></td></tr>
<tr><td>8</td><td>Is water quantity is sufficient? If not, what is the quantity of water required? (Mentions in liters/day</td><td></td></tr>
<tr><td>9</td><td>What do you feel about quality of your drinking water?</td><td>a. Odour : Yes No
b. Colour:
Clear…….Muddy……Blackish……..Other……
c. Taste: Sweet …… Salty…….Other……
d. Any stomach problem? ……..(If Yes please specify)……
e. Any other :</td></tr>
<tr><td>11</td><td>Do you store your drinking water?
Any problems.</td><td>Yes No</td></tr>
<tr><td>12</td><td>Do you treat your water before drinking?</td><td>Yes No
If Yes, Then specify the method of treatment
a. Boiling
b. Use filter, ZeroB, Aquaguard etc,
c. Sieving with Cloth/Alum etc,
d. Sedimentation
e. Chlorination
f. Any other……</td></tr>
<tr><td>13</td><td>With respect to potable water, rate the problem of availability and quality using the following codes:
Very serious …… 1
Somewhat serious…….. 2
No problem…….. 3
Don’t know…… 4</td><td><table><tr><th></th><th>Availability</th><th>Quality</th></tr><tr><td>In summer</td><td></td><td></td></tr><tr><td>In Winter</td><td></td><td></td></tr><tr><td>Overall</td><td></td><td></td></tr></table></td></tr>
<tr><td>14</td><td>Do you pay any water charges?</td><td>Yes No
If Yes, please specify the amount paid monthly:</td></tr>
<tr><td>15</td><td>Is potable water a problem in your village or area?</td><td>Yes No</td></tr>
<tr><td>16</td><td>Do you want better water supply system in your village? If yes, why?</td><td>Yes No</td></tr>
</table>

17	**Do you feel any initiative for solving the drinking water problem can work in your village or area?**	Yes No *If Yes,* What kind of intervention would be appropriate? *(please specify)* – ***Water kiosk*** – ***Mini piped water supply*** – ***Piped water supply*** – ***Hand pump*** – ***Filter units*** – ***Any other……..*** Would you like to be part of the initiative?
19	**Do you get enough rainfall to suffice all of your water needs?**	Yes No *Any Comments:*
20	**Do you find any change in groundwater level over the past 5-10 years in your village or area?**	Yes No If yes, What kind of change (increase or decrease)?
Sanitation		
1	**What is the kind of sanitation facility available to you?**	1. Household Toilet 2. Public Toilet 3. Open defecation 4. Any other
2	**If toilet is not available, what type of toilet do you feel is needed?**	1. House hold toilet 2. Public toilet 3. Any other
4	**How do you dispose your waste water?**	f. Earthen (Kattcha) drainage channel along the streets g. Pukka drainage channel along the streets h. Soak pit i. Kitchen Garden j. Any Other *(please specify)*
5	**Do you feel the need of proper wastewater drainage system in your village or area?**	Yes No *If Yes,* a. What kind of intervention would be appropriate? *(please specify)* – ***Construction of new drain*** – ***Renovation of existing drain*** – ***Construction of soak pits*** – ***Kitchen gardening*** – ***Any other……..*** b. Would you like to be part of the initiative?
6	**How do you dispose your solid waste?**	e. Throwing in open places. f. Disposing in open pits. g. Disposing through burning h. Any other ……
7	**Do you feel the need of proper solid waste disposal system in your village or area?**	Yes No *If Yes,* a. What kind of intervention would be appropriate? *(please specify)* – ***Vermicomposting*** – ***Cluster dustbin installation*** – ***Household dustbins***

		– ***Any other……..*** b. Would you like to be part of the initiative?
Health		
1	**What are the frequent illnesses in your family?**	**Diseases** / **Reason perceived** **Diarrhoea** **Malaria** **Typhoid** **Any Skin disease** **Others specify**
Agriculture		
2	**Is there a change in cropping pattern over the past 5-10 years?**	Yes No *If Yes, reasons*
3	**Is the land irrigated?**	Yes No *If Yes,* What is the main source of irrigation? 1. Tube well 2. Canal 3. Open Well 4. Ponds & tanks 5. Any other
4	**Have you adopted any micro irrigation system?**	Yes No
5	**Do you wish to undertake any measures for soil and water conservation (SWC) activity?**	1. Yes 2. No 3. Not Applicable
Awareness		
1	**Any awareness programs regarding water & sanitation taken up?**	Yes / No
2	**How do you protect drinking water sources?**	
Acceptance of interventions		
1	**Willingness to pay tariff for interventions on drinking water supply/provision**	Yes No *If Yes,* What is the amount you can afford to pay per month? *(please tick)* – *Less Rs. 20/-…, Between Rs. 20 to 35…., Between Rs. 35 to 50…..* – *More than Rs. 50……..*
2	**Willingness to partially contribute for an intervention applied to your village or area**	Yes No

3	Any other comments or suggestions	
4	Self-perception on environmental issues	

Annexures 3 Check-list for Environmental Impacts of Existing/Proposed Programs

S. No.	Is the program/scheme likely to	YES	NO.	Not Known
1.	Affect any natural feature, surface water hydrology, surface water quality, soils, erosion, geology, climate or water resource adjacent to the activity area?			
2.	Affect wildlife or fisheries?			
3.	Affect natural vegetation?			
4.	Affect or eliminate land suitable for agricultural or timber production?			
5.	Affect commercial fisheries or aquaculture resources or production?			
6.	Affect the quality of water resources or catchment areas within or adjacent to the activity area through change in the water supply downstream of irrigation or through human or animal toxins?			
7.	Affect air quality in the activity area or adjacent areas?			
8.	Require relocating the existing population, community facilities and housing?			
9.	Lead to changes in the supply of or demand for infrastructural items?			
10.	Cause substantial change in income and traditional source of livelihood of existing population?			
11.	Include provisions to investigate the impact on regions where resettlement is occurring?			
12.	Result in potential conflicts or affect physical, demographic or attitude/ value cohesion?			
13.	Affect archaeological sites or structures of historic or cultural significance?			
14.	Include or exacerbate erosion in the watershed area?			
15.	Exacerbate water rights conflicts?			
16.	Provoke a significant reduction in downstream flow, impairing aquatic life or endangering wetland water supply?			
17.	Create or exacerbate insect disease hazards?			
18.	Be designed without prior consultation or participation of affected populations?			
19.	Provoke a shift in crop pattern in the region?			
20.	Provoke a shift from low-input to high-input farming practices?			
21.	Ignore provisions for post-project monitoring?			
22.	Require long-term extension services?			
23.	Induce new migration towards the projects area (around reservoirs)?			
24.	Be implemented in the absence of a training programme on techniques for more efficient water use?			
25.	Create or exacerbate soil salinity problems?			
25.	Be designed without adequate drainage facilities?			

Annexures 4 District-wise household data analysis

Household survey analysis for NAWADA District, Bihar

District – NAWADA (24 53′ N and 85 33′ E)

No of Civil Sub Division: 02

Nos. of Block: 14

Nos. of Panchayat: 187

Nos. of Revenue Village: 1220

Nos. of Habitations: 2242

Boundary – Jharkhand, Gaya, Nalanda, Sheikhpura & Jamui

Population as per 2001 Census (Rural): 1671253

Population as per 2011 Census (Rural): 2001120

Availability of Water Source:

Surface Water:

A) No Perinial river exists.
B) 4 nos. of Dam exist over seasonal river for irrigation purpose.
(i) Job Reservoir Scheme near Akbarpur block.
(ii) Kol Mahadev Reservoir Scheme, near Thali Govindpur block.
(iii) Puraini Reservoir Scheme (In between Kol & Job reservoirs near Akbarpur block)
(iv) Phulwaria Reservoir Scheme near Rajauli.

Out of the four reservoirs, the first three become dry after rainy season whereas in the fourth reservoir water Level comes below D.S.L. (dead storage level) after rainy season.

Current Water Supply Scheme:

Functional (Running)

S.no	Particulars	Nos.	Population covered	Percentage Covered (Year 2011)
1.	Rural Water Supply Scheme (Electric)	14	108606	5.43
2.	Rural Water Supply Scheme (Solar)	04	12271	0.61
3.	Mini Water Supply Scheme	10	10420	0.52
	• Solar	21	22015	1.10
	• Solar (Quality)			
			Total	7.66

Under Construction:

S. no.	Particulars	Nos.	Population	Percentage Covered (Year 2011)
1.	Rural Water Supply Scheme (Electric)	09	54092	2.70
2.	Rural Water Supply Scheme (Solar)	01	5582	0.28
3.	Mini Water Supply Scheme	02	2000	0.09
	• Solar (Draught)	09	9354	0.47
	• Solar (Quality)	07	8139	0.41
	• Electric			
			Total	3.95

Total population covered by the Water Supply Scheme after completion of on-going scheme will be 11.61%

Number of functional hand pumps as of 01.04.2012 is 15110.

Proposed schemes for year 2013-2014, 1st batch

1. 15 single village scheme (SVS)
2. 1 Multi village scheme at Rajuli

Water quality issue: Fluoride

Status of IHHL in Targeted NGP

SL. No.	Nos. of Block	Nos. of Panchyat	Target		Achievement	
			APL	BPL	APL	BPL
1.	14	26	30496	29698	2762	6281

Sanitation:

SL. No.	Particulars	Target	Achievement	% covered
1.	IHHL BPL	165884	63163	38
2.	IHHL APL	69176	14337	20.7
3.	School Sanitation	2348 unit	2278 unit	96.77
4.	Anganwari toilet	436	132	30.27

Household survey analysis

Village: Bhola khura

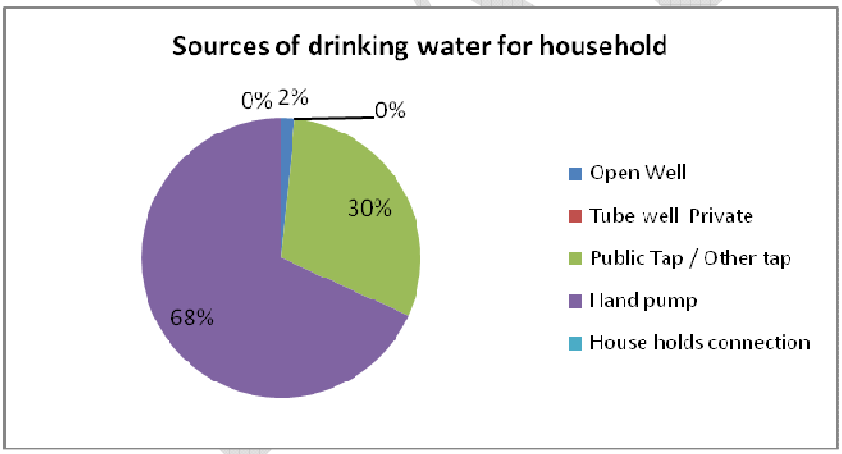
Scheme: Mini water supply system with fluoride treatment system & solar pumps

Water quality issue: Fluoride

As a part of the environmental assessment, household surveys were conducted in Bhola Khura village, Sandmajhgaon panchyat, Sirdala block of Nawada district on sample basis. Households were surveyed covering entire village including SC & SC communities in the village .The findings of household survey are discussed below.

Existing Water Supply System

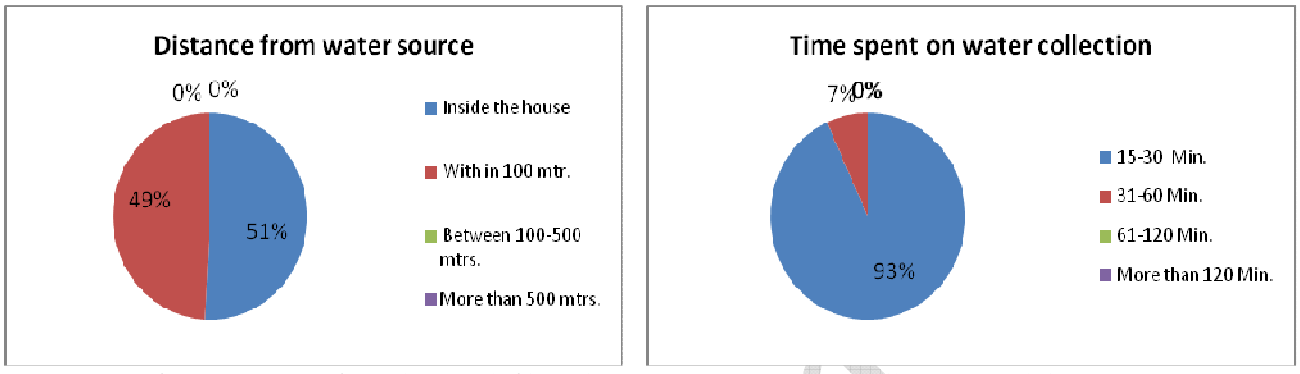
Source of drinking Water



Existing water supply source in the village

The main source of drinking water in the village are hand pumps & mini pipe water supply in addition to one open well (private) in the village. Based on the household survey, approximately 30% of the respondents use the pipe water supply stand posts this water is not used by the entire village due to the limitation of scheme (pipe length & no. of stand posts) and also because of some myths about the filtered water, for example, it creates impotency etc. Majority of respondents (approximately 68 %) use water from hand pumps for all purposes including drinking.

Water supply

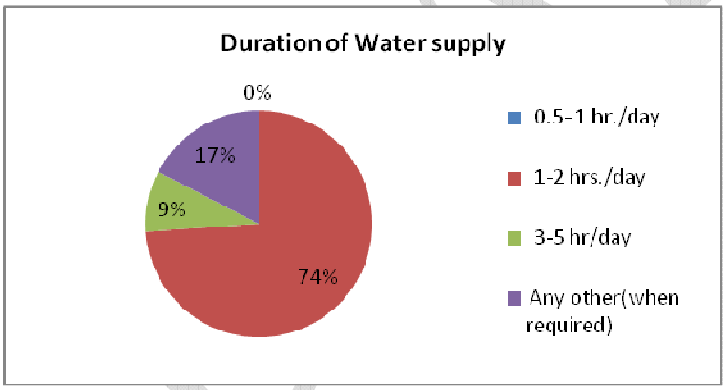


Distance of water source from house (left) and Time spent on water collection (right)

Most of the people have household hand pumps. Other people uses water from neighbours' hand pumps or Public hand pumps. Approximately 51% respondents have the water accessibility within the house, 49 % respondents have to go up to 100 m to fetch water.

Majority of the respondents (approx.93%) spend 15-30 minute for collection of water from the pipe water source. And only 7 % respondents spend more than 30 minutes for fetching water.

Duration of Water supply

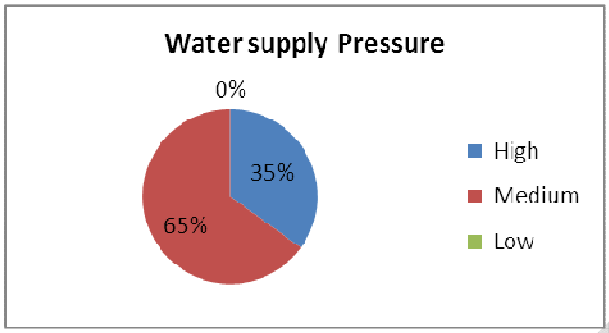


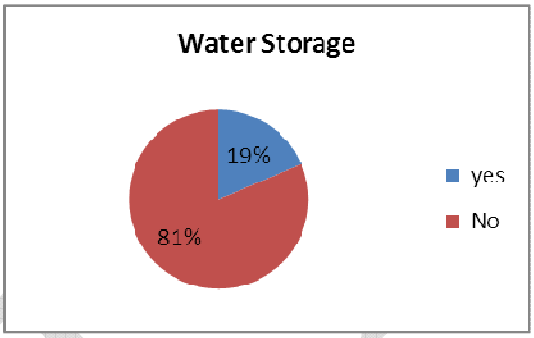
Duration of water supply

There is no uniform timing for water supply in the village from pipe water schemes. Every tola or cluster has their own problems and perceptions. Majority of the respondents (approximately 68%) are dependent on hand pump water and only 30 % respondents use pipe water supply stand posts. Out of the people who use piped water, 74% of them get water 1 to 2 hr /day, 9% respondents get water 3-5 hrs/day and 17% respondents use pipe water when required. The reason for non-uniform supply of pipe water is due to the village terrain, low pressure, broken taps and limited stand posts.

Water Supply Pressure

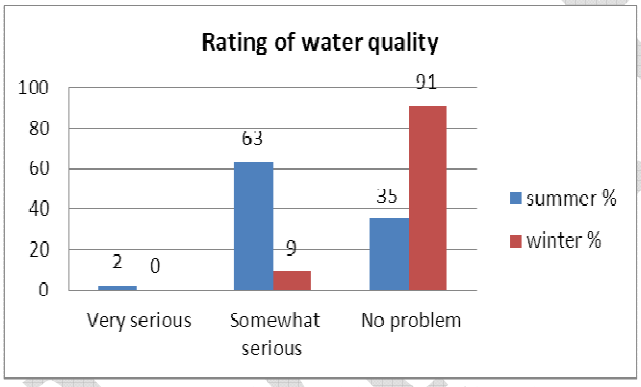
According to the household survey, 35% of the respondents get water at high pressure from the stand posts while 65 % respondents said that the water pressure is not high enough (medium pressure). Approximately 81% respondents do not store water for drinking purpose, while only 19% people's store water for various uses including drinking but the storing time is not more than 12 hrs.

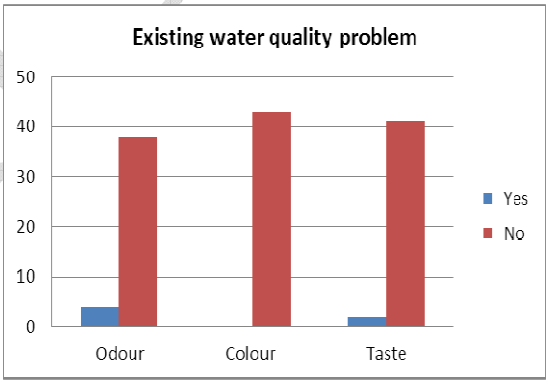




Water Supply Pressure and Storage.

Water Quality





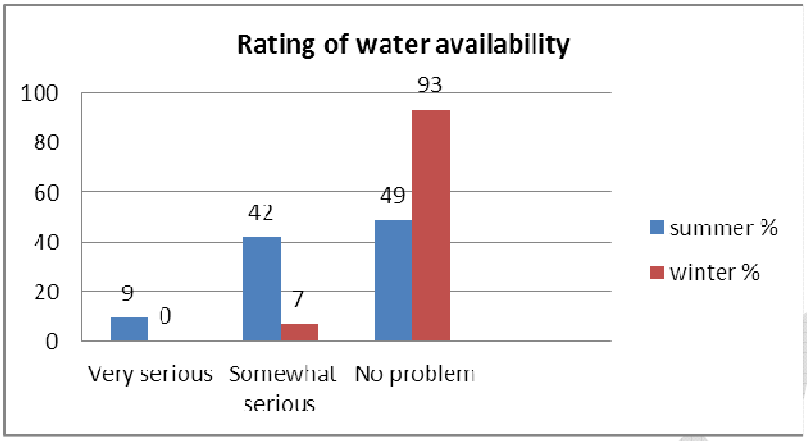
Existing Water Quality problems (Left) and Rating of Water Quality Problems (Right)

Based on the household interactions, most of the population of the village depend on hand pump for water, which has the problem of odour& taste during summer seasons. Pipe water does not have any problem of colour, odour& taste. Approximately 63% respondents have the perception that during summer, water quality problems increase and approximately 9 % respondents said that winter there is slight problem of water quality.

Treatment of Drinking Water

Almost all respondents (100%) do not treat their drinking water before drinking.

Issue of water availability seasonally



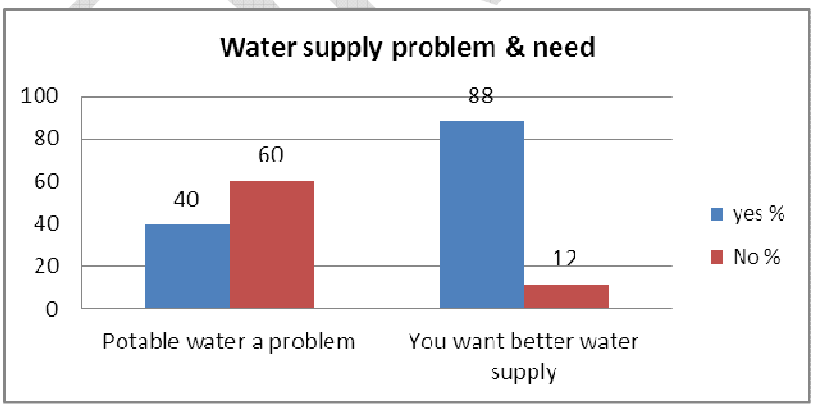
Rating of water availability problem seasonal wise

Water availability is a problem during summer in the village. Based on the household survey, nearly 9% of the respondents expressed that there is serious water availability problem, and 42% respondents expressed that water availability is only "somewhat" serious problem during summer season. Water availability problem has also been observed in winter season, with 7 % respondents expressing it to be "somewhat" serious.

Willingness to participate in water supply intervention

Willingness to participate in water supply intervention

You like to be part of the initiative	Response
1. Yes	100%
2. No	0%



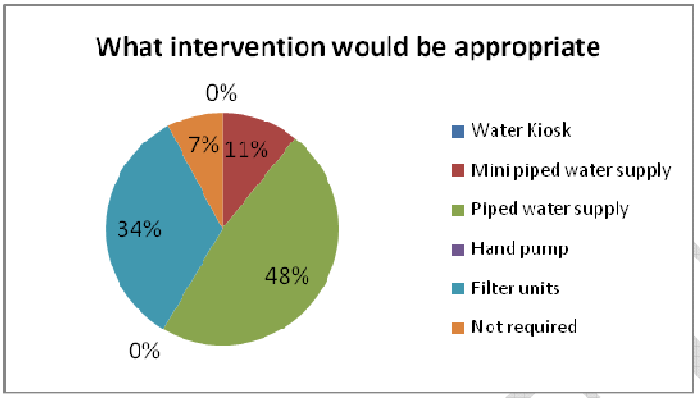
Problem and need of water supply system in the village

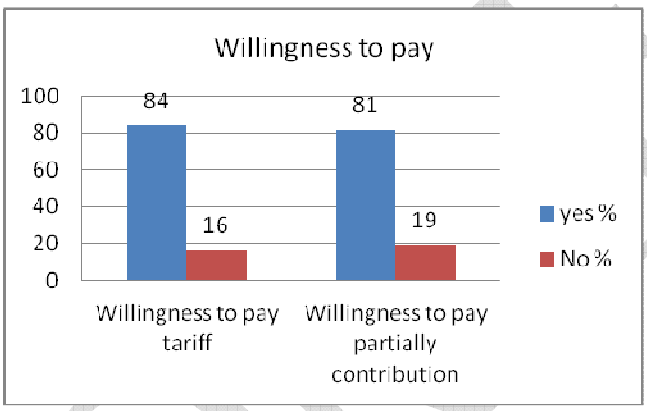
Although the village has pipe water supply system, it is not sufficient to meet the daily needs of entire village community because of limited number of stand posts. Almost 40%

respondents expressed that potable water as an issue in the village and almost 88 % respondent said they need a better water supply system.

Better water supply system and Willingness to pay

Figure 8 Suggested interventions for better water supply system and Willingness to pay/ contribute for water intervention





Based on the interactive responses, nearly 48% expressed the need for better pipe water supply system with more stand posts and household connections, and 34% of the respondents suggested the need for more filter water for better water quality, 11% respondents suggested better mini water supply system with filtration system and more stand posts in the areas of the village where there is severe scarcity of water.

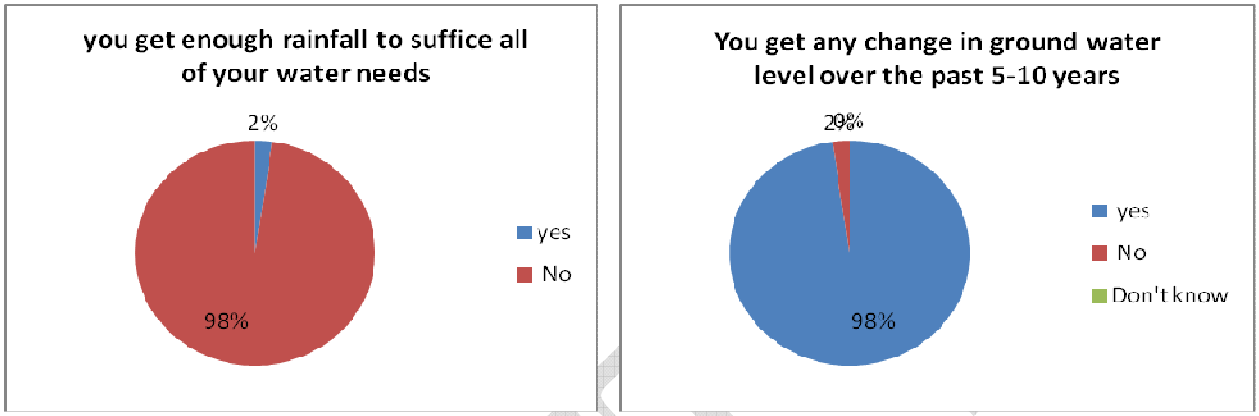
Almost 84% respondents are willing to pay tariff and partially contribute to new water supply intervention. Approx. 16 % respondents are not willing to pay tariff because of poverty.

Water charges

At present nobody pays any charges for pipe water supply to Panchayat/PHED and also there is no water committee in the village for operation and maintenance of pipe water supply.

Perception on rainfall & groundwater level

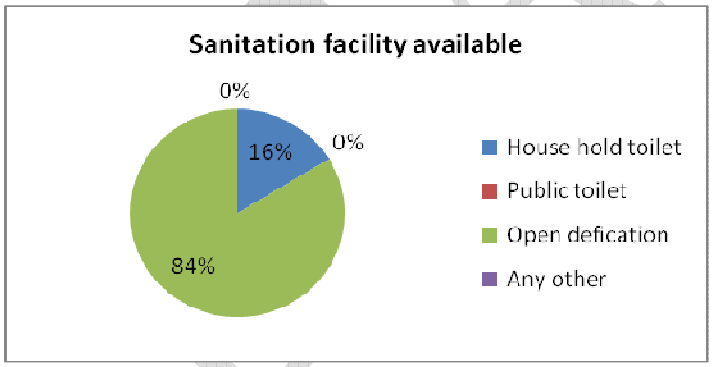
All the respondents expressed the problem of drought condition and decreasing rainfall pattern over the past 10 years. This decreasing rainfall trend has reduced the groundwater resources, which becomes scarce during summer season. Almost 98% respondents perceived that the ground water level has gone down over the past 5 to 10 year.



Perception on rainfall & groundwater level

Existing sanitation and waste management facility

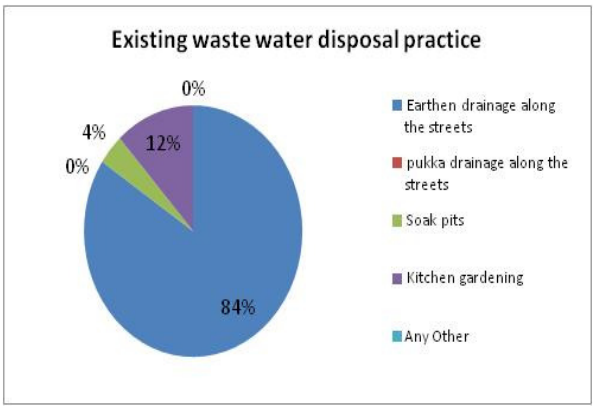
Sanitation Facility

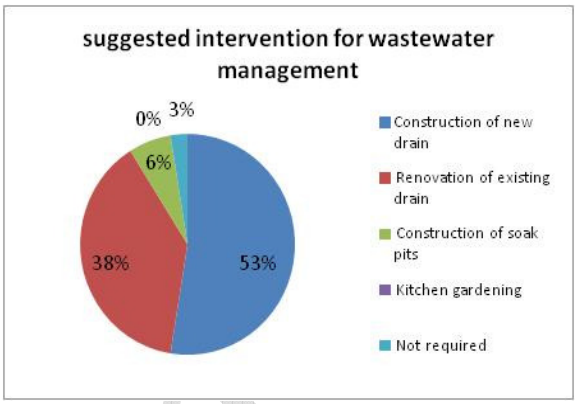


Existing Sanitation Facility in the Village

As per the household surveys, 84% of the respondents go for open defecation in the village. Non-availability of sanitation facility is a major issue expressed during public consultation meetings. Approximately 97% respondents expressed the need for household toilets.

Existing Waste water and Solid waste management Facility

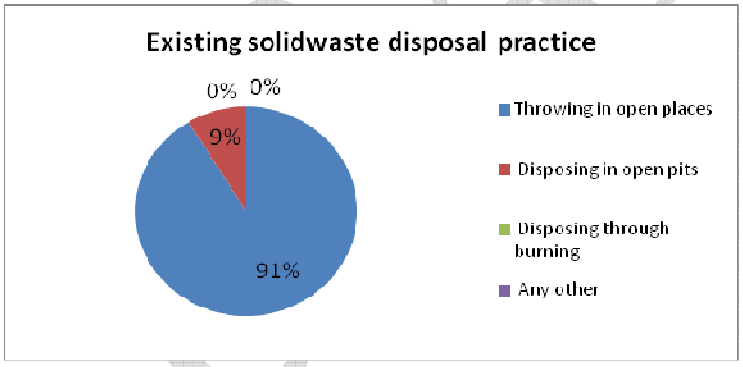


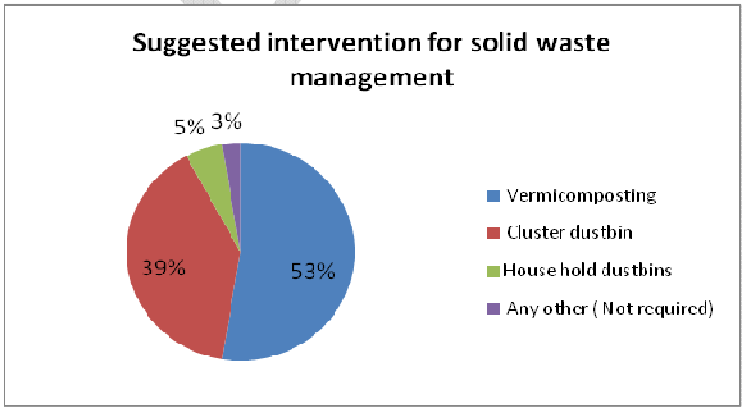


Existing Wastewater management facility & suggested intervention for better waste water management

Most of the village areas do not have any waste water drainage facility, and all the waste water generated from household flow on the village roads. Approximately 84% respondents practice waste water disposal along roads, while 12 % informed of using kitchen garden for waste water disposal and 4% respondent informed of the use of soak pits.
More than 53% respondents suggested construction of new drainage system and renovation of the existing drainage for disposing the waste water from the households. Only 6% respondent suggested for the construction of soak pits.

Solid waste Management facility



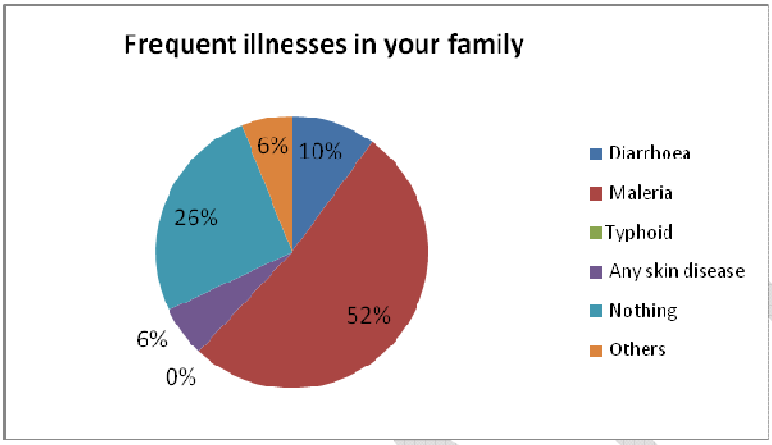


Suggested interventions for solid waste management facilities

As per household surveys, the village does not have any solid waste management facility. Throwing of solid waste in open places was observed in the case of almost 91% of the respondents. Based on household interviews related to better solid waste management facility, nearly 53% suggested for vermi-compositing method, 39 % suggested for cluster dustbin facility and 5% suggested for household dustbin.

Perception on water borne diseases

Based on the perception of village community on health related issues, some of the water borne diseases like Diarrhoea (10 %), Malaria (52 %), Skin diseases (6 %) and other diseases has been reported in the village. The other diseases/health problems are mainly fever, headache, bone pain etc.



Major observation & findings

Water Supply

- The main sources of drinking water in the village are hand pumps and Mini pipe water supply scheme.
- During summers most of the shallow depth hand pumps fail due to the lowering of the ground water level.
- Almost 49% of the village community bring pipe water from more than 100 meter distance from the house.
- Nobody is paying any charges for pipe water supply in the village.
- There is no water user committee in the village for operation & maintenance of pipe water supply scheme. At present, PHED is responsible for operation & maintenance of the schemes.

Water Quality

As per Household survey & public consultation meetings, most of the people in the village are dependent on hand pump water which has the problem of colour, odour & taste during summer season only. Pipe water supply has no quality issue in the village.

As per PHED, ground water is contaminated with fluoride in this region and the concentration is more than 1.8 mg/l, which is above the permissible limit as per Indian drinking water standard IS 10500.

As per house hold survey, most of the village community do not treat or filter the water before drinking.

Rainfall & groundwater level

As per the household surveys & public consultation meetings, drought occurred in the study area during the past 10 years and there is decrease in rainfall over the years. Groundwater level is also decreasing.

Better water supply &Willingness to participate in water supply intervention

Based on the interactive responses, almost all the respondent are willing to pay tariff for new water supply intervention.

Sanitation

As per Household survey & public consultation meetings, there is no adequate sanitation facility in the village and most of the respondents go for open defecation in the village. Non-availability of sanitation facility is a major issue expressed during interaction with women, and most of the people expressed their need for House hold toiles.

Wastewater management

Base on household surveys & public consultation meetings, most of the village areas do not have any waste water drainage facility, and all the waste water generated from household flow along the roadside. More than 50% respondents suggested construction of new drainage system and renovation of the existing drainage. Only 6 % respondent suggested for construction of new soak pits.

Solid Waste Management

As per household surveys & public consultation meetings, the village does not have any solid waste management facility. Throwing of solid waste in open places was observed in the case of all respondents. For solid waste management intervention, most of peoples suggested for vermin-compositing method and cluster dustbins.

Health Issues

There was a very mixed responses observed from the house hold survey, Based on household survey, nearly 10 % experienced problem of Diarrhoea, 52% experienced Malaria, 6% experienced skin diseases, and other diseases. The other diseases/health problems are mainly fever, headache, bone pain etc.

Environmental issue

1. Cutting of 8 Pam trees during construction of the mini pipe water supply scheme in the village.
2. Discharge back of wash water from fluoride treatment system of the mini pipe water supply scheme during operation & maintenance, directly go to open field/agriculture field/pond, which may contaminate the top soil or ground water through percolation.
3. There is no drainage facility in the village resulting in water logging problem almost in every household hand pump.
4. Open defecation practice in the village may cause disease & contaminate groundwater.
5. No facility for solid waste disposal in the village causing problem to human health and contaminating groundwater through leachate percolation.
6. There is a river called "Tiliya", 4 km away from the village, which can be explored for village water supply.
7. As per PHED, groundwater is contaminated with fluoride in this region.
8. There was no major environmental issue reported during construction of the scheme like noise, air, soil pollution & forest land acquisition.

Scenes from the villages:

Village: Kachariah dih

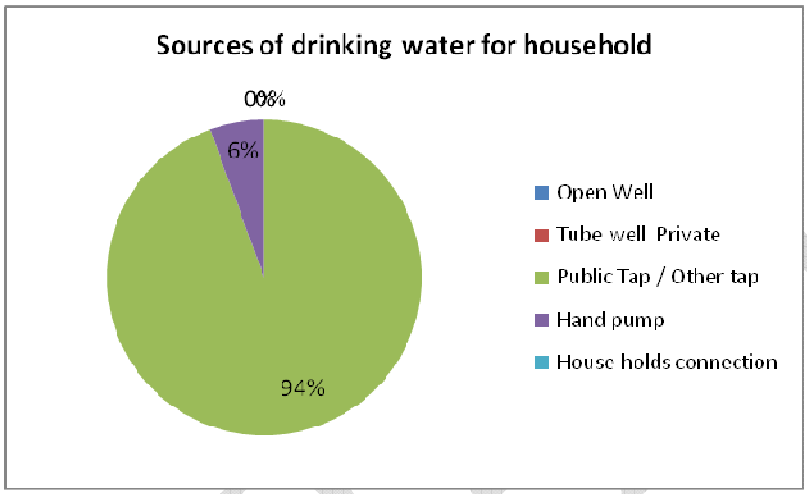
Scheme: Mini pipe water supply with fluoride treatment unit

Water quality issue: Fluoride

As part of the environmental assessment, the household surveys were conducted in Kachariah dih village, Hardia panchyat, Rajuli block of Nawada district on sample basis. Households were surveyed covering entire village including SC & SC community in the village .The findings of house hold survey are discussed below.

Existing Water Supply System

Source of drinking Water

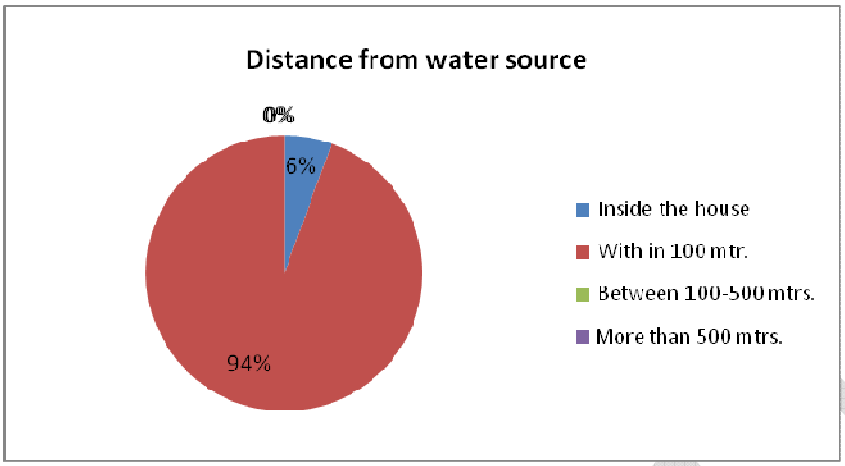


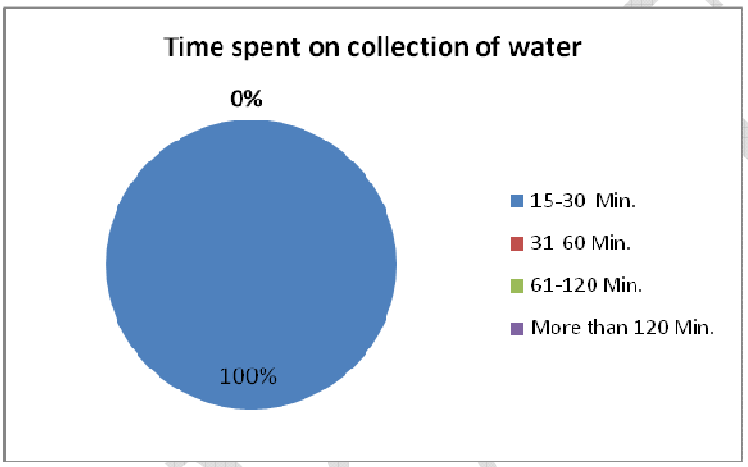
Existing water supply sources in the village

The main source of drinking water in the village is Mini pipe water supply scheme with fluoride treatment unit. PHED has closed all hand pumps in this village due to high concentration of fluoride in the ground water.

Based on the household survey, only about 6% respondents use the hand pump water. It was also reported that the number of stand posts are less and should be increased.

Water supply

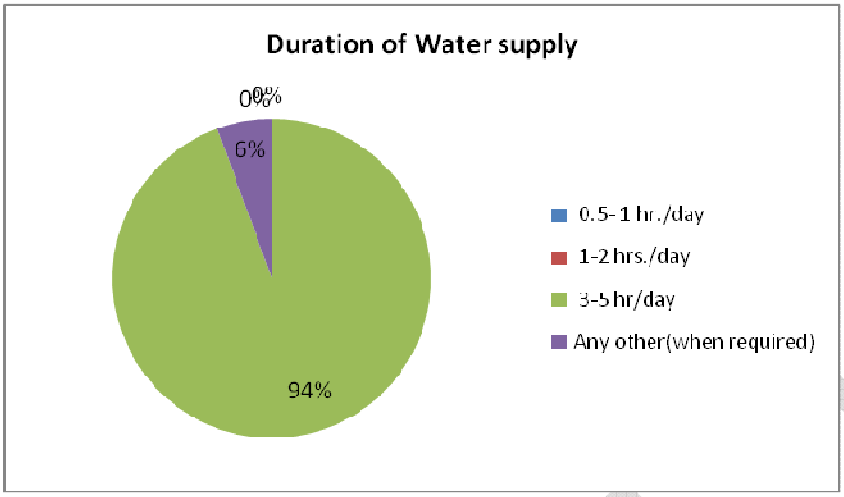




Distance of water source from house (left) and Time spent on water collection (right)

Almost all people go up to 100 meter for collection of water from stand posts, because in this village ground water is contaminated with high concentration of fluoride and PHED has closed all the hand pumps. Approximately 94% respondents have the water accessibility within 100 meter and 100 % respondents spend 15-30 minute for collection of water from the source.

Duration of Water supply



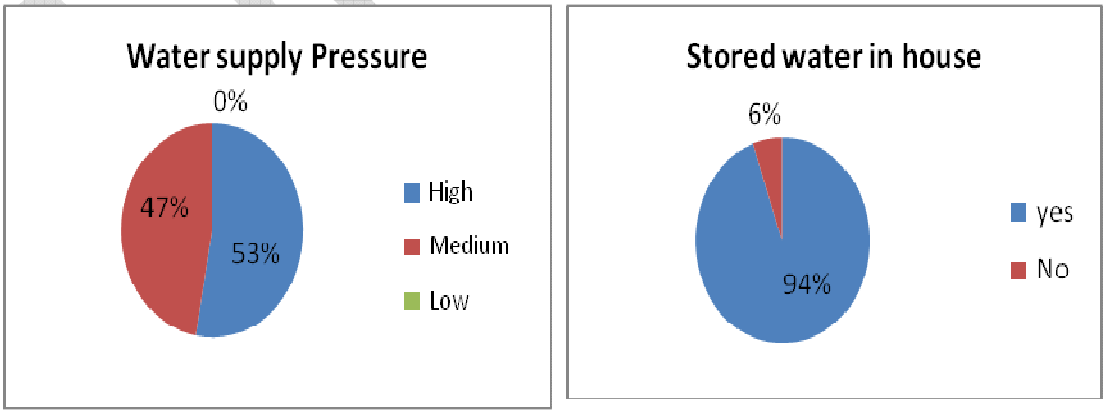
Duration of water supply

Timing for water supply in the village is more than 3 to 5 hrs daily. This ensures that there is no water supply timing issue, but during rainy season and non-sunny days water supply timings get affected because the solar pump cannot work during those periods.

Majority of the respondents (approximately 94%) are dependent on mini water supply scheme and only 6% respondents use pipe water supply when required.

Water Pressure in the distribution pipes

According to the household survey, 53% respondents observe high water pressure while 47% observe medium pressure in the water distribution lines near their locality. Approximately 94% respondents store water for drinking purpose and only 6% peoples do not store water and the storing duration is 1 day.



Water Supply Pressure and Storage.

Water Quality

Based on the house hold interactions, most of the population in the village depend on mini water supply scheme, which does not have the problem of odour, colour & taste. But hand pumps water is contaminated with fluoride as per PHED.

Treatment of Drinking Water

Almost all 100% respondents do not treat their drinking water.

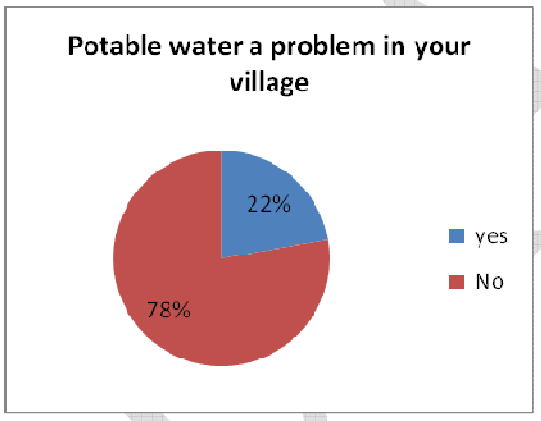
Issue of water availability seasonally

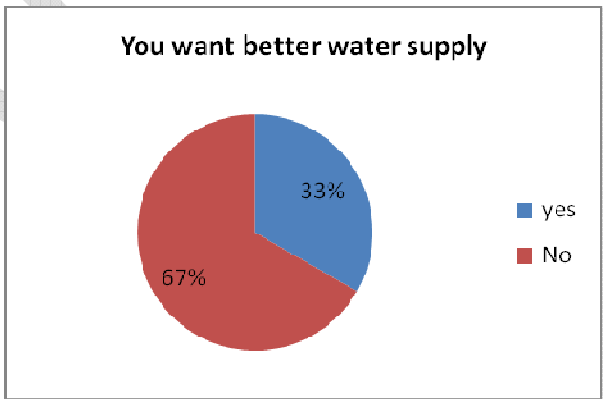
In general, there is no water availability problem in the village. Only during non-sunny days/ rainy season, there is some problem on water availability due to none-functioning of solar pump.

Willingness to participate in water supply intervention

Willingness to participate in water supply intervention

You like to be part of the initiative	Response
1. Yes	17%
2. No	83%



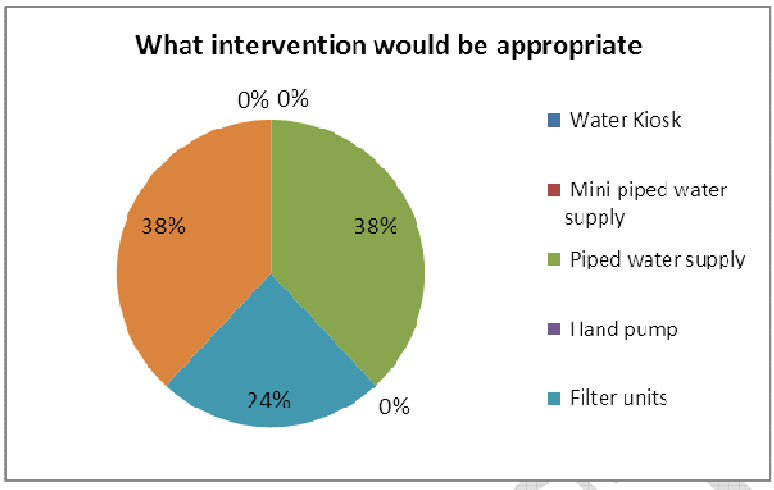


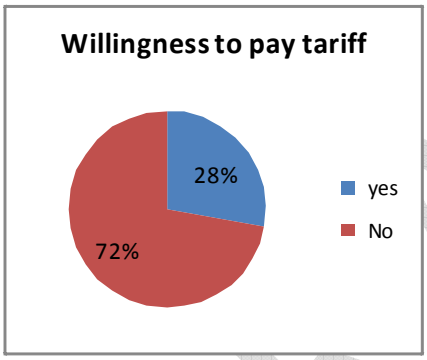
Problem and need of water supply system in the village

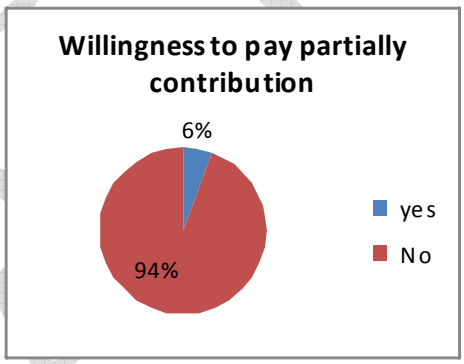
The pipe water supply system is more or less sufficient to meet the daily needs of the entire village community except some households because of the existence of limited stand posts. Only 17% respondents are willing to participate in better water supply intervention. In the village, 67% respondents expressed that the potable water is not an issue in the village and only 33% respondent said they needed a better water supply system.

Better water supply system and Willingness to pay

Figure below suggested interventions for better water supply system and Willingness to pay/ contribute for water intervention







Based on the interactive responses, nearly 38% expressed the need for better pipe water supply system with more stand posts & household connections, and 24% of the respondents suggested the need for filter water for better water quality and only 28 % respondents are willing to pay tariff and 6% are willing to offer partial contribution for new water supply intervention. Approx. 72 % respondents are not willing to pay tariff because of poverty.

Water charges

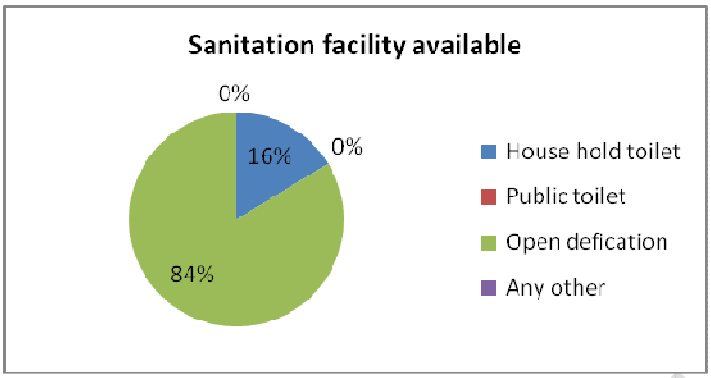
At present nobody pays any charges for pipe water supply to the Panchayat/PHED & also there is no water committee in the village for operation and maintenance of pipe water supply.

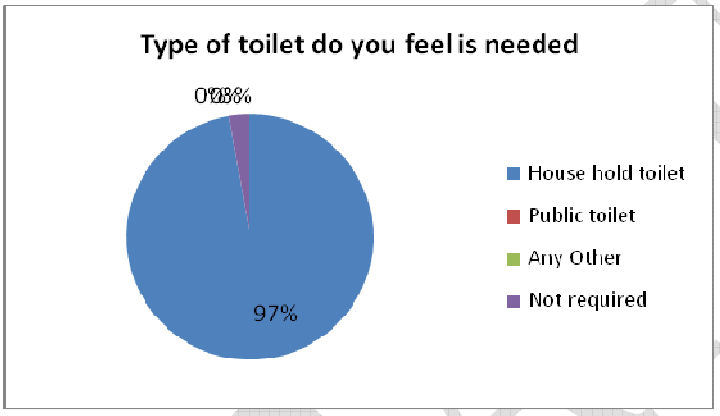
Perception on rainfall & groundwater level

All the respondents expressed the problem of drought condition and decreasing rainfall pattern over past 10 years. This decreasing rainfall trend has reduced the groundwater resources, which become limited during summer season. Almost 100% respondents perceived that the ground water level is decreased over the past 5 to 10 year.

Existing sanitation and waste management facility

Sanitation Facility





Existing Sanitation Facility in the Village

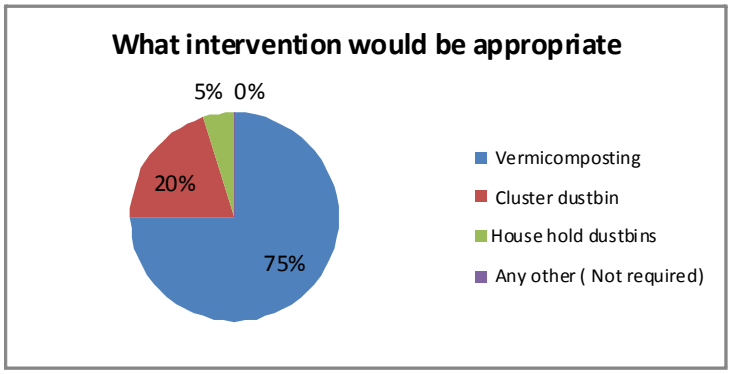
As per the household surveys, 100% respondents go for open defecation in the village. Non-availability of sanitation facility is a major issue expressed during public consultation meetings. Almost 100% respondents expressed their need for household toilets.

Waste water management Facility

Most of the village areas do not have any waste water drainage facility, and all the waste water generated from household flows along the roadside. Almost 100% respondents practice waste water disposal along roadsides and in open place. Almost all 100% respondents suggested construction of new drainage system and renovation of the existing drainage for disposing the waste water from the household.

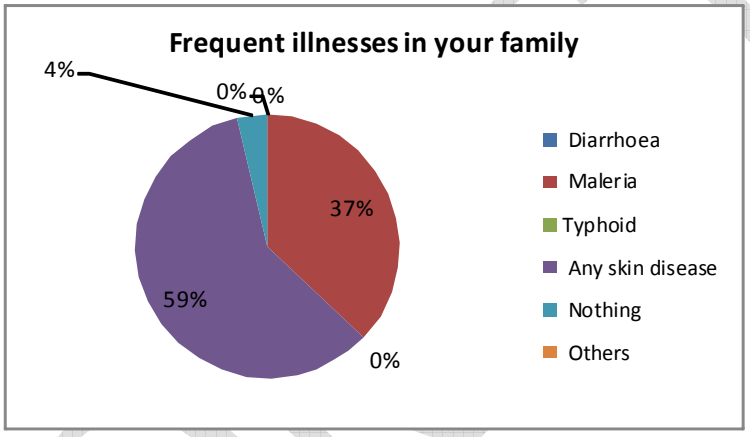
Solid waste Management facility

As per household surveys, the village does not have any solid waste management facility. Throwing of solid waste in open places was observed in the case of 100% of the respondents. Based on household interviews for better solid waste management facility, nearly 75% respondents suggested for vermi-compositing method, 20% suggested for cluster dustbin facility and 5% suggested for household dustbin.



Perception on water borne diseases

Based on the perception of village community on health related issue, some of the water borne diseases in the village have been reported like, Malaria (37%), Skin diseases (59%) and 4% other diseases. The other diseases/health problems are mainly fever, headache, bone pain etc.



Major Observation & findings

Water Supply

The main source of drinking water in the village is Mini pipe water supply with fluoride treatment unit. Based on the household survey, approximately 94% respondents use the mini pipe water supply for all purposes. Most of the respondents (94%) bring water from within 100 meter distance from the house.

During public consultation meetings, it was reported that during rainy season/non-sunny days there is some water scarcity issues as the pipe water supply system runs on solar pumps. At present nobody is paying any charges for pipe water supply in the village to panchayat/PHED and there is no water committee in the village for operation & maintenance of pipe water supply system. Presently PHED is doing operation & maintenance of the scheme through contractors.

Water Quality

As per the household survey and public consultation meetings, most of the people in the village are dependent on pipe water which has the no problem of colour, odour & taste. The quality of hand pump water is poor because of fluoride contamination.

As per PHED, the concentration of fluoride in the ground water in this region is more than 2.0 mg/l, which is much above the permissible limit (1.5 mg/l) as per Indian drinking water standard IS 10500.

As per house hold survey, most of the village community is not treating the water before drinking.

Rainfall & groundwater level

As per secondary data, household surveys & public consultation meetings, drought occurred in the study area during past 10 years and there is a decrease in rain fall over a period of time. Ground water level is also decreasing over a period of 5 to 10 year.

Better water supply &Willingness to participate in water supply intervention

Based on the interactive responses, most of the respondents are not willing to pay tariff for new water supply intervention because of poverty.

Sanitation

As per household survey & public consultation meetings, there is no good sanitation facility in the village and most of the respondents go for open defecation in the village. Non-availability of sanitation facility is a major issue expressed during discussion with women and most of the people expressed the need for household toiles.

Wastewater management

Base on household surveys & public consultation meetings, the village areas do not have any waste water drainage facility, and all the waste water generated from household flows along the roadside. Almost 100% respondents suggested construction of new drainage system and construction of new soak pits.

Solid Waste Management

As per household surveys and Public consultation meetings, the village does not have any solid waste management facility. Throwing of solid waste in open places was observed in all respondents. For solid waste management intervention most of peoples suggested for vermi-compositing method and cluster dustbins.

Health Issues

There was a very mix responses observed from the house hold survey, Based on house hold survey, nearly 37 % experienced problem of Malaria, 59% Skin diseases and 4 % other diseases. The other diseases/problem is mainly seasonal fever, headache, bone pain etc.

Environmental issue

1. Discharge of wash water from fluoride treatment system of the mini pipe water supply scheme occurs during operation & maintenance. The discharge goes directly to open field/agriculture field/pond, which may contaminate the top soil or groundwater through percolation.
2. There is no drainage facility in the village which cause water logging problem almost near every house hold/ stand post.
3. Open defecation practice in the village may cause disease & contaminate ground water.
4. Absence of solid waste disposal facility in the village may cause problem to human health and ground water through leachate percolation.
5. There is a perennial river called "Phulwaria", 2 km away from the village, which can be explored for village water supply.
6. As per PHED, ground water is contaminated with fluoride in this region.
7. There was no major environmental issue reported during construction of the scheme like noise, air, soil pollution & forest area aquisition.
8. The scheme (MWS) was designed without prior consultation/participation of affected populations
9. The scheme was implemented without imparting any training on techniques for efficient water use in the village.
10. The scheme (MWS) was designed without adequate drainage facility
11. The village is close to (approx. 2 to 5 km) mountain and forest area.

Scenes from the village Photographs:

Village: Kadhar

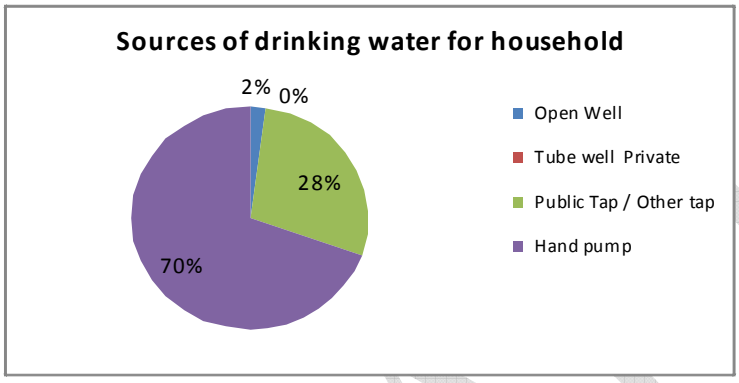
Scheme: Mini water supply system with fluoride treatment system & solar pumps

Water quality issue: Fluoride

As part of environmental assessment, household surveys were conducted in Kadhar village, Kharsadi panchyat, Kauakol block of Nawada district on sample basis. Households were surveyed covering entire village including SC & SC communities in the village .The findings of house hold survey are discussed below.

Existing Water Supply System

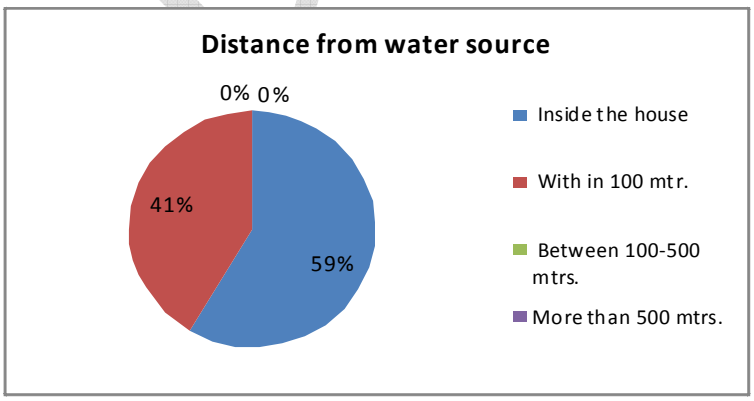
Source of drinking Water



Existing water supply source in the village

The main source of drinking water in the village is Hand pumps & Mini pipe water supply. Apart from that there are some open well (private) in the village. Based on the household survey, only approximately 28% respondents use the pipe water supply stand posts. This water is not used by the entire village due limitation of scheme (pipe length & no. of stand posts). Majority of respondents (approximately 70%) use hand pump water for all purposes including drinking.

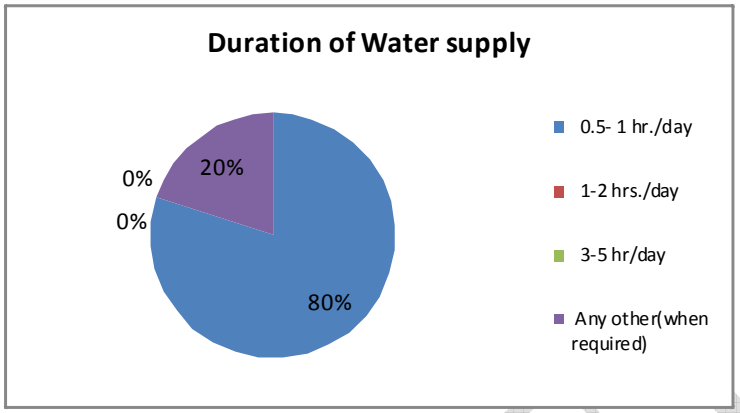
Water supply



Distance of water source from house

Most of the households have their own hand pumps. Some people use neighbour's hand pump or public hand pumps. Approximately 59% respondents have the water accessibility within the house, 41% respondents have to go up to 100 meter for water. Approx. 48% respondents spend 15-30 minutes for fetching water.

Duration of Water supply

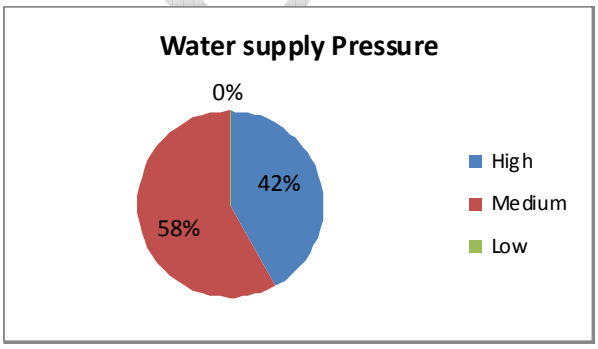


Duration of water supply

There is no uniformity in the timings for water supply in the village. Every tola or cluster has their own problem and perception. Majority of the respondents (approximately 70%) are dependent on hand pump water. Only 28% of the respondents use pipe water supply, out of which 80% respondents get water at 0.5 to 1hr/daily and 20% respondents use pipe water when needed. The reason for non-uniform supply of pipe water is due to the village terrain, low water pressure in the pipes, broken taps and limited number of stand posts.

Water Supply Pressure

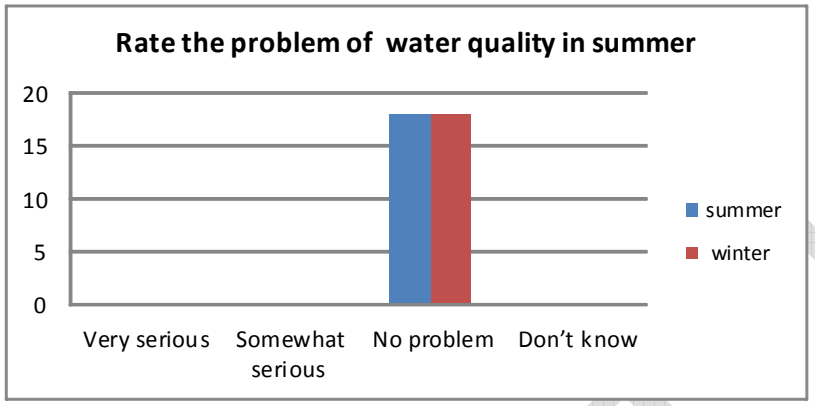
According to the household survey, 42% of the respondents experienced high water pressure in the pipelines in their locality, while 58% respondents experienced medium pressure. Approximately 21% respondents store water for drinking purpose from pipe water supply source, and 79% people don't store water for drinking. They use the hand pumps when needed.



Water Supply Pressure and Storage.

Water Quality

Based on the household interactions, most of the population in the village depend on mini water supply scheme and hand pumps, which have no problem of odour, colour & taste. Even there is no seasonal variability in water quality in the village.



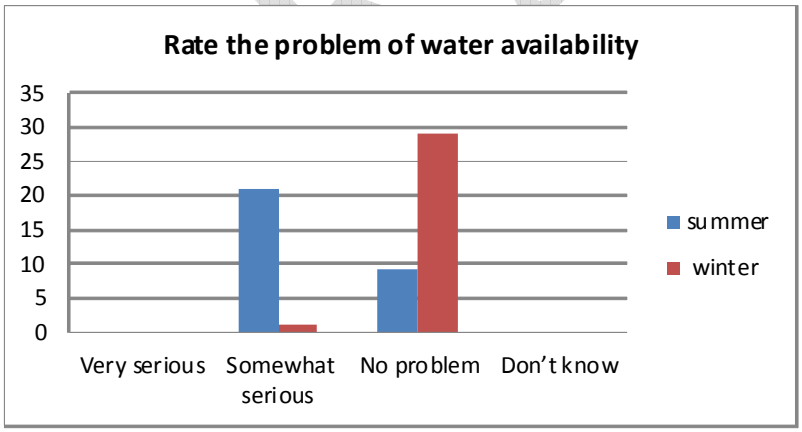
Water quality perception for summer

Treatment of Drinking Water

Almost all 100% respondents do not treat their drinking water before drinking.

Issue of water availability seasonally

Most of the respondents have their own hand pumps. In addition to that, the mini water supply scheme fulfils the water need for the entire village. But during the summer, water availability problem occurs to some extent because the water level goes down during that time.

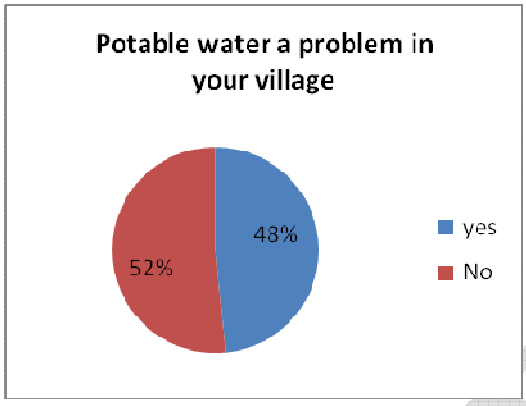


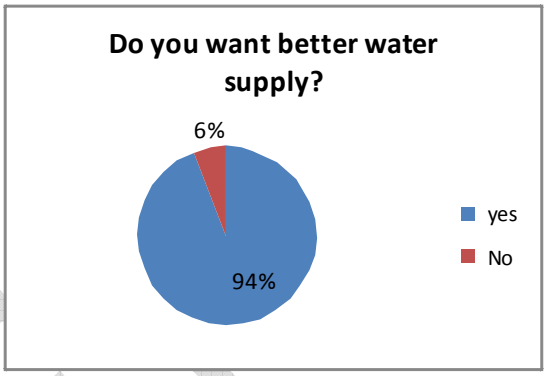
Water availability

Willingness to participate in water supply intervention

Willingness to participate in water supply intervention

You like to be part of the initiative	Response
1. Yes	94%
2. No	6%



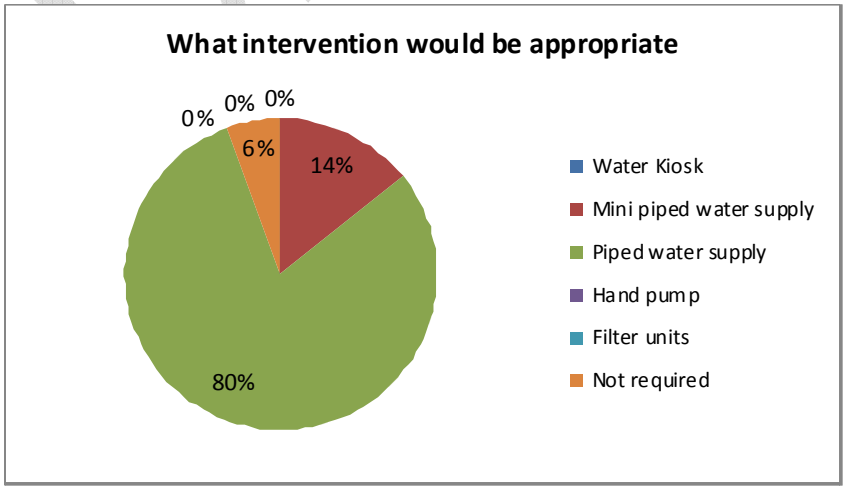


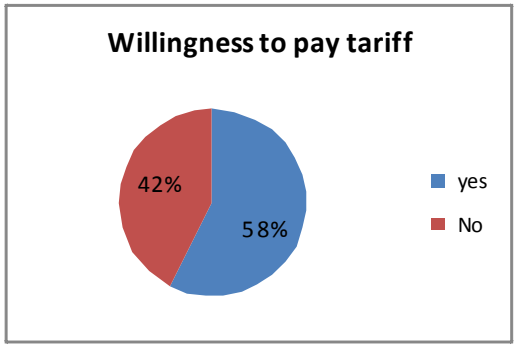
Problem and need of water supply system in the village

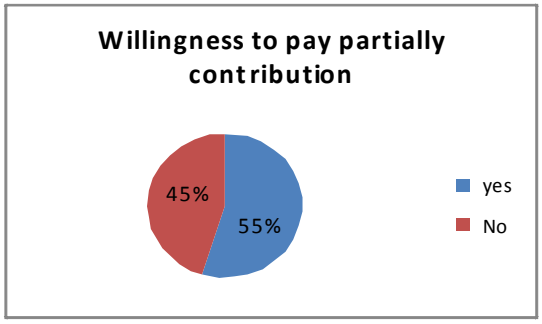
The pipe water supply system is more or less sufficient to meet the daily needs of the entire village community except for some households because of limited stand posts. In the village, 94% respondents are willing to participate in water supply intervention. Approx. 52% respondents expressed that getting potable water is not an issue in the village and 94% respondent feel that they need a better water supply system.

Better water supply system and willingness to pay

Figure below suggested interventions for better water supply system and Willingness to pay/ contribute for water intervention







water supply system and willingness to pay

Based on the interactive responses, nearly 80% respondents expressed the need for better pipe water supply system with more stand posts and house hold connections and 14% of the respondents suggested the need for Mini water supply system with filter for better water quality and 6% of the respondents feel that they do not require any intervention on water supply. Approx. 58% respondents are willing to pay tariff and 55% respondents are willing to contribute partially for new water supply intervention. Approx. 42% respondents are not willing to pay tariff because of poverty.

Water charges

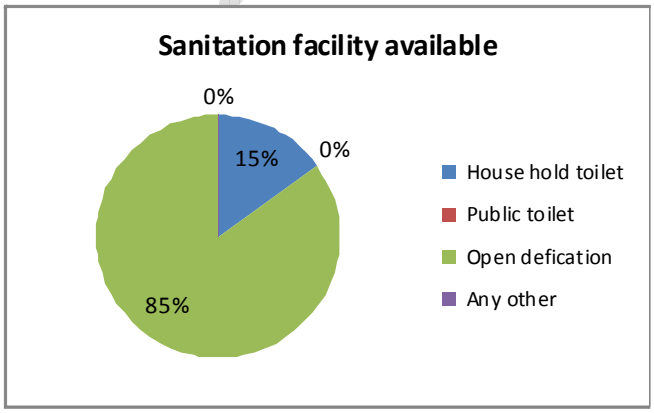
At present nobody pays any charges for pipe water supply to the Panchayat/PHED and also there is no water committee in the village for operation & maintenance of the pipe water supply.

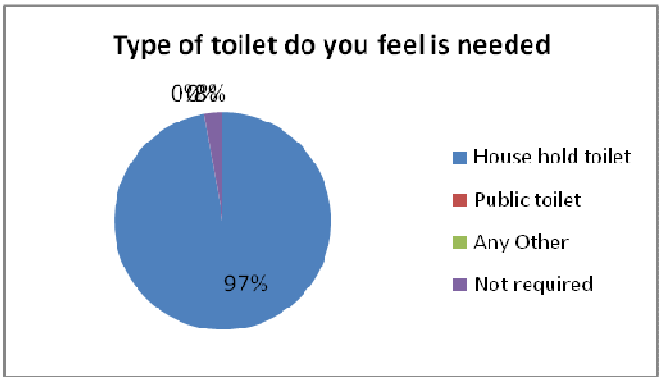
Perception on rainfall & groundwater level

All the respondents expressed the problem of drought condition and decreasing rainfall pattern over the past 10 years. This decreasing rainfall has reduced the groundwater resources, which results in water scarcity during summer season. Almost 100% respondents perceived that the ground water level is decreased over the past 5 to 10 year.

Existing sanitation and waste management facility

3.1.2.1 Sanitation Facility



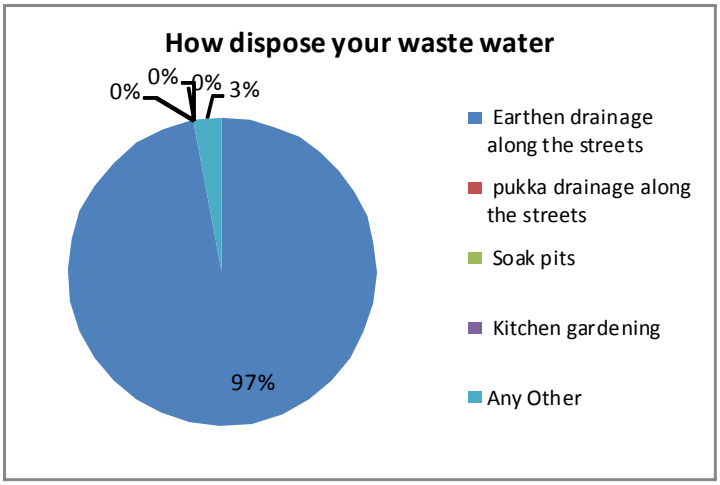


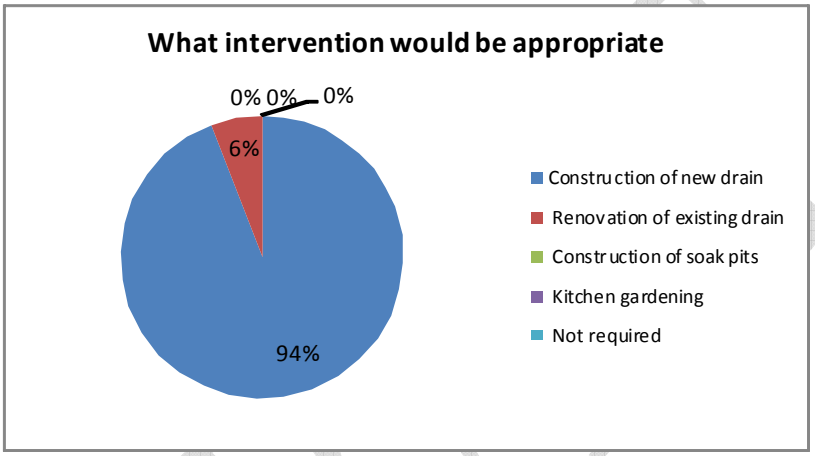
Existing Sanitation Facility in the Village

As per the household survey, 85% respondents go for open defecation in the village. Non-availability of sanitation facility is major issue expressed during public consultation meetings. Almost 97% respondents expressed the need for household toilets.

Waste water management

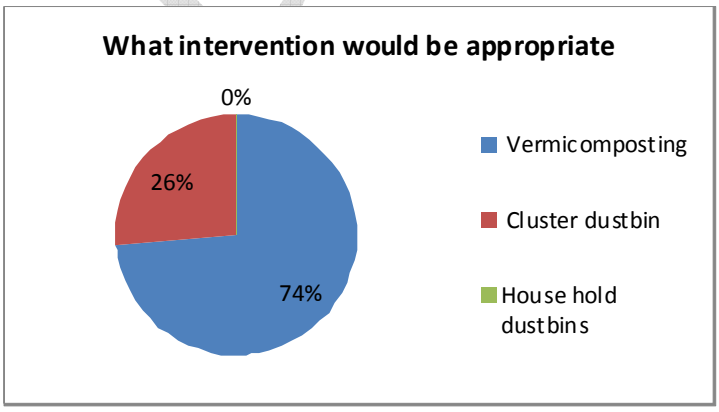
Most of the village areas do not have any waste water drainage facility, and all the waste water generated from household flows along the roadside. Almost 97% respondents practice waste water disposal along streets & in open place. Almost 94% respondents suggested construction of new drainage system and renovation of the existing drainage for disposing the waste water from the households.





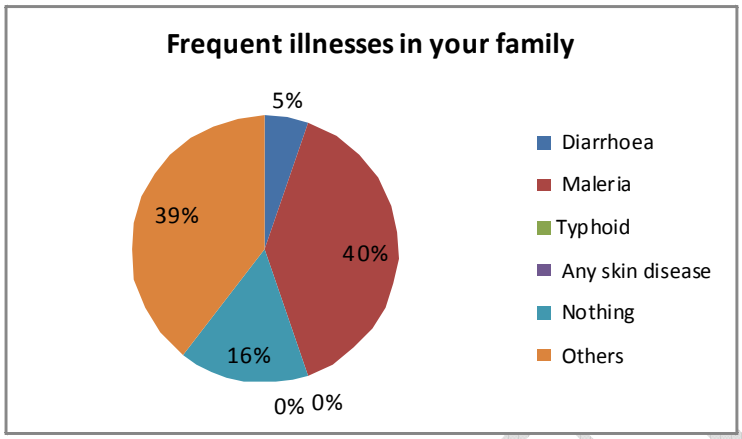
Solid waste Management

As per the household surveys, the village does not have any solid waste management facility. Throwing of solid waste in open places was observed in the case of almost 100% of the respondents. Based on household interviews for better solid waste management facility, nearly 74 % respondent suggested for vermi-compositing method and 26% suggested for cluster dustbin facility.



Perception on water borne diseases

Based on the perception of the village community on health related issues, some of the water borne diseases like Malaria (40 %), Diarrhoea (5 %) and other diseases (39%) in the village has been reported. The other diseases/problem problems are mainly fever, headache, bone pain etc.



Major Observation

Water Supply

The main sources of drinking water in the village are hand pumps and pipe water supply. Based on the household survey, approximately 28% respondents use pipe water and 70% respondents use hand pumps for their water needs (all purposes). Apart from that, 2% of the respondents use well water also (not for drinking purpose). Approx. 41% village community fetch water from within 100 meter distance from the house. It was reported that during summer season there is somewhat water availability problem due to the lowering of the ground water level.

Nobody is paying any charges for pipe water supply in the village to the Panchayat/PHED and also there is no water committee in the village for operation & maintenance of pipe water supply. At present O & M are being done by PHED through contractor.

Water Quality

As per household survey & public consultation meetings, most of the people in the village are dependent on hand pump water which has no problem of colour, odour & taste. Pipe water supply has no quality issue.

As per PHED water quality test reports, fluoride level in this region is more than 1.4 mg/l, which is above the desirable limit (1 mg/l) and below permissible limit (1.5 mg/l) as per Indian drinking water quality standard IS 10500.

As per house hold survey, almost all the village community do not treat water before drinking.

Rainfall & groundwater level

As per household surveys and public consultation meetings, drought occurred in the study area during the past 10 years and there is decrease in rain fall over a period of time. Ground water level is also decreasing over a period of last 5 to 10 year.

Better water supply &Willingness to participate in water supply intervention

Based on the interactive responses, only 55% to 58 % respondents agreed to pay tariff & partial contribution for new water supply intervention.

Sanitation

As per Household survey & public consultation meetings, there is no adequate sanitation facility in the village and most of the respondents go for open defecation in the village. Non-availability of sanitation facility is a major issue expressed by the women, and most of the people expressed the need for household toilets.

Wastewater management

Base on household surveys and public consultation meetings, most of the village areas do not have any waste water drainage facility and existing drains are buried due to road construction. Most of the waste water generated from the households are discharged into the village pond and flow along the roadside. Most of the respondents suggested construction of new drainage system and renovation of the existing drainage.

Solid Waste Management

As per household surveys and public consultation meetings, the village does not have any solid waste management facility. Throwing of solid waste in the open places was observed in the village. For solid waste management intervention, most of the people suggested for vermi-compositing method and cluster dustbins.

Health Issues

There was a mixed responses observed from the house hold survey on health issues. Based on house hold surveys, nearly 40% experienced problem of Malaria, 5% Diarrhoea and 39% other diseases. The other diseases/health problems are mainly fever, headache, bone pain etc.

Environmental issue

1. Discharge of wash water from fluoride treatment system of the mini pipe water supply scheme occurs during operation & maintenance. The discharge goes directly to open field/agriculture field/pond, which may contaminate the top soil or groundwater through percolation.
2. There is limited and blocked drainage facility in the village which cause water logging problem, which promotes vector borne diseases.
3. Waste water generated in the village also go to village pond and this pond is also used for open defecation & excreta disposal. This practice may contaminate (faecal) ground water and affect the aquatic animals.
4. Open defecation practice in the village may cause disease & contaminate ground water.

5. Absence of solid waste disposal system in the village may cause problem to human health and ground water through leachate percolation.
6. There is a non-perennial river called "Nata" in addition to canals in the village. The distance from the river to the village is about 1 km. As this is a non-perennial river, this river cannot be used as water supply source but during rainy season water harvesting can be done through diversion of water.
7. As per PHED, ground water is contaminated with fluoride in this region.
8. There was no major environmental issue reported during construction of the schemes like noise, air, soil pollution and forest area acquisition.
9. The scheme (MWS) was designed without prior consultation /participation of affected populations
10. The scheme was implemented without organizing training programs on techniques for efficient water use in the village.
11. The scheme (MWS) was designed without adequate drainage facility
12. The village is approximately 2 km away from the mountain and forest area.

Scenes from the village:

P.S. Household data analyses for the villages visited in West Champaran, Purnia, and Begusarai to be added.

Annexures 5 Guidelines for the Identification and Selection of Water Supply Sources

Groundwater aquifers are the main source of water in Bihar state for tapping water for various uses. Based upon geological diversities, geomorphological set up and relative groundwater potentialities, hydrogeologically, the various litho-units of the State can be grouped as

- Unconsolidated / Alluvial formation,
- Semi-consolidated formations and
- Consolidated/fissured formations.

Following section presents the procedure for identification of sources.

A. Priority for the selection of sustainable sources for rural water supply

1. Groundwater source with acceptable quality (without any treatment except disinfection). These sources are preferred for single village schemes (SVSs).
2. When option (1) is not possible as the groundwater quality is problematic (fluoride/brackish/nitrate/iron etc.), distant surface water source which requires only simple filtration and disinfection will be preferred. These sources are preferred for multi-village schemes (MVSs) involving number of habitations (MVSs may be located away from the habitations and require treatment and pumping adding to O&M costs).
3. When option (1) and (2) are not possible due to isolation of the habitation and its location at high elevation, and if the local groundwater source is sustainable throughout the year but high TDS (> 2000 mg/L) is the only problem, the local source will be selected. Water from the local source will be treated with innovative technology such as Reverse Osmosis (RO). As RO plants have certain problems (for example, safe disposal of brine) this option will be chosen only under exceptional circumstances.

B. Water Quality Testing

Before selecting the source the raw water quality will be tested to check conformity with the drinking water standards.

C. Spacing between the proposed well and the existing groundwater structure to avoid interference

When a new well is located close to an existing well, the cone of influence of both wells may overlap and affect the yielding potential of both the wells. While locating new wells the spacing between new well and the existing well will, therefore, be fixed appropriately. The following table recommends the spacing between the existing groundwater abstraction structures and the proposed wells.

S. No.	Situation	Recommended spacing between any two wells (m)	
		Filter point or shallow wells	Deep bore wells
1.	Non-command area	120	300 - 500
2.	Command area	160	200 - 300
3.	Near perennial source like river or pond	160	200 - 300

S. No.	Situation	Recommended spacing between any two wells (m)	
	(within 200m)		
4.	Non-perennial stream	160	300 - 500

Source: NABARD

Annexures 6 Sanitary Protection of Water Supply Sources

Presently there is no department looking after the protection of water supply sources in Bihar. The recommended procedures ensuring safe quality water supplies are listed below. The main objectives of sanitary protection of the water supply sources are to avoid the sources getting contaminated.

1. Sanitary Protection of Surface Water Supply Sources
   - The area around the source should be inspected at least once in a year to identify and control any new pollution source.
   - Discharge of industrial/domestic wastewater on the upstream of the off-take arrangement should be prevented.
   - Activities that lead to contamination of the water such as washing clothes, washing cattle, dumping of solid waste and defecation should be prevented.
   - The area around sources including intake arrangements and upstream of river should be well protected and fenced. Trespassing by people and cattle around the source should be prevented.
2. Sanitary Protection of Ground Water Supply Sources
   - Direct runoff of rain water into bore well sources should be prevented
   - A concrete mat of sufficient thickness for 75 cm radius around the bore well shall be provided to seal the outer periphery of the bore well. The casing pipe should be raised 60 cm above ground level and provided with a sanitary plug until the pump is installed.
   - Rainwater harvesting and recharge structure should be located at least 15 m away from the bore well to avoid direct contamination.
   - Soak pit for the disposal of effluent from septic tank or other sanitation facility should not allowed within 15 m radius from the bore well of water supply source to avoid direct contamination.
   - For bore wells, the annular open space on the outside of the well casing needs to be filled with neat cement grout.
3. Other preventive measures for maintaining quality of drinking water
   - Sources of water supply including wells fitted with hand pumps should be disinfected regularly. Free residual chlorine level of not less than 0.2 mg/L and more than 0.5 mg/L should be maintained throughout the distribution system
   - Over Head Tanks (OHTs) and storage sumps should be periodically cleaned at least once in three months
4. Leakages in pipelines should be arrested
   - Pit taps both at public stand posts and house service connections should be prevented- all taps and stand posts should be above ground level provided with platforms around
   - Surroundings of the OHTs, public stand posts and hand pumps should have clean and hygienic environment.

Annexures 7 Guidelines for Sustainability of Groundwater Sources

For sustainability of sources, especially ground water, it is essential to sustain the sources through different methods of recharging, which is described in the guideline given below.

Guidelines for Water Harvesting and Recharge

The guidelines presented in this Annexure are based on the guidelines provided in the publication *Water Harvesting and Artificial Recharge* published by the Rajiv Gandhi National Drinking Water Mission, Department of Drinking Water Supply, Ministry of Rural Development, Government of India (2004).

Recommended water harvesting and watershed management measures for Bihar

Agro-climatic zone	Region	Recommended water harvesting structures
Sub humid and humid Sutlej Ganga Alluvial Zone	Covers part of plains of Bihar	Ponds Check das Gully plugging Contour bunding
High rainfall High runoff Chhotanagpur Plateau	Covers hilly areas of Bihar	Tank/Ponds Check dams/Anicuts Gully plugging Contour bunding

Roof Top Water Harvesting Systems

Roof top water harvesting systems can provide good quality potable water with the design features outlined below are taken into account:

- The substances that go into the making the roof should be non-toxic in nature
- Roof surfaces should be smooth, hard and dense since they are easier to clean and are less likely to the damage and released material / fiber into the water.
- Roof painting is not advisable since most paints contain toxic substances and may peel off.
- No overhanging tree should be left near the roof.
- The nesting of birds on the roof should be prevented.
- All gutter ends should be fitted with a wire mesh screen to keep out leaves etc.

- A first-flush rainfall capacity, such as detachable down pipe section, should be installed.
- A hygienic soak away channel should be built at water outlet and a screened overflow pipe should be provided.
- The storage tank should have a tight fitting roof that excludes light a, manhole cover and a flushing pipe at the base of the tank (for standing tanks).
- There should be a reliable sanitary extraction device such as a gravity tap or a hand pump to avoid contamination of the water in the tank.
- There should be no possibility of contaminated wastewater flowing into the tank (especially for tanks installed at ground level)
- Water from other sources, unless it is reliable source, should not be emptied into the tank through pipe connections or the manhole cover.
- During the rainy season, the whole system (roof catchment, gutters, pipes, screens, first-flush and overflow) should be checked before and after each rain and preferably cleaned after every dry period exceeding a month.
- At the end of the dry season and just before the first shower of rain is anticipated, the storage tank should be scrubbed and flushed all sediment and debris (the tank should be re-filled afterwards with a few centimeters of clean water to prevent cracking).
- Ensure timely service (before the first rains are due) of all tanks features, including replacement of all worm screened and servicing of the outlet tap or handpump.

Percolation Tanks

- Percolation tanks should normally be constructed in a terrain with highly fractured and weathered rock for speedy recharges; in case of alluvium the bouldary formations are ideal. However, the permeability shouldn't be too high that may result in the percolated water escaping the downstream.
- Submergence area should be uncultivated as far as possible.
- Rainfall pattern based on long-term evaluation is to be studied so that the percolation tanks gets filled up fully during monsoon (preferably more than once)
- Soil in the catchment area should preferably be of light sandy type to avoid silting upon the tank bed.
- The location of the tank should preferably be downstream of runoff zone or in the upper part of the transition zone, with a land slope gradient of 3 to 5%.
- While designed, due care should be taken to keep the height of the ponded water column about 3 to 4.5 m above the bed level. It desirable to exhaust the storage by February since evaporation losses becomes substantial from February on wards. It is preferable that in the downstream area, the water table it is depth of 3 to 5 m below level during the post monsoon period, impaling that the benefited area possesses a potential shallow aquifer.

- Construction-wise there is not much difference between a percolation tank and a minor irrigation tank, except for providing outlets for surface irrigation and the depth of the cut-off trench. The cut-off trench is to be provided below the earthen bund with depth limited to one fourth of the height between bed level and full storage level.

Check Dams

Check Dams are constructed in the drainage course of narrow streams in low rainfall area to impound run-off rainwater. The following are some guidelines for constructing of check dams.

- The total catchment of the nala should normally be between 40 to 100 hectares though the local situations can be guiding factor in this.
- The rainfall in the catchment should be less than 1000mm/ annum
- The Nala bunds should be preferable located in area where contour or graded bunding of lands have been carried out
- The rock strata exposed in the ponded area should be adequately permeable to cause ground water recharge through ponded water
- Nala bund is generally a small earthen dam with cutoff core wall of bricks work, though masonry and concrete bunds/plugs are now prevalent
- Dams should be built at sites that can produce relatively high depth to surface area so as to minimize evaporation loses.
- Rocky surface should not be fractured or cracked, which may cause the water to leak away to deeper zones or beneath the dam.
- Dam foundation must of solid impermeable rock with no soil pockets or fracture line
- No soil erosion in the catchment area
- Dams should be site along the edges of depressions or directly across the lower ends of deep gullies into rock.

Ponds/ Tanks

A good pond should possess the following traits:

- The site should be narrow gorge with a fan shaped valley above: so that amount of earthwork gives a large capacity. Junctions of two tributaries, depressions and other sites of easily available fill material and favourable geology should be preferred
- The capacity catchment ratio should be such that the pond can be fill upto about 2-3 months of rainfall. The capacity should not be too small to be choked up with sediments very soon
- The pond should be located where it could serve a major purpose e.g. if irrigation it should be above irrigated field
- The site should not have excessive seepage losses
- The catchment areas should be put under conservative practices

Gully plugging, Contour bunds

The gully plugging measures includes vegetative plantings and brushwood check dams, boulder bunds, brick masonry and earthen bunds or a combination of both, sand bag plugs etc. Contour bunds involve construction of horizontal lines of small earthen or boulder bunds across the slopping land surface.

- Ensure there is no open defecation in/near structure
- No tethering of animals at the site
- There must be no pit-latrines on the bank upstream
- Avoid use of pesticides1 chemicals upstream of the site

Rainwater Harvesting Structures

In Bihar rectangular catchment basins called Ahars are built by building earthen embankments to impound rain water. Sometimes these are built at the lower end of a small seasonal rivulet. The channels for drawing water from the Ahars are called Pynes. Large storages across streams are called Katas, Mundas and Bandhas.

Guidelines for Implementation of Rainwater Harvesting Structures for Sustainability of Drinking water supply sources:

- The rainwater harvesting (RWH) structures should be site specific closer to the source but 15 m away from the bore well to prevent direct contamination; the location should be certified by the hydrogeologists of the PHED department.
- The local geological and hydrogeological conditions have to be studied in conjunction with the location of the groundwater source to facilitate maximum recharge from the structure.
- No RWH structure should be installed in the supply/feeder channel of tanks.
- RWH structure should be simple and suitable to the location and economically viable to the community.
- All the works of RWH structure should be implemented before the onset of the monsoon.
- Pre and post water level and water quality monitoring should be carried out in the well for water supply source to evaluate the benefit accrued of the RWH structures.

Erosion control in catchment

There is no unique solution for erosion control. The following are some of the erosion control measures used in many parts of the country.

Conservation cover: Establish and maintain perennial vegetative cover to protect soil and water resources.

Contour bunding/trenching: Forming contour bunding or trenching along the contour in steep sloped areas may be taken up for reducing runoff and erosion. Terraces are constructed with earthen embankments that retard runoff and reduce erosion by breaking the slope into numerous flat surfaces separated by slopes that are protected with permanent vegetation.

Critical area planting: Planting vegetation such as trees, shrubs, grasses or legumes on highly erodable or eroding areas. While undertaking any plantation programme care must be taken to plant only indigenous species with involving and close coordination with local people

Annexures 8 Water Quality Monitoring and Surveillance

Water Quality Standards

The Bureau of Indian Standards specifications IS:10500-1991 govern the quality of drinking water supplies in India by public agencies.

Physical and chemical Parameters

S1.No.	Characteristics	Desirable limits	Maximum Limits
1.	Turbidity (NTU)	5.0	10
2.	Colour (unit on Pt. Cobalt scale)	5.0	25.0
3.	pH	6.5 to 8.5	No relaxation
4.	TDS (mg/L)	500	2000
5.	Total hardness (mg/L)	300	600
6.	Calcium (mg/L)	75	200
7.	Magnesium (mg/L)	30	100
8.	Chloride (mg/L)	250	1000
9.	Sulphate (mg/L)	200	400
10.	Fluoride (mg/L)	1.0	1.5
11.	Nitrates (mg/L)	45.0	No relaxation
12.	Iron (mg/L)	0.3	1.0
13.	Arsenic (mg/L)	0.01	No relaxation

Bacteriological Parameters

In 100 ml sample, the count of coliforrn organism and E-coli should be zero.

Current Water Quality Monitoring Efforts

There are 38 Water Quality Testing Laboratories functioning at the divisional level in all districts. There also exists a state level Water Quality Testing Laboratory at Patna.

Sampling

Recommended Frequency

Source	Minimum frequency of sampling and analysis		remarks
	Bacteriological	Physical/Chemical	
Ground Water			
Shallow tube wells with hand pump	Every fortnight	Once initially, then 4 times yearly	
Deep tube wells with hand pump	Once initially, then as situation demands 4 times yearly	Once initially, then two 4 times yearly. Residual chlorine test-daily	
Wells and piped supplies	Once initially, thereafter as situation demands	Once initially, then 4 times yearly Test weekly for residual chlorine if water is	Situations requiring testing: change in environmental conditions, outbreak of

Source	Minimum frequency of sampling and analysis		remarks
		chlorinated	water borne disease or increase in incidence of waterborne diseases
Surface Water			
Filtered and /or chlorinated and piped supplies	Once monthly	Once initially, then 4 times yearly. Residual chlorine test- daily	Increase frequency of bacteriological test if situation demands

Recommended Location:

Selection of location for sampling should indicate true representative samples.

- Public stand posts (PSPs)
- Selected consumer locations at random
- In addition to above, raw water source and treated water should also be analyzed in case of canal/surface water based water supply schemes.

Water Quality Record

The water quality test results should be entered in a logbook as per the prescribed format (sample shown below) and should be submitted to the DPMU on monthly basis.

Sl. No.	Point of Sampling (Distribution system)	Turbidity (NTU)	Residual Chlorine	Faecal coliform MPN/100L	Quantity of bleaching powder/sodium hypochlorite being added/day	Initials of pump operator carrying test	Initials of Engineer carrying test	Remarks
1								
2								
3								
4								
…	..	..	..	..				

Annexures 9 Selection of Safe Sanitation Technologies and Environmental considerations in location of toilets

Selection of Safe Sanitation Technology

- Selection and installation of safe sanitation technologies to suit the local soil characteristics and hydrogeology is necessary so as to minimize ground water contamination.

For selecting the most appropriate system for any location the following factors are to be considered:

- Number of people to be served
- Per capita water supply rate and the water availability for ablution and flushing
- Extent of space available within the plot/street for sanitation facility
- Hydrogeological characteristics of the subsoil
- Depth to groundwater table from the ground surface (summer and rainy season)
- Quality of groundwater in the vicinity and their present uses
- Locations of the existing water supply wells sources

Latrine Type	Suitable for high Ground Water table	Suitable for areas prone to floods, tidal floods or flushes	Suitable for loose soils	Suitable for soils of low permeability	Water requirement	Ease of construction	Ease of maintenance	Remarks
Direct Single Pit Latrine Without Pour flush	Yes, if raised	Yes, if raised	Yes, if fully clay soils lined	Not for	No	Easy	Easy	Sludge unsafe
Direct twin Pit Latrine Without Pour-flush	Yes, if raised	Yes, if raised	Yes, for fully lined	Not for, clay soils	No	Easy	Easy	Safe sludge
Offset Single Pit Latrine with Pour-flush	Yes, if raised and with soak away	Yes, if raised	Yes, for fully lined	Yes, with soak away	Yes	Easy	Easy	Sludge unsafe
Offset Twin	Yes, if	Yes, if	Yes, for	Yes, with	Yes	Fairly easy	Fairly	Safe

Latrine Type	Suitable for high Ground Water table	Suitable for areas prone to floods, tidal floods or flushes	Suitable for loose soils	Suitable for soils of low permeability	Water requirement	Ease of construction	Ease of maintenance	Remarks
Pit Latrine with Pour-flush	raised and with soak away	raised	fully lined	soak away				sludge easy
Solar Heated Single-vault eco-sanitary latrine with urine separation	Yes	Yes	Yes	Yes	No	Easy	Difficult	Safe dehydrated material
Single-vault eco-sanitary latrine with Urine separation	Yes	Yes	Yes	Yes	No	Easy	Difficult	Safe dehydrated material
Urinal	Yes	Yes	Yes	Yes	Yes a bit	Easy	Easy	

Considering the various sanitation options available and the factors to be considered, the following on-site sanitation options are recommended as suitable sanitation for the rural habitations:

two-pit pour-flush toilet (TPPT)

composting toilet or eco-sanitation (Eco-san)

The SOs should play a crucial role in facilitating the choice of appropriate sanitation system for the site specific situation.

Environmental Consideration in Location of Toilets

Specific topic on which information/ data is needed	Considerations
Type of soil-stability	
Loose, sides of wall collapse	Line the pits. In very sandy soils, sink cement rings that are perforated or set on top of each other without cement
Hard to dig	Use the pits. In very sandy soils, sink cement rings that are perforated or set on top of each

Specific topic on which information/ data is needed	Considerations
	other without cement
Permeability (how water is absorbed by soil)	
Clay soil	Test by pouring water into a hole and measuring how long it takes to be absorbed. Pits in dese clay may need back filling about 1.2 meters with more sandy soil.
Coarse sand	Back fill around the rings with denser soil and/or locate the latrine pipes far 9 for example, 40 meters or more) from a well-used for drinking
Hard Latrine	If there might be cracks in the latrine, the latrine pits can pollute nearby drinking water sources. Place the latrine far from these sources.
Ground water level in wet season (deepest level)	
Water rises higher than one meter from bottom of the latrine pit, but never completely floods the latrine pits	Locate the latrine pit far from any well used for drinking purpose and should be away for example, 40 meters or more
Water rises to or above the ground level and sludge comes out the latrines	Raise the latrines above the ground level so that the top third of the pit is always above the water level. Place latrines far from drinking water sources
Distance to Water sources	
Distance from latrines pit to drinking water sources	At least 15 meters
Children or teachers may be spent extra tie, for example, more than 15 minutes going one-way to collect water	VIP latrine is preferred as it uses less water

Annexures 10 Recommended Construction Practice and Pollution Safeguards for Twin Pit Pour Flush Latrines[25]

Construction of Pits

1. Pits in Water logged, Flood Prone and High Sub-soil Water Areas

In high sub-soil, water logged or flood-prone areas, the pits should be raised above the ground level to a height such that the invert of the incoming drains/pipes is just above the likely flood water or sub-soil water level. Raising the pipes will necessitate raising the latrine floor also.

In pits located in water logged or flood prone areas, earth should be filled and well compacted all around the pits in 1000 mm width and up to the top. It is not necessary to raise the pits by more than 300 mm above the plinth of the house. In these situations, the pits should be designed as wet pits, taking into consideration the infiltration rate of the type of soil.

2. Pits in Rocky Strata

In rocky strata with soil layers in between, leach pits are designed on the same principles as those for low sub-soil water level taking the infiltration capacity of the soil as 20 litres per sq.m per day. However, in rocks with fissures, chalk formations, or old root channels, pollution can flow over a very long distance; hence these conditions demand careful investigation and adoption of pollution safeguards. In impervious rocky strata the pits will function as holding tanks since there will be no infiltration of liquid. In such situations, a PF latrine with leaching pits is not a suitable system.

3. Pits in Soils with Low Infiltration Capacity

Leaching capacity tends to be the limiting factor when the infiltration capacity of soil is low. In these circumstances, there are two options: construct a larger pit, or increase the critical leaching area by backfilling and compacting with brick ballast, gravel, sand etc., for the required width all around the pit.

Emptying of Pits/Septic tanks

Emptying of pits becomes essential when they get filled. The three most important issues related to emptying of pits are frequency, cost, and hygiene. Manual methods of emptying are common for pour-flush latrines. The responsibility for emptying latrines is with the users. The main guidelines relating to latrine emptying include advising householders that the filling1 emptying cycle is likely to be between three to six years and that they need to make their own arrangements for emptying the pits.

Emptying g costs are location-specific; anticipated emptying costs should be ascertained with local contractors during programme planning.

25 Technical Guidelines on Twin Pit Pour Flush Latrines (1992), Ministry of Urban Development, Government of India

Groundwater pollution

A problem that is related to on-site sanitation is the potential for pollution of groundwater that is associated with these systems. Groundwater under or near pit latrines may become polluted, which can be a serious problem when it affects the quality of drinking-water drawn from wells and boreholes. Water in leaky pipes may also be contaminated if the pressure drops and polluted groundwater levels are above the pipes. A particular problem in densely populated areas is the possible proximity of latrine pits and shallow wells on neighboring plots. The key guideline is that a minimum distance of 15 m, other than in fractured formations, between a pit and a downstream water-point, is normally sufficient to remove all contaminants.

Pollution safeguards for twin pit pour flush latrines

To ensure that the risk of polluting ground water and drinking water sources is minimal, the following safeguards should be taken while locating the pits of the pour flush latrines:

- Drinking water should be obtained from another source or from the same aquifer but at a point beyond the reach of any fecal pollution from the leach pits.
- If the soil is fine (effective size 0.2 mm or less), the pits can be located at a minimum distance of 3 m from the drinking water sources, provided the maximum ground water level throughout the year is 2 m or more below the pit bottom (low water table). If the water table is higher, i.e., less than 2 m below the pit bottom, the safe distance should be increased to 10 m.
- If the soil is coarse (effective size more than 0.2 mm), the same safe distances as specified above can be maintained by providing a 500 mm thick sand envelope, of fine sand of 0.2 mm effective size, all around the pit, and sealing the bottom of the pit with an impervious material such as puddle clay, a plastic sheet, lean cement concrete, or cement stabilized soil.
- If the pits are located under a footpath or a road, or if a water supply main is within a distance of 3 m from the pits, the invert level of the pipes or drains connecting the leach pits should be kept below the level of the water main, or 1 m below the ground level. If this is not possible due to site considerations, the joints of the water main should be encased in concrete.

Operation and Maintenance – Do's and Don'ts s of Twin-pit Pour-flush Latrines

DOs

- Keep a bucket full of water outside the toilet.
- Keep a 2 liters can in the toilet filled with water for flushing.
- Before use, pour a little quantity of water to wet the pan so that excreta can slide smoothly into the pit.
- Flush the excreta after each use.
- Pour a little quantity of water, say half a liter, in the squatting pan after urination.

- The squatting pan should be cleaned daily with a soft broom or soft brush with a long handle after sprinkling a small quantity of water and detergent powder/soap.
- Use minimum quantity of water in washing the pan and toilet floor.
- Wash hands, using soap or ash, after defecation at the assigned place.
- If any construction defect is observed during the defect-liability period, report the matter to the local authority or the construction agency.
- When the pit in use is full, divert the flow to the second pit
- If the trap gets choked, rodding should be done from the pan side as well as from the rear side by means of a split bamboo stick, after removing the cover of the drain or junction chamber.

Care should be taken while de-sludging the pits located in water-logged or high water sub-soil water areas and in case of combined pits, as humus may not be safe for handling.

DON'Ts

- Do not use both the pits at the same time.
- Do not use more than 2 litres of water for each flushing (if the waste is not flushed with 2 litres, pour more water at the specific spots for flushing the waste).
- Do not use caustic soda or acid for cleaning the pan.
- Do not throw sweepings, vegetable or fruit peelings, rags, cotton waste, and cleaning materials like corn cobs, mud balls, stone pieces, leaves, etc. in the pan or the pits.
- Do not allow rain water, kitchen or bath waste to enter the pits.
- Do not provide water tap in the toilet.
- Do not throw lighted cigarette butts in the pan.

Do not de-sludge the pit before 1% years of its being in use.

Annexures 11 Guidelines for Safe Sullage Disposal at Household and community Levels

1.0 Introduction

Bihar state doesn't have any safe sullage disposal system and if planned, this has to be based on the guidelines appended below. The state can come up with a safe sullage disposal mechanism at household or at community level.

The guidelines in this annexure on sullage disposal at household and community levels are based on the guidelines in the publication - *'Solid and Liquid Waste Management in Rural Areas - A Technical Note'* (TSC, UNIECF).

2.0 Technical options for household level management

The village level water management system should be as simple as possible for a village level person to understand and implement and it should be decentralized. The technological options should be based on domestic (Household) level management and/ or community level management. It will always be better to manage and treat domestic grey water generated in the house in the area/courtyard/land surrounding the house. The following technological options will be suitable for this purpose:

- Kitchen Garden with piped root zone system
- Kitchen Garden without piped root zone system
- Leach pit
- Soakage pit.

3.0 Soak Pit

Soak pit is a dug out pit filled with stones or preferably over burnt bricks. The large numbers of stones or bricks increase the surface area over which biological and chemical action takes place. The water seeps into the ground and reduces danger of polluting the ground water sources.

Advantages

- This is the cheapest technology for management of water at household level
- Prevents grey water stagnation
- Prevents vector breading.

Operation and maintenance (O&M)

Filter to be cleaned every fortnight or month, depending on accumulation of dirt

Make a hook of thick wire and pierce it in the filter and take filter media out and clean/wash it and dry and replace it in the earthen pot

Soak pit loses its capacity within a period of 7 to 8 years of work. At that time take out the boulders from the pit, scrap the walls of the pit in order to remove the oily layer; let

the pit dry for a period of 2 to 3 days and clean and dry the boulders and replace into the pit.

Limitations

- Soakage pit is not suitable for rocky terrain
- It will over flow if wastewater flow in the pit exceeds the design flow
- If suspended solids get into the pit, the choking of the pit will take place earlier.

4.0 Off Site Community Level Management:

For the community grey water of this type, the first step would be to establish a system for collecting and transporting this grey water for the final treatment on a suitable location. It will be necessary to establish a suitable drainage system for this purpose. This drainage system could be of two types

a. Open drain with technically sound design, involving semicircular base and trapezoidal cross section so as to maximize self-cleansing velocity for carrying away silt in grey water

b. Closed drain-small bore grey water draining system with intercepting tanks at suitable points.

1. Open or Surface Grey water Drainage System

For collection and transportation of grey water .owing out from the houses, surface drain has been the simplest system, whereby, the community grey water is carried away from the village for onward final treatment. This system can be established easily with available local mason at minimum cost.

Operation and maintenance (O&M)

Gram Panchayat will have to establish a system for periodical cleaning and silt removal from the drain

Community will have to be educated to keep the drain free from garbage, so as to avoid blockages in drain

Care needs to be taken to avoid over-flow water (effluent) from septic tank, from flowing to the open drain. This effluent should be led to leach pit covered at the top.

2. Closed Drainage

a. Small bore grey water drainage system

In rural areas, closed drain system akin to conventional sewerage systems will not be feasible because of the excessive capital & operation maintenance expenditure and the elaborate maintenance requirements.

The small bore grey water drainage system which is laid close to the soil surface is suitable and appropriate as it is low cost and requires minimum maintenance which is easy.

Advantages:

- As the system is closed, materials like garbage, road side solid wastes, plastics, building materials etc. will not and access to the system
- Operation and maintenance becomes easily manageable by Gram Panchayat
- Construction cost is comparable to the cost for surface drain. It may be only marginally varying
- Road space is fully utilized.

5.0 Final Treatment of Community Grey water

Once the community grey water is collected at one or multiple points outside the village, final treatment is required to convert it into harmless and reusable water.

- The treatment technologies need to suit the following requirements.
- As low cost as possible
- O&M should be easy and low cost for Gram Panchayat
- Same cost recovery may be possible by the farmers
- Selling the treated water. Treated water could be used for public gardens or horticulture. The produce may be sold portably
- Vector breeding is avoided
- Pollution of water from nala or river is prevented.
- Some appropriate technologies easily manageable by Gram Panchayat could be as follows:
    - Sullage stabilization pound and reuse
    - Sedimentation and reuse
    - Screening stabilization tank systems like DOSIWAM, DEWATS etc.

A. Sullage Stabilization Ponds

The grey water collected via drainage system is passed to large shallow basins or ponds excavated at suitable land site and placed serially as a stabilization system in which grey water is stabilized, its pathogenicity is reduced and the stabilized water becomes useable.

a. Anaerobic ponds

The grey water reaching the pond via drain, usually has high solid content. In the anaerobic pond, these solids settle at the bottom, where these are digested anaerobically. Thus, the partially clarified liquid is discharged onwards into a facultative pond for further treatment.

b. Facultative ponds

The partially clarified water is led to facultative pond. 1n this pond oxidation of grey water takes place. It is called 'facultative' because in this pond in the upper layer aerobic conditions are maintained while in the lower layer, anaerobic conditions exist.

c. Maturation pond

The stabilized water from facultative pond is led to a maturation pond. The main function of the maturation period is the destruction of pathogens. This pond is wholly aerobic.

Operation and maintenance

- It will be the responsibility of GP
- Maintenance requirements are minimal. Regular cutting of grass on embankments and removal of any floating scum from pond surface are the only requirements
- Occasional anti mosquito spraying treatment may be necessary.

B. Screening, Sedimentation and Filtration

The grey water collected from drainage system can be passed through a screening, sedimentation and filtration tank system. The treated water can be used for irrigation etc.

C. Reuse of Stabilized Water

Grey water stabilized and cleaned by the use of any of the above mentioned systems can be reused in many ways.

- Irrigation for agricultural use
- Irrigation for horticulture
- Fish farming.

Annexures 12 Guidelines for Community Solid Waste Management

1.0 Introduction

Bihar state has a compositing technique for Solid Waste Management, but it has not been implemented fully at the village level. Only few people at village level, are aware of this scheme.

However the annexure presents the guidelines on solid waste disposal at household and community levels are based on the guidelines in the publication - *'Solid and Liquid Waste Management in Rural Areas - A Technical Note'* (TSC, UNIECF). These guidelines will apply to the solid disposal activities to be undertaken in Bihar.

Types of Solid Waste

Biodegradable and recyclable	Non-biodegradable	
	recyclable	Non-recyclable
Kitchen waste	Plastic – carry bags, ilk covers PVC pipes etc. Syringes, Glucose bottles etc. Cotton and nylon cloth Tyres & Tubes	Nitrogen sealed packing for chips
Food Cow dung/animal waste Agriculture Leaves Egg cells Henna paste Vegetable Peels, Eat, Bones Dead animals Paper Wood	Shampoo Bottles Glass Books/notebook Wires Caps of mineral water bottles Plastic Tin can Metal Ash/dirt	Tetrapacks Thermo-cal Carbon paper Plastic coated visiting cards Sachets Modern packing materials (plastic) for food packing PET mineral water bottles

2.0 Approaches for Solid Waste Management

For effective management of solid waste in rural areas, focus should be on management at household level. That which cannot be managed at household level should be managed at the community level. In general, the following approach should be followed:

- Segregation of solid waste at the household level (Biodegradable and non-biodegradable)
- Reuse of non-biodegradable waste at the household level to the extent possible
- Household level treatment of bio degradable waste
- Collection and transportation of segregated waste at the household level to a place identified at the community level (in cases where household level treatment is not possible)

- Community level treatment or recycling/reuse of waste
    - All the biodegradable waste should be composted at the community level
    - Non-biodegradable waste may be further segregated and sold or recycled
    - Waste which cannot be composted, reused or recycled may be disposed at the land.

3.0 Community level composting

Community level composting may be resorted to when management of solid waste at household level is not possible. For community level composting, Panchayat should select a suitable site as Compost Yard for the village. Site should be selected taking into consideration wind flow direction, so that the inhabited areas don't get any foul odour. The site should be easily accessible for transportation of waste and manure. It should not be a low lying area to avoid water logging.

A. Underground *unlined* manure pit or garbage pit: This is applicable for rural areas with low rainfall and villages where there is lack of space at household level for composting. This is not suitable for heavy rainfall areas and rocky terrain.

Use and maintenance of the pits

- Go on adding collected garbage in the pits (only biodegradable type)
- Wherever possible, it is advisable to add cow dung slurry to the garbage to enhance the composting process
- Spread a very thin layer of soil over it (once a week) to avoid odour & fly nuisance
- Continue to add garbage everyday
- Follow the above procedure & repeat the layers till the pit is full. It is recommended to fill the pit up to about 300mm above ground level
- After 3-4 days the garbage above ground settles down
- Plaster it with soil
- Leave the pit as it is for 3-6 months for maturation and start other pits sequentially
- After 3-6 months take out the compost & use it in the fields.

B. Underground brick lined manure pit or garbage pit: This is applicable for rural areas with low rainfall and villages where there is lack of space at household level for composting. This is not suitable for heavy rainfall areas and rocky terrain and is a capital intensive option

Use and maintenance of the pit

- Go on adding collected garbage from the houses in the pits (only biodegradable type)
- Wherever possible, it is advisable to add cow dung slurry to the garbage to enhance the composting process
- Spread a very thin layer of soil over it (once a week) to avoid odour & fly nuisance
- Continue to add garbage everyday
- Follow the above procedure & repeat the layers till the pit is full. It is recommended to fill the pit up to about 300mm above ground level
- After 3-4 days the garbage above ground settles down
- Plaster it with soil
- Leave the pit as it is for 3-6 months for maturation and start other pits sequentially
- After 3-6 months take out the compost & use it in the fields.

C. Overground heap: This is applicable for rural areas with high rainfall and rocky terrain and for villages where there is lack of space at household level for composting.

Use and maintenance of the heap

- Go on adding garbage collected from the houses over the platform (only biodegradable type)
- Wherever possible, it is advisable to add cow dung slurry to the garbage to enhance the composting process
- Spread a very thin layer of soil over it (once a week) to avoid odour & fly nuisance
- Continue to add garbage everyday
- The heaps should be sprinkled with water periodically to maintain the moisture level
- Follow the above procedure & repeat the layers till the heap attains the height of 0.8m
- After 3-4 days the garbage above ground settles down
- Plaster it with soil
- Leave the heap as it is for 3-6 months for maturation and start another heap
- After 3-6 months take out the compost & use it in the fields
- Till the manure in the heap matures, make another heap of the same dimensions at a minimum distance of l m from the first heap.

D. Overground brick lined compost tank: This is applicable for rural areas with high rainfall and rocky terrain and for villages where there is lack of space at household level for composting.

Use and maintenance of the tank

- Go on adding collected garbage from the houses in the tank (only biodegradable type)
- Wherever possible, it is advisable to add cow dung slurry to the garbage to enhance the composting process
- Spread a very thin (1-2 inch) layer of soil over it (once a week) to avoid odour & fly nuisance
- Continue to add garbage everyday
- Follow the above procedure & repeat the layers till the heap attains the height of lm
- After 3-4 days the garbage above ground settles down
- Plaster it with soil
- Leave the heap as it is for 3-6 months for maturation
- After 3-6 months take out the compost & use it in the fields
- Till the manure in the tank matures, make another tank of the same dimensions at a minimum distance of l m from the first tank.

4.0 Vermicomposting at Community Level

- The following steps need to be followed for vermicomposting at community level:
- Appropriate site selection: the site should be protected from direct sunlight and should not be in low lying areas.
- Vermiculture site preparation; Proper ramming of soil or preparation of platform is required before preparation of vermicompost beds
- Construction of appropriate shed: thatched roof/tin sheds on bamboo/metal poles with proper slope to drain rain water, and proper ventilation
- The biodegradable waste should be predigested in a separate bed before transferring to the treatment beds.

Precautions to be taken

- Proper covering of feed bed (local available materials such as coconut leaves etc may be used for covering of the vermicompost pit)
- Avoid excess water (only sprinkling)
- Protect the shed area and the beds from red ants, cockroaches etc. by using haldi (turmeric) sprinkling aata (flour) all around the perimeter of the shed and the bed

- Keep the feed beds away from birds/chicken/ducks/rodents from eating the worms.

5.0 Recycling

A. Recycling of Papers

It is possible to convert waste paper into useful recyclable product. Making pulp from waste paper is an old art. The process has now been refined. Various articles including showpieces may be made using the pulp. The articles are so sturdy that they can be an alternative to wood to some extent. Hence it is also called Pepwood. Women/ SHG members, unemployed youths after receiving thorough training can undertake this activity. It is also necessary to attain a certain level of skill. Materials such as Waste paper, Flour of fenugreek or tamarind seed as adhesive, Water, Rough .at stones for macerating paper, colors, moulds of different shapes and sizes, well ventilated cupboard for storing the articles, etc. are required.

B. Recycling of Plastics

In all types of solid waste in rural areas, plastics have become a major cause of concern due to Non-biodegradability, nuisance value in waste stream and blockage of drainage channels, pollution of surface water and random burning here and there causing air pollution problem. There is no proper collection or disposal system of plastic waste.

6.0 Land Fill

In spite of composting, re-use and recycling, some waste remains untreated unmanaged which requires final disposal, either by incineration or by land filling. Incineration is a technology where waste is burnt in a specially engineered machine called Incinerator. Incineration is not simply burning, but complete combustion. Incinerators are considered to be causes of air pollution. This is not a viable option for waste management. A landfill is a properly designated area and used for the disposal of non-biodegradable and non-recyclable inorganic solid waste. Landfill is considered to be a viable option. This land fill takes care of the problem of disposal of non-recyclable solid waste.

Selection of Landfill Site: Gram Panchayat in consultation with Zilla Parishad, Block Panchayat (as the case may be) should select the landfill site which should be:

- Located at the outskirts of the village
- Accessible
- On vacant/uncultivated land
- Located in the natural depressions with slight slopes
- Waste from landfills leaches into the aquifer below site should be such as to avoid surface water and groundwater pollution
- Before establishing any landfill site, baseline data of ground water quality in the area shall be collected and kept as a record for future reference.

Procedures to be followed for landfill construction

- Wastes should be compacted to achieve high density
- Wastes should be immediately covered with a minimum 10cm of soil/debris/
- Before the monsoon season, an intermediate cover of soil approximately 40-65cm thick should be placed on the landfill to prevent infiltration
- Proper drainage system should be constructed to divert run-off water
- After the completion of landfill a final cover should be provided to prevent infiltration and erosion. This should be according to the given diagram
- Landfill site should be properly fenced with a provision of a gate with locking arrangements by the gram panchayat/community
- Plantation at landfill site should be encouraged to combat pollution. It should be in sufficient density to minimize soil erosion
- The plants should be locally adapted, non-edible, drought and extreme temperature resistant, short rooted and of low nutrient demanding variety.

Operation and maintenance

- Gram Panchayat/community should prevent entry of stray animals and unauthorized persons through protective measures
- Regular Monitoring of groundwater is required for maintaining groundwater quality.
- Avoid entry of cattle and grazing on the landfill site in an unfenced landfill as it would be hazardous.

Annexures 13 Disposal of Reject brine from RO Plant

Desalination process with RO plant for treating the brackish/saline groundwater with high TDS is the solution to supply drinking water to isolated habitations where the groundwater is brackish and supplying water from the distant surface water source is not feasible.

Production and disposal of reject brine are an integral part of an overall desalination process. Reject brine is in the range of 40 to 60% of the feed water depending upon the TDS of the feed water. For inland (located away from the sea coast) desalination plants, this poses a serious challenge, as the option of ocean disposal of reject brine is not available.

Various disposal options currently used for the reject brine are:

- disposal in lined evaporation ponds (lined with polyethylene or other polymeric sheets), where land is available
- disposal in unlined evaporation ponds, where land is available
- deep well injection after assessment of geological conditions
- disposal in natural depressions if no drinking water supply is depending on groundwater in the vicinity of 100 m.

An alternative approach is further processing the reject brine to extract all the salts involving multiple-evaporation and/or cooling, supplemented by chemical processing. However, this may not be economically viable.

Of all the disposal options, disposal of brine in lined evaporation ponds is preferable (technologically simple, risk of groundwater contamination is lesser).

Annexures 14 Formats for Environmental Data Sheets (EDS)

A. EDS for Water Supply

General

Name of the Village:
Gram Panchayat:
Block:
District:
Type of scheme:
Water source
Water quality
Is water sample collected?
Test result:
Date of visit:

Source location

1. Location of the water source:
2. Type of water source:
3. Is the scheme site located in a forest area/ecologically sensitive (National Park. Wildlife Sanctuary) area?
4. Land acquisition: Govt land or private land?

For groundwater source

1. What is the type of aquifer?
2. Total depth of well (metres)
3. Depth to groundwater table (Summer and Winter)
4. Is the groundwater tapping in safe zone (classified based on exploitation)?
5. Type of aquifer
6. If there is water sustainability issue, that are the steps taken for source augmentation

In case of hand pump

1. What is the distance of this source from the nearest leach pit of any existing sanitation facility? (It should be more than 15 metres)
2. Is the nearest latrine on a ground higher than hand pump?
3. Is there any other source of pollution within 10m of hand pump

4. Is the drainage poor causing stagnant water within 2 m of hand pump?
5. Total depth of well (metres)
6. Is a concrete mat (of at least 75 cm radius) planned around the bore well?
7. Is the cement floor less than 1m wide round the hand pump ?
8. Are there any cracks on the cement floor around the hand pump ?

In case of piped water

1. Is there any leakage in the distribution pipe between standpost(s) and the reservoir?
2. Is the inspection cover on the reservoir unsanitary?
3. Is there leakage in the reservoir?
4. Is the reservoir water unchlorinated?
5. Is pressure low in any part of the distribution system ?In case of water quality problems, what are the steps taken for water treatment?

Water Quality

1. Is the water acceptable? (enclose the water quality test report)
2. If not acceptable, mention the type of water quality problem
3. Is there any chemical impurity present? Give details.
4. If the water is to be treated, mention the treatment process
5. What is the frequency planned for testing water for bacteriological/physical/chemical contamination?
6. What is the frequency planned for testing residual chlorine?
7. What is the frequency planned for sanitary inspection? (should be 4 times/year)
8. In case of surface water sources, is there dumping of effluents/sewerage into the surface water
9. How will the sludge and other residue from the water treatment plant be disposed?

In case of surface water source

1. Will the scheme result in land erosion?
2. Is the surface water source sustainable?
3. Is these flood problem in the area, what measures are taken to handle waterlogging?
4. Will the pipes go through forest, environmentally sensitive area(s)?

5. Did the river change course during the last ten years?
6. Is there an alternative/back up source (e.g. groundwater source) planned?

B. EDS for Rainwater Harvesting

General

Village:
Gram Panchayat:
Block:
District:
Type of scheme:
Water source
Water quality
Is water sample collected?
Test result:
Date of visit:

Structure

1. Type of RWH structure
2. Intended use of rain water

Maintenance

1. What is the planned frequency of conducting maintenance check and cleaning of the RWH system?
2. What is the planned frequency of cleaning storage tank? (recommended at end of dry season, before the first rain)
3. What is the distance of the RWH Structure from the nearest borewell? (should be 15 m away)

Household rooftop RWH structure

1. Is there any contamination of the roof catchment area ? (e.g. Plants, din or excreta)
2. Is there any deficiency in the filter box at the tank inlet ? (e.g. lacks fine gravel)
3. Is there any other point to entry to the tank, which is not properly covered ?
4. Is there any leakage in the water tank?
5. Does the water collection area have sufficient drainage facility?

6. Is there any source of pollution (e.g. excreta, sewage etc.) around the tank or water collection area?
7. Is there any possibility of contaminated water flowing into the RWH structure?

C. EDS for Sewerage Schemes

General

Village:
Gram Panchayat:
Block:
District:
Type of scheme:
Water source
Water quality
Is water sample collected?
Test result:
Date of visit:

Location

1. Is the scheme site located in a forest area/ecologically sensitive (National Park, Wildlife Sanctuary) area?
2. Are any trees likely to be cut at the location for construction of the scheme?
3. Type of soil and substrata
4. Type of aquifer
5. Depth to groundwater table during summer and winter

Structure

1. What is the type of sewage treatment proposed?
2. Land acquisition type: Govt. land (including Forest Land or private land?
3. What is the extent of land required for the STP?
4. What is the mode of disposal of treated effluent and plans for the reuse of effluent (if any)?
5. How will the sludge and other residue be disposed?

D. EDS for Sanitation Schemes

General

Village:
Gram Panchayat:
Block:
District:
Type of scheme:
Water source
Water quality
Is water sample collected?
Test result:
Date of visit:

Location

1. Are any trees likely to be cut at the location for construction of the scheme? If yes, mention the number of trees.
2. Type of soil, and substrata
3. Depth to groundwater table during summer and winter
4. Is a shallow aquifer used as source for drinking water supply in the habitation?
5. Is a minimum distance of 15 metres maintained between the pits and the nearest drinking water sources?

Structure (For ISL)

1. Type and number of ISL proposed
2. What are the precautions taken to prevent groundwater contamination?
3. In case of high ground water table, is raising of platform, bottom sealing of pit and earth filling outside along sides of pit planned?
4. In case of flood prone area, is raising of platform and earth filling outside along sides of pit planned?
5. In case of loose soils, is lining of pits with perforated cement rings planned?
6. In case of soils with high permeability, is earth filling around rings with denser soil planned?
7. Is an awareness programme for prospective users on proper use and maintenance of the IHLs being planned?
8. What is the expected cleaning interval of pits?
9. What is the method of disposal of materials from pits?

E. EDS for Storm water / Sullage Drainage Scheme

General

Village:
Gram Panchayat:
Block:
District:
Type of scheme:
Water source
Water quality
Is water sample collected?
Test result:
Date of visit:

Location

1. Current sullage disposal practice and status
2. Type of soil, substrate, aquifer
3. Is any component of the scheme located in a forest area?

Structure

1. Are any trees likely to be cut at the location for construction of the scheme? If yes, mention the number of trees.
2. Depth to groundwater table during summer and winter
3. What are the precautions taken to prevent groundwater contamination from sullage?
4. What is the proposed length of drain?
5. How will the maintenance of the drains be conducted?
6. What is the treatment proposed for the sullage?
7. What is the elevation of the drain in relation to the road.

G. EDS for Community Solid Waste Management

General

Village:
Gram Panchayat:
Block:
District:
Type of scheme:
Water source
Water quality

Waste Management

1. Current solid waste disposal practice and status
2. Type of soil, substrate, aquifer
3. Is any component of the scheme located in a forest area?
4. Depth to groundwater in summer and winter
5. What is the expected quantity of solid waste generation per day? (tons)
6. What is the expected quantity of biodegradable waste (waste that can be composted) per day? (tons)
7. What is the expected quantity of non-biodegradable waste (waste that can not be composted) per day? (tons)
8. Is segregation of wastes at household level (into biodegradable and non-biodegradable wastes) being planned?
9. How will the household waste be collected?
10. Are the community waste bins planned to be located at least 15 m away from any water sources?
11. What is the planned frequency of collecting waste (from community bins or from individual households)?
12. What is the type of composting planned? Underground or overground
13. What part of the non-biodegradable waste will be recycled?

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